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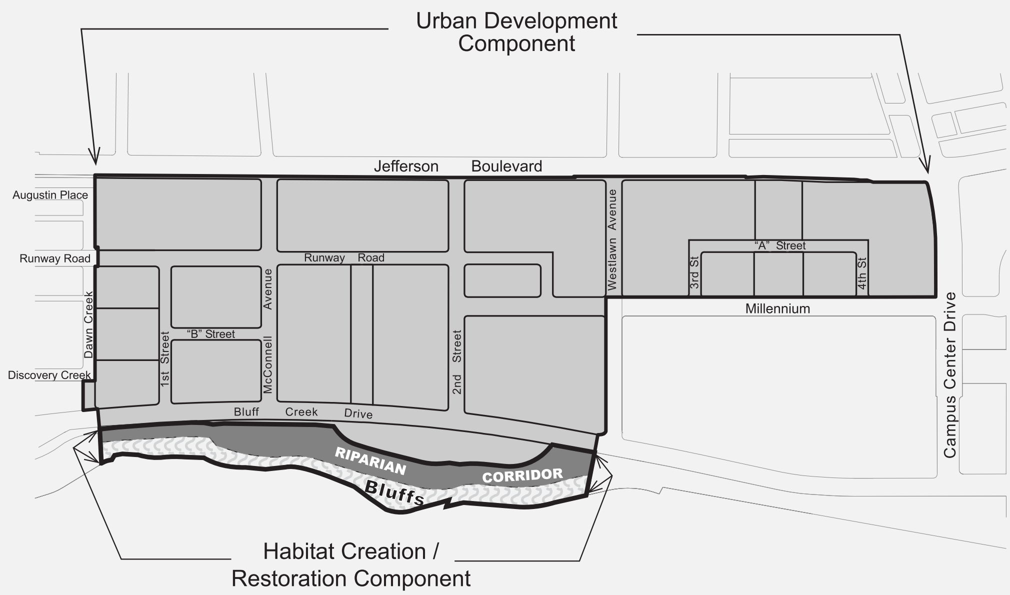
DRAFT ENVIRONMENTAL IMPACT REPORT
(RS-DEIR)

VILLAGE AT PLAYA VISTA



VOLUME III

TECHNICAL APPENDICES D.viii to E

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RECIRCULATED SECTIONS - DRAFT ENVIRONMENTAL IMPACT REPORT (RS-DEIR)

VILLAGE AT PLAYA VISTA

TECHNICAL APPENDICES

VOLUME III

APPENDIX D: (CONT.)
CULTURAL RESOURCES: ARCHAEOLOGICAL RESOURCES

APPENDIX E:
GLOBAL CLIMATE CHANGE

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ALTSCHUL, JEFFREY H., ET.AL., STATISTICAL RESEARCH, INC., TUCSON, AZ, REDLANDS, CA "PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT, AT THE BASE OF THE BLUFF, ARCHAEOLOGICAL INVENTORY AND EVALUATION ALONG LOWER CENTINELA CREEK, MARINA DEL REY, CALIFORNIA", APRIL 2003

PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT

At the Base of the Bluff

Archaeological Inventory and Evaluation along Lower Centinela Creek, Marina del Rey, California

edited by Jeffrey H. Altschul, Anne Q. Stoll, Donn R. Grenda, and Richard Ciolek-Torrello

with contributions by

Jeffrey H. Altschul
Kenneth M. Becker
Eric C. Brevik
Richard Ciolek-Torrello
John G. Douglass
Robert G. Elston
William Feld
Robert O. Gibson
Marc W. Hintzman
Donn R. Grenda
Jeffrey A. Homburg
David Maxwell
Antony R. Orme
E. Jane Rosenthal
Steven D. Shelley
Anne Q. Stoll
Benjamin R.Vargas

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Playa Vista Monograph Series
Test Excavation Report 4

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ABSTRACT

This report documents the completion of four separate, but interconnected tasks undertaken as part of the Playa Vista Archaeological and Historical Project (PVAHP): (1) subsurface inventory and evaluation of cultural resources in a large portion of Area D; (2) boundary testing of CA-LAN-62; (3) National Register evaluation of two sites, CA-LAN-211/H and CA-LAN-2769; and (4) development of an archaeological treatment plan for CA-LAN-211/H, including the updating of the research design for the PVAHP (hereinafter the prefix CA- will be dropped).

The contextual framework that supports the investigations at Playa Vista is presented in the initial chapters of this report. Previous archaeological inquiries, the results of archival research, paleoenvironmental reconstruction, and soils analysis are summarized. We use the enhanced scope of our knowledge of the past in the Ballona to refine our models and create testable hypotheses which are presented in later chapters.

Archaeological inventory at Playa Vista is made difficult by many meters of fill and standing structures from the Hughes Aircraft era that cover the resources. To overcome these obstacles, we devised a deep testing strategy using a bucket auger and coring technique. Results indicating areas of archaeological sensitivity were further tested by trenching and hand excavation in 1999 and 2001. A nearly continuous band of cultural deposit was discovered along the base of the bluff, prompting an extension of the eastern boundary of LAN-62 toward the western edge of LAN-211/H.

To complete our second task, we tested the cultural deposits at LAN-211/H and LAN-2769 by trenching and hand excavating. Site boundaries for both were estimated; the age, condition and integrity of each was assessed; and the research potential of each was evaluated. Hand excavation at LAN-211/H and subsequent radiocarbon dating revealed at least two temporal components at this site, one possibly dating to the Intermediate period and the other dating to the protohistoric and early historical periods.

LAN-211/H contains a unique and intact cultural deposit. Both shell and glass beads were found, as were large quantities of shell and stone tool debris. Bead data, along with cow bone in the midden, point to occupation during the early historical period, confirming our temporal placement of the site within the contact period of early California history. Patterns for the deposition of invertebrate and vertebrate faunal remains seen at other sites within the Ballona Lagoon Archaeological District (BLAD) are not replicated at this site, indicating a distinct change in cultural practices in the protohistoric from the Late prehistoric period. Significantly, cultural materials from the early historical period have not been found elsewhere in the Playa Vista project area and are rare throughout southern California. Based on its condition and its ability to inform on the research questions concerning human-land relationships, culture history, and settlement patterns in the Ballona, LAN-211/H is recommended to be eligible for listing in the NRHP as a contributing member of the BLAD.

We also tested LAN-2769 using standard trenching and hand-excavation methods. In contrast, this site was found to contain a very sparse deposit of cultural material that has been heavily disturbed by rodents and earth-moving activities during the Hughes Aircraft era and later years. The small amount of material retrieved from the site is deemed redundant and does not contribute to our understanding of the complex cultural dynamics at work in the prehistoric Ballona Lagoon area. Thus, this site is recommended as not eligible for listing in the NRHP as contributing member of the BLAD.

The report concludes with a treatment plan designed to guide data recovery at LAN-211/H. An assessment of the impacts to the site by proposed development is included in this chapter, which also presents our strategy for mitigating any potentially adverse affects to the archaeological deposits. To lay

the foundation for the data recovery at LAN-211/H, we present an expanded research design which outlines directions for interpreting anticipated remains from the protohistoric and early historical periods. Data recovery at LAN-211/H presents a unique opportunity to explore one of the least-well understood eras of occupation of the Southern California Bight.

ACKNOWLEDGMENTS

In 2003, Statistical Research, Inc. (SRI), entered its thirteenth year of archaeological investigation at Playa Vista. This report summarizes our efforts, focusing on the three-and-a-half-year span from the inception of fieldwork at LAN-211/H to the publication of this work. We take this opportunity to thank those people and organizations who made our work in the Ballona possible.

First and foremost, we wish to thank Playa Capital, LLC, for the opportunity to investigate this important area and for their continuing support of our research. We are indebted to Pat Larkin and Bruce Harrigan, who oversaw the implementation of the PVHAP; others involved in permitting and regulatory matters were Marc Huffman and Catherine Tyrrell. For their assistance with scheduling, equipment, and facilities at Playa Vista, we thank Mike Helma, Jay Oldham, Doug Richards, and Dave Chernik.

The lead federal agency for this work is the U.S. Army Corps of Engineers; from their ranks we wish to thank Richard Perry, Roderic McLean, and Stephen Dibble for their professionalism and support. For the past 11 years, the State Historic Preservation Officer has been represented at Playa Vista by various individuals, including Thad Van Bueren, John Sharp, Hans Kreutzberg, and Chuck Watford. We thank them and also those members of the Advisory Council on Historic Preservation who have reviewed this project. Our gratitude is also extended to our peer reviewers Drs. Patricia Martz, Charles Rozaire, and John Johnson for their insights and helpful critique.

Many colleagues and consultants contributed to this report. At Playa Vista, working with professional crews from Psomas and Associates, Group Delta Consultants, Camp Dresser and McKee, and Epics International has been both pleasurable and rewarding. Thanks go to the crews from Foothill Drilling, who proved especially resourceful in accommodating our field needs during bucket augering. We also wish to thank our consultants for their assistance and expert analyses: Manuel Palacios-Fest (ostracodes), Caroline Tepley (core descriptions), Monday Mbila (stratigraphy), Owen Davis (pollen), Richard S. Boettcher (forams), and Stanley A. Kling (diatoms). Thanks also go to Stephen Williams, geomorphologist, for his supervision of the trenching in the early phases of the inventory.

The resources of many archives across the state were tapped for this report, and we are grateful for their cooperation and assistance. The following were especially helpful: Morgan Yates, archivist at the Automobile Club of Southern California; Dr. William Frank, curator of Hispanic, Cartographic, and Western manuscripts at the Huntington Library; John Franklin, collections manager at the UCLA Geography Air Photo Archives; Wendy Teeter, collections manager at the UCLA Fowler Museum of Culture History; Kim Walters and George Kritzman at the Southwest Museum; Paul Wormser, chief archivist at the National Archives, Laguna Niguel; Dr. Errol Stevens, librarian and head of Special Collections at Loyola Marymount University; Chris Coleman, curator at the Natural History Museum of Los Angeles County; Elizabeth Barry, collections managers at the Fairchild Aerial Photography Collection, Whittier College; and Fred Machado and the docents at the Historical Society of Centinela Valley.

We also wish to acknowledge our debt to the Native American monitors at Playa Vista, Mat Dorame, Martin Alcala, Evan Alcala, Sam Dunlap, and Theresa Richau, whose vigilance and assistance have proved invaluable. Working closely with these representatives of the Gabrielino/Tongva people over the years and with the designated "most likely descendant," Robert Dorame, has built a relationship of trust and respect of which all who work at Playa Vista are proud.

Many individuals at SRI participated in the fieldwork portion of this project, including almost all of the staff of SRI's Redlands office. Benjamin Vargas deserves special mention for coordinating the bead, shell, lithic, and faunal analysis; authoring three chapters; creating most of the figures; and compiling the original draft. His help and moral support in the completing the final report were invaluable. Ken Becker implemented the bucket auger program, and Angela Keller supervised excavation and trenching in the project's early phases. Under laboratory director Bill Feld's able guidance, Gill Unzueta managed the wet-screen area. Benjamin Vargas directed trenching during later boundary testing. Sincerest thanks to SRI field and lab crew, who all moved a lot of buckets during this project. These include Kholood Abdo-Hintzman, Victor Arvizu, Sara Bholat, Esteban Ceja, Beth Elliot-Hora, Maria Espinoza, Tracy Franklin, Jeff Handlin, Ken Hernandez, Robert Mariani, Michael Mathiowetz, Doug McIntosh, Russell Morse, Ted Perkins, Neil Rhodes, Sharon Rushing, Jay Sander, Ayşe Taşkıran, Dennis Taylor, and Nicole Wallock. We also thank Kathy Carlson for office support, Darcy Wiewall for her assistance with faunal analysis, and Robert Mariani for his expertise with fish remains.

Editing, illustrating, and formatting this report involved the effort of many. The hours of hard work invested to produce a report of this scope are gratefully acknowledged. Artifact illustrations were created by Susan Martin, Amelia Natoli, and Lois Kain. CAD maps and figures were drafted by William Hayden, Benjamin Vargas, and Victor Arvizu. Cindy Elsner Hayward had the ultimate responsibility for all graphics and did her usual excellent job. We are indebted to Gwyn Alcock for formatting and polishing the rough draft and to Toni Tallman and Karen Barber for producing the final report. The patience and careful attention to detail under pressure exhibited by the entire production department was impressive to observe and is clearly the hallmark of a team of first-rate professionals.

Lastly, we gratefully mention the contribution of Malcolm Farmer, a remarkable man who, at the age of 15, recorded many of the Baldwin Hills and bluff-top sites for the first time, creating a corpus of notes, illustrations, and maps that proved invaluable for our research. We deeply appreciate Malcolm opening his home and personal files for our use and for reminding us, by his enthusiasm for the subject at age 88, why we got into archaeology in the first place.

CHAPTER 1

Introduction

Jeffrey H. Altschul, Anne Q. Stoll, and Donn R. Grenda

For thousands of years, people have been drawn to the Ballona Lagoon, a complex, dynamic wetland on the coast of present-day Los Angeles that occupies a low-lying drainage between the Del Rey Hills on the south and the Santa Monica tableland on the north (Figure 1). This once-saturated marshland, former home to countless waterfowl, shellfish, and other wildlife, is now being developed for mixed residential and commercial uses. To comply with federal, state, and municipal laws and regulations pertaining to cultural resources, Statistical Research, Inc. (SRI), prepared a comprehensive research design to explore the prehistory and history of the Ballona Lagoon (Altschul et al. 1991). Implementing the design, the execution of which is stipulated as part of a programmatic agreement between the U.S. Army Corps of Engineers (COE), the California State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP), has been the primary objective of the Playa Vista Archaeological and Historical Project (PVAHP) since 1991.

The overarching research objective of the PVAHP is to understand those cultural processes that characterize the interaction between humans and their environment in and around the Ballona Lagoon. Specific goals of the PVAHP include (1) reconstruction of the paleoenvironment of the lagoon through time, (2) identification and evaluation of archaeological and historical resources within the project area, and (3) creation of a program for the proper treatment of those resources found to be eligible for listing in the National Register of Historic Places (NRHP). Progress toward these goals has matched the phased nature of construction at Playa Vista, in increments linked to development schedules. More than a decade of archaeological investigation since the preparation of the research design has produced some revision and a new level of understanding of the archaeological record in the Ballona Lagoon, demonstrated by this volume.

Because of the size and scope of the overall project, the Playa Vista project area was divided into four separate development areas (A–D). This report documents the findings of SRI's subsurface inventory and evaluation program for a large portion of Area D of the Playa Vista project (Figure 2).

Report Goals

To date, SRI has developed and implemented three work plans (Altschul and Ciolek-Torrello 1997; Ciolek-Torrello et al. 1998; Grenda et al. 1999) that covered portions of the first development phase. This report presents the results of implementing the most recent work plan (Grenda et al. 1999). The results presented here focus on three tasks: (1) inventory of those areas where the paleoenvironmental investigations suggested buried intact cultural deposits were likely, (2) boundary testing of the NRHP-eligible CA-LAN-62, and (3) the NRHP evaluation of CA-LAN-2769 (SR-12) and CA-LAN-211/H (SR-13) (hereafter, the prefix CA- is dropped from site designations).

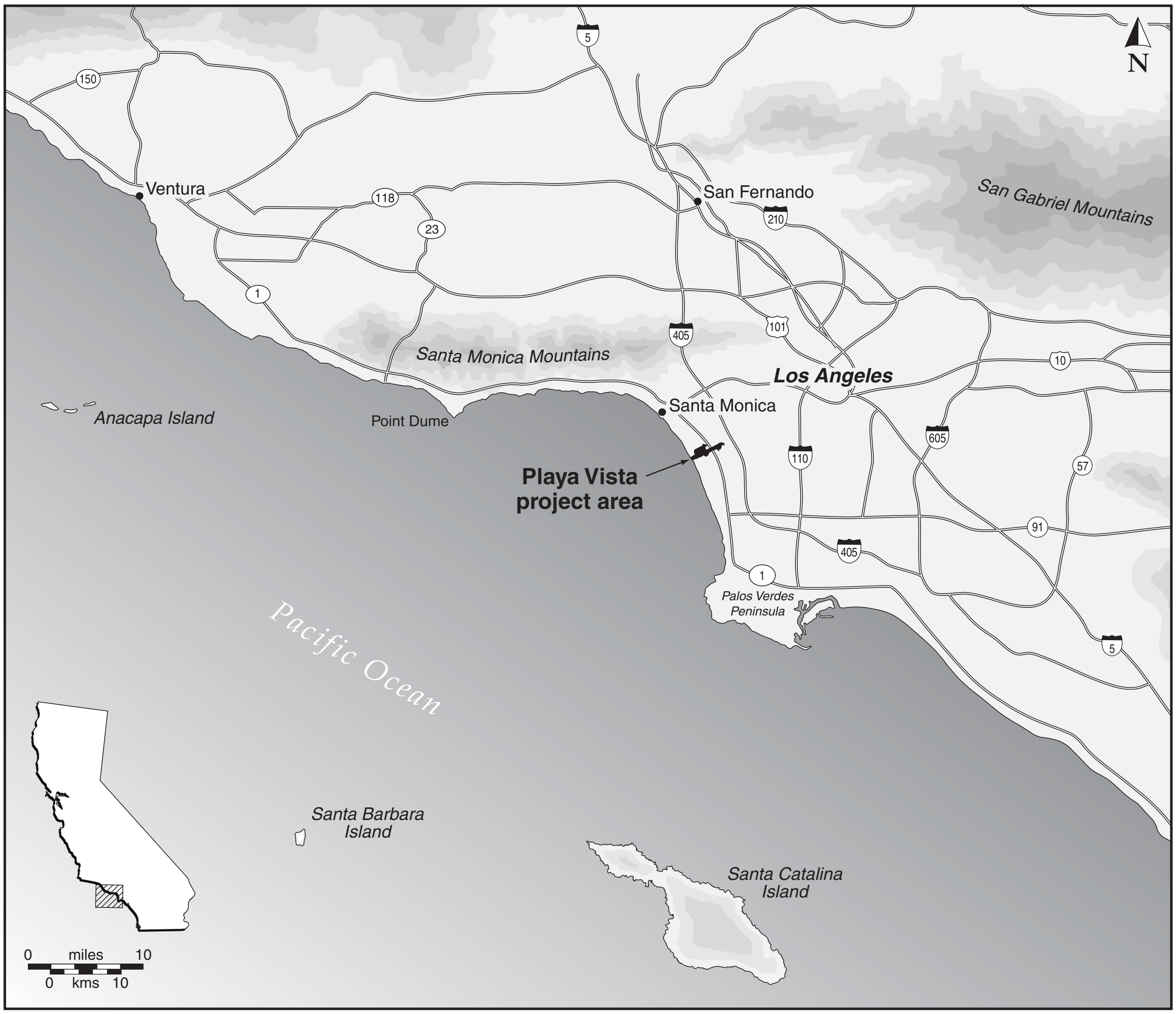

Figure 1. Location of the Playa Vista project area.

Two previously recorded prehistoric sites are included within the tested portion of Area D, LAN-62 and LAN-211. Both were first recorded in the 1940s, and a previously unknown third site, LAN-2769, was discovered in 1990. These sites are located within the Ballona Lagoon Archaeological District (BLAD), an NRHP-eligible district that encompasses the Ballona Lagoon and associated prehistoric archaeological sites around its margins. Created in 1991, the BLAD established the conceptual fabric for examining the archaeological resources in the greater Ballona area collectively, as parts of an adaptive system centered on the lagoonal environment.

The establishment of the BLAD provided a standardized procedure for assessing the relative importance of each site within the district. Once an archaeological site is identified within the BLAD, it must be evaluated to determine whether it is a contributing element of the district. Evaluation is based on an assessment of the site's integrity and its ability to provide information about the research issues described in the PVAHP research design. The parties to the programmatic agreement must determine whether sites found to be contributing elements to the BLAD will be adversely effected by development. The parties then must agree on a treatment plan for each contributing element that minimizes the adverse

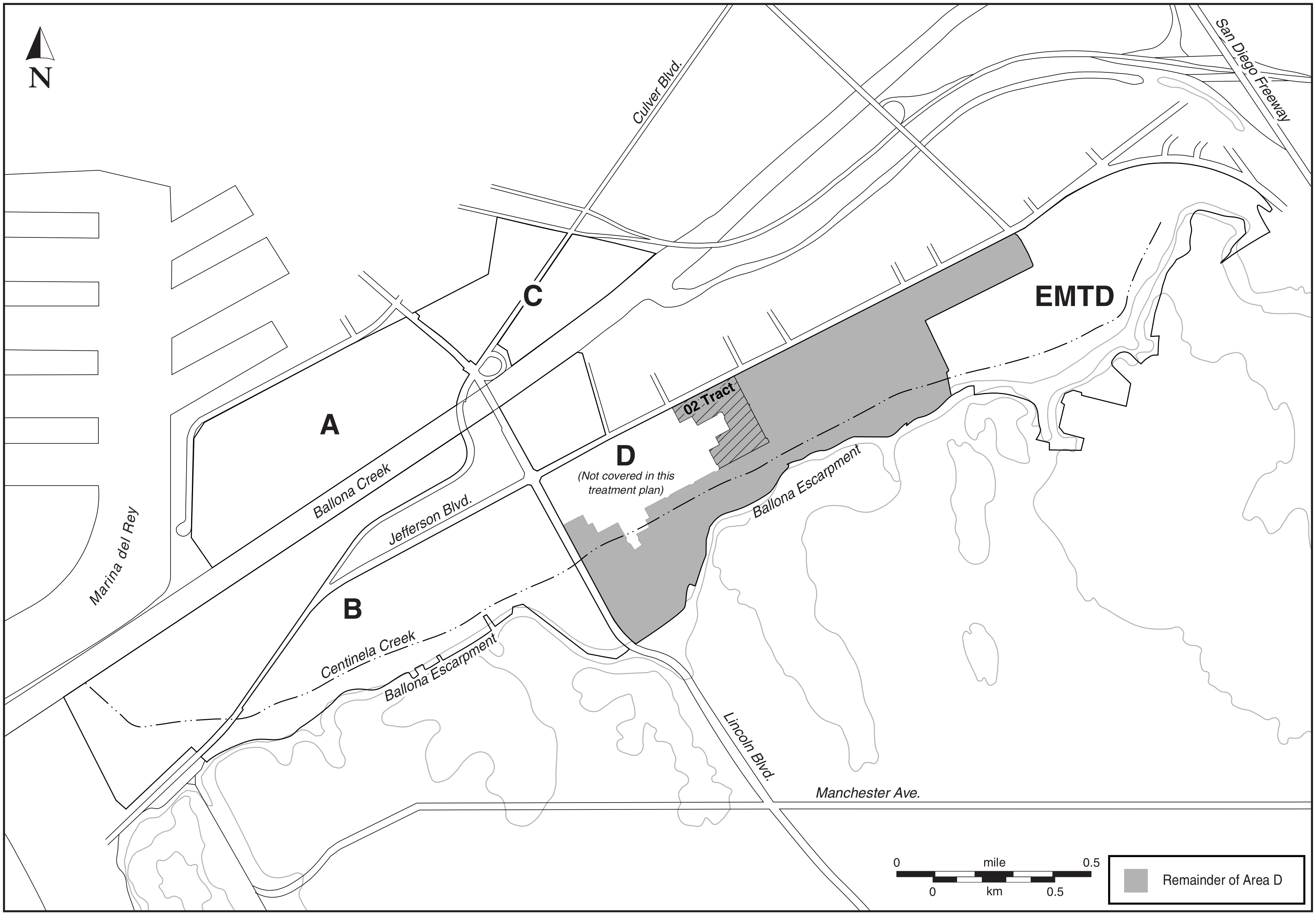

Figure 2. Overview of Playa Vista, showing the current project area, remainder of Area D, and the O2 Tract.

effect, usually by avoidance if possible, and if not, through a program of data recovery, analysis, and curation. Archaeological sites with genuine research value in the Los Angeles area, one of the most built up environments on the planet, are predictably scarce. The BLAD is rare in containing no fewer than six sites—LAN-54, LAN-60, LAN-62, LAN-193, LAN-2676, and LAN-2768—that are of scientific value and have been determined eligible for listing in the NRHP prior to this project. By encompassing these resources within the formal concept of an archaeological district, a broader analytical scope is brought to the research. Using a regional concept, comparisons are made that reflect on the larger issues of cultural chronology and environmental change along the southern California coastline.

Research Objectives

Two principal themes guide archaeological research in the area around Ballona Lagoon: human-land relationships, and the culture history and cultural dynamics of prehistoric settlement. The first theme targets the evolution of the lagoon and its effect on settlement and subsistence patterns over time. The second theme focuses on the role that developing social organization played in the wetlands. Our goal is to reconstruct the structure of human groups as they evolved in response to changes in the natural and cultural landscape. Focusing on the first theme, in 1991, Altschul and his colleagues reasoned that apparent shifts in prehistoric settlement from the bluff tops to the lagoon edge and from east to west along the lagoon edge reflect the variability of critical environmental factors, principally the retreat of the lagoon during progressive siltation and infilling through time. Altschul's original environmental model anticipated that prehistoric sites within the project area would cluster along the course of freshwater Centinela Creek and that their age would decrease as they were located farther west along the retreating resource base (see Altschul and Ciolek-Torrello 1990; Altschul, Ciolek-Torrello, and Homburg 1992; Altschul et al. 1991; Altschul, Homburg, and Ciolek-Torello 1992).

In the ensuing years of research at Playa Vista, we have attained a new understanding of the paleoenvironmental sequence in the Ballona Lagoon (discussed in Chapter 5). The estuarine system was stable by an earlier date than previously thought, ca. 6500 B.P., and open longer. Further, subsequent testing at sites along Centinela Creek revealed a more complex chronological sequence than suggested by the original east-to-west site progression. Late period sites (LAN-62, LAN-211/H, and LAN-2676) do appear to be concentrated at the western end of Centinela Creek; however, Intermediate period occupations (LAN-60, LAN-2768, LAN-193, and LAN-62) extend the entire length of the creek edge, and thus do not conform to the predicted distribution. Clearly, the determinative factors are not yet entirely in focus, and our picture is not complete.

Results

As our understanding of human settlement in the Ballona evolves, our research strategies and expectations change. One task that has proved more complex than anticipated has been establishing the boundaries for LAN-62 and what was thought to be a separate site, designated LAN-211. As defined by previous archaeological work, LAN-62 was among the first to be identified as a contributing element of the BLAD. Excavations at LAN-62 in the late 1980s revealed a deep, multicomponent deposit with two loci, and artifacts and subsistence-related remains in substantial quantities (Archaeological Associates 1988; Freeman et al. 1987; Van Horn 1987). The same researchers saw LAN-211 as a separate deposit, at least 1.5 m thick, dating to late prehistory. They also separated this site into two loci (Freeman et al. 1987:43). Evaluations of both LAN-62 and what was believed to be LAN-211 were included in the PVAHP research design of 1991 (Altschul et al. 1991:194). They were recommended to be eligible for listing in the NRHP (Altschul et al. 1991) (Table 1) as so determined in the programmatic agreement. Although the

Table 1. NRHP Status of Sites in the Project Area (Remainder of Area D)

Site Trinomial (Temporary No.)	NRHP Eligibility	Fieldwork Status	Methods of Investigation	Reference
LAN-62 (SR-15, SR-16)	eligible	testing complete	bucket augers, hand units, trenches, cores	Freeman et al. 1987 Altschul et al. 1991
LAN-211/H (SR-13)	eligible	testing complete	bucket augers, trenches, hand units, cores	this report
LAN-2769 (SR-12)	not eligible	testing complete	bucket augers, trenches, hand units	this report
LAN-1932/H (SR-6, SR-23)	eligible	data recovery complete	surface survey, bucket augers, trenches, hand units	Hampson 1991 Taşkıran and Stoll 2000b
LAN-1934/H (SR-4)	not eligible	testing complete	surface survey, trenches	Hampson 1991

previous testing had been sufficient to establish significance, the sites' dimensions could not be accurately drawn.

Believing that four distinct loci (LAN-62A, LAN-62B, LAN-211A, and LAN-211B) would be found in the area, SRI began systematic subsurface testing in the vicinity of LAN-62 in 1998 (Altschul et al. 1998). We soon realized that site boundaries would be impossible to delineate using traditional methods. With both sites deeply buried by natural alluvium and man-made fill, another discovery strategy was needed. After drilling a series of three-inch cores, our initial conclusion was that both sites extended farther from the bluffs than previously mapped and that they were covered by 2.5–6 m (8–20 feet) of sandy fill. The sites' dimensions were still unclear, however, and questions remained about site structure and integrity. In 1999, a new work plan for archaeological inventory in portions of Area D was created that specifically included a proposal to resolve the boundary issues at LAN-62 (Grenda et al. 1999). An extensive program of subsurface probing was proposed, including drilling cores and bucket augers and digging numerous trenches and test pits. A detailed description of the project methods is presented in Chapter 4.

Foreshadowing here the field results described in Chapter 6, we discovered that there is no real distinction between LAN-62A, LAN-62B, and what had been designated LAN-211A and B. It now appears that LAN-62 is a single very large multifaceted deposit that encompasses all of the original LAN-211 (A and B) and continues around the base of the bluff to the east (see Figure 2). For convenience, we have subsumed all of this archaeological deposit under the designation LAN-62.

Our understanding of LAN-211 has undergone a similar transformation. In 1991, we found no cultural material on the surface in the area where LAN-211 was originally recorded (Altschul et al. 1991:160). Instead, we found the continuation of LAN-62, as described above. Separate cultural deposits were not discovered until trenching began at the site we had originally labeled SR-13, farther east around the base of the bluff. While testing the midden deposit there, an intact portion of a much larger site was exposed under the asphalt-covered parking lot below the bluff. This deposit much more closely matches the original description of LAN-211, which was described by Pence in 1979 as being a rich midden covered by an asphalt parking lot. We conclude that LAN-211 was mislocated on early maps. Our testing results indicate that SR-13 and LAN-211 are the same site. LAN-211/H ("H" indicating the historical-period component)—which has never before been exposed, tested, or evaluated—was found to be a relatively intact, multicomponent site. We recommend that it is eligible for the NRHP and a contributing element of the BLAD (see Table 1). The detailed results of testing at this site are presented in Chapter 6 of this report.

Each project at Playa Vista expands the archaeological knowledge base. Some sites along the base of the bluff appear larger and contain evidence of later occupation than expected. Testing at LAN-62 expanded its borders, whereas LAN-211/H has been revealed as a substantial cultural deposit with good integrity and containing a protohistoric component rarely seen in the Los Angeles Basin. LAN-2769, the small deposit formerly known as SR-12, proved to be an enriched A horizon with scant evidence of prehistoric presence. Without indication of more than ephemeral use, LAN-2769 is not considered eligible for listing in the NRHP (see Table 1). The implications of these discoveries are discussed at length in the succeeding chapters.

Report Organization

This report is divided into 12 chapters. In Chapter 1, we laid the interpretive foundation of this report by presenting the background on the current project. After this introduction, Chapter 2 presents a detailed summary of the prehistoric and historical-period cultural setting and a synthesis of previous research. Chapter 3 recaps the goals of the original research design and explains the strategies we have used to satisfy the regulatory requirements of the project. Chapter 4 presents our field methods, and Chapter 5 introduces the environmental background and presents an analysis of Playa Vista soils and stratigraphy. In Chapter 6 we present a complete discussion of our field results. The next four chapters summarize the results of laboratory analysis. Chapters 7 and 8 present the results of vertebrate and invertebrate analysis, whereas Chapters 9 and 10 contain the analysis of artifacts by material class. Chapter 11 contains the summary and NRHP recommendations, followed by Chapter 12, which presents our treatment plan for minimizing adverse impacts to significant archaeological resources at LAN-211/H, including an impact analysis and research design.

CHAPTER 2

Cultural Setting

Anne Q. Stoll, John G. Douglass, and Benjamin R. Vargas

In this chapter, we review archaeological research at Playa Vista and present an update of our knowledge to set the stage for further investigation. We begin with a summary of the culture history of the California coast, followed by a review of the previous research in the Ballona. We finish with a consideration of recorded impacts to the study area.

Culture History

The cultural chronology for southern California is widely defined here to accommodate data gaps and competing models. Figure 3 presents the most recent synthesis of the various models. These models were based on the results of excavations at major sites throughout the southern California coastal region (Figure 4) over the last seven decades. Selecting the best of earlier regional syntheses (King 1981; Wallace 1955, 1978) and avoiding the pitfalls of ambiguous labels such as "Highland Culture" (Orr 1968), we divide Los Angeles Basin and southern Channel Islands prehistory into five general periods: Paleocoastal, Early, Intermediate, Late, and protohistoric/historical. Additionally, sites in the Ballona (Figure 5) are grouped by topographic location: bluff top, lagoon edge, and creek side (Centinela and Ballona Creeks). Understanding the functional and temporal relationships among these groupings is a focus of our research and guides many of the questions to be explored as we conduct data recovery in the area.

Paleocoastal Period

Spanning prehistory prior to 6500 B.P., the earliest period of human occupation on the Southern California Bight, termed the Paleocoastal period, is understood in only the broadest terms. Sites from this time period are characterized by an abundance of ground stone artifacts, stone ornaments, large, crude projectile points, and charm stones. The people of this early period, often referred to as Paleoindians, located their sites in grassland and sagebrush communities on elevated landforms somewhat distant from the modern shoreline (Vellanoweth and Altschul 2002:100). Erlandson and Colten (1991:3) assert that as many as 75 Paleocoastal sites dating in excess of 7500 B.P. are known from the California coast. They are not found evenly distributed along the coastline, but instead occur in two large clusters. One group ranges from San Luis Obispo south to the northern and western Santa Barbara coast and includes the north coasts of Santa Rosa and San Miguel Islands. The second cluster of early sites is concentrated around the ancient lagoons of San Diego County.

Solid evidence for Paleocoastal sites in the intervening areas of Ventura, Los Angeles, and Orange counties is scant and problematic. Breschini et al. (1992) listed five sites in Los Angeles County that have produced radiocarbon dates older than 7000 B.P. These five are the Malaga Cove site (LAN-138),

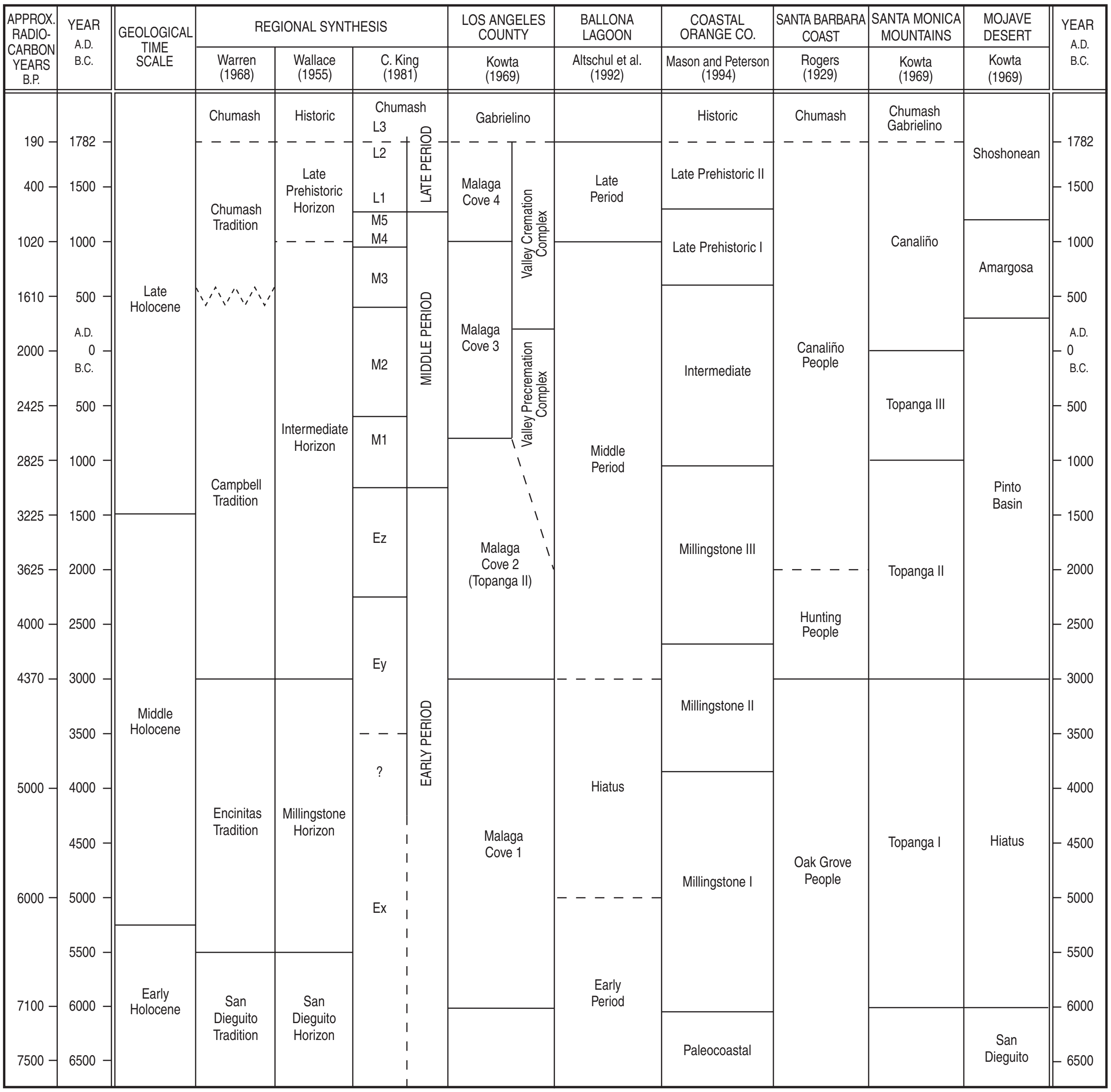

Figure 3. Culture history sequences for southern California.

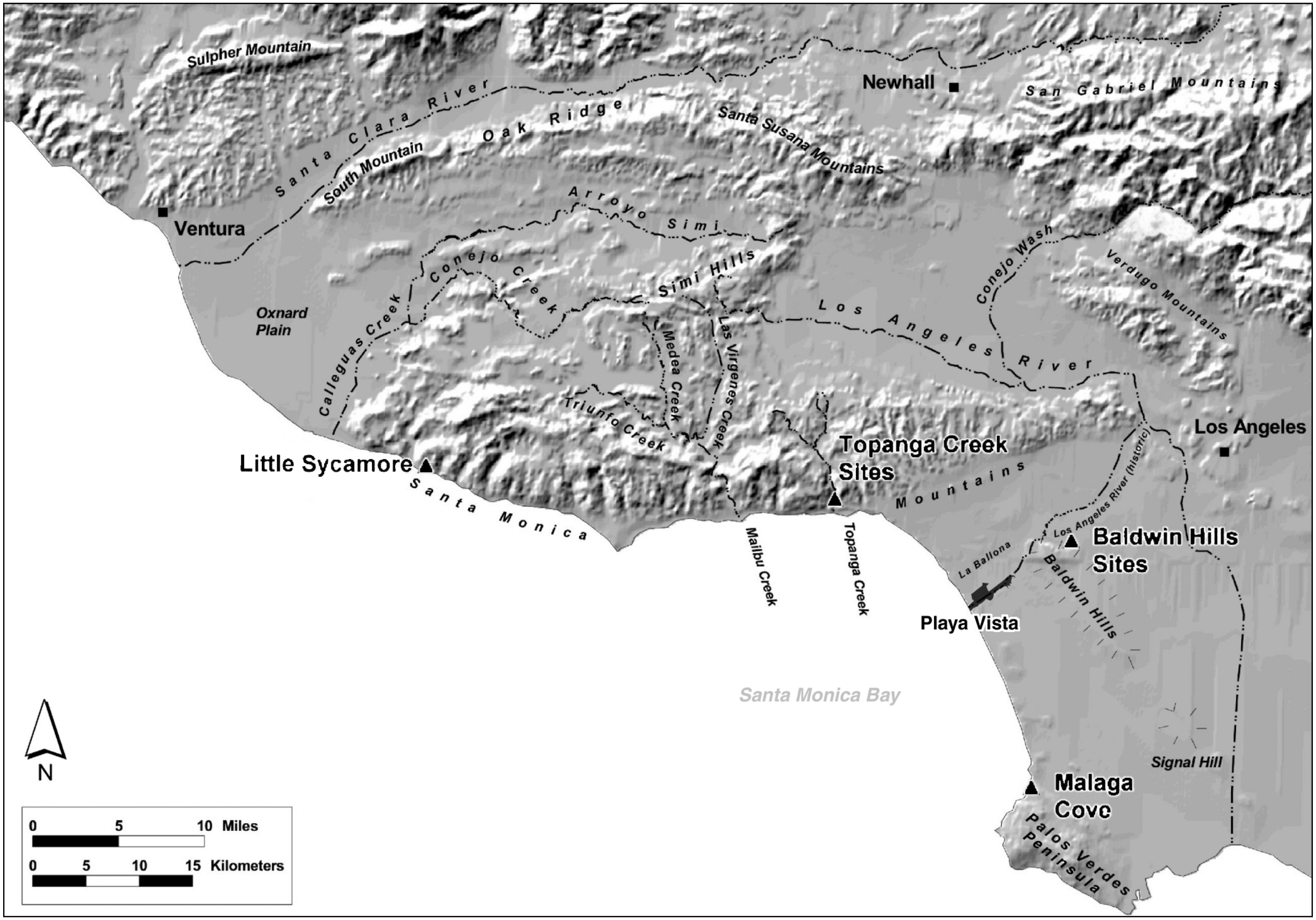

Figure 4. Major archaeological sites in the southern California coastal region.

The exact location of archaeological resources and sites are not subject to public disclosure to prevent harm and unauthorized disturbance of the resources and sites, pursuant Section 5097 of the California Public Resources Code and Section 800.11 of the National Historic Preservation Act, as amended. Therefore, this figure has been excluded.

the La Brea Tar Pits site (LAN-159), the Haverty or Angeles Mesa site (LAN-171), the Los Angeles Man site (LAN-172), and LAN-271. Three of these sites are depicted spatially in Panel A of Figure 6, a map of the Ballona region through time. Questions revolving around the dating of these sites have made their antiquity suspect, however. For example, the early Holocene age of LAN-271 is based on marine shell now thought to have been contaminated by fossil shell (Erlandson 1994:222). A short review of these sites explains the circumstances which have fostered this uncertainty.

Reports of evidence of "Early Man" in Los Angeles were heralded as a major discovery in 1914, when human remains were found in the Rancho La Brea Tar Pits (LAN-159) in general association with the bones of extinct animals (Merriam 1914). Assuming the remains to be contemporaneous with Pleistocene Rancholabrean fauna, this find spawned the sensational notion that human occupation of southern California extended back as far as 34,000 years B.P., clouding serious investigation for years to come. Radiocarbon dates on archaeological materials (Table 2) have brought the range into the more reasonable span of 9000–4450 B.P.; nevertheless, problems inherent in dating bone-collagen extract and in decontaminating samples taken from a tar seep still suggest these dates should be regarded with caution. Contamination of the skeletal material from oil impregnation cannot be ruled out (Erlandson 1994:222).

The discovery of deeply buried human skeletal material by construction workers for the Haverty Company in 1924 at Angeles Mesa (LAN-171) in the Baldwin Hills (Stock 1924) provided more fuel for the debate. Skeletal remains of at least eight individuals—three males, three females and two subadults of indeterminate sex—were uncovered in close association at this site at depths between 5.8 and 7 m (19.03 and 22.97 feet) (Brooks et al. 1990). Bone awl fragments, a quartzite core tool, and some freshwater gastropods were found near the skeletons in the marshy area at the base of the Baldwin Hills. The depth of the finds and the partial mineralization of some of the bones suggested to Stock (1924) that the remains might be Paleoindian; a subsequent amino-acid racemization (AAR) age estimate of more than 50,000 years made some sixty years later seemed to confirm this conclusion (Taylor et al. 1985:137). In 1936, a third discovery of a so-called Early Man was made: a single skeleton, dubbed "Los Angeles Man," was uncovered two miles west of Angeles Mesa (at LAN-172) in a similar stratigraphic context to mammoth bones (Lopatin 1940). By this time, even some of the early skeptics were convinced.

These finds thrust the topic of Early Man in the Los Angeles Basin into an era of controversy from which it has only recently begun to emerge, as more reliable radiocarbon dates have become available. Conducting the first comprehensive, multidisciplinary review of the Angeles Mesa remains, Sheilagh Brooks and her colleagues (Brooks et al. 1990) subjected the bones to new conventional (decay-counting) ^{14}C dating, then obtained a suite of accelerator mass spectrometry (AMS) dates from noncollagen organic bone (osteocalcin) components as a cross-check. Table 2 presents the age initially ascribed to the remains of Early Man at the time of discovery, more-recent AAR age estimates, and the most current revised radiocarbon dates.

The wide range of dates and disparate results depend on the technique used and indicate that dating issues for these sites remain unresolved. Haverty Man No. 4, for example, is apparently anywhere from 3,870 ± 350 to 15,900 ± 250 years old, a span that exceeds an acceptable margin of error for radiocarbon dates. As to their significance, Brooks et al. (1990:80) felt that "the assumption that all of the Haverty skeletons are of similar age also may need to be reassessed," to which Erlandson countered, "It is hard to imagine that the burials are not temporally related" (Erlandson 1994:223). Without additional data about their original context, not likely to be obtained at this late date, or a new series of more reliable dates, the meaning of the Haverty skeletons remains in limbo.

The Malaga Cove site (LAN-138) figures importantly in the discussion of early Holocene adaptions in the Los Angeles area, but its inclusion on the list of Paleocoastal sites is questionable. A multicomponent site located on a bluff overlooking the Santa Monica Bay just north of the Palos Verdes Peninsula, Malaga Cove was "sampled" by collectors such as F. M. Palmer as early as 1906 (Palmer 1906). Two loci at Malaga Cove were first systematically excavated by Richard Van Valkenburgh in 1931–1932 as part of the Van Bergen–Los Angeles County Museum Expedition; however, he never published the

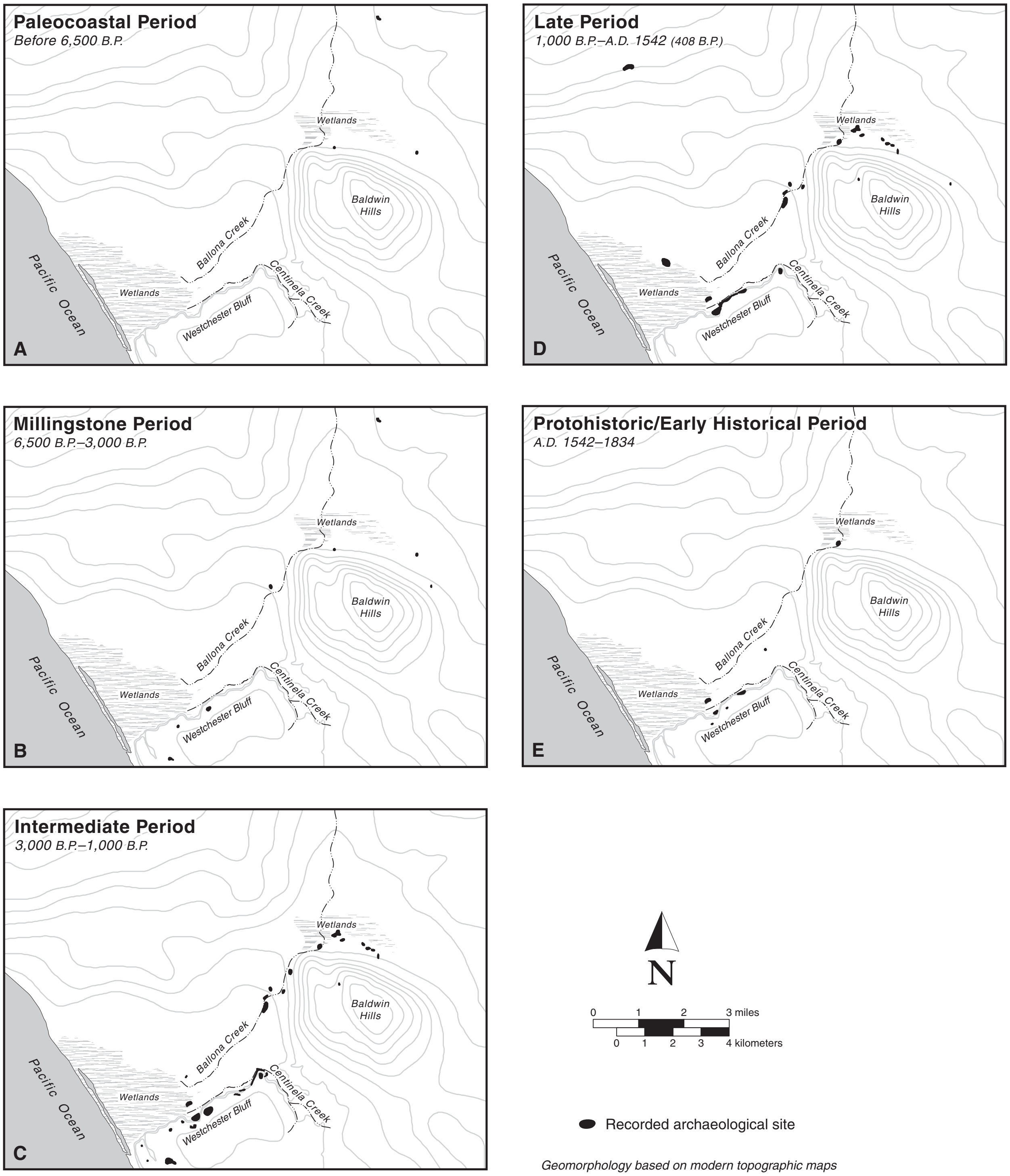

Figure 6. Archaeological site distribution in the Ballona over the last 7,000 years (Panels A–E).

Table 2. Radiocarbon Dates of "Early Man" Sites in the Los Angeles Basin

Material Dated, by Site	Original Date (B.P.)	Revised ^{14}C Date (B.P.)	Citations
LAN-159, La Brea Tar Pits site			
Human skull, skeletal material (Pit 10)	11,000– 34,000	9000 ± 80 (UCLA-1292BB)	Merriam 1914; Berger et al. 1971
Human bone collagen (Pit 10)		12,650 ± 160 (UCLA-1292B)	Dillon and Boxt 1989
Broken wood atlatl dart foreshaft (Pit 67)		4450 ± 200 (LJ-0121)	Payen 1970
LAN-171, Angeles Mesa/Haverty site			
Skeleton #1, organic fraction	4700 ± 600 (AAR)	5280 ± 180 (UCR-1349D)	Brooks et al. 1990
Skeleton #1, osteocalcin		5540 ± 230 (UCR-3083/CAMS-439)	Brooks et al. 1990
Skeleton #2, gelatin fraction	41,000 ± 1500 (AAR)	2730 ± 190 (UCR-3084/CAMS-445)	Brooks et al. 1990
Skeleton #2, osteocalcin		4630 ± 260 (UCR-3087/CAMS-438)	Brooks et al. 1990
Skeleton #3, femur collagen	43,000 ± 500	10,500 ± 2000 (UCLA-1924)	Taylor 1983; Berger and Protsch 1989
Skeleton #4, gelatin fraction	24,000 ± 1,500 (AAR)	3870 ± 350 (UCR-3086/CAMS-440)	Brooks et al. 1990
Skeleton #4, bone		5200 ± 400 (GX-1140)	UCR 1986; Brooks et al. 1990
Skeleton #4, bone		7900 ± 1440 (UCLA-1924A)	Berger et al. 1971; Brooks et al. 1990
Skeleton #4, osteocalcin		12,600 ± 460 (UCR-3088/CAMS-433)	Brooks et al. 1990
Skeleton #4, gelatin fraction		15,900 ± 250 (HA-104B)	Brooks et al. 1990
Skeleton #5, gelatin fraction	22,000 ± 600 (AAR)	4710 ± 190 (UCR-3089/CAMS-441)	Brooks et al. 1990
Skeleton #5, osteocalcin		11,960 ± 500 (UCR-3085/CAMS-437)	Brooks et al. 1990
LAN-172, Los Angeles Man site			
Bone collagen, amino acids	23,600 (UCLA-1430)	3560 ± 220 B.P. (AAR)	Bada 1985; Davis 1976; Lopatin 1940

Note: AAR, amino-acid racemization; CAMS, Center for Accelerator Mass Spectrometry, Lawrence Livermore Nuclear Laboratory, Livermore, California; GX, Geochron Laboratories, Inc., Cambridge, Massachusetts; LJ, University of California, San Diego, (La Jolla); UCLA, University of California, Los Angeles; UCR, University of California, Riverside.

results of this work. As Wallace commented, "It is a great pity that Van Valkenburgh never got around to reporting the results of his investigations, for he found some unique materials and his field notes indicate that he had some good insights into local prehistory" (Wallace 1984:1).

In 1936–1937, Edwin F. Walker of the Southwest Museum began excavation at Malaga Cove (LAN-138) (Walker 1937, 1952). Walker identified four discrete occupational strata in the 28-foot- (8.5-m-) deep sequence; the stratum of interest in the search for Early Man was the lowest of the four, about a meter (3 feet) thick, which he labeled Level I. Walker called the Level I occupants of the site "the Scraper People," believing them to belong to the Paleocoastal period (Walker 1937), which Wallace (1984) later endorsed by equating them with the San Dieguito culture. Both men based their conclusions on an analysis of the artifacts found—specifically, small chert drills that Walker called "microliths," worked shells, flaked and core tools, "rude scrapers," and two crude, leaf-shaped bifaces. Bone and shell artifacts were relatively abundant in Level I, as were shell beads (primarily spire-removed *Olivella*) and bone beads, but milling stones were entirely absent (Walker 1952).

Subsequent radiocarbon dating at Malaga Cove produced a series of dates ranging from 215 ± 80 B.P. (UCLA-1008A) on material from a disturbed area of the site to 7130 B.P. (UCR-1196) on a shell bivalve (Breschini et al. 1992:14). The oldest date was obtained from a shell removed from the sea cliff in an unknown stratigraphic context, throwing its accuracy in some doubt (Erlandson 1994:224). The possibility exists that what Walker labeled as Level I at Malaga was not a discrete deposit. Careful examination of photographs taken during Walker's excavation (Braun Library, Southwest Museum, Walker Papers, Nitrate Box 17) indicate significant bioturbation in Level II at its contact with Level I. In the absence of radiocarbon dates from a secure stratigraphic context, the antiquity of Level I at Malaga Cove remains in doubt.

Millingstone Period

The Millingstone period, sometimes referred to as the Early period, is currently conceived as a 3,500-year span, beginning with the stabilization of sea levels about 6500 B.P. and ending with the first dramatic increase in regional human population around 3000 B.P. (see Panel B, Figure 6) Although six radiocarbon dates from the Angeles Mesa site extend into the Paleocoastal era prior to 7100 B.P., the majority of dates are significantly more recent, ranging from about 5685 to 3560 B.P. If accurate, these later dates place the Angeles Mesa site (LAN-171) more firmly within the Millingstone period. Other important sites with Millingstone components that helped define the period include LAN-1, known as the Tank Site (Treganza and Bierman 1958), and VEN-1, the Little Sycamore Site (Wallace 1954; Wallace et al. 1956; see Figure 4).

Although probably not representative of the early Paleocoastal period as discussed above, the Malaga Cove site (LAN-138, see Figure 4) was clearly occupied during the Millingstone period. A second radiocarbon date of 6510 ± 200 B.P. (Hubbs et al. 1960:201) obtained from a shell sample (*Chione* sp.) places the lowest levels at the Malaga Cove site at the beginning of the period. Millingstone implements from Malaga's Level 2 included large amounts of ground stone, cobble hammers, choppers, a few mortars and pestles, large coarsely flaked projectile points, and knife blades; virtually no shellfish or fish remains were found in Level 2 (Walker 1952:51–60).

Wallace, who studied the Malaga Cove site extensively, expressed complete confidence in the antiquity of the site and accepted Walker's analysis of Level I as belonging to the San Dieguito tradition (Wallace 1955). Wallace further asserted that the shell date of 6510 ± 200 B.P. was recovered from in situ material from Level I (Wallace 1984). Hubbs, however, stated that this shell came from the "next to lowest horizon," which would have been Level 2 (Breschini et al. 1996:14). The chronological context of Level I remains uncertain.

In 1984, Wallace published what amounted to an archaeological obituary for Malaga Cove and three other important coastal sites in the South Bay district of Los Angeles. He reported that all four had been destroyed by construction projects. Malaga Cove, "the most conspicuous and well-known" of the four, had been first to go, "leveled in 1955 to make way for a residential development" (Wallace 1984:1). Closing his article on an optimistic note, Wallace asserted that, although the South Bay sites themselves were gone, "good opportunities for future research still exist" because the artifact collections and field notes were still available.

Three years later, D. L. True (1987) responded to Wallace's assessment with somewhat less enthusiasm for the value of museum collections. The focus of True's article was to present an abbreviated catalog of artifacts he had recovered from Malaga Cove in the mid- to late 1930s. True's collection, recovered from a stratum he felt was comparable to Walker's uppermost Level IV, consisted of small projectile points, knife-like implements, fish hook blanks, slate files, a few bone tools, and a handful of shell beads. After attempting to piece together the stratigraphy at Malaga Cove and struggling with the site formation issues he encountered, True concluded that his work served "primarily to provide additional descriptive data to a poorly known archaeological situation and add still another level of confusion to the interpretation" (True 1987:281).

The research potential of the Malaga Cove collections remains an open question. No complete report exists of Walker's 1937 excavation, the site boundaries were never defined, the artifacts collected have not been completely analyzed, and too few radiocarbon dates have been run to define the temporal placement of the levels. As one of the few deeply stratified sites ever found in the Los Angeles Basin, LAN-138 deserves a thorough reevaluation.

Millingstone period sites have also been discovered in the Ballona, on the bluff tops above the current project area and east near the Baldwin Hills where ephemeral camps were located near an inland swamp later known as Las Cienegas. Early archaeological surveys of this area identified a series of 15 sites in the upper Ballona with artifact collections that included cogged stones, a few large projectile points, and large numbers of ground stones (Farmer 1934, 1936; Rozaire and Belous 1950). The Angeles Mesa site (LAN-171) is among this group of sites.

Evidence of occupation of the lower Ballona during the Millingstone period is scarce; no sites from this time have yet been found on the lagoon edge where well-developed marshes were then absent. Two sites on the bluff above the lagoon, LAN-61 and LAN-206, have yielded radiocarbon dates that fall within the early Millingstone period. A single uncorrected radiocarbon date of 6750 ± 80 B.P. on a shell valve (*Chione* sp.) recovered from 50–60 cm below the surface at the Berger Street site (LAN-206) is the earliest from any site on the bluff tops (Van Horn and White 1997c:19). Another uncorrected date of 4710 ± 80 B.P. on a shell sample from the Marymount site (LAN-61A) falls within this time frame (Van Horn and Murray 1985). Millingstone period use of the bluff, however, is probably more widespread, as suggested by the surface finds of artifacts such as crescents, discoidals, and Lake Mojave–style projectile points (Lambert 1983).

Van Horn and White (1997c) argued that the occupants of the Millingstone period component (Component A) at the Berger Street site fished and collected shellfish in the nearby Ballona estuary. The paucity of tools and faunal remains in the midden is consistent with a short-lived campsite; presumably individual occupations did not last more than a few weeks at any one time. The picture that emerges is one of brief forays to the lagoon from campsites on the bluff tops overlooking the bay. In small mobile groups, Millingstone period residents of the Ballona exploited nearshore and lagoonal fish and shellfish. The absence of potable water would have discouraged permanent settlement on the bluff. Suitable conditions for permanent settlements might have existed in the Baldwin Hills.

Many questions remain about the Millingstone period in the Ballona. The dating of cultural materials from this period continues to pose a methodological and interpretive challenge. Shell was used for radiocarbon assays at LAN-61 (Van Horn and Murray 1985), and although the species was not identified, it was probably *Chione* sp. Most archaeologists in southern California use this shell for radiocarbon dating because the size of the shell allows a sample to be obtained from a single shell, as opposed to combining shell pieces found in various proveniences. Using this species to identify Millingstone period sites may be problematic, as current studies of mollusks from our coring program indicate that *Chione* and estuarine species were not well established in the wetlands prior to 6500 B.P. Thus Van Horn and his colleagues might have dated occupations coeval with the origin of the marsh or maturation of the estuary rather than the initial human occupation of the Ballona. Although they are few in number, the presence of temporally diagnostic artifacts such as Lake Mojave projectile points, crescents, and discoidals supports the model of human use of the region predating the radiocarbon assays by possibly 2,000 years (Altschul et al. 2003).

Intermediate Period

About 3000 B.P., the Ballona received an influx of settlers. Stability in settlement patterns, economic activities, mortuary practices, and technology suggest that this distinct occupation lasted until around 1000 B.P., defining the Middle or Intermediate period (see Panel C, Figure 6). The Intermediate period at Malaga Cove (LAN-138) is represented by artifacts, such as implements for fishing and sea-mammal hunting, found in the upper portion of Level 3. Intermediate period occupation at Malaga Cove, thought to date to around 1450 B.P., is also characterized by big stone mortars and pestles, abalone shell fishhooks, bone harpoon barbs, chert knives and scrapers, steatite vessels, and shell ornaments. These artifacts mark the beginnings of maritime exploitation at the site (Walker 1952; Wallace 1984).

In the Ballona, 10 Intermediate period archaeological sites have been identified through radiocarbon dating, and is the best documented portion of the prehistoric epoch in the area. Within the Playa Vista project, there are five Intermediate period sites. Four sites, LAN-60, LAN-62, LAN-193/H, and LAN-2768, are located at the base of the bluff along the banks of Centinela Creek, whereas LAN-2676 sits at the lagoon edge. Tested in 1999, LAN-2676 was a short-term resource-processing site located in a disturbed context (Altschul et al. 1998). Outside the Playa Vista property, there are five large midden sites that sit above the Ballona Lagoon (LAN-59, LAN-61, LAN-63, LAN-64, and LAN-206), occupying almost every elevated point along the edge of the Westchester Bluff. These sites contain relatively thick deposits, all of which have yielded radiocarbon dates within the Intermediate period (Altschul et al. 1999).

Two basic questions concerning Intermediate period occupation have guided our research in the Ballona: first, what accounts for the increase in settlement during this period, and second, what is the nature of the relationship between the bluff-top sites and the lowland sites? In pursuit of an answer to the first question, previous researchers have hypothesized that some Intermediate period cultural traits indicate the arrival of people from the desert (Van Horn 1987). These traits include tanged projectile points, cremation of the dead, and a lack of shell artifacts. The preference of stone over shell as a raw material for making beads suggests the presence of people without a strong maritime tradition.

Recent investigations have examined the microlith industry and the presence of desert-style projectile point types during the Intermediate period as expressions of a cultural tradition unique to the Ballona (Altschul et al. 2003). Artifacts referred to as microliths were found at Malaga Cove in Level I (Wallace 1984); these artifacts are scarce at large Intermediate period sites such as ORA-83 in Bolsa Chica (Whitney-Desautels 1986a) or ORA-64 in Newport Bay (Macko 1998). This distribution suggests a directed migration toward the Palos Verdes Peninsula. The question of desert migrations during the Intermediate period has been discussed by several authors (Altschul and Grenda 2002; Altschul et al. 2003; Ciolek-Torrello and Grenda 2001; Koerper 1979; Kowta 1961; Kroeber 1925; Moratto 1984; True 1966; Van Horn 1987, 1990). Most have suggested that an arrival date of around 1450 B.P. is consistent with the data; however, a few have argued for a much earlier migration. Both may be right. It is possible that multiple migrations took place over hundreds, if not thousands, of years.

Contrasting characteristics within the faunal collections serve to illuminate the relationship between Intermediate period bluff-top and lowland sites in the Ballona. At bluff-top sites, faunal collections are dominated by lagoonal fish species with few terrestrial mammals, whereas the lowland sites show the opposite pattern. Also puzzling are the low proportions of estuarine mollusks found at lowland sites, in contrast to bluff-top collections, which show a greater dependence on shellfish.

Several hypotheses have been developed to address the questions raised by the archaeological data (Altschul et al. 2003; Ciolek-Torrello and Grenda 2001). Differences in faunal collections between bluff-top and lowland sites may relate to dating issues. Perhaps the bluff-top sites date to the early part of the Intermediate period, whereas lowland sites date to the latter part. This pattern would be consistent with a maturation of the estuary later in the Intermediate period. Radiocarbon dates from both bluff-top and creek-edge sites, however, do not support this argument: sites in both locations appear contemporaneous.

A second set of hypotheses aimed at explaining differences between the structures of the bluff-top and lowland sites relates to the types and numbers of groups who occupied these areas during the Intermediate period. One hypothesis postulates that two distinct social groups occupied the Ballona at different times of the year as part of their seasonal round. Each of these groups had different adaptations to wetlands, thus explaining the differences in the faunal collections. A second hypothesis suggests that the archaeological record could also be the result of two similar adaptive strategies derived from different settlement systems. Perhaps a single social group, while living permanently at the Ballona, moved its settlements seasonally to exploit various resources. Alternatively, permanent settlers of the Ballona might have been diffused into smaller groups and dispersed along the creek edges and on the bluff tops as part of one social system. In any case, the archaeological signatures might look very similar.

A third hypothesis envisions the archaeological record as the result of decision making by one group who returned to the Ballona seasonally and faced differing environmental conditions that would require residence on either the bluff tops or the creek edges. As historical accounts and records have shown, the highly variable nature of Ballona and Centinela Creeks would have strongly influenced where people would have been able to reside at different times of the year (see Chapter 5, Table 5). It is possible that Intermediate period bluff-top sites represent occupations that occurred when a catastrophic event, such as a flood, inundated the marshlands and flushed the estuaries, making the lowlands uninhabitable and damaging or removing the shell beds and other estuarine species. Ballona dwellers would have been forced to shift their residences to higher ground, or possibly to abandon the area altogether for a time. During drier periods, when estuarine species were reestablished, they would have returned, moving closer to the resources. Ciolek-Torrello and Douglass (2002) discuss this in detail in relation to Great Basin wetlands subsistence and settlement patterns. Similar patterns are evident in the Great Basin, as water levels in wetlands in this region fluctuate.

Although this hypothesis has some appeal, it does not adequately account for the low dependence of Intermediate period populations on estuarine resources and the stark differences between lowland and bluff-top faunal exploitation patterns. These differences might be reconciled if the sites on the bluff were dominated by terrestrial species, whereas the sites along Centinela Creek contained an abundance of riparian species, indicating that people had resided near the resources they targeted. Such is not the case, however; the reverse is true. Bluff-top sites contain mostly lagoonal resources, whereas those sites along the creek edge are characterized by terrestrial species, some of which might have been more plentiful on the bluff.

The answer may be that bluff-top and creek-edge sites were occupied simultaneously during the Intermediate period, perhaps by migrants from the desert. The shift in settlement between Millingstone and Intermediate periods is dramatic. The Ballona, which in the Millingstone period was only marginally attractive to human settlement, experienced intensive occupation in the Intermediate period. Assessing which of these multiple working hypotheses best explains the archaeological record of the Intermediate period will be the focus of additional research.

Late Period

The Late period, beginning around 1000 B.P. and ending with European contact in A.D. 1542, was a time of tremendous population growth along the southern California coast (see Panel D, Figure 6). A greater number and variety of sites have been found that date to this period than from any other time in prehistory. The Late period component at Malaga Cove (LAN-138), Level IV, consisted of a midden more than 4.5 m (15 feet) thick containing large quantities of small, leaf-shaped projectile points; steatite bowls; mortars and pestles; bone tools; shell fishhooks; and ornaments of bone and shell (Walker 1952). Late period sites elsewhere in the Southern California Bight include fully developed villages with complex site features, suggesting a corresponding differentiation within the social system. In the Ballona, Late period sites are few, and no village sites have been discovered. Until recently, our understanding of the Late period in the Ballona wetlands was based on an analysis of relatively small sites on the periphery, such as the Hammack Street site (LAN-194) and the Admiralty site (LAN-47). Only LAN-47, located at the edge of the Ballona Lagoon, has been systematically excavated (Altschul, Homburg, and Ciolek-Torrello 1992).

Data recovery at LAN-47 revealed an occupation typical of the Late period throughout coastal California. Nearshore and estuarine species were most numerous in the faunal collection and the lithic material was dominated by flake core, split-cobble, microlith, and bipolar technologies. However, the nature of life in the Ballona cannot be assessed adequately from just one site. As Altschul et al. (2000:13) stated, “the study left larger issues surrounding Late period settlement and culture untouched. In particular, issues of settlement population or permanence have not been addressed.”

Within the Playa Vista project area, settlement appears to have moved westward along the base of the bluff in the Late period. This is the setting for LAN-211/H, located on the truncated foot slope of an alluvial fan at the base of the bluff. From the preliminary analysis of artifacts found during testing, it appears that both LAN-211/H (Stoll and Taylor 2000) and LAN-1932/H (Taşkıran and Stoll 2000a, 2000b) span the transition between the Late and protohistoric periods. Both sites contain flaked glass and glass trade beads as well as stone tools and may hold important clues about the persistence of indigenous populations into historical times.

Another larger Ballona area site, the Peck site (LAN-62), also contains Late period components. One hypothesis suggests that this site and LAN-211/H each represent a distinct locus of a single Late period community. That they are spatially segregated may reflect that social distance, although decreasing, was still apparent. The two sites may represent two social groups that were evolving into becoming a single social entity. As the size of the social group increased, the need for a political hierarchy might have emerged. Support for distinctions in social position are meager, but intriguing. Of the 67 shell beads recovered from LAN-62 in 1998, 10 were typed as *Olivella* wall disc beads (Altschul et al. 1998), which King (1974:86–87) associates with burials of political leaders at the Medea Creek cemetery (LAN-243).

Earlier excavation at LAN-62 (Peck 1947; Van Horn and Murray 1984) suggested that this site holds the key to answering many of our research questions about the Late period. The presence of a well-developed midden, a wide range of artifacts and faunal remains, and the presence of burials all suggest it may have been a village site. If future excavation confirms this hypothesis, the Ballona may fit the model popular for the Late period: that of a restricted area rich in natural resources that supported aggregated villages with 100 or more inhabitants and with small associated campsites and specialized-activity loci nearby.

If the deposit at LAN-62 represents the remains of a village, then there may be evidence to support the model of a LAN-62 community with distinct loci. Altschul and his colleagues (2003) have suggested that distinctions between loci could represent social complexity, with a hierarchy based on location within the Ballona. Another possibility is that the various site locations represent specialized-activity loci, but that the population is the same social or lineage group. Future work at LAN-62 should answer many of these questions.

Protohistoric and Early Historical Periods: Native American Occupation

The line between the Late and protohistoric periods is admittedly an arbitrary one. Protohistory is defined as beginning with European contact in A.D. 1542 and proceeding through the establishment of the Mission San Gabriel in 1771, when direct and recurrent contact began between the Gabrielino and the Spanish (Lightfoot and Simmons 1998:140) (see Panel E, Figure 6). The early historical period (also known as the Mission period) follows, dating from 1771 until secularization in 1834.

The protohistoric period is arguably the least-documented interval in all of southern California prehistory. A distinct time bias against remains from this period can be seen in the work of some early archaeologists, such as Edwin Walker, who actively pursued Early Man, but disregarded later occupants. Walker summarized the protohistoric and early-historical-period evidence he found at Malaga Cove in a single sentence: "Level 4 reached the historic stage as shown by the presence, at its very top, of a few small glass trade beads of the type introduced by Spaniards at the beginning of the 19th century" (Walker 1952:68). Similarly, scant evidence—three glass trade beads—of protohistoric occupation of the bluff tops overlooking the Ballona was found at LAN-63 (Van Horn 1987). Below the bluff, the finds are more numerous: glass trade beads and early-historical-period shell beads were recovered during testing at LAN-211/H, LAN-1932/H, and LAN-2676. Radiocarbon dates from LAN-2676, a disturbed site located at the edge of the lagoon, suggest that a portion of this largely Late period midden dates between A.D. 1450 and 1660 (Altschul et al. 1998). Although there was no Late period occupation on the bluff, a substantial occupation along the edges of Centinela Creek and the Ballona Lagoon might have been present during protohistoric times.

Sa'angna and Guaspita

Fueling the debate surrounding protohistoric and early-historical-period occupations in the Ballona has been the search for the Gabrielino villages of Sa'angna and Guaspita, reputedly located in the area. Anthropologist Alfred Kroeber (1925:Plate 57), placed the Gabrielino name "Sa'an" at the shoreline near modern Playa del Rey (Figure 7), based on information from "an old Luiseño informant" that Sa'an was located "at Ballona" (Kroeber 1907:143–144). J. P. Harrington's informant located "Saa'an" at the old Machado Ranch, farther inland in modern Culver City (McCawley 1996:61). It has never been clear from these sources whether the reference was to a geographic place-name for the general area, or to a specific habitation site. The next to publish was W. W. Robinson (1939a), who learned in an interview with longtime Ballona resident Cristobal Machado that there were two settlements of Native American laborers on the Rancho La Ballona, one near the Machado residential complex and the other at the base of the bluff below present-day Loyola Marymount University. Machado also told Robinson that the word "Guacho," sometimes written "Huacho" and shown on the eastern border of the rancho on the 1839 *diseño* (Figure 8), was a Native American term meaning "high place." Robinson felt this word referred to the Westchester Bluffs, on the southern edge of the Ballona (Robinson 1939a:104). Recent research has shown a connection between Guacho or Huacho and the Gabrielino place-name "Guaspita" (McCawley 1996:63). However, after Robinson, ethnohistoric inquiries left the existence and location of Guacho an open question, researchers choosing instead to focus on the possible location of Sa'an in the Ballona.

Robinson was followed in 1952 by John R. Swanton. In his massive volume on the Indians of North America, Swanton (1952:491) interpreted Kroeber's mention of Sa'an to indicate the location of an actual village. Ten years later, Bernice Johnston (1962), in her study of the Gabrielino, tried to reconcile Swanton's interpretation with Machado's information and what she knew of the archaeological evidence. Johnston argued that

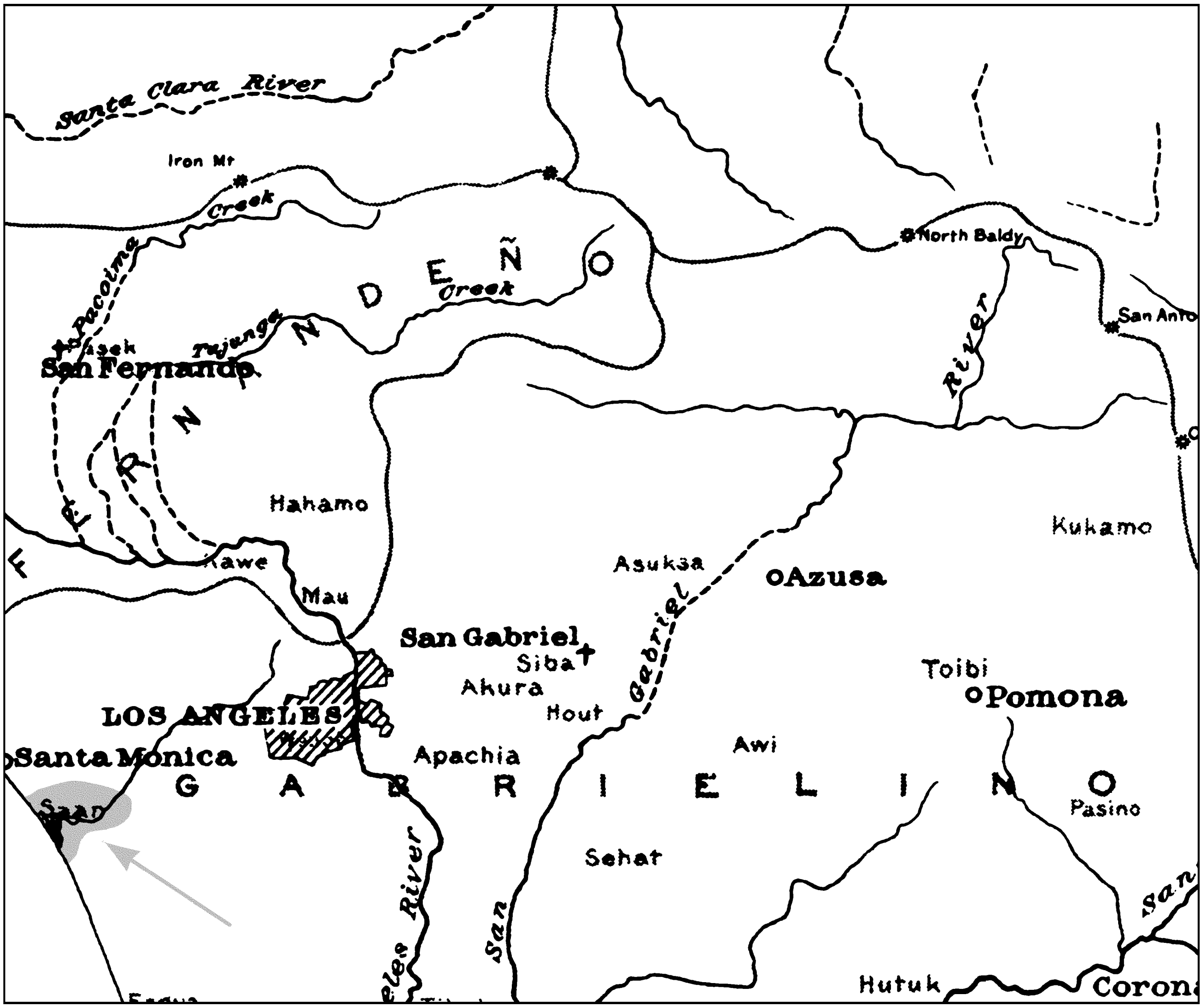

Figure 7. Location of Sa'an near the Ballona, adapted from Native Sites in Part of Southern California (Kroeber 1925:Plate 57).

> [the *rancherías* reported by Machado] were the late survivors of settlements of which archaeological surveys have found the remains of at least 14 along Ballona Creek and the bluffs to the south. One of these could perhaps have been the traditional village, *Sa-an,* root-name of a village placed by Swanton on the coast south of Santa Monica [Johnston 1962:94; emphasis in original].

Although Johnston (1962:94) conceded that "*Sa-an* does not seem to appear on the Baptismal Registers" as the name of a village, she placed "Sa'angna" on the Westchester Bluffs on her map of the Gabrielino settlements at the time of the Portolá expedition (Figure 9). It was she who added the Gabrielino locational suffix, *-gna*, to Sa'an, thereby changing what was probably a simple regional referent into the name of a specific village. Her only mention of Guacho was to repeat Robinson's information.

With the switch from geographic place-name to village, the search began for the village site of Sa'angna (Altschul et al. 2000). In 1983, King and Singer proposed to test the Peck site (LAN-62), located at the base of the Westchester Bluffs on the east side of Lincoln Boulevard, as the purported site

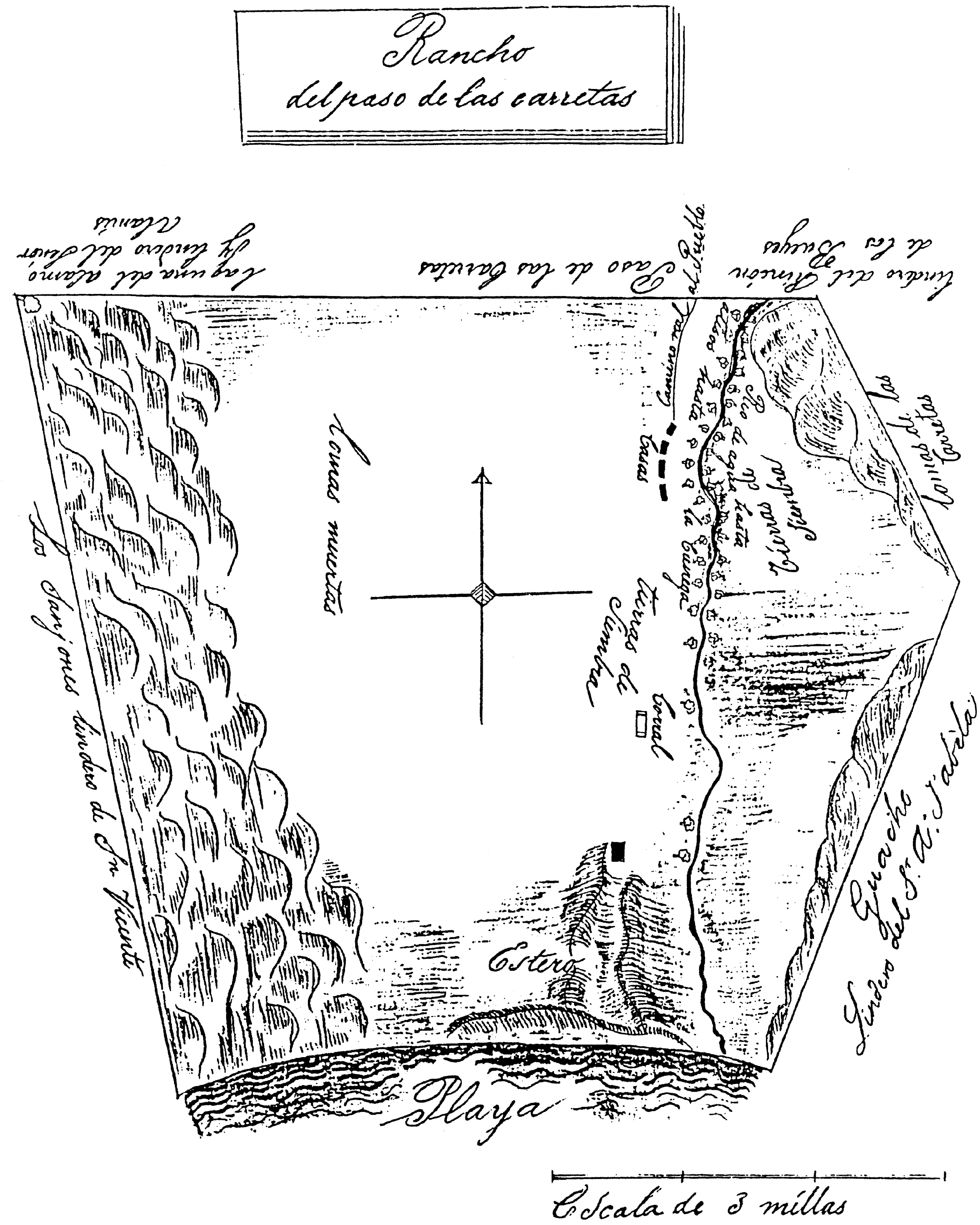

Figure 8. Location of Guacho on the 1839 *diseño* for the Rancho La Ballona (courtesy of the California State Archives, Sacramento).

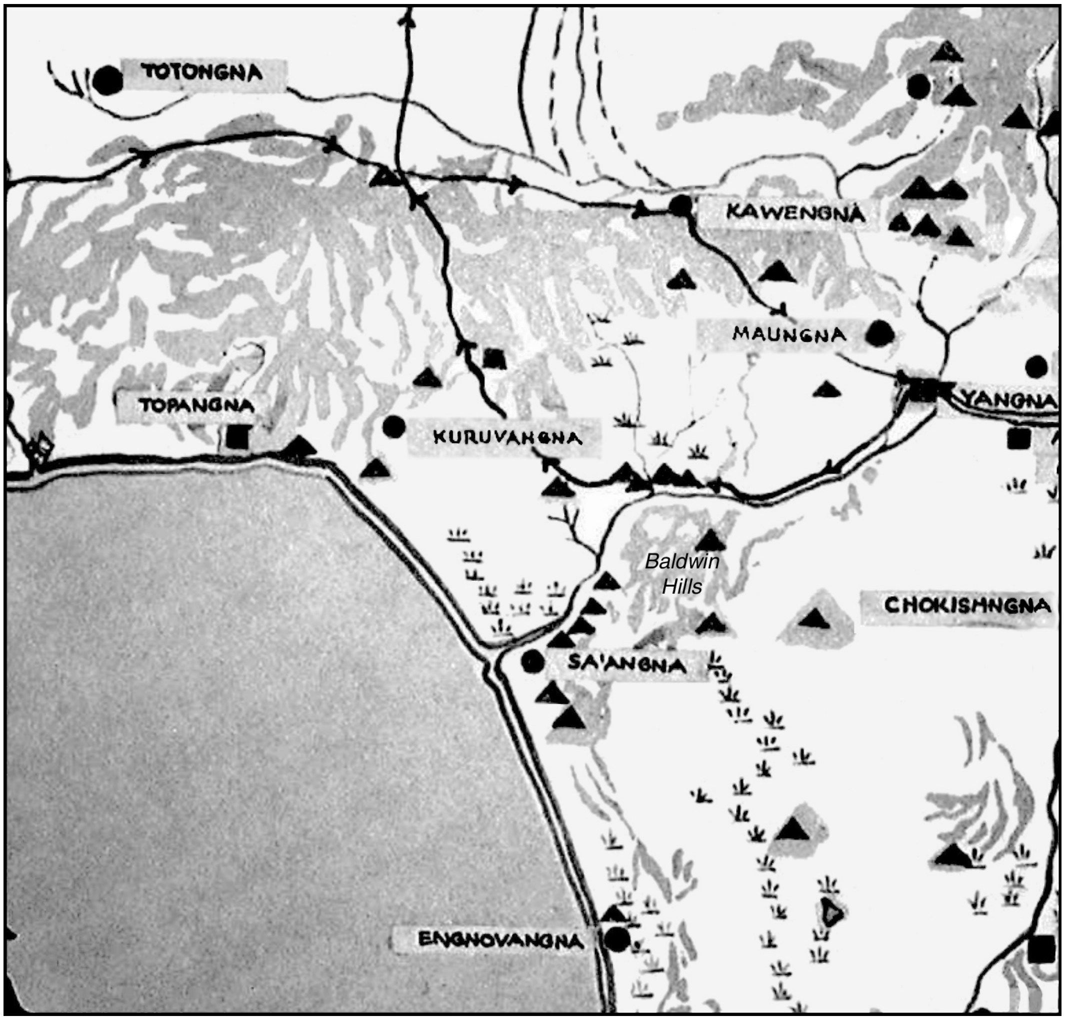

Figure 9. Location of Sa'angna, adapted from Map of the Gabrielino Area at the Time of the Portolá Expedition (Johnston 1962).

of "Suangna" (King and Singer 1983). These investigators added another layer of error when they mistook Sa'angna for "Suangna," an ethnographically known village located just north of the modern city of San Pedro. The results of their search were inconclusive.

The most thorough recent publication on the Gabrielino is *The First Angelinos* by William McCawley (1996). In this work the author examined the issues surrounding a community he labeled "Saa'anga," noting the multiple contradictory statements in the historical and ethnographic records. McCawley seemed to side with Johnston when he stated Saa'anga was located in the vicinity of Ballona Creek. He also introduced an additional source of information, the notes made in the 1930s by J. P. Harrington. According to Harrington (1978:195), the "old Machado Ranch at La Ballona was Saa'an, location of Saanat, pitch, tar" (McCawley 1996:61). Although no historical sources found to date describe tar seeps near Ballona Creek, natural oil reservoirs were likely present in the Baldwin Hills, the location of an active oil field. If Saa'anga was located at the "old Machado Ranch," its location would be east of the Playa Vista project area at the base of the Baldwin Hills, possibly the site of LAN-58. Known as the Machado site, this archaeological deposit was located on a rise of ground near the north bank of Ballona Creek, approximately 76 m (250 feet) southeast of the original Machado ranch house at 4910 Overland

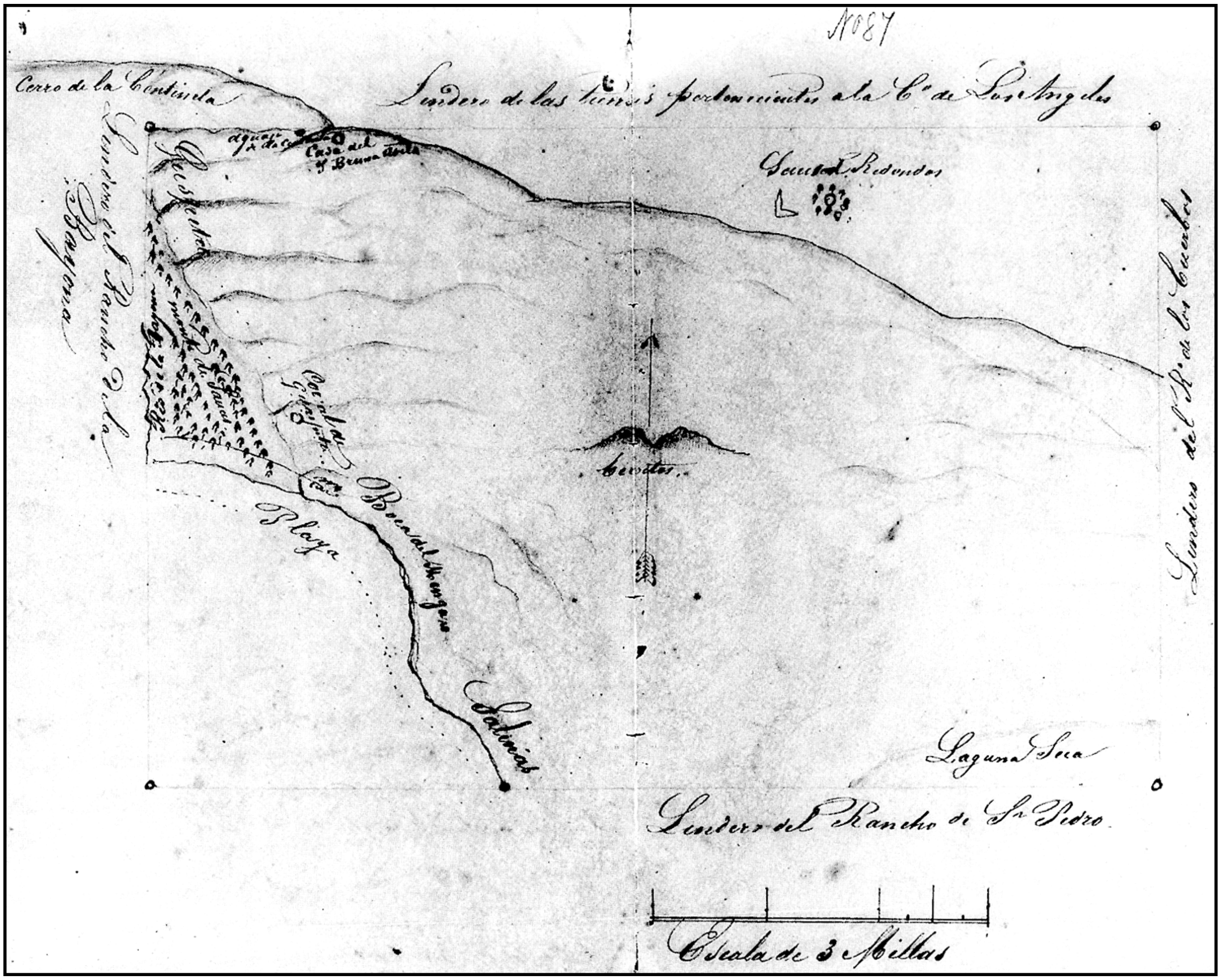

Figure 10. *Diseño* for the Rancho Sausal Redondo. Note the location of Guspita and Coral de Guspita in the upper left corner of the map (courtesy of the California State Archives, Sacramento).

Avenue, Culver City. As recorded by Rozaire and Belous (1950), LAN-58 was a village or campsite located a few hundred yards from a warm spring. The site was said to contain numerous artifacts, including mortars, bowls, whole pestles, metates, large blades, and two cogged stones. The former Machado ranch house on Overland Avenue is now gone, and the lot is covered by a multistory apartment building.

McCawley continued his discussion of Gabrielino communities in the Ballona with a section on the place-name "Waachnga." He commented that the listed variant spellings—Guasna, Guashna, Guaspet, Guachpet, Guashpet, and Guaspita—"provide an important clue to the location of this community" (McCawley 1996:61). Guaspita was the name given to a land grant received by Antonio Ignacio Ávila, which later was combined with the Salinas land grant to become Rancho Sausal Redondo, present-day Westchester. McCawley included a copy of the *diseño* for the Rancho Sausal Redondo (Figure 10), which shows the names "Guspita" and "Coral de Guspita" on the bluff overlooking the "Rio de la Bayona" (Ballona Creek) in essentially the same location as the word "Guacho" is shown on the *diseño* for the Rancho La Ballona (see Figure 8). McCawley (1996:63) suggested that "Guaspita was derived

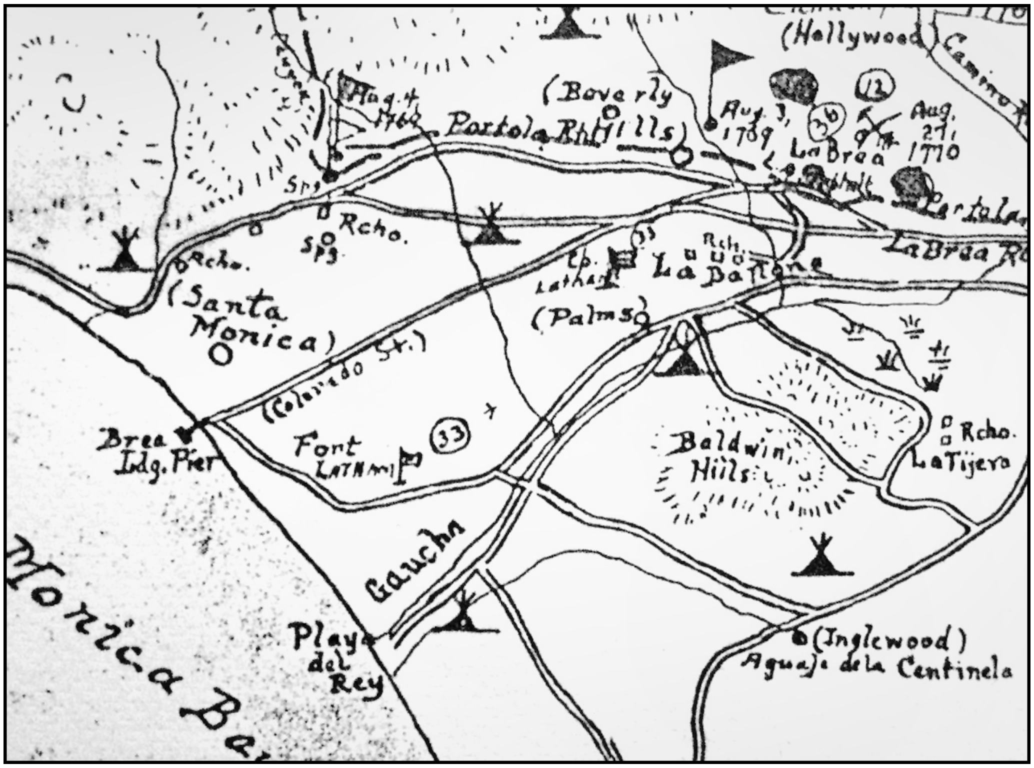

Figure 11. Location of Guacha (adapted from the 1937 Kirkman-Harriman Pictorial and Historical Map, Charles Von der Ahe Library, Loyola Marymount University).

from the earlier Gabrielino placename" of Waachnga and that the grant for Sausal Redondo included the site within its boundaries. Although he seemed to be supporting the placement of Guaspita on the bluff tops overlooking the project area, McCawley cautiously left the question of its exact location unresolved.

Evidence for the location of Guaspita in the Ballona continues to mount. A copy of the 1937 Kirkman-Harriman map, recently located at Loyola Marymount University, also shows the label "Gaucha" (or Gaucho) with the symbol for an "Indian settlement" nearby, apparently west of Lincoln Boulevard (Figure 11). The line of the cliff is not shown, but both Centinela and Ballona Creeks are clearly depicted. The symbol for the Indian settlement is placed alongside Centinela Creek, whereas the word "Gaucha" (probably a misspelling of Guacha, also rendered as Guaspita) floats to the north out in the Ballona.

Chester King (1992, 1994) provided additional information on Guaspita in his work on Native American place-names in the Santa Monica Mountains. King mentioned Guaspita in connection with an important Gabrielino village he called "Comigranga" (also written as Comicraibit, Comicrabit, and possibly Johnston's [1962] Coronababit), which was most likely located in the vicinity of present-day Santa Monica. Citing his research on San Gabriel Mission records, King stated that some of the men who lived at the villages of Comicranga and Guaspita had names with Chumash suffixes and were interrelated with the Gabrielino by marriage. About Guaspita, he reported that "this important village had a large number of ties to Catalina Island (Pimunga). No other mainland villages had as many ties with the Island" (King 1992:28). He also noted that Guaspita might have been located "near the mouth of Ballona Creek because this location would be consistent with its apparent importance as a port town, the presence of Chumash names, and its many ties to Comicraibit" (King 1992:29). In this work, King presented data on the number of people recruited by the San Gabriel Mission from villages located west of "Yanga," near the Pueblo in downtown Los Angeles. Interestingly, recruitment at Comicranga and Guaspita, which began in 1790, peaked at the same period, between 1803 and 1805, then dropped to zero in 1819. Probably not coincidentally, 1819 was the same year that the Machado and Talamantes brothers began grazing cattle in the Ballona. With the arrival of permanent ranching activities in the Ballona, the process of mission recruitment was apparently halted. King suggested that more research in the San Gabriel Mission records may prove fruitful for research into Chumash names among the Gabrielino and may reveal more about mission recruitment in the Ballona as well.

To date, few of the presumed Gabrielino settlement locations have been tested archaeologically. The exception is the bluff top above the Playa Vista project area. One of the most thorough excavations conducted in the area to date claimed to have eliminated the part of the bluff top west of Lincoln Boulevard as the location of Guaspita. As part of their West Bluff project, Van Horn and White (1997a, 1997b) examined the question of a protohistoric or early-historical-period site on the bluff. Although they found three glass trade beads dating to the late eighteenth and early nineteenth centuries at the Del Rey site (LAN-63),Van Horn and White felt the Westchester Bluffs were not plausible candidates for the location of a Gabrielino village. The Del Rey and Bluff (LAN-64) sites were characterized by poorly developed middens, suggesting temporary use. Further, radiocarbon dates indicated that the main use of the sites occurred during the Intermediate period, between 2,000 and 1,500 years ago, many years before the arrival of glass trade beads in California. Van Horn and White (1997a:5) concluded their argument against the presence of a village on the bluff top by stating,

> While it is true that a few Late Prehistoric and Protohistoric artifacts have been found on the bluff tops, these are relatively rare and usually occurred on or near the surface. No doubt, the bluffs experienced some pedestrian traffic throughout their prehistory and one must assume that Late Prehistoric and/or Protohistoric people residing below the bluffs at local sites such as LAN-62 and LAN-211 would have traveled the bluff tops from time to time. But there can be no question regarding Late Prehistoric occupation of the West Bluff [*editor's note:* LAN-63 and -64] property. Indeed, it is abundantly clear that by around A.D. 1,000 prehistoric occupation was concentrated at lagoon-side sites below the bluffs.

The hunt for Sa'angna farther north in the Ballona lowlands received renewed attention in the late 1980s and early 1990s during investigations at the Admiralty site (LAN-47), located in Marina del Rey (Altschul, Homburg, and Ciolek-Torrello 1992; Dillon et al. 1988; Stickle 1988). Much of the interest surrounding this site centered on its possible connection to Sa'angna. Through radiocarbon dating and artifactual material, Altschul, Homburg, and Ciolek-Torrello (1992) demonstrated that LAN-47 had been abandoned by A.D. 1200, more than 550 years before the Portolá expedition, and thus could not be Sa'angna. Politics overruled science, however, and the Los Angeles Cultural Historical Commission declared the Admiralty site to be Sa'angna, Historic-Cultural Monument No. 490 (City of Los Angeles Cultural Affairs Department 1994).

As part of the PVAHP, John Johnson (1991) reviewed the literature pertaining to ethnohistoric villages in the Los Angeles area. Regarding Sa'angna, Johnson (1991:1) stated,

> All the speculation regarding *Sa'angna* is apparently based on Kroeber's and Johnston's publications, which were in turn based on very late ethnographic research (probably from a single Gabrielino consultant, Jose de los Santos Juncos, who was interviewed by both Kroeber and Harrington in the early twentieth century). I have searched to no avail for *Sa'angna* in the lists of Gabrielino village names recorded in mission registers (Merriam 1968; Munoz 1982). My suspicion is that *Sa'angna* is either (1) simply a Gabrielino place-name instead of a village or (2) is the Gabrielino name for a settlement of Indian laborers associated with one of the Spanish/Mexican ranchos in the Ballona vicinity.

In sum, direct evidence of use of the Ballona and the Westchester Bluffs during the protohistoric period is quite sparse. Although documentary sources suggest that several settlements did exist during the early historical period, archaeological confirmation of such sites has not yet occurred. Excavation at LAN-211/H promises to fill the data gap for this temporal period in the Ballona.

Historical Period: Euroamerican Occupation

The broad sequence of events for the historical period (A.D. 1771–1941) in the Ballona has become well established through repetition in published sources. Until recently, lingering gaps between known significant dates have resisted the probe of historical research. As the outline of Ballona history is fleshed out through continuing archival discoveries, new areas of interest are presented for examination.

Although the location of the ethnographic Gabrielino village of Guaspita remains in doubt, the facts of Hispanic and Euroamerican immigration into the area are well established. The term "Hispanic" is used in this context to refer to the Spanish-born missionaries, to the ethnically mixed soldiers and immigrants who arrived from what is now Mexico to settle in the pueblo, and to the European-influenced culture introduced by these eighteenth-century arrivals to southern California.

When Mission San Gabriel (Figure 12) was founded in A.D. 1771, a point of no return was reached for all indigenous people in the Los Angeles Basin, as a tidal wave of social change soon overwhelmed their world. The Spanish government supported the establishment of the missions of Alta California as the preliminary step toward the subjugation, civilization, and ultimate colonization of the country. The Gabrielino were first welcoming, then resistant, but neither stance changed the outcome. The success of the padres is reflected by the more than 7,000 baptisms recorded at the Mission San Gabriel between 1771 and 1820 (Munoz 1982:5). The mission fathers worked tirelessly to both entice and compel all Native Americans to relocate onto mission lands in San Gabriel, where they were baptized and put to work as field hands and domestics.

With the rise of the Hispanic mission and rancho systems, the Gabrielino began to abandon their camps and village sites. Disease and cultural upheaval forced the native population into steep decline, and the survivors merged with other displaced populations. Between 1781 and 1831, the mean death rate was 95 per 1,000 individuals, compared to a mean birth rate of 44 per 1,000. Mean life expectancy at birth was only 6.4 years (McCawley 1996:197). Hugo Reid, a Scotsman married to a Gabrielino woman, wrote in 1852 that the result of this period of turmoil was a massive migration of the remaining Gabrielino away from their traditional homeland, many resettling as far north as Monterey (Heizer 1968). The impression has long been given in the literature that, except for the well-known pockets of aboriginal settlement around a few large ranchos and the expanding pueblo, the Los Angeles Basin was essentially empty of native peoples by the late 1850s. As will be discussed later (see Chapter 12), archaeological investigations in the Ballona at LAN-211/H may prove useful in testing this supposition.

As native Californian lifeways slipped more and more into the past, the future became the domain of Hispanic settlers newly arrived from Mexico. A scant 10 years after the founding of the Mission San Gabriel, the settlement named Pueblo de Nuestra Señora la Reina de Los Angeles was begun on the plain near what became known as the Los Angeles River. Eleven families arrived in 1781 from Sonora and Sinaloa to begin the community. Sixteen years later, the patriarch of the Machados, José Manuel, a soldier-guard stationed at Santa Barbara, moved with his large family to the growing pueblo. They were followed shortly thereafter by the Talamantes family, and these two families were to become closely associated with the Ballona over the next century. José Manuel's fifth son, José Agustín Antonio Machado, was three years old when the family moved to Los Angeles. Agustín, as he was generally known, and his close friend, Felipe de Jesus Talamantes, were employed as young men to care for the family stock herds. At times, they were accompanied on their horseback treks by their brothers, Ygnacio Machado and Tomás Talamantes, forming a partnership of four that would last for many years (Robinson 1939a).

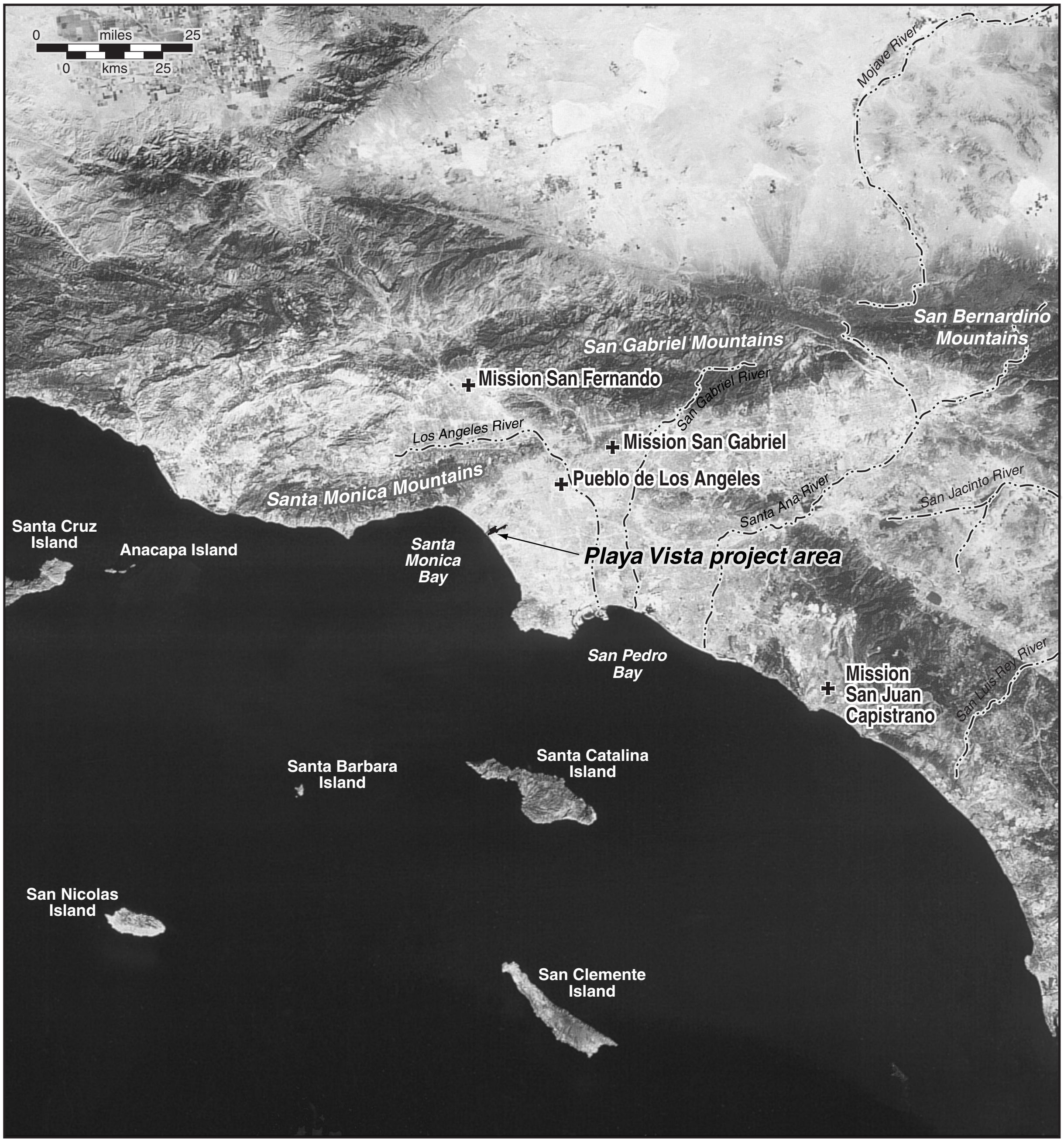

Figure 12. Satellite photograph of a portion of the Southern California Bight, with locations of land features and missions.

The Hispanic community of Los Angeles grew quickly, and soon the need to find new grazing lands for horses and cattle became acute. The Machados and Talamanteses found the land to the southwest in the Ballona to be attractive, in part because its distance from San Gabriel had kept it outside the mission's land claims. Beginning about 1819, with Alcalde Joaquin Higuera's blessing and a permit from the military commander, José de la Guerra y Noriega, the Machado and Talamantes brothers moved their stock to the area now known as Culver City. In their petition of September 19, 1839, for the grazing land that became the Rancho La Ballona (Marie 1955:52), the men stated, "we occupied, with our grazing stock, houses and other interests, the place called "Paso de las Carretas," but more generally known by the name of "the Ballona." Paso de las Carretas (or Wagon Pass) has been interpreted as corresponding to the low place between the sand hills known as the Ballona Gap. Of the road running through the Paso de las Carretas, Robinson shows it as following the path of today's Washington Boulevard (Robinson 1939a:105) (Figure 13). The common interpretation states that "the *paso* fronted on the sea astride the *rancho*'s northern boundary" (Rolle 1952:147). The term "Ballona" might have been derived from "ballena," or whale in Spanish. Although whales are not mentioned in the historical record, killer whale bone has been found in Ballona-area archaeological sites, such as at LAN-63 (Colby 1987a). Alternatively, Ballona may have derived from Bayona, the Spanish birthplace of the Talamantes family.

The statement in the grant petition referring to their occupation of the Ballona has led researchers to assume that because the brothers were grazing cattle there, the Machado and Talamantes families must have lived in the Ballona in 1819. In these early years, only one of the four ranchers, Agustín Machado, lived on the land, and he was at most a part-time resident. Documentary sources state that Agustín raised his family at his principal residence in the pueblo of Los Angeles, not in the Ballona. The first adobe that he ordered built on the Rancho La Ballona was constructed in about 1821, just northeast of present-day Overland Avenue; it was washed away in a flood about a year after its completion. The second adobe, built later in the 1820s, was located near what is now the intersection of Overland Avenue and Jefferson Boulevard (Wittenburg 1973:19); the adobe is no longer standing. Its location, entirely outside of the Playa Vista project area, is generally considered the core of the Rancho La Ballona community.

During the 20 years between 1819 and 1839, the Machado and Talamantes families made good use of their rancho, stocking it with "large cattle and horses and small cattle" and improving it with "vineyards and houses and sowing grounds" (Robinson 1939a:108). Among the crops planted were grapes, corn, pumpkins, beans, and wheat (Wittenburg 1973). Rancho La Ballona became a legal entity on November 27, 1839, when its 13,920 acres were granted to Agustín and Ygnacio Machado and Felipe and Tomás Talamantes by Governor Alvarado (Cowan 1977:18). At the time of this grant, only Agustín Machado maintained a residence on the rancho; the Talamantes brothers had established adobes on the nearby Rincon de los Bueyes, and Ygnacio Machado had moved in 1834 to the rancho he later claimed, the Aguajé del Centinela, west of Inglewood's Centinela Springs (Robinson 1939a:109). An adobe built ca. 1833 and known today as La Casa de la Centinela represents the first *Californio* occupation of this rancho (Robinson 1939a). Located on Midfield Avenue in Westchester, it is currently the home of the Centinela Valley Historical Society. Other ranchos near the Ballona were Sausal Redondo (Antonio Ignacio Ávila, claimant) adjacent to the south, and Ciénega ó Paso de la Tijera (Vicente Sanchez, claimant), 3 miles east of the project area (Cowan 1977). An adobe reputedly built about 1823 and belonging to this later rancho was used prior to World War II as the Sunset Fields Golf Club clubhouse (Parks 1928; Grenier 1978). The adobe still stands, much modified, at 3725 Don Felipe Drive, Los Angeles, and is currently occupied by the Consolidated Realty Board of Southern California, Inc.

The identity of the workforce on these Los Angeles Basin ranchos, and particularly on the Rancho La Ballona, is of special interest. The historical record clearly indicates that the Machados and Talamanteses had help with the work on the Rancho La Ballona and are likely to have given positions of authority to relatives or hired retainers. Cristobal Machado, interviewed by Robinson in the 1930s and "whose memory goes back to Indian days," recalled that "the work of the ranch was done by the local Indians, one group of whom had their huts among the sycamores not far from Agustín's home, while another group

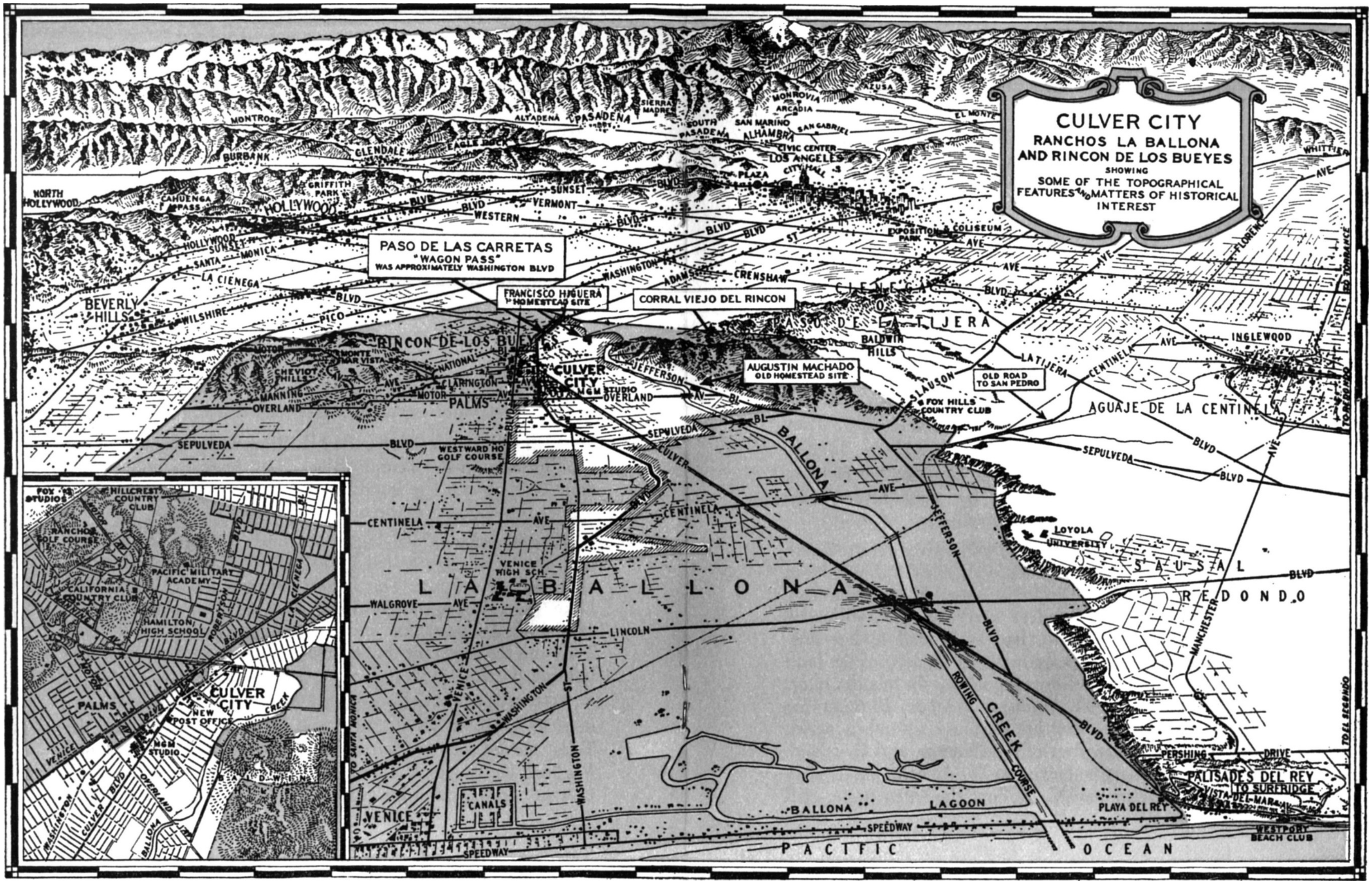

Figure 13. Outline of the Rancho Paso de las Carretas, also known as the Rancho La Ballona, superimposed on a 1939 map of the Culver City area (adapted from Robinson 1939a).

had their village against the hills beneath the present-day Loyola University" (Robinson 1939a:108–109). This latter location would place the settlement not only within the project area, but possibly at the site of LAN-211/H. No known map, not even the 1839 *diseño* of the Rancho La Ballona (see Figure 8), shows the exact location of these dwellings at the base of the bluff, although other residential structures are indicated.

At the conclusion of the Mexican-American War in 1848, Alta California was ceded to the United States, and four years later, in October 1852, the Hispanic families owning Rancho La Ballona filed their claims with the Land Commission for the confirmation of their grant. At first, the Machado and Talamantes families had smooth sailing: on February 14, 1854, the board upheld the Rancho La Ballona grant, and the U.S. District Court upheld the decision on appeal (Robinson 1939b).

The Talamantes family members did not long enjoy their ownership. The insolvency of Tomás Talamantes in 1855 and the death of Felipe in 1856 necessitated the division of their shares of the ranch and the dissolution of the Talamantes/Machado partnership. During this same period, Agustín Machado prospered. In addition to owning a large tract of land in the pueblo of Los Angeles near his town home (Wittenberg 1973:21), Machado increased his landholdings in what is now Riverside County by buying up two large cattle ranches, building adobes, and establishing family members in them. In the summer of 1855, he purchased three leagues of the Rancho Santa Rosa on what is today known as the Santa Rosa Plateau and built an adobe there, which is still standing (Nature Conservancy 2002). In 1858, Machado purchased La Laguna Rancho from Abel Stearns, a 13,339-acre property that included Lake Elsinore. At least one of the adobes Machado built on this rancho became a Butterfield stage stop (Gould 1936:46). The ranch operations were managed by his eldest son, Juan Bautista Machado; other family members also participated (Fred Machado, personal communication 2002).

By the time Agustín Machado died in 1865, he had become one of the wealthiest men in Los Angeles. His estate covered thousands of acres and included livestock, orchards, and numerous adobe dwellings. He also had control over uncounted numbers of Native American workers on his ranchos. Occasionally these were mentioned in contemporary documentation; a report from 1861 mentions native laborers living near La Laguna and "the excellent camp ground near the Machado adobe" there (Gould 1936:47). Native workers are described at La Laguna in some detail by Charles Nordhoff in 1873 (Nordhoff 1873:150). At the time of his visit to La Laguna with "Senor M." (Machado), the native residents of the rancho lived in "open shanties" within a few feet of the adobe. The Lake Elsinore and Santa Rosa Plateau areas fall within the traditional territory of the Luiseño, and the Machado family clearly lived in close association with Luiseño people.

Recent research in the Federal Population Census has revealed there could have been a connection between the Machado's Luiseño ranch workers and Rancho La Ballona (National Archives, Laguna Niguel, California, 1900 Census, T623, Roll 90). In 1900, an Indian Population Census of the "Ballona township" counted a total of three individuals, all of whom were born in Luiseño territory (two in Temecula and one at San Luis Rey). These three were employed in the Ballona township, spoke no English, and could have been brought to the Ballona by the Machados to work on one of their large farms or dairies. It is interesting to note that no Gabrielino individuals remained in the Ballona at this date.

After the death of Agustín Machado in 1865, the boundaries had still to be settled (Rolle 1952:154). Numerous heirs were granted small parcels, most of which were sold within a decade. To resolve a dispute over the boundary between Rancho La Ballona and Rancho San Vicente y Santa Monica on the northwest, the Machado heirs ended up in court. Fortunately for historical researchers, the resolution of the legal disputes required the heirs to hire professional land surveyors to map the rancho boundaries. The original maps and notes created by Henry Hancock and George Hansen during their surveys and resurveys of Rancho La Ballona have been preserved and are available for study.

The surveyors' 1868 map of Rancho La Ballona (Huntington Library, San Marino, California, Solano-Reeves Collection, Folder 12) contains useful information about land use at this time, although no development of any kind is shown within the portion covering the Playa Vista project area

(Figure 14) The surveyors' notes indicate a total of 13,919.46 acres of the rancho was divided among the heirs of Agustín Machado. Eight of the Machado heirs were named specifically and each received an allotment; a separate portion, titled simply "allotment of the heirs of Agustín Machado" consisted of 4,224.16 acres located at the base of the bluff. This portion of the rancho covers most of the Playa Vista project area, including the site of LAN-211/H. The surveyor's notes on this map describe a division of the heirs' allotment into four types or classes with total acreage for each class. First- and second-class lands, comprising 446.70 acres and 479.80 acres respectively, were deemed "irrigable" and adequate for agriculture. The largest portion of the heirs' allotment, 2654.04 acres, was designated third-class "pasture land" and included part of the Playa Vista project area; "land in the bay," the fourth-class land, covered 643.62 acres of the heirs' allotment. At the time of this survey, a large standing body of water occupied the westernmost portion of the rancho, hence the designation, "land in the bay."

The final patent to the Rancho La Ballona, with the partitions as decreed by the U.S. District Court and laid out by George Hansen in 1868, was issued on December 8, 1873. Title to the rancho was confirmed to the heirs of Agustín Machado, long after the death of the four original grantees. A further subdivision of the rancho was accomplished in 1875, after many lawsuits, with the estate of Agustín Machado receiving the largest allotment (Altschul et al. 1991).

The first settlement on the Rancho La Ballona was represented on the 1868 map by two small structures south of Ballona Creek and well to the east of the Playa Vista project area on land allotted to Andrés, José Antonio, Rafael, and Cristobal Machado. This small beginning near Ballona Creek slowly evolved into the community of "Machado," which, by 1880, was occupied by families of cattle- and sheepherders and diary farmers. The Machado brothers operated a dairy of some two hundred cows and produced "about 150 pounds of cheese per day" on the Rancho La Ballona at this time (Wilson 1959: 136). As pointed out by previous research (Altschul et al. 1991), it is likely that Machado had no distinct community center but rather was a scattering of residences along both sides of Ballona Creek beginning about one and one-half miles northeast of the project area. The location of Machado on later maps shifted with the arrival of the California Central Railroad in 1887, which used the name for one of its rail line stops (Adler 1969).

The land boom of the 1880s heavily affected the areas around the Ballona but only lightly touched that part of the rancho in the project area. Throughout the 1890s and into the early 1910s and 1920s, as the old ranchos were bought up and subdivided by new Euroamerican owners, the cities of Santa Monica, Playa del Rey, Palms, Culver City, Inglewood, Westchester, and Venice were platted and the land quickly sold off. These cities now form a circle of dense development surrounding the open space of the Playa Vista project area. The area west of what is today Lincoln Boulevard remained marshland, interspersed with small bodies of standing water; it, too, was extensively used. Through the years, the wetlands saw numerous recreational uses, such as duck hunting (Robinson 1939b:n.p.); boat racing, and automobile racing during the 1910s when a race track called the Motordrome was in place (Osmer 1996:20); and sightseeing by tourists brought by the Pacific Electric Line to Playa del Rey beach (Robinson 1939a:119).

By the 1920s, several important earth-moving projects in the Ballona had been undertaken. By 1923, channelization of upper Ballona Creek had been completed as far as Lincoln Boulevard (Foster 1991). About a year later, a trunk sewer line was laid along the bluff above the project area, followed by a maintenance road graded along the length of the line some years later. Another major project, construction of Lincoln Boulevard to the north and down the bluff, was in progress in December of 1927, as shown by an early Automobile Club photograph (Figure 15). An oblique aerial taken February 4, 1929, also shows recent grading on the slope of the road (Figure 16). Rectangular structures shown in the foreground of this photo are possibly either a pig farm or plant nursery in the area of LAN-62. All three of these construction projects buried and possibly destroyed unrecorded archaeological deposits.

The 1920s also saw the beginning of the oil boom in the Ballona. Highly profitable oil wells sprouted from the wetlands in what was known as the Venice Oil Field. In 1930, there were 325 wells in operation

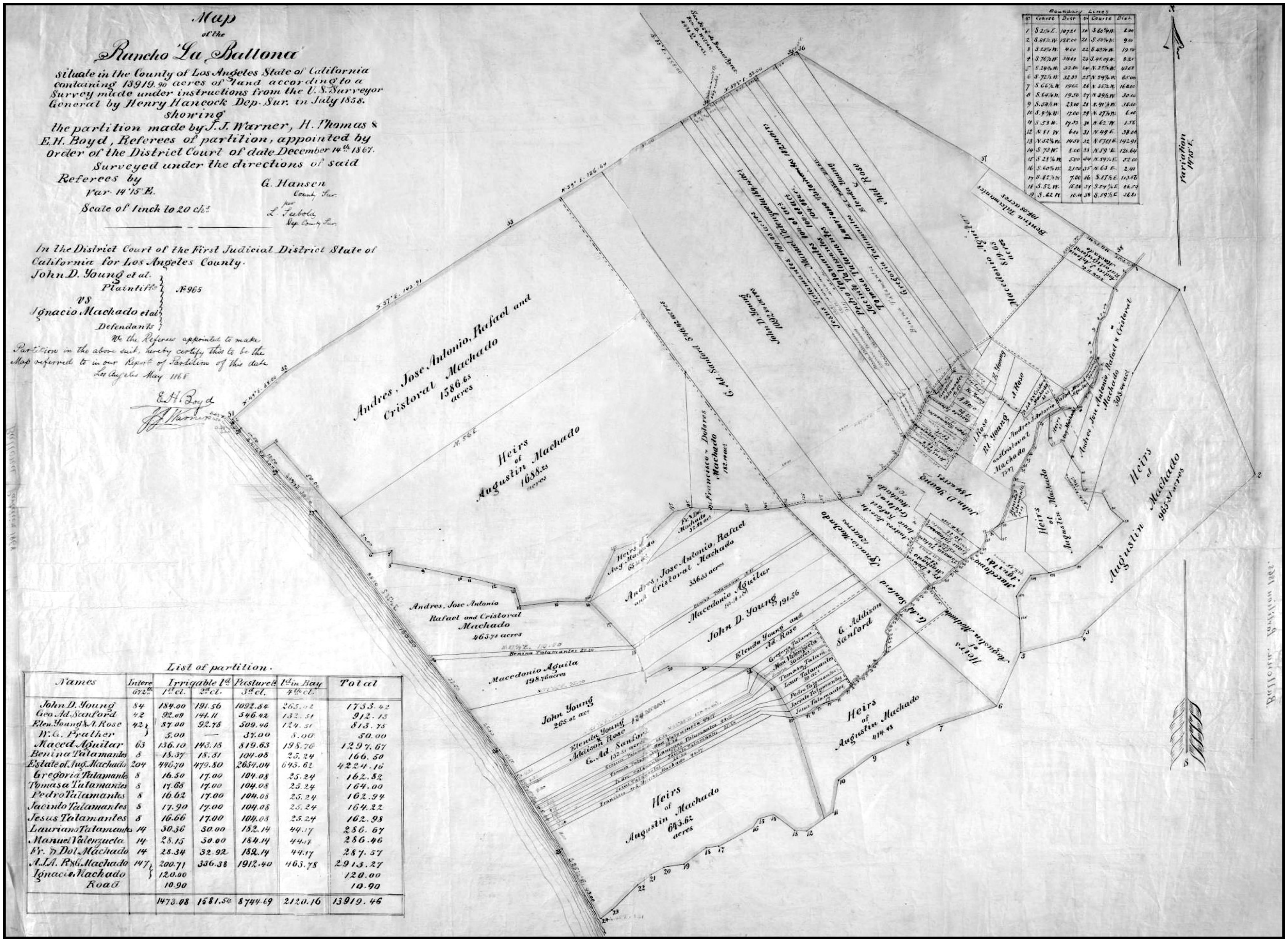

Figure 14. 1868 partition map of the Rancho La Ballona, showing the Machado heirs' allotments (reproduced by permission of the Huntington Library, San Marino, California).

Figure 15. 1927 view to the north during grading for Lincoln Boulevard above the Lincoln Gap (courtesy of the Automobile Club of Southern California Archives).

Figure 16. Oblique aerial photograph taken February 4, 1929, northeast view, showing Lincoln Boulevard and LAN-62 (Spence photograph, courtesy of the UCLA Department of Geography).

in the Ballona (Spalding 1930); most were dismantled by the 1960s. Later in the 1930s, methane gas wells joined those drilled for oil, and several were dug near what is now the intersection of Imperial and Sepulveda Boulevards (Foster 1991:1).

Throughout the 1920s and 1930s, a community of ethnic Japanese farmers leased land within the project area for growing produce (see Figure 16). According to Frances Kitagawa (Altschul et al. 1991: 83), who grew up in the project area on a celery farm, their holdings covered the area from north of Jefferson to the bluff on the south, and from Lincoln Boulevard in the west to a point east well beyond the project area. These farmers built homes and outbuildings on the project area and cultivated the land until March, 1942, when the entire ethnic Japanese population of the West Coast was relocated to detention camps (Altschul et al. 1991:84).

Hughes Aircraft Company Period

In 1940, the Ballona's most famous owner, Howard Hughes, Jr., found the empty land at the base of the bluff an ideal spot to further his moviemaking ambition (Altschul et al. 1991:86). His purchase of the land in 1941 began an era of intense development at the Ballona that lasted until 1986. With the outbreak of World War II, Hughes' interest in the property shifted to industry, and the area became the new home of his business, the Hughes Aircraft Company. The Culver City plant (a misnomer, as it was never located within the city limits) grew from a handful of wooden buildings in 1941 to become the center of a cutting-edge aerospace production facility by 1953. Hughes personally oversaw the construction of structures to house all phases of the industrial process, including administration, research and development, fabrication and manufacture, hangars and storage buildings, and all support facilities. One of the giant hangars became the birthplace of the Hughes H-4 Flying Boat, otherwise known as the Spruce Goose, the world's largest all-wood airplane. Hughes was especially adamant about the design of the runway, which was not paved in asphalt until after he relinquished active control of the business in 1953 (Altschul et al. 1991). Employment at Hughes Aircraft Company rose steadily from 621 in 1941 to 7,259 in 1959, when the company reorganized and separated into several new divisions (Greenwood and Associates 1991). In the mid-1980s, the property was sold and the buildings emptied. The landscaping of the project area was meticulously maintained until final abandonment in 1986. In 1991, 22 of the original company structures, representing the heart of the Hughes Aircraft Company domain, were recorded in detail and eligibility determinations for listing in the NRHP were prepared (Greenwood and Associates 1991).

The establishment of Marina del Rey in the 1960s led to a further evolution of the area into a recreational destination. Today, the region boasts a diverse economy, ranging from movie production to light industry. The Westchester Bluffs have become fashionable and desirable as an upscale residential development close to the booming commercial heart of the South Bay corridor.

Previous Impacts to the Study Area

Hundreds of years of human use inevitably scarred the Ballona; nevertheless, impacts to such a dynamic landscape are sometimes hard to decipher. Within the Playa Vista project area, intensive testing with cores and bucket augers can be insufficient to demonstrate whether archaeological deposits are intact. For example, based on a series of cores and bucket augers at LAN-2676, we argued that the site was intact (Altschul et al. 1998). Later hand excavations at the site, however, demonstrated that it had been mechanically flipped or moved from a nearby location, or both. Although we had anecdotes about sites being moved (e.g., Peck 1947), this was SRI's first direct field documentation that massive earth-moving activities had taken place at Playa Vista.

As a result of our finds at LAN-2676, it became clear that we must reconstruct past land modifications in the Playa Vista area. Overlying a naturally complex environment, land-altering activities were sometimes so extreme as to have moved entire archaeological sites, such as LAN-2676 and LAN-1932/H. In the process of disturbing the land, many of these activities not only destroyed prehistoric sites but also created historical ones (Hampson 1991).

Documents were examined specifically for evidence of impacts to the Playa Vista project area east of Lincoln Boulevard, south of Bluff Creek Drive (formerly Teale Street), and directly below the bluff. The results are presented to examine the issue of site integrity at Playa Vista. In general, badly disturbed or damaged sites are likely to have lost their integrity and have become ineligible for listing in the NRHP; thus, an assessment of postoccupational impacts is essential. In this chapter, we divide these land modification activities into three types of impacts: those from Rancho La Ballona in the historical period, from farming and early industry following the end of the rancho, and from the Hughes Aircraft Company.

Impacts during Rancho La Ballona

Until recently, the only written account of habitations within the Playa Vista project area prior to the arrival of Japanese celery farmers in the 1920s was the reference to "brush-and-mud huts" made by Native American ranch hands "against the hills beneath the present-day Loyola University" mentioned by Robinson (1939a:104). No further information about these huts has been found in any other source, nor have the huts appeared on any known map or in any historical photograph. The source of this information, Cristobal Machado, would have had to have been a very old man in 1939 to have seen these huts himself. Attempts to verify this account continue.

Recently, however, new information about three structures at the base of the bluff in the 1870s was located in the archives at the Huntington Library in San Marino. Surveyor George Hansen's field maps and notes from 1875 contain a description of his resurvey of Henry Hancock's original boundaries of the Rancho La Ballona (Huntington Library, Solano-Reeves Collection, Box 5, No. 87). Hansen's longhand, pencilled notes detail his survey of the southern border of Rancho La Ballona and include careful drawings and sketch maps of the land below the bluff between survey stakes. To create Figure 17, Hansen's field information are superimposed onto a map made circa 1895 of the boundary between the ranchos Sausal Redondo and Ballona (Solano-Reeves, Box 25[10], Huntington Library). The survey points on this map match Hansen's 1875 stations.

According to notes that accompany the sketch maps, on November 12, 1875, the survey crew began chaining at "the largest rock on the point of the hill" (their Station 5) and headed west toward the ocean. After careful examination of earlier notes in the sequence and a cross-check with surveyors' stations recorded on other maps (for example, Figures 10 and 11 in Altschul et al. 1991), it is clear that this "point of the hill" (Station 5) corresponds to the bluff at LAN-2768, near Playa Vista's gate on Bluff Creek Drive, off Centinela Avenue. As the surveyors measured the distances between stations, their landmarks were described in the notes and shown on the accompanying drawings. Due north and slightly west of Station 5, an unlabeled rectangular structure was shown on a sketch map. The notes described this as "the brushhouse of Jose Armiendo" (or possibly "Armiendz"). A short distance west, opposite "the mouth of Cañada," another rectangular structure was indicated, which the notes labeled as "the Mais house." A dashed line representing a road also was mapped south of the structures, closer to the base of the bluff. A third feature of this drawing is another line parallel to the bluff north of the road, which the text suggested was a fence line.

Continuing west toward the ocean, between Stations 6 and 7 (and closer to the latter), a drainage off the bluff was described in the notes as "Cañada del Coral de Barranca" and labeled "Coral de Barranca"

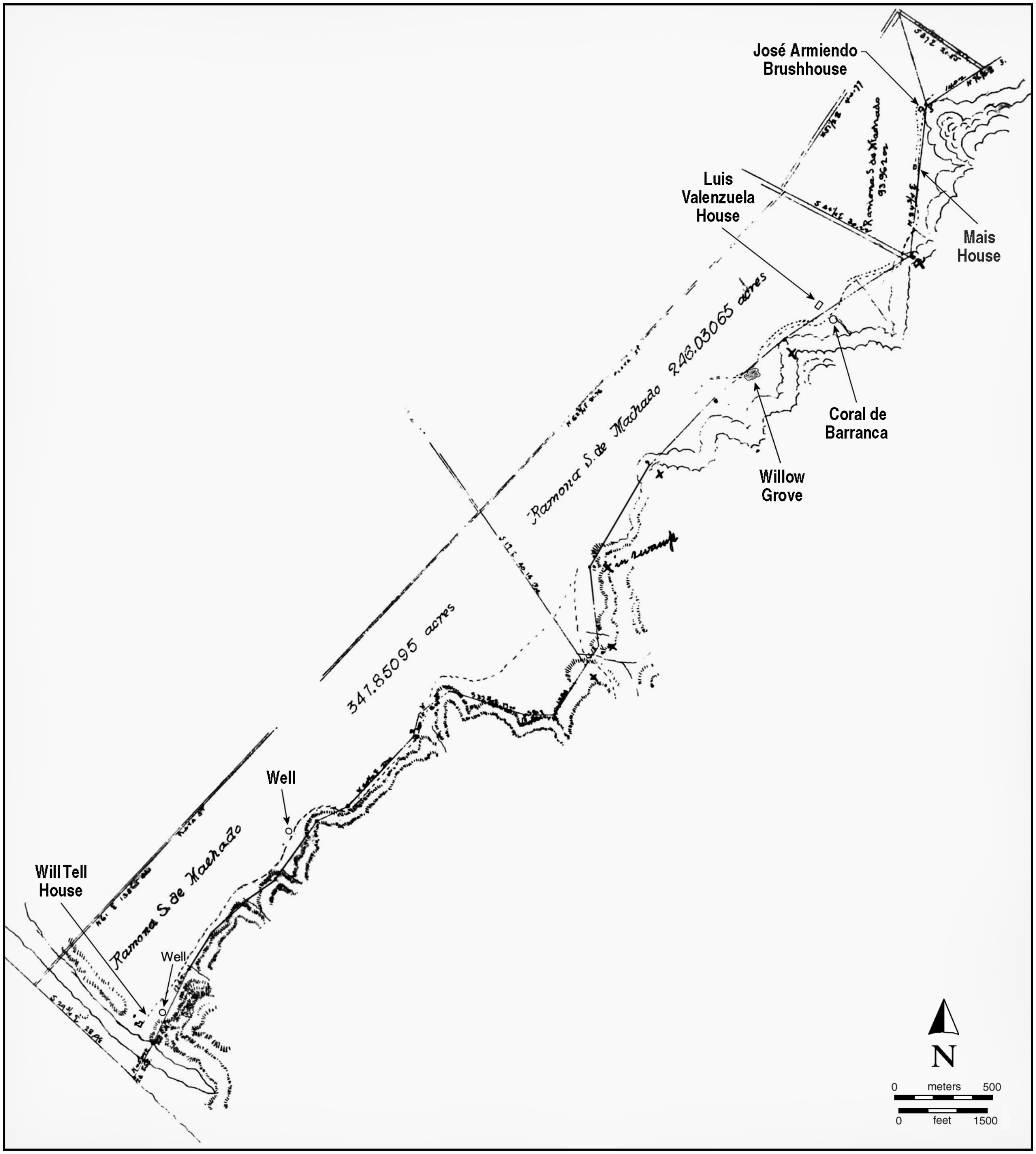

Figure 17. 1875 survey data superimposed onto a draft of the border between Ranchos Sausal Redondo and Ballona, ca. 1895 (reproduced by permission of the Huntington Library, San Marino, California).

on the drawing. Opposite and slightly west of this corral was the “house of Luis Valenzuela,” simply labeled “Luis Valenzuela” on the drawing. As they surveyed to the west, they crossed numerous drainages. A willow grove was depicted on the next notebook page, which covered the distance between Stations 7 and 9; no structures were shown. The fourth notebook page illustrated the area between Stations 9 and 14. This stretch contained the location of LAN-62 and the section of bluff now traversed by Lincoln Boulevard. Hansen’s drawing of the bluff was especially detailed here and provides significant new information about the original, natural appearance of the bluff.

A trail meandered west through all four note pages to the beach, but no additional structures were depicted. The end point of this leg of the survey was Station 23, at “Will Tell’s house” on the beach at what is now Playa del Rey. Will Tell, an opportunistic promoter during the 1870s, filed for a preemptive claim to 150 acres near the mouth of Ballona Lagoon in 1871. Advertising his claim as “Will Tell’s Seashore Resort,” he was never able to gain title to the land. The heirs of Agustín Machado began legal proceedings to have him removed as a squatter (Robinson 1939a:116), and although believed to have moved to Santa Monica around 1874, these survey notes suggest the house was still thought to belong to him in 1875. This house was destroyed by a storm in 1884 (Wittenburg 1973:53).

These 1875 survey notes provide the first documentary evidence that at least two, possibly three, residential structures existed below the bluff prior to 1928. Furthermore, names are associated with these structures, thereby presenting an interesting challenge: who were Jose Armiendo and Luis Valenzuela? Could they have been the Gabrielino or Luiseño ranch hands described by Cristobal Machado? Were they Hispanic vaqueros working for the Machados? Were they perhaps illegal squatters like Will Tell, yet to be evicted by the newly legal owners of the Rancho la Ballona? And what is meant by the “Mais house”? “Mais” could refer to a barn or storage shed for maize or corn, or it could be a proper name. More documentary research is necessary, but archaeology may be better able to resolve this question, as the scant documents may not be up to the task.

These earliest land alterations might have consisted of the construction of small buildings, dirt roads, fences, trash dumps, and other modifications. Although important archaeologically, they probably made relatively minor impacts to the prehistoric landscape.

Impacts from Farming and Early Industry

The first large-scale historic land modifications occurred during the latter part of the historical period. Recorded activities on the property include truck farming, construction of ranch and farm structures, oil and gas development, railroads, channelization of Ballona Creek, road construction, and infrastructure improvements such as the Los Angeles sewer system. Development immediately adjacent to the project area included initial dredging of Port Ballona and construction in the communities of Santa Monica, Playa del Rey, Inglewood, Culver City, and Westchester. At the time these communities began to grow, Loyola University was also established on the bluff directly above LAN-211/H. Historical maps and photographs from the 1920s and 1930s show structures at the base of the bluff. The U.S. Geologic Survey topographic map of the area, surveyed in 1923 and “culture revised” in 1930, depicted at least nine buildings within the project area, seven of which are located at the base of the bluff (Figure 18).

During this period, the title to most of the property in the project area was held by Joseph Mesmer, who leased it to several Japanese families for agriculture. Because these farmers were not citizens and did not own the land, they are difficult to track through documentary sources. About 10 to 15 Japanese families lived scattered along the south side of Jefferson Boulevard between Lincoln Boulevard and the east end of the project area. Each house had its auxiliary storage shed and other outbuildings. A descendent of one of these families indicated that Japanese farmers were living below the bluff from the 1920s to 1942; however, a second source maintained that the dwellings below the bluff in the 1930s represented a Mexican settlement called “Little Tijuana” (Altschul et al. 1991:83).

Figure 18. 1930 culture revised U.S. Geological Survey (USGS) topographic map, Venice quadrangle, showing at least nine structures below the base of the bluffs in the Playa Vista project area.

An oblique aerial photograph looking south at the bluff in 1929 shows the area near LAN-211/H (Figure 19). A long, low structure that may be a celery shed or some other structure is clearly visible, along with at least nine additional buildings, several of which appear to be habitations; these structures cover the majority of the site area of LAN-211/H. A fenced corral or yard, perhaps for animals, is shown near the center of the photograph. The land around these structures has been brushed, and several roads are shown, clearly impacting the natural terrain at the base of the bluff. Also visible is evidence of a recent erosional episode that had cut three significant runoff channels into the bluff. The original track of the Los Angeles sewer, built circa 1924, is also visible along the bluff face. It is important to note that Cabora Drive, the sewer access road along the alignment, did not exist at this time.

A second oblique photograph of the base of the bluff at almost the identical angle taken in 1946 presents an interesting contrast (Figure 20). The large white "L" (in "Loyola University") that was so prominent in 1929 is barely visible in 1946 due to the growth of vegetation. Structures visible in the early shot below this "L" are gone in the later view, presumably removed by the Hughes Aircraft Company. Only two structures are shown below the base of the bluff in 1946, a long, low shed-like building and another long building, perhaps a garage, with an open side facing north. This photograph confirms that, although farming on the property continued into the early years of Hughes Aircraft Company's development, associated structures south of Bluff Creek Drive (formerly Teale Street) were demolished. Also visible in this later photograph is the sewer access road known today as Cabora Drive. Considerable shaping of the bluff was clearly required to construct this road.

By compiling the data from all of the documentary and photographic resources discovered to date and registering it as closely as possible to the bluff line, we have created a composite map showing the location of all known structures near the LAN-211/H project area as of 1956 (Figure 21). The result shows the extent of potential impact to the area at the base of the bluff from historical-period activity. There are two implications of historical-period occupation of the study area: first, intact archaeological deposits dating from this later occupation of the area could be encountered during construction, and, second, historical-period use may have disturbed underlying prehistoric archaeological deposits. Both of these possibilities present important areas of consideration in our investigations into the past at Playa Vista.

Impacts from the Hughes Aircraft Company

Documentary history at Playa Vista enters the modern era with the business ventures of Howard Hughes. Having developed his aviation empire through the 1930s, Hughes purchased what is now known as Area D south of Jefferson and the adjacent portion of Area B in January, 1941 (Los Angeles County Recorder, Map Book 332:1939-46). His initial plans were to pursue his movie interests, but by 1941, he was looking for a new facility for his aircraft division, the Hughes Aircraft Company, which was beginning to win contracts and needed a larger plant. Hughes ended up shifting the orientation of the region's economy when he built the Culver City facility to manufacture military aircraft (Altschul et al. 1991).

Construction of the facility resulted in rerouting Centinela Creek, the construction of a major industrial complex in the southeast portion of Area D, and the filling of the wetlands (often with nearby archaeological site material) to construct a runway in the northwestern portion of Area D. Construction of the industrial complex and runway resulted in massive land modification (Peck 1947). Undulating areas were flattened, terraces were cut, and adjacent rills filled. Large areas were then covered with asphalt and concrete. Other important land modifications during this period include the construction of Cabora Drive along the bluff, massive development of the surrounding residential communities (including the bluff top), construction of Marina del Rey, and road and freeway construction.

Figure 19. 1929 oblique aerial photograph, looking south at the bluff showing structures near LAN-211/H (Spence photograph, courtesy of the Air Photo Archives, UCLA Department of Geography).

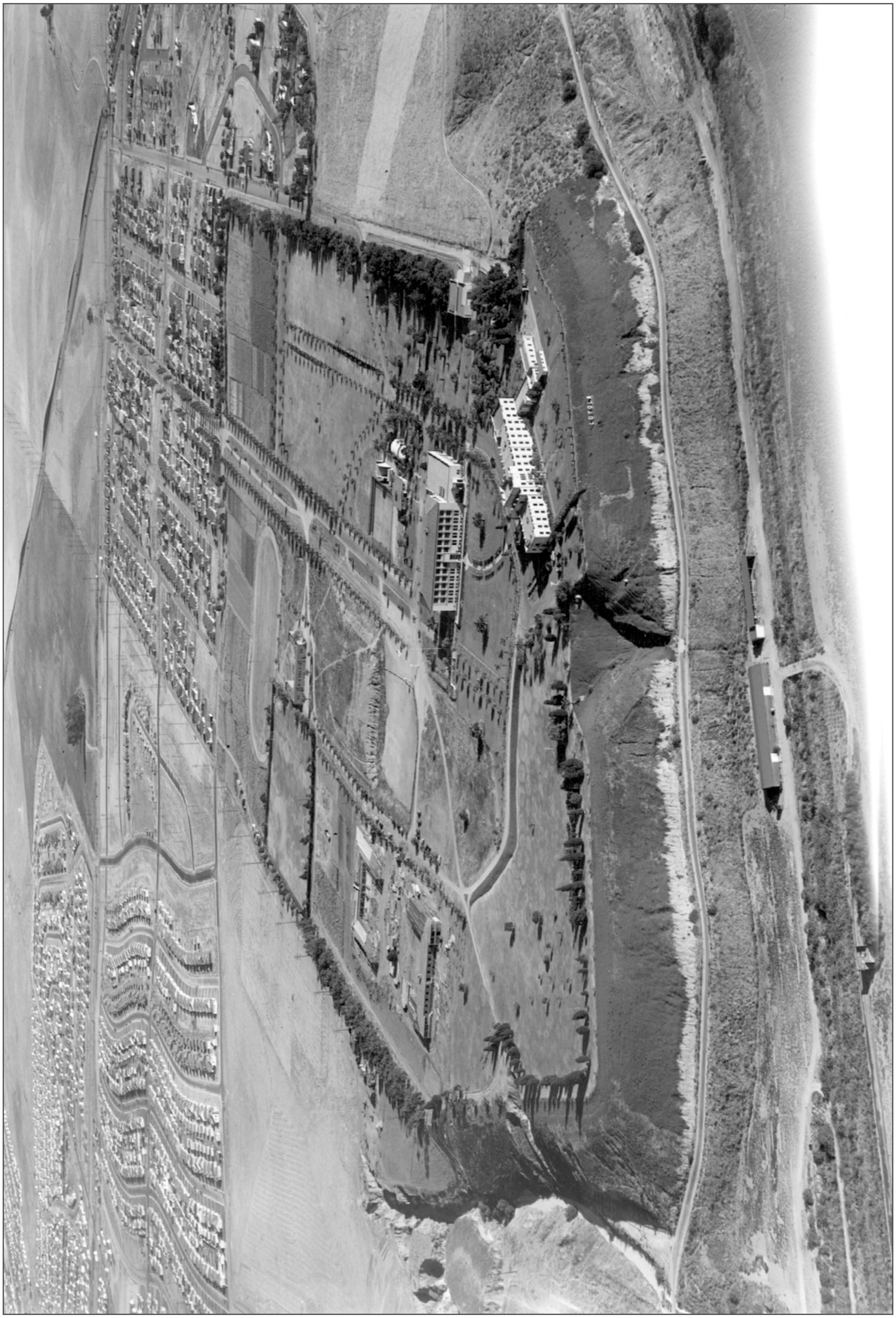

Figure 20. 1946 oblique aerial photograph, looking south at the bluff showing structures near LAN-211/H (Spence photograph, courtesy of the Air Photo Archives, UCLA Department of Geography).

The exact location of archaeological resources and sites are not subject to public disclosure to prevent harm and unauthorized disturbance of the resources and sites, pursuant Section 5097 of the California Public Resources Code and Section 800.11 of the National Historic Preservation Act, as amended. Therefore, this figure has been excluded.

The impacts of Hughes Aircraft Company on the project area have been profound and all-encompassing. Plant buildings, offices, a cafeteria, a jet runway, parking lots, test sites, equipment sheds, a helipad, maintenance shops, a shooting range, aircraft hangars, a health center, roads, rail spurs, and flood control channels were constructed on the site, most between 1941 and 1953, Howard Hughes's active years with Hughes Aircraft Company.

A Historic Property Survey of the original Hughes Aircraft Company complex was prepared by Historic Resources Group (HRG) in 1991 (HRG 1991). Detailed histories of 22 structures were compiled, and evaluations were prepared for 17 of these that were built during the prime period of significance, 1941–1953. Of these 17 buildings, HRG found that 15 contributed to the significance of a potential NRHP historic district. A second report included the NRHP nomination for the district—now named the Howard Hughes Industrial Complex (HHIC)—and documentation for Historic American Engineering Record (HAER) No. CA-174 (Greenwood and Associates 1991). The core of the HHIC encompasses resources of exceptional importance in aviation research and development in southern California during World War II and the years that followed.

The structures that currently cover portions of LAN-211/H were not included in the survey for the HHIC, and their exact dates of construction are not known. At the time of the HHIC evaluation, the area west of Building 45 (Figure 22) contained a number of auxiliary structures, including the gun range, the salvage yard, and the company test sites. Also located on the west end was the Hughes Employee Store, where employees received discounts on assorted merchandise. The store was closed in 1979, and the building was later demolished.

Five of the remaining structures noted in 1991 west of Building 45 are still extant (see Figure 22). The westernmost standing building was formerly referred to as the salvage yard. Run by Hughes Aircraft Company employee Bill Fry, it was used to store the two Caterpillars that kept the company gravel roads level (Altschul et al. 1991). East of this west-facing building is an adjacent asphalt parking lot ringed on three sides by open-sided buildings. These long, shallow wooden structures were used for storage; in the late 1990s, they contained flat theater-type set panels, attesting to recent use of the Hughes Aircraft facilities by the movie industry. At the east end of this paved area is Building 23, a well-constructed lath-and-plaster structure which was boarded up years ago. The outside of Building 23 is essentially intact, although the inside has been vandalized. Appended on the north to the more solid portion of Building 23 is a wooden storage shed. All of these structures have been emptied of their original contents in anticipation of their demolition.

Adjacent to the west side of Building 23 is a cement-lined rectangular pit approximately 9.1 m long, 3.6 m wide, and 1.5 m deep (30 by 12 by 5 feet). The metal housing for a hydraulic pedestal, possibly part of a truck scale, is at the bottom of this pit. The presence of this pit and other garage-like structures in the vicinity confirm that this area was constructed and used for storage, repair, and maintenance by Hughes Aircraft Company.

To the east of Building 23 is another, smaller, paved open area that appears to have been a parking lot. As will be discussed in Chapter 6, the intact portion of LAN-211/H was discovered below this pavement. White lines have been painted on the asphalt surface so that it could be used as an outdoor basketball court. To the east of this lot is a second, unpaved, fenced area choked with castor-bean plants and other weeds that was known fondly at the time of our excavation as "the jungle." During the Hughes Aircraft era, this area was designated the "gun range" and used to test machine guns and grenade launchers (Altschul et al. 1991:108).

In addition to these observable impacts to the site area of LAN-211/H, subsurface features, such as monitoring wells and assorted sumps from Hughes Aircraft Company's tenure, are known to be located in the area around Building 23. Monitoring wells C-41, C-57, C-58, and C-59 are located west of Building 23; monitoring well C-61 is due south; and wells C-5, C-39, and C-60 are to the east. On the west side of Building 23, there are two leakage-collection sumps in a paved, open area, and on the building's south and east sides, there are three general sumps, a waste oil sump, and a storm drain sump (Dave

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Chernik, personal communication 1999). This last feature was probably bisected during the trenching of LAN-211/H.

Previous Archaeological Research

We have established our research perspective by presenting an overview of the cultural and historical sequence at Playa Vista. In the following section, we present a summary of previous archaeological research. The topic has been comprehensively treated in other SRI publications (Altschul et al. 1991; Altschul et al. 1998; Altschul and Grenda 2002; Grenda et al. 1999).

Until the latter half of the twentieth century, archaeological work in the Ballona was undertaken by amateur collectors. F. M. Palmer (1906), a Redondo Beach dentist, was the first investigator to explore the numerous prehistoric sites in the region and write about his discoveries (Wallace 1984). In his "Report on Researches," published after he excavated in the Redondo Beach area, Palmer noted "a number of lesser villages that were situated at points of vantage, for about seven miles, along the coast line of this part of the Southern California mainland" (Palmer 1906:24). From this, it appears that he might have been aware of sites in the Ballona.

Six years later, Nels Nelson (1912) made the first professional archaeological overview of sites in the Ballona, during a brief visit to southern California. Funded by the American Museum of Natural History's Department of Anthropology, Nelson undertook a survey of prehistoric "campsites" and "refuse heaps" from Topanga Canyon to the southern limits of San Diego Bay. Reaching the Ballona, Nelson surveyed at the base of the bluff in the westernmost portion of the Playa Vista project area, in the vicinity of Area B. He found no sites in this area, which corresponds with our survey findings (Altschul et al. 1991). Additionally, Nelson reported on "Site No. 4," "a refuse heap situated at the mouth of a small ravine opening north on Centinela Creek about 3 miles northeast of Port Ballona." Port Ballona was located at the inlet of Ballona Lagoon, near the modern town of Playa del Rey. Nelson's description of Site No. 4, limited as it is, appears to correspond with the recorded location of LAN-62. Nelson did not personally observe this site; rather, he based his report on the observations of a hunter living halfway between the archaeological site and Port Ballona. Nelson recorded the presence of a large accumulation of material, including human skeletal remains and other assorted artifacts. Nelson's 1912 report is the first known published reference to archaeological sites in the Ballona.

Although interest in Early Man brought scientists to the upper Ballona in the 1920s, this decade was relatively quiet for archaeology west of the Baldwin Hills. In 1931, Arthur Woodword, of the Natural History Museum of Los Angeles County, directed the Van Bergen–Los Angeles County Museum Expedition to explore sites in the Los Angeles area, including the famous Malaga Cove site (LAN-138) (Wallace 1984). Work in the field was done by Richard Van Valkenburgh, an astute archaeologist who was employed by Woodward at the museum between 1930 and 1935 under the sponsorship of the State Emergency Relief Act. Van Valkenburgh also conducted ethnographic work for the museum during that time (King 1992:4). By the mid-1930s, the Natural History Museum's collections included a number of artifacts from at least three sites in the Playa del Rey–Ballona area, including mortars, manos, shell, projectile points, and worked stone (Woodward 1932).

For many years, and continuing through the 1930s, local doctor F. H. Racer of Lomita made collections from sites along the coast (Wallace 1984:1). He mounted many of the artifacts in his collection and housed them together with items from other parts of the world in a small "museum" behind his residence. He also maintained a catalog, describing the artifacts and the sites at which they were found. When Dr. Racer died in 1961, his collection passed to his daughter, who permitted only a single, two-hour viewing of the material before putting the entire collection up for sale (Bates 1963:47). The subsequent fate of Racer's collection is unknown. An unpublished manuscript by Racer (1939) documented the sites he explored in what he called the Harbor District, which included the Ballona area. A site that Racer called No. 15, located at the "west end of Centinalia *[sic]* and Jefferson Streets," may correspond to LAN-2768 or, alternatively, to LAN-62. Racer glowingly described the richness of the project area and bluff-top sites in the 1930s:

> Several years ago a man from Inglewood trucking black earth for green houses uncovered a great number of whole or broken mortars, pestles, and other artifacts. These were given to his neighbors and scattered. On the top of the hill above this find was a settlement of several acres. Quantities of broken shells, arrow heads and knives, manos and burned stones. The owner of this field has found several mortars and others have found other artifacts. Several fragments of steatite [were found]. There are several camp grounds on top of the same bluff west of Loyola University. Several steatite vessels were found when the road department excavated a site just west of Loyola [Racer 1939:5].

During this period, another researcher, Malcolm Farmer, began making notes on sites in the Ballona area. Farmer, a boy just 16 years old at the time, with his friend Eugene Robinson—who was loosely affiliated with the Southwest Museum—began a survey of sites in Playa del Rey, along the bluff tops, and in the Baldwin Hills area along Ballona Creek, looking for Early Man (Farmer 1934). Farmer talked with landowners and surveyed on foot those areas where he expected to find cultural remains. His notes were partially copied and later incorporated into the data used by Charles Rozaire to create the first official site records for the area (Farmer 1936; Rozaire and Belous 1950). Table 3 lists the sites recorded by Farmer, Rozaire and Belous in the Ballona area and their current status.

Subsequently, Farmer and Robinson went to work for Edwin Walker of the Southwest Museum on the Malaga Cove site (LAN-138), near Palos Verdes Peninsula. Given their special interest in finding the most ancient remains, Walker put the two young men to work on digging Level I (Malcolm Farmer, personal communication 2001). Most researchers who have studied Farmer's map of site locations in the Ballona (Figure 23) (Farmer 1936) have assumed that the site he labeled as No. 4, apparently located at the base of the bluff in an alluvial fan pocket, was LAN-62. During a recent interview, however, Farmer maintained that he did not explore the area below the bluff in the 1930s and that he never saw LAN-62 (Malcolm Farmer, personal communication 2001). We now believe that Farmer's Site No. 4 most likely refers to LAN-1018, the Helipad site, which was located partway up the Lincoln Boulevard grade (Altschul et al. 1991:16). Farmer did not believe that this was an archaeological site; rather it was a fossil shellbed. Test excavations at LAN-1018 led to a similar conclusion (Peak and Associates 1990). This site has since been destroyed by modern construction.

In keeping with the practice of the times, Farmer collected artifacts during his 1936 survey, which he turned over to the Southwest Museum for curation. Among the items recorded from the Baldwin Hills area are pestle and metate fragments, manos, soapstone and granitic bowl fragments, cogged stones, flaked stone scrapers, smoothing stones coated with asphaltum, hammer stones, stone knives, and shell fragments. Tracings and sketches of some of these items are included with his notes. Unfortunately, collections made by others at this time were not so well documented. In 1939, some 200 artifacts from LAN-193/H (possibly LAN-62) were donated by Ralph Beals to the archaeological research facility at the University of California, Los Angeles (UCLA) (Accession 1, Department of Anthropology records,). No notes of when or how these artifacts were obtained or any additional provenience documentation accompanied this donation, which included projectile points, beads, tarring pebbles, and bone fragments. The complete collection was catalogued by staff at UCLA; however, in 1970, the diagnostic items were loaned out to a visiting professor named Heath Taylor (Accession 1 Catalog, Department of Anthropology Records, UCLA) and all attempts to secure their return have been unsuccessful.

Table 3. Status of Sites Recorded by Farmer and Rozaire and Belous

Site No. (LAN-)	Farmer (1934, 1936)	Rozaire and Belous (1950)	Current Condition
53	not surveyed	recorded	destroyed by school
55	not surveyed	recorded	destroyed by dump
56	not surveyed	recorded	unknown (L.A. sewer line through it)
57	not surveyed	recorded (not seen)	possibly under park
58	not surveyed	recorded (not seen)	destroyed by gravel pit in 1920
59	Playa del Rey #1	recorded	destroyed by housing (1991)
60	Playa del Rey #2	recorded	portions intact
61	Playa del Rey #3	recorded	destroyed by LMU (1999)
62	not surveyed	recorded	intact
63	Playa del Rey #5	recorded	intact
64	Playa del Rey #6	recorded	intact
65	Playa del Rey #7	recorded	destroyed by housing
66	Playa del Rey #8	not recorded	destroyed by beach club
67	Baldwin Hills #1	not recorded	destroyed by housing
68	Baldwin Hills #2	not recorded	destroyed by industrial plants
69	Baldwin Hills #3	not recorded	destroyed by housing
70	Baldwin Hills #4	not recorded	destroyed by housing
71	Baldwin Hills #5	not recorded	destroyed by housing
72	Baldwin Hills #6	not recorded	destroyed by housing
73	Baldwin Hills #7	not recorded	destroyed by housing
74	Baldwin Hills #8	not recorded	destroyed by various developments
171	not recorded	recorded (not seen)	unknown (L.A. sewer line through it, 1924)
172	not recorded	recorded (not seen)	unknown (storm drain through it, 1936)
1018	Playa del Rey #4	not recorded	possibly destroyed by helipad

In addition to Farmer's materials, the Southwest Museum houses several additional small collections of artifacts from the Ballona area. Very little information is associated with these finds, and the larger ground stone artifacts have been commingled with other unlabeled artifacts in a basement storage area at the Museum known as the Stone Room. At some point during the 1930s or early 1940s, Mr. F. R. Johnson conducted an excavation of "a camp in the Baldwin Hills near Playa del Rey" and collected several stone artifacts that he donated to the museum in 1944 (Collection Card 948-G-110, Southwest Museum files). The collection of Dr. Emory Thurston, made in 1958, appears to include at least one item from the Ballona area. Five artifacts from the Farragut School site (LAN-53) collected by Charles Rozaire are also among the museum's collections.

The Southwest Museum also houses specimens collected by Stuart L. Peck. In 1942, "due to the limitations on automobile travel during the War," Peck, who was working for the museum at the time, was looking for a site to excavate that was closer to home than the prehistoric campsites he was

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accustomed to exploring in the Mojave Desert (Peck 1947). The site he chose was LAN-62, which he called the Mar Vista site, “one of several . . . at the base of the bluff on the southeast shore of the tide flat.” He believed that it was “ideal” because its location was convenient for him and because the major portion of the site had already been excavated by the Hughes Aircraft Company “for fill for a runway extension.” Thus, he felt it would be “easy to get a picture of the stratification.” Between 1945 and 1946, Peck worked at LAN-62, excavating numerous “prospect holes” and three trenches of unrecorded depth and length. He encountered a single complete, undisturbed inhumation—flexed, lying on its right side, with head to the east—and a number of cremations. A range of artifacts was recovered, including ground stone bowls, stone tools, faunal remains, and ornaments. Some of Peck’s discoveries, including shell, grinding stones, and two stone bowls, were given to the Southwest Museum in August 1946.

The quantity of material recovered suggested to Peck that LAN-62 was a year-round habitation or village site. Moreover, based upon this site’s stratigraphy, Peck argued for two distinct periods of occupation at LAN-62, both prehistoric because of the lack of Spanish trade goods. The earlier of these two resident groups buried their dead; used metates, manos, and small mortars with short, cylindrical pestles;

ate shellfish; hunted with rather crudely shaped chert implements; and used large shells for dishes. Significantly, Peck believed the presence of red jasper implements in this lower level suggested trade or contact with desert tribes. According to Peck, the people who later occupied the site cremated their dead; used large, deep mortars and basket mortars; made stone bowls, shell beads, and implements and ornaments of bone; used asphaltum; obtained soapstone for bowls and amulets and obsidian through trade; and also ate shellfish (including a large proportion of scallops and cockles), fish, small animals, and birds. Peck suggested that this later group of people might be associated with the Canalino, prehistoric residents of the Channel Islands. Peck's two-culture model outlined here, although lacking solid chronological control, may serve as a useful framework for future research at LAN-62.

Following Peck's excavations, Dorothy Luhrs visited the project area and reported her observations to the Natural History Museum of Los Angeles County (Luhrs and Ariss 1948, cited by Freeman et al. 1987). Luhrs was followed by a series of amateur archaeologists, primarily collectors. According to Rozaire and Belous (1950), Culver City resident Oscar Schulene collected artifacts from a number of sites in the area between 1947 and 1949. Focusing his efforts on LAN-62 after Peck's investigations were complete, Schulene not only recovered a number of artifacts, he also excavated 15 human burials, all of which were flexed and lying on their sides. Rozaire and Belous were allowed to examine Schulene's collection; however, its location now is unknown.

William Deane was another avid collector who created a large collection from the project area during the 1940s. His artifact collection was documented and photographed by Marlys Thiel (1953), who interviewed him at his Torrance home in 1953. Deane told her that although the bulk of his collecting near the Hughes Aircraft plant was done in 1947, he had continued to add a few objects each year after that. He gave a rough provenience for the artifacts in his collection. Items from "east of Lincoln Blvd.," an area which perhaps covers LAN-62 and LAN-211/H, included projectile points, shaft straighteners, abalone shell, bone tubes, a metate, four human skulls, and a deer whistle. The current disposition of Deane's collection is also unknown.

In 1950, two graduate students at UCLA, Charles Rozaire and Russell Belous, visited the Playa Vista project area to obtain information for a term paper on Ballona Creek archaeology. From the site forms they prepared as part of their projects, they showed their familiarity with Malcolm Farmer's survey, as they attempted to relocate many of his sites. Many Playa Vista sites were first formally recorded by these two students. Professional archaeologists returned to the area in 1982, conducting a series of quick surveys with negative results (Dillon 1982a, 1982b; Dillon et al. 1983; King and Singer 1983). These were followed by projects headed by David M. Van Horn and his associates, which took place primarily in the late 1980s in the area above and below the bluff (Archaeological Associates 1988; Freeman 1991; Van Horn 1984, 1987, 1990; Van Horn and Murray 1984, 1985; Van Horn and White 1997a, 1997b, 1997c; Van Horn et al. 1983; Freeman et al. 1987).

The special focus of Van Horn and his associates' work below the bluff was an exploration of LAN-62. While describing their work as "testing via trenches and test units" (Van Horn et al. 1983), none of Van Horn's excavations penetrated the midden: all testing stopped at the interface between the site material and overlying fill levels. Their research (Archaeological Associates 1988) indicated that LAN-62 is deeply buried by modern fill associated with the activities of the Hughes Aircraft Company and construction of the sewer and associated access road (Cabora Drive). Most important, their testing suggested that much of the site may be intact.

In the southern portion of LAN-62, Van Horn and his colleagues excavated a total of 7 wedges and 12 trenches using heavy machinery; his team also hand-dug a 1-by-1-m unit and a 2-by-2-m unit. The average depth of the seven wedges was approximately 3.5 m, whereas the trenches averaged 4–5 m in depth. The 2 units were excavated into the floor of the wedges and reached a depth of 130 cm. Van Horn estimated that midden in the southern portion of the site averaged 1.5 m in thickness, and that there were 5,500 m^3 of cultural deposit.

In the northeastern portion of the site, Van Horn and his associates excavated a total of 20 trenches, 5 wedges, and 6 1-by-1-m test units. Hand-excavated units were dug into the floors of the trenches, reaching an average depth of 90 cm below floor level. Midden material was estimated to average about 0.9 m in depth, with a total volume of approximately 1,050 m^3. As previously noted, however, none of the trenches in either the northern or southern area penetrated into the midden; mechanical excavation was stopped at the contact zone. Recovered from the hand excavations was a wide array of materials, including stone artifacts, bone tools, shell beads, fire-affected rock (FAR), shell, and faunal remains. The combined information from all of these test excavations tended to confirm Peck's reconstruction: LAN-62 was a permanent or semipermanent habitation site with possibly two temporal components. Questions exist as to the antiquity of LAN-62, but most of the time-sensitive artifacts date to the Late or protohistoric periods.

Previous research at LAN-62 has demonstrated the importance of the site, even though we lack certain knowledge of the site's size and integrity. Copious amounts of modern fill overlying LAN-62 have made resolution of these issues difficult. Van Horn and his associates argued that the deposit should be considered two separate sites, LAN-62 and LAN-211. We argue, in contrast, that the site is essentially continuous along the base of the bluff and should be subsumed under a single site trinomial, LAN-62. Only more work at this site will fully reveal its nature.

History of LAN-211/H

The first recorded description of the site later designated LAN-211/H was made by Dorothy Luhrs in 1948 during the Natural History Museum of Los Angeles County survey (Luhrs and Ariss 1948, quoted by Freeman et al. 1987). Luhrs designated the site "LA:3" and noted on her survey form that the deposit covered an estimated area of 45.7 by 121.9 m (150 by 400 feet). Luhrs stated that

> [LA:3 contained a] considerable quantity of abalone shells, clam, oyster. Fragments of stone bowl, pestles, hammering stones. Human toe bones, evidence unmistakable [of] potting 2'–5' [0.6–1.5 m] deep (thru overburden of varying depths) and approximately 25' [7.6 m] long. Piles of abalone shell and broken stones on pits and dump. Black soil 6'+ to 10" [sic] [1.8 m+ to 25.4 cm] deep on hillslope. The Centinela Creek flows 20' [6.1 m] to the north. Major portion of the site is on what appears to be estuary or stream terrace. [Luhrs and Ariss 1948, quoted by Freeman et al. 1987:6].

No further documentation of the site occurred until June 5, 1953, when an official site record for LAN-211/H was created by an unnamed person (probably Hal Eberhart) at the Archaeological Survey at UCLA (UCLA 1953). The recorder equated LAN-211/H with LA:29, a different Natural History Museum site. The UCLA site record contains no mention of Dorothy Luhrs or LA:3. Information used to complete the form was obtained by UCLA student Marlys Thiel (1953) when she interviewed William Deane of Torrance in May 1953 for a student paper. Thiel apparently never saw the sites herself. According to the site record, LAN-211/H was located "on a terrace . . . 2200 feet [670.6 m] east of Lincoln Boulevard" on land owned by Howard Hughes. It was also reported that the attitude toward excavation was "impossible." Thiel reported that Deane had a large artifact collection which he allowed her to photograph. Deane described the site (which he called "Site No. 1") as having "very hard packed soil . . . many broken pieces of mortars and pestles" (Thiel 1953). He made similar observations about his "Site No. 2," which we now know is LAN-62. Clearly, Deane considered the two sites to be distinct from one another but located in a similar setting along the base of the bluff.

In 1979, R. L. Pence, a trained archaeologist, attempted to relocate LAN-211/H. He observed a small area of shell and lithic detritus between an asphalt-paved parking lot and an underground fuel storage complex (Pence 1979), in the approximate location described in the Thiel and Deane (UCLA 1953) site record. The map on file at the Archaeological Information Center, which we used to place LAN-211/H in the 1991 research design (Altschul et al. 1991), is consistent with this location.

Confusion subsequently arose when David Van Horn and his associates began their archaeological investigations along the base of the bluff (Archaeological Associates 1988; Freeman et al. 1987). Despite a diligent search, they were unable to locate LAN-211 at the location Pence reported. They reported being uncertain whether any intact deposits survived or had ever existed at the Pence location. Instead, they found intact deposits buried beneath recently deposited fill at a location along the base of the bluff northeast of LAN-62 and some 121–150 m (400–600 feet) west of Pence's location. They transferred the designation LAN-211 to this site and, because they found two distinct deposits, divided it into two smaller loci, LAN-211A and LAN-211B. After a similar investigation, Freeman et al. (1987) also divided LAN-62 into two parts, labeled "A" and "B."

In 1990, when Altschul and his colleagues began a new survey of the area below the bluff, they found themselves confronted by confused site labels and uncertain site boundaries. To resolve the questions, additional boundary testing was planned. Like Freeman et al. (1987), our tests (see Chapter 5) failed to uncover evidence of substantial cultural deposits in the vicinity of LAN-211A that was comparable to Luhrs's site LA:3 or Thiel and Deane's description of LA:29. Instead, we found sparse deposits and cultural materials redeposited in fill. We also found a fairly continuous distribution of intact material all the way from LAN-62A to LAN-211A and encompassing LAN-62B and LAN-211B. LAN-211, as identified by Freeman et al. (1987), appeared to us to be an extension of LAN-62B. As a result, we decided to simplify the situation and combine all four loci—LAN-62A, LAN-62B, LAN-211A, and LAN-211B—into a single site, which we termed LAN-62.

By contrast, we discovered that site SR-13, which we had initially encountered in our 1990 survey, is a substantial intact deposit containing a diversity of materials similar to that documented by Luhrs (Luhrs and Ariss 1948, quoted by Freeman et al. 1987) and Thiel and Deane (Thiel 1953; UCLA 1953). SR-13 is also the only such deposit at the base of the bluff east of Lincoln Boulevard that is distinct from LAN-62. In our judgment, by its setting and contents, SR-13 is the best candidate for LAN-211 as it was originally recorded. Although it is located some distance (1,219 m [4,000 feet] east of Lincoln Boulevard) from the original recorded location of LAN-211(UCLA 1953), SR-13 is within the area in which Deane collected. Thus, in this report, we have reassigned the site number LAN-211/H to our survey location SR-13.

LAN-211/H and Research on the Protohistoric and Early Historical Periods

There are four sites in the Ballona that have been found so far to contain protohistoric components; LAN-2676, LAN-194, LAN-1932/H, and LAN-211/H. These four sites present a rare opportunity to explore the archaeological signatures from these later periods. Interpretive models for protohistoric sites often target site function and formation processes; those for the Ballona also test the extent of interconnection among local and regional protohistoric sites. The examination of early-historical-period sites can illuminate the differences between aboriginal and mission neophyte sites during the so-called Contact or transition period. Using archaeological, ethnographic, and historical data, we have formulated testable scenarios for protohistoric and early-historical-period occupation of the Ballona. These scenarios and the corresponding expectations for the archaeological record are presented in Chapter 12. The evidence for protohistoric and early-historical-period occupation at two of these sites is summarized below.

LAN-1932/H (formerly SR-23) was a disturbed multicomponent protohistoric and historical-period site located north of LAN-211/H within the boundary of the former Hughes Aircraft Company runway, now destroyed by construction activity. The historical-period component of LAN-1932/H, first discovered in 1990, was tested by Greenwood and Associates in 1991 (Hampson 1991). Consisting of a secondary deposit of mainly household refuse that dated from the mid-1940s through the mid-1960s, the site lacked integrity or scientific potential and was deemed not eligible for listing in the NRHP. While monitoring construction grading in the area in February 1999, a protohistoric deposit was discovered under the historical-period refuse, prompting further evaluative testing by SRI. Results of testing at LAN-1932/H were discussed in two monitoring reports (Taşkıran and Stoll 2000a, 2000b) and are briefly summarized in Chapters 9 and 10 in this report. Protohistoric cultural materials were restricted to a thin layer of organic soil between 10 and 15 cm thick. No archaeological features were discovered during testing. The evidence suggests that the protohistoric portion of LAN-1932/H was transported from the base of the bluff, probably from LAN-211/H, and redeposited as sifted fill during the Hughes Aircraft era. The complete results of the testing at LAN-1932/H are in preparation.

To date, a single archaeological site in the Ballona, LAN-194, the Hammack Street site (originally thought to be an Early Man site) has been found to have remains of early-historical-period occupation. Excavated by Chester King (1967), LAN-194 contained a large number and variety of European manufactured items, particularly glassware, metal items, mission ware ceramics, and horse and cattle bone. From the ceramic data, King concluded that the date range of the site was between A.D. 1825 and 1850. King believed that LAN-194 probably represented an encampment of Native American laborers who either worked at the Rancho La Ballona or possibly raided cattle and horses from this location. He also reported observing the persistence of some traditional practices in food-gathering and technology, as indicated by the presence of shellfish, fish, and pronghorn remains; stone tools; and projectile points. He noted also that the amount of domesticated animal remains in the faunal collection was relatively high and the bones showed the marks of European-style butchering.

SRI's work at LAN-211/H and LAN-1932/H revealed a distinctly different archaeological signature from those deposits found at the Hammack Street site. Other than the presence of glass trade beads and a few fragments of cow bone, neither of these two sites showed heavy European influence. At LAN-211/H, for example, no metal, mission ware, or imported ceramic artifacts have been identified.

Because much of the evidence for protohistoric and early-historical-period sites in the Ballona is enigmatic or from unclear contexts, we have looked to other areas of the Southern California Bight to supplement our data and to aid in developing models for the protohistoric period.

Coastal Area Research

In searching for comparable sites for our research, we sought well-documented archaeological contexts containing both protohistoric and early-historical-period components that were clearly defined and well-distinguished from one another. Well-reported sites meeting these requirements from any part of southern California are quite scarce, however. The implicit assumption that archaeological sites left by other indigenous southern California groups such as the Luiseño, Juaneño, or Chumash are comparable to contemporaneous Gabrielino sites is generally accepted, though untested. The body of literature produced by studies of the Chumash are frequently cited, being the most prolific and accessible (for example, Arnold 1983, 1987a; Gamble 1991; King 1981).

One of the more famous sites with both protohistoric and early-historical-period components is Helo', a Chumash village site located on Mescalitan Island in Goleta Slough, adjacent to the campus of University of California, Santa Barbara (Gamble 1990, 1991). Fr. Juan Crespi, who first documented the island settlement, described it in 1769 as a densely populated village. Its population increased further shortly after the construction of nearby Mission Santa Barbara, as refugees arrived, often driven from their home villages by epidemics or fleeing mission rule. Archaeological investigations in the 1980s revealed deep deposits and clear stratigraphy at the site. During the analysis of the shell beads, researchers discovered they were able to differentiate marks made during protohistoric-period bead drilling from historical-period bead production, in which iron needles were used for drilling stringing holes. Using this dating technique, King concluded that most of the shell beads recovered from the excavations were manufactured between A.D. 1750 and 1803 (King 1990b:63, cited by Gamble 1991:275). Further evidence for the protohistoric period was found when an examination of the midden revealed the skeletal remains of cows but the absence of introduced domesticated plants. Examining the plant remains, researchers observed that no change had occurred in the choice of collected species from those preferred during the prehistoric period. This blending of traditions is indicative of a transition period such as the protohistoric. Gamble concluded that Chumash subsistence behavior was not greatly altered until missionization in the historical period, when Chumash household production units changed from extended to nuclear in terms of size and organization (Gamble 1991:443, 445).

Excavations at San Buenaventura Mission (VEN-87) in the city of Ventura revealed both protohistoric and historical-period Chumash occupation at the site (Greenwood 1976). The small number of shell beads found, which dated to the Medea Creek period (A.D. 1500–1782), suggested minimal use of the area during the protohistoric period; however, the beads were of particular interest because they were made from *Olivella biplicata,* the shell type commonly used as shell money. By the end of the Medea Creek period (corresponding roughly to the end of the protohistoric period), shell beads had been replaced by Venetian glass beads (Greenwood 1976:131).

As previously discussed, excavations were undertaken during the early 1950s at Malaga Cove (LAN-138), at what many thought was the site of Chowigna, a Gabrielino village located on the sand dunes above the cove, on the northern edge of Palos Verdes Peninsula (Walker 1952). Chowigna was a flourishing Gabrielino community at the time of Spanish contact in 1542. Although Walker's deep stratigraphic excavations did penetrate significant cultural deposits at the site, scant evidence of either a protohistoric or historical-period component was found, restricted to a few glass trade beads in the upper portion of Stratum 4 (Walker 1952:68). A connection between LAN-138 and Chowigna remains unproven.

Significant numbers of glass trade beads were recovered from Arroyo Sequit, a coastal Chumash shell mound located at the mouth of Arroyo Sequit Canyon, adjacent to the Pacific Ocean on the far western edge of Los Angeles County (Curtis 1959). Excavated by Freddie Curtis in the late 1950s, the site was occupied during the protohistoric period, though only briefly as indicated by the absence of significant stratigraphy. In contrast, 216 glass trade beads and 1 European coin dating to 1700 suggested a substantial historical-period component. Questions about the integrity of this site persist, however; the presence of a historical-period can found below a burial that was adorned with glass trade beads indicates substantial postdepositional disturbance (Curtis 1959:124–125).

Finally, protohistoric components were also contained in the coastal communities of Las Flores Creek and Horno Canyon located along a dry river channel within Camp Pendleton (Byrd 1996). This area straddles the boundary between the Luiseño and Juaneño cultural groups (Byrd 1996:9). Several calibrated radiocarbon dates from the sites extend into the protohistoric period (A.D. 1450–1685 and 1420–1660) (Byrd 1996:309). Also, ceramics (primarily Tizon Brown Ware) found at the sites may indicate protohistoric occupation. At the time of the first Spanish contact and ethnohistoric documentation, Fr. Crespi noted the use of a variety of ceramic forms in the area. Evidence from several northern San Diego County sites (Byrd 1996) suggests this ceramic type does not predate ca. A.D. 1500–1600.

Inland Area Research

The search for well-documented archaeological sites containing protohistoric and early-historical-period components in inland southern California has yielded several examples. Most reports indicate that useful stratigraphic distinctions, however, are often obscured, even under the most rigorously controlled excavation conditions. For example, although the Serrano village site of Yukaipa't (SBR-1000) in San

Bernardino County contained glass beads and ceramics, the protohistoric and early-historical-period components were difficult to distinguish from among the four components at this site (Grenda 1998).

Tahquitz Canyon, a Cahuilla site (RIV-45) located in the mountains behind Palm Springs, has been extensively studied and may contain evidence of occupation during the protohistoric period (Bean et al. 1995). King disputed this, however; his analysis of shell bead types suggested that the site dates to the early historical period. Regardless, Tahquitz Canyon remains among the best studied sites in this part of southern California. Also in the Palm Springs area is the site of Yamisevul (RIV-269) (Altschul and Shelley 1987). Although only known through test excavations, Yamisevul is an extensive multiethnic Serrano and Cahuilla village that was occupied between A.D. 1876 and 1890.

Further west, the Perris Reservoir area contains evidence of occupation dating to the protohistoric period. At the Oleander Tank site (RIV-331), beads characteristic of late contexts, from A.D. 1500 to 1700, were found (O'Connell et al. 1974:159), whereas ceramic artifacts from the Peppertree site (RIV-463) suggested use after A.D. 1650 (O'Connell et al. 1974:160). Interestingly, artifacts associated with the Spanish settlement of southern California are completely lacking in this area (Wilke 1974).

Several small sites at Rancho Las Flores, near Hesperia, contain both protohistoric and early-historical-period (ca. A.D. 1550–1819) components (Altschul et al. 1989; Chambers Group 1990). These sites include artifacts such as glass trade beads, metal knives, abalone shell ornaments, and *Olivella* beads and disks. These goods could have been traded into the area via the vast exchange network that was in place by the early 1500s: their locations are very close to the Mojave Trail between the Colorado river and the Pacific coast (Altschul et al. 1989).

In western Riverside County, the Luiseño village sites of Temeku and Walker Ranch also contain early-historical-period and protohistoric components (Freeman and Van Horn 1990; McCown 1955). Temeku, near Temecula, is known to have been a subsidiary rancho of the San Luis Rey Mission in the late eighteenth century, and trade goods, including 40 glass trade beads and 11 *Olivella* shell beads, were found at this site. Although the early-historical-period occupation of the site is well documented, the stratigraphic relationship between these deposits and earlier artifacts is poorly understood, and no absolute dates for the site were obtained. Walker Ranch (RIV-333) was considered by Freeman and Van Horn (1990) to be the principal Luiseño village of the Paloma Valley. A wide variety of artifacts and features were discovered at the site. Distinct loci suggest that activities were spatially segregated. The inferences are weakened somewhat by the millennia-long occupation.

In conclusion, interest in the process of culture change guides most of the efforts to understand prehistory in the Southern California Bight. Investigations into the more recent end of the cultural spectrum have lagged, however, primarily due to the lack of archaeological materials identifiable to the protohistoric and early historical periods. Sites known to contain deposits dated to these periods are few, and rarely is the protohistoric component of such a site discrete or clearly definable. Generally, sites containing protohistoric components also have significant prehistoric components, and the two often cannot be differentiated due to postdepositional processes. Further, studies of Native American and European interaction in California have long been dominated by work at sites in and around missions. The research focus of these studies has been either on the effects of enculturation on neophyte populations living at a mission or on aboriginal settlements located adjacent to a mission complex. Few researchers have attempted to look beyond the missions to make quantitative or qualitative comparisons with contemporaneous Native American sites.

In summary, for the Ballona area, LAN-211/H is an extremely rare, if not unique, archaeological resource. Along the coast, there are a number of sites that do have clear early-historical-period components, but these tend to be large village sites that are not analogous to LAN-211/H. Documented inland sites with protohistoric components also tend to be large habitations, although some may be comparable in age with LAN-211/H. In short, LAN-211/H may offer the best opportunity to study a nonmission Native American labor camp, and as such, is a valuable archaeological resource.

CHAPTER 3

Research Design and Historic Contexts

Donn R. Grenda, Anne Q. Stoll, and Jeffrey H. Altschul

This chapter contains our strategy to assess the eligibility of archeological sites within the BLAD for inclusion in the NRHP. We first present a summary of the regulatory requirements, followed by a review of the research design included in the 1999 work plan and implemented during this inventory and testing project. We conclude with our assessment of site eligibility based on relevance to the historic contexts developed for the PVAHP.

Management Framework

Since its inception, the Playa Vista project has had a complex legal history. For the project to proceed, the applicant needed a variety of permits and approvals from federal, state, and municipal agencies. From the COE, the applicant had to obtain a permit to fill wetlands as required under Section 404 of the Clean Water Act. This permitted action requires the COE to comply with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act (NHPA). The proposed development also meets the criteria of an action as defined by California Environmental Quality Act, which is administered by the City of Los Angeles. Various components of the project also require permits from the California Coastal Commission issued under the California Coastal Act.

Each of these laws requires the regulatory agency to consider the effects of the project on significant cultural resources. What constitutes a "significant" cultural resource and how project effects on these resources are treated vary among the laws. Instead of trying to comply with each law individually at every archaeological and historical site at Playa Vista, state and municipal agencies agreed in 1991 to accept Section 106 compliance standards for the project. Because federal law is much more stringent than state and municipal statutes, the treatment of significant cultural resources at Playa Vista is more comprehensive and more involved than would be required if there was no federal involvement.

Under Section 106, the COE must take into account the effect of the proposed undertaking on cultural resources included in or eligible for listing in the NRHP. Thus, the first step is to identify cultural resources within the area of potential effects, and second, to evaluate the significance of the resources to determine whether they are historic properties—that is, NRHP eligible. To complete the required evaluation, the criteria for inclusion in the NRHP are specified, a plan of work outlining the necessary steps and research goals of the testing is implemented, and test excavations and analyses are carried out. The properties are then recommended as either eligible or not eligible for listing in the NRHP. The effects of the project on the significant resources—historic properties—are assessed and mitigation measures selected and implemented to resolve any adverse effects.

On unusually large or complex projects, such as this one, or one that requires numerous individual requests for comment under Section 106, an alternative to a case-by-case review of site eligibility is a programmatic agreement. A programmatic agreement outlines a review process specific to a particular project that streamlines the Section 106 process. In 1991, a programmatic agreement for the Playa Vista development project was entered into by the COE, the California SHPO, and the ACHP; two organizations representing Gabrielinos signed as concurring parties (Programmatic Agreement 1991). The programmatic agreement was extended in 2001 and is now set to expire in 2011.

In addition to Section 106, the Playa Vista project must comply with state law covering the discovery and disposition of human remains and associated grave goods (California Health and Safety Code 7050.5 and California Public Resources Code 5097.98). Pursuant to these statutes, after human remains were encountered during excavations at LAN-193/H in August 2000, the Native American Heritage Commission (NAHC) officially designated Robert Dorame, Tribal Chairperson for the Gabrielino Tongva Indians of California Tribal Council, as “most likely descendant” for the Playa Vista project. Archaeological work in the BLAD complies with a written plan of action submitted by the Gabrielino Tongva tribe (Dorame 2000) that includes the results of consultation and provides for the disposition of affected materials excavated intentionally or discovered inadvertently.

Research Design

A research design outlining a three-component approach for identifying and evaluating cultural resources in Area D was included in the 1999 work plan (Grenda et al. 1999). The first component was to inventory those areas where paleoenvironmental investigations suggested that buried intact cultural deposits were likely. The second component consisted of boundary and integrity testing at LAN-62 to establish the site boundaries and integrity of the site by mechanical means as a prelude to data recovery. The third component called for the evaluation of two prehistoric archaeological sites—SR-12 and SR-13—discovered during the initial 1990 survey of the property (Altschul et al. 1991). SR-12 has been given the site designation LAN-2769, and SR-13 is now the “new” LAN-211/H.

The present concern with the Playa Vista property focuses on the evaluation phase of the investigation. LAN-211/H was recorded nearly 30 years ago and ground visibility was less than optimal; however, the site record and report clearly indicate that the site may be NRHP eligible. The goal of our research design was to outline a research strategy that would provide the data required to make an eligibility determination. Part of that strategy requires that we first define “eligibility.” Four broad criteria (a–d) are used in the evaluation of eligibility, as defined by NHPA and its implementing regulations (36 CFR 800):

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, association, and:
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
> (b) that are associated with the lives of persons significant in our past; or
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

There is also a general stipulation that the property be 50 years old or older, although exceptions to this rule exist (see 36 CFR 60.4, Criteria Considerations a–q). The eligibility of a resource for nomination to the NRHP may be based on any of the four criteria for nomination. The HHIC was determined eligible for listing in the NRHP under Criteria a, b, and c; the BLAD, in contrast, was determined NRHP eligible under Criterion d.

The potential of LAN-211/H and LAN-2769 to yield information on the historic contexts and thus meet eligibility requirements for listing as contributing elements in the BLAD was tested using bucket augering, mechanical trenching, and manual excavation techniques. The methods used were considered most effective to determine the surface and subsurface characteristics of the sites, their condition of preservation and the extent of postdepositional disturbance, and whether these sites can provide sufficient data to answer a suite of research questions. Analyses of these data are then outlined to provide the necessary information for the COE to review the NRHP-eligibility recommendation.

Historic Contexts

Briefly, the issue of site eligibility is ultimately one of significance (see Butler [1987] for a discussion). Historic contexts provide a basis for judging a property's significance and, ultimately, its eligibility under the four criteria (Little et al. 2000). As noted by Hardesty and Little (2000:14)

> The concept of historic context has two meanings. First, a historic context can be understood as an organizing structure for interpreting history that groups information about historic properties that share a common theme, place, and time. Second, a historic context can be interpreted as those patterns or trends by which a specific occurrence, property, or site is understood and its meaning within prehistory or history made clear.

There are four general steps to creating historic contexts (Hardesty and Little 2000:14): (1) identify the theme, time period, and geographic limits; (2) assemble existing information and synthesize the information; (3) define property types; and (4) identify further information needs. In essence, a theme is the equivalent of a research problem, and a historic context is developed by placing the theme or problem in an appropriate setting in both time and space. The context is linked to tangible cultural resources by the concept of a property type (National Park Service [NPS] 1986:7).

> A property type is a grouping of individual properties based on a set of shared physical or associative characteristics. Physical characteristics may relate to structural forms, architectural styles, building materials, or site type. Associative characteristics may relate to the nature of associated events or activities, to associations with a specific individual or group of individuals, or to the category of information about which a property may yield information.
>
> Of particular importance to archeological properties is the fact that property types can be based upon our predictions of what resources likely existed at a given place and time in history and our expectations of what their likely condition is today [NPS 1986:8].

To evaluate the NRHP eligibility of sites found within the BLAD, SRI must determine if a site contributes information to any of the regional research questions we have developed for the district. These questions are grounded in the prehistory and history of the area and in previous scientific investigations. Once these questions are posed, we must determine whether contributing data are found at the site, and analyze their adequacy, integrity, context, and relevance to the research questions. Finally, based on analysis of the data obtained during testing, we will determine whether the site has the potential to yield important information—that is, whether data from it can address the research questions. If the answer is "yes," then SRI will recommend that the site is NRHP eligible.

Research questions are built on current data and theoretical orientation, and are supported by the cultural and historic context of the site. The resultant research framework permits the investigator to identify gaps in understanding of regional culture history, and explain how data from the site may be able to full in such gaps. Two broad historic contexts were first framed in the PVAHP research design (Altschul et al. 1991): (1) culture history and cultural dynamics and (2) prehistoric adaptations and a changing environment. Only one property type—middens—was defined for the BLAD. As Altschul et al. (1991:165) stated:

> All recorded sites consist of midden deposits, representing numerous occupations and reoccupations that occurred over periods of hundreds, if not thousands, of years. Instead of viewing each archaeological site as a separate property, it is more accurate to view the entire lagoon and escarpment as a locus of prehistoric settlement. From this perspective, it is the study of adaptation to the lagoon that is significant: a site's ability to contribute to that study is in essence the best measure of that property's National Register eligibility.

Culture History and Cultural Dynamics

Our first research theme examines culture change through time. The preliminary chronological sequence for the Ballona, as adapted from Moratto (1984) by Altschul et al. (1991), broadly covered culture history from 6500 B.C. to A.D. 1800. Our initial goal in designing this sequence was to achieve comparability by applying the traditional temporal categories, such as the Millingstone horizon, to the evidence of human activity found in the project area. As our knowledge of cultural markers and chronology has grown, our research interest has extended to address questions of greater regional significance. The topic of a desert to coast migration during the Intermediate period has moved to the forefront as issues of mobility, sedentism, and population aggregation are examined (Altschul and Grenda 2002). Formal stone tools are additional support for a desert tie with the Ballona (see Appendix C). The variety of projectile points found at bluff-top sites by Van Horn (1990), collectively labeled Marymount points, suggests a desert connection (Ciolek-Torrello and Grenda 2001). Refinement of the area's chronology continues. Recent discovery of protohistoric and early-historical-period artifacts at LAN-211/H has extended the era of known Native American occupation of the Ballona. Gabrielino village evolution and the process of acculturation at early-historical-period sites in the Ballona join the list of research issues to be addressed by archaeological investigations in the PVAHP.

Human-Land Relationships

Our second research theme focuses on human activities in relation to their surroundings. The human-land relationship theme considers the ways in which people adapt and interact with their environment as they pursue necessities such as food, shelter, trade, and territory and how these individuals are, in turn, affected by the changing environment in which they live. In an effort to examine issues within this second research topic, a program of coring and trenching was undertaken by SRI throughout the Ballona. The result was a preliminary paleoenvironmental reconstruction, summarized in Chapter 5, which is still being refined and which continues to aid our archaeological interpretations. Excavation of more than 400 continuous cores within the Playa Vista project area provided the base material for detailed stratigraphic and chronometric analyses and for paleoenvironmental studies of foraminifera, siliceous microfossil, ostracode, pollen, and mollusks (Boettcher and Kling 1999; Brevik et al. 1999; Davis 2000; Palacios-Fest

2000). Our preliminary model of lagoon development indicates that the wetlands were a highly complex system that contained changing landforms. Some areas of the marsh shifted from inhabitable to uninhabitable and back again. Except where coring revealed that no stable surfaces existed during the Holocene (e.g., in Track 49104-03 and the Freshwater Marsh), relatively intensive testing was required to find areas likely to contain archaeological deposits.

When sufficiently refined, a full paleoenvironmental reconstruction will yield a series of synchronic "snapshots" that represent moments in prehistory. Testable hypotheses are generated by superimposing evidence of human activity onto these snapshots. For example, geotechnical coring established that bay conditions in the Ballona were dominant by an early date, perhaps by 6500 B.P. (Davis 2000; Palacios-Fest 2000). What resources were available in the lagoon at this time? Is there any evidence that people used these resources? To date, only a single site in the lower Ballona area, LAN-206, is known from this period, and it was located on the bluff top overlooking the lagoon (Van Horn and White 1997c).

Three thousand years later, by the Intermediate period, not only were large areas of the bluff top occupied, but sites also appeared below the bluffs along upper Centinela Creek, not far from the lagoon edge (Altschul et al. 1998; Grenda et al. 1994). During the Late period, roughly 1000 B.P., settlement shifted again and the bluff tops were abandoned (Ciolek-Torrello and Grenda 2001). One model to explain these shifts targets the profound change in the ecology of the Ballona Lagoon, from an open saltwater bay to a sediment-choked freshwater wetland. With the lagoon reaching maturity during the Late period, the area should have remained attractive to humans in terms of resources; however, for some as-yet-unknown reason, the bluff tops were no longer inhabited. A major focus of current paleoenvironmental research is an assessment of how productive the estuary and environs would have been at various times in their evolution. Although also examining the cultural implications of environmental change, previous archaeological investigation in the Ballona concentrated on the lagoon edge and the upper Centinela Creek area (Altschul et al. 1999). In this report, SRI's focus shifts to lower Centinela Creek and the base of the bluffs.

Patterns of similarity and dissimilarity between sites in the Ballona Lagoon present themselves for future research. When sites are grouped primarily by their location and proximity to resources, are new, insightful interpretations of the data suggested? Beyond the simple dichotomy between bluff-top sites and those at the base of the bluff (Altschul et al. 1998; Altschul et al. 1999), the relationship of those at the base to those farther north at the lagoon edge can be explored. The intent of testing at LAN-2676 was to compare data from sites along Centinela Creek with data obtained from a site along the edge of the former lagoon. Unfortunately, the data from all three sites north of Bluff Creek Drive—SR-24, LAN-1932/H, and LAN-2676, termed the "Runway Sites"—have apparently been blurred by the construction of the Hughes Aircraft Company runway.

Expanding on earlier models (Altschul and Ciolek-Torrello 1990; Altschul et al. 1999), a division of the PVAHP into west and east halves, corresponding to the lower and upper reaches of prehistoric Centinela Creek, produces a distinct grouping of sites. At the heart of the western group is the area currently occupied by the Lincoln Boulevard incline up onto the Westchester Bluffs. This naturally indented landform was probably terraced alluvium in prehistory, providing easy, stepped access between the bluffs and the lagoon below. Located at a strategic position just east of the Lincoln Boulevard gap is LAN-62, the largest site in the Playa Vista project area, which might have been a prehistoric village. This grouping places LAN-62 at the center of a cluster of important archaeological sites, including LAN-61, LAN-63, LAN-64, and LAN-211/H. These sites, when considered collectively, form a "community," with LAN-62 as its hub. Located farther from the center, LAN-1932/H, LAN-2676, and LAN-2769 may be outlying settlements. These LAN-62 community sites also need to be compared to the upper Centinela Creek sites, LAN-60, LAN-193/H, and LAN-2768. Although the role of LAN-211/H within the LAN-62 community complex remains an open question at this point, given that LAN-211/H is intact, its chronometric and stratigraphic components may contain the answers. LAN-211/H may represent a later phase in the evolution of that community, or it may stand alone as an independent settlement in time and space.

This holistic approach to understanding the evolution of settlement in the Ballona focuses on the concept of a prehistoric community versus dispersed settlements, as examined against the backdrop of environmental change in the Ballona. This approach examines the past in terms of intrasite relationships and interactions, going beyond site attributes and formation processes.

With the theoretical and procedural framework established by this and the previous two chapters in Part I , we now move the report narrative into Part II, the presentation of field data. Chapter 4 presents our field methods; Chapter 5, our current paleoenvironmental reconstruction and soils and stratigraphic analyses; and Chapter 6 is a complete discussion of our field results.

CHAPTER 4

Methods

Benjamin R. Vargas and William Feld

The work plan (Grenda et al. 1999) outlined a three-component approach for identifying and evaluating cultural resources in Area D. This chapter details the methods used to satisfy each of the three components of the work plan. The first component was a discovery phase devised to target areas of potential archaeological sensitivity as suggested by paleoenvironmental reconstruction. The second component consisted of boundary testing at LAN-62, accomplished through two series of trenches. The third component of the 1999 work plan called for the testing and evaluation of two possible sites, then known as SR-12 and SR-13, now LAN-2769 and LAN-211/H, respectively.

Field Methods

Two major obstacles impede a traditional approach to evaluating archaeological resources at Playa Vista. First, the fluvial geomorphology of the Ballona Lagoon is such that cultural resources, particularly those sites near the lagoon edge, have been buried by sediment from floods and natural deposition from Ballona and Centinela Creeks. At the base of the bluff, soil eroding from the steep bluff face has covered archaeological deposits below. Second, archival research (discussed in Chapter 2) and the discovery of numerous fill deposits indicate that modern and historical-period modification of the landscape has been extensive. Traditional methods of archaeological site discovery, such as pedestrian survey or shovel testing, are inadequate; accordingly, SRI devised new techniques for locating deeply buried deposits and analyzing disturbed contexts. The methods described in this section represent the refinement of our strategy, as employed over our decade-long involvement with the PVAHP.

Component 1: Discovery

Bucket augering was used in Area D as a primary means of defining archaeological site boundaries. The bucket auger is a reliable tool for determining presence or absence of cultural materials. Figure 24 shows the location of excavated bucket augers in Area D. Backhoe trenching followed bucket augering; trenches were used to expose soil stratigraphy so that internal site structure could be examined.

Bucket Augering

Mechanical bucket augering was used at Playa Vista to locate subsurface archaeological sites in areas where the depth of fill material and the presence of pavement and improvements made backhoe trenches and hand excavation impossible. SRI Project Director Christopher Doolittle first used bucket augers in the vicinity of the HHIC, with its numerous standing structures, buried utility lines, and large paved areas

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Figure 25. Bucket auger equipment used during inventory of Area D.

(Altschul et al. 1999). The results were generally successful, and SRI continued to use the technique in other sections of Playa Vista.

A bucket auger is a specialized drill rig that excavates and retrieves soil using a hinged bucket drill bit; it is usually used for geological sampling. Mounted on a truck, a hollow-stemmed bucket auger reaches depths of more than 18.3 m (60 feet) below the ground surface. Two different sizes of buckets (12 and 16 inches in diameter) were used in the discovery phase (Figure 25).

Before fieldwork began, we designed a sampling grid with targets placed at 50-m intervals in a pattern across Area D (see Figure 24). This grid was staked off by survey personnel from Psomas, Inc., with unit numbers and elevations indicated at each stake. After augering began, it became clear to supervising archaeologist Kenneth Becker that the grid pattern could not always be followed; buried utilities, subsurface hazardous materials, and the presence of buildings or other Hughes-related features required moving stakes to alternative locations, which were subsequently mapped by Psomas personnel.

Once a testing location was selected, the crew positioned the truck over the stake and leveled it to the immediate surface. A relatively level surface is needed for the rig, which limited its usefulness on the slopes in the project area. The bucket was then rotated in a counterclockwise direction and lowered while mechanical force was applied. An SRI staff archaeologist was present at all times, making observations and taking depth measurements at regular intervals. After drilling for about half a meter, the rig lifted the filled bucket, the hinged lower jaw was dropped, and the sample dumped into a wheelbarrow; drilling then resumed. The SRI archaeologist inspected the soil and made notes on soil color, texture, content, and relative depth. Usually, the first levels penetrated by the bucket auger were either highly disturbed or consisted of modern fill material. Sterile alluvial bluff sands in the upper levels were also typical in some areas; these soils were not sampled. When intact soils were reached, we collected and tagged 40–100 liters of soil (2–5 buckets) for wet screening. All soils that were dark in color (possibly indicating an anthrosol) or that contained artifacts or ecofacts were sampled for wet screening. We assigned provenience numbers to each sample that corresponded to stratigraphic units identified during augering. After drilling, the auger shafts were backfilled with remaining excavated materials or, in some cases, with bentonite chips.

Limitations in the collection technique appeared when unconsolidated alluvial bluff sands or other loosely compacted fill materials were encountered; these sediments usually collapsed the shaft sidewalls, making it impossible to determine the depth of the excavation and often mixing various stratigraphic units. We made numerous attempts to counter this problem, which was especially troublesome at the toe of the slope at LAN-62. In shallow augers, water could be pumped into the unit to stabilize the walls, which increased the recovery. However, most attempts to sample in very sandy substrates failed.

In general, under the best of soil conditions, a minor amount of mixing takes place during excavation with a bucket auger. Because of the composition of soils and the way the rig operates, some materials from upper stratigraphic layers are mixed with those of lower levels. We attempted to compensate for this problem through close supervision by the monitoring archaeologist, who maintained a log noting such disturbance. Although bucket augering will never replace trenching or hand excavation for the amount or quality of data retrieved, the technique does provide reliable and accurate information on the presence or absence of deeply buried cultural deposits.

After augering, we wet-screened and processed the collected and tagged samples, a procedure described fully in "Laboratory Methods," below. The presence or absence of materials was then plotted onto the overall PVAHP map. Results of the bucket augering program are presented in Chapter 6.

Component 2: Boundary Testing

Trench excavation in Area D served two purposes. First, we used trenches to define the boundaries of potential sites located during the 1990 survey (Altschul et al. 1991) and by the bucket augering program. Through trenching, we were able to assess visually the size, depth, and integrity of these cultural deposits. Secondly, trenches were used to define soil stratigraphy within particular sites and in the project area generally. Trenching was directed and monitored by SRI staff.

1999 Trenching

In August and September 1999, 17 trenches of varying lengths and depths were placed along the base of the bluff to explore the extent of LAN-62 (Figure 26). We employed a standard backhoe fitted with a 2-foot bucket with a flat edge (Figure 27). Trench depth generally did not exceed 1.6 m, allowing field personnel to enter them safely. In some cases where these depths were exceeded, observations were made from the ground surface. Project Director Angela Keller monitored the crew and created the site map and work records. Dr. Stephen Williams interpreted the strata during this phase of trenching (Figure 28). While the work progressed, the monitoring crew recorded stratigraphic levels, described soils, and made general observations.

2001 Trenching

Between October 8 and 26, 2001, Project Director Benjamin Vargas monitored the mechanical excavation of an additional 22 trenches and 7 approximately 1-by-1-m test units between the western boundary of LAN-211/H and the eastern boundary of LAN-62. Dr. Jeffrey Homburg recorded and described soils,

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Figure 27. Trenching at LAN-62.

Figure 28. Documentation of stratigraphy in test trenches at LAN-62.

interpreted depositional contexts, and checked the stratigraphic profiles drawn of the trenches in the field.

The trenches along the periphery of LAN-62 were placed 25 m apart, whereas those within the riparian corridor were placed roughly north-south at 50-m intervals (Figure 29). Though varying in length and depth, all 22 trenches were approximately 1 m wide. A backhoe with a 3-foot-wide blade was used to remove 10–20 cm of soil per pass. SRI excavated to the soil level below the strata containing cultural materials, unless we encountered the water table. The project director frequently stopped excavation to investigate soil anomalies or to collect artifacts. Soil thought to contain cultural materials was sampled and wet screened, as described later in "Laboratory Methods." The field crew took notes and photographs during trench excavation and made detailed stratigraphic soil profiles (Appendix A). Some of the loose soil at the base of the bluff proved unstable and required shoring; trenches that could not be entered safely were recorded from the surface.

Seven test units were mechanically excavated into the sidewalls of trenches where intact cultural materials had been identified. These test units were excavated using a 3-foot-wide flat backhoe blade that removed soil in 20-cm lifts, or levels. In each 20-cm level, 16 20-liter (5-gallon) buckets were filled (the approximate equivalent of two 10-cm levels in a 1-by-1-m unit). These units were excavated into potentially intact, culture-bearing soils. Each excavation level was assigned a unique provenience number. The buckets of recovered soil were transported to the SRI water-screening facility for processing. Screening and processing at the PVAHP is described below, in "Laboratory Methods."

Component 3:
Test Excavation at LAN-211/H and LAN-2769

Testing at LAN-211/H and LAN-2769 delineated the vertical and horizontal dimensions of these sites and allowed us to characterize their content and integrity. We used three techniques to test these sites: bucket augers, backhoe trenches, and manually excavated test units. The controlled sample gathered was sufficient to gain the needed information while leaving most of these sites intact.

In the first phase of testing, SRI used the bucket auger, as described above, to determine the presence of cultural materials (i.e., artifacts or ecofacts). Culturally modified soils were recovered in 5-gallon buckets and wet screened as described in "Laboratory Methods" below. The bucket auger was especially useful in areas where access for the backhoe was restricted, such as near the office trailers formerly located at LAN-2769. After analyzing the bucket auger results, we planned a series of backhoe trenches to test the site boundaries of LAN-211/H (Figure 30) and LAN-2769 (Figure 31). SRI dug a total of 10 trenches: three at LAN-211/H (T-6, T-10, and T-11) and seven at LAN-2769 (1-1, 1-2, 1-3, 1-4, 1-5, 1-13, and 1-14). We used the same methods described above: trenches of varying lengths were excavated, and important stratigraphic information was recorded by field personnel, and stratigraphic soil profiles were drawn for those trenches that appeared to contain cultural deposits or features indicating disturbance.

Based on the results from the augers and trenches, SRI placed manual excavation units at both sites. At LAN-211/H, we dug 17 1-by-1-m units. Hand units were placed in four discrete areas (see Figure 30) to test different portions of the site. Units were excavated singly or in blocks of either two or four units. Units 1 and 2 were 1-by-1-m units; Units 3 and 4 were 1-by-2-m blocks. The four-unit excavation block containing Units 5–8 did not penetrate site sediments before reaching the limits of safe excavation. Unit 10 was then placed in the center of the floor of this block and was excavated to sterile sediment, creating a stepped excavation. Unit 9 was excavated as 2-by-2-m block, whereas Unit 11 was a 1-by-2-m block. All materials were wet-screened and processed as described below in "Laboratory Methods."

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At LAN-2769, SRI dug three blocks containing a total of nine 1-by-1-m units; Units 1 and 2 were excavated as 2-by-2-m blocks, each containing four 1-by-1-m units. Unit 3, a 1-by-1-m unit, was placed in the center floor of Unit 2. All materials were wet-screened and processed as described below in "Laboratory Methods."

Testing at both sites was complicated and restricted by the presence of standing structures, paved areas, and underground utilities. Access was restricted in the lower portions of LAN-211/H in the parking lot due to potential soil contamination; cross-trenching in Trench 11 was halted for this reason. The soil type at LAN-211/H also presented a challenge when hand excavation began. On the southern, upslope portion of the site, the covering of alluvial material from the bluff above measured more than 2 m and was very loosely compacted, requiring stabilization. As the units were dug into the hillside, hydraulic shoring was used to hold the sand in place so that field crew could excavate safely (Figure 32). At LAN-2769, access was denied in some areas because of underground utilities and subsurface instability.

Figure 32. Shoring in units at LAN-211/H.

Soils Analysis

The study of soils and stratigraphy is based primarily on observations made during fieldwork. Field observations included drawing profiles of excavated units and selected backhoe trenches and, at a minimum, recording information on the color and texture of the matrix. Typically, additional recorded information included the presence or absence of artifacts and the presence of various types of disturbance and structures that would indicate the environment of deposition or soil development. At LAN-211/H, Dr. Steven Shelley recorded most of the stratigraphy, and Dr. Jeffrey Homburg recorded detailed descriptions of the soils in selected units and trenches; this information is presented in the next chapter and in appendixes to this report. At LAN-2769, the stratigraphy was recorded by the crew excavating the individual units. Drs. Williams, Homburg, and Shelley described the sediments in the trenches west of LAN-211/H.

Laboratory Methods

Under the direction of SRI's laboratory director, William Feld, SRI's staff processed the materials from the excavations, completed an initial inventory, and began the basic artifact catalog. The following section describes the screening, sampling, sorting, transmitting, and cataloging activities. Analytical methods for the various artifact classes and paleoenvironmental studies are detailed in Chapters 6–9.

Screening

The first stage of laboratory processing occurred in the field: collected materials were tagged with their field proveniences and brought in buckets to SRI's wet-screening facility at the Playa Vista project area. Under the supervision of Mr. Feld, the matrix was screened through ⅛-inch mesh with pressurized water to dissolve and remove the soil matrix. The residue that remained in the screens after washing—usually small rocks, shell fragments, and artifacts—was then sun-dried, rebagged, and sent to the SRI laboratory in Redlands for inventory and sorting. Diagnostic artifacts observed during excavation and selected for special analysis (e.g., pollen wash) were not subjected to field washing. Artifacts generally arrived in the laboratory clean of most of their surrounding matrix, dry, and ready for sorting. After initial sorting, additional cleaning was only done as necessary for any particular analysis.

Four-mil reclosable plastic bags containing all materials from a given provenience—including rocks and gravel—were transported to the laboratory. Laboratory technicians used a provenience list to keep track of samples to be sorted and made careful notes of anything unusual and any problems they encountered during the sort. Double checks at each step ensured that all proveniences were processed correctly.

Sorting

Basic laboratory sorting for LAN-211/H was a two-step process. Bulk field materials were sorted by size, then by material type. To obtain a size sort, each provenience was screened through a series of four nested screens (2 inches, 1 inch, ½ inch, and ¼ inch). The fraction larger than ¼ inch was then sorted by basic material type, with the different size classes kept separate. For LAN-211/H, the basic material types were bone, charcoal, FAR, lithics, shell, worked bone, worked shell, and "other." Technicians were instructed to show any materials from the "other" category (seeds, wood, asphaltum, ochre, etc.) to the laboratory director or project director before inventorying. Materials categorized as FAR, lithics, other, worked bone, and worked shell were counted; bone, shell, and charcoal were weighed. All materials were bagged and tagged separately by provenience, size, class, and material type and were boxed by material type.

Laboratory technicians sorted all materials that passed through the 1/4-inch screen into discrete collections of bone, lithics, shell (hinges only), worked bone, worked shell, and "other." FAR, charcoal, and nonhinge shell fragments were separated in this size class. Bagging, tagging, and recording were done as for the larger materials.

As soon as we understood that LAN-211/H was a protohistoric/early-historical-period site, Project Director Benjamin Vargas required that all historical-period materials be recovered as well. New material type categories were added, including glass, ceramic and metal. The new procedure was used for the four units identified for analysis, which are listed below.

The final fraction, known as "dreck," including unsorted materials, rocks and gravel, were returned to their original bags, labeled, boxed, and stored with the rest of the collection. The partially sorted dreck that was smaller than 1/4-inch was bagged separately but put into the original, larger, dreck bag. SRI inventoried the dreck; all materials were retained for future reference in SRI's laboratory storage area.

Inventory

SRI collected the information acquired during sorting (size class, material type, count, or weight) by filling out artifact tags (placed inside each bag) and inventory forms, which were then entered into the catalog database. After data entry was complete, the laboratory director reviewed the inventory and checked for errors and inconsistencies. He also compared the inventory to the field provenience data to be sure that all proveniences were sorted properly. Once all errors had been corrected, the database became available for analysis. One of its first uses was to generate summary reports on the data for use in planning and budgeting the next phase of work.

Analysis

With the initial inventory complete, the quantity of shell and faunal materials collected required that SRI establish a sampling strategy for each site before analysis could begin. For LAN-211/H, the project director identified 34 proveniences for analysis (Table 4). These were chosen to obtain a representative sample from all areas excavated at the site. We selected five units (Units 4, 6, 9, 10, and 11) for analysis, including at least one unit from each of the four sampled areas. The upper three levels of Unit 4, a 1-by-2-m unit, and upper two levels from Unit 6, a 1-by-1-m unit, were eliminated from analysis when analysis of soil profiles revealed them to be recent alluvium or slope wash. The top two levels of Unit 11, a 1-by-2-m unit, were not analyzed for the same reason. Only the south half of Unit 4 was included in the analytical sample, to keep the sampled volume consistent. Unit 6 was chosen from one of the four-unit blocks for analysis; after the first two levels were discarded, the results from Levels 3 through 9, Unit 6, were combined with results from Unit 10, a 1-by-1-m unit excavated into the floor of the four-unit block, to represent the unit to its base. In other words, results from Units 6 and 10 were combined to form a single analytical unit, in order to provide a continuous column of site sediments. All levels chosen for analysis were excavated in arbitrary 10-cm increments in 1-by-1-m units. The level depths and strata encountered in each unit are discussed in Chapter 6 and presented in Table 10.

Table 4. Bone and Shell Analytical Samples from LAN-211/H

Units	Provenience Designations Sampled	Levels
Unit 4, south half	42, 43, 44, 45, 148, 152, 153	4–10
Unit 6 (upper levels, Unit 6/10)	53, 60, 64, 68, 72, 76, 80	3–9
Unit 10 (lower levels, Unit 6/10)	84, 85, 86, 87, 96, 97, 98	1–7
Unit 9, southeast and southwest quadrants	90, 91, 101, 102, 103, 104	1–3
Unit 11, south half	136, 142, 144, 146, 151, 155, 157	3–9

No sampling strategy was used for analysis of stone artifacts or beads: all lithic materials and all beads recovered were analyzed. For LAN-2769, three 1-by-1-m units were selected as the analysis sample: the southeast quadrant of Unit 1, the southeast quadrant of Unit 2, and Unit 3. Results are presented in Chapter 6.

The laboratory director was responsible for making sure that sampled materials reached the appropriate specialists for analysis. The completed sample inventory maintained at the SRI office also functioned as a tracking system for shipments to analysts. Artifacts were counted by both laboratory technicians and individual specialists to cross-check the numbers, improve the reliability of the data, and ensure the complete transfer of collections to the analysts.

SRI staff specialists then conducted their analyses. Provided with an inventory printout for the materials they received, analysts were instructed to check off bags as they analyzed them and to record any comments. Nonartifactual items were discarded at the analyst's discretion, after being recorded on the inventory log sheet. The laboratory director collected these log sheets on completion of the analyses and all data were later entered as updates into the computerized catalog record. The few shell samples taken for radiocarbon dating were destroyed as part of the analytical procedure. This was also noted in the catalog database.

CHAPTER 5

Environment, Soils, and Stratigraphy

Steven D. Shelley, Jeffrey A. Homburg, Antony R. Orme, and Eric C. Brevik

This chapter presents the environmental background, followed by a discussion of the soils and stratigraphy identified in the trenches and test excavations conducted in Area D of the project area. We begin with a discussion of the environmental setting of the Playa Vista project area. The results of the paleoenvironmental investigations conducted as part of the PVAHP are presented, followed by historical and modern characteristics of the Ballona wetlands. The paleoenvironmental reconstruction is then supplemented with stratigraphic and geochronological data to develop a temporal framework for the base of the bluff at LAN-62, LAN-211/H, and LAN-2769. Here, we identify and interpret natural earth processes associated with the formation and alteration of the archaeological record and reconstruct how the landscape evolved over time during different occupations (Homburg and Ferraro 1998:47).

Environmental Background

The Ballona Lagoon formed in a drowned river valley in the Southern California Bight occupying a low-lying gap between sandy uplands. The Ballona Gap is bounded to the southeast by the Del Rey Hills and tectonically uplifted cliffs known as the Ballona Escarpment, to the east by the Baldwin Hills, and to the northwest by the Santa Monica Mountains. Collectively, the wetlands and adjacent uplands are termed the Ballona. The sites reported here are located at the base of the Westchester Bluffs, the local name for a western portion of the Ballona Escarpment. Reconstruction of the evolution of the Ballona sets the stage for generating hypotheses and explaining human adaptation to this complex, dynamic coastal environment. This landscape reconstruction is crucial for testing hypotheses about site function, site distribution, community evolution, and population density.

Paleoenvironmental Reconstruction

SRI's reconstruction efforts have revealed that the prehistoric Ballona Lagoon was a rich but highly variable resource through time. As freshwater, brackish, and saltwater wetlands met, salinity levels rose and fell; habitable landforms emerged, subsided, and were inundated; and plant and animal species emerged, flourished, and disappeared. These changes were usually gradual, but catastrophic storms, floods, tsunamis, and earthquakes also affected the environment, which in turn affected human land use in the Ballona. Human adaptive responses to the evolving lagoon and wetlands were also complex. Placing environmental events in time reduces the number of interpretive variables and provides a framework for evaluating the cultural deposits.

A paleoenvironmental reconstruction of the Ballona was conducted as part of the PVAHP. This reconstruction is based on stratigraphic, radiocarbon, and paleoecological (mollusks, pollen, ostracodes, foraminifer, and diatoms) data obtained from about 200 cores, combined with observations and analysis of archaeological trenches, test excavations, and cores. These data were used to prepare a paleogeographic model for the last 7,000 years (Figure 33).

At the end of the Pleistocene, what is now known as Ballona Lagoon was open marine coastline. Deep sediments seen in cores from the Ballona include sand and gravel overlain by thick silt and clay (Poland et al. 1959). These strata are consistent with marine sands formed by the Pacific Ocean between ca. 15,000 and 7000 B.P. (Brevik et al. 1999). This period was typified by global fluctuations in sea level and regional transgressions of the Pacific Ocean.

At 7000 B.P., sea level globally was about 10 m below present levels, and possibly 12–15 m below. The Pacific Ocean would still have been transgressing across the coastal/estuarine floodplain of the Ballona Creek/Los Angeles River system. This drainage system probably bifurcated into numerous tributaries among freshwater marshes, while mudflats and sand bars would have characterized the land-sea interface. There is no reason to suppose that the sea penetrated any farther inland than the small estuarine wedge shown in Figure 33. The shoreline at 7000 B.P. was at least 500 m offshore, and possibly more than 1 km, from its current location. The Los Angeles River flowed into the estuary for much of the last interglacial/glacial cycle, as indicated by the massive submarine fan-delta off the coast. This does not exclude other outlets (i.e., to Long Beach) because the river is known to have changed course frequently during early historical times. The Westchester Bluffs were cut into the northern edge of the massive Pleistocene aeolian dune field that had accumulated downwind in response to the winnowing of the fan-delta and floodplain during the last glacial stage (and perhaps earlier). Erosion of the bluffs was caused by the Los Angeles River being pushed against the south edge of its floodplain by its own distributary deposits, as occurred historically with the Los Angeles and Tujunga Rivers in the San Fernando Valley. Marshy, vegetated areas rapidly developed in the eastern and southern portions of the bay, and these expanded with increased sedimentation (Brevik et al. 1999:9). Ostracode analysis from the Ballona reveals high sedimentation rates from ca. 6580 to 4600 B.P. (Palacios-Fest 2000). Palynological analysis of soil cores dating to this period also indicates an expansion of the salt marshes, suggested by the dominance of amaranth pollen (Davis 2000:12). Native populations probably fished, hunted, and collected wild plants across the broad floodplain around 7000 B.P., but the bluffs provided better drained landforms for establishing more permanent sites. Sites on the floodplain would have been submerged as sea level continued to rise.

By 5000 B.P., the marine transgression was nearing its eustatic end, as the continental ice sheets had largely disappeared in response to global warming. Thus it is reasonable to invoke a broad "Ballona Bay" at this time with ocean waters covering the Los Angeles River/Ballona Creek distributaries. Deep water at the coast, however, would have precluded the growth of extensive barriers at this time, although shoaling and subtidal bars were likely occurring just offshore of the present coastline because of the significant change in wave energy due to refraction. More likely, mid-bay bars and spits developed in "Ballona Bay" at the null point where seasonal fluvial processes were countered by perennial wave and derived current processes in the outer bay. We have little evidence for this, other than observations of such bays elsewhere, but it is significant that the underlying fluvial gravels in the Ballona aquifer rise to within 20 m of the surface in the location shown and could have provided a foundation for spit growth. Such sites may have been favored by fishing communities because they represented dry land amid marsh, mudflats, and open water. The mid-bay bar near LAN-61 may also have been favored by alluvial fan deposition. The salt marsh around the outer bay was probably limited in extent at this time because sedimentation reaching the intertidal zone would have been quite marginal. The open coastline was still probably 100–200 m seaward of the bluffs because much of the bluff erosion has continued since 5000 B.P., until they were stabilized by historical-period housing developments. The presence of oysters of 6,220 ± 80 RCYBP at -4.72 m in Core 1B reflects open estuarine conditions then in existence in the outer bay. Oysters were also found at shallow depths of -1.6 to 1.8 m in core 100 at 4790 ± 120 RCYBP. The presence of horn snail at -2.05 m and 4900 ± 140 RCYBP at Core 61 indicates intertidal conditions here.

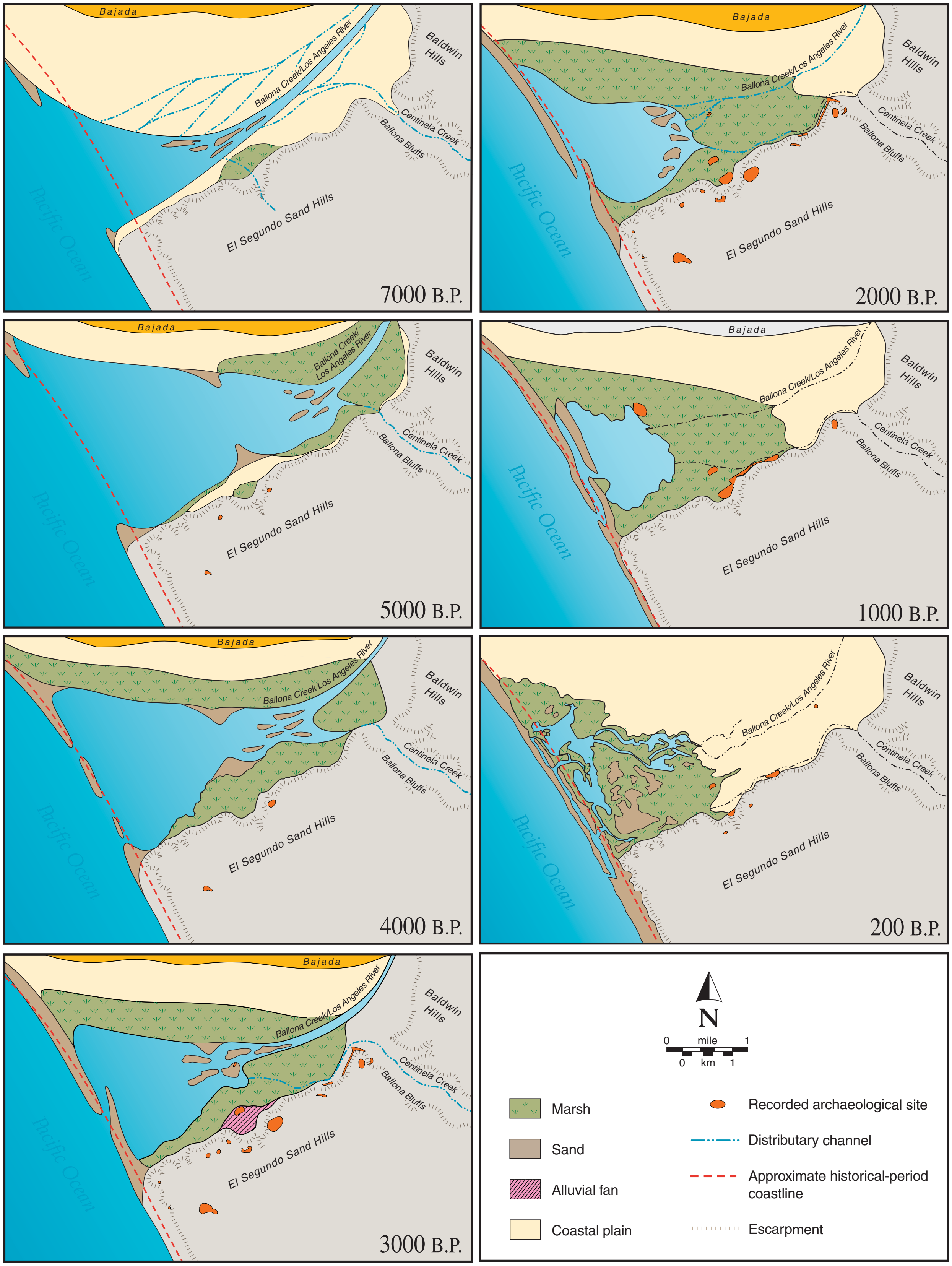

Figure 33. Holocene evolution of the Ballona Lagoon.

By about 4000 B.P., the eustatic transgression had ended. Subsequent changes in the configuration of "Ballona Bay" were attributable to: (1) fluvial sediment inputs from the Los Angeles/Ballona/Centinela Creek which would have caused alluviation of the inner bay in the form of longitudinal middle ground (intertidal) bars and mudflats; (2) salt marsh accretion on supratidal areas around the fringes of the outer bay, with mid-bay bars favoring leeward accretion; (3) marine/estuarine sedimentation in the outer bay, but still limited by the bay's broad dimensions such that intertidal sedimentation was essentially marginal; (4) growth of a nearly continuous beach spit-barrier across the mouth of the outer bay; (5) continued compaction and possible tectonic subsidence; and (6) hydroisostatic depression of the coastal zone generally, and the shelf area in particular, with hydroisostatic loading accounting for as much as 1 m/1000 yr of subsidence relative to fixed inland datums. Soon after 4000 B.P., oyster and jackknife clams disappeared entirely from the bay and were replaced by horn snails. Horn snails are much more tolerant of fresh water, so this shift marks a significant increase in freshwater inputs (Shelley 2001:14). A radical shift in the ostracode population also signaled this change, as a freshwater ostracode assemblage replaced the marine assemblage at around 4200 B.P. (Palacios-Fest 2000:26).

By 3000 B.P., the inner bay that formed in response to the initial transgression would have been largely erased beneath intertidal deposits of sand and mud, thereby restricting open water to the former outer bay. The coastal plain to the north expanded as supratidal fluvial (flood) and aeolian sediment accumulated and pushed the coastal plain/salt marsh interface southward. Salt marshes probably extended farther south from the north shore, as intertidal bars and mudflats extended westward from Ballona Creek. As in earlier times, much of this scenario would depend on the importance of discharge and sediment from Ballona Creek. If this creek still accommodated the Los Angeles River, at least intermittently, rates of accretion and shoreline progradation, as well as reworking during major floods, would have been much greater. If the creek did not receive Los Angeles River inputs, the area would have settled into a more passive state similar to that in historical times.

By 2000 B.P., the coastal plain (supratidal fluvial and aeolian sediments) continued to encroach on the salt marsh along the northern margin. The salt marsh was somewhat more extensive, extending to cover much of the bay beyond the north shore and at the creek mouths. The barrier and bluff shoreline on the open coast was probably still about 50 m seaward of the present. An extensive intertidal, unvegetated mudflat developed in the bay (lagoon).

By 1000 B.P., salt marsh islands and intertidal mudflats had become more extensive. The open coast shoreline was probably near its present location but, as earlier, there would have been perhaps a 100 m wide backshore between the sea and the bluffs. A double barrier that is depicted later in historical maps is inferred to have formed by this time. Double barriers are found along many coasts and they have different origins, including (1) diversion of drainage by a single encroaching barrier; (2) multiple barrier encroachment in a sediment-rich environment; (3) floodwaters breaching an inner barrier but then diverted by a new barrier formed from the floodwater sediment: (4) subsidence; and (5) human interference. For the next millennium, increasingly high volumes of water flowing through Ballona and Centinela Creeks, which led to accelerated sedimentation, the spread of marsh and wetland areas, and a corresponding decrease in the area of open water in the lagoon (Brevik et al. 1999:10). This conclusion is confirmed by pollen data, which indicate that before 3000 B.P., the species present in abundance were those that thrived in open, brackish water (such as *Ruppia, Botryococcus, Pediastrum,* dinoflagellates, and foraminifera), whereas after 3000 B.P., shallow-water species such as cattail and tule *(Typha-Sparganium* and *Cyperaceae)* became more numerous (Davis 2000:26). By 1000 B.P., sedimentation had caused the Ballona Lagoon to shrink to a small remnant of its former expanse.

The configuration of the Ballona was mapped in the 1893 U.S. Coast Survey (Figure 34). By about 200 B.P., sediments had filled much of the lagoon and a complex of sandy islands and extensive salt and freshwater marshes developed throughout much of the former lagoon. The north shore of the lagoon move slightly southward as the coastal plain to the north continued to expand.

This paleogeographic reconstruction provides a model for explaining the evolution of cultural land-use patterns in the Ballona. A major uncertainty in the reconstruction is the extent to which subsidence has influenced the nature, elevation, and distribution of marine, estuarine, and floodplain deposits. Subsidence may be due to compaction caused by dewatering and degassing of sediment, especially in the wetlands rather than marine and floodplain deposits, and locally to tectonism. Thus an estuarine deposit now found at 15 m below sea level may have been deposited originally at 12 m or so. Additional data are needed to further refine this model. Ideally, we need more subsurface evidence for the following: (1) the Core 1B area should be penetrated deeper to determine the depth of the underlying fluvial gravels from the late Pleistocene landscape; (2) petroleum drilling logs should be retrieved to define the entire late Pleistocene land surface; and (3) additional cores should be extracted from the northern part of the basin and another deep core from the basin center.

Biota

During times of low flow, Ballona Lagoon would have been a complex of brackish tidal outlets, freshwater runoffs, marshy pools, mud flats, and sandy islands, bordering an area of open water partially enclosed by a double barrier sand spit. The Ballona Lagoon is an estuary; that is, "a semi-enclosed coastal body of water with an open sea connection, where: (1) seawater is measurably diluted by the river drainage; (2) fluvial and marine sediments co-occur; and (3) marine and continental . . . fauna and flora co-exist" (Palacios-Fest 2000:4). The 1893 map (see Figure 34) depicts how this area appeared during a late stage of its evolution, prior to historical-period modifications over the last century. The Ballona still supports diverse species of marine and terrestrial mammals, invertebrates, and avian fauna, as well as several floral communities. An intensive survey of vegetation in the Ballona region conducted in 1981 identified three habitats and six plant communities that were representative of those that would have existed prehistorically (Gustafson 1981:Bo-1–Bo-29). Pickleweed saltmarsh, mudflat, and saltflat plant communities of the estuary contrast sharply with the freshwater willow and marsh habitat, and the coastal dune and coastal sage plant communities that dominate terrestrial landscapes. Inhabitants of LAN-211/H and LAN-2769 had access to all of these communites, but the freshwater habitat would have been central to their existence.

> Centinela Creek supports a riparian willow community that includes red willow *(Salix laevigata),* arroyo willow *(S. lasiolipis),* cottonwood *(Populus fremontii),* wire rush *(Juncus balticus),* toad rush *(J. bufonius),* field sedge *(Carex praegracilis),* and spike rush *(Eleocharis macrostachya* and *E. montevidensis).* The dominant freshwater marsh species found in the lower reaches of Centinela Creek include bulrush *(Scirpus californicus, S. onlneyi,* and *S. robustus),* spike rush *(Eleocharis macrostachya* and *E. montevidensis),* and cattail *(Typha domingensis* and *T. latifolia)* [Gustafson 1981:Bo-4–Bo-7].

Most of these species were used by the local inhabitants, the Gabrielino (McCawley 1996), but traces of these plants can be difficult to detect archaeologically. Another problem has been the failure of a number of large archaeological studies in the general project area include paleobotanical analyses (e.g., pollen, phytoliths, and carbonized macrobotanical remains).

Hydrology

Historically, the main freshwater sources for the Ballona Lagoon were the Ballona Creek/Los Angeles River and Centinela Creek systems. The combination of fresh water from these drainages and tidal flow

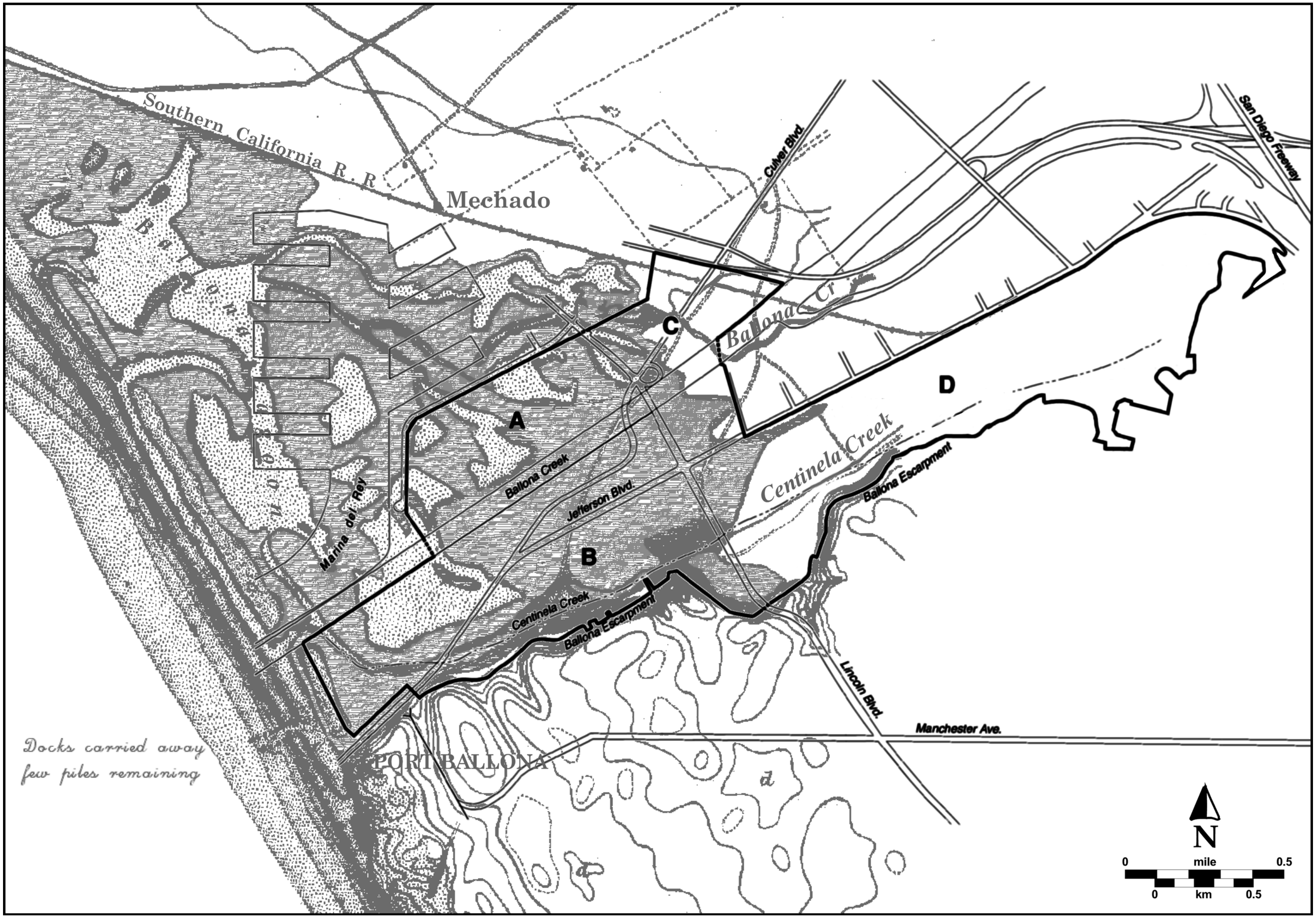

Figure 34. 1893 Coastal Survey Map overlaid with project area boundaries.

from the Pacific are what marks the Ballona as an estuarine lagoon. Episodic flooding changed the course of Ballona Creek, the larger of the two drainages, and drastically altered the biotic communities of the Ballona at various times. Johnston (1962:78) provided a telling description of the area: "During the winter rains the swampy delta became a vast inland sea from the higher ground of Culver City to the ocean. The Gabrielinos called this by their general name for any bay, *pwinukipar,* meaning 'it is full of water,' but in summer, they identified this area as a place where 'the water has departed.'"

Ballona Creek, occupying a remnant channel of the Los Angeles River, drains about 230 km^2 (90 square miles) of the Los Angeles Basin (USGS 2002). Independent of periodic contributions from the Los Angeles River, the Ballona Creek watershed draws from the series of canyons draining the south side of the Santa Monica Mountains, now channelized into the Sawtelle-Westwood and Benedict Canyon runoff-capture systems (Gumprecht 1999:229). Prior to modern channelization, Ballona Creek flowed into the lagoon in the approximate location of the intersection of Lincoln and Culver Boulevards. Ballona Creek was improved in stages, with its course and banks kept in a natural state until the 1920s. A concrete lining to channelize the entire length of Ballona Creek was completed in 1935 (Altschul et al. 1991:76). Tectonic activity through the gap forced underground water to the surface, thereby creating marshy areas that attracted prehistoric settlement (Poland et al. 1959:12).

During past floods, Ballona Creek frequently carried overflow from the Los Angeles River. As noted previously, the Ballona channel was the primary route of the Los Angeles River prior to the 1820s (Johnston 1962). Historical records are corroborated by offshore bathymetry, which indicates that a large submarine delta fan exists that could only have been produced by a substantial drainage over a long period of time, one larger than what could have been created by sediments carried by Ballona Creek alone. Table 5 lists the major historically documented floods of the Los Angeles River when the channel shifted (Gumprecht 1999; Newmark 1984). Archival and geomorphological data indicate that the Los Angeles River discharged into Ballona Creek, both historically and prehistoricaly. Highly variable channel configurations characterized this environmentally dynamic region through time. Coping with catastrophic conditions, such as those caused by flooding, must have been a vital component of local cultural adaptation. A 1938 aerial photograph shows extensive flooding in the Ballona during even a relatively minor flood (Figure 35).

Although draining a much smaller area, Centinela Creek was a much more reliable freshwater source for prehistoric inhabitants than the typical flashy flows of the Ballona Creek/Los Angeles River system. The numerous archaeological sites that dot its historical course are a clear indicator of the attractiveness of its riparian area. Centinela Creek is spring-fed from the Baldwin Hills to the southeast. Prior to historical-period channelization, it was a perennial drainage that flowed into the Ballona along the base of the Westchester Bluffs. Kew (1923:157) noted that:

> Before the city of Inglewood obtained its water supply from the wells at Centinela Spring, a stream carrying one hundred and twenty-five inches of water [3.125 ft^3/second or approximately 1,404 gallons/minute] issued from this spring, and flowed down Centinela Creek, forming these channels, which are now nearly obliterated. During wet weather it was even possible to row a boat up to the spring from Playa del Rey.

Within the gap, both Centinela and Ballona Creeks were subject to "lateral stream migration" during their histories (Brevik et al. 1999:13). Comparison of historical topographic maps and aerial photographs shows how the channels migrated over the last century. Similar channel migrations undoubtedly occurred throughout prehistory as well. For example, the 1893 survey of the area (see Figure 34) showed that Centinela Creek ran near the base of the Westchester Bluffs, whereas later photos show it had meandered northward to near LAN-1932/H. To delineate and date the major channel migrations relative to known and buried archaeological deposits of different ages would require much more extensive subsurface geoarchaeological investigations.

Table 5. Historically Documented Floods Affecting the Los Angeles River and Ballona Creek

Date	Description	Flood and Overflow Drainage
1815	Los Angeles River captured Ballona Creek and changed course into Santa Monica Bay until 1825	Santa Monica Bay
1825	Los Angeles River changed course and cut a new channel back to San Pedro Bay	Los Angeles Harbor (east basin, at the end of Terminal Island)
December 1859	Los Angeles River was impassable for months, river bed shifted a quarter mile	San Pedro Bay
1861–1862	"Greatest of all floods"[a]; Los Angeles River overflowed, split in two below Vernon, widespread inundation	Santa Monica Bay; one branch overflowed to Ballona Creek
January 1868	Los Angeles River overflowed; San Gabriel River cut a new channel to Alamitos Bay, and its old channel became part of the Rio Hondo, draining into the Los Angeles River	San Pedro Bay
January–February 1884	three major floods in three weeks; tremendous property loss; 97 cm (38 inches) of rain in the season; El Niño season	San Pedro Bay; overflow to Santa Monica Bay and Ballona Creek
January 1886	Los Angeles River crested 0.6 m (2 feet) higher but flood was of shorter duration than that in 1884	San Pedro Bay; overflow to Santa Monica Bay and Ballona Creek
December 1889	Los Angeles River overflowed, cut a new channel 3.2 km (2 miles) east, joined with the Rio Hondo and San Gabriel Rivers	San Pedro Bay and Alamitos Bay; overflow to Ballona Creek
February 1914	"Most damaging in history" to that time[b]; river channel shifted again; 12,000 acres inundated; tremendous property damage; El Niño season	Los Angeles Harbor via Dominguez Creek; overflow to Ballona Creek
January 1916	Los Angeles River jumped its banks and created new channel 91 m (100 yards) to south near Vernon; floodwaters join Rio Hondo	Los Angeles Harbor; most overflow to Long Beach Harbor
January 1934	overflow destroyed 1,000 houses in Venice and along Ballona Creek; Los Angeles River overflowed north of Long Beach	San Pedro Bay; overflow to Ballona Creek
March 1938	"Most damaging flood in LA history"[c]; Los Angeles River discharged more than twice the 1914 peak; major flooding along Ballona Creek	San Pedro Bay; major runoff flooding in Ballona Creek

[a] Newmark 1984:309
[b] Gumprecht 1999:167
[c] Gumprecht 1999:215

The exact location of archaeological resources and sites are not subject to public disclosure to prevent harm and unauthorized disturbance of the resources and sites, pursuant Section 5097 of the California Public Resources Code and Section 800.11 of the National Historic Preservation Act, as amended. Therefore, this figure has been excluded.

Stratigraphy

We observed the same basic stratigraphy in archaeological excavation units, trenches, and profiles along the entire base of the bluff. Three sedimentary facies were recorded in the area investigated: hill slope, alluvial fan, and alluvial plain. In the highest landscape position is the hill-slope facies, which is divided into two slope elements, the back slope and foot slope (after Ruhe 1975). In at least two locations, ravines have cut through the hill slope, causing alluvial fans (alluvial fan facies) to form below where there is a dramatic change to a lower slope gradient. Most of the archaeological deposits investigated were associated with the alluvial fan facies. In the lowest landscape position, the alluvial plain facies merges and interdigitates with the floodplain deposits of Centinela Creek and Ballona Creek.

Deposition is the dominant process in all three facies, except on the back-slope portions of the hill-slope facies, where erosion and sediment transport are the dominant geomorphic processes. A complicating factor in the stratigraphy is the extensive human modification of the landscape during the last century. Extensive mechanical excavation and redeposition of fill have altered all of the archaeological sites investigated along the base of the bluff. These modifications are so widespread in some cases that it is very difficult to distinguish historical-period and modern deposits from natural deposits.

Hill-Slope Facies

The hill-slope facies marks the northern edge of the Westchester Bluffs and occupies the highest position in the landscape on the Playa Vista property. In the area of LAN-211/H, the northern edge of these hills forms a steep, east-west-trending bluff. In elevation, the base of the bluff rises from 4.5–6 m to more than 45 m above mean sea level (AMSL) on the summit over a horizontal distance of about 30–40 m. The back-slope position of the hill-slope facies rises at approximately a 40-degree angle. The steep back slope makes the bluff susceptible to mass wasting caused by soil creep, sheet wash erosion, and gullying. Catastrophic slope failures can result from landslides and debris flows, especially in the winter rainy season. Tectonism and loss of vegetation caused by grass fires or long-term drought can help to initiate or accelerate natural erosional processes. Abundant evidence of slope failure and slumping is visible along the much of the bluff face. Steep slopes and geomorphic instability would have made the back slope of the hill-slope facies an unsuitable setting for human occupation. The foot slope at the base of the bluff is the gentle slope below the backslope. The foot slope has undergone some erosion, as indicated by occasional rills and gullies that have been filled in and erosional lag deposits, but the dominant geomorphic process has been deposition.

The lower back slope along the entire length of the bluff was modified when a sewer line and the overlying access road was constructed over seven decades ago. This sewer line appears on plan maps of the area as early as the late 1920s (David Chernick, personal communication 2000) and it is clearly shown on a 1929 aerial photograph (see Figure 19). Construction of this sewer line involved building an artificial bench and excavating a long trench on the back slope of the bluff. A narrow access road for Cabora Road (formerly Sewer Line Road) was built between 1929 and 1945 over the sewer line. To stabilize the sewer and road, earthen fill was placed to form an artificial berm that covers the back slope below the sewer, and in some places, alluvial fans that are crossed. Soil material from the construction might have been the source of some strata found at LAN-211/H and LAN-2769.

Alluvial Fan Facies

At several natural breaks in the bluff south of LAN-211/H, ravines and gullies have formed where there has been headward erosion on the shoulder slope and back slope. Alluvial fans composed of sediment eroded from the bluff have accumulated at the base of these ravines and gullies. Sediments in the alluvial fan facies are typically brown, pale brown, or yellowish brown and dominated by sand. The color and texture of these sediments clearly shows that they are redeposited from the Pleistocene dunes and sheets of sand that cap the bluff to the south. Examination of historical aerial photographs of the project area show that periods of heavy rainfall caused deposition of fan alluvium to form below the ravines and gullies.

In the project area, prehistoric and early-historical-period archaeological sites are concentrated in and on the alluvial fan. From west to east, LAN-62, LAN-211/H, LAN-193/H, and part of LAN-2768 are all associated with this fan alluvium. A major reason that human occupations favored these locations is the elevated position and better drainage of these fans than nearby lowlands to the north. The fans that merge with the river alluvium below are characterized by higher silt and clay contents, poor drainage, as indicated by the greenish and grayish colors that resulted from gleying, caused by significant water-logging for parts of the year. Saturation has resulted in anaerobic (without oxygen) conditions, which has caused iron in the soil to be reduced. By contrast, alluvial fan soils have much better drainage, so reddish, brownish, and yellowish colors result from oxidizing conditions that are dominant here. Darker brown colors mark soils with high organic matter contents, and these colors can mask the pigmenting effects of iron oxidation and reduction.

Lincoln Boulevard ascends the bluff through a large, amphitheater-like ravine in the project area, known locally as the Lincoln Gap. Natural sedimentary infilling of the Ballona covered the lower portion of this fan with alluvium deposited by the Ballona Creek/Los Angeles River and Centinela Creek systems (Brevik et al. 1999). Bucket auger data indicate that this fan may extend another 400 m north, buried below the historical-period surface, where the fan alluvium interfingers with river alluvium on the floodplain. Backhoe Trench 2-9 was excavated on this fan to document and identify the northeastern boundary of LAN-62. The fan surface was altered extensively by farming activities in the last century, including leveling and plowing. Agricultural modifications are visible in historical-period photographs - (see Figure 16 for an example). The fan at LAN-62 was large enough that flooding never completely covered it, so deposition of sediments was limited to low-lying parts of the fan. By contrast, smaller fans were typically covered by fresh deposits during major storms and flood events.

The alluvial fan east of LAN-211/H is located at the base of an unnamed ravine. This ravine once extended at least 400 m south of the face of the hill slope, but Loyola Marymount University filled the ravine to make it nearly flush with the bluff face. In 1938, an alluvial fan extended nearly 200 m north of the ravine and about 120 m to the east and west, forming the classic fan shape landform.

In the 1950s Hughes Aircraft Company, former owner of the Playa Vista project area, excavated the northern two-thirds of the alluvial fan to build several buildings, roads, and a parking lot. This excavation left the southern part of the alluvial fan as a bench-like remnant that initially appeared artificial, as with the fill placed in the ravine farther up slope. Subsequent excavations and examination of the stratigraphy revealed that this bench represented an intact part of the fan. This interpretation is supported by a combination of historical photographs and maps, preserved archaeological deposits, and most important, the presence of at least one moderately developed soil within the fan deposits.

Alluvial Plain Facies

Prior to extensive modification of the hydrology in the Ballona during the early 1900s, two streams flowed through the area, as previously discussed. The larger of the two streams, Ballona Creek, now discharges directly into the ocean because the channel of Ballona Creek is lined with concrete, which keeps it from flowing into the Ballona Lagoon as it did before historical modifications. Before the creek was fully channelized in 1935, it drained into the Ballona Lagoon to the north of its current channel. The channel of the smaller stream, Centinela Creek, is also now lined with concrete to where it empties into Ballona Creek east of Lincoln Boulevard. Historical maps show that prior to channelization, Centinela Creek flowed across the southern part of the Playa Vista project area, near the base of the bluff but skirting the north side of the fans, and then discharged into Ballona Lagoon near the existing Lincoln Boulevard–Bluff Creek Drive intersection. Both streams were prone to flooding, which at times was so extensive that the entire Ballona below the bluffs was covered with water. The alluvial plain facies consists of sediments associated with this extensive floodplain.

The surface of alluvial plain facies is relatively flat to gently sloping and low lying. Deposition is the dominant process, although localized erosion has occurred in places. The most dramatic form of deposition occurred as overbank flood deposits carried by major storm surges, which are now largely controlled by channelization. Massive deposits of sand and fine gravel are found in the overbank deposits near the streams, and finer-grained sediments, mainly silt and clay, characterize deposits further from the channels. Both coarse- and fine-grained, alluvial sediments were documented in Trench 11 at LAN-211/H (see Figure 51).

The floodplain has aggraded due to both major and minor flooding. In areas where the alluvial plain facies is undisturbed (that is, not modified by historical-period or modern earth-moving activities), there is typically a weakly developed soil that is about 1 m thick, consisting of an A horizon that is black to dark brown and usually sandy loam in texture. When moist, this soil appears massive, but when dry, a weakly developed subangular blocky structure is visible. In places, this soil also contains chunks of charcoal, roots, and root casts and apparently formed beneath marsh vegetation. Underlying the A horizon is a greenish gray to pale green silty deposit that is usually several meters thick. This silt is a distinct depositional unit, with an upper contact that is usually abrupt.

The alluvial floodplain was readily available for human use throughout much of the year. Seasonal winter rains and muddy surfaces would have made it more difficult to traverse, but it was dry most of the time and the abundant plant resources made it very attractive to human exploitation. Small numbers of artifacts are scattered in these deposits and they have been documented while monitoring grading operations for the Playa Vista development. These scattered artifacts attest to the generalized prehistoric use of this surface.

Summary

The stratigraphic context was documented through observation and analysis of subsurface excavations along the base of the bluff at Playa Vista. A repetitive pattern of distinctive sediments and soils was identified, divided in three lithostratigraphic facies: the hill slope, alluvial fan, and alluvial plain facies. These facies vary in their archaeological significance and potential for buried cultural deposits. Archaeological deposits are strongly associated with the alluvial fan deposits and the foot slope deposits of the hill-slope facies. Scattered cultural remains are associated with the alluvial plain deposits.

Soils Observations and Interpretations

This section presents observations and analyses made during SRI's inventory and evaluation of the remainder of Area D. Backhoe trenches were excavated at three archaeological sites: LAN-62, LAN-211/H, and LAN-2769. Detailed trench descriptions and profiles are included in Chapter 6.

Stratigraphy in the Area of LAN-62

The three facies described in the previous section were documented in 45 trenches that SRI placed to identifiy the boundaries of LAN-62. We describe the stratigraphy exposed in the trenches in terms of the soil/sediment morphology and type of deposit: artificial fill, fluvial deposits, and colluvial/alluvial deposits.

Trenches in the LAN-62 area (see Figures 26 and 29) frequently exposed one or more layers of artificial fill that contained a wide variety of modern and historical-period artifacts. Chunks of concrete, brick fragments, wire, and rusted metal were commonly found, and bone, glass, and wood fragments were found less frequently. Aerial photographs show extensive land modification in this area after Howard Hughes took possession of the property in 1941. Most of the artificial fill was apparently the result of earth-moving activities associated with the Hughes Aircraft Company.

Fluvial deposits were observed at the bottom of a number of trenches, represented by a series of greenish deposits of silt or loam. In three trenches (Trenches 1-3, 1-4, and 1-5) (see Table A.2), the greenish silts are capped by brown or black silt or sandy loams that represent marsh deposits where A horizons formed on the foot slope. Chunks of charcoal and small roots were found in this A horizon. In Trenches 1-4 and 1-5, the green silt is covered by a brown sandy loam that was tentatively interpreted as a weakly developed A horizon. This sandy loam may represent the first deposition of the hill-slope facies on the fluvial deposits of the alluvial plain facies. In Trench 1-5, this A horizon is covered by a dark brown deposit of sand that is highly laminated and that contains many small, shallow channels. A similar sequence was noted in Trench 11 at LAN 211/H.

Most of the trenches between LAN-62 and LAN-211/H were placed in colluvial/alluvial deposits in the foot slope of the hill-slope facies. Deposits in some of these trenches have A horizons (Trenches 1-7, 2-2a, 2-2b, 2-6, and 2-7) that are relatively undisturbed. These A horizons typically consist of dark brown or grayish brown sandy loams. These are similar in texture and color to strata where archaeological deposits have been identified along the base of the bluff.

Stratum Descriptions

The stratigraphy between LAN-62 and LAN-211/H consists of five distinct strata, four of which were observed below the bluff. A comparison of the strata at LAN-62 and LAN-211/H is presented in Table 6. Stratum 1 consists of artificial fill associated with construction activities. Stratum 1g is a brown (10YR 4/3) sandy loam that contains large chunks of concrete and asphalt. (Note: All Munsell colors are for dry soil.) The lower contact for this stratum is abrupt and truncates both Stratum 1h and Stratum 3d, which indicates that it was placed on a mechanically truncated surface marking an unconformity. Lenses of sediment that contain artifacts and that are similar in color and texture to Stratum 3d, the intact cultural layer, were mixed into this stratum due to historical-period earth-moving activities. Stratum 1h appears to have originated in this manner.

Stratum 2, was not visible in this area. Stratum 3d marks a buried A horizon (2Ab) of a weakly developed soil. It is a very dark brown (10YR 3/2) sandy loam that contains a relatively dense

Table 6. Summary of Strata and Facies at LAN-62 and LAN-211/H

Stratum and Facies (Landform)	LAN-62 Strata	LAN-211/H Strata
Stratum 1: Modern, artificial fill		
Alluvial plain (toe slope)	—	1a–f
Hill slope (toe slope)	1g, h	—
Stratum 2: Modern and historical-period alluvium and colluvium		
Alluvial fan (bench)	—	2a–d
Stratum 3: A horizon of moderately developed soil		
Alluvial fan (bench)	—	3a, b
Alluvial fan (toe slope)	3d	3c
Alluvial plain (toe slope)	—	3c
Stratum 4: B and C horizons of moderately developed soil		
Alluvial fan (bench)	—	4a–f, 4h–p
Alluvial fan (toe slope)	4t	4g, 4q–s
Stratum 5: C horizons of moderately developed soil		
Alluvial plain (toe slope)	—	5a–c
Alluvial fan (toe slope)	—	5d

concentration of artifacts, including shells and flaked stone. The stratum has been heavily bioturbated by the burrowing activities of rodents. Contact with the underlaying Stratum 4 is wavy to irregular due to bioturbation, possibly combined with mechanical disturbance as well. If this contact has been disturbed mechanically, Stratum 3d almost certainly represents redeposited cultural material similar to the lenses in Stratum 1. It is more likely, however, that this contact has resulted mainly from rodent burrowing, as is extremely common on this alluvial fan. Stratum 3, although highly mixed in places, does not appear to represent redeposition from elsewhere on the fan.

Stratum 4 is a layer of laminated, pale brown (10YR 6/3) sand deposited on alluvial fans at the base of the bluff. The oxidized colors indicated these deposits originate from the Pleistocene aeolian deposits on the bluff top to the south. These deposits contrast sharply with alluvium elsewhere in Ballona where waterlogging has caused gleying, which results in greenish to grayish colors due to reduced iron in the sediment. No artifacts were found in the profile of Stratum 4.

Stratum 5d is a deposit of stratified layers of sand that represents fluvial deposition. The relatively high landscape positions suggests that this sediment mainly consists of material eroded from up slope on the bluff and the alluvial fan.

Stratigraphy at LAN 211/H

Testing at LAN-211/H indicates the cultural deposits here are limited to the alluvial fan facies (Figures 36 and 37). The largest intact portion of the site is associated with a bench created when the Hughes Aircraft Company removed part of the alluvial fan to construct buildings and a parking lot. Most test units (Units 3–7, 10, and 11) were excavated on this bench (see Figure 22). Cultural deposits were located in the upper part of a moderately developed A horizon that is about 1 m thick. The sequence of the five strata is relatively consistent in all test units.

Stratum Descriptions

Stratum 1 consists of artificial fill material. Stratum 1a is an asphalt layer built on parking lot and road surfaces that was identified only in the backhoe trenches and in Unit 9. The asphalt usually overlies a bed of yellowish brown decomposed granite (or grus) that was designated Stratum 1b. Decomposed granite was used extensively by Hughes Aircraft Company as a base for roads, parking lots, and runways throughout much of the Playa Vista property, so Stratum 1b dates to the 1940s or later. Trenches were

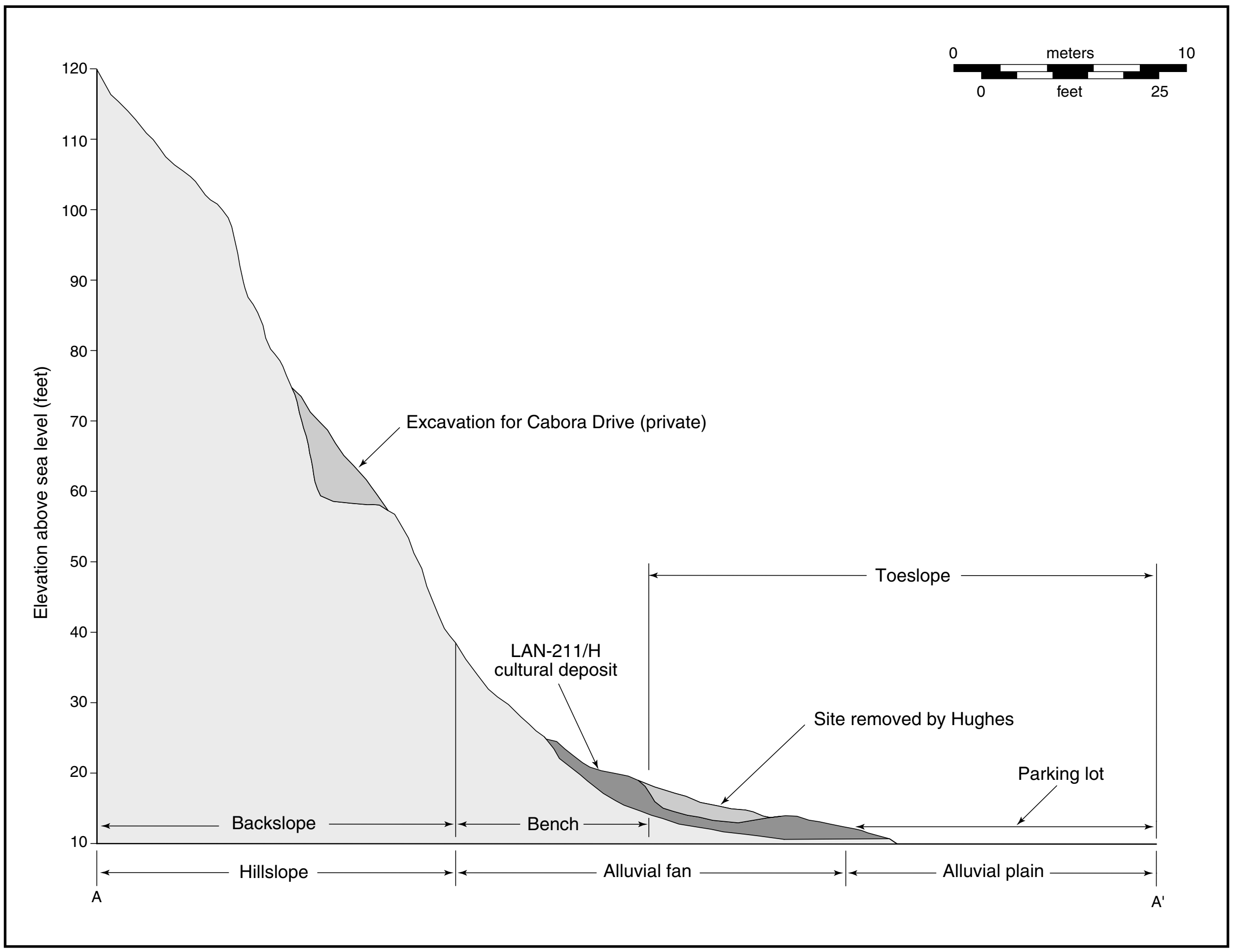

Figure 36. Reconstructed geomorphic cross section of LAN-211/H.

The exact location of archaeological resources and sites are not subject to public disclosure to prevent harm and unauthorized disturbance of the resources and sites, pursuant Section 5097 of the California Public Resources Code and Section 800.11 of the National Historic Preservation Act, as amended. Therefore, this figure has been excluded.

excavated by Hughes Aircraft Company for various underground utilities. These trenches were backfilled with a variety of materials, including gravels (Strata 1b–f), and, in some cases, mixtures of local sediment redeposited from elsewhere (Stratum 1f). The best example of this sequence was noted in Trench 11 (see Table A.4).

Stratum 2 is a mixture of modern and historical-period alluvium and colluvium. Unlike Stratum 1, Stratum 2 is not the product of human activity. All three layers in Stratum 2 consist of fine sandy loams that were designated C subhorizons because they appear to represent naturally redeposited material that is too young for any soil development. Stratum 2a was found only in Units 3 and 4. This stratum is similar in color to the A horizon material of Stratum 3, but it likely represents material washed down from the slope. Stratum 2a is a historical-period deposit that probably represents material redeposited from up slope when the sewer line was built on the bluff face in the early 1920s or, more likely, slope wash from the denuded hill slope. It is uniformly thick across the surface of Units 3 and 4, and the contact with the underlying Stratum 2b is relatively smooth and abrupt. Stratum 2b dates to the twentieth century, as indicated by abundant steel wire nails and rusted steel wire in the matrix. Lenses of culturally sterile sand and thin layers of clay were found at the upper and lower contacts of this stratum. The position and abrupt, irregular boundaries of Strata 2b and 2c suggests that these lenses are the result of mechanical disturbance. Stratum 2b likely postdates construction of the sewer line up slope. Stratum 2c is a fine sandy loam with an abrupt, wavy to irregular boundary, which indicates that it was eroded or mechanically altered prior to deposition of Stratum 2c.

Stratum 3 contains most of the artifacts and it corresponds to the upper horizon of a moderately developed soil. In Units 3 and 4 on the bench, this stratum underlies Stratum 2. In Units 1 and 2 at the edge of the bench, Stratum 2 was either removed during the excavation of the parking lots and building pads or else was never present. The latter is more likely the case. Stratum 3a in Units 1–4 and Stratum 3b in Units 5–8 and 10 are similar in color and texture, located in the same position on the bench, and in both cases are buried under Stratum 2. The A horizon is up to 1 m thick in places, with weak to medium subangular blocky structure.

Stratum 4 contains a moderately developed soil found in the alluvial fan facies and extending downslope to the alluvial toe slope. This soil developed in fan alluvium, but it appears to predate the cultural deposits found in other strata at LAN-211/H. A few artifacts were noted in Stratum 4, but these remains likely represent materials translocated from above by extensive bioturbation. An A horizon was noted in Stratum 4 in most excavation units on the bench in the upper alluvial fan deposit and in fan alluvium in Trench 11 that laps onto the stream alluvium on the floodplain below. Some of the krotovina in Stratum 4 contained sediment and occasional artifacts translocated from Stratum 3. The B and C horizons of Stratum 4 contained no artifacts, so there has been little mixing in the lower part of Stratum 4.

Clay- and iron-rich lamellae were noted in the B horizon of Stratum 4 in Units 1 and 2 (see Table A.5). Lamellae are clayey bands that initially mark bedding planes of fine-grained sediment. The thin deposits of clay can migrate downward by illuviation as clay in suspension is translocated in a sandy matrix during episodic wetting events during the rainy season. Variations in pore continuity through the soil cause differences in the wetting front when the soil is saturated, and clay is concentrated into ribbon-like bands at the wetting front (Figure 38). The processes and time span needed for lamellae formation are poorly known, but they probably take several millennia to form in this climate due to the low rainfall. These lamellae are significant archaeologically because they are a clear indicator of geomorphic stability and they suggest that this fan is several thousand years old.

Stratum 5 marks a C horizon, a zone with no soil development, that is composed almost entirely of fan alluvium lacking artifacts. It may be correlated with the C subhorizons noted in Stratum 4. This deposit is typically pale brown (10YR 6/3) in color and sandy to silty in texture, occasionally some admixed fine gravel. Sediments are usually weakly bedded and well sorted. The lack of soil development in Stratum 5 suggests the sediments were deposited relatively quickly with no intervals of geomorphic stability.

Figure 38. View of Unit 1, LAN-211/H, with lamellae visible at the bottom of unit.

Discussion

The sedimentary sequence for LAN-211/H is complex. The basal deposit in the site area is a greenish, silty fluvial deposit associated with the alluvial plain facies. This silt represents sediment deposited either in shallow water or marsh. Overlying this silty deposit was an extensive alluvial fan deposit (alluvial fan facies) associated with the ravine on the south edge of the site. The sandy loam of the lower fan deposit probably accumulated relatively rapidly because no buried soils were found in the lower fan that would indicate periods of geomorphic stability.

Deposition rates on the fan eventually slowed and stabilized enough for a soil to begin forming, prior to human occupation. An A subhorizon (Strata 4c, 4o, 4p, 4e, and 4 g) with a very low density of artifacts was found in most excavation units, but these remains are like the result of bioturbation. Extensive krotovina were documented in all units and some of these contain Stratum 3 sediment with occasional artifacts. A series of clay-rich lamellae was observed in Stratum 4, which indicates the fan was stable for an extended period of time, perhaps for several millennia before human occupation of the fan.

LAN-211/H was occupied about the time the fan surface stabilized and the rate of aggradation slowed. Stratum 3, the upper A subhorizon is located entirely in the fan alluvium and it is the primary cultural stratum. Some time after Stratum 3 was deposited, fluvial deposits from Stratum 5 from the alluvial plain facies buried the northernmost fan alluvium, as shown in the area of Trench 11. Stratum 5 is a series of alternating beds of sand and silt that represent individual flooding episodes. In Trench 11, Stratum 5a contains fluvial sands separated by thin silt layers that appear to originate from Stratum 3. We conclude that this location is where flooding caused the deposition of courser overbank sediments dominated by sand, probably from Centinela Creek.

In the 1920s the sewer line and overlying access road were built, thus disturbing the base of the back slope. Some material from this construction now obscures part of the foot slope on the alluvial fan. In the late 1940s Hughes Aircraft Company excavated a large part of the alluvial fan to level the area for a parking lot, road, and buildings. A composite map shows the topography of the LAN-211/H area prior to grading by Hughes Aircraft Company (Figure 39). The 1941 map shows the fan visible in the 1938 aerial photographs. An overlay of the photograph with the current topography shows that as much as 3 m (10 feet) of sediment was graded and removed, resulting in a bench that is a remnant of the previous alluvial fan. Historically, the ravine on the bluff face was filled, slope runoff was channelized, and vegetation was planted to slow erosion. During the last two decades, as facilities at the base of the bluff were no longer being maintained, colluvial slope wash deposits have begun to bury parts of the asphalt road and parking lot. Alluvial fan deposition is still in progress.

Stratigraphy at LAN-2769

All trenches and excavation units at LAN-2769 were placed on the foot slope of the hill-slope facies and the deepest trenches reached underlying deposits of the alluvial plain facies (Figures 40 and 41). Where the foot slope meets the back slope, the cultural deposits are relatively intact. A weakly developed soil horizon indicates at least a brief period of geomorphic stability when the site was occupied and perhaps after it was abandoned. Extensive modern disturbance was documented in all of the test units. A large part of the foot slope was removed to create an asphalt parking lot and this activity probably destroyed part of the site, because artifacts extended to the edge of the excavated slope. SRI excavated five trenches in the parking lot just north of the bluff. Details of the stratigraphy are presented in Table A.2.

The first stratum encountered in all five trenches consisted of an asphalt cap below one or more layers of modern fill. The fill varied from trench to trench, but wire and rusted metal were common, along with chunks of concrete and brick fragments. Trench 1-1 was unusual in that it also contained fragments of aircraft parts. All of this fill appears to postdate 1941, the beginning of Hughes Aircraft Company's occupation of the property.

The bottom stratum of all five trenches consisted of fluvial deposits, the deepest of which are deposits of greenish silt or loam. The greenish color indicates the sediments are gleyed due to waterlogging in a marsh deposit, which is further indicated by the presence of small aquatic gastropods. The fill in Trenches 1-1 and 1-2 directly overlies this layer, almost certainly indicating mechanical excavation of the area prior to placing the fill there.

The greenish silt in Trenches 1-3, 1-4, and 1-5 was capped by brown or black silt or sandy loams that mark weakly developed A horizons in the marsh deposit. In Trench 1-3 the green silt is overlain by a black loam containing chunks of charcoal and small roots that is clearly a marsh soil. In Trenches 1-4 and 1-5 the green silt is covered by a brown sandy loam that was interpreted as a possible weakly developed A horizon. This sandy loam may represent the first deposition of the hill-slope facies over the alluvium of the alluvial plain facies. The A horizon in Trench 1-5 was covered by a series of laminated, dark brown sand with small, shallow channels. Here, the fluvial deposits appeared to grade to the hill-slope facies, similar to the sequence observed in Trench 11 at LAN-211/H.

Stratum Descriptions

Four distinct depositional strata were observed at LAN-2769. Stratum 1 consists of artificial fill added to the site during earth-moving activities associated with construction. Stratum 1a is the asphalt layer on the parking lot surface. The asphalt layer in Unit 1 capped a brown sandy loam fill that contained a cow bone

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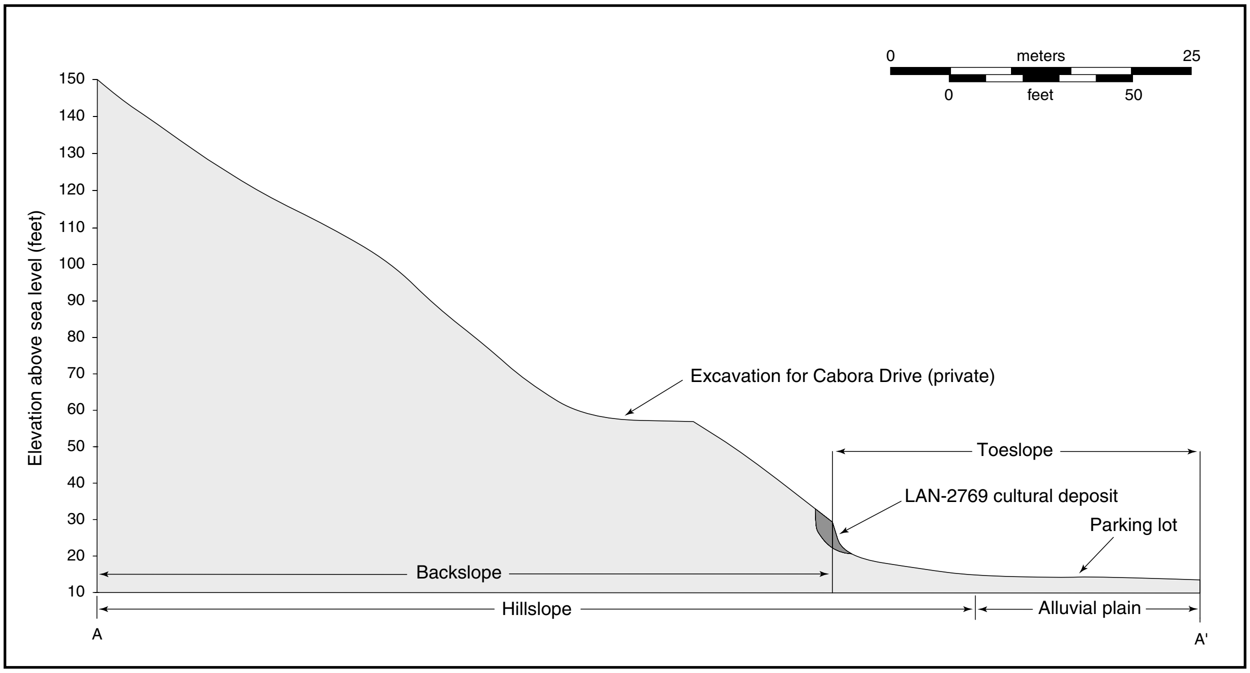

Figure 40. Reconstructed geomorphic cross section of LAN-2769.

and glass fragments. Aerial photographs show that this parking lot was in use by Hughes Aircraft Company during the 1970s. Strata 1b–f are all modern deposits containing a variety of modern artifacts.

Stratum 2 is the upper A horizon (A1b) of a weakly developed soil buried beneath several layers of Stratum 1. Stratum 2 is heavily bioturbated, which makes interpretation of its origin and age difficult. It was interpreted as being an in situ A horizon, but it may be A horizon material that was redeposited from up slope. It is similar to Stratum 3, which it overlies, although it is lighter in color, with light grayish brown (10YR 6/2) in Stratum 2 as compared to dark grayish brown (10YR 4/2) in Stratum 3. Stratum 2 lacks prehistoric artifacts, suggesting that it was deposited after the site was occupied.

Stratum 3 is the in situ lower A horizon (the A2b subhorizon) of a weakly developed, buried soil. It was given a separate stratum designation from the overlying A subhorizon because it contains a low density scatter of artifacts that represents the cultural deposit of LAN-2769. Like Stratum 2, it was also heavily bioturbated.

Stratum 4 is the C horizon, a zone that lacks soil development and that is relatively unweathered. It lacks artifacts except where rodent burrows are filled with material from the overlying Stratum 3 matrix. Stratum 4 consists of brown to yellowish brown sand or sandy loams that represents material washed from the back slope to the south.

Discussion

The sedimentary sequence at LAN-2769 is as follows. Initial deposition at the site and immediately around it consists mainly of alluvium from the alluvial plain facies. The site area is largely at or just above the water table, which has resulted in gleyed sedimentary deposits dominated by silt. The last layer in the alluvial plain facies is a soil formed in marshy conditions that is typically black and contains charcoal chunks and small roots. No evidence of occupation was associated with any of the alluvial plain facies. At some point in time, probably in the last 3,000–4,000 years B.P. judging from the age of nearby

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archaeological sites, the rate of fluvial deposition slowed to the point where material eroding off the bluff began to extend the hill-slope facies northward over the marsh. Weak soil development in the excavation units suggests that this initial extension of the hill-slope facies was rapid. Eventually the rate of deposition slowed to the point where the surface of the foot slope was stabilized, resulting in the development of a weak soil that was associated with human occupation.

Slow deposition of colluvium and continued soil development probably continued after the site was abandoned prehistorically. The landscape remained geomorphically stable until the 1920s, when the sewer line was built and the back slope was disturbed. After 1941, construction activity by Hughes Aircraft Company removed portions of the foot slope to level the area for use as a parking lot. During the 1980s and 1990s, the area was no longer being maintained, and erosion of the back slope was accelerated. The result was renewed colluvial deposition on the foot slope, with an accumulation of sand and silt extending onto the asphalt parking lot.

CHAPTER 6

Field Results

Benjamin R. Vargas

The work plan for the inventory and evaluation of Area D (Grenda et al. 1999) had three objectives: (1) to inventory areas likely to contain buried deposits, (2) to determine the boundaries of LAN-62, and (3) to evaluate the NRHP eligibility of LAN-211/H and LAN-2769. This chapter summarizes the fieldwork accomplished under the work plan. It includes the results of 129 bucket augers, 45 mechanically excavated trenches, and 33 manually excavated test units.

Ultimately, the inventory and evaluation strategy outlined in the plan was successful in defining the boundaries of sites within Area D and in obtaining sufficient information to assess the potential eligibility of resources for listing in the NRHP as contributing elements of the BLAD. We originally planned to obtain all data necessary to accomplish the work plan's goals in a five-month field season between May and September of 1999. Analysis of the results, however, indicated that we were still unable to define the precise boundaries of LAN-62. Accordingly, we returned to the field for additional trenching in October 2001 and secured the necessary data to accomplish this task.

The organization of this chapter follows the three-part strategy of the work plan. First, we present the results of the inventory using the bucket auger; included in this section is the summary of boundary testing of LAN-62. The results of testing at LAN-211/H and LAN-2769 follow. Data are described and summarized in this chapter; they are presented in their entirety in tabular form in Appendix A.

Bucket Auger Inventory

The results of the bucket-auger inventory of Area D are the subject of this section. These bucket-auger data are augmented by the results of SRI's monitoring of bore holes, or cores, excavated in 1999 by Group Delta Consultants, Inc. (Group Delta), for environmental testing (Taşkıran and Stoll 2000b). Although soils from cores were not screened, coring logs provided by Group Delta helped identify intact soils and fill materials. Group Delta cores are identified in chapter figures by a "B" preceding their number.

Following the bucket-auger testing, mechanical trenching and excavation was conducted along the base of the bluff. Trenches were placed to test the integrity of prehistoric cultural materials discovered by the bucket augers and to refine the three-dimensional boundaries of LAN-62, tentatively identified through the auger results.

SRI excavated 129 bucket augers in the discovery phase of the Area D inventory (see Figure 24). Of this total, 55 augers penetrated cultural material; of those, 24 augers contained cultural materials considered to be in situ, 19 recovered cultural materials in questionable stratigraphic context, and 12 encountered cultural material in fill strata (Figure 42). In order to classify the auger results, recovered remains were grouped by artifact or ecofact class (marine shell, bone, lithics, and historical-period artifacts). We based our initial assessment on a simple presence or absence of artifacts within recovered materials. Later, we refined our assessment by developing a ranking system. In many cases, it was obvious that the auger hit intact cultural material: a combination of lithic and faunal material was

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recovered, and the stratigraphic context was good. The results from other augers were more difficult to interpret and required having either a faunal or a lithic specialist review the recovered material while consulting the recorded stratigraphic data. After a second review, we made our final determinations, which are summarized in Table 7. Based on stratigraphic integrity, the presence or absence of cultural materials, and their relative proportions within a given sample, auger results were assigned to one of the following six descriptive categories, based on the predominant soil type:

Category 1. Prehistoric deposit in native soils. Soils in this category are intact and contain cultural materials such as lithic artifacts, marine shell, and bone. This category includes areas of in situ archaeological site deposit. Category 1 soils were found in 24 bucket augers (see Table 7).

Category 2. Possible prehistoric deposit in native soils. Soils in this category contain shell, bone, lithic artifacts, or a combination of all three. The depositional integrity of these cultural materials, however, is suspect. Category 2 soils were found in 19 bucket augers (see Table 7).

Category 3. Prehistoric cultural materials in fill. Some bucket augers encountered prehistoric cultural materials in secondary contexts. In such instances, shell or other cultural material was found in layers identified as modern fill. This fill matrix was often characterized as coarse sand, which may have originated from the Westchester Bluffs or from the alluvial fan at LAN-62. Category 3 soils were found in 12 bucket augers (see Table A.6).

Category 4. Nonsite in fill. This category is composed of soils used as construction fill. These were generally recognized by the presence of modern or historical-period debris (often construction rubble, such as fragments of concrete and brick). Soils of this type are highly variable and can include alluvium and colluvium. In some cases, fill soils were seen in the upper levels of bucket augers, while the lower levels were intact, but contained no cultural material. These auger results were grouped with the Category 4 soils, as the fill was the dominant feature. Category 4 soils were found in 49 bucket augers (see Table A.6).

Category 5. Nonsite in native soils. This category refers to intact soils that do not contain cultural materials. Most often, these silts and clays represent buried marsh deposits that typically contain a large amount of decomposing organic material and small gastropods. Category 5 soils were found in 24 bucket augers (see Table A.6).

Category 6. Unknown. The final category of "unknown" was created in earlier work at LAN-62, where soft, sandy soils caused the bucket auger shaft to collapse before a clean sample could be obtained. Some of these augers may contain prehistoric cultural materials but will require further evaluation when upper fill layers are removed. Only a single bucket auger (BA 88) was classified as *entirely* Category 6. The results of three additional bucket augers were affected by the collapse of the lower shaft walls, but other soils were present above the collapsed areas that permitted classification in another category.

After classification, bucket auger results containing Category 1 and 2 soils were subjected to additional analysis. To this group were added comparable data from cores drilled by Group Delta for soils testing. We created three schematic profiles of portions of the project area by sequencing the grouped augers to represent strata both horizontally and vertically. These soil schematics indicate which soils contain cultural materials and generally where the intact, culture-bearing (Category 1) soils are located. These profiles are a discovery tool, not a full reconstruction of the geomorphology of the project area.

Table 7. Bucket Augers Containing Cultural Materials (Category 1 and 2 Soils)

Bucket Auger	Soil Category	Site	Auger Depth in Meters (feet)			Deposit Depth in Meters (feet)			Lithics (n)	Vertebrate Fauna Wt. (g)	Invertebrate Fauna Wt. (g)
			Top	Bottom	Total	Top	Bottom	Total			
2	2	LAN-2676	4.02 (13.2)	−0.4 (−1.3)	4.42 (14.5)	0.85 (2.8)	0.21 (0.7)	0.64 (2.1)	—	< 1	2
4	2	LAN-2676	3.75 (12.3)	0.12 (0.4)	3.63 (11.9)	1.25 (4.1)	0.7 (2.3)	0.55 (1.8)	—	8	4
6	2	LAN-2676	3.51 (11.5)	−0.12 (−0.4)	3.63 (11.9)	0.67 (2.2)	0.27 (0.9)	0.4 (1.3)	—	11.5	< 1
10	2	LAN-2676	3.81 (12.5)	−0.18 (−0.6)	3.99 (13.1)	0.76 (2.5)	0.37 (1.2)	0.4 (1.3)	—	5	< 1
18[a]	2	LAN-2676/ LAN-62	2.56 (8.4)	0.64 (2.1)	1.92 (6.3)	1.13 (3.7)	0.73 (2.4)	0.4 (1.3)	—	< 1	< 1
30	1	LAN-2676	3.81 (12.5)	−0.3 (−1.0)	4.11 (13.5)	0.76 (2.5)	0.4 (1.3)	0.37 (1.2)	—	< 1	61
54[a]	1	LAN-62	5.76 (18.9)	−0.73 (−2.4)	6.49 (21.3)	2.1 (6.9)	0.88 (2.9)	1.22 (4.0)	1	< 1	5
71[a]	1	LAN-62	5.24 (17.2)	−1.13 (−3.7)	6.37 (20.9)	2.01 (6.6)	1.68 (5.5)	0.34 (1.1)	1	2	29.5
75[a]	2	LAN-62	3.38 (11.1)	−0.03 (−0.1)	3.41 (11.2)	2.01 (6.6)	−0.03 (−0.1)	2.04 (6.7)	1	9	79
77[a]	1	LAN-62	3.40 (11.17)	−1.78 (−5.83)	5.18 (17.0)	1.82 (5.97)	−1.14 (−3.73)	2.96 (9.7)	38	34	80.5
81[a]	1	LAN-62	2.98 (9.78)	−0.07 (−0.22)	3.05 (10.0)	1.91 (6.28)	0.66 (2.18)	1.25 (4.1)	14	20	29
85	2	LAN-62	3.08 (10.09)	−0.28 (−0.91)	3.35 (11.0)	2.19 (7.19)	1.0 (3.29)	1.19 (3.9)	—	< 1	—
89[a]	2	LAN-62	3.88 (12.73)	0.59 (1.93)	3.29 (10.8)	1.53 (5.03)	0.62 (2.03)	0.91 (3.0)	4	1	< 1
93[a]	2	LAN-62	4.05 (13.3)	0.03 (0.1)	4.02 (13.2)	2.32 (7.6)	1.77 (5.8)	0.55 (1.8)	6	20	< 1
99[a]	1	LAN-62	3.78 (12.41)	−0.03 (−0.09)	3.81 (12.5)	1.89 (6.2)	1.13 (3.71)	0.76 (2.49)	7	13	1
103	1	LAN-1932/H	2.65 (8.7)	1.13 (3.7)	1.52 (5.0)	2.35 (7.7)	2.04 (6.7)	0.3 (1.0)	1	< 1	2
104	1	LAN-1932/H	4.38 (14.38)	0.57 (1.88)	3.81 (12.5)	2.31 (7.58)	1.49 (4.88)	0.82 (2.7)	3	5	26
107[a]	2	LAN-62	3.9 (12.79)	0.12 (0.39)	3.78 (12.4)	2.22 (7.29)	1.12 (3.69)	1.1 (3.6)	9	2	1
115	1	LAN-1932/H	4.20 (13.78)	0.12 (0.38)	4.08 (13.4)	1.76 (5.78)	0.69 (2.28)	1.07 (3.5)	3	< 1	—
117[a]	2	LAN-62	4.16 (13.66)	0.81 (2.66)	3.35 (11.0)	4.16 (13.66)	2.18 (7.16)	1.98 (6.5)	6	6	3
121	1	LAN-1932/H	2.71 (8.9)	1.34 (4.4)	1.37 (4.5)	2.26 (7.4)	1.65 (5.4)	0.61 (2.0)	—	1	< 1
122	1	LAN-1932/H	3.95 (12.97)	−0.50 (−1.63)	4.45 (14.6)	2.49 (8.17)	2.06 (6.77)	0.43 (1.4)	1	1.3	8.55
127[a]	2	LAN-62	4.26 (13.96)	−0.32 (−1.04)	4.57 (15.0)	4.26 (13.96)	1.66 (5.46)	2.59 (8.5)	4	2	7
136	2	LAN-62	4.20 (13.79)	1.03 (3.39)	3.17 (10.4)	4.2 (13.79)	2.59 (8.49)	1.62 (5.3)	11	3	< 1
138	1	LAN-1932/H	2.77 (9.1)	1.71 (5.6)	1.07 (3.5)	2.32 (7.6)	2.01 (6.6)	0.3 (1.0)	1	—	—
146	1	LAN-1932/H	3.99 (13.1)	1.71 (5.6)	2.29 (7.5)	2.62 (8.6)	2.01 (6.6)	0.61 (2.0)	—	14	3

Bucket Auger	Soil Category	Site	Auger Depth in Meters (feet)			Deposit Depth in Meters (feet)			Lithics (n)	Vertebrate Fauna Wt. (g)	Invertebrate Fauna Wt. (g)
			Top	Bottom	Total	Top	Bottom	Total			
152	2	LAN-211/H	7.32 (24.0)	4.51 (14.8)	2.8 (9.2)	5.39 (17.7)	5.27 (17.3)	0.12 (0.4)	—	< 1	< 1
176[a]	1	LAN-211/H	4.52 (14.84)	−2.64 (−8.66)	7.16 (23.5)	4.52 (14.84)	1.14 (3.74)	3.38 (11.1)	5	< 1	< 1
192	1	LAN-211/H	3.99 (13.1)	1.77 (5.8)	2.23 (7.3)	3.69 (12.1)	2.04 (6.7)	1.65 (5.4)	1	< 1	< 1
201[a]	2	LAN-211/H	4.42 (14.5)	0.98 (3.2)	3.44 (11.3)	4.02 (13.2)	1.98 (6.5)	2.04 (6.7)	—	< 1	< 1
202	1	LAN-211/H	4.45 (14.6)	1.01 (3.3)	3.44 (11.3)	4.3 (14.1)	2.77 (9.1)	1.52 (5.0)	8	< 1	33
210[a]	2	LAN-211/H	4.48 (14.7)	1.16 (3.8)	3.32 (10.9)	2.68 (8.8)	2.19 (7.2)	0.49 (1.6)	1	—	< 1
211	1	LAN-211/H	4.57 (15.0)	0.0 (0)	4.57(15.0)	4.42 (14.5)	2.9 (9.5)	1.52 (5.0)	1	< 1	4
220[a]	2	LAN-211/H	3.35 (11.0)	0.61 (2)	2.74 (9.0)	2.44 (8.0)	1.83 (6.0)	0.61 (2.0)	1	6.9	< 1
221[a]	2	LAN-211/H	4.27 (14.0)	1.22 (4)	3.05 (10.0)	2.87 (9.4)	2.23 (7.3)	0.64 (2.1)	—	1	8.4
230[a]	2	LAN-211/H	3.99 (13.08)	−0.91 (−2.97)	5.03 (16.5)	3.99 (13.08)	1.43 (4.68)	2.56 (8.4)	1	< 1	< 1
231[a]	1	LAN-211/H	3.96 (13.0)	−0.52 (−1.7)	4.48 (14.7)	2.32 (7.6)	1.16 (3.8)	1.16 (3.8)	2	6	26
211(O2)[b]	1	LAN-1932/H	3.26 (10.7)	1.52 (5.0)	1.74 (5.7)	2.56 (8.4)	1.89 (6.2)	0.67 (2.2)	1	< 1	4
212(O2)[b]	1	LAN-1932/H	2.87 (9.4)	1.49 (4.9)	1.37 (4.5)	2.5 (8.2)	1.8 (5.9)	0.70 (2.3)	4	4	9
213(O2)[b]	1	LAN-1932/H	3.38 (11.1)	1.19 (3.9)	2.19 (7.2)	2.35 (7.7)	1.62 (5.3)	0.73 (2.4)	1	< 1	14
214(O2)[b]	1	LAN-1932/H	3.35 (11.0)	1.58 (5.2)	1.77 (5.8)	2.62 (8.6)	2.01 (6.6)	0.61 (2.0)	3	< 1	17
219(O2)[b]	1	LAN-1932/H	5.76 (18.9)	1.98 (6.5)	3.78 (12.4)	2.35 (7.7)	1.68 (5.5)	0.67 (2.2)	3	< 1	< 1
223(O2)[b]	1	LAN-1932/H	5.0 (16.4)	0.94 (3.1)	4.05 (13.3)	2.07 (6.8)	1.77 (5.8)	0.30 (1.0)	1	—	1

[a] 12-inch bucket, all others are 16-inch buckets.
[b] Bucket augers in the Playa Vista O2 Tract.

Schematic soil profiles were created for three loci within Area D: (1) near the northern boundaries of LAN-62, (2) in the west end of Area D, north of LAN-62, and (3) in LAN-62 along the base of the bluff. We selected these three areas for detailed discussion because of the high number of Category 1 and 2 strata they contained and because these areas will be impacted by planned development.

Boundary Testing at LAN-62

Boundary testing at LAN-62 was accomplished by bucket augering and mechanical trenching. As discussed, portions of the bucket auger lines along the base of the bluff and in the west end penetrated the previously mapped borders of LAN-62. Bucket auger and core data that traced a curved line along the base of the bluff (see Figure 42) passed through LAN-62. Data from the western boundary of LAN-62 near Lincoln Boulevard (Bucket Augers [BAs] 1 and 8 and Group Delta Core B131) indicated substantial Category 1 cultural deposits 1.5–3.0 m thick, topped by about 3 m of fill material or alluvial deposits (Figure 43). Moving east from these augers, the bottom of the LAN-62 site deposit dropped away, following the contour of the buried landform. Moving north down the alluvial fan (BA 54), a corresponding drop in the depth of the deposit was observed. In the next four augers (BAs 71 and 77 and Group Delta Cores B126 and B127), site-bearing strata were encountered at depths ranging from 2.4 to -1.14 m AMSL. The cultural deposit noted in two of these augers (BAs 71 and 77) is substantial, from 2.75 to 3 m thick. Mechanical trenching undertaken in this area revealed similar results.

Continuing the bucket auger sequence to the northeast (BAs 81–136) along the foot of the bluff (Figure 44), a cluster of mostly Category 2 soils was encountered in at depths of approximately 60 cm to almost 3 m AMSL. Interestingly, a drastic difference in the density of artifacts was seen when the soils from BA 81 were compared to those recovered from adjacent auger, BA 85. BA 85 contained no lithic artifacts and insignificant amounts of bone and shell (less than 1 g of each), whereas BA 81, approximately 47 m to the southwest, contained 15 lithic artifacts, 13 g of marine shell, 3 g of bone, and 1 worked bone artifact. The difference in artifact density suggests that LAN-62 is not homogeneous.

Continuing the transect to the northeast, BAs 89–136 showed a corresponding rise in artifact density, suggesting that more of the cultural deposit had been crossed. This pattern of increasing artifact density to the northeast reflects the continuation of LAN-62, clearly seen in the bucket augers except where a substantial amount of historical-period disturbance clouded the picture. BAs 89–136 all contained cultural material (lithics, shell, and bone) at depths from 0.61 to 2.44 m AMSL, overlain by historical-period material. In BAs 93, 99, and 107, SRI recovered prehistoric artifacts from the fill layer, as well as from the native soils below, suggesting that the deposit was mixed.

The presence of prehistoric cultural materials in these mixed fluvial, colluvial, and fill sediments is likely the result of historical-period farming activities that have disturbed the original landforms. Deep plowing would have repeatedly churned culture-bearing soils, creating a homogenous layer of fluvial sediments and anthrosols. In this case, the Category 2 soils in Figure 43 represent a site surface that was plowed, then buried. Aerial photographs of the LAN-62 area show that the large alluvial fan was farmed during the historical period, altered by road building along Lincoln Boulevard in the 1920s, and later disturbed by Hughes Aircraft Company–related construction activity (see Chapter 2). Elevated landforms were truncated and cultural materials were either redeposited or simply removed and used as fill elsewhere. Category 2 soils may also have become mixed when culture-bearing alluvial and fluvial sediments on the eastern margin of LAN-62 were displaced by the action of nearby Centinela Creek. Numerous small channels that could have displaced cultural materials were observed in this area during trenching. The line of bucket augers and cores in Figure 43 sits very near the edge of the historical marsh and outlet of Centinela Creek.

The next three augers to the northeast (BAs 144, 152, and 160), spaced at 50-m intervals, revealed a distinct change in subsurface conditions. BAs 144 and 152 contained no lithic material and very little

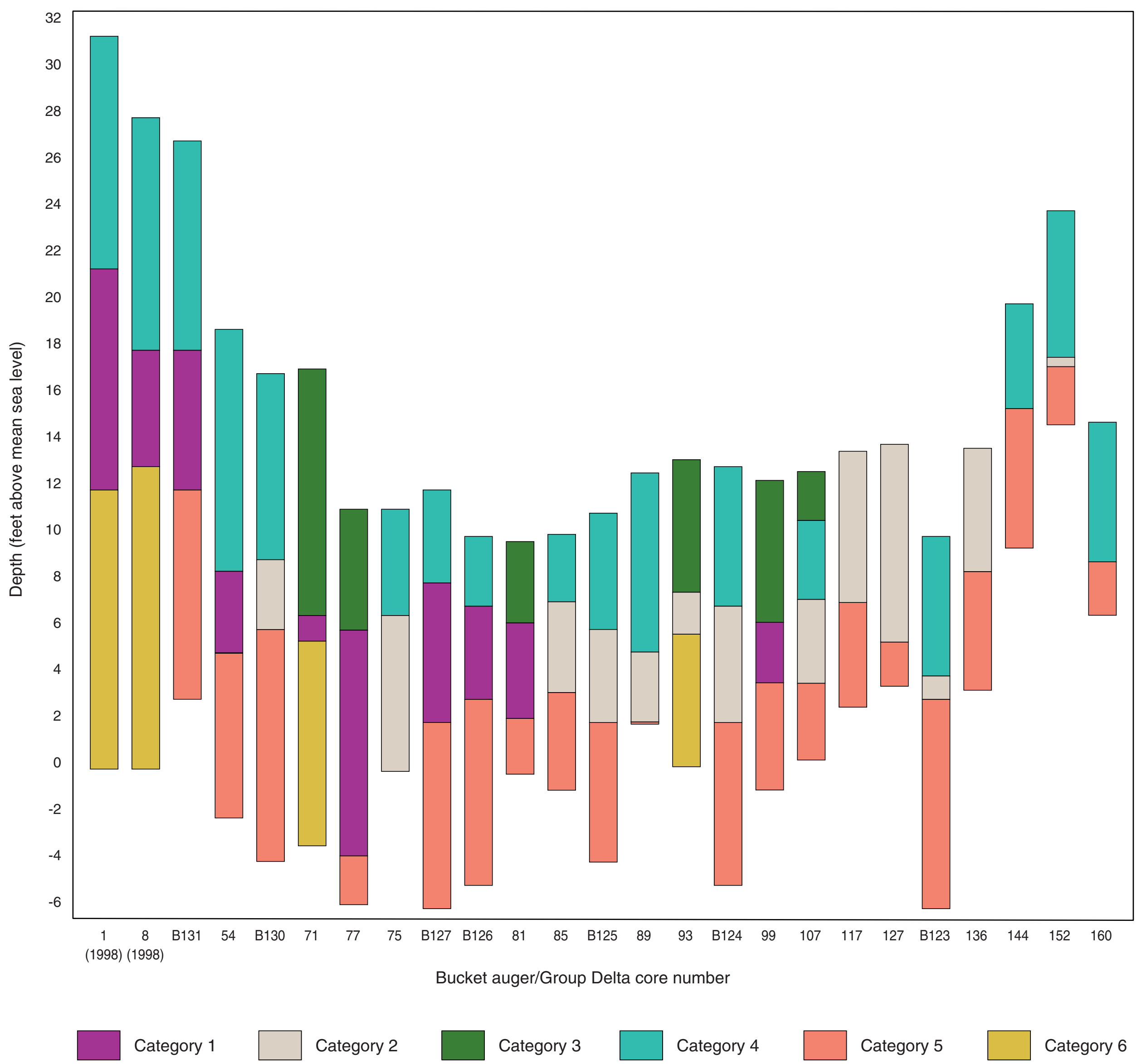


Figure 43. Schematic soil profiles of bucket augers and cores placed along the northern boundary of LAN-62.

Figure 44. A portion of the area at the base of the bluff tested by bucket augering and trenching.

marine shell or bone, and BA 160 recovered no cultural material. Initially, the lack of cultural deposits in this area was puzzling, as the augers were placed near the mapped western boundary of LAN-211/H, and, 100 m east of BA 160, BA 176 penetrated a sparse, intact cultural deposit. The likely explanation is that BAs 144, 152, and 160 were drilled into a disturbed area. All three contained large amounts of historical-period debris and fill soils in their upper levels.

In the central area of LAN-62 near BAs 93, 99 and 107, results from the bucket augers were mixed. Comparing BA 77, located in the most dense portion of the site, with BA 99, located almost 400 m northeast, is instructive. Both augers penetrated intact soils and recovered cultural materials; their contents, however, differed significantly. BA 77 contained 69 g of marine shell, 20 g of bone, 32 lithic artifacts, 1 shell bead, and 1 worked bone artifact, whereas BA 99 contained less than 1 g of shell, 2 g of bone, 3 lithic artifacts, and no worked shell or bone. A pattern of mixture—sparse deposit adjacent to pockets of high density, overlain by historical-period debris—is typical along the base of the bluff in the eastern portion of LAN-62.

We conclude that disturbance is responsible for the mixed distribution of cultural material along the base of the bluff. Those augers displaying high densities of cultural materials on the southwest end of the project area encountered intact portions of LAN-62. To the northeast, the augers hit what appeared to be small pockets of cultural material in lesser concentrations, interspersed with sterile disturbed areas. These “islands” of intact culture-bearing material are primarily the result of historical-period and modern activity in the area. Numerous subsurface utility lines, structural remains, and other types of disturbance probably created this artificial pattern.

West End of Area D, Northwest of LAN-62

Seventeen bucket augers were placed in the western end of Area D northwest of LAN-62; seven of these (BAs 33, 18, 42, 32, 50, 51, and 80) were south of the street now known as Bluff Creek Drive, whereas the remainder were drilled north of Bluff Creek Drive (see Figure 42). Our research interest in this area centered on questions about the northern boundary of LAN-62 and the southern boundary of LAN-2676. Of the 17 augers analyzed, none showed clear evidence of intact cultural deposits; however, six augers (BAs 2, 4, 6, 10, 18, and 30) contained potential site material at a depth ranging from 0.21 m (0.689 feet) to 1.25 m (4.1 feet) AMSL.

This group of bucket augers revealed important information about the amount and composition of the modern fill placed on the western end of Area D (Figure 45). South of Bluff Creek Drive, 1.82 m of fill was noted, whereas north of Bluff Creek Drive, native soil was covered by as much as 3.65 m of fill. In the five augers south of Bluff Creek Drive (BAs 32, 33, 42, 51, and 60), native soils identified as marsh or upper marsh deposits contained no archaeological deposit; however, cultural material was discovered in the upper fill layers. No consistent pattern was noted in the vertical location of this material. A minor amount of marine shell recovered from BA 18 suggested that soil in this vicinity may be intact, although probably not culture bearing, as no artifacts were recovered.

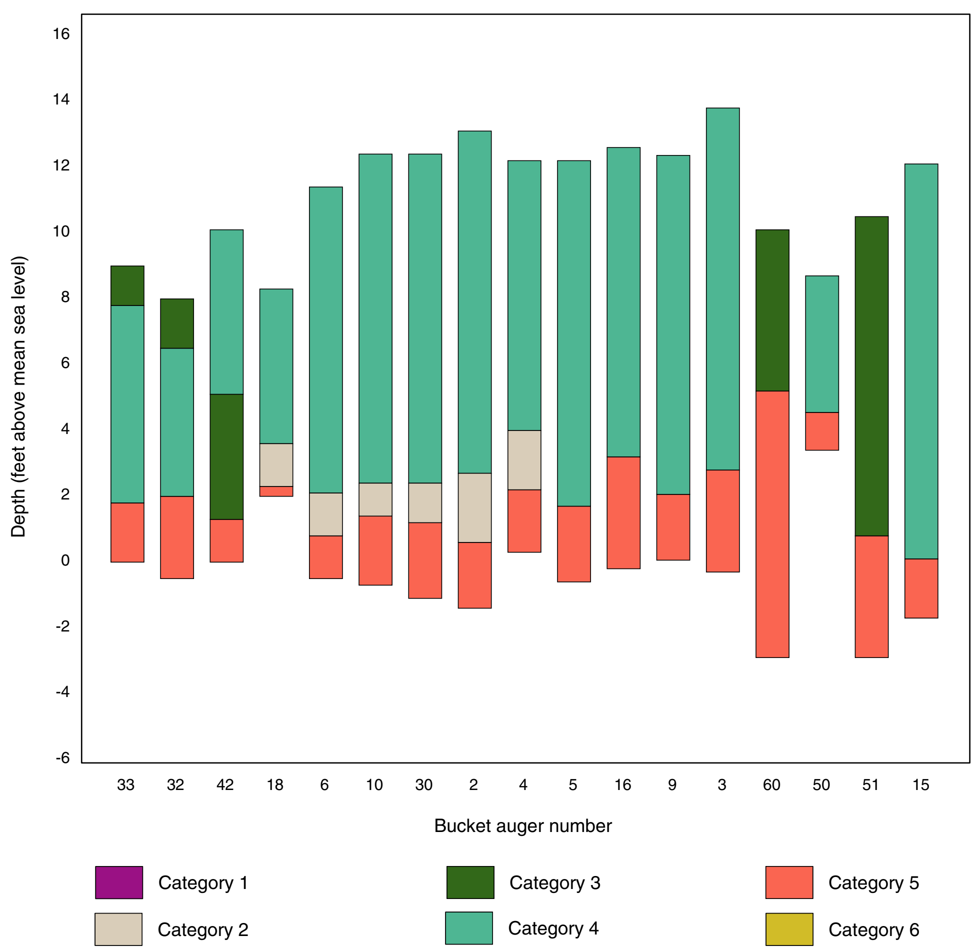


Figure 45. Schematic soil profiles of bucket augers and cores placed in the western end of Area D.

Soil profiles for augers north of Bluff Creek Drive (BAs 2–6, 9, 10, 15, 16, and 30) indicate that their contents were very similar. This area contained an even greater amount of fill surcharge, as much as 3–3.35 m in places. Although no artifacts were noted, BAs 2, 4, 6, 10, and 15 yielded a small amount of marine shell from intact native soil. In BAs 4, 6, and 10, we recovered various species of marine shells that are not found together naturally. For example, the rocky shore species *Mytilus* sp. (mussel) was found in the same stratigraphic layers as *Chione californiensis* (Venus clam, a lagoon species), suggesting that the association of these two different types of shells result from human predation. We encountered no cultural materials in BAs 3, 5, 9, and 16, although intact soil was reached.

Given the distribution of Category 2 soils in bucket augers in this west-end transect, we conclude that site material possibly originating from LAN-62 trends north from the bluff toward the boundaries of LAN-2676. Cultural deposits apparently follow the flow of the alluvial fan that developed at the base of the Lincoln Gap. Oblique and overhead aerial photographs show this area under cultivation in the 1920s, prior to the purchase of the area by Howard Hughes (see Figure 16). An account from 1947 describes the transport of soil from LAN-62 to the area near LAN-2676 when the Hughes Aircraft Company raised the elevation of the runway (Peck 1947:2). The faint archaeological signature present in these bucket augers may be the result of historical-period or modern movement of soil. This would account for the results in BAs 32, 33, and 42, for example, where cultural materials were found within and superimposed over fill layers. Alternatively, these augers may have reached the intact remainder of sparse cultural deposits at the outer boundaries of LAN-62 or LAN-2676. The bucket-auger data reveal the differences between the soil types and show that a break exists between them, whether natural or man-made.

Testing along the Base of the Bluff in LAN-62

A third set of 18 augers and two Group Delta cores were place south of Bluff Creek Drive to test the extent of LAN-62 in this narrow portion of the site. This discussion includes five previously discussed bucket augers (BAs 71, 75, 77, 81, and 85) and one Group Delta core (B131).

Bucket Augers and Cores

Of the 20 tests (18 bucket augers and 2 Group Delta cores) placed around the northern and northwestern boundary of LAN-62, 4 encountered intact cultural deposits, 1 hit native soils with possible site material, 3 were culturally sterile, and 12 encountered cultural materials in stratigraphic layers identified as either modern or historical-period fill (see Figure 42). Figure 46 details the bucket augers and monitored Group Delta cores excavated near LAN-62, plotted with elevations AMSL. Fill layers containing construction debris, such as broken concrete and brick, are pervasive. BAs 20, 33, 34, 36, 42, 51, 52, 60, and 62, uncovered prehistoric cultural materials mixed with construction debris and other modern and historical-period trash. Of varied composition, the thickness of these Category 4 deposits range from approximately 50 cm (BA 33) to 4.5 m (BA 62).

In the augers drilled in open areas or "flats" just south of Bluff Creek Drive (BAs 20, 28, 33, 34, 36, 42, 50, 51, 52, 60, and 62), cultural materials were found consistently mixed with fill layers. No clear pattern between culture-bearing soil and fill deposits is suggested by the schematic for these bucket augers. Only those augers drilled on the toe of the slope encountered in situ cultural material. BAs 54, 71, 77, and 81 revealed Category 1 soils interpreted as an intact portion of LAN-62. The number of artifacts in these four bucket augers was generally high and the thickness of the cultural deposit varied, as did the depth at which it was encountered.

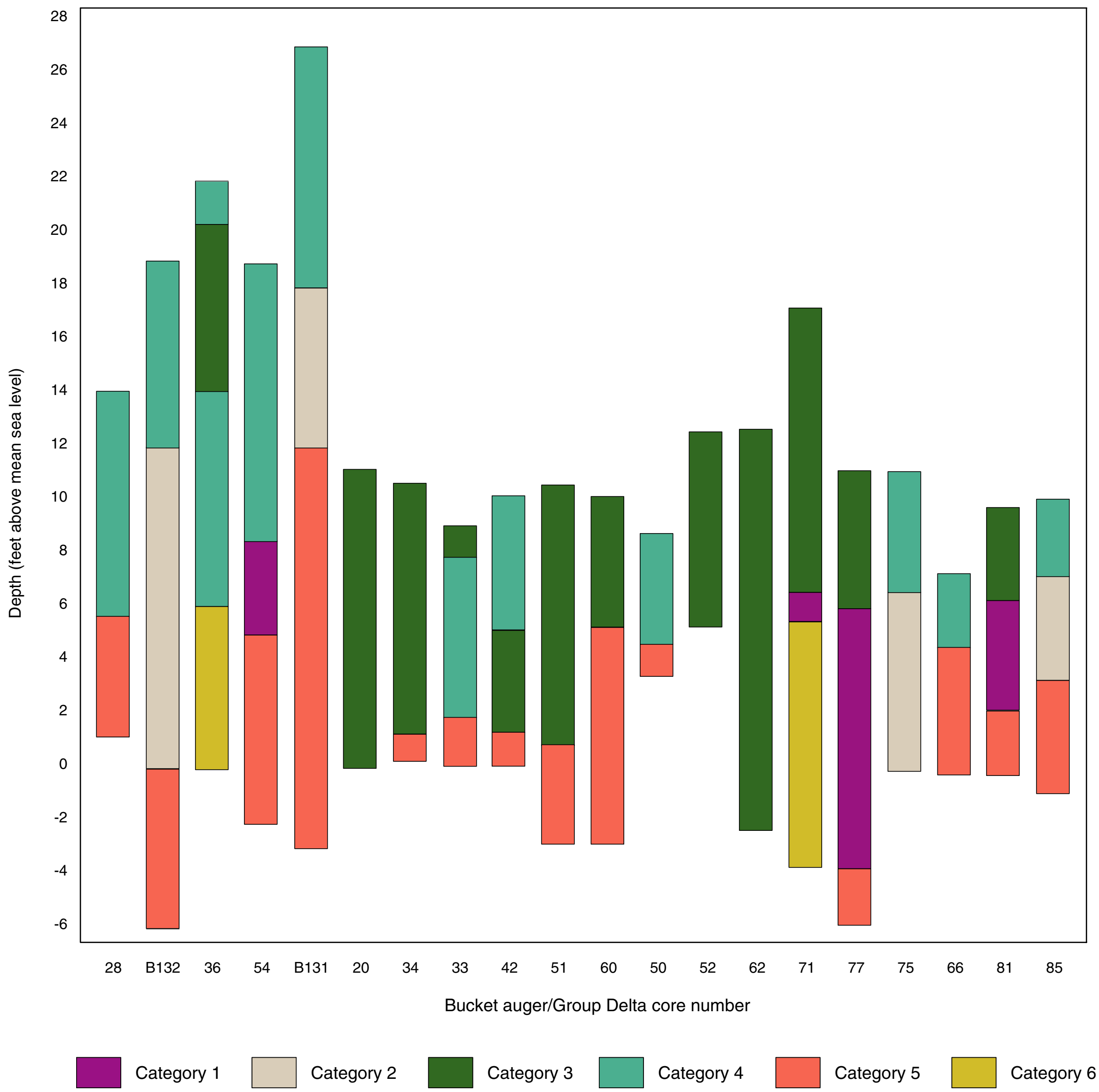


Figure 46. Schematic soil profiles of bucket augers and monitored Group Delta cores along the base of the bluff in LAN-62.

Trenches Excavated in 1999

Results from the bucket augers near LAN-62 and the discovery of intact materials farther east guided the next step in boundary testing. Seventeen trenches were placed along the base of the bluff in LAN-62 to clarify results of bucket augering (see Figure 26). Initial results indicated that some areas at the base of the bluff contain intact soils but do not contain cultural materials, whereas at other locations, cultural materials were recovered from highly disturbed contexts. Most of these trenches were placed in the toe slope of the bluff and all but one encountered intact soil strata. Five trenches (Trenches 1-7, 2-A, 2-B, 2-6, and 2-7) exposed A horizon soils that appeared undisturbed and were labeled as potentially anthropogenic. These A horizon soils along the toe slope are typically dark brown or grayish brown sandy loam, similar in texture and color to those strata that have produced archaeological deposits at known sites.

As described earlier, two augers placed at the base of the bluff in the eastern extension of LAN-62 (BAs 75 and 77) encountered a substantial cultural deposit. Trench 2-9 was placed between the two, south of the large retaining basin, on the northeast portion of the alluvial fan on which most of LAN-62 is located. Measuring 3.5 m long by 1 m wide, Trench 2-9 was excavated to a depth of 4.5 m. The stratigraphic soil profile (Figure 47) presents a 3-m section of this trench. Layers of modern fill, colluvial and alluvial deposits, and redeposited materials were superimposed on a weakly developed A horizon (2Ab). Stratum 3d, a very dark brown (10YR 3/2) sandy loam, contained a relatively large number of artifacts in profile, including marine shell and flaked stone. The contact with underlaying Stratum 4 was wavy and irregular, the result of bioturbation or mechanical disturbance.

Trenches in the eastern portion of LAN-62 also exposed layers of intentional fill that contained a wide variety of modern and historical-period artifacts. Most common were chunks of concrete and brick, though wire and rusted metal were also noted, and occasionally bone, glass, or wood fragments were observed. Some of this fill may have been imported during the Hughes Aircraft Company era from an unknown off-site location. Other fill soils observed within LAN-62 containing cut cow bone and bottle glass may be associated with the historic farmstead at LAN-1934/H or early farming activity that predates the Hughes Aircraft Company era.

After completing the first 17 trenches in 1999, we reasoned that modern and historical-period land use during the past 100 years had created a "swiss cheese" effect in the area below the bluff. Mapping the location and size of each remnant cultural deposit proved difficult: a single bucket auger or trench provides only a narrow observational window from which to infer the nature of the subsurface deposits. We found that by moving only 10–20 m in any direction often resulted in completely different, even contradictory, results. Despite mixed stratigraphic information, the bucket augers and trenches convinced us that intact cultural deposits were present in a discontinuous line from west to east along the base of the bluff. Deciphering the extent and sequence of fill episodes in the project area became a priority.

Trenches Excavated in 2001

In 2001, brush clearing and removal of construction debris at the base of the bluff provided an opportunity to test our "swiss cheese" model and to refine our initial results in areas that had previously been inaccessible. SRI excavated an additional 22 trenches and 7 approximately 1-by-1-m test units in the area west of LAN-211/H and within the eastern extent of LAN-62 (see Figure 29). Results of these tests are summarized here; the data are presented in tabular form in Appendix A.

Of the 22 trenches excavated, all but 7 encountered Category 1 soils containing intact prehistoric cultural materials. The depths and thicknesses of cultural deposits varied, as did the amount of cultural materials within them. In general, deposits were sparse and recognized only after artifacts were seen in trench backdirt or when excavated soils were wet screened. The depths at which cultural deposits were reached ranged from only 20 cm, to more than 2 m below the ground surface. Generally, cultural materials were found within A horizon or transitional A-C horizon soils. At those locations at the base of the bluff where the toe slope pushes out into the alluvial plain, the cultural deposit was clearly definable and often near the surface. As the distance from the base of the bluff increased, the cultural deposit dipped, with the top strata having been truncated by historical-period or modern grading activity. In many cases, the same A horizon soils that were cut were later used as fill material. This process is recorded in the alternating bands of A horizon and fill sands seen in many of the fill layers.

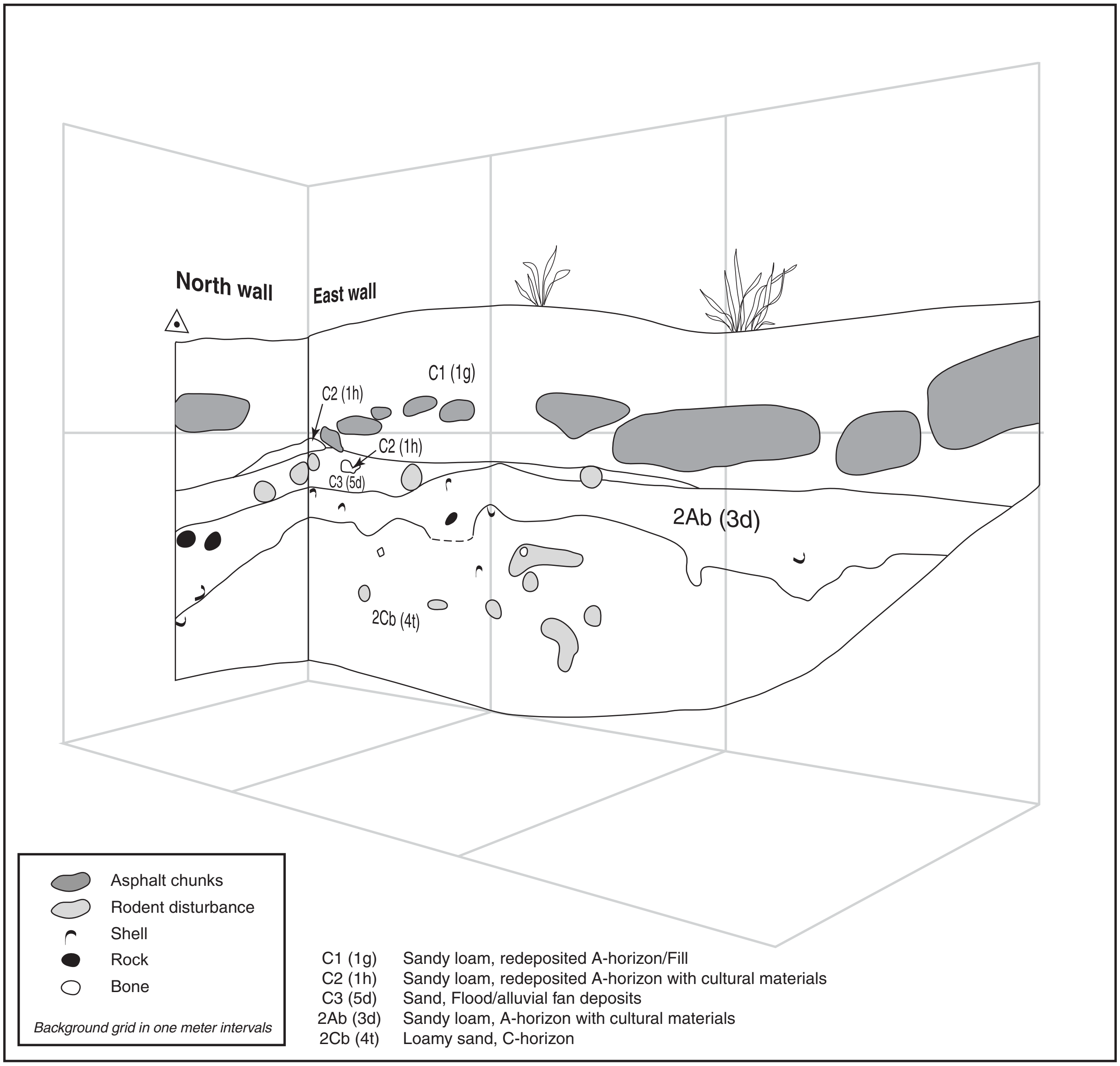


Figure 47. Stratigraphic soil profile of Trench 2-9.

To facilitate analysis, the area being tested at the base of the bluff was broken into three sections: central, eastern, and western. In the central section evidence of modern and historical-period alterations was pronounced. Trenches 103, 104, and 114 contained significant amounts of Category 4 soils, consisting of fill deposits containing historical-period debris such as ceramics, glass, metal, and other materials to depths of over 3 m below surface. We surmise that a large historical-period refuse dump was cut into A horizon soils in this central area. The cut A horizon soils, which contained prehistoric cultural materials, were then used as fill, producing the bedding seen in these trenches. This pattern was especially evident in Trenches 105 and 106, where a thin (50-cm) intact cultural deposit was found approximately 2.5 m below a bedded fill layer.

All trenches in the central portion were relatively distant from the toe slope of the bluff. To the east and west of this central section, intact cultural deposits grew thicker and were encountered at shallower depths below the ground surface; for example, in Trenches 107 and 113. Progressing out from the base of the bluff, buried A horizon soils, often containing cultural materials, either sloped away gently or were mechanically truncated.

In the eastern portion of the tested area, Trenches 101, 102, and 118–122 contained prehistoric cultural materials in varying densities and proportions. The depths of the deposits varied from only 20 cm to slightly more than 2 m below the ground surface, while the thickness ranged from 50 cm (Trench 121) to more than 2.5 m (Trench 102). In the southern ends of Trenches 101, 102, and 118, intact anthropogenic A horizon soils were found at shallow depths. In Trenches 101 and 102, this deposit gradually sloped to the north, where it was truncated and covered with fill. In Trench 118, the A horizon soils followed a similar slope, then were cut abruptly, resulting in a thick, short band of intact material confined to the southern end of the trench. The profile from Trench 101 provides an example of the stratigraphy seen in this area (Figure 48).

In Trenches 119, 121, and 122, we observed buried A horizon soils containing sparse cultural deposits below relatively thick C horizon soils and fill. In Trench 121, the cultural deposits were encountered 2 m below the surface, whereas in Trench 122, cultural deposits began at 1 m below surface. In Trench 119, a sparse deposit was found in a transitional A-C horizon recorded at nearly 2 m below surface; we feel this cultural material was likely transported by bioturbation from an upper A horizon stratum that was truncated in the past. At the far eastern end of the project area near LAN-211/H, Trenches 115, 116, and 117 penetrated a series of fill deposits that extend to depths of over 1.5 m below the surface before reaching the water table. Whereas the fill could contain prehistoric materials, no intact cultural deposits are present.

In the western portion of the testing area, intact A horizon strata containing prehistoric cultural materials were found in three trenches (Trenches 109, 110, and 111). These three trenches had several features in common; first, in all three, the intact, culture-bearing A horizon was encountered at approximately 1 m below surface and continued to unknown depths; secondly, in all three the A horizon was heavily bioturbated; and lastly, the A horizon soil in all three was observed buried below a series of B horizon soils. The soil profile from Trench 111 exemplifies this stratigraphic pattern (Figure 49). This stratigraphy could have resulted when A horizon soils originally at the surface were removed and reworked by historical-period farming or modern construction activities.

Continuing with trenches in the western section, both Trenches 108 and 112 exposed intact A horizon Category 1 soils below a 1.0–1.5-m layer of fill material. Cultural deposits were not noted in the A horizon soils in either trench. Groundwater, however, was encountered at approximately 2 m below the surface and prevented sampling of the A horizon soils. Upper marsh deposits indicating the presence of standing water in the past were noted below the A horizon strata in both trenches.

We made the following observations as a result of trenching below the bluff:

1. In all cases, intact cultural deposits were found within A horizon or buried A horizon soils.

2. The depth and thickness of the cultural deposit varies widely across the project area. As trenches approached the base of the bluff, the intact cultural deposits are thicker and closer to the surface.

3. As distance from the base of the bluff increases, the likelihood that cultural deposits are disturbed or completely removed increases.

4. In all cases, fill materials overlay native soil strata.

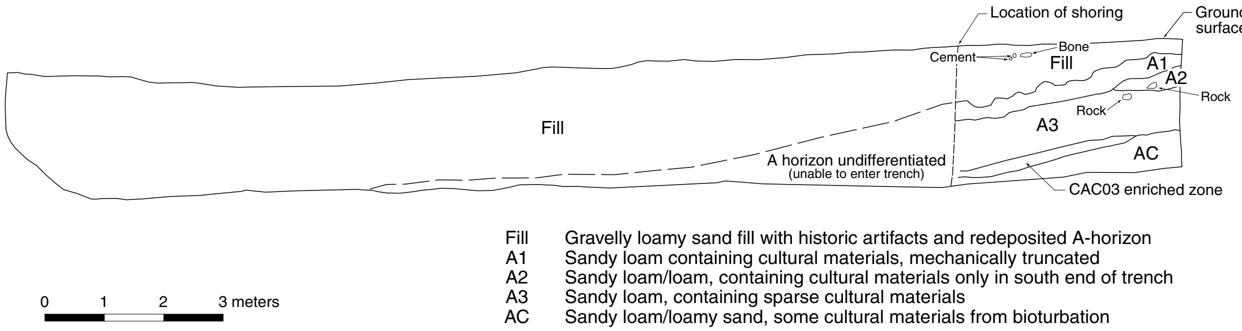


Figure 48. Stratigraphic soil profile of the east wall of Trench 101.

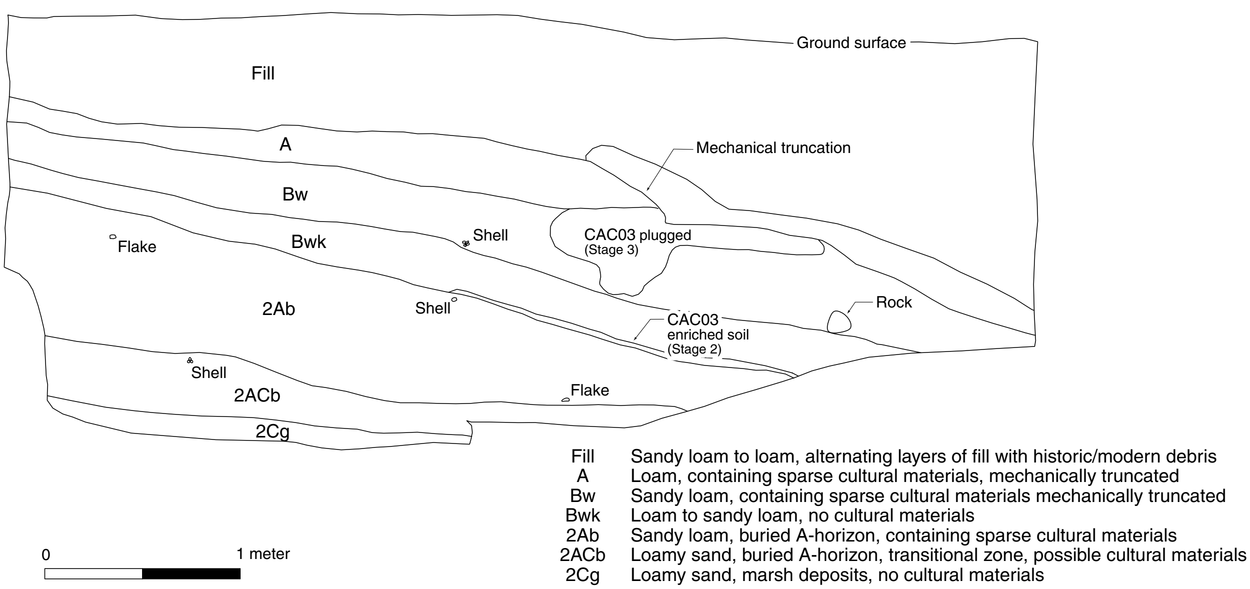


Figure 49. Stratigraphic soil profile of the west wall of a portion of Trench 111.

5. The thickness of the fill deposits varies across the project area, as does the amount of historical-period and modern debris within them.

6. Within the fill, there are bedded layers of A horizon soils and sandy soils, likely the result of local earth-moving activities.

7. When A horizon soils are observed in fill strata, they contain prehistoric cultural materials such as lithics and marine shell.

Mechanically Excavated Units

Although the SRI trenches successfully exposed cultural deposits, we needed more data to characterize them adequately. Seven approximately 1-by-1-m test units were excavated into the trench walls in areas where cultural deposits were noted. Because the excavation depth and the instability of fill materials made the trenches unsafe to enter, these test units were excavated into potentially intact, culture-bearing soils using a 3-foot-wide, flat backhoe blade in 20-cm lifts, or levels. In each 20-cm lift, 16 5-gallon (20-liter) buckets were filled (the approximate equivalent of two 10-cm levels in a 1-by-1-m unit). Although some mixing of soils occurred, adequate samples of each stratigraphic layer were obtained; these samples were screened and stored for analysis. A summary of the materials and qualitative assessments of the amounts recovered from these seven excavation units is presented in Table 8.

These test units confirmed that historical-period materials in fill overlay intact prehistoric deposit across almost the entirety of LAN-62. In Unit 2, the presence of large amounts of historical-period and modern construction debris indicate that the upper A horizon soils as well as the lower 2Ab series were likely redeposited. Historical-period debris—ceramics, glass, metal, and other materials—was found in the fill; modern construction debris, such as concrete, asphalt, metal, plastic, and wood, was also common. No distinct features or strata could be identified that related to either historical-period or modern use; the debris appeared blended in a layer of introduced material throughout the testing area.

On the extreme eastern and southwestern portions of the site and as close to the base of the bluff as the equipment could reach, intact prehistoric material was seen very near the surface; in these areas, only a very thin lens of historical-period debris covered prehistoric cultural material. Farther out from the bluff, the historical-period disturbance increased in thickness.

The cultural deposits we observed in the trenches and excavation units varied and no features were encountered. In addition to the data summarized in Table 8, we made several observations about the contents of the seven excavation units. An intact prehistoric cultural deposit, measuring approximately 2 m in thickness and yielding cultural materials, was found in Unit 1. A very large amount of faunal material and the highest number of flaked stone artifacts recovered from a single 20 cm level were encountered in Unit 3. One shell bead was recovered from a probably disturbed context in the uppermost level of Unit 4; moderate amounts of historical-period and modern debris were also found in the uppermost level. A relatively thick (nearly 1 m) cultural deposit found in the buried A horizon strata in Unit 6 contained a small quantity of lithic artifacts and almost no faunal material. The most interesting find, a leaf-shaped chert biface, was recovered from Unit 6, Level 3. Residue observed on one end suggests this tool may have been coated with ochre, or possibly hafted and used as a knife or other cutting implement. In Unit 7, cultural materials appeared concentrated in the upper A1 stratum, and dispersed lightly with depth into lower A horizon and transitional strata. We observed that the amount of cultural material recovered was relatively low in this area, considering the amount of soil excavated. The amount of invertebrate fauna recovered was also low, which is puzzling given the proximity of these deposits to both the shoreline and the lagoon.

Table 8. Summary of Units Excavated during Boundary Testing at LAN-62

Unit	Adjacent Trench	Total Depth below Surface	Sample (m^3)	Lithics	Faunal Remains	Historical-Period Materials	Intact Deposit
1	102	2.5 m (8.2 feet)	2.0	abundant	abundant	sparse	yes
2	111	2.2 m (7.2 feet)	1.6	moderate	abundant	abundant	no
3	106	2.8 m (9.2 feet)	0.2	abundant	abundant	abundant	yes
4	108	1.9 m (6.2 feet)	1.0	sparse	sparse	moderate	yes
5	121	2.1 m (6.9 feet)	0.4	sparse	sparse	none	yes
6	122	2.5 m (8.2 feet)	1.2	sparse	sparse	abundant	yes
7	118	2.3 m (7.5 feet)	2.0	moderate	moderate	sparse	yes

Summary of Inventory Results

Bucket augers and trenches were successfully used in this inventory phase to locate prehistoric cultural materials in Area D. Bucket augers drilled near the northwestern portion of the project area recovered cultural materials in redeposited and disturbed soils, whereas those placed near LAN-62 and LAN-211/H encountered intact subsurface cultural deposits. The amount of fill overlying intact soils in the vicinity of LAN-62 varied considerably, as did the depths and thicknesses of intact cultural deposits.

Trenching and test unit excavation refined our subsurface model of the site area below the bluff. Despite evidence of extensive historical-period and modern disturbance, intact prehistoric cultural deposits were located in a discontinuous band between the previous boundaries of LAN-62 and LAN-211/H, prompting the extension of LAN-62 to the east (see Figure 42.) Found in A or transitional A-B or A-C soil horizons, the cultural deposits are generally sparse, vary in thickness from 50 cm to 2.5 m, and contain relatively low densities of lithic artifacts, marine shell, and vertebrate fauna. Anthropogenic soils were encountered anywhere from a few centimeters below surface to more than 2 m deep. The water table was encountered at fairly shallow depths, and in some cases, may saturate soil horizons containing cultural materials. As the distance from the toe slope of the bluff increased, intact prehistoric deposits decreased.

As a result of the bucket auger and trenching program, a discontinuous prehistoric deposit has been recorded along the remaining toe slope of the Ballona Escarpment. Further, a dense midden exists at the core of the site at the west end, with less-dense midden lining the banks of Centinela Creek. The data also confirm that a portion of LAN-62 was disturbed by agricultural land use and Hughes Aircraft Company–related construction activities. Despite this disturbance, there may be highly localized “islands” of prehistoric cultural materials in the northeast portion of the site that have survived intact. SRI’s testing resulted in an extension of the boundaries of LAN-62 approximately 950 m to the east toward LAN-211/H. The vertical and horizontal dimensions have been accurately defined; we now estimate that the total dimension of LAN-62 as currently mapped is 1.04 km^2 (258 acres).

Evaluation of LAN-211/H and LAN-2769

The second task outlined in the work plan was to evaluate the potential eligibility of LAN-211/H and LAN-2769 for listing in the NRHP as contributing elements of the BLAD. These two sites, discovered during the 1990 survey and designated at that time SR-12 and SR-13, appeared as organically enriched soil horizons observed near the base of the Westchester Bluffs. Three possibilities were offered to account for these deposits: They could represent (1) natural A horizons on the bank of Centinela Creek, (2) secondary cultural deposits that had washed down from the archaeological sites on top of the bluff or that were bulldozed into the bluff, or (3) intact cultural deposits reflecting prehistoric use (Altschul et al. 1991). Only in the case of the third alternative would they be considered significant; their eligibility would hinge on their integrity and scientific importance. The results of testing and evaluation are presented here.

LAN-211/H

When LAN-211/H (formerly known as SR-13) was rediscovered in 1990, it was initially described as:

> a narrow band of undisturbed, unvegetated soil at the extreme lower edge of the bluff slope. In the vicinity of SR 13, the base of the bluff slope has been truncated leaving an unobscured profile that is approximately 1 m in height and 100 m in width. For a 75 m extent, soil exposed in the profile consists of a dark, organic silty sand. The soil extends from the top of the exposure to the bottom, indicating that the midden is at least 1 m thick and probably more. SR 13 is an intact, thick midden deposit (Altschul et al. 1991:155).

When testing began nine years later, the appearance of the site was substantially the same. The slopes in the general site area were vegetated with ice plant (*Carpobrotus edulis*), and the deposit at the base of the bluff was entirely covered by asphalt. To assess the integrity of the deposit and to establish the extent of intact materials, subsurface investigation was necessary. A multiphased strategy was designed that included bucket augering, trenching, and manual excavation of 1-by-1-m test units. Although the presence of buried utilities, standing structures, and potentially contaminated areas limited where we could auger and trench, sufficient work was completed to offer a stratigraphic interpretation of the site. Subsequent construction monitoring in the vicinity has helped to clarify site boundaries. Bucket augering, trenching, and manual excavation produced abundant data; the test sites are shown on Figure 30 and summarized in tabular form in Appendix A.

Our test excavations confirmed that LAN-211/H is a complex mix of disturbed and intact deposits. In the following sections, we present our test results, including our interpretation of site structure and stratigraphic relationships. The analyses of specific artifact and ecofact types found in the site deposits are discussed in subsequent chapters.

Mechanical Excavation

To test the proposed boundary of LAN-211/H, we used bucket augers, backhoe trenches, and hand excavation. Methods and procedures were the same as those previously discussed in Chapter 4. Three trenches and 11 augers were excavated in the paved parking area below the deposit identified in the inventory to test the site's extent (see Figure 24). Using the same classification system (Category 1–6

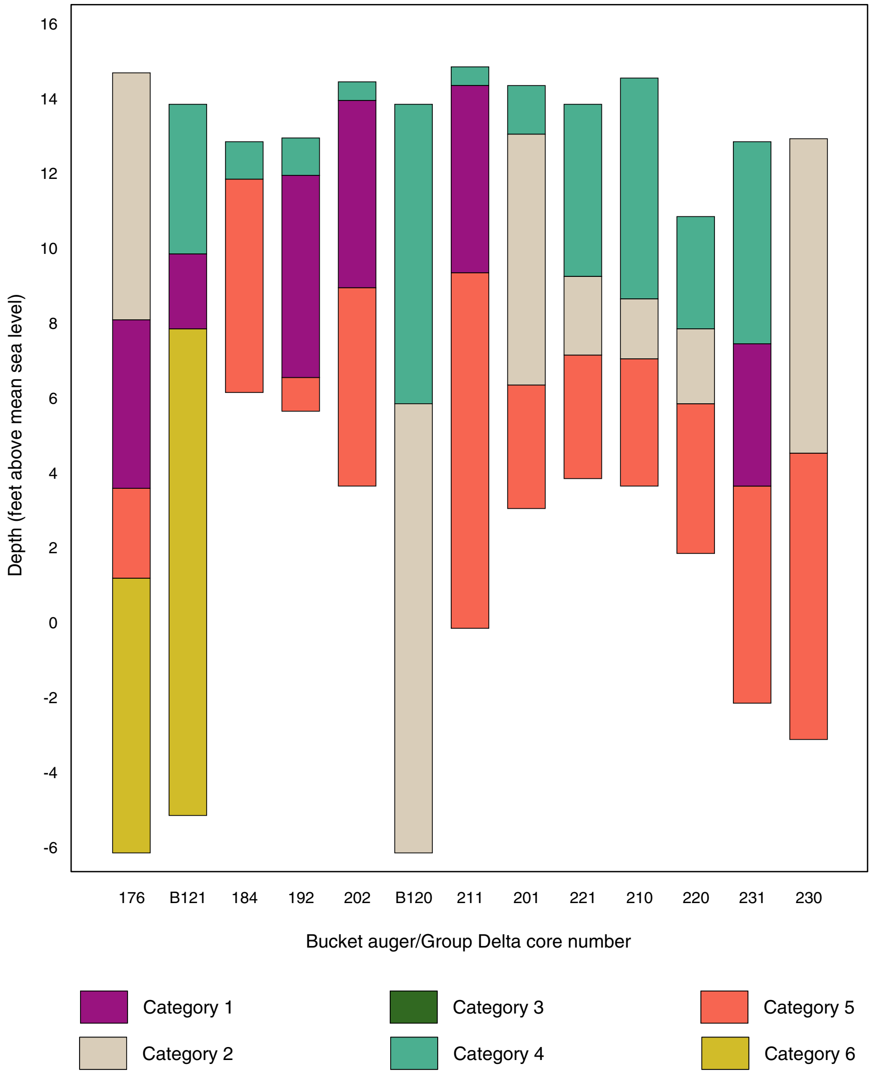


Figure 50. Schematic soil profiles of bucket augers placed in LAN-211/H.

soils), a schematic representation of the stratigraphy at LAN-211/H, as represented in bucket augers, is shown in Figure 50.

Although prehistoric cultural materials encountered were sparse, the bucket augers indicated the presence of a subsurface archaeological deposit with good stratigraphic integrity. Five of the 11 bucket augers (BAs 176, 192, 202, 211, and 231) and 1 Group Delta core (B121) placed in and near LAN-211/H contained cultural materials in soils thought to be intact (Category 1 soils). Screening of the samples through $^{1}/_{8}$-inch mesh recovered lithic artifacts and vertebrate and invertebrate faunal remains. Additionally, five bucket augers (BAs 201, 210, 220, 221, and 230) and one Group Delta core (B120) produced sparse amounts of cultural materials in soils that were likely intact (Category 2). Only BA 184 contained no identifiable cultural materials. Clearly, cultural materials exist below the paved parking lot at LAN-211/H.

BAs 202 and 211 were very similar in the depth and thickness of the cultural deposit and the amount of fill that capped it. BAs 221, 210, and 220 revealed possibly intact site materials of varying thicknesses at similar elevations, capped by equivalent amounts of fill. BAs 201 and 230 also reached possibly intact cultural materials of similar thickness at comparable depths. The amount of fill observed varied significantly as the augers moved north from the base of the bluff into an area of relatively flat topography. Whereas little or no fill appeared in augers spaced about 50 m apart and roughly equidistant from the bluff base (i.e., BAs 176, 184, 192, and 201), augers placed on flat ground but farther east (BAs 210 and 211) penetrated about two-thirds of a meter of fill before reaching possible site soil. Closer to the base of the bluff, we observed a more pronounced archaeological signature, with slightly higher densities of cultural materials found in intact stratigraphic contexts (in BA 202, for example).

The bucket auger data indicated that much of LAN-211/H was disturbed. The "swiss cheese" effect seen elsewhere along the base of the bluff is typical at this site. Historical-period and modern disturbance has created large pockets or "holes" in an otherwise widely dispersed, but intact, buried archaeological deposit; in some areas, the reverse may be true: the intact deposit may be the "hole" or "island" which is surrounded by disturbed fill. When small-area tests such as cores or augers hit one of these holes, readings that are abruptly different from adjacent areas result. This effect underscores the limitations of bucket augering as a testing technique. Bucket augers were successful in locating subsurface cultural materials and in disclosing potential locations for further testing; however, to evaluate the integrity of these deposits, fill materials had to be removed and backhoe trenches excavated to achieve the necessary subsurface exposure.

Trenches

We continued our testing at LAN-211/H by digging three backhoe trenches (Trenches 6, 10, and 11) of varying sizes and depths into presumed boundary areas (see Figure 30). Results were mixed; the trenches exposed a relatively thick, intact archaeological deposit in one area, possible anthropogenic soils in another, and heavily disturbed materials at the third location. No obvious pattern for the distribution of cultural materials was observed; their preservation was apparently the result of some areas having escaped historical-period disturbance. Detailed information on stratigraphic interpretations is presented in Chapter 5 and in tabular form in Table A.4.

Trench 6 was excavated perpendicular to the bluff edge into an asphalt driveway near the western boundary of LAN-211/H, approximately 20 m west of BA 176. Trench 6 was 11 m long, 1 m wide, and reached a depth of 3 m below the ground surface. Cultural materials were not observed in this trench, although the 2Ab soil horizon looked very similar to other anthropogenic soils seen elsewhere. Trench 6 was most useful in identifying the western boundary of LAN-211/H.

Trench 10 was placed to clarify the stratigraphic integrity of the area just east of BA 184. The augers on either side, BAs 176 and 192, both exposed cultural material, whereas BA 184 contained none. Trench 10 was 10 m long by 1 m wide and was excavated to a depth of 3.5 m below ground surface. Trench 10, excavated into an area known as the "salvage yard" during the Hughes Aircraft Company era, penetrated a paved surface in which traces of numerous backfilled potholes and old excavation pits were visible. Several standing structures and subsurface intrusions from Hughes Aircraft Company–era activities remain nearby. The stratigraphic sequence seen in the wall of Trench 10 was relatively simple—dark gray marsh deposits overlain by 2.5 m of mixed fill. No cultural materials were identified in either the fill soils or in the marsh deposits. The abrupt contact with the underlying marsh deposits indicate that the upper soil layers were removed to the depth of the marsh sediments some time in the past, after which a layer of fill material was deposited. The fact that this area has been graded and leveled would suggest that, if prehistoric deposits ever existed in this portion of the site, they were removed historically.

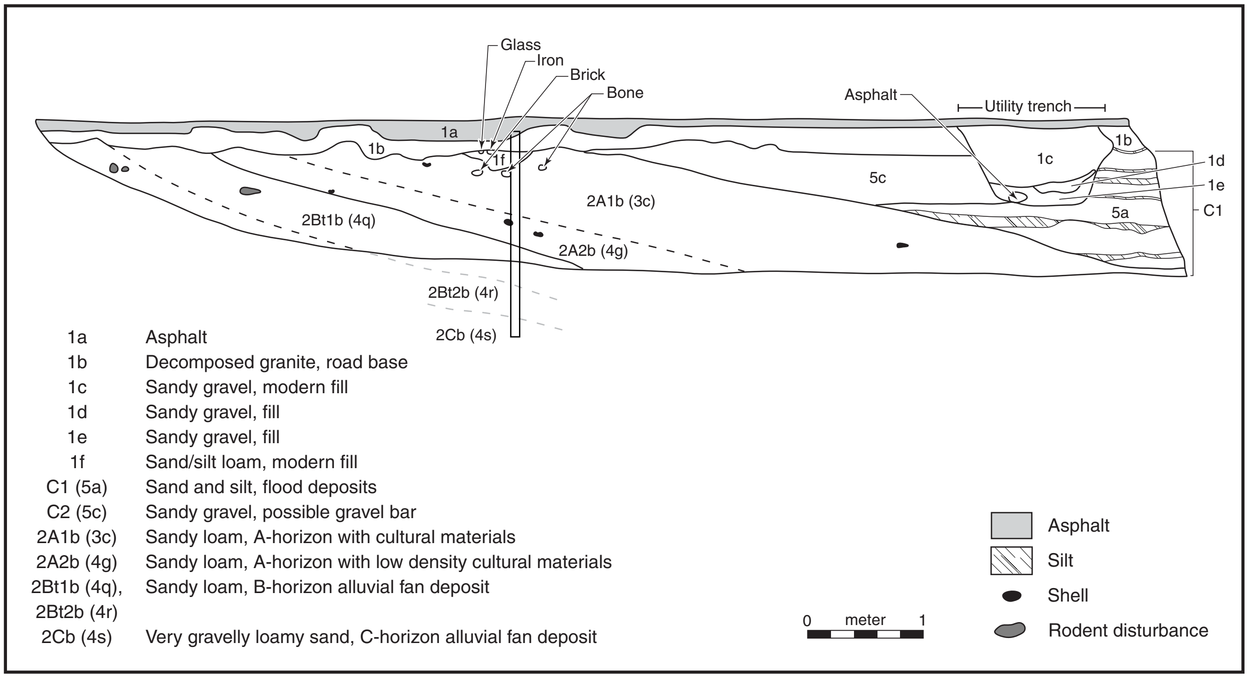


Figure 51. Stratigraphic soil profile of the southwest wall of Trench 11, LAN-211/H.

Trench 11, 26 m long by 1 m wide, was excavated to a depth of 2.25 m below ground surface. Trench 11 penetrated a relatively thick cultural deposit as well as historical-period and modern features, exposing a complex stratigraphic sequence (Figure 51). In the southern half of the trench, the upper 20–30 cm (Strata 1a and 1b) are in direct contact with the cultural deposit, identified in soil horizon 2A1b (Stratum 3c) and soil horizon 2Bt1b (Stratum 4q). Stratum 3c is an intact A horizon containing numerous fragments of marine shell, large mammal bone, ground stone, lithics, concentrations of charcoal, and other prehistoric cultural materials. Intrusive historical-period materials, such as brick, were also found but appeared to be confined to the upper portion of this layer.

Two concentrations of bone, located about 2 m apart in this trench, were recovered and analyzed. One concentration contained fragments of cow and deer, a vertebrae from a yellowfin tuna, and unidentified large mammal bone. The second, smaller concentration contained a mixture of large and small bone. Both these two concentrations may be remnants of the same feature separated by Trench 11. Unit 9 was placed in the east wall of this trench to explore the extent of this feature. The surrounding soil matrix was described as a very dark gray sandy loam and quite distinct from the overlying strata (Figure 52). The lower portion of this stratum graded into Stratum 4g, which was similar in composition to Stratum 3c, but contained less cultural material. Those cultural remains recovered were likely the result of heavy bioturbation in these two strata.

The natural slope of the alluvial fan facies occupied by prehistoric people is illustrated in the stratigraphic profile and photographs of Trench 11 (see Figures 51 and 52). At the southern end of the trench, Stratum 3c was truncated at some time in the past, probably by agricultural activity or Hughes Aircraft Company–related construction. Certainly the A horizon would have continued up the slope, and it probably would have contained a cultural deposit. This section of site material was likely used elsewhere on the property as fill. It is quite possible that the cut-away portion of this site was transported north, where it was later identified as the protohistoric component of LAN-1932/H in a secondary context. Maxwell (Chapter 7) however, argues that the faunal collections from these two sites are quite different

Figure 52. View of the southwest wall of Trench 11 and south wall of Unit 9, LAN-211/H.

and suggestive of distinct origins. Fine-grained mineralogical analysis such as that conducted at LAN-2676 (Mbila and Homburg 2000) is needed to resolve this question.

In the northern portion of Trench 11, the sloping Stratum 3c (lower culture-bearing stratum) came in contact with the 5c-C1 stratum (alluvial fan deposits without artifacts). The well-sorted sands and silts in Stratum 5 are interpreted as representing historical-period flood deposits which would have been deposited in shallow standing water, such as that seen in a photograph taken during a flood event in 1952 (Figure 53). Given that such flooding episodes have continued into modern times, we can assume that repeated shallow flooding took place during prehistory and into the historical period.

At approximately the middle of Trench 11, evidence of a historical-period or modern intrusion was seen (Figure 54). At some point in the past, likely during the 1940s or 1950s, a cross trench approximately 1 m wide and 1 m deep had been excavated into the parking lot, cutting into the 5c-C1 stratum. This intrusive trench (Figure 55) showed layers of gravel and sand; this feature may represent a drainage ditch from Building 23 to the immediate west. No materials were collected from this small feature, which appeared to be related to Hughes Aircraft Company–era activity.

Trench 11 provided important stratigraphic information about LAN-211/H. The results illustrated the highly variable nature of the disturbance at this site and along the base of the bluff in general. The discovery of an intact cultural deposit more than 1 m thick was a significant discovery and required further investigation.

Figure 53. Oblique aerial photograph taken in 1952, showing flood waters across the project area (Spence photograph, courtesy of the Air Photo Archives, UCLA Department of Geography).

Figure 54. View of the northwest wall of Trench 11.

Figure 55. Close-up view of Trench 11, showing intrusive cross-trench.

Manual Excavation

Hand excavations into the identified cultural deposits at LAN-211/H were conducted to provide fine-grained geomorphic data and to obtain a controlled sample of the midden deposit. Eleven units from five separate blocks of varying sizes were excavated at LAN-211/H. Most of the excavation blocks were subdivided into 1-by-1-m excavation units. Excavation proceeded in 10-cm arbitrary levels, except when large amounts of alluvial sediments overlay the cultural deposit; these were removed in increments larger than 10 cm.

Current evidence indicates that LAN-211/H is located entirely on or within the alluvial fan facies. Most of the test units (Units 3–7, 6/10, and 11) were excavated into a bench likely created when the Hughes Aircraft Company removed part of the alluvial fan to build Building 23, its associated structures, and the parking lot. The archaeological deposits were found in the 1-m-thick upper A horizon of a moderately developed soil topped by a substantial layer of fill. Most excavation took place on a sloped surface, and in two instances, the depth needed to reach the cultural deposits required shoring to comply with safety standards set by the California Occupational Safety and Health Administration. Shoring braces and panels blocked large sections of wall stratigraphy from view, hampering field interpretation (see Figure 32).

The test excavations at LAN-211/H provided data for a preliminary reconstruction of geomorphic trends and identified in situ cultural deposits and their stratigraphic context. This section briefly describes selected unit excavation blocks and introduces data pertinent to the interpretation of the cultural deposit. The site map (see Figure 30) details the locations of all excavation units and shows their placement within the site boundaries and their relationship to the local topography. Detailed stratigraphic interpretations are presented in Chapter 4 and in tabular form in Table A.5.

Figure 56. View showing bluff, artificial terrace, and Building 23, facing west.

Units 1–4

Units 1 and 2 were each 1-by-1-m units placed side by side to form a north-south 1-by-2-m block on the edge of the slope overlooking the eastern end of the salvage yard at Building 23. These units were placed above the artificial cut in the slope where LAN-211/H was first discovered during the 1990 survey (Figure 56).

A heavy growth of ice plant (*Carpobrotus edulis*) covers the slope and excavators noted heavy rodent disturbance on the ground surface. Excavators at Unit 1 cleared ice plant from the surface and removed approximately 60 cm of topsoil from the unit before beginning excavation. The stratigraphic profile of Units 1 through 4 shows the steep slope on which the units were placed (Figure 57). Unit 1 was excavated through stratigraphic layers interpreted as predominantly C horizon materials with alternating bands of lamellae (Bt horizon), which developed in an alluvial fan setting (see Chapter 5). A sparse cultural deposit approximately 80 cm thick was encountered in Unit 1.

At LAN-211/H, Stratum 3 corresponds with the uppermost A horizon of a moderately developed soil (see discussion, Chapter 5). Stratum 3 soils generally include cultural-bearing deposit. No Stratum 3a soils were excavated from Unit 1, although artifacts were recovered, likely the result of heavy bioturbation. Unit 2, placed higher on the slope, was excavated in 50-cm increments (as opposed to the 10-cm increments used in Unit 1). As a result, the excavation levels crosscut the strata and the raw counts and weights of artifacts are misleading; artifact density is a better proxy. A deposit of Stratum 3a soil approximately 90 cm thick was excavated in Unit 2, most of it in Level 1. The overall cultural deposit in Unit 2 was 1.5 m thick.

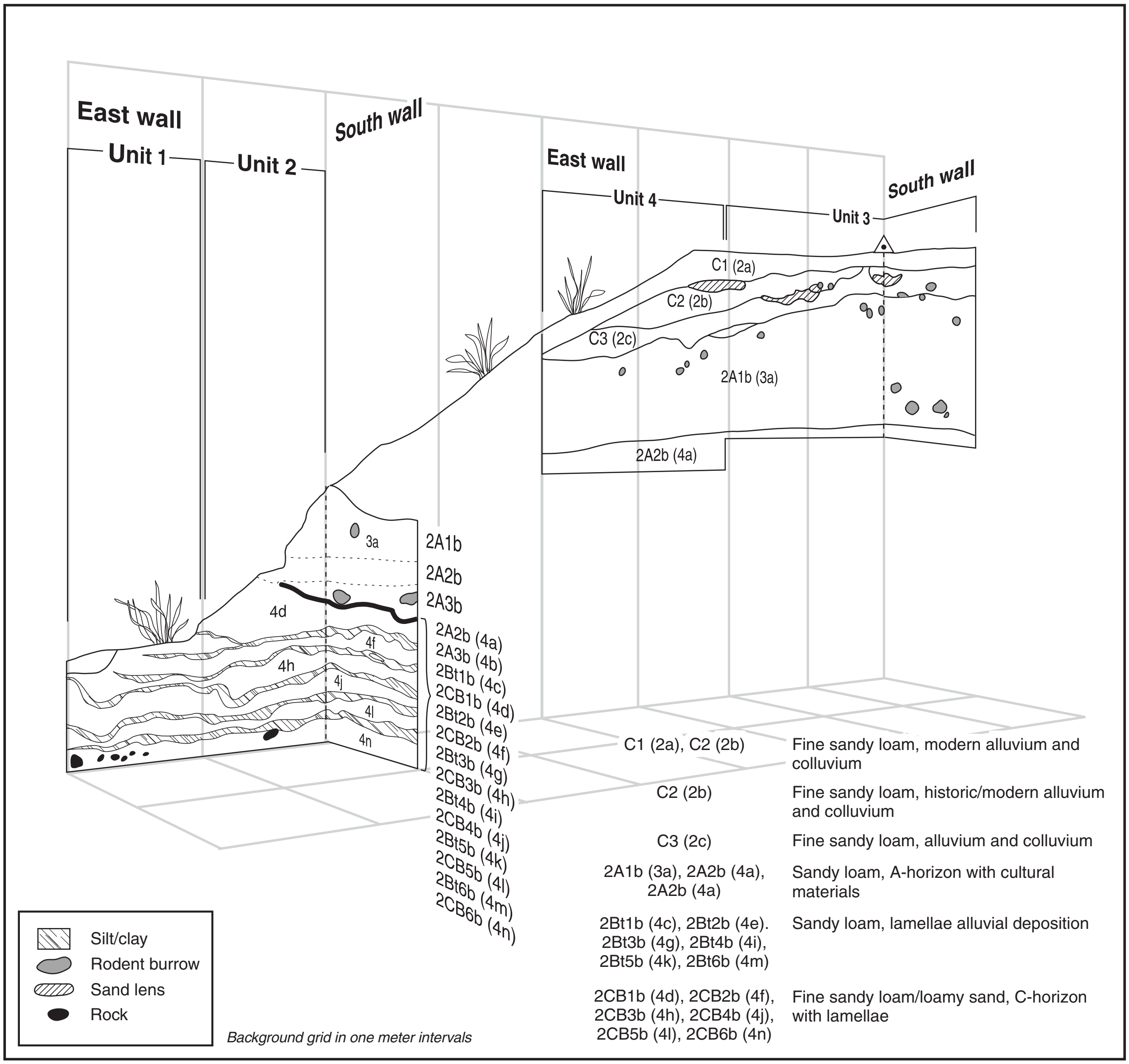


Figure 57. Stratigraphic soil profile of Units 1–4, LAN-211/H.

Compared to other excavation units at LAN-211/H, a relatively small amount of cultural material was recovered in Units 1 and 2. This may be because a large portion of the site was apparently truncated for agricultural purposes or for Hughes Aircraft Company–era activities. Units 1 and 2 appear to be at the edge of this artificial cut. Lamellae were observed in the sidewalls of these units, indicating a stable surface on the fan for some time.

After completing Units 1 and 2, we determined that continuing the line of units south into the slope might reveal more of the cultural deposit and would aid in establishing the site's stratigraphic integrity. For safety purposes, a small balk approximately 2 m wide was left unexcavated between Units 1 and 2 and Units 3 and 4. Units 3 and 4 were both 1-by-2-m units oriented north-south and placed progressively higher up the slope (Figure 58). Unit 3 was excavated in 10-cm increments with provenience maintained for the entire 1-by-2-m unit to a depth of 120 cm below datum. After this depth, the 1-by-2-m unit was

Figure 58. View of east wall of Units 3 and 4, LAN-211/H.

divided into two 1-by-1-m subunits, each of which was excavated in 10-cm-deep levels. This procedure continued to the bottom of the unit at a depth of 2 m below datum.

The excavation strategy for Unit 4 was similar; the first three levels were excavated in 50-cm increments with provenience maintained for the entire 1-by-2-m unit. After a depth of 150 cm below datum, the 1-by-2-m unit was divided into two 1-by-1-m subunits which were excavated in 10-cm increments to a depth of 2.2 m below the datum.

Levels 1–3 in Unit 4 do not align with the same levels in Unit 3. To compare artifact densities between Units 3 and 4, it is more useful to view these densities in relation to stratigraphic layers (Table 9). Unit 3, which was consistently excavated in 10-cm increments, was selected as the proxy for artifact density in this portion of LAN-211/H. The lower three levels of Unit 4 were viewed as a continuation of Unit 3. A clear pattern emerged; artifact density increased with depth into Stratum 3a. The upper levels of Unit 3 contained sparse amounts of cultural materials that were probably the result of bioturbation bringing materials upward. Moving lower in the profile, artifact densities peaked in Levels 7 and 8, below which they began to drop off, with some minor fluctuations. Stratum 3a contained a fairly substantial midden deposit with some structure which continued into Stratum 4a. Stratum 4 represented the B and C horizons of the moderately developed soil on the alluvial fan. The artifact density data are consistent with a midden deposit that has been dispersed vertically through the continuous action of bioturbation. The lack of features within these excavations made it difficult to identify specific living surfaces. There was a concentration of cultural materials between 70–120 cm which may reflect such a surface in approximately the upper middle portion of Stratum 3a.

Table 9. LAN-211/H Artifact and Ecofact Densities

Level, by Unit	Size (m)	Strata	Soil Horizon	Depth (m)	Volume (m^3)	Lithic Artifacts		Vertebrate Fauna		Invertebrate Fauna	
						Count	Density ($/m^3$)	Weight (g)	Density (g/m^3)	Weight (g)	Density (g/m^3)
Unit 1											
1	1 × 1	4d, 4e	2CB1b, 2Bt2b	0.68–0.85	0.09	19	211.11	9	100.00	—	—
2		4d, 4e	2CB1b, 2Bt2b	0.85–0.95	0.10	6	60.00	6	60.00	1	10.00
3		5d, 4e	2CB2b, 2Bt2b	0.95–1.05	0.10	9	90.00	4	40.00	7	70.00
4		4f–h	2Bt3b, 2CB3b, 2Bt4b	1.05–1.15	0.10	9	90.00	3	30.00	1	10.00
5		4g–i	2CB3b, 2Bt4b, 2CB4b	1.15–1.25	0.10	3	30.00	—	—	3	30.00
6		4h, 4i	2Bt4b, 2CB4b	1.25–1.35	0.11	4	36.36	3	27.27	2	18.18
7		4i, 4k	2CB4b, 2Bt5b	1.35–1.45	0.10	5	50.00	—	—	—	—
8		4k, 4l	2Bt5b, 2CB5b	1.45–1.55	0.10	—	—	—	—	—	—
9		4m, 4n	2Bt6b, 2CB6b	1.55–1.65	0.10	—	—	—	—	—	—
10		4n	2CB6b	1.65–1.75	0.10	—	—	—	—	—	—
Unit 2											
1	1 × 1	3a	2A1b	0.45–0.95	0.26	23	88.46	21	80.77	2	7.69
2		3a, 4a, 4c, 4d	2A1b, 2A2b, 2Bt1b, 2CB1b	0.95–1.45	0.30	30	100.00	31	103.33	6	20.00
3		4d–h, 5d	2CB1b, 2Bt2b, 2CB2b, 2Bt3b, 2CB3b, 2Bt4b	1.45–1.95	0.49	16	32.65	22	44.90	3	6.12
4		4g–i, 4k–n	2CB3b, 2Bt4b, 2CB4b, 2Bt5b, 2CB5b, 2Bt6b, 2Cb6b	1.95–2.45	0.50	2	4.00	—	—	—	—
Unit 3											
1	1 × 2	2a	C1	0–0.30	0.34	2	5.88	—	—	6	17.65
2		2a–c	C1, C2, C3	0.30–0.40	0.20	6	30.00	8	40.00	10	50.00
3		2b, 2c	C2, C3	0.40–0.50	0.20	5	25.00	1	5.00	—	—
4		2b, 2c, 3a	C2, C3, 2A1b	0.50–0.60	0.20	23	115.00	9	45.00	2	10.00

Level, by Unit	Size (m)	Strata	Soil Horizon	Depth (m)	Volume (m^3)	Lithic Artifacts		Vertebrate Fauna		Invertebrate Fauna	
						Count	Density ($/m^3$)	Weight (g)	Density (g/m^3)	Weight (g)	Density (g/m^3)
5		2c, 3a	C3, 2A1b	0.60–0.70	0.20	25	125.00	30	150.00	7	35.00
6		2c, 3a	C3, 2A1b	0.70–0.80	0.21	49	233.33	28	133.33	—	—
7		2c, 3a	C3, 2A1b	0.80–0.90	0.19	59	310.53	50	263.16	3	15.79
8		3a	2A1b	0.90–1.00	0.20	74	370.00	30	150.00	3	15.00
9		3a	2A1b	1.00–1.10	0.20	39	195.00	21	105.00	6	30.00
10		3a	2A1b	1.10–1.20	0.20	45	225.00	38	190.00	4	20.00
11		3a	2A1b	1.20–1.30	0.19	29	152.63	8	42.11	—	—
12		3a	2A1b	1.30–1.40	0.20	19	95.00	10	50.00	1	5.00
13		3a	2A1b	1.40–1.50	0.22	6	27.27	8	36.36	—	—
14		3a	2A1b	1.50–1.60	0.18	9	50.00	5	27.78	—	—
15		3a	2A1b	1.60–1.70	0.22	11	50.00	11	50.00	—	—
16		3a	2A1b	1.70–1.80	0.18	9	50.00	3	16.37	2	11.11
17		4a	2A2b	1.80–1.90	0.16	8	50.00	1	6.25	4	25.00
Unit 4											
8	1 × 2	3a, 4a	2A1b, 2A2b	1.95–2.00	.09	7	77.00	4	44.44	—	—
9		4a	2A2b	2.00–2.10	.20	7	35.00	2	10.00	1	5.00
10		4a	2A2b	2.10–2.20	.23	9	39.13	7	30.43	1	4.34
Unit 6											
1	1 × 1	2c	C1	0–0.30	0.10	6	60.00	3	30.00	—	—
2		2c, 2d, 3b	C1, C2, 2A1b	0.30–0.60	0.30	16	53.33	13	43.33	—	—
3		3b, 2c	2A1b, C1	0.60–0.70	0.10	21	210.00	43	430.00	—	—
4		3b, 2c	2A1b, C1	0.70–0.80	0.11	6	54.55	16	145.45	2	18.18
5		3b	2A1b	0.80–0.90	0.10	15	150.00	30	300.00	—	—
6		3b	2A1b	0.90–1.00	0.11	20	181.82	44.6	405.45	14	127.27
7		3b	2A1b	1.00–1.10	0.11	5	45.45	25	227.27	3	27.27
8		3b	2A1b	1.10–1.20	0.10	17	170.00	19	190.00	7	70.00
9		3b	2A1b	1.20–1.30	0.09	13	144.44	13	144.44	5	55.56

continued on next page

Level, by Unit	Size (m)	Strata	Soil Horizon	Depth (m)	Volume (m^3)	Lithic Artifacts		Vertebrate Fauna		Invertebrate Fauna	
						Count	Density ($/m^3$)	Weight (g)	Density (g/m^3)	Weight (g)	Density (g/m^3)
Unit 10											
1	1 × 1	3b	2A1b	1.30–1.40	0.10	19	190.00	26	260.00	—	—
2		3b	2A1b	1.40–1.50	0.10	17	170.00	16	160.00	—	—
3		3b, 4o	2A1b, 2A2b	1.50–1.60	0.10	12	120.00	16	160.00	2	20.00
4		3b, 4o	2A1b, 2A2b	1.60–1.70	0.09	4	44.44	12	133.33	1	11.11
5		3b, 4o	2A1b, 2A2b	1.70–1.80	0.10	26	260.00	52	520.00	1	10.00
6		4o, 4p	2A2b, 2A3b	1.80–1.90	0.13	15	115.38	18	138.46	—	—
7		4p	2A3b	1.90–2.00	0.08	6	75.00	3	37.50	1	12.50
Unit 9 SE, SW, NE, NW											
1	2 × 2	3c	2A1b	0.86–0.96	0.40	807	2,017.50	3,522.8	8,807.00	270	675.00
2		3c	2A1b	0.96–1.08	0.45	372	826.67	3,035.8	6,746.22	338	751.11
Unit 9 SE, SW											
3	1 × 2	3c	2A1b	1.08–1.16	0.09	8	88.89	27	300.00	29	322.22
Unit 11 S											
1	1 × 1	3d	A1	0–0.25	0.12	3	25.00	5	41.67	94	783.33
Unit 11 N, S											
2	1 × 2	3d	A1	0.25–0.30	0.11	2	18.18	—	—	58	527.27
3		3d	A1	0.30–0.40	0.13	3	23.08	5	38.46	77	592.30
4		3d	A1	0.40–0.50	0.19	9	47.37	17	89.47	42	221.05
5		3d	A1	0.50–0.60	0.20	7	35.00	5	25.00	38	190.00
6		3d	A1	0.60–0.70	0.19	15	78.94	20	105.26	18	94.74
7		3d	A1	0.70–0.80	0.20	15	75.00	22	110.00	19	95.00
8		3d	A1	0.80–0.90	0.20	5	25.00	14	70.00	54	270.00
9		3d	A1	0.90–1.00	0.20	10	50.00	8	40.00	44	220.00
10		3d, 4e	A1, A2	1.00–1.10	0.20	8	40.00	17	85.00	7	35.00
11		3d, 4e	A1, A2	1.10–1.20	0.22	7	31.81	2	9.09	8	36.36

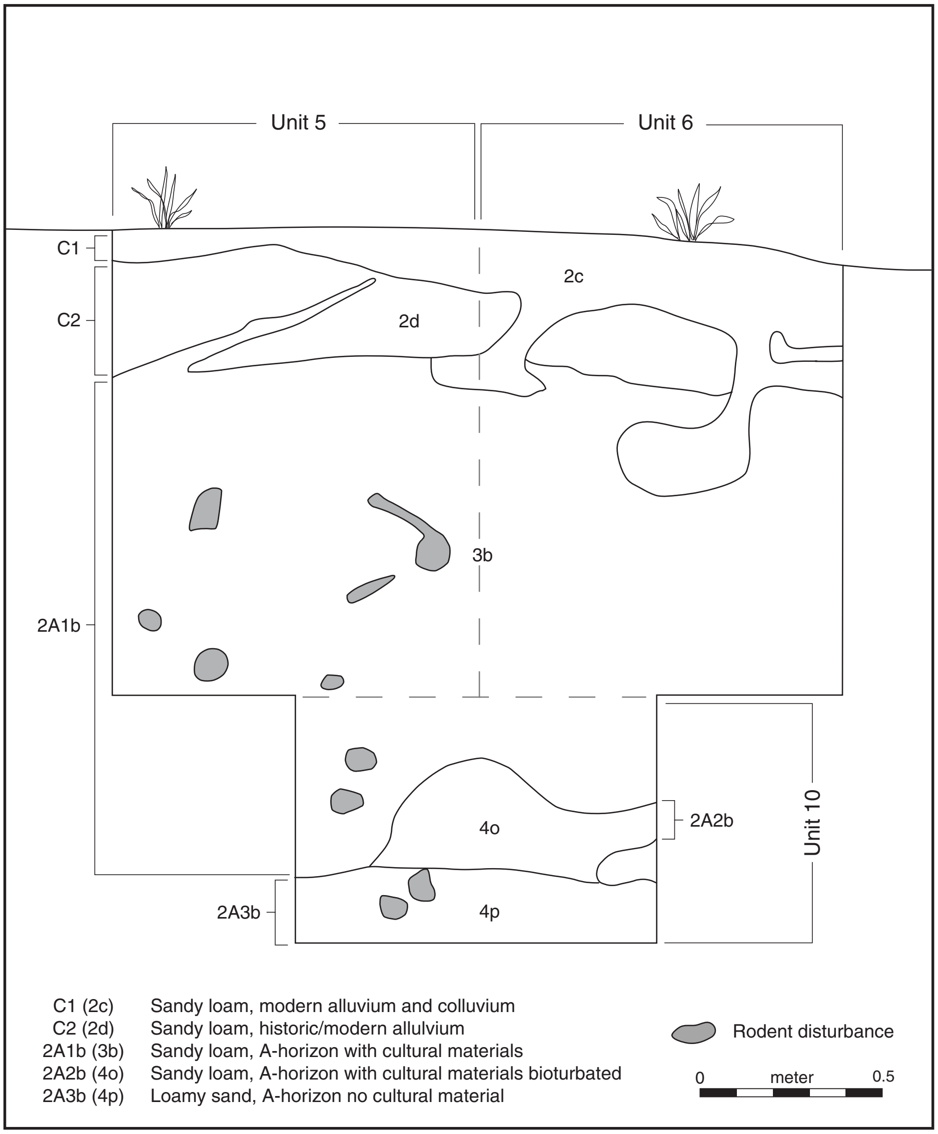


Figure 59. Stratigraphic soil profile of the south wall of Units 5, 6, and 10.

Units 5–8 and 10

This set of units was excavated as a 2-by-2-m block of four 1-by-1-m units (Units 5–8). Each unit was excavated to a depth of 130 cm, whereupon a 1-by-1-m unit (Unit 10) was placed in the center of the block and excavation continued for another 70 cm, to a total depth of 2 m. This excavation block was placed on the same bench as Units 1–4, but slightly further up the slope. For analytical purposes, Unit 10 was seen as a continuation of the 2-by-2-m unit block containing Units 5–8. In Table 9, we included only Units 6 and 10 and consider them a continuous data set, labeled elsewhere Unit 6/10.

Stratigraphically, this block of units looked very similar to Units 1–4 (Figure 59). Modern and historical-period alluvium and colluvium (Strata 2c and 2d) capped a heavily bioturbated A horizon (Strata 3b and 4o) that contained a thick, vertically diffused cultural deposit. Distribution of cultural material in this block of units differed from that seen in Units 3 and 4. No pattern in the vertical distribution or concentration of cultural materials was discovered in Unit 6/10. Apparent from an examination of Strata 3b, 4o, and 4p was a homogenous layer of cultural material; minor fluctuations between levels and artifact classes appears random. Heavy rodent disturbance occurred throughout and is likely responsible for the lack of structure in the deposit.

Again comparing Units 3–4 and Units 5–8 and 10, we note that instead of tapering off with depth, the highest density of vertebrate fauna was in Level 5 of Unit 10, at 1.7–1.8 m below the surface. This difference in site structure seems puzzling given that the stratigraphic profiles look similar and the unit blocks were separated by less than 20 m. The block containing Units 5–8 and Unit 10 was placed close to a large drainage to the east, which could have reworked the soils in this area.

Marine shell samples were collected from Unit 6, Level 6, and Unit 10, Level 7, and sent in for radiocarbon assay (Table 10). Both samples date to the beginning of the Late period but appear to be a reversal of what would be expected if there was good stratigraphic integrity at this location. The sample of *Chione* sp. collected from Level 7 of Unit 10 returned an intercept date of A.D. 1000, nearly 400 years later (i.e., more recent) than the date (A.D. 610) from the sample from Unit 6, Level 6, which was 90 cm higher and within a different stratum. Several possibilities could account for such results. Excavators noted heavy bioturbation throughout this set of units. Burrowing rodents and other natural forces have moved cultural materials vertically and horizontally throughout this area of the site. Fragments of shell could have been transported 1 m or more by such disturbance. This cultural deposit may also be secondary in nature, having washed down the slope from a location above on the bluff tops. In this case, the later components of sites on the bluff might erode and build up below in the reverse order of their original depositional sequence.

A third possibility is that these deposits were created by modern disturbance associated with the construction of the sewer line and adjacent service road or the development of Loyola Marymount University on the bluff above. Cultural materials from the bluff tops or from elsewhere on the property may have been imported as fill to stabilize the bluff edge below the sewer line. Archival photographs show that during construction of Loyola Marymount University, the large drainage above LAN-211/H was mechanically filled. Grading on the university campus undoubtedly disturbed archaeological materials that may have been transported to the drainage for fill. Subsequent flooding and erosion of the hill slope could have washed cultural materials down onto the bench on which LAN-211/H sits. The reversal of these two radiocarbon dates attests to the amount of disturbance within Strata 3b, 4o, and 4p.

Unit 9

Unit 9 (Figure 60; see Figure 52) at LAN-211/H was by far the most productive as measured by the amount of cultural material recovered per cubic meter of soil (see Table 9). Placed on the eastern side of Trench 11 in the paved parking area of the salvage yard, Unit 9 was a 2-by-2-m block divided into four 1-by-1-m quads and excavated in arbitrary 10-cm increments. Upper sterile soils that were described in Trench 11 as historical-period flood deposits were mechanically removed prior to excavation.

The stratigraphic sequence observed in Unit 9 (Figure 61) was essentially identical to that recorded for Trench 11 (see Figure 51). Alternating layers of sand and silt capped a naturally sloping A horizon that contained a dense 30-cm-thick deposit of cultural material. Unit 9 was placed at the toe slope of the alluvial fan at the mouth of the large drainage that cuts the bluff above the site. In the northern portion of Unit 9, the fan slope flattens out, perhaps as a result of flood episodes subsequent to or during occupation of this part of the site. The density of cultural material in even the lowest level of Unit 9 was far higher than anywhere else at LAN-211/H. Despite the fact that the cultural deposit was relatively thin, a variation in the distribution of artifacts was noted; artifact density decreased with depth. Whether this was a result of cultural material being washed down the fan and settling below or the product of human behavior could not be determined.

Table 10. Radiocarbon Data from LAN-211/H

Provenience	Depth m AMSL (feet AMSL)	Sample Number[a]	Species Sampled	Measured ^{14}C Age (B.P.)	$^{13/12}C$‰	Corrected ^{14}C Age (cal B.P.)[b]	Intercept	Calibrated Age (95% probability)
Unit 6, Level 6	8.6–8.5 (28.3–27.9)	Beta-145027	*Chione* sp.	2030 ± 60	+1.3	1810 ± 70	cal A.D. 610	cal A.D. 440–715
Unit 10, Level 7	7.6–7.5 (24.9–24.6)	Beta-145028	*Chione* sp.	1640 ± 40	+3.6	1420 ± 50	cal A.D. 1000	cal A.D. 890–1065
Unit 9, Level 1	3.2–3.1 (10.5–10.2)	Beta-145029	*Haliotis* sp.	910 ± 70	+1	690 ± 80[c]	cal A.D. 1640	cal A.D. 1465–1810
Unit 9, Level 2	3.1–3.0 (10.2–9.8)	Beta-145030	*Chione* sp.	1030 ± 70	0	810 ± 80	cal A.D. 1490	cal A.D. 1405–1665

[a] Beta = Beta Analytic, Inc., Miami, Florida
[b] INTCAL98 Radiocarbon Age Calibration (Stuiver et al. 1998)
[c] MARINE98 database

Figure 60. View of the south and east walls of Unit 9, LAN-211/H.

Unit 9 was different from the other units at LAN-211/H in a number of important aspects. Despite a significant amount of bioturbation, the thin, dense deposit in Unit 9 was intact. Shell collected for radiocarbon assay from Levels 1 and 2 of the southeastern quadrant returned promising results (see Table 10). The sample collected from Level 1 returned a date of A.D. 1640, whereas the sample from Level 2 returned a date of A.D. 1490. Separated by only 10 cm, these levels appear to be internally consistent, placing this portion of the site well into the protohistoric time period. Calibrated to 1 sigma, the two dates overlap and can essentially be considered the same date. These dates correspond well with bead data collected from this block of units (see Chapter 9), suggesting that this portion of the site represents a single temporal component dating to a transition period between the Late and protohistoric periods.

Unit 11

Unit 11 was a 1-by-2-m unit placed on the eastern side of the large drainage at the eastern end of LAN-211/H. Unit 11 was excavated to a depth of 120 cm below ground surface in arbitrary 10-cm increments with provenience maintained to the 1-by-1-m unit. Excavated on a steep slope (Figure 62), the first four levels dug in northern and southern 1-by-1-m units recovered differing amounts of matrix. Unit 11 had a different stratigraphic and cultural composition from other units at LAN-211/H. In contrast to the other unit blocks, the stratigraphic sequence in Unit 11 was very simple. The entire unit was excavated through an A horizon 1.2 m thick with cultural materials recovered in varying densities throughout all levels. Two strata were identified: Stratum 3d, seen in most of the unit, was defined as a fine sandy loam, and Stratum 4e appeared as a lighter colored sandy loam with a lower artifact density. Extensive bioturbation was noted throughout all levels of excavation; in some cases, cultural materials were only found within the krotovinas.

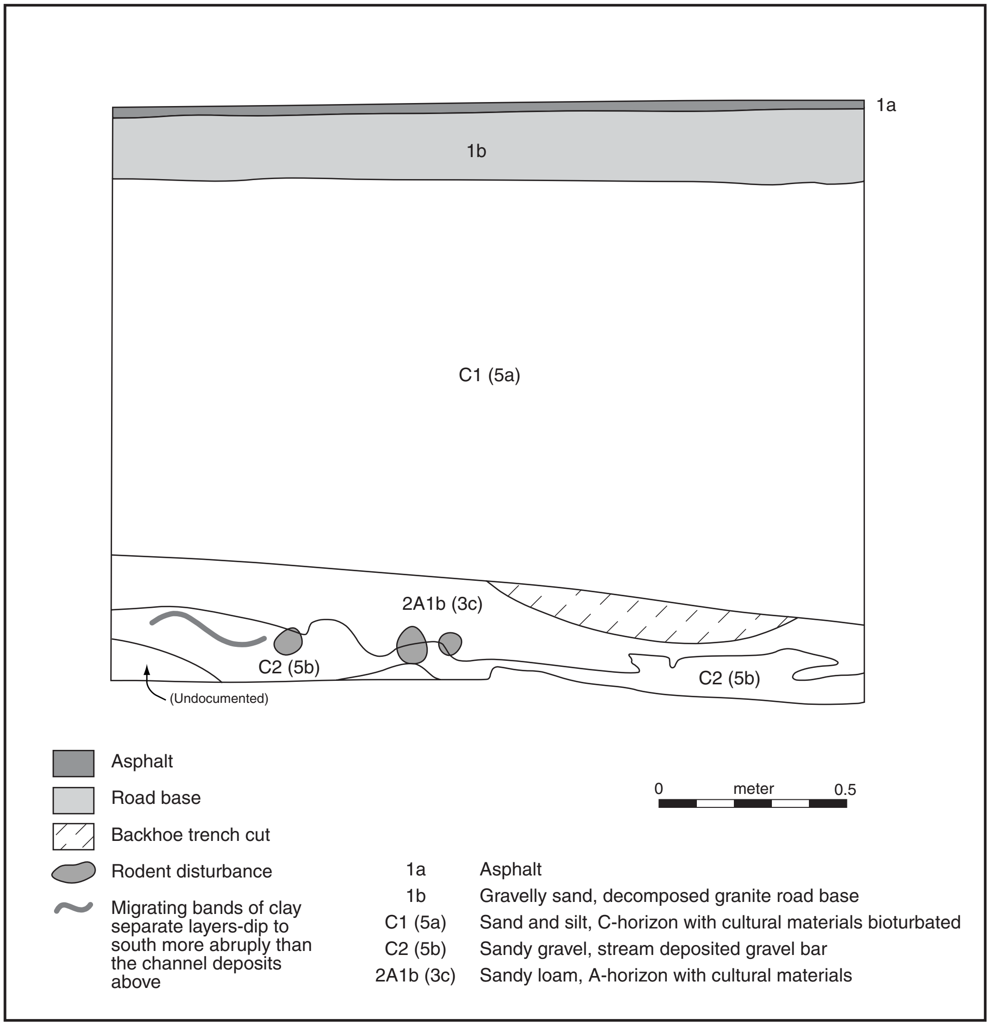


Figure 61. Stratigraphic soil profile of the west wall of Unit 9, LAN-211/H.

Comparison of artifact densities between levels in Unit 11 presents a curious picture (see Table 9). Interestingly, the highest density of invertebrates is in the top level, which we assume has been severely disturbed in the recent past. The weights and overall densities of invertebrates are higher than all other units at LAN-211/H, with the exception of Unit 9. Below Level 1, the density of invertebrates drops steadily until Levels 8 and 9, where large numbers were again recovered. Densities of vertebrate fauna are more consistent; there is a peak in the density at Levels 6 and 7, which corresponds with a peak in lithic density and a drop in invertebrate density. This phenomenon also occurs in the bottom levels of Units 10, where shell densities drop significantly and densities of lithic and vertebrate fauna rise slightly.

Although the cultural deposit in Unit 11 was in places quite dense, it was difficult to interpret. There were large numbers of invertebrates recovered from this unit in almost every level, whereas the counts of lithics and weights of vertebrate fauna were relatively low. The stratigraphic integrity of the cultural deposit found in Unit 11 appeared intact, although the lack of modern colluvial and alluvial materials in the upper levels of the unit was puzzling. As this unit was placed just east of a concrete channel that was constructed to control runoff from the bluff above, we expected to find signs of historical-period or modern disturbance, but there was little evidence found during excavation. Unit 11 may have penetrated

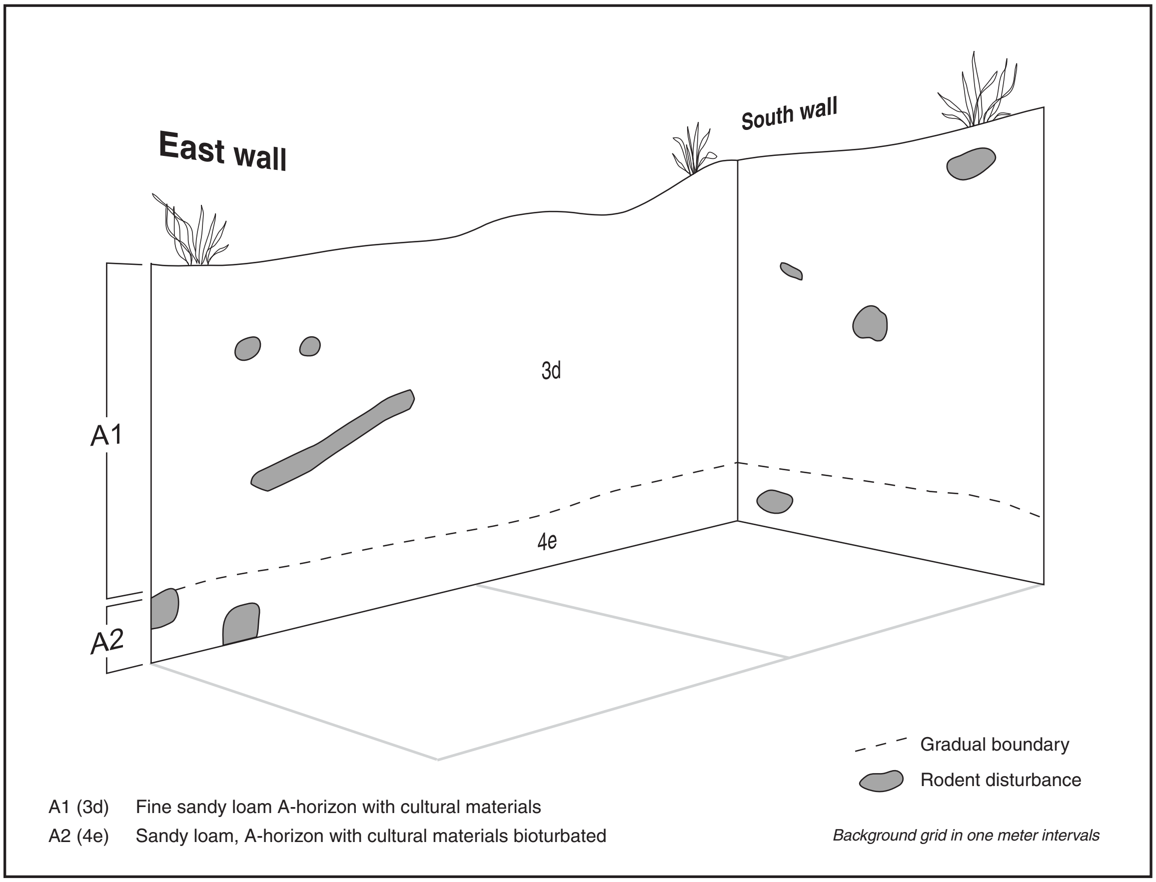


Figure 62. Stratigraphic soil profile of Unit 11, LAN-211/H.

a deposit of cultural material that had washed down from the bluff top or was disturbed during the construction of the runoff control channel; however, the patterning seen in the artifact density data argues against this interpretation. Further excavation at LAN-211/H may resolve the question.

LAN-2769

The cultural deposit at LAN-2769 was described in 1990 as "two narrow bands of dark, organic soil nestled along the edge of the bluff. Both bands are composed of dark organic silty sand with shell intermixed" (Altschul et al. 1991:153). At that time, neither the extent nor the integrity of the deposit could be determined. Its location—behind and to the west of the asphalt-covered parking lot known as "Trailer City" at the time of this investigation—suggested that the lower portion of the site had been removed during construction of the parking lot (Figure 63). To determine the extent and integrity of cultural deposits at LAN-2769, we implemented a multiphased strategy similar to that described for LAN-211/H.

Figure 63. Excavation at LAN-2769, showing proximity of “Trailer City.”

Mechanical Excavation

At LAN-2769, we excavated three bucket augers and seven trenches (see Figure 31). Of the three augers, only BA 251 encountered artifacts (five pieces of lithic debitage) and these were found in a highly disturbed stratum of Category 4 soil that also contained modern construction debris (concrete and asphalt). Augering was stopped after three holes were excavated because the truck-mounted rig could not negotiate between the trailers. Consequently, the core area of the site could not be tested using this method.

On August 19, 1999, three trenches (Trenches 1-1, 1-2, and 1-3) were dug in the parking lot, in the area of LAN-2769 just north of the base of the bluff, and four trenches were excavated to the west, in and south of an equipment yard (Trenches 1-4, 1-5, 1-13, and 1-14). Using a backhoe, we placed the trenches as close to the surmised site boundaries as possible. The soils at LAN-2769 appeared in six distinct soil horizons, although not all trenches exposed these soil types, nor were they uniformly encountered across the site. These strata are described in detail in Chapter 5, and are shown in tabular form in Table A.2. In general, the trenches penetrated the toe-slope portion of the hill-slope facies, and in several cases, floodplain deposits of the alluvial plain facies were reached. None of the seven trenches located intact prehistoric cultural deposits. The excavation of Trench 1-5 did reveal that the channeling identified in one stratum in Trench 1-4 appeared to run parallel to the base of the bluff. This channeling is interpreted as representing a historical-period flood deposit.

A graphic presentation of the results of bucket augering and five of the trenches at LAN-2769 shows that soils in the LAN-2769 area are highly mixed, probably the result of disturbance from historical-period and Hughes Aircraft Company–era activities (Figure 64). Trenches 1-2 and 1-3, for example, were placed only 10 m north and 5 m south of BA 251, but look very different from each other. Trench 1-2 follows a similar pattern as observed in BA 251, with only slight variation between the depths of

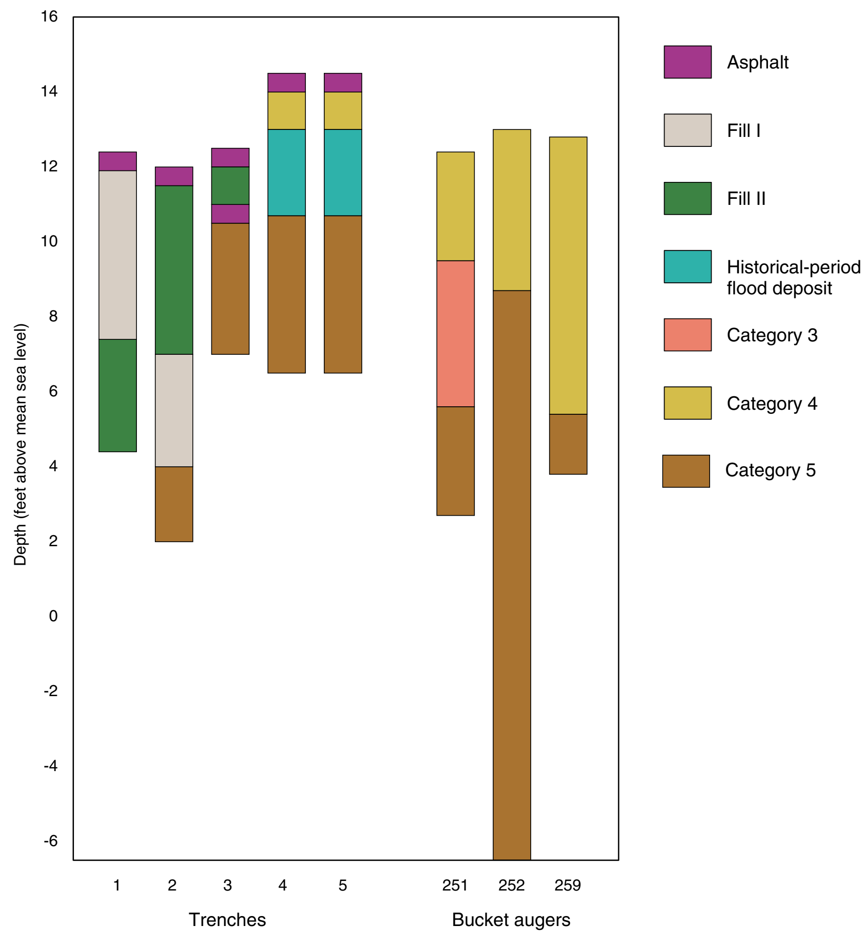


Figure 64. Schematic soil profile of LAN-2769.

native soil. In Trench 1-2, we found native soil at about 1.22 m AMSL, whereas in Trench 1-3, native soils were encountered at a much shallower depth, at 3.2 m AMSL, suggesting that the prehistoric alluvial fan may be partially intact near the base of the slope. Trenches 1-1 and 1-2 illustrate the severity of modern and historical-period disturbances in the area. In Trench 1-1, fill type I (fill that appears intentionally placed during construction, see Table A.2) overlies fill type II (sediment that was redeposited as part of either modern construction or earth-moving activities), whereas the opposite sequence is seen in Trench 1-2, located approximately 35 m to the west.

Manual Excavation

Trenching was partially successful in establishing the site boundaries at LAN-2769. We discovered no intact cultural deposits in the north end of the parking lot, suggesting that we had correctly mapped the site's northern limit. However, on the southern perimeter at the base of the slope, standing structures prevented mechanical trenching. SRI hand-excavated units in this area to provide controlled information on the horizontal and vertical distribution of prehistoric cultural materials (if present), to obtain fine-grained geomorphic data to establish the integrity of the deposit, and to tie the cultural materials to the site stratigraphy.

We excavated a total of nine 1-by-1-m units in this site (see Figure 31). The units were placed judgmentally in the toe slope in areas where cultural materials had been observed during the 1990 SRI survey of the property. Two 2-by-2-m blocks (Units 1 and 2) were excavated in 1-by-1-m quadrants. In Unit 2, at 1.2 m below ground surface, safety concerns dictated that we continue excavation in a single 1-by-1-m unit. Unit 3 was placed in the center of Unit 2 and was excavated 70 cm deeper. For purposes of analysis, Unit 3 was viewed as a continuation of Unit 2. We dry-screened all material in the field through ⅛-inch mesh screens, then sent the residue to the SRI water-screening facility to be water screened through ⅛-inch mesh screens for further removal of sediments. Sidewalls of the units were faced, and stratigraphic soil profiles were drawn. Results of stratigraphic analysis are presented below and are followed by a discussion of artifact density from the excavation units (Table 11).

Unit 1

Unit 1 was placed at the base of the slope on the south edge of the paved parking lot, close to the center of the site boundary as identified by the SRI survey in 1990 (Altschul et al. 1991). At the base of the bluff, where the toe slope meets the back slope, a weakly developed soil horizon is present that indicates at least a brief period of stability in the past.

Unit 1, a 2-by-2-m block, was excavated on the slope, with the high corner at 4.91 m AMSL and the low corner at 4.33 m AMSL. Excavation methods were previously described in Chapter 4. We excavated 1-by-1-m quadrants in arbitrary 20-cm levels to 90 cm below the surface. Individual provenience designations were assigned to each level by quadrant. Because Unit 1 was placed on a slope, the northern half of the unit was not excavated for the first two levels. Figure 65 details the soil profile of the south wall of this unit, and Table A.3 contains stratigraphic descriptions. The southeastern quadrant of Unit 1, excavated from the ground surface to a depth of 90 cm, was chosen for analysis.

Five layers (Strata 1a–1e) of redeposited fill or colluvial material overlay a sparse cultural deposit in Unit 1. All colluvial or fill strata contained modern debris, such as glass, cow bone, and fragments of rubber, as well as a very small number of prehistoric cultural artifacts. The upper strata likely represent a combination of fill and modern "slope wash" created during the construction of the sewer line in the 1920 on the slope of the hill above. The modern and historical-period materials seen in Stratum 1 are recent litter.

Level 2, which crosscut three strata, had the highest density of lithic artifacts and vertebrate fauna in Unit 1, though these densities were still very low considering the 20-cm thickness of levels excavated. Vertebrate fauna counts may be inflated by intrusive taxa, such as rodents or reptiles (see Table 9). Several possible explanations could account for the cultural deposit in Unit 1: first, cultural materials may have been imported with fill for Hughes Aircraft Company–related activities from some unknown location; second, they may have originated at one of the sites on the bluff top or on the slope above LAN-2769, and subsequently been redeposited below by erosion or the construction of the sewer and its associated service road; third, the cultural deposit is in situ, albeit highly disturbed.

If the source of the cultural deposit in Unit 1 is imported fill, we would expect an even distribution and an abrupt contact with the lower strata. In fact, the contacts between Strata 1a, 1b, 1e, and 2a are abrupt, indicating that these strata have been recently introduced. The fact that Strata 2a and 3a appear to be A horizon materials but without an underlying B horizon adds credence to this argument. The contact with underlying Stratum 4a, however, is diffuse and appears to represent an intact soil.

Cultural materials in Unit 1 may also represent an aggraded deposit which has eroded from the bluff tops or been redeposited during construction of the sewer line. A small prehistoric site (LAN-2379) , about which very little is known, was recorded by Chester King in 1995 on the bluff above and slightly east of LAN-2769 (see Figure 5). During housing construction in this area, cultural materials from this site might have been graded and pushed to the edge of the bluff for slope stabilization, after which, erosion brought them down the bluff face. Unfortunately, we cannot investigate this possibility further, as no data are available from LAN-2379 for comparison with the LAN-2769 collection. If culture-

Table 11. LAN-2769 Artifact and Ecofact Densities

Level, by Unit	Strata	Soil Horizon	Depth (m)	Sample Volume (m^3)	Lithic Artifacts		Vertebrate Fauna		Invertebrate Fauna	
					Count	Density ($/m^3$)	Weight (g)	Density (g/m^3)	Weight (g)	Density (g/m^3)
Unit 1 SE										
1	1a–e, 2a	colluvium or fill	0–0.3	0.10	2	20.00	0.10	1.00	—	—
2	1b, 2a, 3a	colluvium or fill, A1b, A2b	0.3–0.5	0.12	3	25.00	12.0	102.92	—	—
3	3a, 4a	A2b, C1b	0.5–0.7	0.20	1	5.00	11.10	54.57	—	—
4	3a, 4a, 4b	A2b, C1b, C2b	0.7–0.9	0.20	1	5.00	5.50	27.50	—	—
Unit 2 SE										
1	1f, 1g, 3b	C1, C2, 2Ab	0–0.4	0.21	—	—	—	—	—	—
2	1g, 3b	C2, 2Ab	0.4–0.6	0.20	—	—	—	—	1.00	5.00
3	3b	2Ab	0.6–0.8	0.20	2	10.00	—	—	—	—
4	3b	2Ab	0.8–0.9	0.10	1	10.00	—	—	—	—
5	3b	2Ab	0.9–1.0	0.10	1	10.00	—	—	—	—
6	3b	2Ab	1.0–1.1	0.10	—	—	—	—	—	—
7	3b	2Ab	1.1–1.2	0.10	—	—	2.0	20.00	—	—
Unit 3										
1	3b	2Ab	1.2–1.3	0.10	2	20.00	—	—	—	—
2	3b	2Ab	1.3–1.4	0.10	—	—	—	—	—	—
3	3b, 4c	2Ab, 2ACb	1.4–1.5	0.10	3	30.00	—	—	—	—
4	4c	2ACb	1.5–1.6	0.10	2	20.00	—	—	—	—
5	4c	2ACb	1.6–1.7	0.10	3	30.00	0.3	3.00	2.59	25.90
6	4c	2ACb	1.7–1.8	0.10	5	50.00	2.0	20.00	—	—
7	4c	2ACb	1.8–1.9	0.10	6	60.00	—	—	—	0.00

Note: All units are 1 by 1 m.

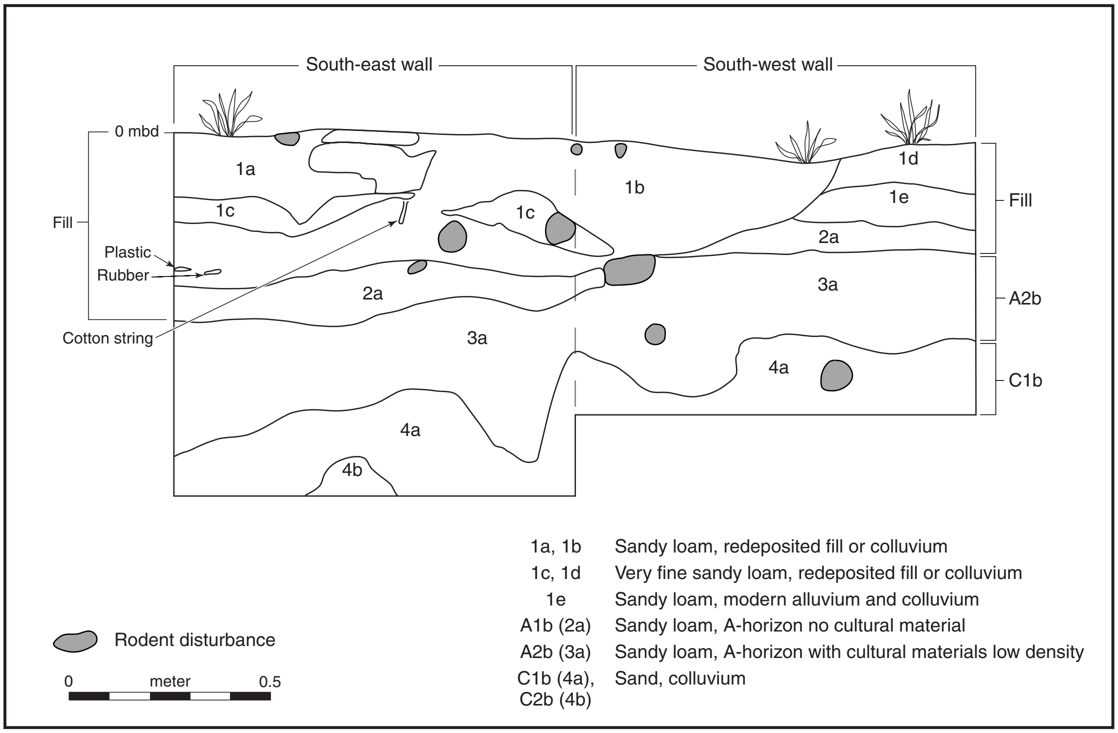


Figure 65. Stratigraphic soil profile of Unit 1, LAN-2769.

bearing soils had been brought down by erosion, the result would likely look very similar stratigraphically to that outlined above and is probably the case for at least the upper portion of the potentially intact Stratum 4 deposit.

Lastly, Stratum 4 of Unit 1 may represent an intact, very sparse, in situ deposit. The lower contacts between the A horizon Strata 2a and 3a are gradual and appear natural, as does the contact between Stratum 3a and the underlying Stratum 4a. However, both the soil profile and the excavation notes describe a large amount of natural disturbance in these strata. Any analysis of prehistoric cultural materials found at Playa Vista must factor in a high degree of disturbance from bioturbation. Numerous recent rodent holes were visible in the soil profile, and we assume that there were many more which are no longer visible. The sparse prehistoric deposit found in this location may have been diffused throughout the strata by the many agents of bioturbation.

A number of factors complicate the analysis of the integrity of the Unit 1 cultural deposit, but it is clearly highly disturbed. We conclude that Unit 1 is a secondary deposit.

Units 2 and 3

Units 2 and 3 were excavated farther up the slope and south of Unit 1. Unit 2 was a 2-by-2-m block, which terminated at a depth of 1.2 m below ground surface. We placed Unit 3, a 1-by-1-m unit, into the center of the floor of Unit 2, and continued excavating another 70 cm to a depth of 1.9 m below the highest corner of Unit 2. Unit 2, like Unit 1, was excavated on a significant slope; the sloping portion of the unit was taken down in three partial 10-cm levels. At the end of level 3, excavation proceeded in arbitrary 10-cm levels.

The first two levels of Unit 2, excavated almost entirely through modern trash-filled alluvium and olluvium, yielded almost no prehistoric cultural material (Figure 66). Stratum 1g soils, which dominated

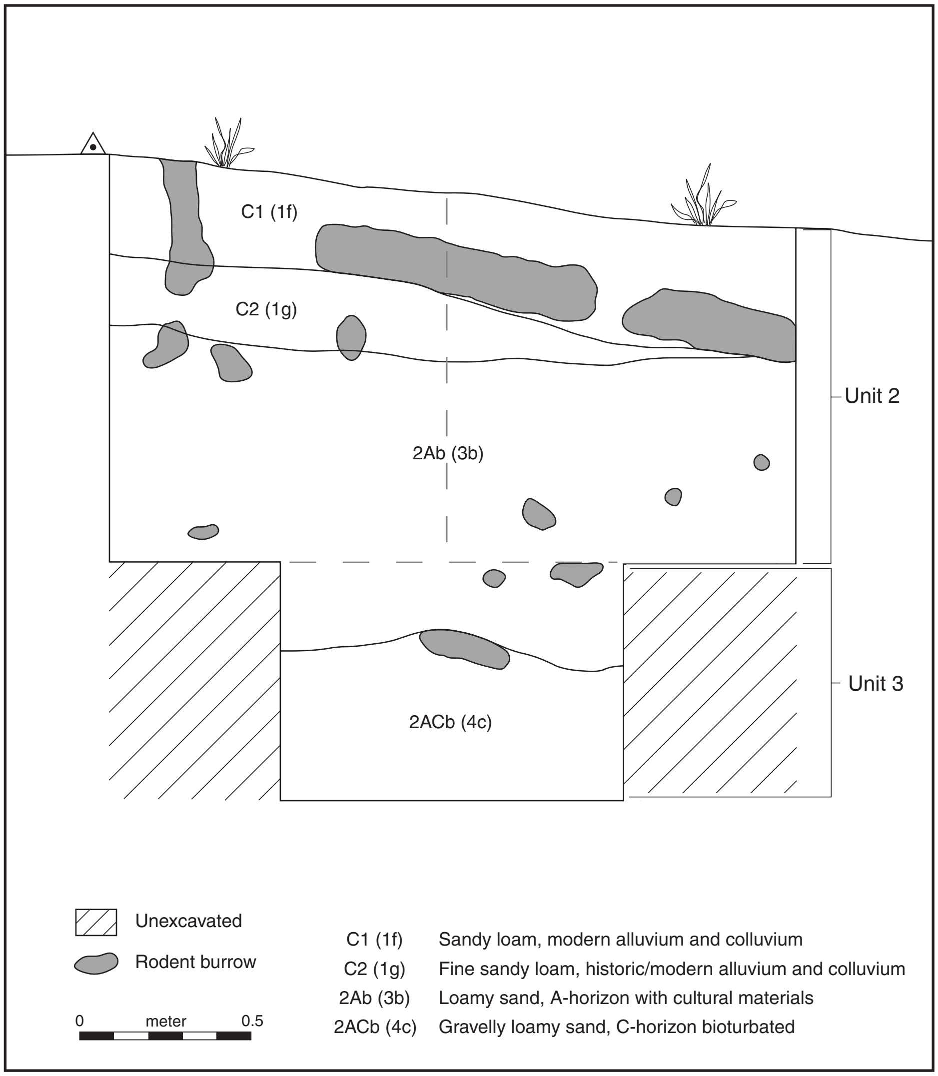


Figure 66. Stratigraphic soil profile of Units 2 and 3, LAN-2769.

Level 2, included sandstone chunks representing the bedrock underlying the bluff that was likely cut into when the trench for the sewer line was excavated and transported downslope. A small portion of the bottom of Level 2 reached Stratum 3b, a heavily bioturbated A horizon that contained lithics, marine shell, and a small amount of vertebrate faunal material. Stratum 3b was approximately 80–90 cm thick, and the contact between it and Stratum 1g was abrupt, whereas the contact with the underlying Stratum 4c was gradual, suggesting that at least a portion of this stratum was intact. Stratum 3b graded into Stratum 4c within Level 3 of Unit 3.

Curiously, Stratum 4c, a bioturbated C horizon, contained higher densities of shell, vertebrate fauna, and lithics than Stratum 3, and the amounts increased with depth. One possible explanation for the increase may be that artifacts were transported down into this stratigraphic layer by bioturbation. The actual numbers of artifacts recovered are quite low and reflect the small sample size; nevertheless, it appears that a sparse, intact prehistoric cultural deposit was found in Units 2 and 3 at LAN-2769.

Summary and Conclusions

A three-phase strategy was employed to locate and evaluate known and previously unknown cultural resources within Area D. The three phases were (1) bucket augering to find sites, (2) trenching to define site boundaries, and (3) manual excavation to assess site integrity and obtain controlled samples. This strategy resulted in redefining the boundaries of three sites. The boundary of LAN-62 was substantially expanded; the site now covers the area previously recorded as LAN-211 (Thiel 1953). The designation of LAN-211/H was moved east to encompass a cultural deposit identified in 1990 as SR-13. The trinomial was also changed from LAN-211 to LAN-211/H, to reflect the fact that it is a multicomponent site covering a total of 23,270 m^2 (5.75 acres).

LAN-2769 is the trinomial given to the cultural deposit previously known as SR-12. LAN-2769 contained a very sparse cultural deposit that may be highly disturbed, if not secondarily placed. At the base of the bluff, intact sediments were identified, although investigations did not find intact cultural materials. We infer from these observations that the slope that currently exists above LAN-2769 is probably a by-product of the construction of sewer line and Cabora Drive along the bluff face. Bucket augers and trenches in the lower parking lot clearly indicate extensive disturbance. Culture-bearing deposits found in that area likely have no stratigraphic integrity. At final mapping, LAN-2769 covered 3,240 m^2 (0.07 acres).

Current conditions at the site present a false impression of its appearance in prehistory. Most likely, the inhabitants of LAN-2769 resided on the toe slope of a gradual alluvial fan that extended out into the wetlands. Much of the site has been truncated, and the remaining sparse deposit—probably peripheral to the original site core—has been covered by a significant amount of recent and historical-period alluvial and colluvial materials and possibly imported fill.

By contrast, intact cultural deposits were located in several areas at LAN-211/H. Excavations on the large bench at the base of the bluff revealed a thick, intact deposit covering a relatively large area. Surprisingly, a very dense, intact deposit was found buried below the paved parking area. Numerous artifacts and high densities of vertebrate and invertebrate fauna were collected from a unit placed into this deposit. Differences in relative densities of various artifact classes between units may be an indication of internal site structure.

Radiocarbon dates were derived from four samples of marine shell collected from two unit blocks at LAN-211/H. The results indicate that at least two components are represented, one dated to the Late period and the other to the protohistoric period. The date range may reflect temporally distinct loci at the site or it may be a function of sample size. The stratigraphic context for dates collected from Units 6 and 10 was questionable, whereas that for Unit 9 appeared intact.

Bucket augering throughout Area D revealed cultural remains scattered throughout the project area. Many of the cultural materials recovered were found in highly disturbed contexts used as fill for Hughes Aircraft Company–era activities. As with most areas at Playa Vista, the nature of historical-period disturbance is highly variable. Through the various testing phases, we have learned that the placement of individual bucket auger units, trenches, or excavation units of even moderate size can provide information only on a specific unit of space. A "swiss cheese" effect has been noted, meaning that, because of significant landscape modifications, the archaeological signature can change abruptly, both horizontally and vertically, across the project area. Small trenches placed only 20 m away from each other may reveal very different subsurface stratigraphic profiles. Experience in data recovery at LAN-2768 and LAN-193/H has shown us that locating intact cultural deposits requires extensive subsurface exposures. The three-phased strategy of bucket augering, trenching, and manual excavation achieved this exposure and was successful in accomplishing the goals of identifying and evaluating buried cultural deposits at the base of the bluff.

CHAPTER 7

Vertebrate Faunal Remains

David Maxwell

This chapter is organized in two parts: the first part consists of the analyses of the vertebrate faunal remains from LAN-211/H and LAN-2769; the second part compares the results from those sites to other sites in the Ballona. I begin with a discussion of the descriptive and analytical methods employed to study the vertebrate remains. The remains from each site are then described, with most of the attention being focused on those from LAN-211/H, by far the larger collection.

The second part of the chapter presents a series of synopses to highlight the patterning noted at other sites in the area. With this baseline established, LAN-211/H is discussed in the context of the Ballona in general and in relation to nearby LAN-1932/H in particular. The chapter concludes with a brief discussion of the evidence for both continuity and change during the protohistoric period.

Methods

All faunal materials recovered from the $^1/_4$-inch mesh screen and larger were analyzed. From the $^1/_8$-inch mesh screen, a nonrandom sample of faunal remains, excepting the fish bones, was selected as described in Chapter 4. This strategy produced faunal material for analysis from four units at LAN-211/H (Units 4, 6/10, 9, and 11). Additional faunal remains from Units 1, 2, 3, 5, 7, 8 and 10 were also submitted for analysis. The relatively small faunal collection from LAN-2769 was analyzed in its entirety. Staff analyst Robert Mariani examined and identified all fish remains recovered larger than $^1/_8$ inch. Results from all analyses are combined here.

As part of the ongoing PVAHP in the Ballona, faunal analysis has been previously conducted for several sites (Maxwell 1998a, 1999a, 1999b, 1999c, 2000). To maintain comparability and consistency, all have used the same methods of identification, description, and analysis. These are discussed in detail below.

Identification

Each recovered specimen was identified to as specific a taxonomic level as possible, beginning with class and skeletal element. Highly fragmentary specimens, lacking recognizable features such as muscle attachments or articular surfaces, were described simply as "unidentifiable." When possible, specimens were identified to the family, and frequently the generic, level. Identifications were made using the Zooarchaeology Comparative Collection, housed in Simon Fraser University (SFU) in Burnaby, British Columbia; fish were identified by Robert Mariani using his personal comparative collection, augmented with materials from the Natural History Museum of Los Angeles County. Additional osteology references included Yee Cannon (1987) for fish, Castro (1983) for shark teeth, Gilbert et al. (1996) for birds, Gilbert (1990) for mammals, Olsen (1968) for reptiles, and Hillson (1986) for teeth.

The majority of the genera and species reported are very common in the Los Angeles Basin, and their identification needs no discussion. However, several exceptions should be mentioned. A single shark tooth fragment was identified as great white (cf. *Carcarodon carcharias*) on the basis of morphology, using Castro (1983) as a guide. Several large bird bones were identified as swan (cf. *Cygnus* sp.) based on morphological similarities to specimens in the SFU faunal collection. Ten specimens of domestic cow *(Bos taurus)* were recovered from LAN-211/H; all were compared with other large ungulates (deer, moose, horse, caribou, and elk) to ensure a correct identification, and all matched positively with domestic cow. Also present were two fragments of pronghorn *(Antilocapra americana).* One of these was a fragmentary specimen of frontal (skull) bone, including the horn core, which allowed for positive identification following lengthy comparison with other horned and antlered species.

Size Classes

Each bone or fragment was attributed to one of four body-size classes. Sizes employed in this study are (1) large, indicating body size similar to a deer or larger; (2) medium, ranging from jackrabbit to coyote; (3) small, encompassing larger rodents through cottontails and skunks; and (4) very small, including most microfauna. Body-size classification of unidentifiable materials are gross estimates based entirely on "eyeballing" the specimen, rather than on metric criteria. Unidentifiable materials allow for overlap, and thus specimens are described as "medium to large" and so forth.

Taphonomy and Formation Processes

Because the study of taphonomy and other formation processes can potentially illuminate the factors leading to assemblage formation and deformation, it is important to record as many types of taphonomic data as possible for each bone. These are discussed below.

Weathering

Bone weathering has been of great interest for the past 20 years (see Behrensmeyer 1978; Lyman 1994; Lyman and Fox 1989) and is frequently used to infer differences and similarities in the depositional histories of different specimens and assemblages, particularly with regard to periods of surface exposure prior to burial. For the LAN-211/H and LAN-2769 collections, analysis of weathering follow the stages outlined by Behrensmeyer (1978), as these are well known and provide a comparative standard. It is, however, acknowledged that those stages were developed to describe patterns of diagenesis noted for large-bodied African animals, rather than the patterns of weathering present on small animals from coastal southern California. Therefore, these stages are employed on a descriptive basis only, and we do not assume they can be used to estimate the duration of exposure prior to burial (see especially Lyman and Fox 1989; Potts 1988). Further, there are no published descriptions of weathering stages for any non-mammalian species; thus, whereas obvious weathering is frequently noted on the bones of birds, reptiles, and fish, there are no criteria for describing these patterns. In this study, birds and reptiles are classified in the same descriptive stages as mammals; fish are classified simply as weathered or unweathered, rather than in stages. This allows for assessment of weathering damage to the entire collection, rather than just the mammalian portion.

Burning

Like weathering, the burning of bone has received considerable attention (Lyman 1994; McCutcheon 1992; Nicholson 1993; Stiner et al. 1995). Burning, however, is perhaps less understood than bone weathering, and its interpretation is problematic. Szuter (1991) argued that patterns of burned bone at Hohokam sites are a reflection of the roasting of whole rodents, and burning results from deliberate human behavior. Bone burning also can occur incidentally to human behaviors, such as during wildfires or when refuse-bearing deposits burn (Maxwell 2003a).

For the present study, bone is classified as either unburned or burned; the latter state is further classified into the following categories:

Blackened: The entire specimen has been exposed to heat sufficient to turn it black, similar to charcoal. This is suggestive of exposure to low heat (240–440°C).

Calcined: The specimen has been exposed to heat sufficient to turn at least part of it white or gray, and the bone frequently takes on a chalky consistency. Calcination is suggestive of exposure to high heat (> 440°C).

Partial: Part of the bone is blackened, whereas other parts remain unburned. Partial blackening may be suggestive of exposure of only part of the specimen, possibly during roasting or similar activities.

Bone Completeness and the Fragmentation Index

In mainland southern California, rodent burrowing and historical-period agricultural practices frequently disturb the upper levels of archaeological sites, and bone collections are typically highly fragmentary. The fragmentation index (FI) has been developed as a means of assessing the degree of bone breakage present in a collection (Maxwell 1998b, 1999c). Fragmentary bone is described as a simple percentage of the original whole specimen; a complete specimen is given the value of 1.0, whereas a minute fragment is classified as 0.1; all other specimens fall within this continuum. FI is calculated as follows:

$$FI = \left(\frac{\Sigma c}{f}\right)100$$

where *c* is the numeric degree of completeness (e.g., 0.3, or 30 percent) and varies between 0.1 and 1.0, and *f* is the number of fragments.

The degree of completeness *(c)* of each specimen is estimated during initial examination, the *c* values are totaled, and the sum is divided by the number of specimens. For example, hypothetical Unit A contained eight bone fragments whose *c* values are 0.2 (n = 1), 0.3 (n = 3), 0.4 (n = 2), and 0.5 (n = 2). The sum of these *c* values is 2.9. This sum is then divided by 8 and multiplied by 100, producing an FI of 36. The higher the FI value, the lower the degree of fragmentation in the assemblage. A value of 100 indicates that none of the bone is broken, whereas a value of 10 demonstrates that the entire assemblage is highly fragmentary. Hypothetical Unit A has a low FI value, indicating that most of the bones have been broken and are relatively fragmented.

Low FI values are useful as indicators of postdepositional disturbance, such as plowing, at a site. Beyond this simple use, the FI is more valuable as a tool for recognizing intrusive specimens. Recently intruded bones should be less fragmentary than bones of long-buried specimens. Food bones are likely to show a high degree of fragmentation as a result of common food preparation practices; for example, the Gabrielino reportedly crushed small animals, bones and all, before adding them to soup or mush

(McCawley 1996:117). Rodent activity can also be responsible for fragmentation of bones buried in archaeological deposits, through scavenging, tunneling, and nest-building. Thus, taxa with a high FI value (meaning the bones are relatively whole) are more likely to be intrusive than taxa with a low FI value. This assumption has been supported in several previous studies (Maxwell 1998b, 1998c, 1999c).

Data from ORA-116, Newport Bay, demonstrated the utility of the FI (Grenda et al. 1998). At ORA-116, rodent disturbance was widespread, and faunal remains were abundant; further, the presence of house pits indicated considerable reworking of the deposits by the prehistoric inhabitants of the site. Thus, I hypothesized that bone completeness could be used as a proxy measure of which bones had been present at the time of house-pit construction, and which had entered the archaeological context later. When degree of completeness was calculated by taxon, it became apparent that only two taxa tended to be complete: rodents (particularly gophers) and reptiles (specifically, snakes). As noted, rodent burrows were found throughout the site, strongly suggesting that the bones of these animals were intrusive. The generally complete nature of the rodent bones further intimated that these remains had not undergone the same types of formation processes as the other bones at the site. Snake remains were more concentrated, but were found in an area with particularly large and notable rodent burrows. Snakes are known rodent hunters, and at this site, their bones were generally complete as well. Thus, the evidence from spatial analysis, combined with the FI values, strongly suggested that the snake and rodent component of the ORA-116 faunal collection was intrusive.

Being able to separate intrusive faunal elements from those reflecting cultural behavior represents an important increase in the accuracy and usefulness of faunal data. The “noise” level in the data is decreased, and we can be more confident that the bones we examine represent prehistoric food and resource residue, rather than postdepositional, intrusive species.

Mineral Staining

Bones stained by minerals in groundwater are commonly found in both archaeological and paleontological assemblages. Examination of the formation process involved has received very little attention, however (see Shahack-Gross et al. 1997), and its interpretation is unclear. In this study, mineral staining was recorded as a simple presence or absence variable; staining is distinguished from burning on the basis of color, with stained specimens appearing dark brown and burned specimens being blackened or calcined. The goal of recording such data was to recognize the presence of very recent intrusive specimens, based on the assumption that recent bone would be less likely to be stained than bone that has been in the assemblage for a longer period of time.

Other Formation Processes

A number of other taphonomic indicators have been recorded for this collection; most of these tend to be rare finds. *Cut marks* have only been identified macroscopically, and are very rare. They are seen as sharp, usually short, straight incisions into the bone, frequently running perpendicular to the long axis of the bone. *Gnawing* on bones by both rodents and carnivores is widely reported; however, evidence of this type of damage is extremely rare in the LAN-211/H collection and, thus, offers little insight into bone-scavenging activities. The scarcity of gnawing is a surprising observation, given the high frequencies of rodent bones within the collection. *Root etching* is recognized as a series of very small indentations into a bone. These are jagged and angular, rather than straight like a cut mark, and typically mineral stained, whereas the surrounding matrix is not. Root etching should occur primarily within the root zone; high frequencies of root-etched bone in deeper subsurface contexts may show areas of heavy rodent disturbance or a prolonged buildup of soil deposits. *Caliche* (calcium carbonate) coating on bone is assumed to indicate the presence of groundwater with a high degree of calcium in it, quite likely due to dissolved shell. *Water rolling* of specimens is recognized by the presence of gently rounded and lightly polished edges on bone, where edges might be expected to be sharp. This type of damage suggests that parts of the collection were transported by water action, even if only over a very short distance. Water-rolled bone is distinguished from worked bone by the lack of an obvious form, and by the presence of rounding and polishing over the entire specimen, rather than only in certain places.

Vertebrate Faunal Remains from LAN-211/H

Of the nearly 3,800 bones analyzed and described from LAN-211/H, roughly 80 percent were identifiable to at least the class level (Table 12). Bony fish, reptiles, and birds were found in unusually high frequencies in comparison with other lowland Ballona sites; mammal bones were much less common than in other sites. Taphonomic damage, including burning and weathering, were surprisingly uncommon in this collection. Bone fragmentation patterns strongly suggest the presence of a large number of intrusive reptiles (especially snakes) and rodents. Also present were several specimens of domestic cow, including three exhibiting cut marks. LAN-211/H yielded several exotic faunas, including great white shark, pronghorn, and swan. Whereas these species suggest long-distance interaction, a local origin cannot be ruled out. Finally, the LAN-211/H vertebrate data helped determine that the site was occupied at or near the historical period. Ten specimens of domestic cow *(Bos taurus)* are present in the collection, clearly indicating that at least some portions of the site were occupied after contact.

Several research questions were posed during the study of these remains:

Spatial comparison. How similar is the vertebrate collection from LAN-211/H to that of other sites from the Ballona? In particular, is this "lowland" collection (Maxwell 1999a) similar to other "lowland" collections? Is it more similar to collections from bluff-top sites? Is it unique?

Chronological comparison. How similar is the LAN-211/H collection to other protohistoric-period collections in the Ballona? How similar is it to collections from Late period sites? Intermediate period sites?

Wetlands adaptations. Can we learn anything from this collection about patterns of human adaptation to the wetlands through time?

As will be discussed later in this chapter, the comparison of the LAN-211/H vertebrate collection with those from other sites in the Ballona raised a fourth set of questions:

Taphonomic processes. Is weathering always more severe in older sites than younger sites? Did sites along upper Centinela Creek undergo different formation processes than other sites in the Ballona wetlands?

Table 12. Vertebrate Faunal Remains from LAN-211/H

Order, by Class	Family	Genus and Species	Common Name	Count
Chondrichthyes				
Carcharhiniformes	unidentifiable	unidentifiable	shark	6
	Lamnidae	*Carcharodon carcharias*	great white shark	1
	Triakidae	*Triakis semifasciata*	leopard shark	11
	Carcharhinidae	unidentifiable	requiem sharks	20
	Squatinidae	*Squatina californica*	Pacific angel shark	2
Rhinobatiformes	Rhinobatidae	*Rhinobatos productus*	shovelnose guitarfish	70
Myliobatidiformes	Myliobatidae	*Myliobatis californica*	bat ray	4
Unidentifiable			cartilaginous fish	4
Osteichthyes				
Clupeiformes	Clupeidae	*Sardinops sagax*	Pacific sardine	5
Batrachoidiformes	Batrachoididae	*Porichthys myriaster*	speckled midshipman	1
Atheriniformes	Atherinidae	*Atherinopsis californiensis*	jacksmelt	2
		Leurestes tenuis	grunion	4
Scorpaeniformes	Scorpaenidae	Sebastes sp.	rockfish	2
Perciformes	Cottidae	*Scorpaenichthys marmoratus*	cabezon	1
	Carangidae	*Seriola lalandi*	yellowtail	1
	Sciaenidae	*Genyonemus lineatus*	white croaker	2
		Menticirrhus undulatus	California corbina	13
		Roncador stearnsii	spotfin croaker	5
		Seriphus politus	queenfish	1
		Umbrina roncador	yellowfin croaker	1
		unidentifiable	unidentified croaker/drum	24
	Embiotocidae	*Amphistichus argenteus*	barred surfperch	352
		Damalichthyes vacca	pile surfperch	8
		Embiotoca jacksoni	black perch	1
		Hyperprosopon argenteum	walleye surfperch	93
		Rhacochilus toxotes	rubberlip surfperch	5
		unidentifiable	unidentified surfperch	53
	Labridae	*Oxyjulis californica*	senorita	2
		Semicossyphus pulcher	California sheephead	1
	Sphyraenidae	*Sphyraena argentea*	Pacific barracuda	1
	Scombridae	*Scomber japonicus*	Pacific mackerel	8
Unidentifiable			unidentifiable bony fish	356
Reptilia				
Squamata	unidentifiable		reptile	30
Squamata (Sauria)	Iguanidae	*Phrynosoma* cf. *coronatum*	coast horned lizard	1
Squamata (Serpentes)	Colubridae	unidentifiable	nonpoisonous snake	270
	Crotalidae	unidentifiable	poisonous snake	60
	unidentifiable		snake	38

Order, by Class	Family	Genus and Species	Common Name	Count
Chelonia	Testudinae	unidentifiable	tortoise/turtle	5
Unidentifiable			reptile	3
Aves				
Anseriformes	Anatidae	cf. *Cygnus* sp.	swan	7
		cf. *Anser* sp.	goose	1
		Anas sp.	duck	47
		unidentifiable	swan/goose/duck	5
	unidentifiable		swan/goose/duck	1
Falconiformes	Accipitrdiae	cf. *Aquila chrysaetos*	golden eagle	1
Charadriiformes	Laridae	*Larus californicus*	California gull	1
		Larus sp.	gull	1
cf. Passeriformes			passerines	2
Unidentifiable			bird	198
Mammalia				
Lagomorpha	Leporidae	*Lepus californicus*	black-tailed jackrabbit	2
		Sylvilagus sp.	cottontail	10
		unidentifiable	hares/rabbits	7
Rodentia	Sciuridae	*Sciuris* sp.	gray squirrel	18
	Cricetidae	*Peromyscus* sp.	mouse	1
		Neotoma sp.	wood rat	1
		Microtus sp.	vole	50
		unidentifiable	native mice/rats	1
	Geomyidae	*Thomomys* sp.	pocket gopher	70
	unidentifiable		rodent	277
Carnivora	Procyonidae	*Procyon lotor*	raccoon	4
	Mustelidae	*Martes pennanti*	fisher	1
		Lutra canadensis	river otter	1
		cf. *Mephitis mephistis*	skunk	2
		Taxidea taxus	badger	1
	Canidae	*Canis* sp.	coyote/dog	15
		unidentifiable	canid	6
	Felidae		cats	3
	unidentifiable		carnivore	15
Pinnepedia	Otariidae	*Zalophus californicus*	California sea lion	1
Artiodactyla	Bovidae	*Bos taurus*	domestic cow	10
		Antilocapra americana	pronghorn	2
	Cervidae	*Odocoileus* sp.	deer	74
	unidentifiable		hooved mammal	5
Unidentifiable			mammal	750
Unidentifiable				734
Total				3,792

Taxonomic Analysis

Cartilaginous Fish

Cartilaginous fish constitute only 4 percent of the vertebrate collection, consistent with other lowland Ballona sites (Maxwell 2000). These remains consist primarily of shovelnose guitarfish *(Rhinobatos productus),* bat ray *(Myliobatis californica),* and several species of shark. The majority of shark remains are lagoon species, such as Pacific angel shark *(Squatina californica)* and leopard shark *(Triakis semifasciata).* One specimen is worthy of note: a single tooth fragment, likely from a great white shark *(Carcharodon carcharias),* was recovered. Great whites are present in the area (Love 1996); whether this specimen was obtained through local fishing or by trade is unknown.

Bony Fish

Bony fish are a major component of the identifiable bone from LAN-211/H, making up nearly one-third of the vertebrate fauna. Identifiable specimens are predominantly barred surfperch *(Amphistichus argenteus),* accounting for more than one-third of the fish collection. Surfperch in general (family Embiotocidae) make up more than half of all bony fish remains recovered from LAN-211/H; slightly more than one-third of the material could not be identified to order, meaning that surfperch constitutes 86 percent of the identified bony fish. This extremely limited distribution of resources indicates that the inhabitants of LAN-211/H concentrated their fishing primarily on the nearshore coastal environment. This represents a switch towards open, coastal, fish resources and away from lagoon resources and probably results from increasing sedimentation of the lagoon itself, a change that will be discussed in more detail towards the end of the chapter.

Reptile Remains

Reptiles were found in surprising abundance among the LAN-211/H material (13 percent of identifiable bone); this represents nearly twice the frequency of any other site studied in the Ballona region. Most of the reptile remains were from snakes, and the vast majority (88 percent) of the snake remains come from the southwestern quadrant of Unit 9. This is highly suggestive of a nesting area or place of high food availability, such as a pit feature or other area used for refuse disposal.

Four varieties of reptilian remains are present: nonpoisonous snakes (family Colubridae) are the most common, and probably consist of king snake and gopher snake. Rattlesnake (family Crotalidae) is a distant second, including several burned specimens. Also present are a handful of turtle or tortoise (family Testudinae) carapace fragments, and a single specimen of coastal horned lizard *(Platyrhinos californicus).*

Bird Remains

Bird bone makes up 9 percent of the materials identified from LAN-211/H. Although three-quarters of the bird remains could not be identified beyond class, those that were show a remarkable consistency. Ninety-five percent of the identifiable bird remains are ducks, geese, and swans (family Anatidae). The most common form was identifiable only as duck (*Anas* sp.). Also present were several very large specimens tentatively identified as swan (cf. *Cygnus* sp.), with trumpeter swan the most likely variety. This is a surprising find, as trumpeter swan is considered a rare bird in this area today. Also present were specimens of gull, goose, and a single eagle talon.

Mammal Remains

The LAN-211/H material contains a wide variety of mammalian remains. Ten specimens of domestic cow *(Bos taurus)* demonstrate that some components of LAN-211/H date to the historical period. The cow remains consist of three vertebral fragments, small portions of a distal humerus and proximal metapodial, two complete phalanges, and three complete sesamoids. None shows any signs of mechanical butchery, despite half of the bones being potential meat cuts. The lack of mechanical butchery suggests that these bones are probably not intrusive modern refuse. They were concentrated in the upper levels of Unit 9; seven specimens were discovered in Level 1 of Unit 9, and a single specimen was found in Level 2. Of the two remaining fragments of cow bone, one was recovered from Trench 11, adjacent to Unit 9, and the second was located during nonintrusive monitoring prior to the excavation of Unit 9. With this clustering, we cannot rule out the possibility that these bones are the remains of an isolated bovine individual.

Three of the cow bones exhibit cut marks. Both phalanges have cut marks in a pattern ringing the diaphysis (shaft), whereas one of the vertebral fragments has two roughly parallel marks on the spinous process. According to Binford (1981:110–111), marks on the spinous process of a thoracic vertebra are consistent with removal of the tenderloin. Binford (1981:126) notes that cut marks on phalanges are rare in North America; he suggests that these occur during skinning if "great pains are being taken to skin out the foot in great detail." There are no signs of mechanical butchery, and the types of cut marks present seem consistent with butchery being conducted by someone very familiar with skinning and obtaining choice cuts of meat. Cut marks were also noted on a duck or goose element and a deer antler tine. It seems very likely that these marked bones indicate a protohistoric or historical-period component at LAN-211/H.

Of other large mammals recovered from LAN-211/H, deer (*Odocoileus* sp.) was the most common. Also present was a single specimen each of California sea lion *(Zalophus californicus)* and pronghorn *(Antilocapra americana).* Two pronghorn bones were recovered, a vertebral fragment and a portion of the frontal bone, including the horn core; whether these are part of the same individual cannot be determined, although both come from the same area of the site. Although rare, pronghorn were known in the greater Los Angeles Basin and were present in Antelope Valley, some 70 miles away, until 1933 (Jameson and Peeters 1988:225). In the Ballona, pronghorn remains were reported from two other sites: LAN-60, a tentative identification (Cairns 1994), and LAN-194, a historical-period site (King 1967).

Lubinski (1999) noted that pronghorn meat is musky in flavor, and ethnographically was not a favored food source if other large game (e.g., deer, bighorn sheep) were available. He suggested that pronghorn might have been hunted for its hide, which was used to make clothing. Techniques for hunting pronghorn were discussed by Lubinski (1999) and Arkush (1999); however, given the paucity of materials recovered at LAN-211/H, it is impossible to suggest how the animal(s) was taken, or whether it was hunted for its meat, its hide, or its antlers; the presence of a cranial element may indicate that the antler was used, possibly for tool manufacture. It is also possible that the skull or entire head had some ritual function. Pronghorn is not listed among the known biota of the Ballona (Friesen et al. 1981), either in historical-period times or at present.

A variety of carnivores also form part of the LAN-211/H faunal collection, including dog or coyote (*Canis* sp.), unidentified cat (family Felidae), river otter *(Lutra canadensis),* fisher *(Martes* cf. *pennati),* badger *(Taxidea taxus),* skunk (cf. *Mephitis mephitis*), and racoon *(Procyon lotor).* Carnivores constitute nearly 4 percent of the mammalian collection, and the diversity suggests that a wide range of prey animals was available for these hunters.

Rabbit and hare remains were not plentiful in the LAN-211/H collection, although specimens of both cottontail (*Sylvilagus* sp.) and jackrabbit *(Lepus californicus)* were present. These species do not appear to have been a major dietary component.

Rodent remains are abundant and make up 31 percent of the mammalian fauna at LAN-211/H. As is typical of southern California sites in general, gopher (*Thomomys* sp.) is the dominant form; however, LAN-211/H is unusual among Ballona sites in that vole (*Microtus* sp.) is also very common, and second in frequency only to gopher. Also recovered were several specimens of ground squirrel (*Sciurus* sp.), and single examples of wood rat (*Neotoma* sp.) and meadow mouse (*Peromyscus* sp.).

Formation Processes

LAN-211/H can be distinguished from other sites in the Ballona region by a marked lack of obvious taphonomic formation processes affecting the vertebrate collection. There are few instances of large-scale burning, concentrations of advanced weathering, or clusters of mineral-stained bones.

Weathering

More than three-quarters of the nearly 3,800 bones analyzed from LAN-211/H fall into Behrensmeyer's (1978) Stage 1; these exhibit little damage beyond the basic degreasing expected of bone buried under typical soil conditions. This pattern indicates that most of the materials recovered from LAN-211/H were buried rapidly. Another 10 percent of the bones fall into a range between Stage 1 and Stage 2 (Stage 1.5 in numerical tables), marked by slight defoliation and cracking, and indicating a short period of surface exposure prior to burial. Fewer than 15 percent of all bones fall into more advanced stages of weathering.

The few accumulations of heavily weathered, Stage 2 bone that were discovered were located away from the main bone concentration in Unit 9, suggesting a different depositional history. The bone collections from Units 4 and 6, though small, were found in concentrations which exhibit heavy weathering. The southern portion of Unit 4 at a depth of 170 cm contained a high frequency (60 percent) of bones displaying Stage 2.5 weathering, suggesting noncontinuous deposition, although the sample size—fewer than 50 specimens—is very small. Faunal material recovered from 60 to 70 cm deep in Unit 6 shows a similar pattern (66 percent of bone in weathering Stage 2 or greater), but with a sample of more than 200 pieces. Again, this suggests noncontinuous deposition, with much of the bone exposed on the surface for some time prior to burial.

Such patterning may be the result of refuse-disposal practices. If people occupying the bluffs above LAN-211/H were to dispose of their refuse by tossing it down the hillside (a practice Hayden and Cannon [1983] demonstrated to be quite common in the Maya highlands), then much of this material might be exposed on the surface prior to its eventual burial, and thus would exhibit a greater degree of weathering than would rapidly buried bone. Another possible explanation for the discontinuous areas of weathered bone would be localized erosion, leading to the exposure of buried bone. Future research should concentrate on the comparison of weathering patterns in bluff sites and lowland sites, as this may help to clarify these issues.

Burning

There is surprisingly little burned bone at LAN-211/H, with more than 85 percent of the collection showing no signs of such treatment. Further, what bone was burned was not found in any concentration; such materials were well distributed throughout the analyzed sample. Only a handful of exceptions exist:

the 1-by-1-m unit in the southern part of 2-by-2-m Unit 9 yielded nearly 250 specimens, of which 20 percent are burned; Level 3 and Level 6 of Unit 6 both yielded more than 200 specimens each, and have burn frequencies of 14 percent and 17 percent, respectively. None of these examples contains enough burned bone to suggest an area of repeated refuse burning, such as a hearth used for this purpose over a prolonged period of time; rather, these appear more likely to be isolated burning events. Minimally, these data suggest that refuse was not routinely disposed of by fire, at least in those parts of the site tested to date. Those specimens that were burned are blackened or partially burned, rather than calcined, indicating that very hot fires (greater than 440°C [McCutcheon 1992]) were rarely present.

Other Formation Processes

A variety of other formation-process indicators were recorded for the vertebrate faunal remains from LAN-211/H, including the presence or absence of mineral staining, water rolling, and caliche accumulation; however, analysis was not particularly enlightening. Only a handful of specimens showed signs of either water rolling or caliche; mineral staining divided the collection almost in half, with 47 percent of the specimens stained. There were few areas with high frequencies of mineral staining—which may be indicative of prolonged exposure to groundwater—or of low frequencies of staining, possibly indicative of intrusive specimens. Only one provenience, with a substantial bone collection of more than 800 bones, shows a high frequency of mineral staining (67 percent). This collection was recovered from the second level of the southwest quadrant of Unit 9, an area with a high concentration of bone, that possibly functioned as a catch basin; it is possible that water was retained with the bone in this area, and this resulted in the mineral staining observed.

Fragmentation

An FI value (Maxwell 1998b) was calculated for each order of vertebrate fauna recovered at LAN-211/H (Table 13), using the method described above. This index is designed to create a relative measure of bone fragmentation, leading to insights into likely intrusive specimens and food-processing behaviors. The LAN-211/H data conform to the pattern observed elsewhere in southern California, where those orders most likely to be intrusive (rodents, snakes) also show the least amount of fragmentation. Snakes from LAN-211/H, for example, have an FI of 0.92, indicating a very low incidence of fragmentation, and suggesting many in situ deaths. Rodents have an FI of 0.70, also demonstrating a low incidence of breakage and, therefore, a higher likelihood of burrow death. The high frequency of snake remains in a single locale (the southern quadrants of Unit 9), combined with the high FI argues for a burrow of some sort, with many of the remains probably intrusive. A similar pattern was observed at ORA-116 (Maxwell 1998b), where high frequencies of largely complete rodent and snake bones in the same context were hypothesized to be the result of a predator-prey relationship in a localized environment. Based on the preliminary data from LAN-211/H, a similar situation likely existed in the Ballona.

The other orders of vertebrate fauna from LAN-211/H have much lower FI values, making it unlikely that any are intrusive.

Table 13. LAN-211/H Fragmentation Index (FI) Values

Class	Order	FI
Chondrichthyes	All	0.61
Osteichthyes	All	0.56
Reptilia	Squamata	0.36
	Squamata (Sauria)	0.10
	Squamata (Serpentes)	0.92
	Chelonia	0.10
Aves	Anseriformes	0.52
	Falconiformes	1.00
	Charadriiformes	0.15
	Passeriformes	0.65
Mammalia	Lagomorpha	0.56
	Rodentia	0.71
	Carnivora	0.54
	Pinnipedia	0.90
	Artiodactyla	0.48

Vertebrate Faunal Remains from LAN-2769

A small bone collection (n = 1,235) was recovered from testing at LAN-2769; it consists almost entirely of mammal bones, with rodent remains the most common (Table 14). The analysis of these remains was approached with the three following research questions in mind: does LAN-2769 represent an intact archaeological site? Can we distinguish between site materials and intrusive remains? How does LAN-2769 compare with other sites in the Ballona in terms of faunal class representation and taphonomic processes? Analytical methods employed in this study are identical to those described for LAN-211/H.

Taxonomic Analysis

Fish Remains

LAN-2769 yielded only seven fish bones (four bony fish and three cartilaginous fish); all remains are vertebrae. This distribution suggests minimal use of both lagoon and open coastal resources. Burning is rare in the fish collection, with only a single cartilaginous specimen showing signs of exposure to heat.

Table 14. Vertebrate Remains from LAN-2769

Order, by Class	Family	Genus and Species	Common Name	Count
Chondrichthyes				
Unidentifiable	unidentifiable	unidentifiable	cartilaginous fish	3
Osteichthyes				
Unidentifiable	unidentifiable	unidentifiable	bony fish	4
Reptilia				
Squamata (Serpentes)	Crotalidae	unidentifiable	rattlesnake	5
	Colubridae		nonpoisonous snake	43
Squamata	unidentifiable	unidentifiable	snake or lizard	7
Aves				
unidentifiable	unidentifiable	unidentifiable	bird	15
Mammalia				
Rodentia	Geomyidae	*Thomomys* sp.	pocket gopher	120
	Cricetidae	*Microtus* sp.	meadow vole	8
	Sciuridae	*Sciurus* sp.	squirrel	5
	unidentifiable	unidentifiable	rodent	230
Carnivora	unidentifiable	unidentifiable	carnivore	1
Artiodactyla	unidentifiable	unidentifiable	artiodactyl	1
unidentifiable	unidentifiable	unidentifiable	mammal	631
Unidentifiable			bone	162
Total				1,235

Reptile Remains

Fifty-five reptile bones are present in the LAN-2769 collection; the majority (n = 48) were identifiable as snake remains. Nonpoisonous snakes (family Colubridae) are prevalent, with 43 specimens present. Rattlesnakes (family Crotalidae), recognizable by the presence of a haemal spine on the vertebra, are also present (n = 5), but turtle or tortoise remains are absent. None of the reptile specimens is burned.

Avian Remains

Fifteen bird bones were recovered from LAN-2769; none could be identified beyond the class level. Comparison with other sites in the Ballona suggests that ducks and their allies are the most likely specimens at LAN-2769. None of the bird bones appeared burned in any way.

Mammal Remains

Mammals are by far the predominant taxon at LAN-2769, constituting an astonishing 92.8 percent of all bone identified to the class level. Nearly two-thirds (63.4 percent) of the mammal bone could not be identified beyond class. Rodents are the dominant order (n = 363); no other order is represented by more than a single specimen. Gopher (*Thomomys* sp.), squirrel (*Sciurus* sp.), and meadow vole (*Microtus* sp.) are all present, with gopher by far the most common. Both artiodactyls and carnivores are very rare in the collection: only 18 bones from LAN-2769 come from animals larger than the small to medium (roughly jackrabbit- to coyote-sized) body-size class. This is a very unusual pattern and strongly suggests a high number of intrusive specimens.

Taphonomic Processes

Weathering

Weathering beyond Stage 1 is common in the LAN-2769 material, with 35.2 percent of the bones showing some signs of this type of damage. Most of the weathering is minimal (Stage 1.5), however, suggesting that surface exposure was not prolonged in most areas of the site. Bone from Provenience 1 is especially heavily weathered, with 29 of 30 bones recovered falling into weathering Stage 2.5 or higher. Heavy weathering may indicate that surface materials were collected or that this area was damaged prior to excavation. Other heavily weathered specimens tend to be widely dispersed throughout the site.

Burning

LAN-2769 has the lowest frequency of burned bone of any site this author has studied, with only 1.5 percent showing signs of exposure to heat. Typically, any archaeological site has about 10–15 percent burned bone, and all other sites in the Ballona analyzed by SRI have burn frequencies of at least 25 percent. The very low frequency seen at LAN-2769 is probably indicative of a very high number of intrusive specimens.

Other Formation Processes

A variety of other types of taphonomic data were recorded for the LAN-2769 collection; examples are exceedingly rare (cut marks, water rolling, root etching) and affect no more than five bones each, or are absent entirely (gnawing, caliche). The one common type of damage is mineral staining, which affects nearly three-quarters of the bone present.

Fragmentation Index

An FI value was calculated for each identifiable taxon from LAN-2769 (Table 15), and these calculations demonstrate that, in general, the bone recovered is not highly fragmentary. This finding is particularly notable in the case of rodents and snakes—taxonomic groups likely to be intrusive—which are very complete. All specimens identifiable to the family level tend to have high FI values, indicating a low degree of fragmentation; further, all taxa identifiable to the ordinal level have relatively high FI values also. The pattern of largely complete rodents and reptiles is typical of the Ballona sites studied to date and very suggestive of an intrusive origin.

Table 15. LAN-2769 Fragmentation Index (FI) Values

Class	Order	Family	FI Value
Chondrichthyes	unidentifiable	unidentifiable	1.00
Osteichthyes	unidentifiable	unidentifiable	0.38
Reptilia	Squamata (Serpentes)	Colubridae	0.96
		Crotalidae	1.00
		unidentifiable	0.43
Aves	unidentifiable	unidentifiable	0.20
Mammalia	Rodentia	Geomyidae	0.71
		Cricetidae	0.94
		Sciuridae	0.86
		unidentifiable	0.41
	Carnivora	unidentifiable	1.00
	Artiodactyla	unidentifiable	0.30

Regional Comparison

Sufficient faunal analysis has been conducted on sites in the Ballona for distinctive local patterns to emerge. Previous studies demonstrate that significant variation exists between sites located along the bluff tops and those located in the lowland areas along the creeks and around the lagoon edge. Such differences are generally unsurprising, given the microenvironments of these regions; what is surprising is that the patterns found are in almost direct opposition to what was expected, with lagoon fish dominant in the bluff-top sites and terrestrial mammals most common in lowland sites. This section provides a summary of the vertebrate fauna recovered from different sites in the Ballona and serves as a background for the comparative studies that follow. Figure 67 provides proportional representation by faunal class for each site. Sites are classified by topographic setting and the dominant temporal component. The discussion begins with the bluff-top sites and continues with those in the lowlands.

Bluff-Top Sites

The faunal material from the bluff-top sites shows a high degree of consistency (see Figure 67). The collections from most sites are dominated by lagoon fish species, particularly bat rays, guitarfish, and other cartilaginous fish. Bony fish and terrestrial fauna were also found, although generally in very small numbers, suggesting that the acquisition of both of these types of resources was secondary to catching rays. Physical proximity of these sites to the local lagoon makes the high frequency of lagoon fish species unsurprising. It is intriguing that these animals were transported so far from their place of capture prior to their entering the archaeological record. Transport of fauna indicates the bluff-top sites were probably used for fish-processing activities such as drying or smoking. To date, none of the bluff-top sites has been studied with respect to taphonomic processes, making comparison with the lowland sites impossible.

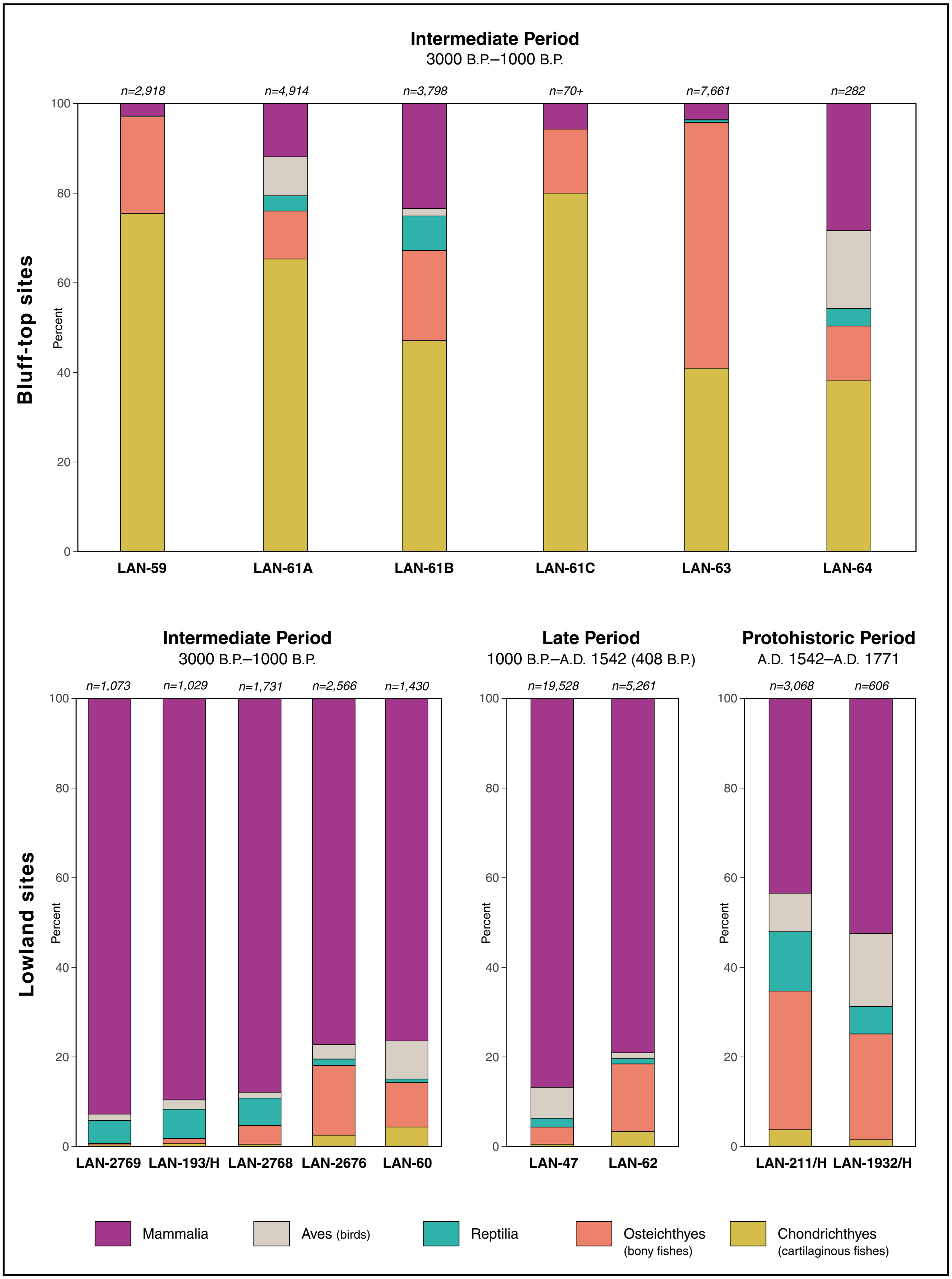


Figure 67. Faunal classes from bluff-top and lowland sites by temporal period.

The Hughes Site (LAN-59)

From the Hughes site, a terminal Intermediate period bluff-top site, Colby (1984) reported nearly 1,000 specimens of nonfish bone, although fewer than 100 of these bones were identifiable. The materials were dominated by pocket gopher, which accounted for nearly half of the identifiable remains. Unusual animals were rare, with only bobcat, weasel, grasshopper mouse, and horse (all tentative identifications) being out of the ordinary. The faunal report for this site was brief and preliminary, and birds were mentioned only in passing, with several specimens attributed to ducks. Taphonomic processes were not mentioned.

The Hughes site was dominated by fish remains (Salls 1988), particularly cartilaginous specimens; thus, LAN-59 is an archetype of the bluff-top pattern in the Ballona: high frequencies of cartilaginous lagoon species and low frequencies of terrestrial fauna. More than three-quarters of the 2,830 fish bones identified were cartilaginous, indicating an intense utilization of the bay estuary habitat. Guitarfish (23 percent) and angel shark (21 percent) dominated the Chondrichthyes collection, followed by thornbacks and bat rays (11 percent each), and smoothhound sharks (10 percent). Surfperch (22 percent), croakers and drums (13 percent), and flatfishes (11 percent) were the dominant forms among the 627 bony fish recovered. This distribution suggested that open coastal habitats were fished but were secondary to the local lagoon. Bony fish indicated seasonal use of the area, with the surfperch captured locally during winter and spring, the croakers and drums nearshore during the summer, and the mackerels offshore during the summer. The other common taxa were probably taken locally throughout the year.

The pattern at LAN-59 is one of heavy predation on cartilaginous fish, suggesting an economic emphasis on the lagoon itself. All other types of fauna were secondary and probably of little specific importance. It is also apparent that the site has undergone some degree of rodent disturbance, as is typical for mainland southern California.

The Marymount Site (LAN-61A)

LAN-61A, on the east side of the Lincoln Gap, dates primarily to the Intermediate period; nearly 1,100 nonfish specimens were collected at the site (Colby 1985), which showed a rather different pattern than other sites in the area. A high proportion of rabbit remains (19 percent) and a relatively low number of rodents (17 percent) suggested that although intrusive specimens were present, they were not the dominant fauna. Pinnipeds (seals and sea lions) were also important, accounting for almost 7 percent of the collection and indicating that marine hunting was practiced in the area (Brown and Smith 1985a). Reptile remains were common (14 percent), and, surprisingly, were dominated by turtle or tortoise fragments (75 percent) rather than the typical situation of intrusive snake vertebrae. Bird remains (Brown and Smith 1985b) were also found with surprising frequency (36 percent of all nonfish remains); however, the method of data presentation made it very difficult to determine which species were present. Minimally, it appeared that ducks and geese dominate the collection—a situation typical for the area.

Fish remains were primarily cartilaginous, with bat rays the most common (nearly one-quarter of the fish collection). Also found in high frequencies were guitarfish (13 percent), thornback (6 percent), and leopard sharks (5 percent). These species indicated fishing within the local lagoon environment, with a concentration on bottom-dwelling species. Rays account for more than 85 percent of the identifiable cartilaginous collection. Although uncommon, large oceanic sharks (makos, great whites) were also present, pointing to open-ocean fishing.

Bony fish accounted for only slightly more than 10 percent of the bone at the Marymount site; surfperch was the most common (16 percent), followed by croakers and drums (11 percent); other species were found only in low numbers. These species suggested that the site was used during more than one season, with surfperch probably taken during the winter and spring, and the croakers and drums during the summer. These species indicated that not all fishing was done in the lagoon environment. LAN-61A was also unusual in the high number of unidentifiable fish specimens (46 percent), suggesting a high degree of fragmentation-causing processes.

The pattern at the Marymount site is one of heavy predation on cartilaginous fish, suggesting an economic emphasis on the lagoon. All other types of fauna were secondary and probably of little economic importance. It was also apparent that the site has undergone some degree of rodent disturbance.

The Loyola Site (LAN-61B)

Nearly 3,800 bones were analyzed from the Loyola site (Brown and Smith 1985a, 1985b; Colby 1985), another mostly Intermediate period site on the east side of the Lincoln Gap. Nonfish remains accounted for almost one-third of the material. Gophers were the most plentiful taxon (33 percent), and rodents in general accounted for 35 percent of the collection. The high numbers of rodent remains suggested that postdepositional disturbance processes were important at this site, and the high frequency of snake remains (18 percent) was also indicative of the same type of disturbance. Thus, the probably intrusive fauna accounted for more than half of the terrestrial bones.

Two mammalian species are of interest in this collection: rabbits were plentiful at LAN-61B, representing one-quarter of all mammals. Rabbits were probably taken when available as a dietary supplement. Pinnipeds were also found in some quantity (6 percent), suggesting maritime hunting.

Cartilaginous fish were the dominant fauna at LAN-61B, constituting nearly half of the collection. Bat rays were the most common (30 percent), followed by guitarfish (19 percent), thornbacks (6 percent) and leopard sharks (10 percent). These species indicated fishing within the local lagoon environment, with a concentration on bottom-dwelling species. Rays made up over 80 percent of the identifiable cartilaginous collection. Bony fish accounted for 20 percent of the collection, and surfperch was the most common bony fish at LAN-61B (23 percent), followed by mackerels and tunas (15 percent); other species were found in low numbers only. The presence of these fish demonstrated that this area was used during multiple seasons: the surfperch suggest a winter-spring occupation, whereas the mackerels are a warm-water taxon and were probably caught during the summer. Fragmentation also appears to be high at this site, with 40 percent of the fish remains unidentifiable beyond class.

The pattern observed at LAN-61B is consistent with a generalized resource-gathering strategy. The adaptation concentrated on the collection of cartilaginous fish in the lagoon and was supplemented with bony fish and terrestrial resources.

LAN-61C

LAN-61C, the third of the Loyola-Marymount site loci, had a sparse terrestrial fauna collection. Only four specimens were reported (Colby 1985), although, interestingly, three of these were pinnipeds. The cartilaginous fish collection from LAN-61C was also very small, with only 56 specimens present. Bat ray was most common (36 percent), followed by guitarfish (23 percent); rays made up over 80 percent of the identifiable cartilaginous fish, suggesting an emphasis on fishing within the local lagoon environment, with a concentration on bottom-dwelling species.

The Del Rey Site (LAN-63)

The Del Rey site is an Intermediate period occupation on the bluffs; faunal remains recovered from the site are difficult to interpret due to contrasting analytical styles (Colby 1987a; Salls 1988). Colby displayed nonfish data by weights and minimum number of individuals (MNI) values, whereas Salls presented fish remains by count. Based on these data, nonfish remains account for slightly more than 4 percent of the bone recovered. Of the minimum of 315 terrestrial animals present at this site, more than 80 percent of the collection was mammalian. Forty-eight taxa were reported, although only gopher (*Thomomys* sp.), cottontail (*Sylvilagus* sp.), and deer (*Odocoileus* sp.) were represented by more than 10 individuals; this undoubtedly reflected the method of quantification (MNI) more than any other factor. Several unusual species were present in the Del Rey materials, including bobcat *(Lynx rufus),* opossum *(Didelphis marsupialis),* killer whale *(Orcinus orca),* two species of dolphin, Pacific loon *(Gavia pacifica),* albatross (*Diomedea albatrus*), great blue heron (*Ardea herodias*), and three species of snake. Most of the mammal specimens are common and likely intrusive, however; nearly 60 percent of the mammalian collection were rodents of some sort, and more than 40 percent of those fully identified were gophers. Rabbits were roughly 17 percent of the small terrestrial collection, suggesting that they functioned as a dietary supplement. Also present were carnivores (canids, eared seals) in small numbers (11 percent combined); these might have been hunted by humans, or might have been a natural component of the site. Colby noted a very high degree of fragmentation in most faunal remains and commented that medium to large mammalian bones were frequently burned (25–75 percent, depending on location). She argued that burning was indicative of food preparation and suggested that dogs were consumed on site. Other taphonomic factors were not described.

Salls (1988) reported on more than 7,300 fish remains; bony fish were the dominant form, an unusual circumstance for a bluff-top site in the Ballona, where cartilaginous fish are usually more numerous. The dominant taxa at LAN-63 were sardine (14 percent), guitarfish (13 percent), bat ray (11 percent), and surfperch (10 percent), indicating a strong mixture of bay estuary and open-water fishing. The presence of sardines and surfperch, two common families, suggested that the site was used throughout much of the year (though not necessarily continuously), as sardines are a warm-water species, implying summer capture, whereas surfperch are a cold-water species, and their presence indicated winter-spring fishing.

Unlike many sites in the Ballona area, the inhabitants of LAN-63 did not concentrate solely on local resources. The variety within the large collection of fish bone at this site demonstrated the habitual exploitation of various environments. Croakers, drums, and flatfish, for example, indicated the routine procurement of bottom dwellers, whereas sardines, tunas, and mackerels were taken in the open ocean. Nearshore species were also very common. Thus, a generalized fishing strategy can be posited for LAN-63. It is worth mentioning that LAN-63 has 11 specimens of freshwater sucker and is one of two sites in this area where freshwater fish remains were present.

The overall pattern at LAN-63 is indicative of its repeated use as a short-term fishing camp, probably recurring throughout much of the year. Burning was the only formation process recorded at this site, and evidence of it was not found in a high frequency. Just under 20 percent of the fragments from this site were burned, falling within the common background frequency of 15–20 percent.

The Bluff Site (LAN-64)

The Bluff site is an Intermediate period deposit located on the west side of the Lincoln Gap. Faunal remains suffered from the same problems as those reported from the nearby Del Rey site, in that two analysts took very different analytical approaches to the nonfish (Colby 1987b) and fish (Salls 1988) remains; the disparities make comparisons with each other and with other sites problematic. The nonfish collection was very small (140 specimens) with only 16 taxa reported; only eared seal, dolphin, and badger were at all unusual. Gopher and cottontail were the dominant fauna. At LAN-64, burning appeared to have particularly affected cottontail and bird remains (41 and 53 percent burned, respectively). Other taphonomic factors were not reported, although the collection was described as fragmentary. The low numbers suggest that terrestrial fauna contributed little to the total economy.

Fish remains from the Bluff site were scanty, with fewer than 150 reported. These were dominated by cartilaginous fish (76 percent), with bat ray the most common (33 percent), and only stingray, angel shark, and guitarfish found in frequencies greater than 10 percent. This distribution is consistent with estuary fishing. Bony fish were very rare at LAN-64, with only 34 specimens present. Sheephead and flounder were the most common (18 percent), suggesting that some bottom and kelp-bed fishing occurred in this area, although plainly lagoon fishing was more important.

LAN-64 seems to have been used only rarely for human habitation. The fauna collected from this site were probably captured locally. Burning was surprisingly common among the few terrestrial remains, with more than one-third of the terrestrial specimens affected in this fashion (burning was not recorded for the fish remains). Burning may reflect the disposal of animal remains into fires during the limited periods of site occupation.

The Berger Street Site (LAN-206)

Nonfish remains from the Early or Intermediate period components at LAN-206 (Colby 1997) were described by weight rather than count, making comparison with other sites in the area difficult (hence, LAN-206 is not on Figure 67). MNI values were also calculated, although none of the species identified was represented by more than two individuals. Colby noted that nearly half of the remains were burned, and suggested that this burning was indicative of food preparation. Based on this argument, she reconstructed the prehistoric diet as including raccoon, canid, rabbit, jackrabbit, turtle, bird, snake, squirrel, and possibly badger and sea otter. Colby stated that a high percentage of the large unidentifiable mammal bones were burned, and that these were probably deer. Fish remains consisted of 185 specimens (Salls 1997); two-thirds of these were cartilaginous. Bat ray and guitarfish were the dominant forms, constituting nearly half of the remains. Bony fish were less common, and few were identified in any quantity; croakers/drums and surfperch were the most common.

Lowland Ballona Sites

The lowland sites show a consistent—if perplexing—pattern (see Figure 67). Compared to the bluff-top sites, all contained relatively low frequencies of fish bone and relatively high percentages of terrestrial fauna, particularly mammals (Maxwell 1999a). Logically, one would expect sites near the lagoon or in riparian areas to have fauna indicative of localized fishing and that the faunal collection would be composed primarily of lagoon fish. Those fish that are present typically reflect a wide range of habitats, ranging from lagoon to open ocean. It appears that these sites were used for a variety of hunting and fishing activities but that fish processing was never a dominant practice in the lowland areas. This may indicate that the edge of the lagoon was not favorable for such behavior; if fish were preserved through drying or smoking, the lagoon edge might not have had a climate conducive to such activities—particularly if it was too damp to keep fires going. The trend at all lowland sites is toward short-term occupation at various times throughout the year, similar to the pattern identified by Van Horn (1987) for the bluff-top sites. Intrusion into these sites by burrowing animals, particularly rodents, seems to have resulted in heavy fragmentation of the bone in all the lowland sites.

The Admiralty Site (LAN-47)

LAN-47, a Late period site located on the edge of the historical Ballona Lagoon, yielded a large faunal collection that was overwhelmingly terrestrial, with mammals the dominant form (Sandefur and Colby

1992). LAN-47 was the only site in the area that yielded amphibian bones, although these composed only a small portion of the herpefaunal collection. The vast majority of the reptilian bone was snake, suggesting a high proportion of intrusive materials. The bird collection was indicative of the nearby marsh environment, with a very high proportion of ducks and geese (n = 410, 30.4 percent). Other birds expected for such an environment—rails, loons, grebes—were also present. There were few shorebirds in the collection, which suggests that nearby beaches were not exploited or that birds from this environment were not brought to LAN-47.

Of the nearly 2,300 mammalian bones identifiable to at least the family level, the dominant form was gopher (62 percent), indicating that there was considerable disturbance at LAN-47 and that rodent burrowing was an important site-formation process. Rodents accounted for 85 percent of the fully identifiable mammal bone from this site, and although some of these specimens might have been food remains, it is likely that the majority were intrusive.

Cartilaginous fish were rare at LAN-47: only 102 specimens were present. These were dominated by bat ray and guitarfish; combined, these composed nearly three-quarters of the Chondrichthyes collection, suggesting that sharks were not a targeted species at this site and that fishing was centered on the local environment. Bony fish were slightly more abundant, accounting for nearly 4 percent of the collection. Surfperch was the most common (21.5 percent), followed by silversides (18 percent), and flatfish (11 percent). From this, we conclude that fishing took place during the winter months along the local coast, away from the lagoon. The presence of silversides and the small quantity of sardines also provided evidence for nearshore and even pelagic fishing. LAN-47 is also the only site in the area with sea chubs (family Kyphosidae), probably taken from local kelp beds.

The overall pattern at LAN-47 was unclear, due to the high number of intrusive specimens and the high degree of fragmentation. Fish processing, however, did not appear to have been practiced to any great extent, as fish remains accounted for less than 5 percent of the bone present. Twenty-two percent of the specimens were burned, and, as Sandefur and Colby (1992) pointed out, this was a high percentage given the frequency of intrusive specimens. Although these authors suggested that roasting was a frequent means of food preparation, the burning was more likely the result of fires built in existing midden areas and of bone occasionally disposed into fires.

The Centinela Site (LAN-60)

LAN-60 is an Intermediate period site located on the bank of Centinela Creek (Grenda et al. 1994); vertebrate remains were analyzed by Cairns (1994) and Salls and Cairns (1994). Cairns (1994) studied more than 2,200 nonfish remains, identifying 13 species of mammals, 12 bird species, and 2 varieties of reptiles. Cairns noted that nearly 90 percent of the bones recovered were unidentifiable, indicating considerable breakage; she suggested (following Altschul and Shelley 1987) that at least some of the bone damage related to food-preparation techniques was to access bone marrow and grease. Cairns also reported that 12 percent of the collection exhibited signs of burning, with small rodents being the most frequently burned taxon; unfortunately, weathering and other taphonomic processes were not reported.

The Centinela site yielded cottontail, jackrabbit, tree and ground squirrels, pocket gophers and mice, kangaroo rat, wood rat, canids, racoon, skunk, deer, and pronghorn; avifauna consisted of Canada goose, scrub jay, falcons, northern harrier, and a variety of ducks. Reptile remains were undifferentiated lizards and snakes. Rabbits were also of some importance at LAN-60, constituting roughly 8 percent of all terrestrial fauna; these were probably taken for food, and, given the paucity of fish remains at this site, rabbit hunting might have been a primary focus of activity in this area. Birds were also common in the collection (10 percent of all terrestrial resources), suggesting that these might also have been hunted locally. The majority of the bird remains are unidentifiable, making it difficult to suggest whether they were hunted for food or feathers or were simply intrusive.

Salls and Cairns (1994) analyzed 205 fish bones and identified 27 species. The most common were shovelnose guitarfish, Pacific bonito, Pacific sardine, and shiner surfperch; no species clearly dominated the collection. Bony fish account for almost 70 percent of the recovered remains. Burning was less common in the fish collection (7 percent) than in the nonfish remains. Salls and Cairns suggested that fishing occurred year-round based on the species distribution present at LAN-60. They also posited that a variety of fishing strategies, such as beach seines, dip nets, hooks and lines, and lights, might have been employed to catch bay and estuary fish.

The Chondrichthyes collection at LAN-60 was very small, with only 63 specimens present. The most commonly identified species were guitarfish, thornback, and leopard shark. Rays made up nearly 90 percent of the identifiable cartilaginous collection. The presence of these species indicate that fishing took place within the local lagoon environment, with a concentration on bottom-dwelling species. The bony fish collection at LAN-60 was also very small, with only 142 specimens present. Surfperch was the most common, followed by mackerels and tunas, flatfish, and sardine. Worth noting was the presence of a single specimen of Santa Ana sucker, a freshwater species. The pattern at LAN-60 suggested fishing throughout the year, with surfperch taken during the winter and spring, and mackerels and sardines caught offshore during the summer; flatfish were probably taken throughout the year.

The faunal exploitation pattern at LAN-60 suggested short-term occupations repeated throughout the year for different resource-acquisition activities, including both nearshore and offshore fishing and the hunting of rabbits and probably birds. However, the extremely high frequency of intrusive rodent remains makes any other human-fauna interactions impossible to recognize.

The Peck Site (LAN-62)

Located at the confluence of Centinela Creek and the Ballona Lagoon, LAN-62 is considered crucial for understanding prehistoric cultural evolution in the Ballona. Unfortunately, previous excavations by Peck (1947) and Van Horn (Van Horn et al. 1983) did not systematically collect faunal remains. Thus, only SRI's limited testing program will be discussed here (Maxwell 1998a). Inferences from this analysis are considered tentative.

Testing at LAN-62 yielded a collection dominated by terrestrial mammal remains, with relatively few bony or cartilaginous fish present (despite a sample bias towards these remains). Unusual species were rare, with only intrusive fauna falling outside the standard Ballona range of snakes, ducks, rodents, coyotes, and deer. Fish remains from LAN-62 showed a high frequency of bony fish (15 percent of the site materials); surfperch was the dominant fish (41 percent of all bony fish), indicating that coastal fishing was more common than lagoon fishing and that this probably occurred during the winter-spring seasons. Cartilaginous fish were uncommon (3 percent of collection).

Formation processes indicated that the bone assemblage was transformed considerably after deposition. This was obvious from the high degree of fragmentation, which affected all nonrodent and nonreptile remains. Both burning and weathering also had dramatic effects on the assemblage. A high frequency of burned bone (approximately 30 percent) was noted, possibly due to the repeated use of this site. Repeated hearth construction in existing midden deposits can result in the burning of old bone in addition to anything disposed of into an active fire. Weathering is suggestive of prolonged breaks in the depositional sequence, such as would occur in the repeated cycle of site use and abandonment. If bones were left on the surface of the site and then the site was abandoned for some time, the bones will display a considerable amount of weathering. It appears that this process occurred on several occasions, resulting in concentrations of bones exhibiting heavy weathering.

The Hammack Street Site (LAN-194)

LAN-194, located north and east of the Playa Vista project, was tested by Chester King in 1967 (King 1967). His preliminary report gave only cursory attention to vertebrate fauna but mentioned the presence of three species of domestic animal: cow (*Bos* sp.), horse (*Equus caballus*), and goat (*Capra* sp.); horse was the most common find with six specimens present. None of the domestic fauna are described as butchered or otherwise modified, with the exception of a single horse metatarsal (cannon bone) used as an awl. A variety of other fauna were found, including ground squirrel, gopher, wood rat, kit fox, ring-tailed cat, pronghorn, turtle or tortoise, and unidentified birds and fish.

LAN-1932/H

This site contains a disturbed protohistoric component that was either mechanically mixed in place or redeposited from somewhere in the immediate vicinity. This component contained an unusual distribution of vertebrate remains (see Figure 67). Though superficially similar to the other lowland sites in having a relatively high frequency of mammalian fauna, LAN-1932/H was distinctive in its high proportions of bony fish and bird remains. With the exception of LAN-211/H, all other lowland sites had class distributions in which mammal remains accounted for at least three-quarters of the collection; at LAN-1932/H, mammals made up only slightly more than half. Further, at other lowland sites, the combined bony fish and bird remains yielded just 20 percent of the bones, whereas these accounted for nearly 40 percent at LAN-1932/H. These discrepancies may result from sampling error; to date, our analysis consists of only some 600 bones. However, this pattern is sufficiently distinctive to suggest a different resource exploitation pattern, possibly related to the late date of LAN-1932/H. The similarities of LAN-1932/H and LAN-211/H are discussed later in this chapter.

The unusual frequencies of vertebrate fauna may be attributed to cultural change brought on by European contact. Contact resulted in population movements, decimation by disease, and probably a breakdown in the traditional hunting and gathering lifeway. If the subsistence economy had shifted away from strict hunting and gathering towards the use of domestic crops, and trade for various resources, it may explain why this site looks so different from the others in the area. Of particular interest are the bird remains, as these are dominated by wing and shoulder elements. This may be evidence that aboriginal people were targeting specific species for their feathers, possibly to manufacture items for trade. Further analysis is needed to identify as many of these bird bones as possible, to determine which feathers might have been in demand (see Brown 1989 for discussion).

LAN-2676

LAN-2676 is a difficult site to interpret. Located on the lagoon edge, the site was heavily disturbed and there are no remaining intact deposits. Most evidence suggest the site was “flipped” in place when the runway was expanded by Hughes Aircraft Company in the 1950s. Thus, although internal site structure is gone, the faunal collection does provide information on lagoon edge adaptations through the Intermediate and Late periods and possibly extending into the protohistoric and historical periods.

More than 2,500 bones have been analyzed from LAN-2676 (Maxwell 1998a). These were dominated by mammalian remains, which accounted for three-quarters of the collection. This material was highly fragmentary and much was unidentifiable beyond class. Rabbits were found in some frequency but were not a dietary staple. Rodents were the most numerous identifiable specimens, and most of these might have been intrusive. Much of the reptilian bone was also probably intrusive, although a number of turtle or tortoise remains were present; these are unsurprising in a marsh environment, and might have been exploited as an occasional food source. Bird remains likewise reflected the marsh environment, with ducks and geese the most common forms; gull and kingfisher were also present. All the bird specimens might have been exploited for either food or feathers, although the element distribution did not support the idea of targeting specific birds for their feathers (see Brown 1989 for discussion).

Preservation of cartilaginous fish was poor, and less than 10 percent could be identified beyond the class level. Bony fish were dominated by sardines (40 percent); surfperch was the only other fish found in significant numbers (roughly 11 percent). The high frequency of sardines, an open-ocean species, indicated that considerable attention was focused on offshore fishing, probably during the summer when the water is warmer. Love (1996) noted that sardine populations go through cycles of abundance and scarcity and that these cycles last from 20 to 150 years. Thus, their abundance may be indicative of an El Niño event. Surfperch prefer cold water and were probably caught during the winter or spring. As both species are present, LAN-2676 might have been occupied throughout the year.

Taphonomic damage to the collection was both common and severe. Burning affected one-third of the bone, probably reflecting the practice of using fires for refuse disposal. Weathering affected more than 20 percent of the collection, suggesting that bone was routinely left exposed during periods of temporary site abandonment. This same situation would also occur if older midden materials were reworked by later site activities, including human occupation and rodent burrowing.

LAN-2676 appears to have been used repeatedly at different times of the year for the exploitation of different resources, such as sardines during the summer and surfperch during the winter and spring months. During these occupations, other vertebrate resources were likely exploited when available, and the processing of these materials (particularly mammals) resulted in heavy fragmentation of the bone. Further bone destruction occurred as a result of burrowing activity by rodents and reptiles.

LAN-2768 and LAN-193/H

LAN-2768 and LAN-193/H represent similar occupations of Centinela Creek just upstream from LAN-211/H; both are Intermediate period sites. The faunal collection from these two sites fits well within the pattern established for lowland sites in the Ballona region: they contained a wealth of terrestrial mammal remains and few marine resources, including lagoon species (Maxwell 1999a). The taxa recovered indicated that much of the faunal exploitation was focused on locally available animals. The people using this area were targeting species that either inhabited the narrow riparian zone on a regular basis or were drawn there by the availability of fresh water. The bones of animals such as rabbits, squirrels, turtles, and deer were found in the collection, with few examples of fauna that could be considered exotic. A single tiger-shark tooth is of some interest, as the Los Angeles area is at the northern extreme of their typical habitat; this specimen might have been traded in from the south, where waters are warmer. Also of some interest, although certainly not exotic, is the presence of a single bobcat phalanx. Traditionally, Gabrielino lineages belonged to one of two moieties, either "wildcat" (bobcat) or coyote (McCawley 1996:89). The remains of these common animals might have had some ritual significance.

Most of the bones from these sites were weathered—nearly 55 percent at LAN-2768 and just over half at LAN-193/H. The high percentages suggested that large quantities of bone were exposed on the surface prior to final burial. This exposure might have occurred prior to their initial interment, or these bones might have undergone a cycle of burial, reexposure, and reburial, perhaps as a result of bioturbation, human activity (ancient or modern), geological or fluvial action, or some combination of these processes. The effects of burning were not commonly observed on these remains, affecting less than 20 percent of the collection at either site.

Comparative Taphonomy of Sites in the Ballona Region

Taphonomic processes have played a considerable role in altering the bone collections of all the sites in the Ballona region, and the effects of weathering and burning in particular have been noted by various researchers. Unfortunately, different analysts have been involved in projects in the Ballona, and each has had different methods of recording and reporting taphonomic faunal attributes. Comparisons are therefore difficult. For purposes of this study, we will only examine sites analyzed by SRI.

Weathering

Weathering appears to be the taphonomic indicator with the greatest degree of intersite variation. The seven sites studied to date can be broken into three classes based on the percent of bone exhibiting signs of weathering (Figure 68).

Low

This class includes LAN-2676, LAN-211/H, and LAN-1932/H. Sites in this class are characterized by 75 percent or more of the bone collection being typed as weathering Stage 1, indicating little damage beyond basic degreasing. Little evidence of weathering suggests the bones were not exposed to the elements for long periods of time. For LAN-2676, the faunal collection may have been buried relatively rapidly after disposition given this site's location in the wetlands. For the collections from LAN-211/H and LAN-1932/H, a different postdepositional mechanism may have been responsible for their unweathered condition. These bones may have been deposited during the late eighteenth century and buried by sewer line construction about 150 years later.

Medium

This class, which includes LAN-62 and LAN-2769, is defined by 50–75 percent of the bone collection falling into weathering Stage 1. A greater degree of variation in depositional rates is observed at medium-class sites than in the low-weathering group, and may indicate postdepositional damage leading to bone exposure. LAN-2769 is deleted from further discussion due to its small and problematic sample. LAN-62 lies on saddles above the wetlands. Flooding would reach this site less frequently than LAN-2767, its neighbor immediately north in the wetlands. Faunal remains deposited on an elevated surface might have been exposed to the elements for longer periods of time than at sites located in the wetlands.

High

LAN-193/H and LAN-2768 constitute this class, which is defined as less than 50 percent of the bone falls into weathering Stage 1. Intriguingly, both sites fitting this pattern are from the upper reaches of Centinela Creek. Elsewhere, Maxwell (1999a, 1999b) suggested that these sites might have experienced burial and reexposure as Centinela Creek covered the area with sediments during floods and cut open new exposures during periods of down-cutting.

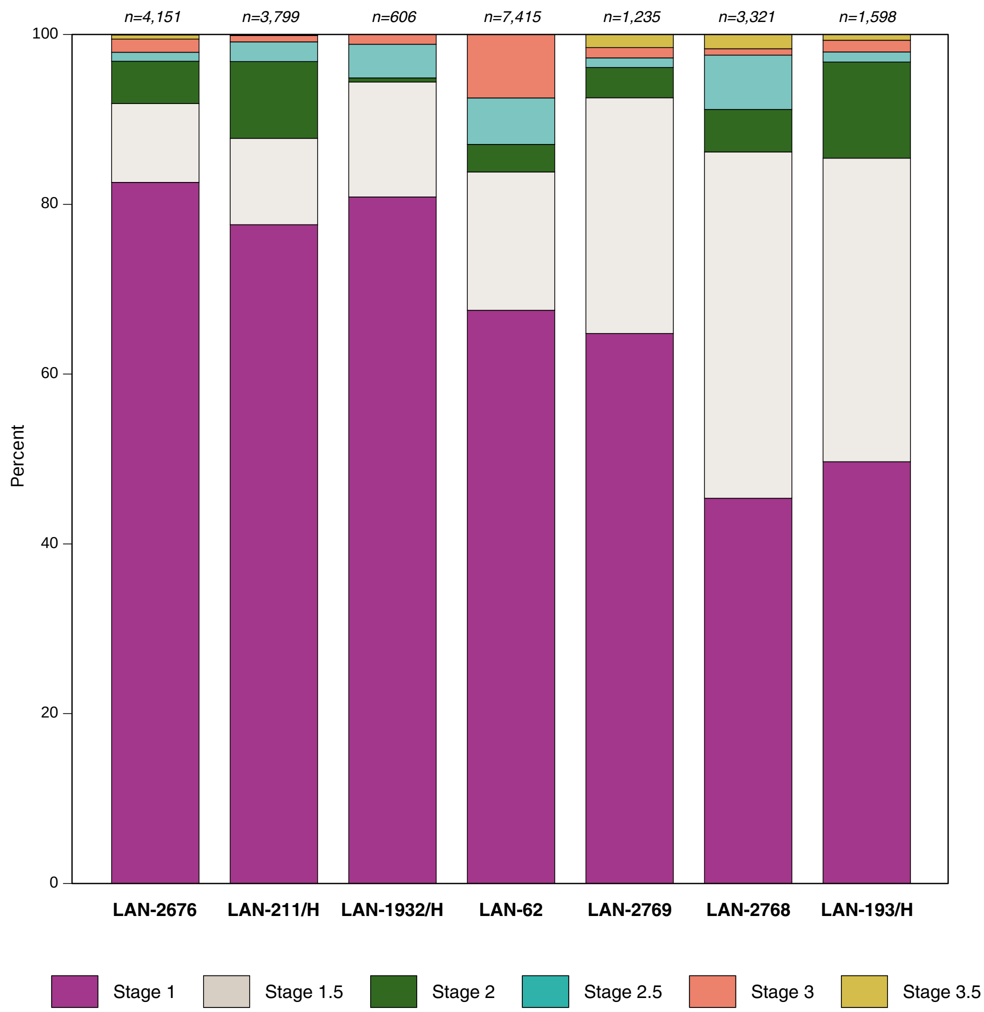


Figure 68. Weathered faunal remains by percentage at selected Ballona sites.

The pattern observed is certainly preliminary, based on only a handful of sites and excluding any from the bluff-top area (where weathering was not described in detail). However, they do show a remarkable pattern, where those sites that are the oldest (LAN-193/H and LAN-2768) have the highest frequency of weathered bone, and those that are the youngest (LAN-211/H and LAN-1932/H) have the lowest frequency of weathered bone. As noted in the methods section, weathering has traditionally been used as a proxy measure for duration of exposure *prior* to burial, with the assumption that bone ceases to weather once it is in the ground. The data at hand, however, may reflect that weathering continues to affect bone after burial. It is certainly possible that the upper Centinela Creek sites underwent very different depositional histories than those in other areas; a larger sample of sites studied with specific attention to taphonomy is needed prior to a judgment being made about the meaning and causality of the pattern observed.

Weathering may be a very telling measure in future studies, suggesting that age is the primary factor being measured by recording weathering patterns, rather than postdepositional actions, whether human or nonhuman. Further studies need to assess whether age is the primary factor being measured by recording weathering patterns, rather than postdepositional actions, whether human or nonhuman. Our work

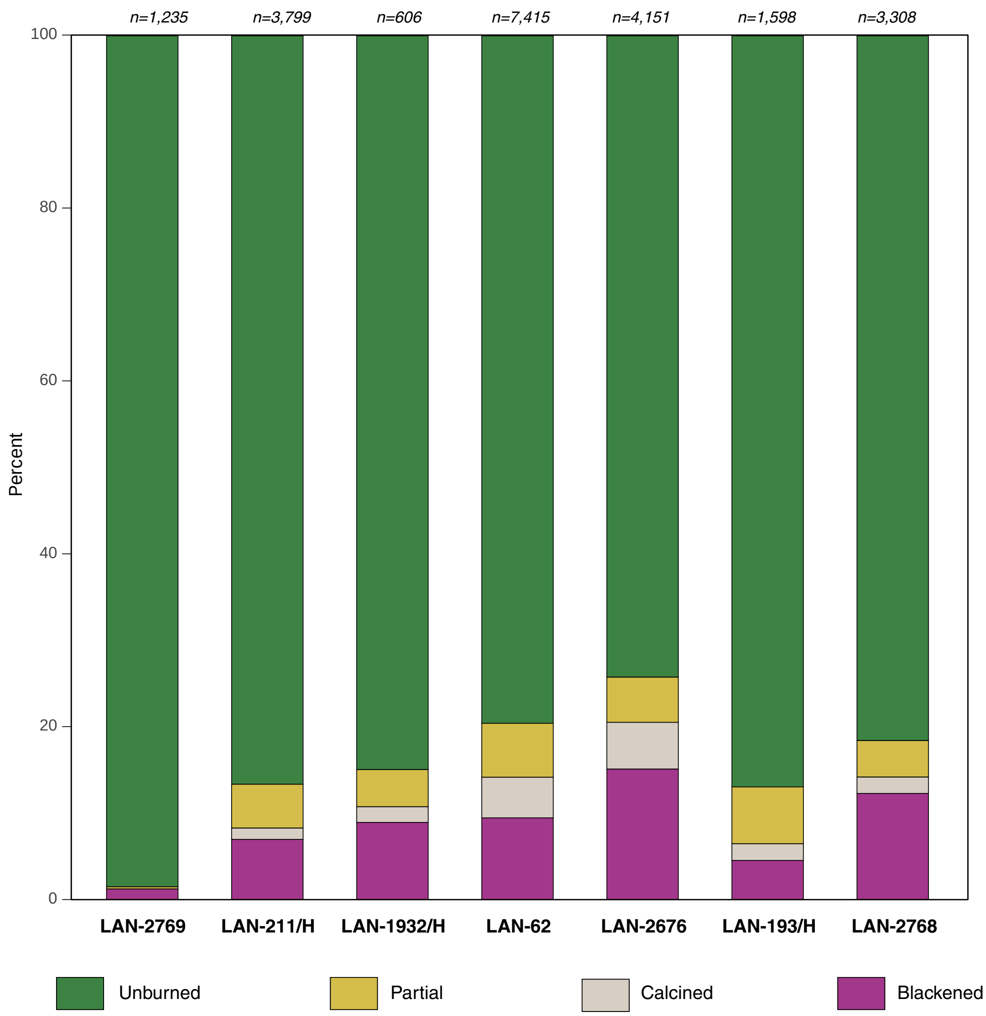


Figure 69. Burned faunal remains by percentage at selected Ballona sites.

emphasizes the tremendous need for a series of well-documented experiments designed to study patterns of weathering for southern California in general, and in particular, on the types of fauna typically encountered in the region, particularly small mammals and nonmammalian fauna.

Burning

In contrast to the patterns observed for weathering data, burn patterns are remarkably consistent for the Ballona region, although, again, only a handful of sites have sufficient data recorded to address this issue. Seven sites are currently available for comparison (Figure 69), and most show remarkably little variation in burn frequencies, with all but one site falling into the range of 75–87 percent unburned. At the one exception, LAN-2769, less than 2 percent of the bone collection showed signs of exposure to heat. Although the sample from this site was relatively small (n = 1,235), it is sufficient to suggest that sampling error alone is not entirely to blame. The low occurrence of burning at this site is probably related to the high frequency of intrusive remains in the collection.

Discussion

In the introduction to the LAN-211/H vertebrate analysis, a series of general research questions was presented; these stressed the importance of determining how LAN-211/H fits into the adaptive system employed in the Ballona by comparing these data with materials from other sites excavated in the area, rather than interpreting the site in isolation. This section begins by reviewing the research questions in turn; following this, I discuss some of the distinctive features of the LAN-211/H collection and offer some directions for future research. The discussion concludes with commentary on the possible relationship between LAN-211/H and nearby LAN-1932/H.

Spatial Comparison

A general system of classifying the Ballona sites based on their vertebrate class distributions has been presented previously (Maxwell 1999a). In short, sites tend to break into the "lowland" pattern, with a high frequency of terrestrial mammals, or a "bluff-top" pattern, with a high frequency of cartilaginous fish.

The LAN-211/H collection is quite distinct from most other sites in the Ballona, having high frequencies of bony fish, reptiles and birds, and a relatively low frequency of mammal remains (see Figure 67). The proportions of bony fish and mammal at LAN-211/H are consistent with nearby LAN-1932/H, but very different from other Ballona sites. Only LAN-63, on the bluff tops, has a higher frequency of bony fish remains (55 percent) than LAN-211/H. Indeed, LAN-59 and LAN-61B—both on the bluffs—are the only other sites where bony fish compose more than 20 percent of the total bone sample.

LAN-211/H also has relatively high frequencies of reptile and bird remains. Reptiles account for 13 percent of all identifiable bone, nearly twice the frequency seen at any other site in the Ballona. The other sites in the region with high frequencies of reptile remains primarily date to the Intermediate period: LAN-193/H (6.5 percent), LAN-2768 (6.1 percent), and LAN-61B (7.7 percent), although a protohistoric-period site, LAN-1932/H (6.1 percent) also fits this pattern. Bird bone makes up 9 percent of the identified collection at LAN-211/H; this is one of the highest frequencies seen in Ballona sites with bone collections larger than 1,000 specimens. Similar frequencies are seen at LAN-60 (8.5 percent) and LAN-61A (8.7 percent), both Intermediate period sites situated on the bluff top. LAN-47, located quite some distance from the bluffs, is the only Late period site where birds account for more than 5 percent of the identified fauna. LAN-1932/H, the other protohistoric site, has an even higher frequency of bird remains (16.3 percent) than LAN-211/H, but a bone collection of only 600 pieces. Perhaps high frequencies of bird bone is a behavioral feature of the protohistoric period.

Mammal remains at LAN-211/H account for only 43 percent of the identifiable collection; the typical lowland frequency is 75–80 percent. The LAN-211/H vertebrate collection most closely resembles materials from nearby LAN-1932/H, where mammalian remains constitute only 53 percent of the collection. LAN-211/H lacks a unique mammalian species, although a handful of those present are known from very few sites in the Ballona. LAN-211/H and LAN-60 are the only sites where pronghorn has been identified; LAN-211/H and LAN-2676 are the only sites with domestic cow remains. Domestic fauna in general are rarely reported in the region (sheep is known from LAN-47; horse is reported from LAN-193/H, LAN-194, and LAN-59). The domestic cow remains from LAN-211/H are significant because of the presence of cut marks; these marks are located on phalanges, an area where they would be unexpected if European butchers were responsible, but indicative of careful removal of the hoof. This behavior is likely indicative of Native American or Mexican butchery of this domestic animal. How the cow was obtained by the Native peoples is unknown.

Chronological Comparison

LAN-211/H bears little resemblance to any of the other sites studied in the Ballona, with the exception of LAN-1932/H, which is of a similar age and located nearby. LAN-211/H shows general similarities with Intermediate and Late period sites from the Ballona, having a similar complement of taxa present, and suggesting a primarily hunter-gatherer lifestyle. Specific similarities are superficial, however, and more in-depth examination suggests that significant change had occurred by the time LAN-211/H was abandoned. Most notable among the changes are the presence of domestic fauna and the apparent reliance upon bony fish as a food resource. Hispanic contact is obviously responsible for the presence of domestic cattle in the faunal collection. The high frequency of bony fish at both LAN-211/H and LAN-1932/H may relate to the late ages of these sites, and suggests that subsistence was shifting to the open coast, probably due to increasing siltation of the lagoon areas. Determining whether LAN-211/H is typical of the early historical period will require testing of other sites of the same age.

Wetlands Adaptations

There is evidence for a pattern of adaptation shifts through time in the Ballona. Earlier occupations, particularly those on the bluffs, seem to have a subsistence economy centered on lagoon fishing; later occupations, all from the lowlands, focus more on open coastal resources, and less on lagoon species. The high frequency of surfperch at LAN-211/H may result from amplified coastal fishing due to increased sedimentation of the lagoon in late prehistory. Surfperch are found nearshore (Salls 1988), and were probably taken either from the shore or from small boats just offshore. Surfperch prefer cooler waters (Love 1996), and their presence may indicate periods of winter fishing. The high frequency of surfperch among the bony fish from LAN-211/H is a relatively common feature in the Ballona, being observed both in the lowlands (LAN-60, LAN-62, and LAN-47) and the bluff tops (LAN-59, LAN-61A, LAN-61B). In most other sites where surfperch dominates the bony fish collection, however, there are relatively few bony fish remains; LAN-47 is the exception to this rule.

LAN-47 predates LAN-211/H by about 500–700 years, but even so, both have piscine assemblages suggesting nearshore fishing during times of cooler water temperatures. This fact may indicate a switch from the lagoonal resources, utilized in earlier occupations on the bluff tops and along the river's edge, toward coastal resources. Our reconstructions of the Ballona suggest that sedimentation increased considerably through time, to the point where there was far more marsh than lagoon by the late 1800s. The shrinking lagoon would result in fewer and fewer local marine resources—such as guitarfish and bat ray—and a need to exploit other environments. If the late prehistoric population was moving away from the lagoon as a result of decreasing productivity, the nearshore environment would be the next closest resource area. Intensifying exploitation in this habitat would result in a marked increase in the numbers of bony fish in general, and during winter months, surfperch in particular.

Taphonomic Processes

Taphonomic and other formation processes can only be compared with other sites studied by SRI; there are currently no data on these types of damage from bluff-top sites. Burning at LAN-211/H appears to be consistent with the distribution seen at most sites in the Ballona, with unburned bone accounting for roughly 85 percent of the collection. Weathering is considerably more common in older sites than in younger ones. LAN-193/H and LAN-2768, Intermediate period sites, have 50 percent or more of their bone collections fall into weathering Stage 1.5 (that is, between Stages 1 and 2) or higher. In contrast, weathering affects less than one-quarter of the collections from primarily younger sites like LAN-211/H, LAN-1932/H, and LAN-2676.

Exotic Faunas

Of considerable interest at LAN-211/H are several exotic faunas, species that are either not normally found in the Ballona region or are unusual as components of archaeological sites. It may also be significant that all exotic elements were recovered from Unit 9. Great white shark is present at LAN-211/H in the form of a single tooth fragment. Although great whites are not uncommon in the waters off southern California (Love 1996), given the size of these animals and the dangers inherent in their capture, their remains qualify as exotic. Great white remains also were reported at the Admiralty site (LAN-47) (Sandefur and Colby 1992), the Marymount site (LAN-61A, three specimens) (Salls 1988), and at the Del Rey site (LAN-63, eight specimens) (Salls 1988). Any of these specimens could have been taken locally; it is unclear whether great whites played any role in the prehistoric economy. It is also possible that a single tooth could have been collected out of context (on the beach, for example) and that it represents a curiosity or ritual item, rather than having economic significance.

Also recovered at LAN-211/H are unusual bird species, including swan (*Cygnus* sp.) and goose (*Anser* sp.). Although both frequent wetlands environments such as the Ballona, neither is common in the area today (Dunn and Dickinson 1999). In a recent survey of Ballona avifauna, Dock and Schreiber (1981) reported only two species of goose (*Branta bernicla,* the brant, and *Anser anser*, the domestic goose) and no examples of swan. Dunn and Dickinson (1999:66) noted that the trumpeter swan *(Cygnus buccinator)* normally ranges south only to the central coast of Oregon, but is considered "rare in winter south to California." Trumpeter swans (or closely related species) could have visited the Ballona. If such a rare bird were present in the area, its feathers might have been quite attractive to humans as status symbols or trade items. The swan remains all come from the same general area, and the nonoverlapping element distribution suggests a single individual. Goose remains are less surprising; several species of geese have winter ranges well into southern California (Dunn and Dickinson 1999). These include: the greater white-fronted goose *(Anser albifrons),* the snow goose *(Chen caerulescens),* and Ross's goose *(C. rossii),* all with a winter range into the San Fernando valley; the Canada goose *(Branta canadensis),* whose winter range encompasses all of southern California and into Baja; and the Brant *(B. bernicla),* mentioned previously. Brown (1989) noted the presence of snow goose, Canada goose, and cackling Canada goose in the faunal collection from LAN-59 on the bluffs. Any of these species could have contributed the goose bones recovered at LAN-211/H; some of the species (white-fronted, snow, and Ross's) might have been brought into the Ballona from the San Fernando Valley, suggesting long-distance movement or trade. However, birds are well known for straying outside their normal ranges and could well have been taken locally.

The presence of at least two bones (horn core and vertebra) of pronghorn *(Antilocapra americana)* is intriguing at LAN-211/H. Pronghorn has been recovered from two other sites in the Ballona (LAN-60 and LAN-194), although the animal is not known today from the area or coastal California in general (Freisen et al. 1981). This species is most common in the Great Basin and eastern Sierra Nevada (Jameson and Peeters 1988; Lubinski 1999), although Jameson and Peeters (1988) stated that pronghorn was known from Antelope Valley until the 1930s, meaning it might have been available in prehistory. Lubinski (1999) noted that pronghorn flesh is musky in flavor, suggesting that these remains may not be related to subsistence. Antler is a common raw material for tool manufacture and for use in soft-hammer percussion; pronghorn hides were also favored materials for the manufacture of clothing in the Great Basin (Lubinski 1999). The remains recovered from LAN-211/H could be consistent with either type of material function.

In comparison with other Ballona sites, LAN-2769 is intriguing for both its similarities and its differences. The contents of the vertebrate collection, dominated by mammal remains, is not very different from other lowland sites in the region; the 92.8 percent mammal distribution is only a few percentage points higher than what is seen at LAN-193/H (mammals = 89.6 percent). LAN-2769 is also very similar to LAN-193/H in its very low frequency of fish remains. From the perspective of weathering, LAN-2769 is also typical; 64.8 percent of the bone from LAN-2769 is in weathering Stage 1 making the site very similar to LAN-62; the high frequency of bone in Stage 1.5 is reminiscent of LAN-193/H and LAN-2768, both Intermediate period sites. Indeed, based on the class distribution and weathering patterns, LAN-2769 appears to be a typical Intermediate to Late period site from the Ballona. The differences lie in the remarkable lack of burning seen at LAN-2769—by far the lowest in the Ballona—and in the very limited range of species present in the material. Only five taxa (rattlesnake, nonpoisonous snake, gopher, squirrel, and meadow vole) were identified (although there were a handful of unidentifiable bird remains), and all of these species—while potential food sources in prehistory—are extremely likely to intrude into archaeological sites.

The vertebrate component of LAN-2769 leads to two possible conclusions: either this is a nonsite, or it is a portion of a site that has been heavily impacted and is full of intrusive specimens. I tend to favor the latter interpretation, given the presence of weathered specimens, and of highly fragmentary remains. LAN-2769 definitely has a very high proportion of intrusive materials, especially rodents and snakes, which constitute the bulk of the identifiable fauna. The general lack of burned bone also supports the idea that very little of this material is of archaeological origin. However, the presence of fish remains (including a burned specimen), and a few cut marked bones indicates human presence. I suspect we are dealing with a site that has been heavily impacted or perhaps largely destroyed, leaving only a handful of highly mixed remains for us to examine. Whether this occurred in prehistory or in the twentieth century is unclear at this time. The limited range of species present, combined with the generally high FI values for identifiable materials suggests a large intrusive component.

LAN-211/H and LAN-1932/H: Evidence for a Connection?

As noted above, the vertebrate collections from LAN-211/H and LAN-1932/H are remarkably similar in class distribution, and in terms of taphonomic factors such as burning, weathering, and bone fragmentation. There are currently two working hypotheses for the origins of the LAN-1932/H material: (1) the site is flipped and the original midden was located near its present location, or (2) the material derives from a site near the base of the bluffs. The remarkable similarities in the vertebrate collections from these two sites suggests the latter, that LAN-211/H is the source of the materials in LAN-1932/H. The class distributions at these sites are very similar to one another and demonstrably different from any other site in the Ballona. These two sites also have very similar patterns of taphonomic damage (burning and weathering), although their distributions conform to general Late period patterns for the Ballona and cannot be distinguished confidently from those at other sites.

Directions for Future Research

The collection from LAN-211/H provides many new insights into protohistoric adaptations to life on the Ballona. But, like any research, it creates many questions as well. Four specific research questions are constructed from this analysis; two relate to taphonomy, one to butchery, and the last focuses on comparative analysis within the Southern California Bight.

Preservation of Bird Bone

LAN-211/H is notable for a relatively high frequency of bird bone in comparison with other sites in the area; this is also noted at LAN-1932/H. The question is whether this pattern is related to human activity, or if there is some sort of taphonomic issue to be considered. Bird bone has a much thinner cortex than mammalian bone, and thus may be more susceptible to weathering and mechanical damage than mammal bone. If this is indeed the case, it may explain why bird bone is found in greater frequencies in more recent sites than in older ones. Experimental work is needed to determine whether, given exposure to the same types of elements, bird bone breaks down more quickly than mammal bone. If there is no appreciable difference, then the pattern seen at LAN-211/H may be attributable to human behavior.

Differences in Weathering Frequencies

This study demonstrates that frequencies of bone weathering in the Ballona seem to correlate with the age of the site in question, with older sites having a much higher frequency of weathered bone than recent sites. As noted above, weathering studies tend to make the implicit assumption that weathering essentially ceases to affect bone following burial. Materials from the Ballona may be demonstrating that this assumption is incorrect. We need to determine whether the differences in weathering frequencies observed reflect differences in site age or differences in formation histories. Future research should emphasize comparison with other studies of sites of different ages in the same location and, ideally, should include replicative experiments.

Native American Butchery Practices

At LAN-211/H, we have examples of domestic cattle bones butchered by Native American peoples. Future research should address whether the cut marks on the cow phalanges reflect a native tradition or if the marks might have been produced by people influenced by Hispanic butchery practice. Conclusive examples of native butchering of large mammals, both wild and domestic, should be compared to the LAN-211/H collection to determine whether the same patterns of cut marks are present.

Protohistoric and Historical-Period Adaptations in the Bight

Research at LAN-211/H has shown a need for comparative analysis of protohistoric and historical-period adaptions within the Southern California Bight. How similar is the LAN-211/H collection to other protohistoric and historical-period collections outside the Ballona? What does faunal variability in the protohistoric period tell us about the nature of diet and adaptation during this period? Results from LAN-211/H need to be compared with a wider range of protohistoric and historical-period sites outside the Ballona to establish trends in subsistence practices during this period of dramatic cultural change in southern California.

Conclusions

LAN-211/H provides a glimpse into the final chapter of a prolonged system of indigenous adaptation employed in the Ballona region. The early occupations in this region show a reliance on extremely localized fishing concentrated on the lagoon. Although this preference did not preclude coastal fishing—

coastal species are recovered from all sites—the lagoon seems to have been the primary focus, and the bluff tops were probably used for processing rays and guitarfish for storage. The increased reliance on surfperch seen at LAN-211/H indicates a shift in resource exploitation, probably as a result of increasing siltation of the lagoon that made it a less productive environment. With local access to large numbers of lagoon species cut off, the focus shifted to the open coast. The shift from the lagoon to coast was probably far less dramatic than it appears archaeologically; it probably occurred gradually over time. Further, surfperch is reported from most sites in the Ballona and is the dominant bony fish at four lowland sites (LAN-47, LAN-60, LAN-62, and LAN-2676) and three bluff-top sites (LAN-59, LAN-61A, LAN-61B), indicating that this was hardly a change to a new and unfamiliar resource. These other sites range from the Intermediate to the Late periods, suggesting that the exploitation of the open coast in general and surfperch in particular was a long-standing adaptation in southern California.

The LAN-211/H vertebrate collection shows an intriguing blend of continuity with and change from earlier occupations of the Ballona. Change is most evident in the presence of domesticated animals, the increased importance of surfperch, and in the distribution of fauna by class, with mammals being much less dominant. One of the most intriguing aspects of the LAN-211/H collection is the presence of domestic cow bones with what appear to be aboriginal butchery marks. Although there are a few cow bones present, and only a few of these are cutmarked, the location of the marks are strongly suggestive of a non-European butchery practice of skinning out the hoof. Thus, we see a demonstrative change from the prehistoric period in terms of food resources, yet strong continuity based on the method of preparation. Continuity stems from the general similarities in common species of mammal and fish, and in the taphonomic similarities with other sites in the region. The weathering pattern at LAN-211/H is very similar to that seen at other late sites, with more than three-quarters of the bone falling into weathering Stage 1.

LAN-211/H has the potential to provide a wealth of faunal information about a poorly known period of late prehistory, one in which profound social changes were occurring. Additional research is needed in order to determine the extent to which social changes influenced diet, patterns of trade and travel, butchery patterns, and methods of refuse disposal.

Invertebrate Faunal Remains

Kenneth M. Becker

Analysis of invertebrate faunal remains recovered during testing at LAN-211/H and LAN-2769 has the potential to increase our understanding of the prehistory of the Ballona region. The shell remains contained in these sites reflect the complex interaction of human behavior, paleoenvironment, and site-formation processes. Potential research domains involving analysis of shell data have been outlined in previous studies (see Altschul and Ciolek-Torrello 1997; Altschul et al. 1991; Altschul, Homburg, and Ciolek-Torrello 1992; Grenda et al. 1994), and include questions of chronology, settlement patterning, subsistence strategies, habitat use, paleoenvironmental reconstruction, social organization, and site-formation processes. The limited amount of shell recovered during test excavation at LAN-211/H and LAN-2769 restricts the issues that can be profitably explored with these data. Consequently, this chapter focuses on habitat use, site structure, and formation processes. Variability in shell abundance among sites in the Ballona area is explored from both a geographical and a temporal perspective, and the site is compared to other protohistoric and historical-period sites outside the Ballona.

Methods

The initial sampling strategies and laboratory procedures used for this analysis were previously described in Chapter 4. All shell pieces larger than 1/8 inch were identified and analyzed completely. Previous work at LAN-62 (Keller and Ford 1998:101) showed virtually no significant difference in taxa representativeness between the 1/8-inch fraction and larger sizes. Given the considerable effort required to analyze 1/8-inch shell and the tendency for the relative number of identifiable specimens to decrease with smaller screen sizes, SRI decided to cull for analysis from the 1/8-inch fraction only those pieces with diagnostic elements that could be used for calculating the number of identified specimens (NISP).

The shell material from each provenience was analyzed separately. Each specimen was identified to the most specific taxonomic level possible with reference to standard identification guides (e.g., Keen and Coan 1974; McLean 1978; Morris et al. 1980; Rehder 1996; Ricketts et al. 1985) and to the SRI shell type collection. Where the guides differ, we rely on Rehder's (1996) more recent classification. Nearly all of the specimens recovered were identifiable to the family level, and the majority were identified to the genus level. In addition to taxonomic identification, all shell pieces were weighed, and their NISP value recorded. Analysts assigned NISP values by counting all pieces containing a nonrepetitive element. For bivalves (class Pelecypoda), NISP reflects the number of whole hinges and hinge fragments that are more than 50 percent complete, whereas for gastropods (class Gastropoda), each whole shell, columella, and apex was counted. The NISP count is useful for comparison of shell density with other sites in the Ballona, which generally have shell amounts expressed in this form. MNI is another useful unit of measure for expressing taxon frequency. For bivalves, MNI was calculated by dividing NISP by 2 because in life, each animal has two valves. The MNI count for gastropods is the same as NISP.

Shell analysts have long debated the merits of quantification by weight versus by count (see Mason et al. 1998). Both methods have their strengths and weaknesses. Using weight will generally overemphasize the relative abundance of more robust species like Venus clam (*Chione* spp.) or Pismo clam (*Tivela stultorum*) and underestimate the occurrence of more fragile species like scallop (*Argopecten* spp.). Weight, however, is useful for developing measures of relative dietary importance of shellfish taxa because it tends to compensate for size variability within species. Conversely, MNI, which more accurately reflects the actual proportions of individual animals represented, is better suited for determining habitat use and paleoenvironmental reconstruction (Claassen 1998:106–107; Glassow 1998:412). The overall low frequency of shell from LAN-2769 and low frequency of shell recovered from several areas within LAN-211/H resulted in extremely low NISP, and correspondingly, even lower MNI values, calling into question the representativeness of these counting measures for characterizing these sites. Consequently, our analysis relies more heavily on shell weight than count, although counts are presented here for comparative purposes.

Results

LAN-211/H

Of the four units from LAN-211/H selected for analysis, all contained invertebrate remains (Units 6 and 10 are considered a single unit, as explained in Chapter 4.) The majority of the shell was recovered from Units 9 and 11, whereas Unit 6/10 contained far fewer shells, and only trace amounts were recovered from Unit 4. Together, these four units produced a total of 437.4 g of shell (Table 16) and 60 identifiable specimens that exhibit distinct invertebrate attributes (Table 17). The invertebrate remains from the three units on the alluvial fan (Units 4, 6/10, and 11) are discussed first, followed by a discussion of the invertebrates from Unit 9, which was on the floodplain.

Unit 4

Unit 4, located in the southwestern portion of the site, contained only trace amounts of shell. Identifiable species noted here are limited to scallop (*Argopecten circularis*) and littleneck clam (*Protothaca staminea*), which were confined to Levels 5 and 6 (Figure 70). All shell from this unit consists of small fragments smaller than ¼ inch (Figure 71). The few species recovered from this unit commonly inhabit the intertidal zone of bays and estuaries.

Unit 6/10

Unit 6/10, placed approximately 15 m east of Unit 4, represents a continuous column of site sediments from this area. Shellfish remains are more abundant here than at Unit 4 and include abalone (*Haliotis* spp.), scallop, and littleneck clam, as well as Venus clam and fragments of unidentifiable shell (Table 18). The frequency distribution of fragment size shows that just over 20 percent of all shell is from the ¼-inch size class, whereas well over half measure 1 inch or larger. The vertical distribution of shell density (standardized as shell weight/m^3 of sediment) shows a trimodal distribution, with obvious peaks at Levels 6, 8, and 16, separated by levels with little or no shell (see Figure 71). Radiocarbon assays from shell recovered from Level 6 of Unit 6 and Level 7 of Unit 10 returned dates of A.D. 610 and 1000,

Table 16. Invertebrates Identified at LAN-211/H

Class and Family	Genus and Species (Common Name)	Habitat	Comments	Weight (g)
Marine invertebrates				
Gastropoda (snails and slugs)				
Unidentified			broken or eroded fragments lacking identifiable features	0.1
Haliotidae	*Haliotis* spp. (abalone)	most live along rocky shores in intertidal or moderately deep water	feeds on algae, especially giant kelp	130.0
Pelecypoda (bivalves)				
Unidentified			broken or degraded fragments lacking identifiable features	8.9
Donacidae	*Donax gouldii* (bean clam)	intertidal, buried in sand on surf-washed beaches	very small clam, unlikely food source	0.6
Mactridae	*Tresus* spp. (horse or gaper clam)	low-tide line to 30 m, buried in sand or sandy mud offshore	locally collected and reportedly delicious	0.7
Mytilidae	*Mytilus* spp. (mussels)	intertidal to 40 m, on rocks, gravel, and wooden structures along the coast and in bays and estuaries		5.8
Ostreidae	*Ostrea lurida* (native Pacific oyster)	intertidal to 35 m, attached to hard substrates and in beds on mud flats and gravel bars, in quiet bays and estuaries	prehistorically a primary food source, today replaced commercially by imported species	0.7
Pectinidae	*Argopecten circularis* (speckled scallop)	intertidal to 50 m, on sand and mud in bays and estuaries, also free-swimming		35.6
Solenidae	*Tagelus* spp. (jackknife clam)	intertidal, in sandy mud flats of bays and estuaries	used as fish bait today	1.3
Veneridae	unidentified (Venus clam family)	most are found intertidally and in moderately deep water buried in sand or mud offshore and in bays		11.6
	Chione spp. (Venus clam)	intertidal to 45 m, in mud or sand flats in bays and estuaries and also offshore	includes *C. californiensis*, *C. undatella*, and *C. fluctafraga*.	119.2
	Protothaca staminea (native littleneck clam)	intertidal, on sandy mud with gravel in protected bays and estuaries, also offshore near rocks and rubble	very popular commercial clam today	78.9
	Saxidomus nuttalli (common Washington clam)	low-tide line to 40 m, deeply buried in sand in bays and estuaries, also in sand near rocks along the open coast	also known as the butter clam, fished commercially along the California coast	15.3

continued on next page

Class and Family	Genus and Species (Common Name)	Habitat	Comments	Weight (g)
Polyplacophora (chitons)				
Unidentified	(chitons)	intertidal, under rocks or in crevices, also under algae		0.9
Unidentified	(marine invertebrates)		broken or degraded fragments lacking identifiable features	16.7
Subtotal				426.3
Freshwater invertebrates				
Pelecypoda				
Margaritiferidae	*Margaritifera falcata*	prefers clear swift streams partly in gravel and sandy substrates	larva transported upstream by attaching themselves to gills of certain fish species; some adult specimens are hermaphroditic, allowing small populations to reproduce	11.1
Total				437.4

Table 17. Invertebrate Taxa from LAN-211/H in Order of Abundance

Taxon	NISP [a]	MNI [b]	Percentage of Total MNI
Veneridae			
Chione spp.	24	12	40.0
Pectinidae			
Argopecten circularis	12	6	20.0
Veneridae			
Unidentified	12	6	20.0
Veneridae			
Protothaca staminea	7	4	13.3
Haliotidae			
Haliotis spp.	1	1	3.3
Unionidae			
Margaritifera falcata	2	1	3.3
Total	58	30	99.9

Note: Only specimens identifiable to family or more specific are included (site total NISP = 60; site total MNI = 32).
[a] NISP = number of identified specimens
[b] MNI = minimum number of individuals

respectively (see Table 11), demonstrating disturbance of the deposit and throwing into question the meaning of this vertical patterning. This reversal of dates coincides with small quantities of modern materials found dispersed throughout the site sediments here. The invertebrate remains from Unit 6/10 are equally split between those species commonly inhabiting the intertidal zone in bays and estuaries (e.g., scallop, Venus clam, littleneck clam) and those typically found living along rocky shores in intertidal or moderately deep water (e.g., abalone).

Unit 11

Unit 11 was located in the eastern portion of the project area on an alluvial fan at the mouth of a small drainage emanating from the bluff top to the south. This unit produced over three times as much shell as was found at Unit 6/10 and accounts for roughly one-third of the shell recovered from the site. The range of taxa recovered is similar to that found at Unit 6/10 but in substantially different amounts. Unlike Unit 6/10, which was dominated by abalone, the most frequently identified taxon at Unit 11 are Venus and littleneck clams, which, occurring in virtually identical amounts, together account for nearly all the shell recovered from this area (see Table 18). The vertical distribution of shell density (see Figure 71) exhibits a unimodal tendency, although small peaks are present in Level 5 and again in Levels 8 and 9. Analysis of the shell collection from Unit 11 shows that the vast majority of shell here measures ½ inch

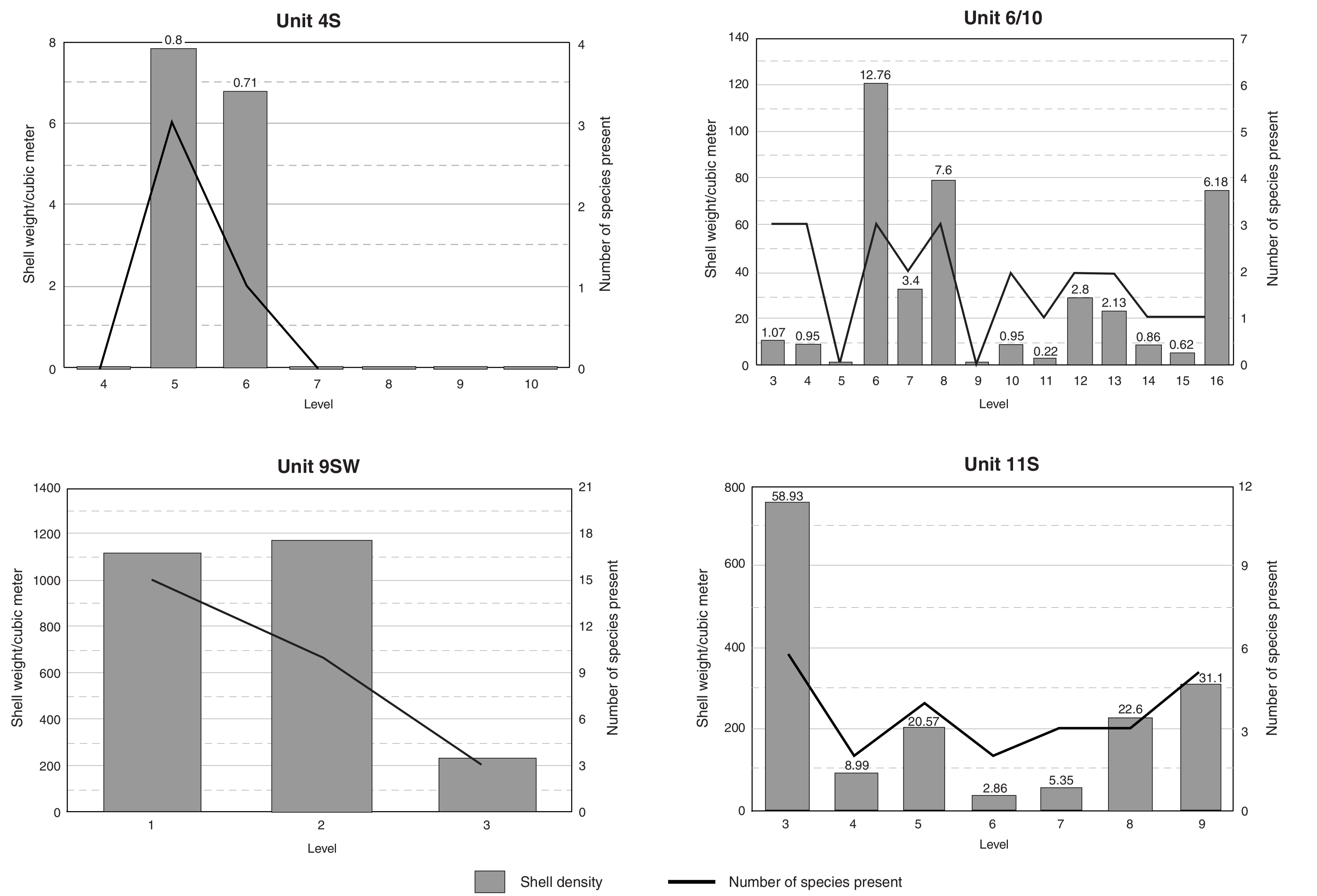
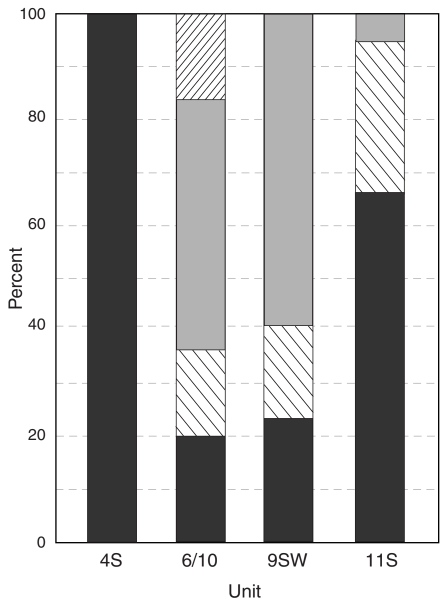


Figure 70. Shell density by unit and level at LAN-211/H.



Size in inches	Unit 4S		Unit 6/10		Unit 9SW		Unit 11S		Site total	
	Weight	Percent	Weight	Percent	Weight	Percent	Weight	Percent	Weight	Percent
0.25	1.5	100.0	8.3	21.0	58.0	23.6	99.6	66.2	167.4	38.3
0.5	0.0	0.0	6.5	16.4	45.7	18.9	43.6	29.0	95.7	21.9
1.0	0.0	0.0	18.6	47.0	142.2	57.8	7.2	4.8	168.0	38.4
2.0	0.0	0.0	6.2	15.6	0.0	0.0	0.0	0.0	6.2	1.4
Total	1.5	100.0	39.5	100.0	245.9	100.0	150.4	100.0	437.3	100.0

Note: Percentage of total weight (g) by size class per unit

Figure 71. Shell fragmentation at LAN-211/H.

or smaller and that roughly two-thirds of the collection is from the 1/4-inch size class (Table 19). The invertebrate remains recovered from this unit are overwhelmingly dominated by bay or estuarine species, with only trace amounts of abalone found.

Unit 9

A markedly diverse collection of invertebrate remains was recovered from Unit 9. Located on the flat floodplain below Units 4, 6/10, and 11, this unit produced more shell by weight than the three other units combined and accounts for over half of taxa documented at the site. The size distribution of shell fragments has a very similar pattern to that observed in Unit 6/10, with just a little less than 25 percent of the shell fragments coming from the 1/4-inch size class and over half the collection larger than 1 inch (see Table 19). The shell collection from this unit contains abundant abalone, which accounts for nearly half of the invertebrates by weight. The remainder of the shell is the typical mix of bay or estuarine species already documented at other areas of the site, as well as small amounts of California mussel *(Mytilus californianus),* and bean clam (*Donax* spp.) (see Table 18). Abalone are typically found attached to rocks along rocky shores from the intertidal zone to moderately deep water. Mussels inhabit the intertidal zone, attached to rocks and gravel along the open coast and in bays and estuaries, whereas bean clams live buried in sand on surf-washed beaches. The vertical distribution of shell density shows a thin cultural deposit mostly confined to the upper two levels (see Figure 71). Two radiocarbon assays from Unit 9, one from Level 1 in the southwest quadrant and one from Level 2 in the southeast quadrant, were run on shell from this unit; they returned dates of A.D. 1640 and 1490, respectively. At one sigma (see Table 11), these dates overlap and statistically are interpreted as the same age.

Table 18. Invertebrate Weight (in Grams) by Unit at LAN-211/H

Class and Family	Genus and Species	Unit				Total	%
		4 S	6/10	9 SW	11 S		
Gastropoda							
Haliotidae	*Haliotis* spp.	0.7	19.4	109.8	0.1	130.0	29.7
Unidentified		—	—	0.1	—	0.1	< 0.1
Pelecypoda							
Donacidae	*Donax* spp.	—	—	0.6	—	0.6	0.1
Mactridae	*Tresus* spp.	—	—	0.7	—	0.7	0.2
Mytilidae	*Mytilus californianus*	—	—	5.8	—	5.8	1.3
Ostreidae	*Ostrea lurida*	—	—	0.7	—	0.7	0.2
Pectinidae	*Argopecten circularis*	0.1	3.3	32.1	0.1	35.6	8.1
Solenidae	*Tagelus* spp.	—	—	0.8	0.5	1.3	0.3
Veneridae							
	unidentified	—	—	9.2	2.4	11.6	2.7
	Chione spp.	—	8.1	38.4	72.7	119.2	27.3
	Protothaca staminea	0.7	0.9	5.3	72.0	78.9	18.0
	Saxidomus nuttalli	—	—	15.3	—	15.3	3.5
Unionidae	*Margaritifera falcata*	—	—	11.1	—	11.1	2.5
Unidentified		—	3.0	4.6	1.3	8.9	2.0
Polyplacophora							
Unidentified		—	—	0.9	—	0.9	0.2
Unidentifiable shell		0.1	4.8	10.5	1.3	16.7	3.8
Total		1.6	39.5	245.9	150.4	437.4	100.0

Table 19. Fragmentation Indexes (FI) at LAN-211/H, LAN-1932H, and LAN-2676

Shell Size	LAN-211/H					LAN-1932/H	LAN-2676
	Unit 4S	Unit 6/10	Unit 9SW	Unit 11S	Site Total	Site Total	Site Total
1/2 inch and larger	—	31.3	187.9	50.8	270.0	2888.0	6334.4
1/4 inch	1.5	8.3	58.0	99.6	167.4	3013.4	6937.6
Fragmentation Index	0.0	3.8	3.2	0.5	1.6	1.0	0.9

Perhaps the most interesting invertebrate recovery from Unit 9 is two specimens of freshwater mussel, *Margaritifera falcata* (western pearlshell mussel). The documented range of this mussel is from southern Alaska to central California, and eastward to western Montana, western Wyoming, and northern Utah. The most southerly distribution of this species in California is the southern Santa Cruz Mountains and upper Kern River in Tulare County (Burch 1947:6; Taylor 1981:143). Inhabiting the same areas preferred by trout, these mussels live in cool, clear, swift-moving streams with sand or gravel substrates.

LAN-2769

Only a very small amount of invertebrate remains were recovered from LAN-2769 (Table 20); the vast majority by weight was Venus clam, with trace amounts of scallop, mussel (*Mytilus* spp.), and unidentifiable shell present. Venus clam is also the most prevalent by count, accounting for half of the MNI recorded at the site (Table 21). Shell was recovered from both excavation blocks, but Unit 3 at Block 2 accounts for nearly half of the shell remains (Table 22).

Habitats indicated by this collection mostly reflect bay and estuary settings (Venus clam and scallop). Open, rocky coast may be indicated by the presence of mussel, although the specimens recovered from LAN-2769 are not identifiable to the species level and might be bay mussel *(Mytilus edulus),* which prefer quieter water.

Discussion

In this section, the results of the analysis of shellfish remains are discussed from four perspectives of increasing scope. First, results are examined within the site boundaries with particular focus on shell fragmentation ratios, followed by a discussion of shellfish within Ballona Lagoon generally. The results are then considered from a wider geographical and temporal perspective; comparisons are drawn with sites beyond the Ballona and from earlier periods. Lastly the invertebrate collection from LAN-211/H is examined for its usefulness in addressing questions of subsistence procurement during the protohistoric period.

Intrasite Comparison

Comparison of the four areas tested by SRI during excavation at LAN-211/H shows considerable difference in the distribution of shell abundance and variability across the site. Relatively little shell was recovered from Units 4 and 6/10. Unit 4, in particular, was nearly devoid of invertebrate remains and may mark the western site boundary. Unit 11, located in the southeastern portion of site, produced considerably more shell. Although this area produced a greater range of species, the collection here is overwhelmingly dominated by Venus clam and littleneck clam. Unit 9 produced the majority of shell recovered during excavation and provided more than half of the species diversity. Aside from abalone, which accounts for nearly half the shell collection by weight, this unit is almost equally dominated by Venus clam and scallop. Unit 9 also differs from the other units by the presence of mussel and bean clam, which inhabit areas outside the bay or estuarine habitat.

The degree of shell fragmentation also varies considerably across the site. Assuming that shells were relatively undamaged when they were discarded in prehistory, the degree of fragmentation of a collection is assumed to be the result of postdepositional processes such as weathering, trampling, modern

Table 20. Invertebrates Identified at LAN-2769

Class and Family	Genus and Species (Common Name)	Habitat	Comments	Weight (g)
Pelecypoda (bivalves)				
Mytilidae	*Mytilus* spp. (mussels)	intertidal to 40 m, on rocks, gravel, and wooden structures along the coast and in bays and estuaries		< 0.1
Pectinidae	*Argopecten* spp. (scallop)	intertidal to 50 m, on sand and mud in bays and estuaries, also free-swimming		< 0.1
Veneridae	*Chione* spp. (Venus clam)	intertidal to 46 m, in mud or sand flats in bays and estuaries and also offshore	may include *C. californiensis*, *C. undatella*, and *C. fluctafraga*	5.4
Unidentified			broken or degraded fragments lacking identifiable features	< 0.1
Total				5.4 + trace

Table 21. Identified Invertebrate Taxa from LAN-2769, in Order of Abundance

Taxon	NISP	MNI	Percentage of Total MNI [a]
Chione spp.	4	2	50.0
Argopecten spp.	2	1	25.0
Mytilus spp.	1	1	25.0
Total	7	4	100.0

Note: Only identifiable specimens are included (site total NISP = 8; site total MNI = 4).

Table 22. Invertebrate Weight (in Grams) by Unit at LAN-2769

Taxon	Block 1		Block 2				Total
	Unit 1 NW	Unit 1 SE	Unit 2 NW	Unit 2 SE	Unit 2 SW	Unit 3	
Argopecten spp.	—	< 0.1	< 0.1	—	—	—	< 0.1
Chione spp.	1.8	—	—	1.0	—	2.6	5.4
Mytilus spp.	< 0.1	—	—	—	—	—	< 0.1
Unidentifiable shell	—	—	—	—	< 0.1	—	< 0.1
Total	> 1.8	< 0.1	< 0.1	1.0	< 0.1	2.6	> 5.4

mechanical disturbances, and even archaeological excavation. Shell refuse discarded away from site activity areas is expected to contain less-fragmented shell, whereas shell discarded in activity areas subject to heavy foot traffic would be more highly fragmented.

In order to compare the degree of fragmentation between areas, we follow the method outlined by Claassen (1998:114–115), in which the fragmentation ratio is calculated by dividing the total weight from the ½-inch and larger size classes by the total weight of shell from the ¼-inch size class. This ratio reflects the amount of fragmentation; the smaller the value, the higher the fragmentation, and conversely, the larger the number, the less fragmented the shell collection. As displayed in Table 19, there are considerable differences in the fragmentation ratios across the site. The least fragmented and potentially least-disturbed areas are found at Units 6/10 and 9, with fragmentation ratios of 3.8 and 3.2, respectively. Unit 4 contained too little shell to interpret, but Unit 11, which contained one-third of the recovered shell, has a fragmentation ratio of 0.5., the lowest of all the analyzed units. The reason for the highly fragmented condition of the shell from Unit 11 is unknown and could be attributable to any number of postdepositional processes.

To help interpret the meaning of these numbers, it is useful to compare them to fragmentation ratios from other Ballona sites with better-known depositional histories. LAN-1932/H and LAN-2676, two sites highly disturbed by agricultural plowing and later runway construction, have fragmentation ratios of 1.0 and 0.9, respectively. Considering that the shell from Unit 11 is even more fragmented than the shell from these two mechanically disturbed sites suggests that the deposit here may likewise be disturbed. Unit 11 is on an alluvial fan at the mouth of a small drainage near a concrete-lined channel and below the sewer access road, making it particularly vulnerable to disturbance. Alternatively, site sediments here could derive from LAN-212 on the bluff top above LAN-211/H, and could have been transported downslope during construction of Loyola Marymount University or washed downslope during heavy rains. The shell from Units 6/10 and 9 have comparatively high fragmentation ratios and appear intact.

The Economics of Shellfish Use

Most invertebrate analyses at archaeological sites in the Ballona area view human predation on shellfish populations as opportunistic, with the frequency and variability of shellfish found reflecting environmental conditions in the immediate site vicinity at the time of occupation. Human agency or preference is seldom seen as explaining the patterns of shellfish remains. This position leads archaeologists to use archaeological shell collections to develop paleoenvironmental reconstructions, which they then use to explain the patterns seen in invertebrate remains. This perspective apparently prompted Van Horn (Van

Horn and Murray 1985:200) to interpret a decrease in the amount of oyster *(Ostrea lurida)* from earlier to later components at the Loyola Marymount site, LAN-61, as an indication of the gradual siltation of the Ballona estuary. Similarly, Van Horn (1984:44) suggested that the abundance of Pismo clam at LAN-59 indicated the possible presence of a sandy shoreline much farther inland than exists at present.

However, these ecological models of human behavior are better envisioned as hypotheses requiring validation rather than as assumptions with which to interpret data. Using archaeological data to develop paleoenvironmental reconstructions and then using those reconstructions to infer human behavior from those same data creates a circular argument. In a given collection, the dominance of particular taxa that are restricted to specific habitats allows us to state that the site inhabitants had access to those habitats, but it does not necessarily follow that those habitats had to be close to those sites. It may very well be that the temporal variability in dominance of one taxon over another in a region is the result of changing environmental conditions, but it may also be the result of other causes. Keeping paleoenvironmental reconstructions independent of archaeological data allows us to test our models of human behavior against independent environmental data.

Current paleoenvironmental models of the Ballona (Homburg et al. 2001; see Chapter 5) are based on sediment cores collected from across the eastern Ballona. A suite of paleoenvironmental studies including ostracode, pollen, and mineralogical analyses of these cores is helping us refine our understanding of the Ballona environment. The picture emerging from these studies is one of relative stability punctuated by periods of significant environmental perturbations.

Sea-level rise between 15,000 and 7000 B.P. flooded what was essentially a terrestrial valley. After this time, the rate of sea-level rise slowed, keeping pace with tectonic uplift and resulting in a sort of quasistatic equilibrium. Also at this time, sedimentation rates increased compared to sea level rise, and a sandy barrier began to form across the bay, creating a lagoon. The earliest known invertebrates from geologic contexts in the Ballona are Venus clams radiocarbon dated to 7520 ± 90 B.P. (Shelley 2001), although oysters first appear in sediments immediately beneath the clam and would seem, therefore, to be older. These two species, and others represented in the cores, are common in mudflat habitats in the intertidal zone.

Sedimentation of the Ballona continued between about 7500 and 4000 B.P. During this time, the lagoon supported extensive beds of oyster and jackknife clam *(Tagelus californianus),* but by about 4000 B.P., the oyster and jackknife clam beds along the eastern edge of the lagoon were abruptly silted over. Invertebrates recovered from above these beds are restricted to horn snails (*Cerithidea* sp.) and freshwater snails. Horn snails can tolerate more fresh water than oysters or jackknife clams, and their presence coinciding with the absence of oyster and jackknife clam indicates a hydrologic shift from marine to fresh water. This shift may be attributable to the sand barrier closing off the mouth of the lagoon, drastically reducing the effect of tidal influence and the incursion of salt water into the lagoon. Increased sedimentation after 3000 B.P. continued to fill the lagoon, forming extensive marshes and wetland areas. As the inlet to the lagoon became more restricted and the volume of the lagoon decreased from increased sedimentation, the lagoon would have been transformed from a marine-influenced lagoon to an estuary as the relative amount of fresh water in the lagoon increased. Depending on the fluctuating dominance of marine versus freshwater regimes, the nature of the estuary changed along with the composition of its invertebrate populations. Through time, increasing sedimentation transformed the wetlands into coastal plain. The nature of the lagoon west of present Lincoln Boulevard is still poorly understood, but a historical map from 1861 shows the lagoon confined to an area northwest of the present intersection of Lincoln and Jefferson Boulevards. Between 4000 and 7000 B.P., extensive marshes and mudflats flanked the open-water lagoon. By 200 B.P., these mudflat habitats appear to have diminished faster than the lagoon.

A recent inventory of marine mollusks inhabiting the Ballona (Ramirez 1981) showed that despite its small size, the Ballona salt marsh still supports a varied invertebrate population similar in composition to Mugu Lagoon in Ventura County and Mission Bay in San Diego County (Ramirez 1981:Mo3). Although the Ballona marsh has been severely altered from its configuration between the Late and historical periods, the mix of species present during modern invertebrate studies provides an indication of the types of invertebrates that would have previously inhabited the marsh and lagoon during the recent past. The results of Ramirez's study show that the three most common species are littleneck clam, bent-nosed clam (*Macoma nasuta*), and jackknife clam. During that study, Venus clams were observed as dead specimens only.

Radiocarbon assays from LAN-211/H indicate the site contains two temporal components, one component sampled in Unit 6/10 and dating between A.D. 610 and 1000, and the other in Unit 9 dating between A.D. 1490 and 1640. Glass beads recovered from both Units 9 and 6/10 date to the early historical period, confirming occupation during that time. Paleoenvironmental reconstructions of the Ballona for the late prehistoric and protohistoric periods depict a small lagoon blocked from the sea by a sand barrier and ringed with extensive salt marshes and wetlands. Shellfish populations would have been dominated by bay- and mudflat-loving species like Venus clam, littleneck clam, oyster, and scallop, with small populations of bay mussel, Washington clam, and gaper clam. A few more open coast species like abalone, slipper shell, and chiton might have inhabited the mouth of the inlet (Keller 1999:88) although abalone generally prefer more open coast. Neither rocky-shore species (California mussel) nor sandy-shore species (Pismo clam, bean clam) would be expected to live in the Ballona estuary.

Analysis by weight of shellfish recovered from LAN-211/H shows that the collection is dominated by three species: abalone (30 percent), Venus clam (27 percent), and littleneck clam (18 percent). MNI values show a different pattern, with Venus clam being the most prevalent species, followed in order of abundance by scallop, Veneridae (Venus clam family), and littleneck clam. Abalone, which is the most frequent by weight, constitutes only a little more than 3 percent of the invertebrate MNI. Other species represented by weight but absent from MNI calculations due to a lack of diagnostic elements include bean clam and California mussel. The MNI and weight data show a mixed collection of species that typically inhabit different habitats. Although some abalone species are reportedly found in estuary mouths, more suitable abalone habitat is located some distance to the north and south of the Ballona. Bean clams are found in the sand along surf-swept beaches, and California mussels are found in open-coast, rocky-shore habitats. The remainder of the species prefer bay and mudflat habitats and are still found in the Ballona today.

LAN-211/H is positioned relatively near the western edge of the estuary, and the prehistoric inhabitants of the site would have had easy access to the Ballona's mudflats, tidal marsh, and lagoon. Aside from abalone, the shell from the site shows an overwhelming dominance of mudflat or bay taxa and only a small amount of shell from sandy- and rocky-shore habitats. Shellfish procurement is quite simple, and cross-cultural studies have shown that all members of a community including women, children, and the elderly can participate (Meehan 1982). Most invertebrate species live in sandy, gravely, or muddy substrates and are easily collected by digging at low tide using a simple fire-hardened digging stick (Greengo 1952). Venus clams would have been particularly easy to collect as they are frequently found on the surface of mudflats (Ricketts et al. 1985:372). Two clam species (gaper clam [*Tresus* sp.] and Washington clam [*Saxidomus nuttalli*]) recovered from LAN-211/H are more difficult to collect because they tend to burrow deeper into the mud than the other species. Gaper clams are particularly difficult to collect, as they live in burrows up to 1 m deep (Ricketts et al. 1985:376–378).

Regional Comparisons

The placement of LAN-211/H in a regional context is critical to evaluating SRI's models of human settlement and subsistence in the Ballona. Previous shellfish research has looked at the distribution of archaeological sites in the Ballona based on geographical position (e.g., bluff top, lagoon edge, and riparian zone) (Table 23) (Keller 1999; Keller and Ford 1998). Unfortunately, comparison with other

Table 23. Comparison of Invertebrate Remains at Selected Ballona Sites

Site	NISP	NISP per m^3	Number of Genera	Dominant Taxa	Dominant Taxa (%)
Bluff sites					
LAN-59 (Hughes)	2,480	28.5	8	*Tivela stultorum*	86
				Chione spp.	8
				Argopecten circularis	6
LAN-61 (Loyola Marymount)	789	1.9	10	Veneridae	67
				Ostrea lurida	29
				Haliotis spp.	2
LAN-63 (Del Rey)	23,792	117.4	23	*Chione* spp.	84
				Ostrea lurida	7
				Argopecten circularis	5
				Protothaca staminea	4
LAN-64 (Bluff)	187	19.9	4	*Chione* spp.	94
				Ostrea lurida	4
				Protothaca staminea	1
				Haliotis spp.	1
LAN-206 (Berger)	776	161.7	15	*Chione* spp.	56
				Argopecten circularis	28
				Ostrea lurida	16
Lowland sites					
LAN-60 (Centinela)	976	116.2	12	*Chione* spp. [a]	72
				Protothaca staminea [a]	21
				Ostrea lurida [a]	3
				Tivela stultorum [a]	2
LAN-194	no data	no data	no data	*Tivela stultorum* [a]	38
				Chione spp. [a]	28
				Ostrea lurida [a]	19
				Argopecten circularis [a]	7
LAN-211/H	59	19.8	10	*Haliotis* spp. [a]	33
				Chione spp. [a]	27
				Protothaca staminea [a]	18
				Argopecten circularis [a]	8
				Saxidomus nuttalli	3
LAN-2768	319	35.1	13	*Argopecten circularis*	34
				Protothaca staminea	23
				Chione spp.	15
				Ostrea lurida	13

Site	NISP	NISP per m³	Number of Genera	Dominant Taxa	Dominant Taxa (%)
Lagoon-edge sites					
LAN-47 (Admiralty)	14,290	595.4	24	*Chione* spp.	43
				Ostrea lurida	32
				Protothaca staminea	13
				Argopecten circularis	5
LAN-62 (Peck)	1,273	252.5	15	Veneridae [a]	73
				Pectinidae [a]	8
				Haliotis sp. [a]	4
				Ostrea lurida [a]	3
LAN-1932/H	230	511.1	10	*Chione* spp.	26
				Protothaca staminea	25
				Ostrea lurida	21
				Pectinidae	15
LAN-2676	2,412	193.0	38	Veneridae [a]	49
				Ostrea lurida [a]	15
				Pectindae [a]	7
				Haliotis sp. [a]	2

Note: Adapted from Keller (1999).
[a] Percentage calculated from weights, not counts.

Ballona sites is difficult because various researchers quantified shell using different methods. Bluff-top sites were quantified by NISP (Van Horn 1984, 1987; Van Horn and Murray 1985; Van Horn and White 1997c), whereas several of the riparian and lagoon-edge sites were quantified by weight (Altschul et al. 1998; Altschul, Homburg and Ciolek-Torrello 1992; Grenda et al. 1994). Because of differences in shell density, there is no direct correlation between NISP and shell weight (Mason et al. 1998). The effect of this on our ability to compare sites in the Ballona is that the percentage of thick-walled shell, such as Venus clam, in a collection will show elevated amounts when calculated as weight as opposed to NISP. Sites where Venus clam dominates the collection by NISP will show even greater quantities of this species when amounts are calculated by weight.

Keller (1999) and others (Keller and Ford 1998; Shelley 2001) pointed out that most Ballona sites, regardless of location, are dominated by estuarine species, most notably Venus clam. The two sites that deviate from this pattern, LAN-59 and LAN-2768, are dominated by Pismo clam and scallop, respectively. The prevalence of Pismo clam at LAN-59 was explained by Van Horn (Van Horn 1984:44) as resulting from a sandy bayshore northwest of the site, whereas the prevalence of scallop at LAN-2768 was similarly argued as possibly reflecting a changing estuarine environment (Keller 1999:98). (As summarized above, paleoenvironmental data do not support the notion of a Pismo clam habitat having been close to LAN-59 when the site was occupied.) The prevalence of Venus clam at most Ballona area sites is hardly unexpected considering the estuarine nature of the Ballona during most of prehistory. To elicit behaviorally relevant inferences from these data requires looking at these distributions in a new way.

I concur with previous observations that the range of shellfish species remains relatively constant from site to site. Apparent differences in species diversity can result from several factors, including availability, shell taphonomy, excavation sample size, and of course, human behavior. Most sites in the Ballona exhibit the same general mix of shellfish, but the ratios of dominant shell species differ among sites. As stated earlier, the distribution of the most prevalent species found in the Ballona clearly show that many sites are dominated by Venus clam. Previous explanations for this pattern apparently assume that shellfish species were collected in proportion to their abundance in the estuary. This, however, might not necessarily have been the case. Each shellfish species occupies an optimal microhabitat within the estuarine zone, so that Venus clam and littleneck clam, both of which inhabit the estuarine intertidal zone, are most prevalent in mudflat and bay-mouth zones, respectively. As noted above, the burrowing behavior of invertebrates also varies considerably; Venus clam, which live in the intertidal zone of mud-flats and bays, are frequently found on the ground surface at low tide (Ricketts et al. 1985:372), whereas gaper clam, which are found in the same habitat as Venus clam, can burrow to depths of up to 1 m (Ricketts et al. 1985:376–378). Both of these factors—portion of the estuarine system and burrowing behavior—can affect the ease with which specific species can be collected: within the mudflat zone, it is much easier to collect Venus clam from the surface and near-surface than it is to extract gaper clam from their burrows. It may be that shifting dominance of one species over another, as demonstrated in Ballona archaeological sites, is not solely a reflection of the natural abundance of these taxa as determined by environmental factors but might result from human decisions to target specific resources.

Hunter-gatherer foraging and subsistence strategies can be classified as generalized or specialized (Winterhalder 1981). Generalized subsistence strategies are those that rely on a broader range or diversity of food types, whereas specialized strategies are focused on fewer but more abundant resources. All things being equal, a decrease in resource abundance should foster a broadening of the resource base (Winterhalder 1981); that is, a decrease in the abundance of a particular shellfish species should result in an increasing reliance on alternative taxa. The causes of decreasing abundance can be natural or cultural factors. Using this simple notion, we categorize the sites in the Ballona based on relative abundance of shellfish species recovered. Sites where the majority (greater than 50 percent) of the shellfish collection is attributable to one taxon are classified as focused, whereas sites where no taxon dominates by majority are classified as general. Classifying the Ballona sites in this manner and plotting their presence by both geographical location and temporal period produces an interesting pattern (Table 24).

This pattern shows that the bluff tops were occupied during the Early and Intermediate periods by people primarily focusing their shellfish-collection strategy on Venus clams. During the Intermediate period, people were also occupying the riparian and lagoon-edge zones. Along the riparian zone, shellfish collection was split between focused and general, with the LAN-60 collection dominated by Venus clam, whereas the collection from LAN-2768 represented a generalized collection strategy based on scallop and littleneck clam. Lagoon-edge occupations during this time were mostly focused on Venus clam, and although the invertebrate collection from LAN-2676 (a lagoon-edge site) does not have a majority of any one species, Venus clam accounts for 43 percent of the collection. It is important to note that LAN-2676 was occupied throughout the Intermediate period and on into the Late period, and that construction activities have mixed the deposit.

Only one site in the Ballona, LAN-47, is firmly dated to the Late prehistoric period. Located along the northern edge of the lagoon, this site contains a shellfish collection reflecting a generalized collection strategy emphasizing Venus clam. The tentatively dated Late period component at LAN-211/H, located along the riparian zone, also shows a generalized pattern based on Venus clam and littleneck clam. Occupations in the Ballona dating to the protohistoric and early historical periods are found in both the riparian and lagoon-edge zones. Shellfish-collection strategies during this time, regardless of location, have a generalized pattern. However, the protohistoric component at LAN-211/H, represented by Unit 9, exhibits a focused collection strategy dominated by abalone. The meaning of this pattern is not exactly clear because, although abalone meat can be an important food source, abalone shell was highly prized

Table 24. Distribution of Ballona Area Sites by Environment and Temporal Period

Environment	Millingstone Period	Intermediate Period	Late Period	Protohistoric or Historical Period
Bluff top	***F*** LAN-206 (*Chione*)	***F*** LAN-59 (*Tivela*) ***F*** LAN-61 (*Veneridae*) ***F*** LAN-63 (*Chione*) ***F*** LAN-64 (*Chione*)		
Riparian		***F*** LAN-60 (*Chione*) ***G*** LAN-2768 (*Argopecten*, *Protothaca*)		***G*** LAN-194 (*Tivela*, *Chione*) ***G*** LAN-211 (*Haliotis*, *Chione*)
Lagoon		***F*** LAN-62 (*Chione*) ***G*** LAN-2676 (*Chione*)	G LAN-47 (*Chione*, *Ostrea*)	***G*** LAN-1932H (*Chione*, *Protothaca*)

Note: Dominant taxon/a at each site in parenthesis.
Key: ***F*** = focused: majority (> 50%) of assemblage attributable to one taxon; ***G*** = general: no taxon dominates by majority (> 50%)

for fish hooks, beads, and ornaments. The abundance of abalone shell at this unit may represent a specialized abalone tool- or ornament-manufacturing location. Taken as a whole, however, the collection from LAN-211/H reflects a generalized collection strategy focused on abalone and Venus clam.

In summary, the Early and Intermediate period collections on the bluff top represent a focused collection strategy based on Venus clam. Intermediate period occupations along the riparian and lagoon-edge zones also indicate focused collection strategies mostly based on Venus clams. LAN-2676 appears to have a more generalized strategy, but the mixed nature of the deposits and long time-span represented calls into question the validity of the data. LAN-2768 also contains a collection reflecting a generalized collection strategy, although the abundance of scallop and littleneck clam and conspicuously low amounts of Venus clam are puzzling. During the Late and protohistoric periods, shellfish collection appears to be based on a generalized strategy.

At present, the causes of this apparent shift in collection strategy are unknown and may very well reflect changing environmental conditions. Regardless of the causes, the effect of these changes is interesting in its own right. Erlandson (1994:Table 4-1) and Meighan (1959:Table 6) provided conversion factors for estimating the amount of meat represented by a given weight of shell (Table 25). Although these conversions are subject to a host of problems (Claassen 1998:187–191; Erlandson 1994:57; Mason et al. 1998), they can be used to estimate relative amounts of meat provided by shellfish. From these conversion factors, it is clear that Venus clam provides the least amount of meat relative to shell weight. Pismo clam, oyster, and surprisingly, abalone supply only slightly more meat per shell weight than Venus clam, whereas scallop yields more than twice as much meat as Venus clam, littleneck clam more than three and one-half times the amount, and gaper clam 10 times the meat as Venus clam for the same weight of shell. When viewing archaeological shellfish remains in light of the amount of meat provided by a given taxon, the relative dominance of species in a collection shifts. At LAN-211/H for instance, Venus clam is 1.5 times more prevalent than littleneck clam by shell weight, but littleneck clam provided double the amount of meat. In fact, when viewed by meat weight, littleneck clam is more abundant at this site than any other taxon, including abalone. From this it is apparent that all things being equal, a replacement of Venus clam with any other species results in increased amount of meat procured in relation to shell weight. We recognize that this is an overly simplistic model and does not account for

Table 25. Meat Yield Conversion Factors for Some Common Marine Shellfish

Taxon (Common Name)	Meat Yield Conversion Factor	Meat Yield Compared to *Chione californiensis*
Chione californiensis (common Californian Venus clam)	0.171	1.00
Tivela stultorum (Pismo clam)	0.254	1.49
Haliotis spp. (abalone)	0.263	1.54
Ostrea lurida (native Pacific oyster)	0.292	1.71
Mytilus californianus (California mussel)	0.298	1.74
Septifer bifurcatus (bifurcate mussel)	0.364	2.13
Tegula funebralis (black tegula)	0.365	2.13
Argopecten circularis (Pacific calico scallop)	0.400	2.34
Mytilus edulis (bay mussel)	0.438	2.56
Saxidomus nuttalli (common Washington clam)	0.463	2.71
Protothaca staminea (common Pacific littleneck clam)	0.61	3.57
Polinices lewisii (Lewis' moon snail)	0.722	4.22
Tagelus californianus (California jackknife clam)	1.24	7.25
Tresus nuttallii (Pacific gaper clam)	1.70	9.94

Note: Adapted from Erlandson 1994:Table 4-1 and Meighan 1959:Table 6.

several variables—most notably, the total amount of shell present—but it does provide an indication of an apparent increase in meat yield.

Preliminary analysis indicates that the shift from the Early and Intermediate period focused collection strategy that targeted Venus clams to the Late and protohistoric period generalized strategy that emphasized a greater proportion of other species, particularly scallop and littleneck clam, could have resulted in an increased meat yield. The question that must be answered is why people living in the Ballona would shift from collecting Venus clams, which are easy to procure, to collecting species like littleneck clams, scallops, and gaper clams that are harder to collect. The most expedient explanation is that the diminishing proportion of mudflats relative to open-water lagoon precipitated a decline in the abundance of mudflat species, and the local inhabitants began to rely more heavily on open-water species. Although this explains the apparent shift from a Venus-clam–based, focused collection strategy to a generalized one, it begs the question of why, in the first place, the people of the Early and Intermediate periods focused on Venus clams to the near exclusion of other species, especially considering that paleoenvironmental data suggest the presence of an open-water lagoon environment that would have been a prime habitat for other species. Our analysis seems to show that these earlier inhabitants were focusing their attention on the species that were the easiest to collect, supporting the contention that the ratio of shellfish remains is not necessarily a reflection of their relative abundance in the estuary. If the shellfish patterns in the Intermediate period reflect deliberate decisions on which species or what part of the estuary to target, then it is possible that the distribution of shellfish found at later sites might also reflect behavioral rather than exclusively environmental factors. In this light, the apparent intensification noted at the Ballona sites might reflect prevailing settlement patterns, in addition to environmental reasons. Increasing pressure on the existing shellfish populations, as inferred from the shift from a focused to a generalized collection strategy, could have resulted from decreasing mobility, with people visiting the Ballona either for longer periods of time or more often. Perhaps the cause was larger groups visiting on the same approximate schedule as before. In either case, as existing stocks of easy-to-collect Venus clams were depleted, the people of the Ballona began to rely on other species to a greater extent than before.

The invertebrate collection from LAN-211/H is unique among Ballona sites in two respects; first is the abundance of abalone present. Although Keller (1999:88) suggested that abalone might have previously inhabited the outer portion of the Ballona estuary system, at present there is no evidence for this except for the recovery of abalone at local archaeological sites. Even if abalone did previously inhabit the estuary, it would have most likely been during the early formation of the lagoon, when the presence of submerged rocks to which these animals typically attach themselves was more likely. By the time that LAN-211/H was occupied during the protohistoric period, sedimentation would have reduced the number of rocky exposures, thus decreasing the natural abundance of these species in the bay, and we would not expect an increase in abalone use at this late time. A more likely explanation is that the abalone present at LAN-211/H were specifically targeted by the site inhabitants, who either had to travel outside the Ballona area to collect them from more suitable habitats north or south of the estuary, or who acquired the shell through trade.

The second unique aspect of the LAN-211/H shellfish remains is the presence of the freshwater western pearlshell mussel. Western pearlshell mussel is characterized by a highly nacreous interior surface, a trait it shares with abalone, with which it can be easily confused when identifying small fragments lacking diagnostic elements. Western pearlshell mussel was widely used in the manufacture of buttons around the turn of the nineteenth century (Melton 1996:252), providing an indication of the potential suitability of this shell for making beads and ornaments. At present, the southernmost identification of western pearlshell mussel in California is from the southern Santa Cruz Mountains (where it is now probably extinct) and the upper Kern River (Burch 1947:6; Taylor 1981:143). The preferred habitat of these mussels—clear, cool, swift-moving freshwater streams with sand or gravel substrates—is not present in the Ballona, and these shells had to be imported from outside the area. Although it is possible that these mussels could have previously inhabited streams of the upper watershed of the Los Angeles River, or other southern California mountain streams, it is more likely that they were imported from central or northern California. No other examples of western pearlshell mussel are reported from the Ballona.

The low frequency of this mussel in the collection (three specimens are known from the collection, two from Unit 9 and one from a provenience not included in this analysis) and the great distance over which it was imported make it highly unlikely that this mussel was used for food at LAN-211/H; it seems more likely that the shell itself might have been traded to use in ornaments. Taken together, abalone and western pearlshell mussel indicate a sharp rise in the amount of highly nacreous shell at LAN-211/H as compared to other sites in the area and may indicate an increase in shell-ornament manufacture here. If the western pearlshell mussel was traded for use in ornament manufacture, its presence is puzzling, considering abundant nearby abalone supplies. Additional data may help resolve this issue.

LAN-211/H and the Protohistoric Period

A fair number of protohistoric and early-historical-period sites occupied by Native Americans are known from coastal California. Only a few have been systematically excavated, however, and of those, most do not contain discreet deposits attributable to these time periods. Of those sites reviewed for the current project (see Chapter 2), only three sites contain data relevant to our invertebrate analysis, and two of these are located far to the north of the Ballona area. These three sites are the Hammack Street site, Helo' on Mescalitan Island in Goleta Slough of the Santa Barbara Channel area, and Mission Santa Cruz on the north shore of Monterey Bay.

The Hammack Street site (LAN-194) is a stratified deposit with two distinct temporal components. The youngest component dates to the historical period between A.D. 1825 and 1850, whereas the older component could not be firmly dated but apparently lacked contact-period artifacts and probably dated to the Late period (King 1967). Although King excavated the site stratigraphically, it is difficult to distinguish one component from the other in his report, so we must look at the shellfish collection from the site in its entirety. Furthermore, King reported the presence of both marine and freshwater mollusks but omitted data on the freshwater specimens. In all, 12 taxa of marine invertebrates were recovered from the site. Pismo clam was the most common species by weight and constituted 38 percent of the collection. Next in abundance were Venus clam (28 percent), oyster (19 percent), scallop (7 percent), and abalone (4 percent). No other species is present in amounts greater than 1 percent. A range of habitats was reflected in the collection, including rocky coast, sandy beach, and bay or estuary. The presence of two species, Pismo clam and California mussel, that inhabit environments outside the Ballona is noteworthy because they indicate that the Native Americans living at the site retained access to the coastal zone.

The Chumash village of Helo' (SBA-46) was a multicomponent site occupied mostly during late prehistory to the early historical period, but earlier components were also identified (Rockwell and Gamble 1992). The shellfish collection contained over 43 identifiable species. Although the greatest species diversity was found among snails, the vast majority of shellfish by weight are bivalves. The total shell collection was dominated by Venus clam (50 percent by weight), followed in order of abundance by littleneck clam (26 percent), oyster (13 percent), Washington clam (3 percent), and bent-nosed clam (2 percent). The remaining species, including abalone, each made up less than 1 percent of the collection (Denardo 1990:18-5). The majority of these shellfish inhabit the estuarine habitats found in nearby Goleta Slough, with only small amounts from sandy-beach and rocky-shore environments (Denardo 1990:18-3–18-4). Analysis of the temporal distribution of shellfish from Helo' shows very little change over time, except for a slight increase of Venus clam from earlier to later deposits. The frequency of littleneck clam remains stable over time (Denardo 1990).

Mission Santa Cruz was established in 1791 and continued to house a neophyte population until secularization in 1834. Excavations at the mission resulted in a surprisingly large quantity and variety of marine invertebrates (Allen 1998:58–59). In all, 7257.7 g of shell representing 29 species were recovered from the site. More than 50 percent of the shell, both by MNI and by weight, is California mussel. The next most frequently identified species are abalone (17 percent) and Washington clam (11 percent) (Allen 1998:Table 6.2). Analysis of the shellfish remains by size showed the presence of varying sizes of shellfish, suggesting that all sizes were indiscriminately gathered, and habitats represented by the collection reflect the nearby shoreline and estuaries of Monterey Bay. Excavation of the site focused on two temporally discreet areas, one dating to what Allen referred to as the Early Mission period (A.D. 1800–1824) and the other to the Late Mission period (A.D. 1824–1834). Comparing the invertebrate remains between the Early and Late Mission periods, Allen (1998:57) saw no significant differences between the two collections and viewed shellfish gathering and consumption as indicating continuity of use of this traditional food resource (Allen 1998:63).

Both abalone and *Olivella* shell beads were recovered from the Mission Santa Cruz. Interestingly, so was a large amount of bead-making detritus, suggesting the presence of a shell-bead making workshop at the mission. Shell ornaments made at the mission are believed to have been traded to other mission and nonmission Native Americans (Allen 1998:95).

Direct comparison of sites situated along different bays and estuaries is generally meaningless because the shellfish assemblages are dependant to a great extent on the unique environmental conditions and history of each area. What makes these mission-era sites important to our understanding of LAN-211/H is what they can tell us about the protohistoric and historical periods in general. The most compelling commonality between these sites is the demonstrated continuity of shellfish in the subsistence practices of these people. During the early historical period, neophytes living at Mission Santa Cruz retained access to Monterey Bay. They routinely gathered a range of shellfish there and brought them back to the mission where they prepared and ate the meat and manufactured beads and ornaments from the shells.

The continued manufacture and use of shell ornaments is also interesting. Shell ornaments, mostly *Olivella* beads, abalone beads, and pendants, continued to be manufactured during the early historical period and were traded at inland sites far from the coast (Chambers Group 1990; McCown 1995). The importance of shell ornaments is not completely understood, but Curtis (1959:129) suggested that the extensive use of shell ornamentation was a diagnostic trait of the protohistoric and early historical periods at Arroyo Sequit (LAN-52), a coastal Chumash village in northern Los Angeles County. This observation is very interesting in light of the abundant abalone and the presence of western pearlshell mussel at LAN-211/H, which might indicate shell-ornament manufacture. It is possible that shell ornamentation served as a means of displaying ethnic identity during times of social change in the protohistoric and early historical periods, and that the intensity of shell manufacture increased in response to accelerated social change and acculturation. This is a question that deserves further exploration.

Summary

Archaeological testing at LAN-2769 and LAN-211/H revealed that both sites contain varying quantities of invertebrate remains. The extremely small amount of shell recovered from LAN-2769 during test excavation consists of mostly bay- and estuary-loving species. This habitat is located relatively close to the site and would have been easily exploited by the site inhabitants.

The collection from LAN-211/H is much more substantial, with a wider range of species reflecting a generalized collection strategy from multiple marine environments, including open or rocky coast, sandy shore, and bay or estuary. Spatial analysis at LAN-211/H indicates relatively robust patterns of the majority of shellfish by weight and greatest species diversity at Unit 9. The collection at this unit is dominated by abalone, which might indicate shell-tool or -ornament manufacturing, a hypothesis further supported by the presence of the exotic, freshwater western pearlshell mussel.

When placed in context with surrounding Ballona area archaeological sites, the LAN-211/H shell indicates a generalized collection strategy typical of Late and protohistoric-period sites in the area. This collection strategy, which used a broad range of marine shellfish, including harder to collect species, is different from the earlier Intermediate period and Early period focus on the easy-to-collect Venus clam. This subsistence shift takes fuller advantage of the marine environment by targeting animals with larger meat weight to shell weight ratios. The reason for adopting this strategy is unclear, but most certainly is based to a large extent on changing environmental conditions (decreasing mudflat habitat relative to open-water lagoon); it might also be partly based on shifting settlement patterns influenced by social dynamics reaching outside the Ballona.

One of the noteworthy aspects of LAN-211/H is its age. Preliminary analysis of radiocarbon dates indicates the presence of two temporal components: the earlier from a Late period occupation, followed by a later protohistoric-period use. The protohistoric deposit from Unit 9 contains a very rich and diverse invertebrate collection. Most striking about the Unit 9 collection is the abundance of abalone, a characteristic absent at all other Ballona sites. Also unique to this unit is the presence of western pearlshell mussel, an exotic species that was probably traded into the area from the mountains of central California. Both the abalone and western pearlshell mussel are highly nacreous, a quality prized for shell ornaments. Some evidence suggests that extensive use of shell ornamentation is a diagnostic trait of the protohistoric period (Curtis 1959:129). The discovery of a neophyte shell-ornament workshop at Mission Santa Cruz showed that this trait extended into the early historical period as well (Allen 1998).

The results of test excavation at LAN-211/H indicate that the invertebrate remains found here have the potential to add to our understanding of how people lived in the Ballona. Future research should explore changing patterns of shellfish exploitation in the area and show how they relate to environmental conditions. Understanding the ways in which the shell collection deviates from predications based on environmental models may allow us to infer social organization. The abundant abalone and presence of the exotic western pearlshell mussel are also important because they may provide data that may help to better understand the social significance of shell ornamentation and elucidate the nature of trade relationships during the protohistoric period, a particularly volatile period of social change.

CHAPTER 9

Beads, Ornaments, and Other Artifacts

Robert O. Gibson, David Maxwell, Anne Q. Stoll, and Donn R. Grenda

In this chapter, we present the results of the analysis of beads, ornaments, and other artifacts, including worked bone and shell tools, excavated from test units at LAN-211/H and LAN-1932/H (which is included for comparative purposes). Excavations at LAN-2769 produced no artifacts of these types. Excavations yielded a total of 128 items; of these, 70 consisted of artifacts recovered from LAN-211/H. These include 37 shell beads, 20 glass beads, 4 stone beads, 1 bone bead, 1 stone disk, 1 shell fishhook, 1 shell with asphaltum, 1 burnt shell fragment, 2 bone awls, 1 bone tube, and 1 drilled tooth. Fifty-three artifacts were found at LAN-1932/H consisting of 38 shell beads, 4 unidentified shell disks, 1 glass bead, 5 bone beads, 1 serpentine bead, 1 bone awl, 1 bone gorge or awl fragment, and 2 unidentified worked bone fragments. Five items initially included in the analysis and listed in the bead catalog in Appendix B, were subsequently discarded as nonartifactual. David Maxwell analyzed the 14 worked bone artifacts, and the other 109 artifacts were analyzed by Robert Gibson.

This chapter begins with background information concerning the usefulness of beads as chronological and social indicators. This section is followed by a discussion of the methods and results of bead analysis and local site comparisons. This chapter ends with the results of the worked bone analysis. For a complete presentation of bead data, including traits and measurements, see Appendix B.

Beads

Generally speaking, this class of artifacts is thought to have both an economic and social function. For the Chumash, shell bead ornaments denoted wealth and status and were conspicuously displayed during ritual and social gatherings. Beads were used as offerings and adorned the dancers during festivals and special rituals, such as the harvest ceremony (Librado 1981:48, 85–86). Beads also served as a medium of exchange and as a validation of social and political authority (King 1974:91). Archaeologically, beads are highly prized for their usefulness in dating cultural deposits, as many bead types are temporally sensitive. As the most commonly used material for bead manufacture, *Olivella* shell beads have been recovered in large numbers from archaeological deposits throughout the state. *Olivella biplicata* beads have proven especially useful for dating, as a chronological sequence for their manufacture has been devised using burial lot seriation (King 1990a).

Recent research on the trade network of shell beads across California suggests that the Gabrielino may have acted as go-betweens in shell bead trade between the Chumash and inland groups such as the Cahuilla and Kumeyaay (Gamble and Zepeda 2002). Cremations at the historic Kumeyaay site of Amat Inuk in eastern San Diego County were found to contain 7,831 *Olivella* rough disk beads, a discovery made especially significant by the fact that shell beads of any type were not generally manufactured in San Diego County (Gamble and Zepeda 2002:80). Bead characteristics, such as diameters and hole perforations, indicated manufacture after 1800, leading the authors to deduce that long distance exchange networks among California Indian societies continued well into the period of Spanish contact (Gamble and Zepeda 2002:87). Following this lead, shell beads from Ballona area sites may reflect patterns of exchange that operated into the historical era.

Beads discussed in this chapter include those manufactured from glass, shell, stone, and bone. A discussion of the temporal placement of these artifacts is presented below, followed by a brief description of their social and technological implications. The methods used for the bead analysis are then described, followed by results, which show that the majority of the beads were found in Unit 9 at LAN-211/H and date to the protohistoric and early historical periods.

The project area is located within the territory historically occupied by the Gabrielino (Bean and Smith 1978). Manufacturing techniques and use of shell beads among the Gabrielino are poorly understood; however, a well-documented body of research exists for similar types of beads found in adjacent Chumash territory. Our analysis assumes that Chumash data apply to shell beads from the Ballona. The interested reader is referred to work by Gibson (1976, 1992), Gibson and King (1991), and King (1974, 1976, 1978, 1988, 1990a, 1990b, 1991).

Chronology

As discussed in Chapter 2, the protohistoric period (A.D. 1542–1771) and early historical period (A.D. 1771–1834) have been separated to facilitate differentiation between pre- and post-contact native contexts. Glass beads, by definition, are post-contact and must date to A.D. 1542 or later. Bead data from LAN-211/H and LAN-1932/H indicate that occupation of these sites, ranging between A.D. 1550 and 1850, overlaps both the protohistoric and historical periods.

Whole *Olivella* Beads

These shell beads, which are made from a nearly complete *Olivella* shell with the spire removed perpendicular to the body axis, have been produced and distributed throughout most of California and the Great Basin over a span of at least 7,000 years (Bennyhoff and Hughes 1987; King 1981). In central California and the Great Basin, *Olivella* beads with the spire ground diagonally (Type A2a) are known in quantity only after the end of the Early period (ca. 3000 B.P.). In the Santa Barbara Channel Islands, *Olivella* beads with diagonally ground spires are commonly found in contexts dating to the Intermediate period from around 2450 to 1900 B.P. The beads become scarce after 1800 B.P. but have been found as late as 1500 B.P. (Gibson 1975:116; King 1981:56, 192).

Bead size can be temporally significant. Beads made from small shells (less than 6.5 mm in diameter) were most popular during the Intermediate period (ca. 2000 B.P.), then gained favor again beginning around A.D. 1850 (800 B.P.). However, little significance can be attached to size alone unless a large sample from intact strata is available for analysis.

At ORA-64, a large site overlooking Upper Newport Bay, more than 350 shell beads were recovered, most of which were of the whole *O. biplicata* bead type. Fourteen of these beads were sent to Lawrence Livermore National Laboratory for AMS radiocarbon dating. Two returned dates circa 7600 B.P., and the remaining 12 dated to between 8300 and 8950 B.P. (Macko 1998:93–96). These beads provided the oldest dates for the site and confirm that this bead type represents the early Holocene bead styles.

Olivella Lipped Beads

The date range for the types of *Olivella* lipped beads found at LAN-1932/H and LAN-211/H spans the period between A.D. 1550 (400 B.P.) and A.D. 1780 (170 B.P.). Within that span, the different varieties grade from thin-lipped round, diagnostic of the early protohistoric period; through thin-lipped oval (transitional between thin-lipped and full-lipped forms); to full-lipped beads, generally diagnostic of the later protohistoric period. Deep large-lipped beads first occur ca. A.D. 1650 and become increasingly common in the historical period (Bennyhoff and Hughes 1987:129).

Lipped beads were used as a medium of exchange between individuals and households. Although not common in Santa Barbara Channel Island grave lots, they were widely used throughout central and southern California (King 1978:60).

Olivella Cup Beads

Olivella cup beads are chronological indicators of the Late period in the Chumash cultural area; they are absent from sites before A.D. 1100. Two subgroups have been distinguished. From ca. A.D. 1100 to 1500, larger cups (around 3.8 mm to larger than 4.3 mm) were prominent, whereas from ca. A.D. 1500 to 1782, smaller cups (2.1–3.8 mm) were more popular (King 1990b:157). The specimens from LAN-211/H and LAN-1932/H are within the size range of examples that have been dated to the later end of the spectrum, between A.D. 1650 and A.D. 1782 (King 1990b:8–23). Incised cups are most common during the protohistoric period. At the Medea Creek Cemetery (LAN-243C), a Late period site in Agoura Hills, cup beads were found in all areas of the cemetery; however, the highest concentrations were in the western area, where persons of wealth and status were interred (King 1974).

Cup beads were used as a medium of exchange between individuals or households. King (1990a:160) found that coiled strings of *Olivella* cup beads sometimes were found in graves but usually in small numbers. Occasionally, very large numbers are found with high-status burials. Cup beads were sometimes attached to other implements (e.g., bone or wooden objects) with asphaltum and might also have been sewn onto perishable items such as baskets.

Olivella Cut-Wall Beads

The classification "cut-wall beads" is an overarching category that includes saucers (Gibson Type G), disks (Gibson Type H), and wall disks (Gibson Type J). All three of these bead types were found at LAN-211/H and LAN-1932/H. *Olivella* wall disks and tiny saucer beads were first manufactured during the Intermediate period, ca. 2450–1940 B.P. By around 1900 B.P., both large and small wall disk beads had become the most common form of shell bead in the Santa Barbara Channel region, and both types continued in use into the Late period in southern California. Hole diameter is critical to distinguishing the tiny saucers (G1 type) made during the Intermediate from those in use during later periods. Tiny saucer beads from the project area have relatively large hole diameters, thus placing them at the later end of their temporal spectrum, after A.D. 1550.

Shortly after A.D. 1780, wall disk beads grade into rough and chipped disks (Gibson 1976:157). The earliest evidence of the complete manufacturing sequence of *Olivella* disk beads (chipped, rough, semi-ground, to ground) dates to about A.D. 1780. Eventually, during the historical period, they became the most common type of shell bead made in southern California, based on sequences defined at Medea Creek (LAN-243), Malibu (LAN-264), and San Buenaventura Mission (VEN-87) (Gibson 1976; King 1990a, 1990b, 1991). Dynamic interaction between native populations and European culture resulted in many changes in the size and shape of this bead. Between A.D. 1780 and 1840, these beads generally increased in overall diameter, while the degree of grinding on their peripheries decreased, thus blurring some of their diagnostic distinctions. The overall diameter, periphery treatment, hole size, and form are time-sensitive variables, as past researchers have shown (Gibson 1976; King 1990b, 1991).

Data on rough disk beads from LAN-211/H and LAN-1932/H were compared to those data obtained from the Chumash sites Helo' (SBA-46), SBA-60, and at Malibu (LAN-264) (Gibson 1975, 1995, 2000; King 1990b). Comparing rough disk beads from these sites with those from LAN-211/H and LAN-1932/H, it is clear that the average diameter of the LAN-211/H and LAN-1932/H beads is relatively small compared to those from SBA-46 and the later portions of LAN-264. Further, the perforations of the five mostly ground (Type H1b) specimens from both of SRI's sites average 1.0 mm, representing the small end of the size range for these disk beads. Based on this size comparison, the *Olivella* Type H beads from LAN-211/H and LAN-1932/H are most similar to the beads found the Malibu site (early phase) and SBA-60 and thus probably date between about A.D. 1780 and 1800, at the latest.

Chumash ethnographic data indicate that *Olivella* wall disk beads were strung and used as bracelets. Long strings were wound around the wrist several times or worn as belts by chiefs on fiesta days. Strands were also used as necklaces and functioned in ritual intervillage or interregional exchanges between village chiefs and other individuals of high status. *Olivella* saucers and wall disks were not used as a medium of exchange between individuals or households; rather, such items were used to validate social and political authority (King 1974:91).

Mytilus and *Haliotis* Disk Beads

In the Santa Barbara Channel region, *Mytilus* disk beads most frequently date between A.D. 900 and 1150. After A.D. 1400, these beads were used less frequently, but they continued to be used into the historical period (King 1990a:187). Two *Mytilus* disk beads were recovered from LAN-1932/H, likely dating to the post–A.D. 1400 period.

No beads made from *Mytilus* shell were found at LAN-211/H; three *Haliotis rufescens* epidermis disk beads were recovered from this site, however. These disk beads are first seen at sites dating from A.D. 1550 and become more common by A.D. 1780. The smaller sizes (about 2.6 mm in diameter, 1.0 mm thick, and having a 1.2-mm hole) date from about A.D. 1650. After A.D. 1780, these beads increase in size, ranging from 3.5 to 6.5 mm in diameter. The three specimens from LAN-211/H average 4.4 mm in diameter, suggesting the later period for their manufacture date. No beads made from *Haliotis* shell were recovered from LAN-1932/H.

Glass Beads

Cane beads are not diagnostic of the historical period only; they are known from protohistoric contexts also. These beads' wide temporal span makes them less useful in dating than shell beads. Wire-wound beads are a relatively rare type in historical-period contexts. They were not recorded at Malibu (LAN-264) and were assigned to a post–A.D. 1816 period or later at VEN-87 (Gibson 1976:122; King 1990b; King and Gibson 1972).

Stone Beads

The dating sequence for stone beads has not been well established, and some local variation may exist. According to King (1981), beads of hard stone were mostly made during the Early period and the first phase of the Intermediate. Hard stone beads were probably the most commonly used shaped beads during most of the Early Period; they become relatively rare after about 1950 B.P. (King 1981:172). In the Chumash culture area, hard stone disk-cylinder beads made from serpentine, serpentine-jadeite, and jadeite are usually associated with large, thick disk-cylinder beads made from clam shell. Both types increased in frequency at the end of the Early period (King 1981:177). Thin chlorite-schist disk beads found at LAN-264 were dated to the Early and Intermediate periods (Gibson 1975:113). The sequence of change in stone beads during the Intermediate period is poorly understood. Steatite beads are known from both Intermediate and Late period sites and are generally not culturally or chronologically diagnostic.

Bone Beads

Although bone beads have been found throughout the Ballona, they are relatively rare in lowland sites. Generally bone beads are not considered culturally or temporally diagnostic. More than 2,000 bone beads were found at ORA-64, a site occupied between 9000 B.P. to about 4300 B.P. (Macko 1998:93). King noted that in Chumash territory, small-mammal tube beads were frequently used ca. 3000 B.P. and persisted as a rare bead type through to the historical period (King 1990a:123). A bone bead was found in association with Rose Springs projectile points, a bone awl, and an *Olivella* spire-removed bead in a cairn burial in Death Valley. The burial dated to Death Valley III period, ca. A.D. 1–1000 (1950–950 B.P.) (Wilke 1978:446). No solid chronological sequence has yet been devised for bone beads, as they are known from the full temporal range of sites in southern California.

Methods

Gibson examined 109 artifacts (102 beads and 7 miscellaneous shell artifacts) using a 15-power binocular microscope, then placed each of the beads into one of 24 distinct categories of glass, shell, and stone. Typological bead analysis uses the classification system and temporal framework established for the Santa Barbara Channel region by C. King (1981, 1990a) which has been correlated with the California bead typology of Bennyhoff and Hughes (1987). The shell bead classification system of King (1981) and Bennyhoff and Hughes (1987) is based on bead shape, material, overall dimension, perforation characteristics, periphery and surface appearance (focusing on attributes such as incising and grinding), and other minor modifications. Glass beads introduced after A.D. 1769 were typed using the Buenaventura Mission typology (Gibson 1976).

All measurements, made in millimeters, were taken as if the bead were on a string held between the hands horizontal to the surface of the earth. Bead diameter is measured as the greatest distance across the face of the bead, perpendicular to the string. If a bead is irregular in shape, the maximum and minimum diameters are generally given (i.e., 9.0 by 7.5 mm). If only one measurement is given, it is assumed the bead is approximately circular in outline (Gibson 1992).

In the proper orientation, the thickness of a bead is the same as its length, which is measured as the greatest distance between the ventral and dorsal surfaces. The thickness of *Olivella* disks, cups, and lipped beads is dependent on the natural thickness of the *Olivella* shell. The thickness of other types of beads (including clam, *Mytilus,* and *Haliotis* disks) is related to the amount of energy expended in grinding one or both faces of the bead, as well as its circumference or perimeter.

The hole diameter is measured as the minimum distance across the perforation. If a hole is labeled as "biconical" (meaning drilled from both the ventral and dorsal sides of the bead), the minimum diameter will be somewhere near the midpoint of a bead. A "conical" perforation refers to a hole drilled from one side of a bead only. It is important to note whether a hole is drilled from ventral or the dorsal side. In some cases after drilling a conical hole, the bead maker would turn a bead over and slightly ream out the other side in order to make the hole smooth and even. This type of perforation is generally not considered to be biconically drilled. For this analysis, the biconical perforations were examined to determine if they had been equally drilled from each side or more from the ventral or dorsal side. This information is noted in Appendix B as "b80v" (biconical hole drilled 80 percent from the ventral side of the bead), or "cv" (conical hole drilled from the ventral side of the bead). The bore of a hole is considered straight if the sides of the hole are parallel. Holes were carefully examined and measured using a 10× reticle with a metric scale in 0.2-mm divisions. The format used to express all bead measurements presents the diameter (or length and width) first, followed by bead thickness, then minimum hole diameter, for example, 5.0/2.4/1.2 mm. All bead data were cataloged in a Panorama database using a Macintosh G4 computer. Appendix B contains the detailed artifact catalog.

Olivella Beads

Thirty-four *Olivella* shell beads were found at LAN-211/H and 36 at LAN-1932/H. A selection of these beads are presented by type in Table 26. Each of these types is discussed below.

Whole Spire-Removed Beads

Beads of this type were made by grinding the spire ends of *O. biplicata* shells to produce a circular hole perpendicular to the long axis of the shell. The one example of this type from LAN-211/H (Figure 72a) was ground at a slight diagonal (about 30 degrees or less) but not enough to classify it as an oblique (A2) type. *Olivella* spire-removed beads, including diagonally removed spire types, were probably strung together. Sometimes flat wear facets occur on the sides of shells, suggesting they were strung or sewn as appliqué (King 1981:193). One small *O. biplicata* shell from LAN-1932/H (Figure 73a) was modified at about a 45 degree angle and showed traces of a red stain around the top of the spire.

Callus Beads

Callus beads are normally round to oval beads made from the upper callus (inner lip) and adjacent body whorl of the *Olivella* shell. Nine varieties of *Olivella* callus beads were analyzed in this collection, all types of either lipped beads (E type) or cup beads (K type). Lipped bead varieties consist of thick, thin round (Figure 73b), full (Figure 73c), deep large, thin round (Figure 72b), and thin oval. Lipped beads manufactured from the *O. biplicata* shell display a cross section with a thicker side (the callus area) and a thinner side (the wall area). The outline of this type of bead can range from circular through oval to rectangular. Peripheries are ground, and the perforation is typically drilled midway between the wall and callus areas.

Cup bead types consist of plain (Figures 72c–d and 73d), diagonal incised (Figures 72e–f) and "X" incised. Cup beads, also manufactured from the callus portion of the *Olivella* shell, are relatively small and circular in outline when viewed in cross section. The ventral side is more convex than the dorsal side, thereby giving this form a cup-like appearance. Usually cup beads are thicker than 1.3 mm; thin cups grade into wall disk beads. Perforations may be conically or biconically drilled. Four of the 16 cup beads were decorated with either diagonal or "X" incising.

Table 26. *Olivella* Beads from LAN-211/H and LAN-1932/H

Bead Type,[a] by Shell Portion	LAN-211/H	LAN-1932/H	Figure	Dates
Whole				
Spire removed, simple, A1c	1	—	72a	
Spire removed, oblique, A2a	—	1	73a	5000–4500 B.P.
Callus				
Lipped, E	—	1		
Lipped, thin, E1	—	1		
Lipped, round thin, E1a	—	3	73b	A.D. 1500–1650
Lipped, oval thin, E1b	1	4	72b	A.D. 1600–1700
Lipped, thick, E2	1	—		A.D. 1650–1785
Lipped, full, E2a	1	10	73c	
Lipped, deep large, E3b	—	1		A.D. 1650–1785
Cups, plain, K1	7	5	72c–d, 73d	A.D. 1150–1785
Cups, incised	2	2	72e–f	post–A.D. 1500
Cut wall				
Saucers, tiny, G1	6	5	72g–i	A.D. 700–1780
Saucers, normal, G2	2	—		A.D. 700–1780
Disc, ground, H1a	2	—	72k	A.D. 1780–1790
Disc, mostly ground, H1b	3	1	72l–n	A.D. 1780–1790
Disc, rough, H2	2	—		A.D. 1780–1790
Disc, rough, ground, H2a	4	—	73e–f	A.D. 1780–1790
Wall disc, abraded, J	—	2		A.D. 700–1780
Wall disc, irregular	2	—		
Total	34	36		

[a] Type keys are equivalents in Bennyhoff and Hughes (1987).

Cut-Wall Beads

Two decades of research have provided a solid seriation for *Olivella* cut-wall beads. Three principal varieties of cut-wall beads were analyzed: saucers (Type G), disk beads (Type H), and wall disks (Type J). Saucer beads, made from the wall of the *Olivella* shell, are circular in outline and usually have a well-ground periphery (Figures 72g–i). In cross section, the curvature of the internal and external surfaces is the same. At LAN-211/H and LAN-1932/H, the overall diameters of these beads are small, varying from 2.9 to 4.3 mm, with a minimum average diameter of 3.4 mm. Hole types range from

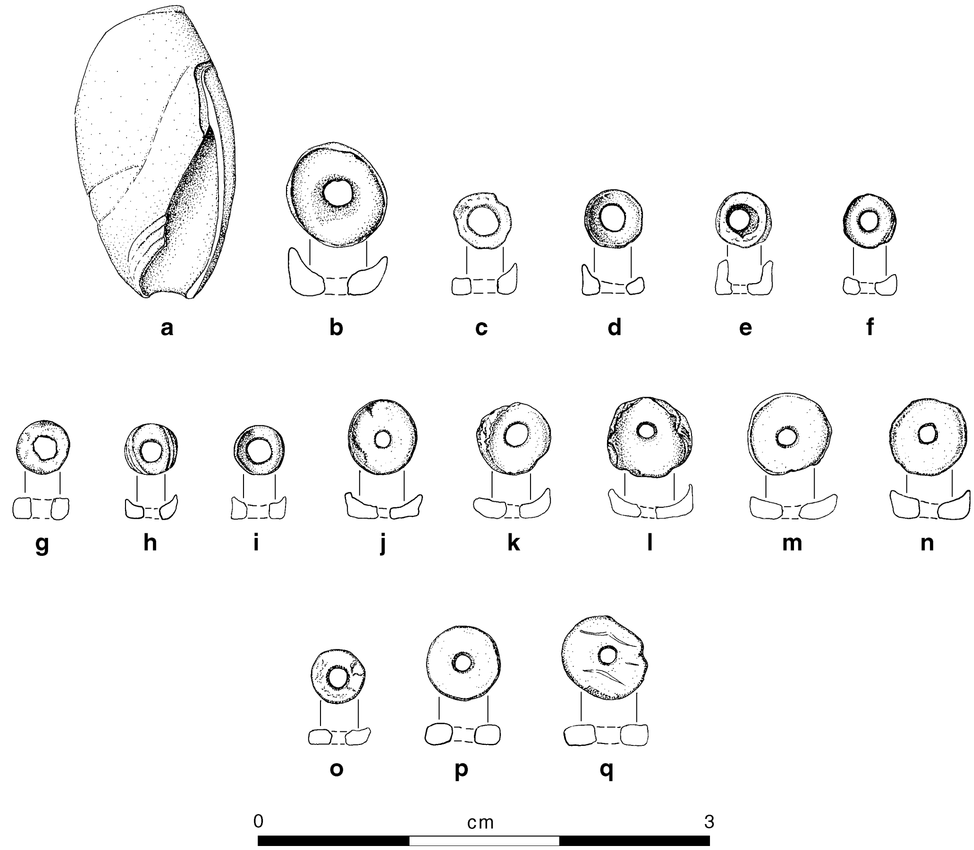


Figure 72. ***Olivella biplicata*** **shell beads from LAN-211/H: (a) large spire removed; (b) thin-lipped oval; (c–d) cup; (e–f) cup with diagonal incising; (g–i) tiny saucer; (j) ground disk; (k) semiground disk; (l–n) rough disk.** ***Haliotis rufescens*** **disks: (o–q).**

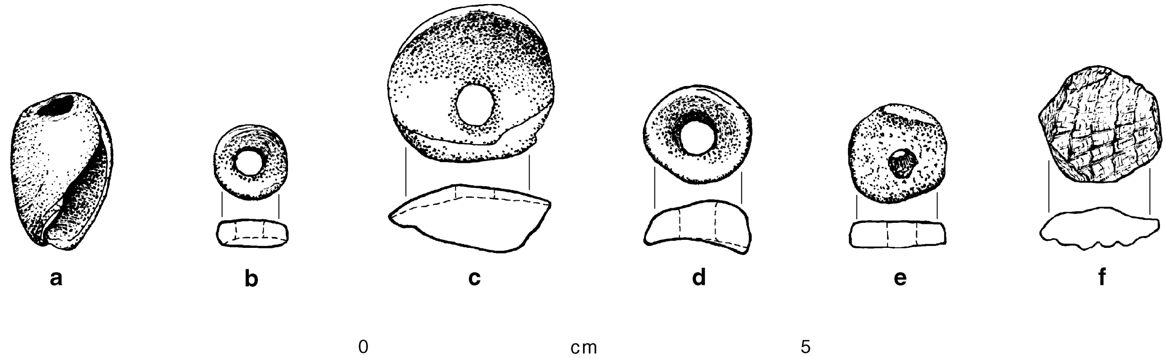


Figure 73. ***Olivella biplicata*** **shell beads from LAN-1932/H: (a) oblique spire removed; (b) thin-lipped round; (c) full lipped; (d) cup. Unidentified shell: (e–f) rough disks.**

conical (drilled from the ventral surface) to biconical, and their diameters run from 1.2 to 1.6 mm, with an average of 1.4 mm. Asphaltum stains were observed on one example from LAN-1932/H.

Disk beads (Type H), also manufactured from the walls of *Olivella* shells, are circular to square in outline. In cross section, the curvature of the internal and external surfaces is the same, and the thickness does not vary. The external margin or periphery of this bead varies from chipped to ground, passing through six graduations as defined by King (1991:8-14). Disk beads are divided into subcategories: well-ground, ground mostly ground, partly ground, rough-ground and chipped, based on degree of finishing. Ground disk beads (Type H) belonging to the last two gradation categories (ground and well-ground) can be difficult to distinguish from wall disk beads (Type J) and saucer beads (Type G) that have completely ground peripheries. Hole diameter and shape are the main criteria for separating these varieties of ground disk beads from wall disks and saucers. Ground disk beads have holes smaller than 1.2 mm, usually have a straight bore, and often have a punched dorsal side. Holes such as these are produced by using metal needles to drill them. By contrast, wall disk beads usually have biconical or conical holes larger than 1.2 mm.

Another important variety of *Olivella* cut-wall bead is the wall disk bead (Type J). This type of bead is made from the wall of the shell, is circular to oval in outline, and usually has a well-ground periphery. In cross section, the curvatures of the internal and external surfaces are the same. The single Type J bead, a wall disk bead, from LAN-211/H is a fragment but is larger overall than the two wall disk beads found at LAN-1932/H (Figure 73e–f). From LAN-211/H, SRI recovered 11 Type H disk beads: 2 ground disk beads, one of which is shown in Figure 72j, 3 mostly ground disks, one of which is illustrated in Figure 72k, and 6 rough disk beads; three are shown in Figures 72l–n. A single mostly ground disk bead was recovered from LAN-1932/H.

One of the two abraded wall disk beads from LAN-1932/H was made from the thin wall area of an *O. biplicata* shell. The dorsal side has been abraded almost through the shell and the last bit was punched through from the ventral side to form an irregular, almost triangular hole about 1.4 mm in diameter. This bead was recovered from Unit 13, Level 2, the same unit and level that produced an *Olivella* spire-removed diagonal (Type A2a) bead. This rare type of bead dates to the period from A.D. 1550 to 1780.

Other Shell Beads

The two *Mytilus* disk beads recovered from LAN-1932/H are made from cream-colored mussel shells, most likely those of the California mussel *(M. californianus).* Without seeing an interior cross section of the bead, it is often difficult to distinguish cream-colored *Mytilus* disks from pale pink red abalone *(Haliotis rufescens)* epidermis disks. These specimens are circular to slightly irregular in outline, flat in cross section, and their dorsal and ventral faces are well ground.

Beads made from *Mytilus* shell were usually combined on strings, named *'ikimis,* with white *Olivella* or clam-shell beads (Gibson 1976:90). At the Medea Creek Cemetery site (LAN-243C), *Mytilus* disks and cylinders were found in the western and central areas of the cemetery. They appear to have been used in ritual exchanges between political leaders and chiefs (King 1974:89).

The three *H. rufescens* epidermis disk beads recovered from LAN-211/H are well ground, circular in outline, and pale pink in color. This type of bead is made from the outer epidermis of the shell (Figures 72o–q). At Malibu (LAN-264) and Medea Creek (LAN-243C), these beads were found in the central and west areas of the cemetery. They were sometimes strung with clam and *Mytilus* disks to form necklaces used by chiefs and other high-status people (Gibson 1976:90; King 1974:87). The *H. rufescens* epidermis disks, *Mytilus* disks, clam, and possible stone disks could all have been used as jewelry or ornaments for special occasions.

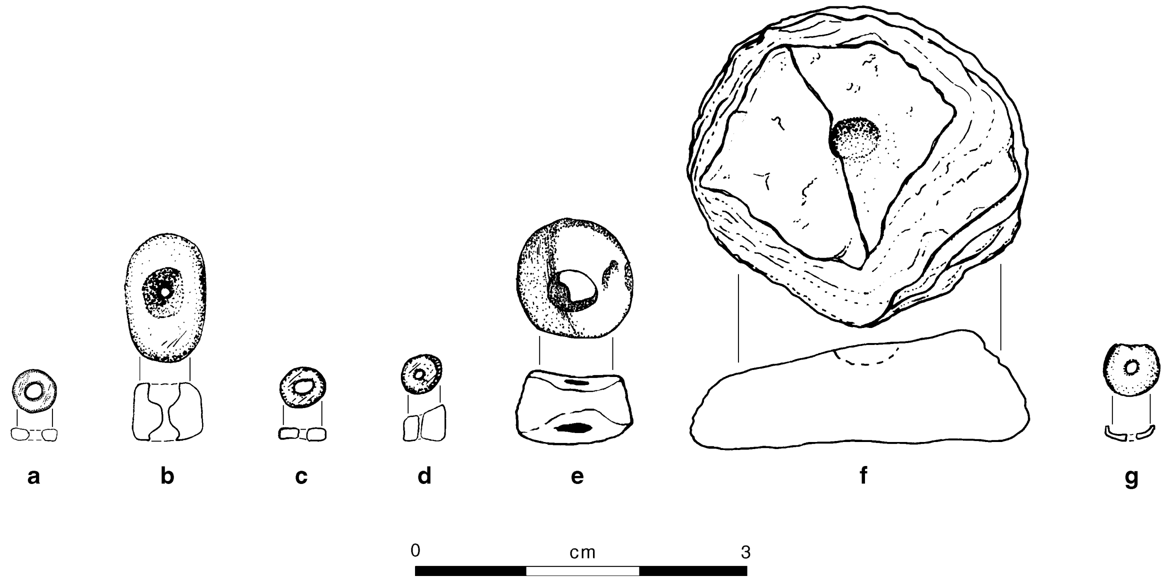


Figure 74. Stone and bone beads from LAN-211/H and LAN-1932/H: (a–d) steatite beads from LAN-211/H; (e) serpentine bead from LAN-1932/H; (f) schist disk from LAN-211/H; (g) bone bead from LAN-211/H.

Stone Beads

Four stone beads (Figure 74a–d) and one stone disk were found at LAN-211/H; a single serpentine bead was recovered from LAN-1932/H (Figure 74e). Stone beads were usually made by cutting or grinding down pieces of stone to shape, which were then perforated. In many cases, hard stone beads were finished by polishing using fine-grained abrasives. The stages of manufacture of barrel-type stone beads were essentially the same as those used to make cylinder and tubular shell beads. Most of the materials used for stone beads such as talc schists, chlorite schists, and reddish brown and yellow burned shale are softer than the shells used to make beads. Some of the harder materials used include serpentine, serpentine-jadeite, and chert (King 1981:168–171). The single dark serpentine bead recovered from LAN-1932/H measures 9.0 mm wide by 5.6 mm thick, and has an interior perforation of 2.3 mm. It is nearly complete, with only a small chip missing from one surface, which may have occurred during manufacture.

The stone beads from LAN-211/H were carved from Santa Catalina Island steatite, are centrally perforated, and represent two separate bead types. One of the four specimens, a dark gray steatite bead in cylindrical barrel-style shape (Figure 74d), has a rating greater than 3 on the Mohs hardness scale.

In addition to these four steatite beads, a rough stone disk made from gray schist was found at LAN-211/H (Figure 74f). Both faces of this disk have been lightly drilled, creating a small cup-like mark on each surface. The two drill marks were offset from each other and would not have joined if drilling had continued. This artifact could be an abandoned attempt to create a schist disk bead; such beads were found in large numbers at LAN-264 (Gibson 1975:113). The identification of this specimen remains uncertain, however; the drilled depressions give this artifact the appearance of a spindle whorl.

Bone Beads

Most bone beads and tubes were made by cutting segments of the shafts of long bones of small mammals (King 1981:168–169). Six bone beads were recovered during this project, five from LAN-1932/H and one from LAN-211/H (Table 27). Considering worked bone as a whole, beads are the dominant artifact form. Three of the beads from LAN-1932/H are very small and very roughly shaped pieces, exhibiting little evidence of grinding. It appears that these were simply cut off from a small mammal long bone, with the marrow cavity minimally worked for stringing. The other two beads are larger in size, thoroughly polished, and exhibit signs of mineral staining. One of the specimens from LAN-1932/H is roughly barrel shaped while the other is more tubular in shape. The single specimen from LAN-211/H was roughly concave in cross section and drilled with a metal needle (Figure 74g).

Glass Beads

SRI recovered 21 glass beads from these two sites: 20 from LAN-211/H and 1 from LAN-1932/H. Of these, 20 were cane beads and 1 from LAN-211/H was wire wound.

Table 27. Stone, Bone, and Glass Beads from LAN-211/H and LAN-1932/H

Manufacture Method, by Material	Description	Gibson Type	LAN-211/H (n)	LAN-1932/H (n)	Figure
Stone					
Abraded	dark steatite		4	—	74a–d
Ground	black serpentine		—	1	74e
Chipped, abraded	grey schist disc		1	—	74f
Bone					
Well shaped	mammal bone shaft	EE1	—	2	
Roughly shaped	rodent bone shaft		1	5	74g
Glass					
Cane	cobalt blue	C1a	5	—	75a–c
Cane	copper blue	C2a	4	—	75d–e
Cane	green	C3a	7	1	75f–g
Cane	clear	C5a	1	—	75h
Cane	translucent red with green core	C6a	2	—	75i–j
Wire wound	red	W6e	1	—	75k
Total			26	9	

Cane Beads

Six types of glass cane beads are commonly found in historical-period sites in southern California; all types were recovered from excavations at the San Buenaventura Mission (Gibson 1976; King 1990a; King and Gibson 1972). Five of these types were recovered from LAN-211/H and LAN-1932/H: cobalt blue (Figure 75a–c), copper blue (Figure 75d–e), green (Figure 75f–g), clear (Figure 75h), and translucent red with green core (Figure 75i–j).

Cane beads are made by snapping long tubes of glass and tumbling the segments in drums of hot sand to produce an oblate spheroid shape with rounded ends. To create red cane beads, for example, an oblate spheroid bead was made by taking a colorless cane and rolling it in brick-red molten glass to give the clear glass core a thin coating of red color. Then the cane was cut and tumbled. The single clear example (from LAN-211/H) represents the same manufacturing technique as other cane beds except that no coloring agent was added to the glass. These beads were manufactured in Venice, Italy, and purchased by the Spanish for their commerce in the New World. The construction of the Santa Barbara Presidio was accomplished in part by paying the Chumash for their labor with glass beads (Geiger 1965:14). All specimens recovered at LAN-211/H and LAN-1932/H exhibit a dark patina from weathering.

Wire-Wound Beads

Wire wound beads are manufactured by drawing a rod of hot glass, heating one end and wrapping it around a copper or iron wire, after which the glass is cut away from the rod. The glass ring on the wire is then heated until it softens to become round or oval in shape. The wire is set aside to cool, after which the glass bead slides off (Gibson 1976:104).

Wire-wound beads are a relatively rare type in archaeological contexts. They were not recorded at Malibu (LAN-264) and were assigned to a post–A.D. 1816 period or later at VEN-87 (Gibson 1976:122; King 1990b; King and Gibson 1972). The single specimen from LAN-211/H was the only example of a wire wound glass bead submitted for analysis. The bead has been broken in half and is translucent red in color; small bubbles in the glass are not distorted (Figure 75k).

Miscellaneous Shell Artifacts

A single curved fragment of nacreous *Haliotis* shell from LAN-211/H may represent the midsection of a body fragment of a circular shell fishhook. The fragment is 16.1 mm long and 3.1 mm thick (Figure 76a). Shell fishhooks generally occur in the Intermediate period by 2150 B.P. in southern California (King 1990b:231; Koerper et al. 1995). Some confusion has occurred about the antiquity of circular shell fishhooks in southern California. This largely stems from the work of Orr (1968:185) on Santa Rosa Island, who depicted two long, grooved, shank shell fishhooks from a highland site found in a radiocarbon-dated context of about 5000 B.P. These data were referenced by Strudwick (1985) in his study of circular fishhooks. However, the large volume of data from many Early period sites in southern California sites does not support this early date for large shell fishhooks. The earliest date for small circular (simple "J" shape, Strudwick types 1b and 2) shell fishhooks is about 2500 B.P., obtained at the Malibu site (LAN-264). The shift to larger fishhooks occurred after 2000 B.P. The hook style with short to long grooves on the proximal end (Strudwick types 1a and 1b) dates from about A.D. 900 to 1650 (King 1990b:232). Unfortunately the specimen from LAN-211/H is too fragmentary to type.

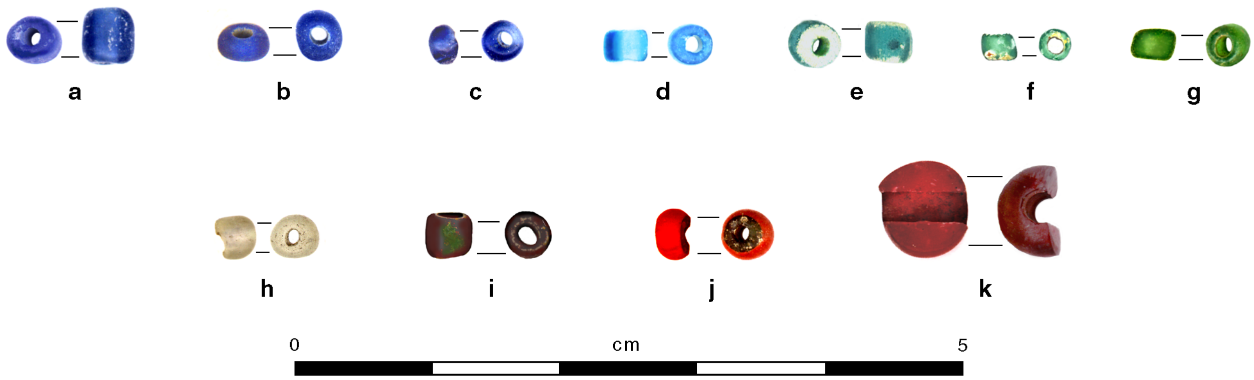


Figure 75. Glass beads from LAN-211/H: (a–c) cane, cobalt blue; (d–e) cane, copper blue; (f–g) cane, green; (h) cane, clear; (i–j) cane, translucent red with green core; (k) wire-wound, red.

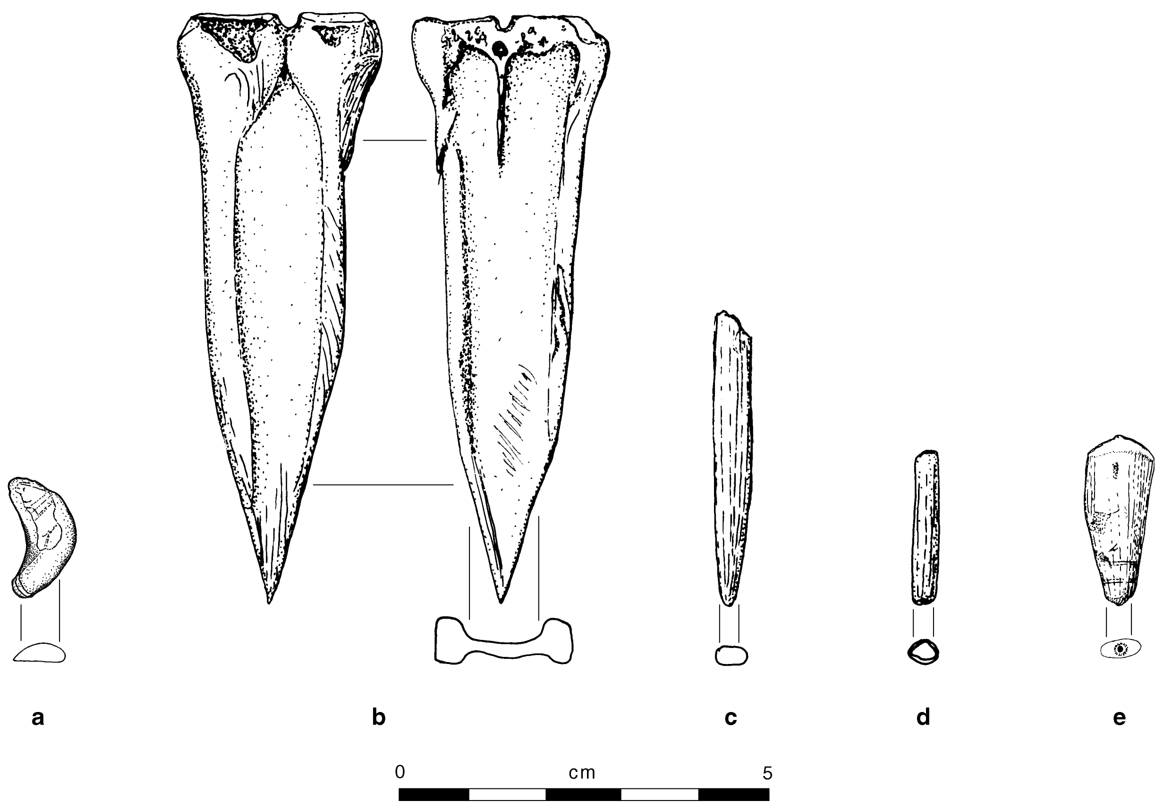


Figure 76. Miscellaneous shell and bone artifacts from LAN-211/H: (a) shell fishhook preform; (b) bone awl; (c) bone awl tip; (d) bone tube bead; (e) canid tooth pendant.

Four miscellaneous shell disks were recovered from LAN-1932/H. Three of these were white to cream colored; their color suggests either *Mytilus* or *Haliotis* shell but they appear harder than either of these two shell varieties. The edges of one specimen are chipped or weathered. The material of the remaining specimen from LAN-1932/H could not be identified. One circular disk of an unidentified species of shell was recovered from LAN-211/H. This disk is burnt gray and slightly weathered, and measures 8.8 mm in diameter and 1.6 mm thick.

A single small fragment of *Haliotis* shell with a lump of asphaltum on its ventral side was found at LAN-211/H and may be a fragment of an asphaltum container. It measures about 10 by 20 mm and does not exhibit any other modification. Whole abalone shells were often used to store asphaltum and other materials.

Worked Bone

The bone artifact inventory from LAN-211/H is very small. Five worked or possibly worked specimens were recovered, including two awls (one complete and one fragmentary), a single bone bead (discussed above), a bone tube, and one drilled canid tooth. Of the two awls, the largest and best preserved is very similar to Gifford's (1940) Type A1b2, and is made from the proximal portion of a deer metapodial (cannon bone) (Figure 76b). The proximal end of this artifact was partially drilled from one side to produce an eye. A second awl fragment, the distal portion of an awl (Figure 76c), is slightly weathered and heavily mineral stained. The material is mammal bone; element and species are unidentifiable.

A bone tube made from the long bone of a mammal, probably a rodent, was recovered from Unit 9 at LAN-211/H (Figure 76d). The tube was ground at both ends and may have been polished. A single canid canine tooth, split longitudinally, was also recovered from Unit 9 (Figure 76e). The split may have occurred after deposition, as teeth frequently split this way in the ground. Some minimal grinding was observed on the enamel surface. The bone awls were probably used in the preparation of basketry and possibly clothing, whereas the bone bead, the tube, and perhaps the tooth may have been used in decoration.

Five bone beads, one bone awl, one bone gorge or awl tip fragment, and two unidentified worked bone fragments were recovered from LAN-1932/H. The bone beads have been discussed above. The bone awl fragment, a medial fragment with the tip missing, was probably manufactured from a deer metapodial (cannon bone). This specimen bears a remarkable resemblance in both size and shape to another bone tool recovered from nearby LAN-60; this would suggest minimally that some of the same sorts of activities occurred at both sites. The gorge or awl tip fragment is a simple bone point with minimal shaping.

The two unidentified bone specimens appear to have been worked. One is clearly polished on the cortical surface but is so fragmentary that neither its form nor its function can be inferred. The second specimen may or may not be worked. It is notable for the presence of approximately 12 striations perpendicular to the axis of the bone shaft. These may be cut marks, although the size of the bone in question makes this questionable; the specimen is small enough to suggest an animal no larger than a cottontail rabbit, and cut marks are virtually absent in the remainder of the analyzed faunal collection. The origin of these marks remains unclear.

Discussion

Bead data from LAN-211/H and LAN-1932/H clearly indicate occupation of the Ballona during the protohistoric period and into the early historical period. Results of a spatial analysis of the distribution of shell and glass beads at LAN-211/H and a careful search for evidence of shell artifact manufacture are presented below. We conclude with a brief comparison of bead data from bluff-top and lowland sites, showing that a distinct pattern prevails within the Ballona.

Distribution of Temporally Sensitive Beads within LAN-211/H

The bead sample from LAN-211/H consisted of 37 shell, 20 glass, 4 stone, and 1 bone bead. The date range for the shell beads, ca. A.D. 1500–1800, clearly places this site within the protohistoric period. One wire-wound glass bead may date to A.D. 1816 or later, indicating a temporal overlap into the early historical period.

The distribution of selected bead types across the site was examined. Test units at LAN-211/H were clustered into three groups: Units 1–8, Unit 9, and Unit 11 (Unit 10 was excluded from the analysis as no beads were found in it). These three groupings are all approximately 20–30 m apart. When a comparison is made of these three groups, a definite concentration of selected beads types is apparent.

Taken collectively, Units 1–8 were found to contain 12 glass cane beads and no shell beads. These beads were distributed from the surface to as deep as 90 cm (Level 9) in an area of the site thought to be disturbed. It is unusual for only glass beads to occur in an area. It suggests a marked difference between this part of the site and the other two areas where shell beads were recovered. Unit 11, at the far eastern end of the site, contained only three *Olivella* semiground wall disks, which probably date to the 1790s. No earlier types of shell beads or later glass beads were recovered from this area.

The four test units in Unit 9 produced the largest number of bead types, including glass cane beads, stone and bone beads, rough disks, tiny saucers, spire-removed beads, cups, semiground disks, wall disks, and full-lipped beads. The temporally diagnostic beads (rough disks, ground needle-drilled wall disks, semiground and full lipped) from this unit suggest use only during the protohistoric and early historical periods from A.D. 1650 to 1780. The nine *Olivella* cup beads (four of which are incised) and *Haliotis* disks also found in Unit 9 could also date to this period. None of the thin-lipped round beads and only one thin-lipped oval *Olivella* beads were recovered from LAN-211/H; these types precede the full-lipped type. These data suggest very little occupation, if any, prior to 1650 at Unit 9 and none in the other two areas.

Temporally sensitive beads from LAN-211/H and LAN-1932/H suggest two different occupations during the Intermediate and protohistoric to early historical periods. The earliest date range, between 3,400 and 2,200 years B.P., is represented by a single *Olivella* bead, a diagonally spire-ground Type A2a bead from Unit 13, LAN-1932/H. No other definite Intermediate period beads were found; the only other possible candidate is an *Olivella* wall disk with an abraded hole also recovered from Unit 13, LAN-1932/H. A unique type, it may also date to the Intermediate period, but this is uncertain. A few very weathered, fragmentary *Olivella* wall disks were found that could be Intermediate period saucers, but they were found in association with Late period beads. Even if complete, these disks are in the size range that could also be Late period types.

As indicated by the date ranges for shell beads from LAN-211/H and LAN-1932/H (see Table 26), both sites were occupied during the protohistoric and historical periods between ca. A.D. 1550 and 1800. At this time, native culture in southern California was experiencing rapid and profound change; the resultant social upheaval was reflected in their beads and ornaments. Manufacturing techniques and choice of raw materials changed abruptly as trade networks were disrupted. The introduction of glass beads significantly altered the traditional bead-making and distribution systems for southern California's indigenous peoples.

Bead and Ornament Manufacture at LAN-211/H and LAN-1932/H

Based on bead data, reliable evidence of *Olivella* bead manufacture was absent from the samples at both LAN-211/H and LAN-1932/H, as was evidence of abalone ornament or fishhook manufacture. LAN-211/H contained a higher frequency of *Haliotis* fragments than was observed at LAN-1932/H; 175 pieces of abalone (*Haliotis* sp.) were collected and examined for evidence of modification to produce shell beads, ornaments, or fishhooks. The following observations were made:

1. Fragments were often from the apex, the thickest portion of the shell, or from the thicker rim of the shell.

2. Fragments were often thin pieces of epidermis, usually a weathered green or dark color.

3. Only about 10 of the 175 fragments were from *H. rufescens*; the others were probably from other *Haliotis* species, such as *H. cracherodii* or *H. fulgens.*

4. Eleven pieces were weathered and chalky with rounded edges, often nacreous.

5. All remaining pieces had been recently broken. A few appeared to have ground surfaces, but under the microscope the surfaces were irregular, not abraded.

Based on these observations, no evidence was noted of *Haliotis* shell being made into beads, ornaments, or fishhooks at LAN-211/H. Most of the epidermis fragments examined were not *H. rufescens,* which is typically used for beads in the Late period.

Three finished *H. rufescens* epidermis disk beads were recovered from LAN-211/H. It is possible that these disks, along with the *Mytilus* disks and white shell and stone disks, were used as jewelry worn by high-status people on special occasions. Although the four incised *Olivella* cups are types typically found in areas of sites occupied by high-status people, most of the rest of the beads from both sites appear to represent all socioeconomic classes.

Site Comparison

A comparison of identified beads from selected sites within the Ballona and Los Angeles Basin highlights an interesting pattern in their distribution by material type (Table 28). Glass beads appear in small numbers on the bluff tops and in the lowlands; however, a distinct pattern emerges when data on shell and stone beads are compared. Van Horn and his associates recovered almost no shell beads during their bluff-top excavations but did find hundreds of stone beads (Van Horn 1987; Van Horn and White 1983). Bone beads also are more numerous on the bluffs than below.

This result is reversed at lowland sites such as LAN-211/H and LAN-1932/H, which have far greater numbers of shell beads than stone or bone. At LAN-47, the Admiralty site in Marina del Rey at the northern edge of the Ballona lowlands, more than 96 percent of beads recovered were made from shell (Troncone and Altschul 1992). Very similar numbers were seen at the contemporaneous Late period site of Yaangna (LAN-1575/H), the Native American community located at the Los Angeles Pueblo

Table 28. Beads from Sites in the Ballona

Bead Type	Bluff-Top Sites			Inland	Lowland Sites			
	LAN-59	LAN-61A, B, C	LAN-63	LAN-1575/H [a]	LAN-47	LAN-211/H	LAN-1932/H	LAN-2676
Olivella	few	—	6	675	322	34	36	143
Other shell	rare	—	—	28	138	3	2	8
Stone	75+	136	416	7	10	4	1	3
Bone	3	94	34	—	7	1	5	—
Glass	—	10	3	—	—	20	1	—

[a] Yaangna

(Denardo 1999:88). Of the beads recovered during excavations there, nearly 95 percent consisted of shell beads.

The most parsimonious explanation is that the numbers of stone and bone versus shell beads simply reflect the difference in the relative dates of occupation of bluff-top sites versus lowland sites. All four bluff-top sites were occupied during the Intermediate period, whereas the lowland sites date to the Late and protohistoric periods.

CHAPTER 10

Stone Artifacts

E. Jane Rosenthal and Marc W. Hintzman

In this chapter, we present results of the analysis of lithic artifacts recovered from SRI's excavations at LAN-211/H and LAN-2769, and some of the data from LAN-1932/H. Our analysis focuses on LAN-211/H, whose 3,026 stone artifacts account for more than 97 percent of the 3,111 artifacts recovered from LAN-211/H and LAN-2769. We begin by providing the research context that guided the analysis of LAN-211/H, followed by a discussion of our analytical methods. We then present the results by material type, after which we conclude with a discussion of artifact distribution, tool production, and an analysis of the site's distinctive toolkit. The discussion of the stone artifacts recovered at LAN-2769 is much more descriptive. The results of the analysis are presented first, followed by general inferences of the kind allowed by small collections. Lithic artifacts from LAN-1932/H are presented in tabular form for comparison purposes only; their analysis will be presented in a future publication. For this chapter, Jane Rosenthal was responsible for artifact identifications and analysis; descriptions of artifacts and material types were contributed by Marc Hintzman.

LAN-211/H

Testing at LAN-211/H recovered 3,026 stone artifacts. All specimens were analyzed. Table 29 presents the artifact classes recovered.

The stone artifact collection from LAN-211/H represents a flaked and ground stone tool kit of which a substantial portion consists of smaller edge-modified flakes and bifacially worked hunting gear. Ground stone food-processing and cooking equipment was used and, as it broke, was discarded at the site. The presence of numerous tarring pebbles suggests that canteens and other baskets were woven and waterproofed locally. Four stone beads and one stone disc (described and discussed in Chapter 9) indicate ornamentation. These artifacts imply that a group resided at LAN-211/H long enough to accumulate specialized tools and ornaments at the site

Radiocarbon and bead dating indicate that the later component of this site dates to the period between circa A.D. 1600 and 1825 (see Chapters 6 and 9). Temporally diagnostic stone projectile points found at the site support this date range. The stone artifact collection from LAN-211/H represents a rare opportunity to examine the use of stone artifacts during this poorly understood period of rapid change for Native American cultures of southern California.

Research Context

In lithic studies, technological organization is used as a theoretical concept to focus on strategies for the procurement, manufacture, use, transport, and discard of lithic materials and tools (Nelson 1991:57). These strategies are applied by people to the problems they encounter in their physical, biological, and

Table 29. Distribution of Stone Artifact Classes from LAN-211/H

Location	Projectile Point	Biface	Core	Other Flaked Stone Tools [a]	Hammer Stone	Ground Stone	Tarring Pebble	Debitage [b]	Total
Unit 1	—	1	—	—	—	—	1	53	55
Unit 2	—	—	—	—	—	—	—	71	71
Unit 3	1	3	—	7	1	—	6	400	418
Unit 4	2	6	1	3	1	5	4	595	617
Unit 5	—	2	1	2	—	1	4	97	107
Unit 6	1	—	—	4	—	—	4	110	119
Unit 7	—	3	—	6	1	1	1	91	103
Unit 8	1	2	—	2	—	1	3	150	159
Unit 9	4	11	6	24	1	8	22	1,100	1,176
Unit 10	1	—	—	2	—	—	1	95	99
Unit 11	1	—	4	1	—	—	2	80	88
Trench 11	—	—	1	2	—	5	1	5	14
Total	11	28	13	53	4	21	49	2,847	3,026

[a] Includes scrapers, burin spalls, and edge-modified flakes
[b] Includes flakes, shatter, and tested cobbles

social environments (Carr 1994a:1). Lithic studies also typically seek information about the method of reduction used to produce stone tools, how such tools were used, and details of their abandonment (Flenniken and Raymond 1986). Toward these goals, technological and morphological attributes of the lithic artifacts were used to identify the behavior behind reduction strategies and tool function.

At LAN-211/H, we are primarily interested in how native people coped with the social, economic, and ecological problems created by Hispanic colonization and missionization and the ways in which their adaptation is reflected by changes in technological organization. Our expectations regarding technological change are guided by work plan developed for LAN-211/H (Grenda et al. 1999), as well as by propositions offered by Deetz (1963:180–182), Bamforth (1990a, 1993), and Allen (1998).

James Deetz was one of the first researchers to highlight the high degree of technological continuity and slow pace of replacement in California mission artifacts. Deetz observed that although activities introduced by the Hispanic missionaries and settlers (e.g., tanning hides, farming, milling) were generally accomplished using metal tools, stone or bone tools were retained for use in other domestic tasks, such as wild-game butchering or seed grinding. New materials, such as iron axes and vesicular basalt metates, were slow to be adopted in domestic contexts. At Mission La Purísima Concepción, Deetz's excavations yielded just four stone flakes in the tanning vat area but numerous mortars, pestles, comals, and basketry impressions, as well as Mexican manos and metates, in the neophyte quarters (Deetz 1963:180–182).

Deetz (1963:186) suggested that the broad trend in the selective retention or abandonment of various aspects of aboriginal technology was related to gender. Allen (1998:68) expanded this hypothesis by proposing that the mission division of labor and assignment of tasks expanded male roles but restricted those of females. Although native women continued some shellfish- and plant-collecting using traditional methods, when neophytes were processing European foods and materials, they employed nontraditional stone or metal tools. Many neophyte quarters have produced metates and manos of Mexican vesicular stone (Allen 1998; Deetz 1963; Greenwood 1976; Hoover and Costello 1985). By contrast, choice of tools for native men engaged in activities such as hunting or fishing was not proscribed. For such discretionary activities, traditional techniques and tools were used.

Bamforth (1993) agreed with Deetz and carried his ideas a step further in the analysis of the early-historical-period stone artifacts from Helo,' a village at Goleta Slough. Noting that metal tools were more effective for certain tasks, Bamforth suggested that the greater efficiency of new tools prompted the replacement of traditional technologies in economically important tasks. In labor-intensive activities such as woodworking, stone tools were almost immediately replaced by metal axes, saws, planes, and the like. In contrast, stone-tool use persisted for less labor-intensive tasks particularly if their economic importance was declining (Bamforth 1993:67–69).

Bamforth (1993) suggested that some technological change resulted from the general disruption of indigenous society at contact. Metal or glass replaced obsidian or fused shale because the exchange system that delivered these desired commodities dissolved as Native Americans were removed to the missions. Knowledge about the sources and use of these commodities disappeared, and often there was insufficient time to obtain or work these special materials.

We feel these authors have perceptively described the effects of missionization on stone tool technology in the early historical period. Our analysis of stone tools from LAN-211/H supports the assertion that foraging and hunting with stone tools remained important enough to persist well past the introduction of metal. To some extent, the persistence occurred with mission support, as traditional food-gathering strategies enabled native people to supplement their diet and buffered them from crop failure. When food reserves were exhausted in the early years of the missions, the missionaries out of necessity encouraged a temporary return to native practices (Coombs and Plog 1977; Englehardt 1927a:36; Hoover 1989).

These discussions are important in framing the study of LAN-211/H. Archaeologists have researched the replacement of traditional technologies at the missions, where neophytes were repeatedly exposed to the new materials. But what about in the settlements just outside the reach of the missions? Were "gentiles," or nonmissionized Native Americans, as quick to adopt the more efficient technology? Was post-contact indigenous technology in rapid decline anyway, for other, more complex social reasons not related to efficiency?

To monitor change in technological organization, we must control for time. We suspect that the pace of technological change was gradual in the prehistoric and protohistoric periods, then extremely rapid with the establishment of the missions. Our ability to separate the Late period component from the protohistoric and early-historical-period component is central to our use of the LAN-211/H stone artifact collection to address this topic. Ideally, absolute dating, along with relative dates provided by beads and other diagnostic artifacts, provides temporal control of these components.

Methods

All carefully formed, deliberately modified, or heavily edge-damaged artifacts from LAN-211/H and LAN-2769 were analyzed. The analysis identified both morphological and functional artifact categories. Morphological categories combined attributes of manufacture and shape, whereas functional categories recognized known or presumed uses. Our methods follow those previously used in the PVAHP (see Altschul et al. 1999). Key points of the analysis are described below.

Formal tools such as points, manos, pestles, scrapers, and bifaces, as well as flaked artifacts with either invasive or margin retouch were included in the tool category. Flakes with no deliberate retouch but with rounded, smoothed, or crushed margins were considered to be probable tools. We recorded striking-platform attributes (natural, single-facet, and multifacet), and the exterior (dorsal) flake surface (completely cortical, greater than 50 percent cortical, less than 50 percent cortical, and noncortical) for all tools. We also noted what portion of the artifact (proximal, distal) was recovered. Flake edge-preparation attributes such as the location and method of retouching or damage were observed. For ground stone, we noted the intensity of use and the number of surfaces used. When possible we measured maximum dimensions oriented from the striking platform, including length (perpendicular to the platform), width (parallel to the platform from margin to margin), and thickness (from the bulbar to exterior face). Core platform and flake-removal direction attributes were described.

For the unmodified flaked stone, including the debitage, we recorded the platform, amount of cortex, terminus attributes, and the reduction system (flake-core, bifacial, or bipolar reduction). A platform-to-terminus dimension was measured for each complete flake to indicate standard size; among fragmentary, nondiagnostic flakes, however, only the maximum size, in 5-mm intervals, was noted.

Results

We summarize tool categories by grouping artifact types of similar manufacture, provide information about quantity, predominant materials, type, and size, and describe where the tools were found. Next, information about core reduction and debitage is presented. We conclude by describing material procurement, manufacture, use, repair, reuse, and discard. Our analysis then addresses questions about observed changes in the tool kit to demonstrate the research potential of the stone collection.

Flaked Stone Tools

Flaked stone artifacts produced by either percussion or pressure method were common (n = 2,956). We identified 111 whole and fragmentary flaked stone tools (Table 30) The flaked stone collection suggests a number of activities, including hunting, butchering, woodworking, and tool manufacture and maintenance.

Points and Bifaces

Just over 23 percent of the stone tools found at LAN-211/H were either projectile points or bifaces (see Tables 29 and 30). Points were made by careful bifacial pressure flaking of small (30–40-mm) flake blanks. Point blanks were first worked on one face, then on the other. The hafting area was then thinned or shaped to form one of three haft elements: a straight, oval, or concave base. For the purposes of this analysis, bifaces are defined as artifacts that are generally lenticular in cross section, with flake scares on both sides, and lacking evidence of hafting or extensive modification from use. This definition includes the large “rough-out” bifacial flake cores, preforms for projectile points and knives, and fragments of the distal ends of weapons. The definition excludes projectile points that retain hafting elements (bases, notches, tangs), and drills.

Complete points (Figure 77a–k) and bifaces (Figure 78a–h) from LAN-211/H were almost identical in size (mean length of 21 mm), suggesting that many bifaces were preforms lacking only the final finishing of their bases. Proximal (base) and distal (tip) sections of bifaces showed bending fractures, which can be produced during production or use or can result from postdepositional damage. Chert dominates the collection, but both chalcedony and fused shale are present in small quantities.

Of the 39 points and biface preforms SRI recovered, nine are Cottonwood Triangular arrow points. This point type, which is found at late-prehistoric and historical-period sites throughout southern California, changes form and decreases in size over time (Koerper, Schroth, Mason, and Peterson 1996). Thomas (1981) indicated Cottonwood Triangular points are always less than 30 mm long. The mean length of the points from LAN-211/H is 19 mm; therefore, these specimens are smaller Cottonwood points and, following Koerper, indicate relatively late manufacture. Unit 9 contained four of these points and 11 bifaces, the largest quantity found in any unit.

Table 30. Flaked Stone Artifacts from LAN-211/H, by Material Type

Material	Projectile Point	Biface	Core	Scraper	Burin Spall	Modified Flake	Hammer Stone	Tested Cobble	Unmodified Flake	Shatter	Total
Andesite	—	—	1	—	—	4	1	—	120	4	130
Basalt	—	—	2	—	—	16	—	—	231	11	260
Chalcedony	—	4	1	—	—	3	—	—	264	10	282
Chert	10	24	9	—	3	21	—	—	1,921	164	2,152
Fused shale	1	—	—	—	—	—	—	—	1	—	2
Glass	—	—	—	—	—	1	—	—	2	—	3
Metasedimentary	—	—	—	—	—	1	—	—	5	—	6
Metavolcanic	—	—	—	—	—	—	—	1	9	—	10
Obsidian	—	—	—	—	—	—	—	—	7	2	9
Quartz	—	—	—	—	—	1	—	—	4	—	5
Quartzite	—	—	—	1	—	—	2	1	60	1	65
Shale	—	—	—	—	—	1	—	—	5	—	6
Other	—	—	—	—	—	1	1	—	19	5	26
Total	11	28	13	1	3	49	4	2	2,648	197	2,956

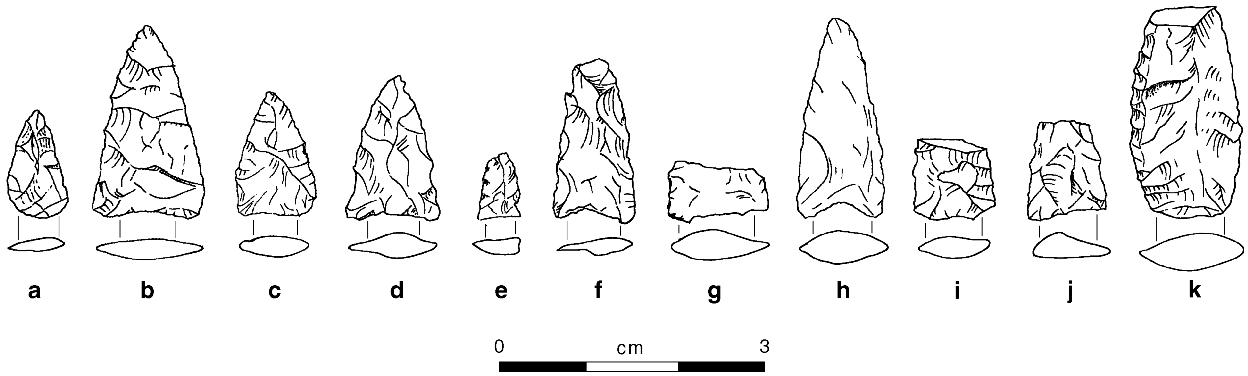


Figure 77. Projectile points from LAN-211/H:
(a–d) whole chert points; (e–g) chert point fragments; (h) whole chert Cottonwood point;
(i–j) chert Cottonwood point fragments; (k) fused-shale point fragment.

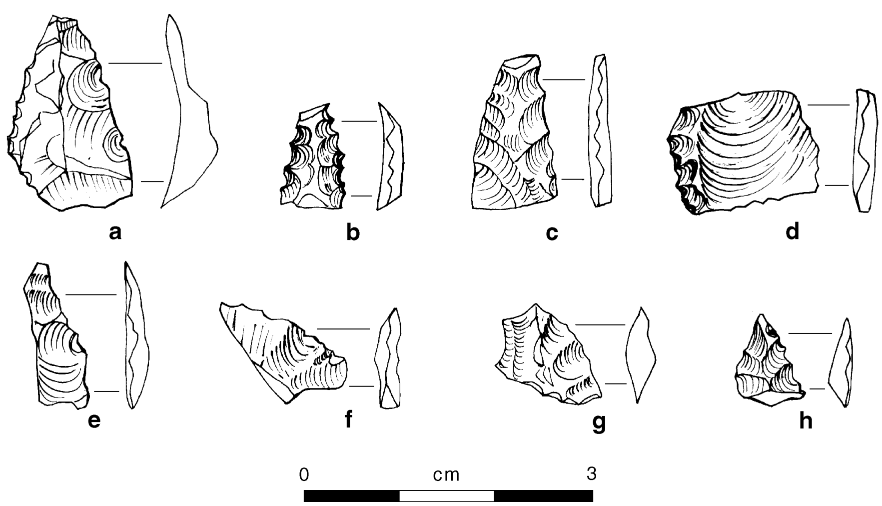


Figure 78. Bifaces from LAN-211/H:
(a–h) chert bifaces and biface fragments.

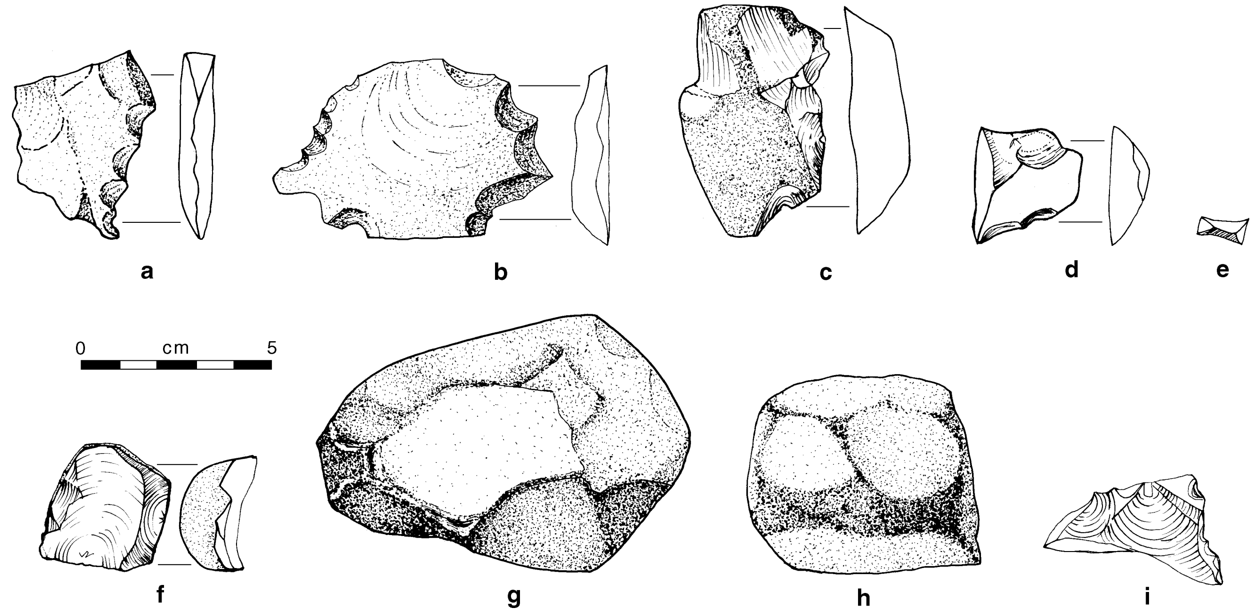


Figure 79. Percussion artifacts from LAN-211/H: (a) quartzite scraper; (b–c) basalt modified flakes; (d) chert modified flake; (e) chert burin spall; (f) chert core; (g–h) quartzite hammer stones; (i) glass percussion-retouched flake.

The single Desert Side-notched point was found in Unit 6 and was made from a small chert flake pressure-flaked into a triangular form. The point is very small, barely 16 mm long, and is identical to Desert Side-notched types commonly found in late prehistoric and early-protohistoric-period sites throughout much of the California desert (Koerper, Schroth, Mason, and Peterson 1996).

The two projectile point types, Cottonwood and Desert Side-notched, are roughly contemporary (Thomas 1981:16–18). Their basal differences probably relate to either functional requirements or cultural tradition (Shott 1996:281–282). Socketing, as seen on Cottonwood points, might have made it easier to repair and shape a point in its foreshaft. Lashing with notches, as is typical for side-notched points, could have accommodated a variety of foreshaft diameters. Both point types are characteristic of the lightweight, penetrating projectiles that are associated with complex bows (Christenson 1986).

Scrapers and Edge-Modified Flakes

Two types of simple flake tools—scrapers and edge-modified flakes—were recovered from LAN-211/H (see Table 30). Scrapers, which are larger tools with steeper edge angles than modified flakes, are usually "all-purpose" tools used for working wood, bone, antler, or hides. These tools were used for more demanding tasks that required more rejuvenation than the tasks performed by modified flakes. At this site, SRI recovered a single scraper that had been made from a noncortical quartzite flake and exhibited deliberate, invasive, sequential retouch on its lateral margin (Figure 79a).

Edge-modified tools are a relatively diverse tool group that lack the diagnostic features of a specific tool type. The most common edge-modified tool category at LAN-211/H consisted of flakes made by retouching an exterior (dorsal) face on a lateral margin (Figure 79b–d). Retouching was apparently used to resharpen or rework the cutting edge. Chert (43 percent) and basalt (33 percent) flakes were preferred. The mean lengths (43 mm) and widths (44 mm) of these tools suggest that rectangular to square flakes were selected as blanks. These flakes were probably simple cutting tools. Three specimens had notches, so these might have functioned as spokeshaves to smooth wooden branches or reeds. Nearly half of all edge-modified tools were found in Unit 9 (see Table 29).

Burin Spalls

A burin spall is produced when a platform is prepared on a flake and then struck to remove a long sliver of the flake's sharp edge or margin. The initial detachment of a burin spall produces an element that is triangular in cross section; the removal of more spalls from the same margin results in spalls that are trapezoidal in cross section. Spalls are sometimes recycled and appear as drills or perforating tools. Burin spalls were commonly used as drill bits in the flaked stone industries of the Caspian, but the spalls were not used as blades because they lack the blades' cutting edge. We presume that the same pattern of use would be found in southern California. Distal portions of three chert burin spalls less than 15 mm long were found in Unit 3 (Figure 79e). One was slightly crushed; we could not establish if the damage occurred during production or use of the spall.

Cores

Cores are cobbles, pebbles, or rock nuclei that show evidence of deliberately detached flakes. Because core reduction produces flakes that can be used as blanks for tools, analysis of cores can discover whether there was a consistent or patterned approach to tool production, and which artifacts can be predicted to be present or missing from the site. Cores are the products of three distinct reduction strategies, which are identified from their platform and flake-removal attributes: bifacial, bipolar, and multidirectional. The bifacial and bipolar cores were specifically prepared to make specialized tools. The more generalized multidirectional cores produced flakes of various sizes that could either have been retouched or used without further modification.

At LAN-211/H, SRI found 13 fully formed cores (Figure 79f). Two tested cobbles, each with a single flake removed, were also found at the site; these are included with the totals for flaked stone implements (see Table 29). Most of the cores were either chert or basalt; one andesite and one chalcedony core were also found. Bifacial and multidirectional cores were most common (four each); there were two bipolar cores. Three fragmentary or "exhausted" cores could not be typed. Below, we describe how the cores were reduced and what tools and debitage resulted. Most of the cores were found in Units 9 and 11.

A bifacial core is a percussion-flaked tabular stone with a beveled platform (Whittaker 1994). The four bifacial cores found at LAN-211/H range in maximum dimension from 22.7 to 33.0 mm and differ from bifaces in that the cores are much thicker (6.6–11.2 mm) and could have produced flakes large enough for tools. Alternatively, these cores could have been knife blanks, or could have been further reduced by pressure flaking to make projectile points, or all of these could have happened in sequence.

A bipolar core is made by placing a small pebble or cobble on an anvil and striking it with a stone hammer; this technique produces flat flakes with cortical margins and leaves distinctive marks on the cores (Hayden 1980:3). These cores characteristically have crushed platforms, flake scars that extend the length of the core, and show pronounced concentric rings of force, although a core face may be flat if shearing occurred. Bipolar reduction also produces split-end pebbles and large quantities of shatter, the result of trying to initiate fractures. One of the two bipolar cores found at LAN-211/H, made from chert, had both a sheared face and crushed platforms. This small core, just 20.0 by 19.7 mm, produced flat tool blanks, deduced from its sheared face. Only two bipolar flakes and three burin spalls were recovered. Much of the chert shatter in the collection might also have resulted from bipolar reduction, as will be discussed in the debitage results.

Multidirectional cores are worked in an expedient manner from several platforms. Flakes are struck from prepared platforms, negative flake scars, or cortical surfaces. The goal is to create large flakes and maximize the size of the finished tool. Blanks could be used immediately or further shaped by pressure flaking. Of the four multidirectional cores found, two were made from basalt.

Hammer Stones

A hammer stone is used for the percussion reduction of cores, percussion production of tools, and whenever else a hard percussor is needed. Hammer stones are identified by battering that results from striking two stones together repeatedly (Rondeau 1995). Hammer stones that were used for making or repairing flaked stone tools are usually round or oval fist-sized cobbles with rounded margins and battering on the ends or edges. Although less frequently identified, hammer stones also were used for the production of ground stone tools (Schneider 1993). Four slightly cylindrical cobbles or pebbles were found that were battered on their ridges and poles (Figure 79g–h). This damage indicates that they were used for pounding, possibly for making or reshaping manos or metates or as flaked stone percussion hammers. Three of the four were heavily battered. Two were andesite and two were quartzite, and the largest dimension was 94 mm while the smallest was 56 mm. They were not concentrated in any one unit.

Debitage

Debitage consists of complete flakes which are diagnostic; included in this category are flake fragments or shatter; and tested material, which results from the core-reduction process (Arnold 1983) or from tool manufacture (Crabtree 1982). Debitage constitutes 94 percent of the stone artifact collection at LAN-211/H, and chert is the material of more than 70 percent of the debitage. Few flakes (less than 10 percent) have any cortex.

Pressure flakes constitute 50 percent of the debitage recovered from LAN-211/H, an unusually large proportion, which indicates that tool-production and -reshaping activities occurred frequently at this site. Most chert, chalcedony, and obsidian flakes are by-products of biface reduction and arrow-point manufacture or repair and are typically elongated, curved, and small (the mean length of complete flakes is 16 mm). The basalt and quartzite debitage represents a more generalized flake-core reduction. This large quantity of pressure debitage, along with the number of points and point fragments (both proximal and distal segments) found, suggest that points were breaking through use and production at this site, implying it was a hunting camp.

The overall small to moderate size of the debitage indicates that later-stage flake production predominated. With so few cores in the collection, this conclusion was expected and was confirmed by reviewing the size of complete and fragmentary flakes. Eighty-two percent of complete flakes were smaller than 20 mm, and 69 percent of fragmentary flakes and 64 percent of shatter specimens were smaller than 10 mm.

A minor amount of chert shatter was found, suggesting that Monterey Formation pebbles were occasionally worked at the site. These pebbles were either bipolar or bifacially reduced as a prelude to flake or bifacial-tool manufacture.

Flaked Glass

Two artifacts made from olive green bottle glass and one from clear glass were recovered from LAN-211/H. One of the olive green specimens (Figure 79i) is a percussion-retouched flake; the second green glass flake is a late-stage pressure flake. The latter has a multifaceted platform with the remnant of a bifacial margin that appears to have been prepared by lightly abrading the platform prior to the flake detachment. The dorsal surface of this flake has a strong central ridge that runs along the long axis of the flake, where the margins of two previous pressure flakes intersected. The evenness of this central axis suggests the flakes were removed sequentially; such a technological trajectory is consistent with the production of projectile points and knives. The flake was broken at some previous time, possibly when it was detached. The third (clear) glass specimen is the distal end of a percussion flake that has scars from previous detachments on its dorsal surface. Additional small amounts of glass were found at the site but were unmodified and appeared to be intrusive.

Ground Stone Tools

LAN-211/H contained a variety of tools finished by pecking, abrading, or that evolved through use (Table 31). Along with diagnostic tools, nine fragmentary, ground stone artifacts were found. The activities indicated by these tools include grinding or pulverizing of seeds, plants, or small animals; net fishing or hunting; shell-fishhook finishing; and arrow shaft manufacture and repair.

Manos

Hand-held grinding implements for processing vegetal materials were classified as manos. Manos were usually seed-processing tools but might also have been used to prepare pigments. When manos were broken, they were sometimes reused as hearth stones and asphalt applicators. They are generally used on a metate in a rubbing, rocking, or crushing motion, and the area of wear is usually on flatter faces, rather than concentrated on or adjacent to ends, as with pestles. Six oval manos that had been created by pecking local sandstone, andesite, rhyolite, or granitic cobbles were found at LAN-211/H. Each had use facets on a single face, creating a plano-convex cross section. Three of the six mano fragments were found in Unit 9. An additional piece was found in Trench 11, adjacent to Unit 9.

Metates

Stones used with manos for crushing seeds and other plant materials and for grinding or mashing other foods or substances, such as pigments or small rodents, are generally called metates. The tool stones used for metates are frequently coarse grained or vesicular and often have been flaked to form and pecked to shape. Small fragments (97 and 78 mm on their largest dimension) of two oval, sandstone basin metates were found. They were fully shaped by pecking both the exterior and interior surfaces. Both specimens were trench collections.

Table 31. Ground and Other Stone Artifacts from LAN-211/H

Material	Mano	Metate	Pestle	Reamer	Shaft Straightener	Net Weight	Tarring Pebble	Unidentified Fragments	Total
Andesite	1	—	—	—	—	—	—	—	1
Granite	1	—	—	—	—	—	—	3	4
Igneous	—	—	—	—	—	—	2	—	2
Quartzite	—	—	—	—	—	1	2	—	3
Sandstone	3	2	1	1	—	—	4	1	12
Steatite	—	—	—	—	1	—	—	1	2
Rhyolite	1	—	—	—	—	—	—	—	1
Unknown	—	—	—	—	—	—	41	—	41
Vesicular basalt	—	—	—	—	—	—	—	4	4
Total	6	2	1	1	1	1	49	9	70

Pestles
Pestles are roughly cylindrical stones used in conjunction with a mortar to grind, pound, or crush everything from acorns to small rodents. It has been suggested that pestles and mortars were used predominantly for acorn processing and that metates were used for small-seed processing (Sutton and Arkush 1998:95). A single carefully shaped sandstone pestle fragment was found, showing slight wear polish on its surface. Pestles were used in combination with mortars for pulverizing. This small midsection (28 mm long by 61 mm in diameter) was found in Unit 5.

Tarring Pebbles
Nearly one-quarter (23 percent) of all tools recovered from this site are medium to small pebbles covered with tar. Heated pebbles were used to apply asphalt to baskets for waterproofing, particularly canteens. Pebbles were also used to melt tar to repair equipment and on occasion to attach a basket to a hopper mortar. The mean length of the LAN-211/H pebbles was 31 mm; the largest pebble was 49 mm. Hudson and Blackburn (1986:174–175) suggested that tarring pebbles seldom exceeded 50 mm (2 inches), as this was the typical diameter of a canteen's orifice. Asphalt covered 41 pebbles from LAN-211/H so completely that their material could not be identified. Tarring pebbles were found in every test excavation except Unit 2, and 22—almost half—were found in Unit 9. A small amount of loose asphaltum was also found dispersed throughout the site sediments.

Weight Stones
Weight-stone artifacts in southern California are commonly divided into three types: fishing weights or sinkers, digging-stick weights, and weighted composite tools. Although weight stones were likely used for a variety of tasks, their main function is to add mass to increase the efficiency of a tool. A single specimen, a net weight made from a subangular quartzite cobble, was recovered from LAN-211/H (Figure 80a). A shallow groove covers about three-quarters of the circumference of this stone, indicating where a cord was tied around the stone to attach it to the net. Net weights were used with fishing gear to keep lines or nets submerged. The presence of such artifacts corroborates the evidence from the faunal materials (Chapter 8) that fish were being exploited by the occupants of this site.

Shaft Straighteners
Shaft straighteners are tools with one or more grooves that were used to straighten arrow shafts and were generally heated prior to their use. Shaft straighteners were analyzed by shape, material type, and presence of incisions. A single straightener, made from steatite, was recovered from LAN-211/H; it has a concave groove on one surface that has been darkened and polished through use (Figure 80b). This artifact is an indication of the production and maintenance of hunting gear, specifically arrow shafts.

Reamers
A reamer is used to smooth or enlarge perforations using a grinding action and is commonly associated with shell-fishhook manufacture (Reinman and Townsend 1960:107; Strudwick 1986:139). After punching or drilling a hole in a shell fishhook blank, a reamer is used to enlarge the interior hole. Thus, reamers are a necessary part of the tool kit for fishhook production. The single specimen from LAN-211/H was complete and made from local sandstone (Figure 80c). Polish can be observed along two-thirds of the length of the tool, and a slight shoulder can be detected where the polish stops. Similar artifacts of the same material have been recovered from Late period sites on San Nicolas Island (Maxwell et al. 2002).

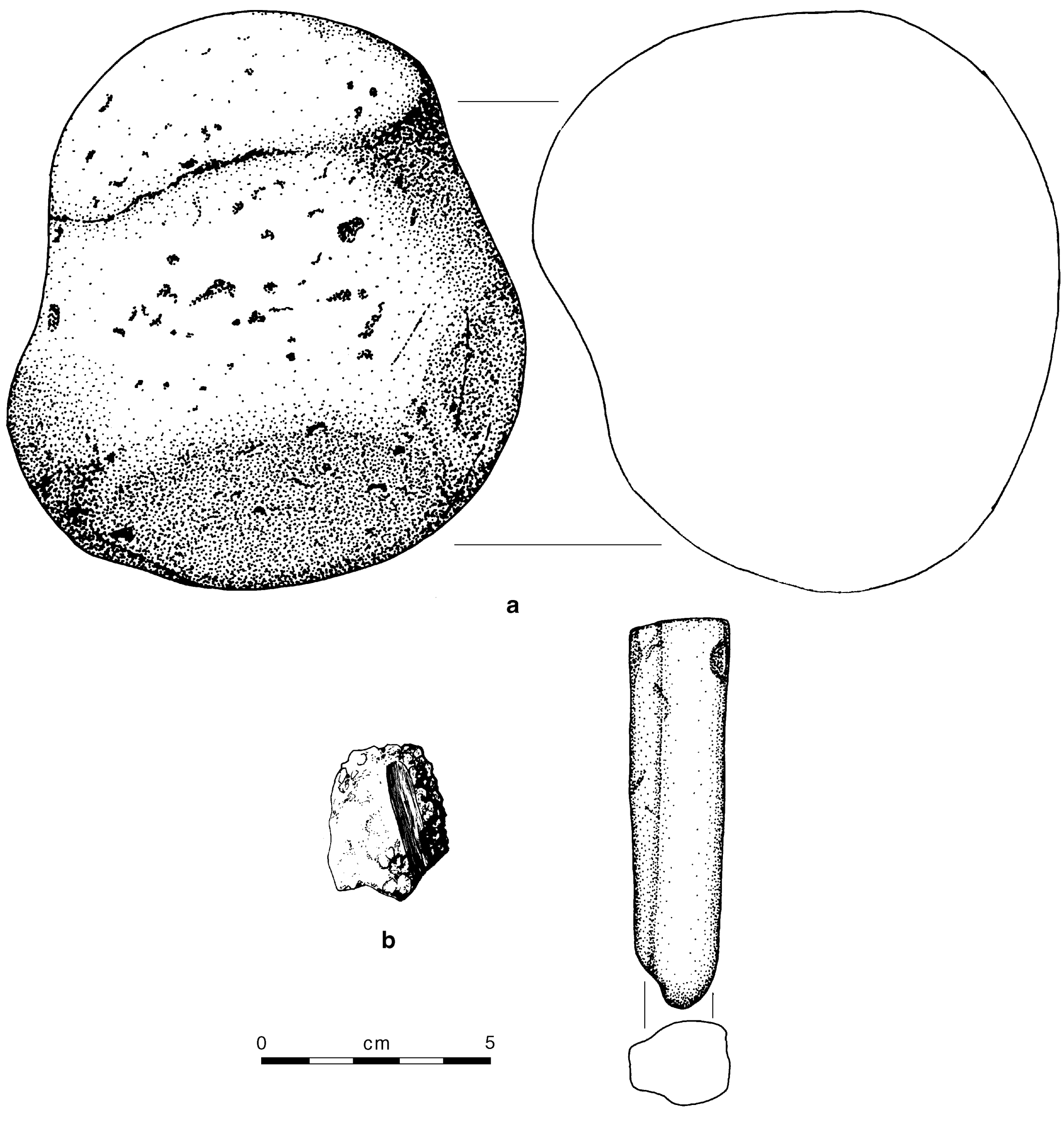


Figure 80. Miscellaneous stone artifacts from LAN-211/H: (a) quartzite weight stone; (b) steatite shaft straightener; (c) sandstone perforator, fishhook reamer.

Discussion

In the following section, we discuss our observations and conclusions concerning the lithic artifacts from LAN-211/H. We begin with a discussion of the spatial distribution of the stone artifacts, focusing on the concentration in Unit 9. We follow this with an examination of the tool stone used, and analysis of stone tool production, usage, repair, and discard. In the closing portion of this section, we compare the stone collection, or "tool kit," from LAN-211/H to other collections throughout southern California. We hypothesize that stone points would persist in the Ballona well into the early historical period because of the Spanish prohibition against providing weapons, such as firearms, to native people.

Artifact Distributions

Stone artifacts were unevenly distributed in the test units at LAN-211/H (see Table 29). To examine the intrasite distribution, we clustered the excavation units into three sets: Units 1–8 and Unit 10, Unit 9, and Unit 11. The three sets were all located about 20–30 m apart. When comparisons are made among these sets, we observed that the bluff terrace units (Units 1–8) contained most of the debitage, and little ground stone. Units 4 and 5 from the terrace set also contained the widest diversity of flaked tools.

The most pronounced concentration of stone artifacts was found in Unit 9. More than a dozen tarring pebbles, half of all obsidian, nearly a quarter of all debitage, all vesicular basalt, and the only scraper were found in 30 cm of deposit within the southwest and southeast quadrants of Unit 9. The deposit in this unit might have been created in prehistory when a work area, possibly adjacent to a residence, was cleaned, so that broken tools, finishing and repairing flakes, and tarring pebbles were collected and then discarded together. Such a concentrated refuse deposit suggests a relatively long-term occupation of the site and a specialized use of space. Although it is premature to infer activities based on these distributions, the spatial variation in stone tool location is consistent with a strongly patterned occupation. We would expect such patterning at sites where behavioral sets were spatially segregated along economic or social lines.

Material Procurement

Monterey Formation chert and chalcedonies dominate the flaked stone in the collection, whereas on the whole, the ground stone tools were made from sandstone or igneous (andesite, granitic) rock. All of the large ground stone tools were produced from the local sandstone. Although local quartzite cobble flakes were present, they provided only a minor, ad hoc, constituent of the tool kit.

The Ballona area and its drainages lack the cherts and chalcedonies that tool makers often preferred for specialized tool manufacture (Rozaire and Belous 1950; Woodford et al. 1954:65–74). Because they had particular material, size, and sturdiness parameters in mind, the tool makers preferred the beaches or outcrops of either the Palos Verdes Hills or the Santa Monica Mountains, to the Westchester Bluffs. Even more distant sources were occasionally tapped. Grimes Canyon fused shale and obsidian (possibly from Obsidian Butte in the Salton Sea area, given its ashy appearance) were recovered in small quantities at LAN-211/H.

Preshaped cores, large flakes, and finished tools of chert, chalcedony, and basalt were brought to the site for use, repair, and reworking. We found evidence that a broken obsidian tool had been recycled into an edge-modified flake. These items might have traveled a circuitous path to reach the Ballona.

We found four fragments of vesicular basalt ground stone at LAN-211/H. There are various sources for this material, ranging from the Channel Islands to the California desert. Vesicular basalt manos have been reported from the neophyte quarters at Missions San Buenaventura (Greenwood 1976:16–17) and

La Purísima (Deetz 1963), as well as among materials at Mission Santa Cruz (Allen 1998:64). The basalt fragments from LAN-211/H are too small to interpret or to identify their original shape.

Tool Production

The LAN-211/H collection exhibits little evidence of initial flaked stone reduction and no ground stone tool production. Only two tested cobbles were found. Cores were principally well-reduced (exhausted), multidirectional types that were being worked with fairly dense quartzite or igneous hammer stones. Cortex, a secondary indicator of initial core shaping, was observed on just 8 percent of all flaked stone. The paucity of completely cortical or partly cortical flakes implies that blanks or preforms were brought to the site and then transformed into points or knives by finishing their surfaces and creating a haft. Flake blanks were occasionally systematically retouched, but mostly they were just used and resharpened.

Tool Use

How were flaked and ground stone tools used at LAN-211/H? Several readily recognizable functional types are present in the collection. We know how manos, metates, and pestles were used, even though the foods were being processed or cooked cannot always be identified. The size and shape of points and bifaces indicate that point blanks (those made in anticipation of use) were being finished and hafted into shafts and used as arrow tips during hunting expeditions.

The modified flakes are more enigmatic. Sharp or resharpened flakes are convenient and appropriate tools for many tasks. Replication and microwear studies (Hayden 1979; Keeley 1980) have suggested that scrapers and utilized flakes were used for butchering; food preparation; and for working wood, bone, plant fiber, and hides. Future investigation in the Ballona could benefit from similar replication and microware studies.

Burin spalls are infrequently reported, probably because they are difficult to identify. In southern California, chert burin spalls are found occasionally among Santa Cruz Island debitage (Arnold 1987a: 80–81). The spalls from LAN-211/H are similar to “bladelets” recovered at LAN-63 and LAN-64, two Intermediate period sites on the bluff tops above the Ballona Lagoon (Van Horn 1987). Quartz bladelets are also known from LAN-47, a Late period site on the north side of the lagoon (Altschul, Homburg, and Ciolek-Torrello 1992:237). Both Van Horn (1987) and Towner (1992) suggested their bladelets were made by the bipolar technique, whereas Arnold described a blade-core manufacturing system (Arnold 1987b).

We maintain that these bladelets were produced by the burin-spall technique and that these small artifacts were probably drills used to make shell beads. Although these rather fragile tools were frequently broken, their triangular shape made them ideal for drilling. Some of the tiny flakes recovered from the site likely reflect pressure retouching to repair broken spalls.

Tarring pebbles represent one element in an important manufacturing activity, basket waterproofing. We can readily envision site residents collecting nearby rushes and reeds (*Juncus* spp., *Phragmites* spp., *Scirpus* spp.) and returning to LAN-211/H to weave and tar new water bottles.

Tool Repair and Discard

Occasionally small chert and obsidian tools were resharpened and repaired; the use-life of most tools, however, ended when they were broken, lost, buried, or swept into the refuse pile. Debitage from secondary reduction, final shaping, and repair activities also might have been removed from work spaces and dumped with other refuse into a marshy area or the nearby creek. The artifact diversity found in Unit 9 may reflect a clean-up and discard pattern rather than abandonment in-place.

The Tool Kit at LAN-211/H

The tool kit, or stone artifact collection, from LAN-211/H includes arrow points, bifaces, and unifaces in some quantity, all attesting to the continued use of stone projectiles into early historical times. Contrary to Allen's (1998:83) hypothesis that points would be cursorily made during this period, the chert Cottonwood Triangular and Desert Side-notched arrowheads at LAN-211/H are carefully fashioned using traditional pressure-flaking techniques. Small stone flakes that could have been used to fillet fish and butcher wild game are present at LAN-211/H, and the sandstone, andesitic, as are the granitic milling equipment that could have processed saltbush seeds, buckwheat, or acorns.

A review of protohistoric and historical-period research suggests that fewer nonlocal materials should be present because aboriginal trade networks were disrupted. Small pressure flakes, an edge-modified flake, and shatter made from imported fused shale and obsidian were observed in small quantities at LAN-211/H, but only one formal tool of imported material was discovered, a fused shale projectile point. These artifacts may represent scavenging or recycling of material, possibly from nearby multicomponent sites such as LAN-62. The absence of obsidian and the manufacture of points from Monterey chert at LAN-211/H could be a reflection of trade limitations; toolmakers substituted the more easily obtainable chert for imported obsidian. Although we saw no porcelain substitution, we did find three glass flakes showing signs of other flake removals and deliberate reduction or creation strategies. This discovery suggests a practice of material replacement.

We hypothesize that native people familiar with the new technology introduced by the missionaries and faced with labor-intensive activities requiring sturdy tools would generally prefer iron knives or axes because of their greater efficiency, if they had access to them. We expect that the transition from traditional technology to the new system would be documented by a paucity of large volcanic and quartzite flaked stone tools such as scrapers, bifacial knives, and choppers (Binford and O'Connell 1984). We also anticipate that fewer hammer stones would be found because metal hammers might have replaced stone precursors during tool manufacture. Only four hammer stones were found during the testing, and this may document their predicted decrease. No metal artifacts, however, have yet been recovered from at LAN-211/H.

Summary

The stone artifact collection from LAN-211/H has three aspects: first, a small, portable tool kit representing a restricted range of activities; second, a larger seed-processing tool collection; and third, tools for producing fishing gear and waterproofing basketry. These tools may reflect a pre-Spanish, aboriginal tool kit, or portions of a mission-period tool kit where metal had not yet replaced stone, either due to Spanish firearm prohibitions or to limited access to smaller iron pieces. We see new materials replacing old: glass is used in place of obsidian. We wonder if the foods being caught, collected, and processed are changing too?

Tools from non-Ballona stone (chert) were finished, repaired, and used at LAN-211/H. Carefully designed tools appear to have been imported in finished form. Cores and flakes from reworking and repairing tools tend to be small, suggesting that imported materials (obsidian, fused shale) might have been scavenged. The characteristics of the curated tool kit, how it was made, why it was retained as well as its prominence in the technological organization of the protohistoric or early historical periods are research issues that future LAN-211/H investigations may help answer.

Table 32. Stone Artifacts from LAN-2769

Material	Projectile Point	Biface	Drill	Core	Hammer Stone	Mano	Unmodified Flake	Total
Andesite	—	—	—	—	—	—	1	1
Basalt	1	—	—	1	1	—	5	8
Chalcedony	—	—	1	—	—	—	10	11
Chert	—	4	—	—	—	—	42	46
Granite	—	—	—	—	—	1	—	1
Quartz	—	—	—	—	—	—	10	10
Quartz crystal	—	—	—	—	—	—	1	1
Quartzite	—	—	—	1	—	—	6	7
Total	1	4	1	2	1	1	75	85

LAN-2769

Test excavations at LAN-2769 recovered 85 stone artifacts: 8 tools, 2 cores, and 75 pieces of debitage (Table 32). All specimens were analyzed. Most of the artifacts were chert pressure flakes representing final finishing, resharpening, or refurbishing of flake tools. We briefly summarize the tool categories and provide information about core reduction and debitage as indicators of the technological organization; we also discuss material procurement, manufacture, use, repair, reuse, and discard patterns. These categories and the methods used in this study were described previously in the results for LAN-211/H.

Results

Stone artifact categories in the LAN-2769 collection are presented in Table 32. Broken bifaces (n = 4), a drill (n = 1), and cores (n = 2) suggest that tool production rather than tool use was the principal activity at the site. This hypothesis is further confirmed by 75 unmodified flakes, 30 complete and the remainder fragmentary, that also were found. Most artifacts were made from chert from the Santa Monica Bay vicinity; no imported material was present.

Bifaces

Four fragmentary chert bifaces were found (Figure 81a–b). One had been discarded because of a bending fracture (a manufacture break); the other three specimens were so fragmentary that the reason for their abandonment is unclear. All were percussion flakes shaped by pressure retouch.

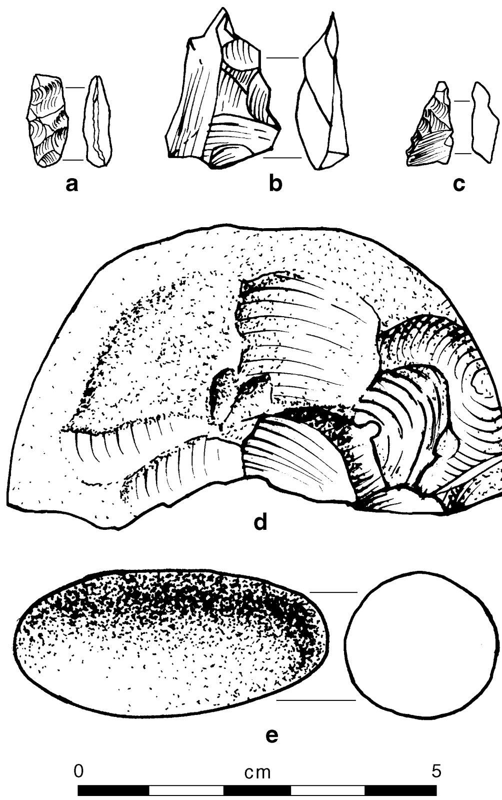


Figure 81. Stone artifacts from LAN-2769: (a–b) chert bifaces; (c) chalcedony drill; (d) basalt core; (e) basalt hammer stone.

Drill

We recovered the distal portion of a drill formed on a chalcedony pressure-retouched burin spall (Figure 81c). The retouch is rounded and ground, and the fragment measures just a little over 11 mm long.

Cores

Cores are cobbles, pebbles, or rock nuclei that show evidence of deliberate, patterned, flake detachment. Two flake cores were recovered from LAN-2769: the first is a basalt multidirectional core with multifacet platforms (Figure 81d). This core is complete and is the larger of the two recovered. The second flake core, made of quartzite, has been fragmented; only the midsection of it was recovered. This core is small, portable, and could readily be used to produce a flake. Although quartzite can be obtained in the immediate vicinity of LAN-2769, the core was not shaped when the material was quarried; instead, it appears to have been selected and brought to the site for finishing.

Hammer Stone

A small, cylindrical basalt pebble, 43 mm long and 24 mm in diameter, with battered poles was recovered (Figure 81e). The damage to the ends suggests it was used as a bipolar percussion hammer. This pattern of damage on this hammer stone is interesting in that bipolar battering is not usually found on the poles, but on a face.

Debitage

Debitage consists of complete flakes and flake fragments (see Table 10); no shatter was found. Of the 75 flakes recovered, only 30 are complete. Conclusions about tool making and debitage characteristics are limited by the absence of key attributes in this small and mostly fragmentary sample. As Table 32 shows, a majority of the debitage is chert. Seventy-five percent of the debitage is Monterey Formation material; quartzite and volcanics account for only a few pieces.

Pressure flakes from biface reduction are the most common debitage type (52 percent). Almost three-quarters of the flakes have no cortex. Over half the debitage are flakes produced during biface and arrow point manufacture or repair (bifacial thinning flakes). The overall small debitage size (91 percent less than 10 mm) indicates most flakes were generated during late stage percussion and pressure reduction.

Mano

The single milling stone recovered, an almost complete granite mano; it is roughly oval and has two worn, flattened faces. The mano measures 95 by 91 by 40 mm.

Discussion

In this section, we present our observations about this small stone collection. The disturbed context of this site limits its information potential. After a brief discussion of the intrasite distribution of artifacts and tool stone used in production, we summarize our findings regarding stone tool production, use, repair, and discard.

Artifact Distributions

Stone artifacts were unevenly distributed among the nine 1-by-1-m test units at LAN-2769. No unit contained large numbers of stone artifacts, and we suspect that variation in density and frequency has more to do with postdepositional processes moving artifacts throughout the site, such as water movement and rodent burrowing, than with human behavior.

Material Procurement

The tool stones used are mostly Monterey Formation cherts and chalcedonies, with small amounts of quartzite. These materials can be procured either on the coast of the Palos Verdes Hills or in the Santa Monica Mountains. Quartzite can be found in the Ballona drainages, with local deposits in the Baldwin and Del Rey Hills. Material from distant sources, such as Coso (eastern Sierra) obsidian, is not represented. No soapstone from Santa Catalina was recovered. In general, materials were collected either as pebbles in the Ballona vicinity or from outcrops or detritus along the coast. The single mano, a granitic stone, could have a distant origin, such as the San Gabriel Mountains, although it likely was manufactured locally from a cobble deposited in the Baldwin Hills gravels.

Tool Production

There are two flaked stone reduction techniques represented in this collection. One reduction trajectory involves smaller, chert tabular cores and quartzite pebbles. The size of the cores restricted production to flakes smaller than 40 mm. Alternatively, some chert flakes were made into bifacial preforms and then probably finished as projectile points.

Tool Use

A single finished tool, a projectile point made from basalt, was found at LAN-2769. All flaked material basically results from tool manufacture. The biface and drill are indirect evidence for the use of arrow points and larger notched tools. The mano indicates that seed or possibly small-mammal processing occurred at the site.

Tool Repair and Discard

Small chert flakes can be attributed to biface manufacture and finishing, which produces such small flakes in considerable quantities. Some of the percussion flakes result from resharpening or repair. This kind of debitage can occur in many contexts. Tools can be repaired at camps or activity areas while waiting for game to arrive, the tide to change, or for materials to be gathered. Debitage also could have been cleared from work areas and discarded.

Summary

We recovered a light scatter of tools and debitage from LAN-2769, the result of finishing, reworking, and repairing tools. The small sample size probably accounts for the lack of diagnostic flaked stone; only a single diagnostic stone artifact was recovered. This suggests that the stone artifact collection primarily reflects a tool kit representing a restricted range of maintenance activities—principally, preparing hunting gear and processing plant food.

Intersite Comparisons

In the Ballona, the preference for small tools made from chert continued from prehistory into the protohistoric period. This assertion is evidenced by the stone tool collection from LAN-1932/H, a protohistoric site located in the Ballona lowlands. Initial analysis of stone artifacts from this site indicate a similar tool type profiles and material preference to LAN-211H (Table 33). A small number of finished tools fashioned mostly from chert (Figure 82a–b) were found, along with debitage primarily made from chert. A projectile point made from jasper was also recovered (Figure 82c). Of the ground stone specimens recovered, one was identified as a sandstone mortar and a second, found in two pieces and stained with asphaltum, is a basalt bowl fragment (Figure 82d). The lithic collection is consistent with the interpretation that LAN-1932/H was once part of LAN-211/H before being mechanically removed and spread as fill in the runway area by Hughes Aircraft Company contractors.

A second Ballona-area archaeological site that provided important, if scant, comparative material is the Hammack Street site (LAN-194). Excavation at this single-component, early-historical-period site was limited. Finds included two Cottonwood-style projectile point bases, one of fused shale and one of Monterey chert; a chert and a quartzite scraper; a basalt mano; a hammer stone; and several tarring pebbles. In general, the tools and materials found at Hammack Street are quite similar in type and material to those found at LAN-211/H. The stone tools found at the Hammock Street site demonstrate the survival of some traditional stone tool use patterns into the rancho environment of the early historical period.

Distribution of artifact types in the Ballona has often been discussed in terms of location because of clear distinctions between bluff-top collections versus those from lowland sites along the lagoon edge. Van Horn (1987) separated stone artifacts from his bluff-top excavations into micro- and macroindustries, then further identified specialized flakes (e.g., microliths, so-called potato flakes) and tools (e.g., microdrills) that are produced from small and large flakes. This classificatory scheme has not proved useful in the analysis of stone artifacts from lowland sites. Further, artifact totals by type or material are not consistently reported for bluff-top sites. As a result, comparisons between bluff-top and lowland collections can only be made in general terms.

Table 33. Stone Artifacts from LAN-1932/H, by Material Type

Material	Projectile Point	Biface	Drill	Uniface	Scraper	Core	Modified Flake	Unmodified Flake	Mortar	Unidentified Ground Stone	Total
Andesite	—	—	—	—	1	—	1	57	—	—	59
Basalt	—	—	—	—	1	—	3	32	—	—	36
Chalcedony	—	—	—	—	—	1	—	34	—	—	35
Chert	4	5	1	1	—	3	1	313	—	—	328
Fused shale	—	—	—	—	—	—	—	1	—	—	1
Jasper	1	—	—	—	—	—	—	—	—	—	1
Metavolcanic	—	—	—	—	—	1	—	—	—	—	1
Obsidian	—	—	—	—	—	—	—	1	—	—	1
Porphyritic andesite	—	—	—	—	—	—	1	—	—	—	1
Quartzite	—	—	—	—	—	—	—	15	—	—	15
Rhyolite	—	—	—	—	—	—	—	1	—	—	1
Sandstone	—	—	—	—	—	—	—	—	—	1	1
Vesicular basalt	—	—	—	—	—	—	—	—	1	—	1
Total	5	5	1	1	2	5	6	454	1	1	481

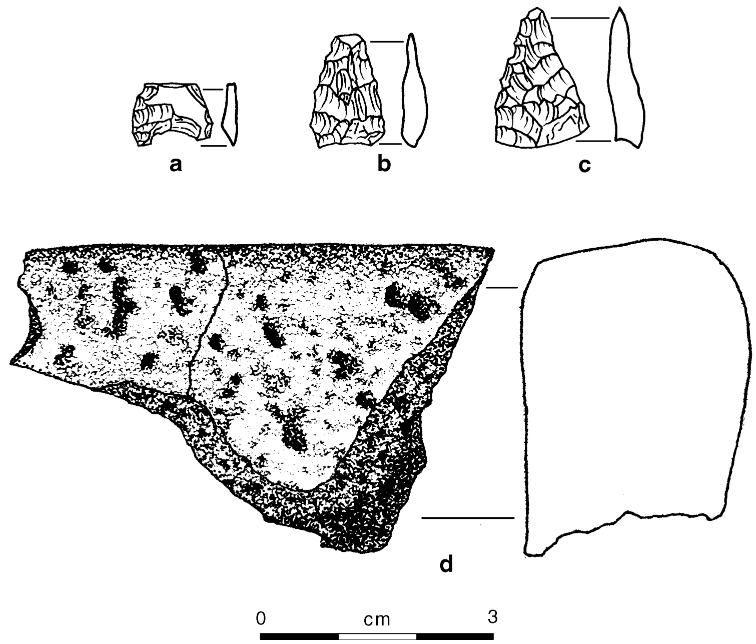


Figure 82. Stone artifacts from LAN-1932/H: (a–b) chert projectile points; (c) jasper projectile point; (d) basalt bowl fragment in two pieces.

Discounting the differences in excavation, reporting strategies, and nomenclature for the purpose of highlighting a general trend, Table 34 presents the results of intersite comparison of selected stone artifact types between bluff tops and lowlands. Small tools, such as a variety of unifaces, edge-modified flakes, and bifaces, as well as dart and arrow points, have been found in both bluff-top and lowland sites and are commonly found throughout the region. By contrast, large, carefully made tools of quartzite or igneous materials, and expediently produced flakes that were used for many tasks are uncommon in lowland-site collections. Further, relatively few ground stone or milling implements are found at Late period lowland sites; however, these artifacts are plentiful at Intermediate period bluff-top sites (Van Horn 1987; Van Horn and Murray 1985). There may also be important distinctions within lowlands site along temporal lines. For example, projectile points, which appear scarce in lowland Intermediate sites, become more common in protohistoric and historical-period sites. Additional data to test this observation may become available when lithic collections recovered during data recovery from two additional Intermediate period Ballona-area sites, LAN-193/H and LAN-2768, are analyzed.

Conclusion

We have analyzed two collections from tested sites LAN-211/H and LAN-2769 in the Playa Vista project area and we have summarized the ways in which LAN-211/H compares with earlier and contemporaneous Ballona sites. The small quantity of artifacts from the disturbed context of LAN-2769 provided limited data about the prehistoric people occupying the base of the bluff. In contrast, the stone artifacts

Table 34. Comparison of Stone Artifacts from Ballona-Area Sites

Selected Stone Artifact Types	Bluff-Top Sites			Lowland Sites				
	Intermediate and Late Periods			Intermediate Period	Late Period	Late and Protohistoric Periods		Historical Period
	LAN-61A [a]	LAN-61B [a]	LAN-63 [b]	LAN-60 [c]	LAN-47 [d]	LAN-211/H	LAN-1932/H	LAN-194 [e]
Projectile point	63	90	261	—	36	11	5	2
Scraper, scraper plane	9	15	181	—	—	1	2	—
Burin, burin spall, drill	21	54	13	—	—	3	1	2
Microlith, bladelet, microdrill	130	460	18	—	24	—	—	—
Biface	2	—	11	1	37	28	5	—
Core	96	152	151	9	—	13	5	—
Hammer stone	119	156	276	—	4	4	—	—
Mano	284	299	122	61	13	6	—	1
Metate	55	122	64	3	3	2	—	—
Pestle	1	21	16	—	3	1	—	—
Mortar, bowl	110	138	51	—	—	—	1	—
Tarring pebble	no data	279	659	8	—	49	—	> 1

[a] Van Horn and Murray 1985
[b] Van Horn 1987
[c] Grenda et al. 1994
[d] Towner 1992
[e] King 1967

from LAN-211/H paint an intriguing picture of a hunting and limited-activity camp during a period of transition for the indigenous people of the Ballona. The investigations at LAN-211/H along with data recovery efforts at LAN-2676, -2768, -193/H, -60, and -54 have led to new understandings about the manner in which prehistoric and protohistoric peoples of the Ballona used stone tools. As we prepare for the next phase of the PVAHP, a fresh look at our goals, methods, and procedures was needed. Accordingly, a research design was prepared by Dr. Robert Elston to guide analysis of all lithic collections obtained at Playa Vista sites during data recovery. The research design is presented in Appendix C.

CHAPTER 11

Summary and National Register Evaluation

Richard Ciolek-Torrello

This chapter addresses the third component of SRI's research design (Grenda et al. 1999), summarized in the introductory chapters to this volume: do the archaeological materials designated as LAN-211/H and LAN-2769 represent properties that are eligible for listing in the NRHP? Early in the course of the PVAHP, the decision was made that instead of viewing each archaeological site as a separate property for the purposes of NRHP evaluation, it was more efficient as well as more accurate to view the entire area surrounding the lagoon as a locus of prehistoric settlement. At that time, it was decided that the study of adaptation to a dynamic environment such as the Ballona was a significant research issue. From this perspective, a site's ability to contribute important information to our understanding of such adaptation was the best measure of that site's NRHP eligibility. As a result, the BLAD was proposed to encompass all sites within the Playa Vista project area (Altschul et al. 1991:165–166). Two historic contexts—"human-land relationships" and "culture history and cultural dynamics of prehistoric settlement"—were presented in the research design (Altschul et al. 1991:23–26) as a framework for evaluating prehistoric cultural resources. Since 1991, several sites have been determined to be contributing members to this district, based on previous archaeological investigations.

Among the latter were the sites recorded at the South Central Coastal Information Center as LAN-62 and LAN-211/H. As discussed in Chapter 2, these sites have been combined into the designation LAN-62, which has been determined eligible for the NRHP (see Table 1), and because a treatment plan for data recovery has already been accepted (Altschul et al. 1991), LAN-62 will not be considered further in this chapter.

LAN-211/H, however, will be considered here. Archival research and investigations described in previous chapters reveal that the archaeological deposits that had been designated as LAN-211/H appear to be a continuation and extension of LAN-62, and the designation LAN-211/H had been incorrectly assigned to these deposits during the 1980s. SRI now believes that archaeological materials previously recorded with the temporary designation of SR-13 (Altschul et al. 1991:155) are a better candidate for the site discovered by Deane (Thiel 1953) and originally recorded in the early 1950s (Rozaire and Belous 1950); as a result, SRI transferred the designation LAN-211/H to SR-13. It is this manifestation of LAN-211/H, as well as LAN-2769, that is the subject of the current evaluation. The objective of this chapter is to evaluate whether these two sites represent intact archaeological deposits that are contributing elements to the BLAD.

Although historic contexts for evaluating archaeological properties in the PVAHP were developed in the research design (Altschul et al. 1991) and subsequent treatment plans were prepared for other archaeological properties in the PVAHP (Altschul et al. 1998; Altschul et al. 1999), little was known about the protohistoric and early historical periods in the Ballona, and research themes specific to these periods were not well developed. Considerable information relating to occupation in the Ballona has recently become available as a result of archival research and other investigations. Because of these new data and the nature of the archaeological properties investigated in this report, it became necessary to devote much of this report to developing historic contexts for the protohistoric and early historical periods in the Ballona.

Controlled excavation at LAN-211/H and LAN-2769 achieved most of the goals described in the work plan (Grenda et al. 1999). Cultural deposits located in the 1990 survey (Altschul et al. 1991) were confirmed, site boundaries were estimated, and the integrity and research potential of both sites were evaluated. Evaluation of the two archaeological sites is accomplished by individually summarizing and synthesizing the field results and analytic information presented in the preceding chapters for both sites. First, the age, condition, and integrity of each site are assessed. For the purpose of this discussion, an intact archaeological site is one where the specific cultural resource was deposited by the ancient residents of the Ballona in the location in which it was discovered. The research potential of each site, or its ability to contribute important information to our understanding of adaptation to the lagoon, is then examined. For this purpose, special consideration is given to archaeological materials that provide unique information, especially with respect to the poorly represented protohistoric and early historical periods. Based on this discussion, this chapter concludes with recommendations for NRHP eligibility and additional research.

LAN-211/H

A combination of evidence suggests that there are two, perhaps three, temporal components at LAN-211/H: one possibly dating to the Intermediate period, one dating to the Late period, and one dating to the early historical period. Stratigraphic research revealed a thick, apparently intact midden deposit on a large bench near the base of the bluff. A much denser, intact midden deposit was found below this bench underneath the abandoned parking lot at the foot of the bluff. These deposits occur in Stratum 3, which corresponds with the uppermost A horizon of a moderately developed soil overlying an alluvial fan deposit generated by drainages channeling run-off from the bluff (Chapter 4). Fan sediments located between this A horizon and the underlying C horizon contain clay-rich bands, termed lamellae, that indicate the fan deposit has been stable for the past several thousand years. The fan accumulated very rapidly as sediments were washed down from the slope; however, there is little evidence for human occupation until the fan stabilized and soils began to form on its surface. There is some evidence to suggest that this fan was subjected to intermittent flooding and deposition of fluvial deposits, probably by Centinela Creek, while LAN-211/H was occupied.

Four radiocarbon assays from LAN-211/H suggest two components, one sampled from Unit 6/10 and dating between A.D. 600 and 1000, and the other recovered from Unit 9 and dating between A.D. 1490 and 1640. Unfortunately, the two samples from Unit 6/10, located on the bench west of a large channel that now drains the bluff and divides the deposit at LAN-211/H, appear to be reversed. A radiocarbon sample of *Chione* sp. collected from Level 7 of Unit 10 returned a date of A.D. 1000—some 400 years younger than a *Chione* date of A.D. 610 from Level 6 of Unit 6, 90 cm higher and in a different stratum. Although both samples date to the last millennium of the Intermediate period, such a reversal of dates is not expected if stratigraphic integrity was retained at this locus. Extensive bioturbation of the sediments on the bench could have resulted in the mixing of the deposit and downward transport of shell fragments through the alluvium. Another possibility for this reversal is that the deposit on the bench of the bluff slope is secondary in nature and was redeposited by the erosion of cultural material from the archaeological sites on the bluff top above. Historical-period activities such as the construction of the Los Angeles sewer and the associated Cabora Drive along the middle of the slope above the bench, or Loyola Marymount University on the bluff top above the site could also have resulted in the transport of fill material containing archaeological materials to the bench area (Chapter 5).

By contrast, the deposit sampled in Unit 9 below the parking lot at the foot of the bluff appears to represent a much richer and more intact deposit that dates from the end of the Late period to the early historical period. The two radiocarbon samples from *Chione* specimens in this unit recovered overlapping dates (A.D. 1490 and 1640) that indicate a Late prehistoric to protohistoric age for this deposit. A total of 37 shell beads and 20 glass beads recovered from the entire site confirm a primarily protohistoric age for this deposit. The largest number and greatest variety of beads were recovered from Unit 9. The dates for these beads range from about A.D. 1500 to 1800, although Gibson et al. (Chapter 9) believe that bead evidence indicates very little occupation prior to A.D. 1650. At least one glass bead may date to A.D. 1816 or later, indicating the occupation of the site continued into the early decades of the nineteenth century. Surprisingly, only glass beads were recovered from the bench area around Unit 6/10, which returned the Intermediate period radiocarbon dates. No Intermediate period beads were recovered from the bench area. Unit 11, located on another bench east of the large ravine dividing the site, produced several shell beads, which Gibson et al. date to the 1790s. The presence of a flaked glass tool (Chapter 10) and the butchered remains of domestic animals (Chapter 7) further confirm the protohistoric to historical-period occupation of this site.

Stone tool collections, which are often temporally diagnostic, in this case contribute little to the assessment of the site's age and condition (Chapter 10). The Cottonwood arrow points and the single Desert Side-notched arrow point recovered from the site represent projectile point styles that were most common in the Late and protohistoric periods. The few fragments of carved soapstone bowls and steatite beads are not temporally diagnostic but appear most commonly in the Intermediate and Late periods.

Bone weathering and fragmentation of faunal materials provide support for the relative dating of the different components (Chapter 7). LAN-211/H is quite different from many other sites in the Ballona in terms of taphonomic processes that usually affect bone preservation in archaeological deposits. There are few instances of advanced weathering or patterns of mineral staining that can be expected when bone is exposed to the elements or buried for long periods of time (Chapter 7). In this respect, LAN-211/H is similar to LAN1932/H, another presumed protohistoric-period deposit, and LAN-2676, a disturbed Intermediate to Late period site. Bones from LAN-62, another Intermediate to Late period site, and LAN-2769 are moderately weathered. By contrast, bones from LAN-193/H and LAN-2768—Intermediate period sites located in a similar physiographic context at the foot of the bluff east of LAN-211/H—exhibit the greatest degree of weathering.

Variation in bone weathering across LAN-211/H provides additional evidence suggesting that the midden sampled by Unit 9 is an intact protohistoric-period deposit, whereas the deposit on the bench area may be older or more disturbed. Although the bone collection from excavation units placed on the bench is relatively small, bone from this location exhibits the highest degree of weathering at the site, indicating either longer or periodic disturbance, or older age. By contrast, the least amount of weathered bone was recovered from Unit 9, which produced the greatest accumulation of bone.

As Maxwell points out (Chapter 7), the pattern is preliminary, being based on only a handful of sites and excluding the bluff-top sites. But the pattern is remarkable, with the youngest sites being distinguished by the least degree of bone weathering, whereas the oldest sites have the highest frequency of weathered bone. As Maxwell notes, weathering has traditionally been used as a proxy measure for the duration of exposure prior to burial, the data from the Ballona indicates that weathering may continue to affect the bone after burial. Maxwell presents the intriguing thought that age, rather than postdepositional activities, may be the primary factor being measured by weathering patterns. At this stage in our studies of the Ballona, we cannot place a great deal of confidence in these patterns, but the study of bone weathering as a relative temporal indicator has promise.

The distribution and condition of invertebrate remains adds some credence to the pattern exhibited by bone weathering. For example, the degree of shell fragmentation varies considerably across the site. As Becker (Chapter 8) points out, shell refuse generally exhibits little damage when originally discarded. Fragmentation of shell is generally considered to be the result of postdepositional processes. Thus, highly fragmented shell often indicates redeposition or disturbance. Becker observes that the shell from

Units 6/10 and 9 exhibit the least degree of fragmentation, whereas the shell from Unit 11 is severely fragmented to a degree comparable to sites LAN-2676 and LAN-1932/H, which are severely disturbed.

Taken together, these various lines of information suggest that the alluvial terrace sealed below the parking lot at the base of the bluff represents an intact midden deposit dating to the protohistoric and early historical periods. Even this area, however, appears to have been subject to the “swiss cheese” effect that characterizes much of the area below the bluff. Unit 9 appears to be intact, but trenches placed in nearby areas of the parking lot did not locate intact deposits. The situation is much less clear in areas of the bench near the base of the bluff. None of the excavation units on the bench contain as rich or diverse deposits as Unit 9, and all appear to have been disturbed to some extent. Unit 11 appears to have been the most disturbed. Artifacts dating from the Intermediate period to the early historical period were encountered in several units. It remains unclear, based on current data, if the archaeological materials found on this bench represent a multicomponent occupation that is bioturbated to various degrees. Alternatively, the deposit found on the bench may be mixed with Intermediate period archaeological materials that were either eroded from LAN-61, located on top of the bluff above LAN-211/H, or brought as fill from an unknown location.

LAN-211/H is a rich and diverse site that represents a locus of human activity from at least the seventeenth to the early nineteenth centuries, and perhaps as early as the fifth century. The site, especially the area around Unit 9, is rare, if not unique. Although protohistoric occupations are common along the coast of the Southern California Bight, our search for comparative analogues found few, if any contemporaneous single-component occupations similar to that evident in Unit 9. None is known in the vicinity of the Ballona—LAN-1932/H, which appears to be contemporary, appears to have been severely disturbed and, indeed, may represent a secondary deposit of LAN-211/H. The Hammack Street site, LAN-194, located on the northeast side of the Ballona, may contain a discrete early-historical-period component that overlaps the end of the occupation at LAN-211/H, but little is known about this site from the limited excavations that were undertaken in the 1960s.

SRI’s test excavations reveal further that LAN-211/H may contribute important information about human occupation in the Ballona. Analysis of material culture remains suggest that the protohistoric-period occupation of the Ballona was distinct from those of previous periods. Faunal remains indicate a shift in prehistoric subsistence strategies from a long-standing strategy focused on lagoonal shellfish and terrestrial mammals to a generalized shellfish-collection strategy that included a range of coastal habitats. Subsistence at LAN-211/H also evidences an increase in the exploitation of bony fish from near-shore habitats, and the use of birds and exotic animals such as swans, pronghorn, antelope, and domestic animals. Given the unique nature of LAN-211/H, it is difficult to determine if these changes reflect general protohistoric patterns. Cultural materials from LAN-1932/H reflect similar patterns, but because of that site’s lack of integrity, they have little research value. The silting in of the lagoon and the reduction in its size during the protohistoric and historical periods, however, is consistent with these changes in subsistence strategies. Becker (Chapter 8) suggests that as the lagoon silted in during the protohistoric period, shellfish beds were reduced in size, forcing the last inhabitants of the Ballona to diversify their collection strategy and target rocky shore and sandy beach habitats. Such diversification might also have involved a shift from lagoon fish to bony fish from the open coastal zone, as well as the increased exploitation of birds. Overall, the vertebrate and invertebrate faunal collections from LAN-211/H contain a wider variety of species than most earlier sites.

The presence of exotic animals in the faunal collection and other aspects of material culture suggest that cultural interaction and exchange patterns also changed during the protohistoric period. Based on the beads recovered from LAN-211/H and other sites in the Ballona, Gibson et al. (Chapter 9) argue that the protohistoric occupants of the Ballona were fully involved in a large-scale economic interaction sphere that operated in southern California during this time. An important part of this interaction sphere was the increased use of shell ornaments. Becker (Chapter 8) points to the abundance of abalone and the presence of an exotic western pearlshell mussel, both highly nacreous shell species that were prized for shell-tool and -ornament manufacture, as indications of a tool or ornament manufacturing area. No direct evidence for shell tool or ornament manufacture, however, was found at LAN-211/H.

Rosenthal and Hintzman (Chapter 10) also tentatively suggest the tool collection reflects technological changes. With the exception of the presence of three flaked glass artifacts (as well as the glass beads), the artifact collection from LAN-211/H lacks evidence of materials, tools, and containers of European derivation such as those found at the early-nineteenth-century Hammack Street site, LAN-194. Rosenthal and Hintzman, however, suggest that the LAN-211/H collection reflects the decline in the use and manufacture of traditional stone tools. They see this pattern in the reduced volume of stone, a decline in the number of stone tool categories, and an increased use of smaller, portable tools. High-quality imported raw materials appear to have become difficult to obtain, and local quartzites were rarely selected for tool production. Instead, most tools were made from basalt and chert, which were obtained locally.

LAN-211/H can contribute unique and important information to our understanding of the two historic contexts that are the basis of our research at Playa Vista. Data from LAN-211/H fill a large void in the culture history of the Ballona area. Previous research at Playa Vista and the Ballona reveals a robust record of Early, Intermediate, and Late period occupation—from the initial settlement atop the bluff in the Early period to resettlement and reorganization along the edge of the lagoon in the Late period. By contrast, the data from LAN-211/H provide insights into the long-speculated, but poorly understood period of time that represents the transition from prehistory to history and from Native American to European lifeways. Preliminary evidence suggests that major changes occurred in human-land relationships in the Ballona during this important time period, as well as in the cultural dynamics of settlement. Our initial analysis of the data collected from the evaluation of this site reveals that these changes involved shifts in subsistence, technology, and social interaction. Much more research, however, will be required at LAN-211/H to explore these patterns fully.

LAN-2769

LAN-2769 presents a marked contrast to LAN-211/H. Although located in an identical setting at the base of the bluff a few hundred meters east of LAN-211/H, LAN-2769 is a sparse site of questionable integrity. LAN-2769 contains a very low-density cultural deposit that may be highly disturbed, if not secondarily deposited (Chapter 6). Only a small portion of the site could be investigated because of restrictions placed upon our excavations. Intact cultural deposits were apparent in an exposure at the base of the bluff when the site was first discovered (Altschul et al. 1991). The investigations reported in this volume, however, were unable to locate any intact deposits below the surface. Instead, severe disturbance was seen in our excavations. We did not attempt any radiocarbon assays from this site because of the paucity of cultural material and the questionable integrity of the deposit. Thus, its age is not known.

No temporally diagnostic artifacts were recovered from LAN-2769. The flaked stone is comparable to Late period collections in the Ballona in the prevalence of small tools made from chert and chalcedony such as unifaces, edge-modified flakes, bifaces, and dart and arrow points (Chapter 10). The small numbers of shellfish remains are mostly the bay- and estuary-loving species that characterize the shellfish collections from most of the prehistoric sites in the Ballona (Chapter 8). These habitats were located relatively close to the site in prehistory, and would have been easily exploited by the site's inhabitants. The equally small collection of vertebrate remains is also similar in its makeup to most other prehistoric sites located along the banks of Centinela Creek. The collection is dominated by terrestrial mammals, whereas the frequencies of fish and birds are very low (Chapter 7). Much of the bone is weathered and highly fragmented. Maxwell (Chapter 7) suggests that weathering patterns point to a typical Intermediate to Late period site from the Ballona. The high proportion of intrusive remains, especially rodents and snakes, which constitute the bulk of the identifiable fauna, together with the general lack of burned bone suggests to Maxwell that little of the recovered material from this site is of cultural origin. The presence of a few fish remains and some butchered bone are the only clear indications of human occupation. On the basis of the vertebrate fauna, Maxwell concludes that the site has been heavily impacted, if not largely destroyed, leaving only a handful of highly mixed remains. Stratigraphic analysis and other cultural materials suggest little else is present.

Recommendations

LAN-211/H is a rich cultural deposit, portions of which appear to be intact. The integrity of other portions of the site remain in doubt, and additional testing will be required to determine the full extent of intact deposits. A variety of mechanical and manual excavations by SRI revealed the presence of a unique and intact cultural deposit below the old parking lot at the base of the bluff that dates from the protohistoric to the early historical period. Cultural materials of this age are not replicated at any other intact site currently known in the Ballona. Our preliminary investigations suggest that this deposit can contribute much significant information to our understanding of man-land relationships, culture history, and the dynamics of settlement in the Ballona. Therefore, SRI recommends that this site is eligible for listing in the NRHP as a contributing member to the BLAD (see Table 1).

By contrast, LAN-2769 is a very sparse and low-diversity deposit of cultural material that appears to have been heavily disturbed by intrusive animals. The small amount of cultural material that is present is very similar to that found at several nearby sites with richer and more substantial intact cultural deposits. What little information is present at this site is redundant and can add little more to our understanding of man-land relationships, culture history, and the dynamics of settlement than what we have already learned from the investigations reported in this document. Therefore, SRI recommends that this site is not eligible for listing in the NRHP as a contributing member to the BLAD (see Table 1).

CHAPTER 12

Treatment Plan

Benjamin R. Vargas, Donn R. Grenda, and Anne Q. Stoll

In Chapter 11, we recommended that LAN-211/H is eligible for listing in the NRHP as a contributing element of the BLAD and that LAN-2769 is not eligible. In this chapter, we assume that the COE, after consultation with the SHPO, ACHP, and other parties to the Playa Vista programmatic agreement, has accepted our recommendations and has determined that LAN-211/H is an NRHP-eligible property. Based on this assumption, we have prepared a treatment plan that, when implemented, will mitigate potential adverse effects to LAN-211/H caused by proposed construction, through data recovery, analysis, and curation. As a noncontributing element of the BLAD, no further work is recommended at LAN-2769.

We begin with a discussion of the planned impacts to LAN-211/H to establish the background for the proposed data recovery. Next, we present our research design, including anticipated outcomes and data requirements. The scope and details of the treatment plan for LAN-211/H are then presented. A plan of work and level of effort for data recovery concludes the chapter.

Impact Analysis

LAN-211/H is situated within the riparian corridor, a strip of land following the base of the bluff destined to be occupied by landscaping and a drainage channel that will conduct run-off to the freshwater marsh west of Lincoln Boulevard. Much of the site will be destroyed by construction of the corridor and bluff stabilization efforts, although direct impacts vary across the site (Figure 83). Three planned construction projects within the corridor will impact LAN-211/H; first, a 30-m-wide (100-foot) drainage channel will be built at the east end of the site, which will open into a 39.6-m-wide (130-foot) drainage at the west end; second, an entry culvert will be constructed for water runoff from the bluff, and third, bank stabilization activities are planned that will involve various combinations of recontouring and revegetation with a variable depth of impact between 0.3 and 1.8 m (1 and 6 feet).

Impact depths of the drainage channel at finished grade are variable and have been estimated at about 1.5 m (5 feet) below the current ground surface at the east end to about 0.6 m (2 feet) at the west end. However, due to compaction requirements and soil conditions, the actual depth of impact will exceed finished grade. The exact amount of overexcavation, soil compaction, and building demolition is unknown, and other construction requirements have not been projected, so SRI has added a buffer of 1.5 m (5 feet) below the finished or existing grade, depending on which is lower. In some cases, finished grade is to be filled above the existing elevation. In this situation, the existing grade will be grubbed and ripped prior to filling. Under these assumptions, nearly all portions of LAN-211/H in the riparian corridor will be severely impacted or completely destroyed. Construction is not proposed for those portions outside the riparian corridor, primarily the northeast section of the site. In fact, deposition in this part of the site, though rare, should be spared from adverse effects of the development. Table 35 presents the type and depth of impact at specific points (i.e., known depths of culture-bearing strata) within the LAN-211/H site boundaries. Construction of the new alignment of Bluff Creek Drive will disturb the

The exact location of archaeological resources and sites are not subject to public disclosure to prevent harm and unauthorized disturbance of the resources and sites, pursuant Section 5097 of the California Public Resources Code and Section 800.11 of the National Historic Preservation Act, as amended. Therefore, this figure has been excluded.

Table 35. Impacts of Construction and Grading at LAN-211/H

Location	Impact	Depth of Impact AMSL		Top of LAN-211 AMSL		Bottom of LAN-211 AMSL	
		m	feet	m	feet	m	feet
Units 3 and 4	bluff stabilization	6.1	20.0	8.5	27.9	6.8	22.3
Unit 9	corridor bank	1.6	5.0	3.1	10.1	3.0	9.8
Unit 11	bluff stabilization	7.6	25.0	9.1	30.0	8.0	26.4
BA 176	corridor bottom	0.9	3.0	2.5	8.2	0.4	1.3
BA 192	grubbing	2.1	7.0	3.7	12.1	2.0	6.7
BA 202	rip and fill	2.9	9.5	4.3	14.1	2.8	9.1
Trench 1-6	corridor bank	4.0	13.0	1.8	5.9	2.9	9.5

area immediately north of the mapped boundaries of LAN-211/H. This area remains uninventoried for cultural resources as a result of restricted access, and there is a moderate probability for buried site deposits. Data recovery, then, will focus in the riparian corridor. This constitutes approximately 14,000 m^2 of the 27,000-m^2 site.

Research Design

In SRI's 1991 PVAHP research design, two historic-context themes were presented as guiding the evaluation of prehistoric cultural resources. These two themes are "human-land relationships" and "culture history and cultural dynamics of prehistoric settlement" (Altschul et al. 1991:23–26). The first theme relates to the ways in which prehistoric inhabitants of the Ballona adapted to variable environmental conditions. To create testable models of adaptive prehistoric response, SRI developed a large-scale, high-resolution paleoenvironmental reconstruction of the Ballona, which was presented in Chapter 5. The second theme encompasses the processual issues of chronology, technology, and cultural affiliation. Within the research scope of the PVAHP, these themes have been organized using either a locational (Altschul et al. 1999:113–123) or temporal orientation (Altschul et al. 1998:123–128; Altschul et al. 2003; Grenda et al. 1999:21–29). Our goal has been to establish the Ballona's interpretive context by examining prehistoric sites within their temporal and spatial contexts. Unfortunately, sites dating to both ends of the temporal spectrum are underrepresented in the Ballona. Because of the lack of archaeological data, research on the most recent phase of prehistory, the protohistoric period (which extends from about A.D. 1542 to 1771), and the early historical period (from A.D. 1771 to 1834) has lagged. The fortuitous discovery of LAN-211/H brought new information to light; we are now poised to pursue research on protohistoric-period occupation of the Ballona.

In this chapter, we present a model of settlement, subsistence, and technology as the main body of this research design. In this model, various scenarios are postulated that incorporate assumptions about the corresponding material record. These scenarios, presented as examples of what an archaeological site might look like given a specific set of conditions, provide hypotheses to be tested against the archaeological data recovered from LAN-211/H. The nature of the relationships between native people and Spanish and Mexican missionaries and settlers determines the form of the material culture to be found at the site.

Regarding the efficacy of model building in archaeology, Foster et al. stated:

> Theoretical models or "pure types"—abstractions of historical reality that can be used in predictive and generalizing ways—are useful tools for advancing comprehension of the data gathered during historical archaeological studies in the project area (Greenwood et al. 1993; Greenwood and Shoup 1983:7). Such models or pure types are logically precise conceptions and thus internally unambiguous. They allow the interpretation of material differences to take place within a holistic framework, without excavating an entire neighborhood or city (Cressey and Stephens 1982:50). They are constructed by isolating the underlying forces and tendencies in a given political economy and social system.
>
> Historical reality—with its multiple actors and complex interplay of human will, ideology, and material forces—does not follow such neat patterns. Yet, such constructs help to interpret a given society, as well as the process of change and development, by comparing and testing the historical and archaeological reality against the model (Foster et al. 1996:8–9).

The model of settlement and subsistence presented in this chapter follows Foster et al.'s (1996) statement in its idealistic intent. We acknowledge that the reality of the archaeological record is more complex and ambiguous. The scenarios are simplified; nevertheless, we feel they accurately reflect the behavioral responses of native people during the "contact" or protohistoric and early historical periods. Our model is useful for exploring the processes of change and development in a given society, in that the model provides a defined structure for comparison and thus a platform for analysis. We present these scenarios and their corresponding archaeological signatures as a heuristic device, to illuminate a part of Native American history not covered by written records.

Protohistoric and Early-Historical-Period Occupation of the Ballona

Following the cultural chronology presented in Chapter 2, the protohistoric period is given a clear definition. The first nonnative to make contact with the Gabrielino was Juan Rodriguez Cabrillo, a Spaniard, who reached Santa Catalina Island in October, 1542 (Beck and Haase 1974:13; McCawley 1996:4). We use the year of Cabrillo's landfall, A.D. 1542, to mark the beginning of the protohistoric period. Using this reasoning, we define a protohistoric period site as one that was created by Native Americans after this initial contact. The founding of the Mission San Gabriel in 1771 has been generally adopted for the end of the protohistoric period (King 1978:58), the date by which "Hispanics" are permanently established among the aboriginal residents of the Los Angeles Basin. As discussed in Chapter 2, the term "Hispanic" is used in this context to refer to the Spanish-born missionaries, to the ethnically mixed soldiers and immigrants who arrived from what is now Mexico to settle in the pueblo, and to the European-influenced culture introduced by these eighteenth-century arrivals to southern California.

At LAN-211/H, radiocarbon assays revealed that Late period components are present; however, they were discovered in a questionable context. The protohistoric and early-historical-period components of the site, dating after A.D. 1640, were identified within an intact, clearly definable stratum. With the integrity of this portion of the site established, LAN-211/H has the potential to illuminate one of the most obscure areas of history in the Ballona and the greater Los Angeles Basin.

Protohistoric and early-historical-period sites in the Los Angeles Basin are extremely rare and have been little studied. As our research has shown (see Chapter 2), the protohistoric and early historical periods in this region are poorly understood. As King observed more than 23 years ago, "The state of knowledge of protohistoric and historic California archeology is limited due to a general lack of intensive archeological investigations and failure of archeologists to distinguish protohistoric and archeological components from earlier components" (King 1978:58). It would seem that little has changed since these words were written. In contrast, elsewhere in the Americas, interaction between Native Americans and Hispanics has received much attention, with several volumes devoted to this issue (Cusick 1998; Farnsworth and Williams 1992; Fitzhugh 1985; Rogers and Wilson 1993; Spicer 1961; Walker 1972).

Although Cabrillo's arrival on Santa Catalina Island in A.D. 1542 marks the moment of initial contact, direct interaction between Hispanics and mainland Native Americans was delayed many years until 1769, when the Portolá expedition crossed the Los Angeles Basin on the way north to Monterey. Portolá found the area populated by people living in numerous small villages dispersed along the major drainages of the basin or in sheltered areas of the coast. These people came to be known as the Gabrielino, the result of their association with the Mission San Gabriel; today, some prefer the name Tongva.

Aside from very brief mentions of coastal people by sixteenth- and seventeenth-century explorers, the journals of the Franciscan missionaries are the primary sources available from which to reconstruct early-historical-period life in the Los Angeles area. Unfortunately, these are biased accounts written long after the fact. Their focus is exclusively on mission activities, with little mention of native people beyond those under the missions' direct sphere of influence. Mission records are essentially silent regarding the aboriginal inhabitants of the Ballona Lagoon, as they are concerning the population of "gentile" or non-missionized natives living in the rural portions of the Los Angeles Basin. Most ethnographic data were collected in the late nineteenth and early twentieth centuries by anthropologists such as J. P. Harrington, C. Hart Merriam, and Alfred Kroeber from informants who generally lived near or were associated in some way with one of the Franciscan missions in the region. These sources provide some indication of protohistoric and early-historical-period occupation of the Ballona, yet supporting evidence is frustratingly fragmentary and incomplete.

According to traditional documentary history, the demise of the indigenous residents of the Los Angeles Basin followed the familiar pattern of subjugation and steep population decline under mission domination. This simplified scenario overlooks the role played in Native American affairs by the pueblo of Los Angeles. Relations between the mission and the pueblo, tense from the beginning, were regularly inflamed by the employment of large numbers of gentile natives who lived at Yaangna, the village adjacent to the pueblo. These gentiles worked as day laborers in the fields and vineyards surrounding the pueblo (Phillips 1980). Through the early 1800s, this relatively self-sufficient group existed outside the spiritual and legal reach of the missionaries and were allowed to remain independent because their labor was in high demand. Contrary to Franciscan chroniclers, not all Native Americans, perhaps not even the majority, came under mission influence during this period. A few *rancherías* or communities of gentile natives might have persisted in the Los Angeles Basin through the 1850s, though their numbers were greatly reduced by such diseases as measles, dysentery, influenza, and, later, smallpox (Mason 1978:8; Phillips 1980:448).

In the Ballona, there was no established mission presence. When the sons of the Machado and Talamantes families sought pasturage for their cattle there in 1819, the Ballona's swampy lands were empty of official claimants, though perhaps not without occupants. With official permission from the Pueblo *alcaldes*, the brothers developed the rancho, herded animals, built adobes, and planted crops, all using native labor. In 1839, the Machados and Talamantes received formal possession of the Rancho La Ballona and created the hub of the historical community of Machado near present-day Culver City. A check of the census records shows that a few native ranch hands and servants still lived in the Machado area in 1900 (see Chapter 2).

From this perspective, our task is to explain what has been found at LAN-211/H and to create a framework within which our discoveries may be interpreted. Unfortunately, comparative material to build such a framework is lacking. Comparable studies of Native American–Hispanic interaction sites are dominated by work at the missions. Generally, these studies focus on the effects of the missionization process on Native American culture, and have been confined to examinations of neophyte dormitory areas (Hoover 1985), or aboriginal settlements located within a mission complex (Lightfoot 1995:204). The results of excavations at these sites are interpreted with the aid of a generalized culture history. Very few scholarly studies have attempted to look beyond the mission quadrangle for quantitative and qualitative comparisons with contemporaneous Native American sites.

The works of Deetz (1963), Bamforth (1993), Larson et al. (1994), Lightfoot (1995), Lightfoot et al. 1991, 1993, 1997, 1998), and Allen (1998) are exceptions. In each of these studies, especially that of Lightfoot and his colleagues (Lightfoot et al. 1991, 1993, 1997, 1998), the effects of aboriginal-Hispanic interaction are considered, and archaeological data are studied from outside of the colonial establishment as a comparative tool. These studies demonstrate a methodological approach which could be successfully employed in the southern California area.

Perhaps the most important characteristic of LAN-211/H is that the protohistoric and early-historical-period component is clearly definable, a unique situation among archaeological sites in the Los Angeles Basin. Because the postcontact component can be segregated and analyzed separately, we escape the problems that have plagued investigations of some other protohistoric and early-historical-period sites in California. So often when early-historical-period sites also contain significant prehistoric components, the two cannot be differentiated because of postdepositional processes such as plowing and rodent disturbance. Because such mixing appears to be absent in parts of LAN-211/H, a complete investigation of the postcontact component at this site during data recovery will provide an opportunity to address acculturation questions pertinent to the Ballona and the larger southern California region.

Research Domains

The research goals of the testing project in the remainder of Area D were basic: to locate and evaluate the integrity of archaeological resources within the project area boundary. As a result of SRI's initial findings, we are able to develop more complex research questions addressing site function and the relation of LAN-211/H to other sites in the Ballona. In this research design, we have divided the broad categories of human-land relationships, culture history, and the cultural dynamics of prehistoric settlement into three domains: paleoenvironment, chronology, and cultural adaptations. Paleoenvironment and chronology are treated as essentially separate research domains, whereas cultural adaptation—issues of subsistence, settlement, exchange and interaction, and technology—is addressed by the creation of several models of protohistoric adaptation in the Ballona. For each research domain, we present a brief context with research questions and our expectations of the archaeological record, followed by the data requirements necessary to address these issues.

Paleoenvironment

In our reconstruction of the paleoenvironment in Chapter 5, we discuss several broad issues that target prehistoric human occupation of the Ballona in relation to the development of the lagoon. Much of our work has focused on the Intermediate and Late periods within the Ballona, and questions specific to the protohistoric and early historical period have generally not been addressed. Two main issues are presented here: what was the depositional environment, and which plant and animal communities were present and exploited during the protohistoric and early historical periods?

Information from paleoenvironmental reconstructions, including pollen data (Davis 2000), indicate major fluctuations between periods of flooding and drought in the Ballona during the Holocene. Using historical data, Altschul, Homburg, and Ciolek-Torrello (1992) described high-magnitude flooding in the

Los Angeles Basin on the average of once every 84 years. Historically, the Los Angeles River was known to change course and sometimes enter the Ballona Creek drainage (see Chapter 5). In our initial work (Altschul et al. 1991), we assumed that Centinela Creek was perennial due to the reliability of its source, freshwater Centinela Springs. Archival research now casts some doubt on this assumption. On several historical maps, including the *diseños* of both the La Ballona and Sausal Redondo Ranchos, Centinela Creek was not shown nor was it mentioned in the 1875 survey notes (see Chapter 2). It seems unlikely that a potable water source such as Centinela Creek would have been omitted from these maps, if it existed. Whether Centinela Creek ran near its present route or entered Ballona Creek farther to the northeast has a bearing on the nature of occupation at the base of the bluff.

Stratigraphic profiles from the northern portion of LAN-211/H (see Chapter 6) and historical photographs of the project area (see Figures 35 and 53) from the twentieth century depict both major and minor flooding events in the Ballona. The timing and magnitude of these events, however, is not well understood. We assume that the prehistoric and historical-period inhabitants of the Ballona, especially those occupying the lowlands, developed strategies for coping with the unpredictable nature of flooding. Understanding the toll that episodes of flooding and drought had on Ballona plant and animal communities during the protohistoric period is an important research domain to be addressed during data recovery; also important is explaining the effect that floods have on archaeological resources.

The introduction of farming to the region would probably have affected water flow as streams and rivers were diverted to irrigate agricultural fields. The construction of *zanjas,* or water diversion channels, was common among the first building projects undertaken at new settlements; the main irrigation ditch, or *Zanja Madre,* from the Los Angeles River to the pueblo was completed at the end of October 1781, less than two months after the original Hispanic settlers arrived (Gumprecht 1999:44). Survey maps of parcels within the Rancho La Ballona indicate that irrigation ditches taking water from Centinela and Ballona Creeks to the fertile agricultural lands east of the Playa Vista project area were well established by 1866 (Huntington Library, San Marino, California, Solano-Reeves Collection, Hansen Field Book 38, Box 2). Although many of these features have been mapped and recorded, little is understood about the effects that such features had on the natural flow of water in the region.

A further significant environmental impact to indigenous populations of the Los Angeles Basin was the decimation of native plant and animal communities as a result of the introduction of agriculture and grazing of domesticated animals (Crosby 1986; Farnsworth 1987:92; Greenwood 1989:455; Hoover 1989:398; Johnston 1962:136). During the historical period, mission and pueblo grazing lands covered thousands of acres over most of the Los Angeles Basin. The result of overgrazing, inadvertent introduction of plant species, and field agriculture was that native plant communities were largely overrun by introduced species of European grasses and weeds. Often carried in the wool of sheep, European grasses and plants were quick to overwhelm native species (Chartkoff and Chartkoff 1984:267–268). The Gabrielinos who worked as ranch hands were occasionally allowed to cultivate their own crops to supplement traditional subsistence plant foods that were quickly disappearing (McCawley 1996:200–201). Depending on the period during which a particular site was occupied, the introduction of new plant species and the destruction of native plant communities may be visible in the archaeological record. This presents a topic of interest to be addressed in data recovery at LAN-211/H.

Research Questions

The following questions are specific to the protohistoric and early historical periods within the Ballona and can be addressed with data collected at LAN-211/H:

1. What was the relative importance of Ballona and Centinela Creeks during the protohistoric and early historical periods? Why does Centinela Creek frequently fail to appear on historical maps? Is upstream irrigation a significant factor effecting the Ballona Creek's flow? Are there major differences between the depositional environments of the Early, Intermediate, Late, protohistoric, and

early historical periods? Can we map the locations of both creeks during the protohistoric and early historical periods? Is there a riparian zone located near the base of the Ballona escarpment during those times?

2. What is the nature of flooding in the Ballona? Are particular events visible in the stratigraphic sequence? Were floods strong enough to affect decisions on the location of settlements, or were these events minor, with no bearing on settlement? Are such floods associated with Centinela or Ballona Creeks?

3. Were native plant populations in the Ballona affected by contact, and establishment of Hispanic settlements in the Los Angeles Basin? Do we see the effects of Hispanic contact in the paleobotanical record?

Data Requirements

Three types of data will be used to address these questions. The primary type of data to be collected will be fine-grained stratigraphic data collected from controlled sampling of midden and feature contexts, as well as from locations peripheral to the site boundaries. Recording of attributes, and physical testing of soils will be used to assess the integrity of cultural deposits and to identify particular geologic data such as flood episodes. Radiometric dating of particular stratigraphic units will aid in tying particular events to human occupation of the Ballona.

Macro- and microbotanical samples constitute the second type of data to be collected. Microfossils that are sensitive to environmental changes will be collected from midden and feature contexts to be compared with nonarchaeological materials of the same age. Macrobotanical samples, such as burnt seeds, will be collected from soils in similar contexts. By collecting these data, environmental and human alterations to the landscape can be reconstructed.

The third line of data to be pursued comes from archival resources. We propose extensive archival research that would include the study of various historical maps and photograph collections. Based on our initial research, it appears that there are some inconsistences in the mapping of environmental features such as Centinela Creek and the extent of marsh areas. Historical records covering boundary disputes and irrigation water rights may provide data on historical flow rates in Centinela and Ballona Creeks. Collecting and georeferencing such data will aid in interpretations of field data and the nature of postdepositional processes.

Chronology

Key to understanding the nature of LAN-211/H is the placement of the site within the temporal context and cultural evolution of the Ballona. Radiocarbon assays returned dates from the Late and protohistoric periods (see Table 11); shell bead data place the site squarely within the protohistoric period (see Chapter 9). Whereas Late period dates were obtained from a possibly disturbed context, the protohistoric period dates are from a clearly definable, intact deposit at the base of the slope. The Late period dates from Unit 6/10 were obtained from shells that were separated by approximately 1 m. The resulting dates, A.D. 610 and A.D. 1000, are suspect because the more recent date was obtained from the lower sample, whereas the older date was derived from shell in the upper level of the unit.

The two remaining radiocarbon assays run from LAN-211/H were both obtained from shell found in Unit 9. Two different shell species were used for the testing, *Haliotis* spp. and *Chione* spp., which, when adjusted for the reservoir effect, produced two-sigma calibrated dates that statistically represent the same time span, between A.D. 1405 and 1810, solidly within the protohistoric and early historical periods.

Although producing credible results from Unit 9, the site's disturbed soils and relatively recent age suggest that we may be working at the limit of the effectiveness of the radiocarbon assay technique.

Corroboration of this date range is indicated by the presence of butchered cow bone in the deposit (see Chapter 7). Cattle were first introduced into Baja California by Jesuit priest Eusebio Kino in 1679; they arrived in numbers in Alta California with the expedition of Juan Bautista de Anza, who brought 1,000 head from Mexico to supply the settlers among his group (Santos 1994:2). Thus, unless they are intrusive, the cow bones found in and near Unit 9 place the date of the upper levels of the site to the early historical period.

The lack of an Intermediate period component to the site is intriguing. Clearly, there is a significant Intermediate period occupation along the base of the bluff at adjacent sites such as LAN-193/H and LAN-2768. It is possible that an Intermediate period component also exists at LAN-211/H, but the limited sample drawn for radiocarbon testing failed to include the earlier material. Additional data are needed to resolve these chronological issues at this site.

Documentary information about Native American lifeways in the Los Angeles Basin during the early historical period has only been partially explored and synthesized; probably the best effort to date is the work of McCawley (1996), which, though scholarly, leaves many questions unanswered. An extensive body of research exists for the Chumash cultural group who lived north of the Ballona area (e.g., McLendon and Johnson 1999) and the later phases of the protohistoric San Luis Rey culture to the south in San Diego County have been well studied (e.g., True et al. 1991). However, most of what is conjectured about Gabrielino cultural patterns prior to the establishment of Franciscan missions is based on a cloudy ethnohistoric record. For example, ethnographer John P. Harrington's principal informant on the Gabrielino, José de los Santos Juncos, was actually of Juaneño descent, while his second-most useful source, José Maria Zalvidea, was unable to speak the Gabrielino language (McCawley1996:14–16).

Recent research with aerial photos and various map collections has revealed intriguing new data about occupation of the Ballona during the latter part of the historical period (see Chapter 2); information about the Ballona during the earlier "mission" period, however, is entirely lacking. Study of San Gabriel Mission registers has the potential to yield information regarding early-historical-period occupation of the Ballona as well as illuminating issues of social organization for the Gabrielino in general. Data from primary sources such mission registers and journals, along with other archival sources such as newspaper articles, maps, government documents, and photo archives, has the potential to yield information on the little known inhabitants of the Ballona during the early historical period.

Regional models of protohistoric and early-historical-period occupation of southern California are lacking. Most often, at other archaeological sites, a protohistoric or early-historical-period component may be known by the presence of glass trade beads or temporally sensitive shell beads but cannot be discerned from the rest of the archaeological record. Unfortunately, mainland sites in southern California are usually subject to years of destruction and mixing from bioturbation. In a portion of LAN-211/H, we have uncovered an intact deposit dating solely to the protohistoric and early historical period, providing a unique opportunity to study this period in isolation. The ethnohistoric record for the Los Angeles Basin is based largely on data collected years after the end of Native American occupation of the area. Rather than using the historical record as a tool for explanation of the archaeological data, our focus will be to develop a comparative approach that moves back and forth between the archaeological and ethnohistoric records.

Research Questions

Two sets of questions are addressed under the category of chronometric issues:

1. Can we distinguish temporal components within the site? Can temporally discrete strata be identified within the deposit? Is the LAN-211/H location unoccupied during the Intermediate period?

2. Is the ethnohistoric record for the Ballona reliable? Is there information regarding Ballona inhabitants available from the registers of Missions San Gabriel or San Fernando? Can we develop regional models useful for answering questions about protohistoric and early-historical-period sites based on the ethnohistoric record in addition to the archaeological record?

Data Requirements

To address the first question, we must further evaluate the integrity of the cultural deposit from which the Late period dates were obtained. Data recovery efforts will need to include large-scale excavations with large subsurface exposures to document the content and integrity of the stratigraphic units. Radiocarbon samples will be collected from identified strata to confirm the occupational history of the site. If features are located through excavation activities, then radiocarbon samples on items such as shell and, if possible, matched pairs of shell and carbon will be collected.

Results from radiocarbon assays will be compared to dates produced by temporally sensitive artifacts such as cow bones and shell beads that can be correlated to particular strata. Absolute dates obtained from marine and freshwater shell species are subject to several problems associated with the natural environment in which they form. Problems such as the reservoir effect, isotopic fractionation, and the presence of radioactive carbon have all been discussed previously (Altschul et al. 1999). As part of the data recovery process at LAN-211/H, SRI intends to develop a calibration curve for the Ballona to compensate for the variation created by these problems. The collection of numerous radiocarbon samples will aid in this process.

As part of the data recovery process, we suggest extensive archival research be undertaken, comparable to that done in the Chumash region (Gamble 1991; Johnson 1982, 1988; King 1992, 1994). The study of mission registers, as well as historical photographs, maps, and government-document collections may provide new primary source data for the Ballona,. The resultant synthesis of the archival data will be used to develop a model for postcontact archaeology in the region, to be tested at other protohistoric and early-historical-period sites.

Cultural Adaptation Model

In this section, we have combined the broad issues of subsistence, settlement, and technology under the heading of cultural adaptation. Blending the archaeological, ethnographic and historic data, the model presents potential scenarios for early-historical-period occupation of the Ballona area, and the accompanying patterns that might be seen in the resulting archaeological record. The scenarios differ largely on the inferred degree of interaction with the Missions San Gabriel or San Fernando, the fledgling pueblo of Los Angeles, or one of the Hispanic ranchos in the area. Figure 84 presents a graphic representation of the model, and Table 36 presents the basic assumptions underpinning the model, with corresponding data categories.

Occupation Scenario 1: Gentile or Renegade

There is a strong possibility that the archaeological signature at LAN-211/H was produced by non-Christianized "gentile" or ex-neophyte "renegade or fugitive" Gabrielinos. A gentile site is one that was inhabited by independent natives who never entered the mission system. A letter written in 1820 by Fathers José Maria Zalvidea and Joaquin Pasqual Nuez from Mission San Gabriel mentioned native settlements and *rancherías* existing outside of the missions in that year:

> With regard to the personal affairs of the missionary Fathers of Mission San Gabriel, we have to say to Your Honor with all due respect that we are in a Mission of 1,600

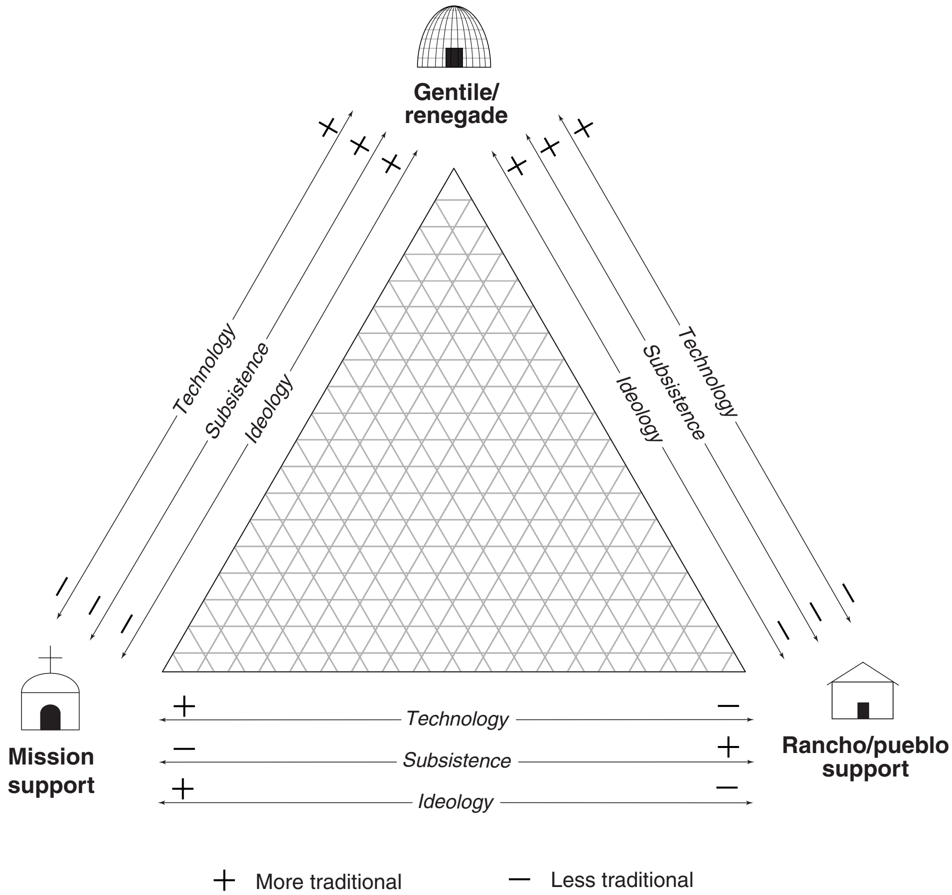


Figure 84. Cultural adaptation model for early-historical-period archaeological sites.

> Christian Indian souls, distributed through necessity in fifteen ranches at various distances, whose care in spiritual and temporal matters is entrusted to us. . . . Furthermore, there are in our charge a reduction of hundreds of pagan Indians who live in their villages (Santa Barbara Archives, letter from Zalvidea and Nuez to Antonio Yorba, April 6, 1820; quoted by Engelhardt 1927a:118).

This statement, made nearly 50 years after the founding of the mission and 40 years after the establishment of the pueblo, clearly shows that hundreds of native peoples still lived outside the direct sphere of the mission system. Similar statements were made regarding the existence of "pagan" or nonmissionized Native Americans at almost all of the other missions in California (Geiger and Meighan 1976). The purported village locations of Sa'angna or Guaspita (Chapter 2), if they existed, may represent this type of settlement.

Another possibility is that LAN-211/H may represent a renegade or fugitive site; that is, one created by estranged neophytes or runaways from the mission, living in the Ballona to escape retribution. Once natives entered the mission, were baptized, and became neophytes, it was understood that they were to maintain residence at the mission or mission establishment, other than brief trips to collect resources or visit relatives (Engelhardt 1927a; Johnston 1962; McCawley 1996:196). In describing the conversion process, Father Pedro Font stated:

Table 36. Cultural Adaptation Model

Factor	Mission-Support Scenario	Gentile or Renegade Scenario	Rancho- or Pueblo-Support Scenario
SETTLEMENT	TEMPORARY	PERMANENT	SEMIPERMANENT TO PERMANENT
Use of space	little site structure; houses absent or temporary	Structured use of space on site; permanent houses in traditional style	Structured use of space on site; permanent houses in Hispanic style
Middens	poorly developed	Well developed	Well to moderately developed
Features	few or small; little variability, mostly hearths or related to food processing	Numerous; wide variety of types: houses, hearths, roasting pits, storage pits, refuse dumps, dance floors	Moderate number; mostly traditional houses, hearths, roasting pits, storage pits; nontraditional feature structure associated with nontraditional activities
Mortuary practices	few or no burials; if present, unstructured use of space, Christian style	Cemetery present; structured, traditional mortuary patterns	Few or no burials; if present, structured use of space, Christian style
Ceremonial features	None	Present	Few or none
DIET BREADTH	FOCUSED OR HOMOGENOUS	GENERALIZED OR DIVERSE; MOST TRADITIONAL	DIVERSE; LEAST TRADITIONAL
Faunal remains	Focused strategy: low variability, or high numbers of few taxa	Diversified; wide variety of taxa; possible emphasis on juvenile or small taxa due to constricted procurement range	Diversified; wide variety of taxa
Domesticated species	Few or none	Few or none	Numerous; possibly majority of faunal collection
Plant remains	Focused strategy; high numbers of some traditional species, some or no introduced species	Diversified; few or no introduced species, some traditional species	Diversified; higher numbers of introduced species; lesser quantities of traditional species, but focused on a few taxa
TECHNOLOGY	MIXED	MIXED; RENEGADE: SOME HISPANIC GENTILE: MOSTLY TRADITIONAL	MIXED: MOSTLY HISPANIC
Lithics	Expedient; possibly crude technique, mostly traditional materials, some flaked glass; traditional ground stone forms	Formal tools. Renegade: some Hispanic ground stone types. Gentile: mostly traditional forms; mostly traditional materials, little or no flaked glass; traditional ground stone forms	Mixed formal and expedient; new forms, crude work; some traditional materials, flaked glass or ceramics; both traditional and Hispanic ground stone forms
Butchering	Traditional methods of butchery with both traditional and Hispanic processing	Renegade: traditional butchery and processing, few Hispanic tools and methods. Gentile: traditional butchery and processing, traditional tools	Hispanic methods of butchery, traditional and Hispanic processing
Clothing	Mostly Hispanic styles	Traditional; some Hispanic	Mostly Hispanic styles
Ceramics	Few or none; mission ware	Few or none; mission ware	Numerous; mission ware, and Hispanic and Chinese styles
Trade goods	Restricted: both traditional and Hispanic materials	Restricted: some traditional materials	Restricted: mostly Hispanic materials

> As those Indians are accustomed to live in the plains and hills like beasts, they are informed in advance that, if they wish to be Christians, they can no longer go to the mountains, but have to live at the Mission; that, if then they leave the rancheria (thus they call the huts and dwelling-place of the convert Indians), they will be followed and sought and then will be punished [Font diary, January 5, 1776, quoted by Engelhardt 1927a:34].

There are few written descriptions of military forays to gather runaways or renegade individuals. Nonetheless, it is clear from the writings of the missionary fathers that desertion was a common problem (Cook 1976; Engelhardt 1927a, 1927b; Geiger and Meighan 1976; Johnston 1962; McCawley 1996:196). At Mission San Gabriel, until the year 1817, almost 10 percent of all converts had deserted (Cook 1976: 61). Several small military incursions into the gentile settlements were described, but usually in response to attacks on missions or other neophyte groups.

If Gabrielino renegades were only briefly associated with the mission, it might be nearly impossible to differentiate the signature of such a site from one that had been occupied by Gabrielino gentiles. The difference between these occupations is a matter of degree. An ex-neophyte renegade site might contain slightly more evidence of familiarity with mission commodities and practices, but there would be very little, if any, evidence of direct contact with Hispanic culture. Indeed, it is likely that renegades ran to familiar gentile villages for safety, further blurring the distinction between these two site types. Archaeologically, a few purported renegade or fugitive settlements have been found in the Central Valley (Jackson and Castillo 1995:36; McCawley 1996:196). The material culture of these sites is of great interest but has proved difficult to interpret. In the absence of better-reported examples, we are obliged to consider gentile and renegade sites to be archaeologically indistinguishable.

Very few gentile settlements dating to the early historical period are known in the Los Angeles Basin and those identified are poorly represented in the literature. Those at which archaeological work has been done generally lack conclusions regarding such important considerations as site structure (Ciolek-Torrello 1998:209) and integrity. Limited excavations have been conducted at the historical Gabrielino villages of Siutcanga (the Encino Village site) (Mason 1986; Whitney-Desautels 1986b), Povuu'nga (Dixon 1972), Kengaa or Genga (Koerper and Drover 1983; Koerper, Earle, Mason, and Apodaca 1996a), Engva or Ongoovanga (Wallace 1984), Malaga Cove (Walker 1937, 1952; Wallace 1986), Suanga or Swaanga (D. Bonner 2000; W. Bonner 2000a, 2000b; Christy 2000; Frazier 2000; Luhnow 2000), yet all have produced only brief descriptive reports.

These sites have been linked to ethnohistoric data from mission registers, and all contained artifacts reflecting their occupation during the early historical period. Excavations at these sites, however, produced little in the way of structural or regional interpretations. For comparisons, we resort to work done in the Chumash area to the north, where sites have been described and interpreted in more detail. Gamble's (1990, 1991) discussions of the historic village of Helo' are an example of an interpretive work at a mission-era gentile site in which site structure was compared to ethnographic and archaeological descriptions. Although admittedly outside of the Gabrielino area, Gamble's work serves as the basis for much of the discussion of site structure in this section.

Archaeological Signature of a Gentile or Renegade Site. In this scenario, settlements should reflect permanent occupations with houses, extramural features, and well-developed middens. A description of a Gabrielino house made by Father Antonio de la Ascensión, a chronicler of the 1602 Vizcaino expedition, while visiting Santa Catalina Island, indicated that these structures could be substantial: ". . . houses made like cabins . . . [were covered with] . . . a mat of rushes very closely woven . . . which they set up on some great upright forked poles. They are so spacious that each will hold fifty people" (Wagner 1966:237; quoted by McCawley 1996:29).

At Helo’, excavated house pits with well-defined features and multiple floors were found that proved consistent with similar ethnohistoric descriptions of Chumash houses (Gamble 1991). From this example, we hypothesize that a gentile or renegade archaeological site should show signs of traditional placement of houses and use of space. In a survey of archaeological and ethnohistoric data, Gamble (1991) discussed several mapped historic Chumash villages in which alignments of houses in rows or lines were described, clearly showing structural organization, and other researchers have also examined the size and formal layout of Chumash villages, defining a village by the number of occupants (Brown 1967; King 1969). On the other hand, using data generated during excavations on Santa Cruz Island, Ciolek-Torrello (1998:212) described houses arranged in a compact group, rather than in lines; a renegade settlement might be clumped this way for protective purposes. Regardless of their organization, we hypothesize that village settlements will exhibit signs of formal or strategic arrangement of structures. Further, the settlement will include a complex suite of extramural features, as these are typical components of villages built by people at this level of cultural complexity (Binford 1983:190; Ciolek-Torrello 1998:191–222; McCawley 1996:23–33; Raab 1993:149).

At a sedentary village, the normal range of activities should produce a variety of features such as house pits, hearths, roasting pits, storage features, activity areas, discrete refuse dumps, processing features, and ritual features. Interpreting site structure based on ethnoarchaeological research, Binford (1983:190) stated:

> I think it is fairly obvious that the care with which an area is maintained is related to the intensity of its use, other things being equal. Areas used intensively are maintained the most thoroughly and will therefore be associated with specialized disposal areas. The degree to which this is true, however, is also a direct function of the length of time that such intensive use lasts—maintenance of areas used intensively only for short periods is minimal. . . . Moreover, the longer the occupation, the more diverse are the activities which are likely to be conducted, so there should be a correlation between length of occupation and the numbers of special purpose activity areas and/or the quantity of carefully maintained, large-scale areas on the periphery of the major activity area.

At Helo’, extramural features such as refuse dumps, rock and FAR clusters, storage pits, ash lenses, and post holes were all found in association with house floors (Gamble 1990:7-1–7-23, 1991:231–273). House floors were well defined and consisted of compacted layers of clayey soil, with a small amount of artifactual material. Several layers were often noted, indicating multiple episodes of preparation and use. Refuse dump features, such as ash lenses, shell lenses, and pits containing concentrations of shell, ash, bone, and other refuse, were typically found outside of house floors, a trait seen at other sites with house pits. Hearths and other rock cluster features were found within and external to the house floors. Many of these features had artifacts and ecofacts associated with them, suggesting they were used in processing activities as well as for providing warmth. Rock-cluster features and hearths are common in the archaeology of southern California, and often these are the only types of identifiable features found at sites.

Based on comparable examples, evidence of traditional ceremonial or ritual activities should also be present at a gentile or renegade site. The likely forms of such features are sweat lodges, dance floors, or other ritual structures (Ciolek-Torrello 1998; Gamble 1990, 1991). In Gamble’s survey of ethnohistoric and archaeological data for the Chumash area, most village sites had some indication of ritual space commonly identified as a sweat lodge, menstrual hut, or sometimes a dance floor. Ciolek-Torrello (1998) discussed these features at length, presenting common traits and describing several variations in the styles. Sweat lodges were typically semisubterranean, with mud roofs and walls, medial support posts, and large central hearths. Ciolek-Torrello also noted that these buildings were usually located near a water source and sometimes appear to have been intentionally burned.

The remains of ritual features such as dance floors and ceremonial enclosures are likely to be more subtle in the archaeological record than other occupational features such as house pits. Gamble (1991) identified possible dance floors as large areas of cleared and compacted earth, sometimes surrounded by cobbles. Ethnohistoric literature details the presence of windbreaks around ritual features in the Gabrielino territory (Kroeber 1925:628; McCawley 1996:148). In one of the earliest encounters between the Gabrielino and the Spanish at Santa Catalina Island, Father Antonio de la Ascensión described the *yovaar,* or ceremonial enclosure, as a

> place of worship or temple where the native perform their sacrifices and adorations. . . . [It] was a large flat patio and in one part of it, where they had what we could call an altar, there was a great circle all surrounded with feathers of various colors and shapes, which must come from the birds they sacrifice. Inside the circle there was a figure like a devil painted in various colors, in the way the Indians of New Spain are accustomed to paint them. At the sides of this were the sun and the moon [Wagner 1966:237; quoted by McCawley 1996:5].

The mortuary practices of gentiles are also expected to be essentially traditional, although the presence of Hispanic items is expected. In later ethnohistoric accounts of the funerary practices of the Gabrielino, both interment and cremation methods were used for the disposal of the dead (Blackburn 1963:33–36). Generally, grave goods were interred with the dead, or, in the case of cremation, the belongings of the deceased were burned. That both methods were used seems to signal a change in practices during the protohistoric and early historical periods:

> Nowadays they do not burn the dead as they did at the beginning of the conquest; but they do still put seeds with them at burial. When an unconverted Indian dies, they make a deep hole for him. Into this they put a pot, a basket, an otter skin, and some two or three pesos worth of beads, above these the dead body, and this they cover with earth [Blackburn 1963:34].

Comparing several Chumash gentile cemetery sites, Martz (1992) noted that practices diverged significantly during the early historical period. In her study of status differentiation in burial populations, Martz was able to identify an increased emphasis on wealth in later populations, which she attributed to the greater availability of high-status goods as a result of interaction with the Spanish (Martz 1992:150). Status differentiation in household activities was well documented at mission sites, but was not an expected trait at early-historical-period gentile settlements; Martz's results represent a significant step forward in archaeologists' understanding of gentile burial practices. Martz also observed low numbers of females in the subject population, a pattern that differed from earlier sites.

The discovery of numerous protohistoric and early-historical-period burials at LAN-2682, the ARCO site, promised a wealth of comparable data about Gabrielino mortuary practices. Located in the city of Carson, this site is probably associated with the ethnohistoric Gabrielino village of *Su'anga* or *Swaanga* (W. Bonner 2000a; Luhnow 2000). Incomplete documentation has made interpretation of this site problematic; nevertheless, the burial assemblages are noteworthy. Two burial populations were uncovered; more traditional methods of burial were noted in the earlier population, whereas burial practices for the later, mission-era population exhibited no patterning of any kind. Inhumations in varying positions, cremations, and partial cremations were all recorded within the small area excavated into the later component, where a limited number of Hispanic items such as leather discs and glass beads were found in association with the human remains (Luhnow 2000). The lack of consistency in the method of the disposal of the dead fits with the ethnohistoric data (Blackburn 1963). The irregularity in mortuary styles in the later population is associated with cultural upheaval during the early historical period (Luhnow

2000). If human remains are found during data recovery at LAN-211/H, an analysis of burial methods used by the occupants will probably prove useful in distinguishing gentiles from missionized occupants.

Considering the predicted subsistence practices in the gentile or renegade scenario, a generalized procurement strategy, with a variety of taxa evident in the faunal collection, is expected. Because of constricted collection range and the associated subsistence stress (overpredation), certain taxa may be represented in what is considered normally small size classes by increasingly smaller individuals or juvenile stages (Salls 1988). Diet breadth expands predictably in response to constricted environmental circumstances also (Halstead and O'Shea 1989:4; Raab 1996; Raab et al. 1995; Winterhalder 1981). For example, the shellfish collection may include different, "less desirable" taxa that would have been passed over during normal collecting conditions (Glassow 1992:127). Gentile sites may include the remains of small species such as rodents or reptiles, sometimes in large numbers, also indicating expanding diet breadth. Sites later in the historical period may also show evidence of overgrazing and agriculture. These practices strongly affected the botanical and mammalian resources that were available to indigenous people attempting to retain a traditional lifestyle (Lightfoot 1995). Macrobotanical samples should indicate the presence of introduced plant species.

Domesticated animal species that might be found in the faunal collection at a gentile site should be few, and those present should show mostly traditional butchery and processing methods. In the case of a renegade community, a slightly greater number of domesticates might appear, as ex-neophytes would be more familiar with the introduced species. If significant numbers were present, it might indicate that the former neophytes were raiding cattle or other animals, a practice known to have occurred (Engelhardt 1927a:352; Lightfoot 1995:201). However, even if remains of cattle or other domesticates were found in large numbers, the method of butchery would still be traditional, using a mostly native tool kit. Bones exhibiting Hispanic-style cut marks, indicating that butchered meat had been given to the natives by the mission fathers or rancheros, would not be anticipated.

Stone tools found in a gentile site would probably appear similar to those used in prehistory, as this type of occupation is essentially a slightly modified continuation of prehistoric and protohistoric lifeways. Most of the lithic collection should use traditional materials, with very little or no substitution of such Hispanic materials, as glass or ceramics. Traditional ground stone forms should persist also, unless decimation of native plant species has lowered the relative amount of ground stone found in the collection overall.

Formal or curated tool technologies, as opposed to more expedient methods, are expected because of restricted access to tool stone. Trade for tool stone was greatly effected by the mission system as marriage and economic ties to other kin groups were disrupted and traditional trading partners were slowly eliminated by incorporation into the mission system (Bamforth 1990a, 1993; McCawley 1996). Lithic collections will reflect the alteration of traditional trade relationships by containing smaller amounts of imported materials such as obsidian or fused shale. As Hispanic technology became increasingly available in the early historical period, obsidian and fused shale were replaced by metal and glass. This trend was observed at the historic village site of Helo', where Bamforth (1990a) noted the influx of metal tools; for example, shell beads were drilled with metal needles, rather than the earlier chert microdrills. At later sites, the technological transition should be clearly visible in the archaeological record: gentile sites would include the smallest quantity of these introduced materials.

Little or no prehistoric ceramics are expected, as pottery-making generally was not practiced in this area; there might be a small amount of what is commonly called "Mission ware," a low-fired brown ware made at the missions and widely traded. At the coastal Chumash village of Muwu, small amounts of plain brown ware of this type were identified as forms produced at Mission San Buenaventura (Love and Resnick 1983). A few other ceramic types such as Mexican majolica and Chinese porcelain were also found at Muwu, but in very small numbers. Gentile clothing is expected to follow traditional lines—that is, almost nonexistent and leaving little or no trace in the archaeological record.

Engelhardt (1927a:83) asserts that San Gabriel Mission territory extended to Santa Monica Bay. Mission records indicate gentiles were occasionally recruited for the mission from the Santa Monica area as late as 1819 (see Chapter 2), so some gentile population continued in the area. The distance from the mission and the marshy nature of the Ballona wetlands, however, might have permitted gentile residents to live at the base of the bluff in relative isolation during the early historical period.

In summary, the archaeological signature for a gentile site may be difficult to distinguish from the renegade type; essentially the difference between the two is one of degree. We expect some indication of contact with Hispanic lifeways, though possibly indirect, and we anticipate that the renegade site will show the greater influence. Renegades, we assume, had some type of early relationship with the mission, however brief and, through this, were exposed to Hispanic technology and goods. In general, we expect a slightly higher degree of Hispanic influence in the renegade site than in the purely gentile settlement. In both, the faunal collection should reflect a generalized subsistence strategy with permanent rather than seasonal occupation of the site and many, if not most, of the lifeways expressed in the material culture found at the site should reflect the persistence of traditional practices.

Occupation Scenario 2: Mission Support

In our mission-support scenario, we hypothesize that neophytes in good standing and associated with Mission San Gabriel (or, possibly, Mission San Fernando) might have established a camp in the Ballona for temporary subsistence procurement or in support of mission activities, such as basket making.

The mission-support scenario is framed by two opposing scholarly perspectives regarding the relationship between the natives and missionaries during the early historical period. The traditional view sees the Franciscan missions as the harbingers of the immediate demise and destruction of Native American lifeways (Castillo 1978, 1989; Chartkoff and Chartkoff 1984; Cook 1976; Costo and Costo 1987; Jackson and Castillo 1995; Moratto 1984). This perspective holds that native people were forcibly brought to missions, detained against their will, and stripped of their native identity by being compelled to adopt Hispanic lifeways (Castillo 1978:101; Costo and Costo 1987:3). The opposing view, which relies on ethnohistoric and archaeological data for support, sees Native Americans as more autonomous and points to the continuation of many traditional practices outside and inside Hispanic institutions during the early historical period (Allen 1998; Deetz 1963; Farnsworth 1987, 1992). Our mission-support scenario follows the arguments of these later scholars, in a departure from the traditional view of Native American–Hispanic interaction during this period.

Archaeological models promoting the concept of forced acculturation have long been attacked for their failure to recognize that Native Americans often entered the mission system of their own volition. The popularized view of the past invariably depicts native people as passive recipients of Hispanic culture, until pushed to overt revolt or resistance. More current research has shown that native peoples were active participants in the cultural exchange, able to make conscious decisions about their degree of interaction with Hispanics (Bamforth 1990a, 1993; Dias 1996; Larson et al. 1994; Lightfoot 1994, 1995; Lightfoot et al. 1998; Phillips 1974; Schortman and Urban 1998; Wilson and Rogers 1993). Although there is no doubt that the effects of disease and abuse had disastrous consequences on Native Americans in the region, there is little solid evidence to substantiate forced conversion.

Mission records (an admittedly biased source) from the early years of the mission system state that native people were not forced into the Christian fold. Engelhardt (1927a), who wrote extensively on practices at Mission San Gabriel, maintained that the Gabrielino were free to choose whether they desired to become Christians. Father Pedro Font, a chronicler of the Anza expedition, explained that "The method which the Fathers observe in the Mission is this: They do not oblige any one to become a Christian, since they admit only those who voluntarily offer themselves" (Font diary, January 5, 1776; quoted by Engelhardt 1927a:34). Although once pagans chose to be converted, they were obliged to remain at the mission, the image of impoverished natives incarcerated within the mission walls is clearly inaccurate. Recent studies indicate that some native cultural practices were tolerated, if not encouraged, inside the mission system. On occasion, generally when prompted by necessity, neophytes were encouraged to temporarily leave the missions to return to traditional subsistence practices to supplement meager diets (Bamforth 1993; Coombs and Plog 1977; Engelhardt 1927a:36; Hoover 1989; Johnston 1962). On the subject of native conversion, Father Font continued:

> If an Indian wishes to go to the mountains to see his relatives or to gather acorns, he is given permission for a certain number of days, and generally they do not fail to return. At times they come with a pagan relative who stays for the catechetical instruction, either drawn by the example of the others or attracted by the *pozole* [“a thick soup of grain, vegetables, besides flesh meat”] which suits them better than the herbs and the food they gather in the hills. So these Indians are wont to be collected through the stomach [Font diary, January 5, 1776; quoted by Engelhardt 1927a:36; explanatory footnote by Engelhardt inserted].

Mission-support sites, we expect, would be short-term camps located within easy traveling distance from the host mission and were established for the acquisition of traditional resources in areas where resources had been exploited prehistorically; there, neophytes might have pursued such activities as fishing, hunting, plant harvesting, shellfish collecting, and basket making. We now explore the anticipated components of such a site.

Archaeological Signature of a Mission-Support Site. The archaeological signature of a mission-support site should reflect only temporary, possibly seasonal, occupation and should contain evidence of highly focused subsistence activity and moderate or sustained contact with the missions. Such a camp site would lack permanent structures, and middens would be poorly developed, relatively homogeneous in composition, and contain the detritus of processing a limited number of species of animals or plants. There would be little evidence of ritual activity or the structured use of space; few areas indicating a discrete activity, such as dumping, would be found in relation to structures or features (Raab 1993:149). In this focused, temporary setting, a mission-support camp would contain few formal features; those present would be of limited variability, such as hearths or lithic concentrations related to processing of particular materials. Cultural materials should be distributed throughout the deposit, with little evidence of structured use of space (Binford 1989b:256).

At such sites, variability of species within the faunal collection, also referred to as “taxonomic richness,” is expected to be low, reflecting a focused strategy of food procurement (Chatters 1987:341). Collections from a site of this type are expected to contain proportionally high numbers of taxa characteristic of traditionally favored food sources such as selected species of fish, shellfish, wild game, or native plants. If a camp were established to supplement the mission diet, the faunal assemblage might indicate targeting of specific animals or plants. During excavations at Mission La Purísima, a storeroom was found containing the remains of a “basket full of paired mussel shells,” indicating targeted foraging (Deetz 1963:184). At Mission Santa Cruz, Allen (1998), clearly saw a supplemented mission diet in the large numbers of fish and shellfish remains found in midden deposits. A large number of fish bones was also noted at Mission San Buenaventura, leading researchers to conclude that the diet of neophytes was augmented by native fauna (Greenwood 1976). Hoover (1985:100) found wild game and seeds from native plant species at the Mission San Antonio de Padua, suggesting the continuation of native gathering practices there.

Although neophytes were likely to have had greater access to domesticated plants and animals than gentiles, scant evidence of domesticates should be found in a temporary camp site, especially if the function of the site was to supplement the mission diet during times of food shortage. If the camp functioned only for material procurement, the amount of domesticated animal bone present at the site might be related to distance from mission settlements. For example, at the historic Chumash village of

Helo,' located approximately 16 km (10 miles) from the Mission Santa Bárbara, only a small amount of cattle bone was found (Gamble 1990, 1991), whereas faunal collections from features associated with neophytes at Mission San Buenaventura were dominated by domesticates (Greenwood 1976). Interestingly, although cattle bone was most numerous in these neophyte features, a higher proportion of wild species was found in the collection from the site as a whole. Neophytes at San Buenaventura clearly were permitted regular access to traditional foods, which they transported back to the mission.

Native American basketry was highly esteemed by the mission fathers (Farnsworth 1987:483). Basket impressions were commonly found at Mission La Purísima (Deetz 1963) and were observed at Mission San Buenaventura (Greenwood 1976) as well. Specialized basket production seems a likely focus for a mission-support site, as raw materials for baskets had to be gathered outside the mission, sometimes from a considerable distance. Whereas the baskets themselves would probably have deteriorated, the tools for their production may be found in the archaeological record. Basket production is reflected in the archaeological collection by a high of number of tarring pebbles, bone awls, lithic tools used for processing reeds, and concentrations of asphaltum.

A small number of Hispanic goods might be found at a mission-support site; the range of Hispanic artifacts expected include glass beads, ceramics, glass, and metal items. Because of a general scarcity of metal (Chartkoff and Chartkoff:1984:268; Frierman 1982), and a prohibition on trading firearms with Native groups early during the early historical period (Bamforth 1993:50), the discovery of Hispanic tools or weapons is unlikely. We anticipate that neophytes in the early years of the missions would use a traditional tool kit, particularly in pursuit of traditional foods and raw materials. Lithic technology should reflect expedient manufacture and use of stone, as these locations were temporary settlements. Debitage from the maintenance of curated tools should dominate the lithic assemblage, and those whole tools that were produced on site should be informal such as edge-modified bifacial thinning flakes (Binford 1979).

Later in the mission era, stone tools became relatively crude as traditional knowledge declined as a result of native assimilation into the mission system. Allen described the stone artifact collection from Mission Santa Cruz as "degenerative forms of lithic tools" (Allen 1998:83). The argument follows that, as successive generations were born within the mission system, traditional knowledge about stone tool manufacture atrophied as the utility of traditional tool types dwindled. This pattern is noted especially at mission locations as traditional male-related activities such as hunting became obsolete.

Ground stone artifacts recovered from a mission-support site should reflect traditional forms, and, if the site was occupied only temporarily, ground stone tools may show little use. Metcalfe and Barlow (1992) proposed that the condition of ground stone when it is discarded reflects group mobility. These authors suggested that highly mobile groups produced ground stone forms that were lightly used and poorly formed. Conversely, if the mission-support site was visited repeatedly on a seasonal basis, ground stone artifacts might have been cached and have heavy use wear.

Hispanic styles of dress may be represented in a mission-support site by the presence of metal, bone, or shell buttons, or leather goods. Neophytes were reported as adopting the Hispanic style of dress to distinguish themselves from gentile populations (Engelhardt 1927a:36), and the presence of apparel items at the site might further distinguish neophyte sites of this type.

Religious paraphernalia such as crucifixes or rosary beads might also be found, reflecting association with the mission. Burials should be few or absent at a mission-support site, however, as Catholic practices necessitate burial at the mission cemetery. If an interment did take place at such a site, we hypothesize that mortuary practices could mimic Christian styles, with little or no native artifacts interred with individuals. We would not expect to find evidence of traditional ritual activity at this site, following the people's conversion to Christianity.

Overall, a mission-support site might appear very similar to a prehistoric seasonal or temporary resource extraction camp, except for the presence of Hispanic items and Christian burial practices, if observed. Radiocarbon or shell-bead dating might be used to differentiate the two occupation periods. A close relationship with the mission might be visible in the faunal collection if evidence of a focused procurement strategy could be discovered; this would be in contrast to the much more generalized strategy practiced in Late period sites.

Occupation Scenario 3: Rancho- or Pueblo-Support

In a rancho- or pueblo-support scenario, we hypothesize that the site was created by a group of gentiles, or possibly ex-neophytes, who were employed by Hispanic landowners. This scenario departs from the previous two in that the defining factor is not the type of cultural interaction between natives and the missions, but on a relationship between native and employer.

Native labor was economically important throughout California, but it was especially so in the Los Angeles Basin. Most of the labor involved in the founding of the pueblo of Los Angeles was performed by non-Christian Gabrielinos (Engelhardt 1927a). The pueblo was founded at the location of the Gabrielino village known as Yaangna in 1781 (Johnston 1962; McCawley 1996), and not long thereafter, gentiles were regularly employed in the pastures, fields, and vineyards surrounding the little town. Communications between mission fathers, as well as journals and the recollections of visitors to the area describe the economic relationship of the budding pueblo to its native laborers (Engelhardt 1927a; Greenwood 1989; Phillips 1980). The settlement of Yaangna remained on the outskirts of the pueblo for many years, inhabited by native laborers and domestic servants.

Native laborers living in villages outside the pueblo also sometimes came in to the pueblo to work. Native workers were vital to cattle-grazers and grape-growers throughout the basin, particularly at harvest time. Hispanic rancheros were said to intentionally incorporate gentile settlements, or *rancherías,* into their rancho boundaries when making their land claims, so that resident populations could be used as a labor force (Engelhardt 1927a:94; Greenwood 1989; McCawley 1996:200). Often, wealthy Hispanic landowners lived in the pueblo and controlled rancho activities from a distance, while the native workers tended the herds and lived on the land. During the later mission era, the use of gentiles, or "pagans," as workers was so prevalent that it became a source of conflict between mission priests and pueblo-dwellers. In 1812, a questionnaire called *Preguntas y Repuestas* (Questions and Replies) was sent to each mission to be answered by the mission fathers. The fathers at Mission San Gabriel responded to Question 32, a query about classes, including pagans, as follows:

> In the pueblo and ranchos of the other classes, pagans, men as well as women, serve as farm laborers, cooks, water carriers, and in other domestic work. This is one of the most potent causes why the people, calling themselves *Gente de Razón,* are so addicted to idleness. As the pagans labor for one-half or one-third of the product, they are constantly in the service of their masters during the time of planting and harvesting, while the masters, some excepted, never put their hand to the plow or to the sickle. Hence there is the other drawback, that the adult Indians delay having themselves baptized, since in the service of their masters they may follow their notions and pagan habits. This liberty by which they forfeit Christianity, inspires them with a great disaffection for Christianity [quoted by Geiger and Meighan 1976:128–129, italics in original].

Based on recent archival research (see Chapter 2) and Robinson's (1939a) anecdotal account of Native American workers at Rancho La Ballona living at the base of the bluff, we anticipated finding evidence of a rancho-support site within the Playa Vista project area. LAN-211/H possibly includes a component of this site type. The remains of such sites have doubtless been uncovered during excavations at rancho sites in the past, but were not recognized as such. At several early-historical-period excavations (e.g., Frierman 1982; Wilke 1974), the material culture of native laborers and Hispanic rancheros had been blended to the point that it was impossible to separate them in the archaeological record. For example, excavations between 1979 and 1981 at the Ontiveros Adobe, located within Gabrielino territory in the city of Santa Fe Springs in Los Angeles County, uncovered numerous Native American artifacts in addition to an extensive early-historical-period artifact collection. Finds included flaked stone tools, flaked glass debitage, ground stone artifacts, shell and glass beads, and steatite bowl fragments (Frierman 1982:75–90). The discovery context of these artifacts was not mentioned in the report and no analysis was presented. The material culture of native people encountered archaeologically in historical-period Hispanic sites has not been consistently reported.

From ethnohistoric accounts, we know that non-Christianized natives were employed in large numbers by Hispanic landowners in the early historical period. The division of labor on the rancho followed the traditional Hispanic cultural regime: native women worked at domestic chores within Hispanic households, while native men generally labored out-of-doors, either tending stock or in the fields. The presence of the *rancherías* or communities in which many of these ranch-workers lived has been recorded in the Los Angeles Basin (in census documents, for example), but none has been studied in depth.

Archaeological Signature of a Rancho- or Pueblo-Support Site. There are two possible site types for this scenario, permanent and temporary; in the first case, native laborers essentially "belonged" to a rancho, working and living there permanently. In the second case, native laborers were employed temporarily, perhaps seasonally and when released, returned to their native village or *ranchería.* We suggest that the length of employment will have a significant bearing on site structure; if the site we have found was a temporary workers' camp, it will not exhibit the depth of deposit or diversity of features that would be expected at permanent workers' settlement.

The subsistence remains of a rancho- or pueblo-support site should be distinct from the archaeological signature of other scenarios. Although some traditional subsistence practices might continue, one of the defining characteristics of this site type will be the relatively large quantity and treatment of domesticated animal remains in the faunal collection. Native ranch and field workers were often paid in goods for their services (Engelhardt 1927a; Greenwood 1989; Johnston 1962; Kealhofer 1991; McCawley 1996; Phillips 1980); thus, domesticates are expected to make up a much larger relative percentage of this collection than those from other scenarios.

We anticipate that beef would comprise a significant portion of the rancho workers' diet. That the rancho diet typically included great quantities of beef can be seen in the archaeological record uncovered at the Ontiveros Adobe (Frierman 1982). Excavations at this site revealed a faunal collection with the predicted rancho signature: almost the entire collection—96 percent—consisted of the remains of domesticated animals, and approximately 80 percent of that total consisted of cattle bone. The remains of only a few wild birds, rodents, or fish were noted (Gust 1982:143). Although the context of the faunal collection cannot be exclusively tied to native workers at the site, traditional materials such as stone tools were found in association with the faunal remains.

At the Hammack Street site, LAN-194, a component dating to the rancho era between A.D. 1825 and 1850 was identified (King 1967). Very limited salvage excavations were conducted at this site, but what was found provided a glimpse into what is interpreted as a rancho-associated site occupied by Native Americans, likely Gabrielino. At this site, the remains of domesticated animals such as cattle and horses dominated the vertebrate faunal collection. Other large mammals, such as domesticated goat and pronghorn, and smaller mammals, such as rodents, were also found but in much smaller proportions. A small number of fish bones were also recovered. The large mesh size—¼ inch—used for screening the deposit, and the small sample size—only four 1-by-1-m units—probably affected the diversity of the faunal collection; nevertheless, the results are consistent with the model, in that the faunal collection was dominated by domesticated-animal remains.

To account for the bones of domesticated animals in a deposit, we hypothesize that native workers might have accepted lower-quality cuts of meat as payment for labor, or they might have scavenged those that were unwanted by rancho owners. In either case, domesticated animal remains in a rancho-support site should show evidence of Hispanic butchering techniques using Hispanic metal tools, whereas to process the meat, native workers might have favored traditional stone tools. Evidence of crushing bones to extract marrow might also be noted. Cattle and horse bones recovered from LAN-194 showed signs of splitting (possibly for marrow extraction) and bore “hacking” marks from processing. The fact that horse meat was being consumed and that marrow was possibly being extracted from the bones suggest that the native occupants of this site might have been using traditional techniques for processing meat.

Locally made brown ware appears to be a new and important addition to Gabrielino material culture in the early historical period. Found at the Ontiveros and Bandini-Cota Adobes and in excavations near the original Pueblo de los Angeles, this pottery was apparently made by natives for domestic use in Spanish households (Frierman 1982; Kealhofer 1991). The name “Southern California Brown ware” has been given to this ceramic type (Frierman 1982, 1983), likely the same pottery labeled “mission-ware” at the Hammack Street site (King 1967). Given that ceramic industries were generally absent in Gabrielino territory during prehistory (McCawley 1996:138), this manufacturing technique might have been a trait learned at the missions. Brown ware of this type is an anticipated find at a rancho-support site.

Hispanic goods are expected to be present in greater quantities at a pueblo- or rancho-support site than at sites fitting either of the two previous scenarios. Mason noted that native laborers were paid for farming and ranching activities “in old clothing, grain, cotton yardage, tools such as knives and hatchets, strings of beads and a variety of other goods” (Mason 1975:94). Hispanic ceramics and glass are expected to be found in much higher numbers from rancho support than in other scenarios, as these items might also have been given as payment for work, or scavenged from the refuse of Hispanic settlers or rancho owners. At the Hammack Street site, the early-historical-period component was dominated by Hispanic items such as ceramics, glass, and unidentifiable pieces of metal. Units containing these materials also produced small quantities of traditional artifacts such as stone tools. Showing the adaptation of traditional technology to new materials, a bone awl was recovered from this site that had been made from the metatarsal spur of a horse. Artifacts such as these clearly demonstrate the transitional state of native culture during the early historical period.

At the peak of the rancho era, ca. 1850, the style of native residential structures changed drastically. The domed structures seen during the protohistoric and early historical periods were gone; dwelling styles appear to mimic Hispanic structures. Descriptions and historical photographs indicate that later native houses were rectangular buildings constructed of traditional materials such as tules and wood posts, or from adobe in the Hispanic style (McCawley 1996:206). When rancho employment was seasonal, native peoples lived in temporary structures built in a more traditional style, such as those occupied in prehistory. The “brush-and-mud huts” described by Robinson (1939a:104) below the base of the bluff at Rancho La Ballona (see Chapter 2) fit this description.

Traditional stone tool technology was greatly affected by the introduction of metal tools. With prolonged exposure to Hispanic lifeways, native people became increasingly reliant on introduced technology at the expense of traditional knowledge. Stone tools found in early-historical-period sites should reflect a transition towards lower quality, more expedient tool types. Lithic collections should be dominated by debitage and utilized flakes, with little in the way of formal tools. As metal knives would have been present at ranchos and might have been given in payment to native laborers, stone tool collections are likely to be dominated by expedient cutting and processing artifacts such as utilized flakes used for processing meat, rather than butchering. Locally available materials will probably dominate the collection, with the nontraditional materials such as ceramics and glass also introduced. Exotic lithic materials that would have been obtained through trade prehistorically are not expected to be recovered in high numbers, as we assume that the traditional trade alliances and networks would have all but disappeared by the time of ranchos. At the Ontiveros Adobe, debitage dominated the flaked stone tool collection and few formal tools, made mostly from locally available materials, were found (Frierman 1982:80–83). Similarly, at excavations near the Pueblo de los Angeles (Kealhofer 1991), only a small number (n = 22) of flaked stone artifacts were recovered, of which 15 represented unmodified debitage.

Excavations at the Hammock Street site produced a few formal tools such as projectile points; overall, stone tools made up a very small proportion of the artifact collection from the site (King 1967).

We hypothesize that the processing of plant materials utilizing traditional methods with ground stone implements would have continued into the early historical period. Traditional ground stone artifacts such as metates and manos, as well as imported steatite vessels, are found in small numbers in most rancho period settlements (Frierman 1982; Greenwood et al. 1983; Kealhofer 1991). New tool types might also have been introduced, such as the Mexican grinding stone, the *molcajete,* to process the new domesticates. These are also found in mission and rancho contexts.

Data Requirements

To test the hypotheses presented in the model, data from a temporal and regional range of sites must be compiled for comparison. For comparative analysis within the Ballona, artifact collections from LAN-47, LAN-62, LAN-1932/H, and LAN-2676 will be used. Specific targets for analysis are the identification of introduced taxa and evidence of new methods of procurement or processing.

The discovery of burials and ritual structures would provide the clearest means of perceiving ritual practice at the site, activity that might otherwise be difficult to detect in the archaeological record. Such features would contain important data relative to the impact of Hispanic goods, technology, and ideology on the local population. Materials recovered from a site on the periphery of the Hispanic sphere of influence can be compared to prehistoric sites and to those at the missions and ranchos to test the degree of acculturation and resistance to change. Large samples must be collected from midden deposits and features to provide data for detailed analysis.

Dating issues are central to the investigation of protohistoric and early-historical-period sites. Working at nearly the limit of refinement for radiocarbon dating means relying on all available means for temporal control. Time-sensitive materials and specific strata and features that can be securely radiocarbon dated will be sought to place the site in the Ballona chronology, and to distinguish protohistoric from early-historical-period components. Locating house floors or extramural features such as hearths, refuse pits, or burials will allow us to understand site structure and interpret settlement patterns. We may be able to determine the length of occupation of the site from large-scale excavations.

Addressing the various hypotheses suggested by our model requires a break from the traditional southern California model of midden excavation and analysis. Traditionally, southern California archaeological investigations have used a strategy of spacing test units either systematically or randomly across a site to locate features and to acquire a sample of midden. Although this approach is an important tool in any archaeological study, it can only address a limited scope of research questions. Analysis of small, spatially dispersed test units is useful for inferring the nature of faunal and artifactual assemblages; however, it cannot provide information regarding the overall site structure. The discovery of features using the traditional site sampling technique is left to chance, and the result generally does not shed light on the nature of settlement at the site.

To answer questions about site structure and the nature of site settlement, excavations covering a large aerial extent of the site are necessary. This can be accomplished, at least in the discovery stage, by controlled mechanical scraping. With the identification of features such as house pits, ritual structures, artifact concentrations, cemeteries, and refuse dumps, important temporal and behavioral questions of context can be addressed. After excavation and identification of such features, comparative analysis that considers data from prehistory and later historical periods can begin.

Conclusions

Our testing at LAN-211/H revealed a substantial archaeological deposit which exhibited interesting patterns. In addition to the predictable array of large and small mammal species, the faunal collection included a small amount of butchered domesticated cattle bone, and the remains of exotic animal species such as pronghorn, swan, and a species of freshwater mussel, none of which was indigenous to the Ballona Lagoon. We also found that bony fish species constituted a very high proportion of the vertebrate fauna, a result seen in only one other local archaeological site, LAN-63, located on the bluffs. In terms of tools, none of Hispanic manufacture were found at LAN-211/H; tools were essentially traditional in form and material. The collection included numerous stone projectile points, bifaces, utilized flakes, ground stone, and a large number of tarring pebbles. The small amount of imported materials such as obsidian and fused shale found indicated that trade was apparently limited. Hispanic influence is reflected only through the presence of glass trade beads, a few bones of domesticated cattle, and three pieces of flaked glass; no brown ware was recovered.

We present these three scenarios (summarized in Table 36) in the hope that they may be useful in addressing what we perceive as a significant gap in the study of the so-called "contact" period in the Los Angeles Basin. Although the prehistory of the area has been widely studied and general trends are recognized, the brief but critical period of drastic change following Hispanic contact has scarcely been examined archaeologically.

Based on our analysis of the artifacts from LAN-211/H, we assume the site's occupants had minimal contact with Hispanic establishments. Our initial interpretation is that this site fits best into the gentile or renegade scenario due to the limited signs of Hispanic influence, and the presence of a wide array of activities suggesting a permanent habitation. Alternatively, the high proportion of bony fish and large numbers of tarring pebbles suggest specialized activity at the site, an attribute we describe in the mission-support scenario. With the limited excavation undertaken so far at LAN-211/H, our interpretation is preliminary.

Treatment Plan

In the previous section, we have developed scenarios to lead data recovery efforts at LAN-211/H. Because the site contains a discrete protohistoric and early-historical-period component in a clearly non-Hispanic context, we believe that LAN-211/H presents a unique opportunity to answer questions about the poorly known transition from Native American lifeways to the historic period. Our plan for data recovery is the subject of this section.

Excavation Procedures

Data recovery at LAN-211/H will entail four, possibly five, phases, and will include both mechanical and manual excavation (Figure 85). The procedures are comparable to those used on other archaeological sites within the PVAHP. The five phases of work are: (1) mechanical stripping of fill and overburden material; (2) mechanical excavation of trenches; (3) manual excavation of control units into the cultural deposit; (4) mechanical striping and screening of soils to locate features; and if they are discovered, (5) manual excavation of features.

The exact location of archaeological resources and sites are not subject to public disclosure to prevent harm and unauthorized disturbance of the resources and sites, pursuant Section 5097 of the California Public Resources Code and Section 800.11 of the National Historic Preservation Act, as amended. Therefore, this figure has been excluded.

Mechanical Stripping, Phase I

Mechanical stripping at LAN-211/H will be done in two phases for two different purposes. The goal of the first phase is to remove late-historical-period and modern fill materials that have been placed over cultural deposits. This stripping will be conducted within the boundaries of the proposed riparian corridor. From our initial testing, it appears that the depth of fill material is approximately 0.3–1.5 m (1–5 feet). Fill will be removed to a depth just above cultural deposits as determined by a monitoring archaeologist. This depth may vary according to location, and it will be necessary to track changes in soil structure and color to determine the presence of cultural material. The excavation of fill materials may encounter buried utilities; these will be avoided when encountered. Most likely, an excavator or backhoe fitted with a flat blade on its bucket will be used to remove fill materials.

Trenching

Trenches will be used to document soil stratigraphy and the depth and composition of the cultural deposit, to collect samples, and to delineate site boundaries. Trenching will be conducted following the removal of fill materials, using a backhoe fitted with a flat blade. We anticipate excavating three to four trenches to allow adequate profiling of the site stratigraphy. Additionally, five to 10 trenches will be excavated to delineate site boundaries.

We do not anticipate digging deeper than 2 m (6.5 feet) in most areas. It will be necessary for archaeologists to conduct sampling and recording from within the trenches. If trenches have to be excavated to a depth of more than 1.5 m (5 feet), trenches will be shored, sloped, or stepped following California Occupational Safety and Health Administration guidelines. Stepping excavations more than 1.5 m (5 feet) in depth will be the desired course of action because shoring obscures the view of soil stratigraphy. Depending upon the stability of soils and depth of trenching, multiple benches of no more than 0.9 m (3 feet) high at a slope of 1–1.5 percent will be excavated. Ladders will be used for entry and exit of trenches, and, if trench length is extensive, ladders will be placed at 7.6-m (25-foot) intervals. As it may be necessary to leave trenches open for an extended period, trenches will be properly marked and covered, and areas of excavation will be fenced.

To document soil stratigraphy, all walls of each trench will be "cleaned" with a trowel to expose artifacts, stratigraphic boundaries, and possible features. After a trench sidewall has been prepared, documentation will include photography and a measured drawing that delineates identifiable characteristics. Samples for pollen, phytolith, soil testing, and flotation will also be collected from the trenches, and all sample-extraction locations will be identified on the stratigraphic profiles. When collecting such samples, care will be taken to minimize contamination. Unless obvious microstratigraphy can be identified in the field, samples will be generally collected at 10-cm intervals to match the excavation levels within the units. If a stratigraphic or soil-horizon boundary will intersect a 10-cm level, subsamples of each zone will be taken. Pollen samples will be collected and stored in sterile polyethylene bags to avoid contamination from pollen rain, whereas flotation samples will be placed in plastic bags. All samples will be assigned a unique provenience designation number that will allow for tracking through laboratory procedures.

Manual Excavation

Manual excavation of control units will allow us to collect comparable samples of midden constituents so that faunal, lithic, and other analyses may be conducted. Manual excavation of control units will involve four tasks: excavation, dry screening, documentation of stratigraphic profiles, and collection of samples. Excavation will be conducted using shovels, hand picks, and trowels. The size of excavation units may vary according to the factors identified in the field. Generally, 2-by-2-m units will be excavated in arbitrary 10-cm levels from a known datum point. Unique provenience designation numbers will be assigned to each 1-by-1-m, 10-cm-deep level within each 2-by-2-m unit. Arbitrary excavation levels will be used assuming that microstratigraphy has been severely distorted by bioturbation.

If prehistoric cultural features such as hearths, pits, or clusters of rock, are encountered, they will be recorded, and each will be treated as a unique entity. Generally, a small excavation unit will be placed to encompass the feature. The feature will then be sectioned, meaning that half the feature will be removed in 10-cm arbitrary levels. A profile of the feature will be drawn and photographs taken. The remaining half of the feature will then be removed. If large numbers of such features are encountered during excavation, determinations will be made in the field as to which features will be excavated. If features are found that may indicate living surfaces, large block excavations will be required to recover them in their entirety.

If soil conditions allow, excavated materials will be dry screened through ⅛-inch-mesh screen in the field to reduce the quantity of matrix. After such reduction, or if soils are too moist for field screening, excavated materials will be transferred to SRI's water-screening facility. Water screening of excavated materials will use ⅛-inch-mesh hardware cloth. Water-screened materials will be air dried and then sent to SRI's laboratory facility for sorting and analysis.

Mechanical Stripping and Screening, Phase II

Small 1-by-1-m units are well suited to providing data on midden constituents. The issues of social organization that are central to SRI's general research questions, however, cannot be addressed through data gathered that way. Instead, we need to locate and excavate house floors, activity areas, burials, and other extramural features and map these features relative to each other to explore questions of site structure. To do so, we must expose and investigate larger areas of the site.

If conditions allow, geophysical techniques, such as magnetometer surveys, are an excellent approach to locate subsurface cultural features, such as hearths or pits. Unfortunately, at LAN-211/H, buried utility lines and fill material containing construction debris may preclude the use of such techniques. An alternative approach would be to excavate a very large number of manual excavation units. The disadvantages of this method are the extreme costs, and the likelihood that no greater yield of information would be obtained.

The method SRI advocates entails the use of a backhoe or mechanical excavator to strip soils until the archaeological targets are encountered. Soils are removed in increments of approximately 10–20-cm levels by a backhoe or excavator fitted with a flat blade that will make a clean, level cut. Soils are removed in 4-by-4-m blocks identified within a grid system placed over the site prior to excavation. An archaeologist monitors the stripping and notes any soil changes or artifact concentrations. As features are encountered, large areas surrounding them are left untouched so that later excavation will recover the entirety of the feature. Each 4-by-4-m block is excavated in 10–20-cm levels, with the fill stockpiled for later screening. Excavation will proceed in this manner until the entire area of impact or boundaries of the site have been removed and screened.

A mechanical sorter will be used to screen the bulk samples. Mechanical sorters are diesel-powered machines, usually used for sorting gravel, that allow for high-speed screening of large amounts of soil. The screening plant is fitted with two decks of heavy duty screens—the upper one with ¾-inch-mesh screen, and the lower one with ⅛ inch. A large hopper is fed a bulk unit of soil, which then passes through a system of conveyers and the screening box, collecting the larger items in the box. The soil is recycled back through to the hopper and screened again until a sufficient amount of less than ⅛-inch matrix has been sifted out and discarded. After completing a cycle of screening, the residue is then bucketed, labeled with its specific provenience designation, then sent to the water-screening facility for further processing. After this material has been water screened through ⅛-inch mesh hardware cloth and sun dried, it is sent to the lab for sorting.

The bulk sample is collected for the purposes of recovering temporally diagnostic or unique artifacts that may be useful in dating the site. Artifacts such as shell and stone beads, projectile points, and other rare artifacts will be saved, whereas faunal materials will not usually be collected. Data from manual control units will be used for faunal and lithic analyses because the materials were recovered in a systematic and comparable fashion.

Feature Recovery

If features are encountered during the second phase of mechanical stripping, additional units will be excavated by hand. Feature recovery will follow the same procedure described above under the manual excavation units, with features being described, drawn, and photographed. Unique provenience designation numbers will be assigned to each 10-cm level in the 1-by-1-m excavation units and to any other samples that may be collected. Floatation, pollen and phytolith, soil, and chronometric samples will be recovered from all features. Recording of features will involve mapping of horizontal and vertical locations of artifacts, creating measured drawings, photographing, and collecting special samples.

Native American Participation and the Treatment of Human Remains and Associated Grave Goods

All archaeological work at Playa Vista is monitored by Native Americans affiliated with the area. Affiliation was determined by the California NAHC, and a list was provided to SRI. After human remains were encountered in the project area during excavations at LAN-193/H in August 2000, the NAHC officially designated Robert Dorame, Tribal Chairperson for the Gabrielino Tongva Indians of California Tribal Council, as Most Likely Descendant for the Playa Vista project. Archaeological work in the BLAD complies with a written plan of action submitted by the Gabrielino Tongva tribe (Dorame 2000) that includes the results of consultation and provides for the disposition of affected materials excavated intentionally or discovered inadvertently.

In the event that human remains, funerary objects, sacred objects, or objects of cultural patrimony are discovered during data recovery or construction monitoring at LAN-211/H, ground-disturbing activities will cease in the immediate area, and SRI will contact the Los Angeles County Coroner's office. If the remains are determined to be of Native American origin, the Coroner's office will inform the NAHC, and the Most Likely Descendant will be contacted, who will consult with SRI regarding the preferred treatment of the remains, in accordance with NAGPRA and state law. All care will be taken to record and recover human remains with respect, under the supervision of the Most Likely Descendant. Disposition of the human remains and associated grave goods will be in accordance with procedures and requirements set forth in California Health and Safety Code Section 7050.5 and Public Resources Code 5097.98.

Analysis and Report

Analysis will be conducted on the following classes of material, as appropriate: flaked stone, ground stone, shell artifacts, bone artifacts, vertebrate faunal, invertebrate faunal, soils, paleobotanical, and chronometric samples. Analytical methods have been set forth in the PVAHP research design (Altschul et al. 1991) and have been refined during the course of the last decade. Analysis of LAN-211/H collections will provide data comparable to other work within the Ballona and on a regional scale. Methods for each class of material are described below, with the exception of the lithic analysis methods, which are presented in its entirety in Appendix C.

Worked Shell and Bone Artifact Analysis

All culturally modified shell and bone artifacts will be analyzed. Shell artifacts will be classified according to established types (Bennyhoff and Hughes 1987; King 1981). Artifacts will be separated first by species, and then a variety of attributes will be assessed, including type of manufacture, size, placement and size of hole, and type of perforation. The chronological placement of shell beads will be based on King's (1981) study of Santa Barbara Channel beads. Bone tools will be typed following categories defined by Gifford (1940). Attributes recorded for each specimen will include species, size, portion of artifact, percentage complete, presence of incising, nature of design, presence and intensity of polish.

Vertebrate Faunal Analysis

Specimens will be identified to taxon using comparative material at the Natural History Museum of Los Angeles County and other repositories as needed. Additionally, field guides and reference works will be consulted. Identifications will be made to the most specific taxonomic level possible. When a specific identification cannot be made, a bone will be placed to class and size. Additional information recorded for each specimen will include element, side, portion of the element, percentage of the element present, fusion, breakage, presence of gnawing, whether the bone has been worked, the degree and nature of weathering, burning patterns, and weight.

Measures such as the NISP and the MNI will be calculated, if appropriate: both measures assume that the collection reflects a single cultural component. Our objective is to discern such units; if we do, both measures would be appropriate. For general midden contexts, however, both measures are largely meaningless. Measures of dietary contribution of each taxon, based on carcass weight, will be used if strong contexts are discerned.

Invertebrate Faunal Analysis

During the sorting process, all whole shells and shell fragments larger than 12 mm (e.g., the size of a U.S. nickel) with umbos (hinges) will be saved. Because the fill from units will be water screened, there will be little need to clean the assemblage. Species identification will be aided by SRI's comparative collection (Troncone et al. 1992) and standard shell references (e.g., Abbott 1968; McLean 1978).

Geoarchaeological Analysis

The geoarchaeological study will involve both field and laboratory phases. Fieldwork will consist of recording site stratigraphy and relating the depositional units represented to natural processes. The field director and crew chief will be assisted by SRI's geomorphologist and soil scientist Dr. Jeffrey Homburg in deciphering the stratigraphy and ensuring that profiles are created in a standard manner.

Laboratory tests will include pH and particle-size analysis on a sample of units if considered necessary by Dr. Homburg. Soil-reaction (or pH) determinations will be made on a 1:1 soil-and-distilled-water slurry. Particle-size analysis will be performed using the pipette and sieve methods, with samples pretested with sodium hexametaphosphate to deflocculate the clay, and hydrogen peroxide to digest organic matter.

Paleobotanical Analysis

Both microbotanical and macrobotanical analyses will be performed. Microbotanical analysis will focus on fossil pollen, which will be extracted from 5-cm^3 sediment samples using acid digestion to remove inorganic matter and easily dissolved organic matter. Ground stone wash samples will be centrifuged and extracted from a 5-cm^3 aliquot of the centrifugate. Tracers, in the form of one Lycopodium tablet, will be added to each sample to determine the concentration of pollen and aid in the calculation of sedimentation rates. Three hundred pollen grains of upland plants will be counted per sample. In the case of low pollen abundance, identification will be continued until 200 grains are counted; additional slides will be prepared as necessary.

The macrobotanical samples consist of 1-liter bags of fill. These samples will be processed first by flotation and poured through 1.0-mm (in the field) or 0.25-mm (in the laboratory) mesh. The resulting light fraction will then be passed through a series of nested screens (2.0, 1.0, and 0.5 mm). Residue smaller than 0.5 mm will be scanned, and only whole seeds will be removed. Next, each screen will be examined under a binocular microscope (10–40×) for the presence of carbonized plant remains. Charcoal wood will be removed and its weight calculated. If the weight is negligible (less than 0.005 g), then only its presence will be noted. Larger charcoal and all other carbonized remains will be identified to genus and species using a modern reference collection and seed-identification manuals.

Chronometric Analysis

We anticipate that most of the datable organic material will consist of seashells. SRI will attempt to use only shells that can be associated with features from archaeological contexts. In using shell samples, we will correct the dates for the reservoir effect. It also is possible that we will find charred seeds in the flotation analysis; if these derive from annual plants, they too may be dated (use of annuals obviates the "old wood" problem).

Report

A technical report of publishable quality will be prepared upon the completion of all analyses. The document will begin with a summary of the research goals and objectives of the data recovery project, highlighting its place with the family of PVAHP projects. Field results will include detailed maps showing results of geomorphological studies, all trenches and excavation units, and the location of any features found. Profiles of representative hand-excavated units and trenches also will be presented. Analytical results will be presented in tabular and written form. The report will incorporate a synthetic component devoted to addressing the research questions posed in the treatment plan.

Parties to the programmatic agreement will be provided draft copies of the technical report for comment. SRI will incorporate these comments in a final report, which will be distributed as part of the Playa Vista Monograph Series through a cooperative agreement with the University of Arizona Press.

Schedule

Data recovery fieldwork at LAN-211/H will require approximately 3 months (Table 37). Another 4 months has been allocated for the screening, processing, sorting of material recovered in the field. Analysis of the remains will begin in April 2004 and continue through the year. A draft report will be prepared during the first quarter of 2005 and be available for review in May 2005. A final report is anticipated to be submitted to the COE in August 2005, with curation completed by the end of 2005.

The level of effort required to complete these tasks is presented in Table 38. Nearly 9 person years of effort have been allocated to the data recovery. A third of this effort will be expended in the field, with the balance dedicated to analysis, report, and curation.

Table 37. Schedule of Tasks

Task	Start Date	Completion Date
Field logistics and preparation	September 2, 2003	September 30, 2003
Mechanical stripping and trenching	November 3, 2003	November 21, 2003
Manual excavation	November 24, 2003	December 31, 2003
Mechanical screening	December 8, 2003	December 31, 2003
Water screening	December 8, 2003	December 31, 2003
Laboratory sorting	January 5, 2004	March 31, 2004
Analysis	April 1, 2004	December 31, 2004
Draft report	January 1, 2005	April 31, 2005
Review	May 1, 2005	June 1, 2005
Final report	June 1, 2005	August 1, 2005
Curation	August 1, 2005	December 31, 2005

Curation

All project-related notes, records, photographs, and sorted materials (except those repatriated under California State burial law) will be curated at a repository that meets federal standards and in accordance with 36 CFR 79. The curation agreement between the University of California, Los Angeles, and the Playa Vista project managers is presented in Appendix D.

Table 38. Level of Effort (Field and Laboratory Hours) for Data Recovery at LAN-211/H

Position	Adminis-tration	Field Preparation	Excava-tion	Mechanical Screening	Water Screening	Laboratory	Analysis	Report	Total Hours by Position
Principal investigator	40	—	24	—	—	16	40	120	240
Research director	40	24	40	—	—	40	80	320	544
Project manager/ operations manager	80	24	40	8	—	40	80	320	592
Project director	40	160	320	16	8	160	320	480	1,504
Database manager/ quality assurance	16	—	—	—	—	120	160	160	456
Lab director	24	40	40	16	80	160	80	40	440
Crew chief	—	40	440	160	—	480	—	640	1,760
Crew II	—	—	1,120	—	240	—	—	—	1,360
Crew I	—	—	480	—	—	—	—	—	480
Laborer	—	—	400	320	1440	—	—	—	2,160
Lab tech	—	—	—	—	—	1,920	—	—	1,920
Lithic analyst	16	—	—	—	—	—	240	240	496
Faunal analyst	16	—	—	—	—	—	240	240	496
Geomorphologist	—	8	80	—	—	80	80	240	488
Ethnohistorian	—	—	—	—	—	—	480	240	720
Faunal analyst	—	—	—	—	—	—	240	240	480
Assistant analysts	—	—	—	—	—	—	720	720	1440
Illustrator/CAD operator	—	—	40	—	—	160	80	320	600
Editor	—	—	—	—	—	160	—	320	480
Typist\clerk\data entry	—	—	80	48	—	680	80	240	1,128
Production manager	—	—	—	—	—	—	—	240	240
Safety monitoring	—	—	320	—	—	—	—	—	320
Total hours by task	272	296	3,424	568	1768	4,016	2,920	5,120	18,344

APPENDIX A

Soils

Tables A.1a–d. Trenches West of LAN-211/H

Table A.1a. Trenches 1-7–1-9, 2a, 2b, and 2-3–2-12

Facies & Landform, by Trench	Soil Horizon	Depth [a] or Stratum (feet)	Color	Texture	Description
Trench 1-7					
Hill slope Toe slope	fill	0–3.0 feet	brown	sand	Historical-period fill; contains glass, ceramics, concrete, brick, and wood fragments. Extensive rodent and root disturbance.
	C	3.0–4.0 feet	light brown	loamy sand	Probable historical-period flood deposits. Bedded sands with shallow channels.
	2A1b	4.0–7.0 feet	dark brown	loamy sand	A horizon material. Similar to A horizons within the sites, but no artifacts were found.
Alluvial plain Floodplain	2A2b	7.0–7.5 feet	black	loam	Marsh deposits. Contains roots, charcoal and some freshwater gastropods (species not noted).
Trench 1-8					
Alluvial plain Floodplain	C1	0.0–3.0 feet	brown	loamy sand	Flood deposits. Poorly sorted, bedded sand. Small, 0.3-m-deep channel in north end of trench. Extensive krotovina.
	C2	3.0–10.0 feet	olive green	loamy sand	Marsh deposits.
Trench 1-9					
Alluvial plain Floodplain	fill	0.0–6.0 feet	dark brown	loamy sand	Historical-period fill, includes chunks of asphalt and glass bottles. Deposits are banded light to dark brown, may indicate combination of natural and cultural deposition.
	C	6.0–10.5 feet	dark brown	loam	Marsh deposits. Grades from brown to green with depth. Freshwater gastropods are present in the bottom of the trench.
Trench 1a and b					
Alluvial plain Floodplain	fill	0.0–5.5 feet	brown	loamy sand	Historical-period fill. Extensive evidence for burning. Large pieces of charcoal present. Lenses of burned sand at 0.3 and 0.6 m below the surface.
	fill	5.5–11.0 feet	reddish brown	sand	Historical-period fill. Sand is similar to matrix from bluffs to south, but contains historical-period artifacts. Either intentional fill or historical-period colluvium with trash.
	C	11.0–11.5 feet	greenish gray	sandy loam	Marsh deposit. Oxidation streaks indicate frequent drying.

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Facies & Landform, by Trench	Soil Horizon	Depth [a] or Stratum (feet)	Color	Texture	Description
Trench 2a and b					
Alluvial plain Floodplain	C	0–11.0 feet	yellowish brown	sand	Historical-period flood deposits. Yellowish brown sands banded with grayish brown bands. Bands appear to be layers of burnt organics. Contains asphalt chunks, plastic bottles, and wire.
	2A1b	11.0–12.0 feet	dark grayish brown	sandy loam	A horizon. Upper portion of marsh. Contains small freshwater gastropods. Extensive bioturbation. One piece of historical-period glass was discovered.
	2A2b	11.0–12.0 feet	black	clay loam	A horizon. Has blocky structure. Contains small freshwater gastropods.
Trench 2-3					
Alluvial plain Floodplain	fill	0–11.5 feet	black	sand	Historical-period fill. Layered dark and light sands, containing lenses of pebbles and cobbles. Contains historical-period artifacts.
	C1	11.5–11.7 feet	greenish gray	sandy loam	Marsh deposits. Greenish gray silt with laminated black clay lenses.
	2Ab	11.7–12.0 feet	greenish black	clay loam	A horizon in marsh deposits. Small chunks of charcoal, also small worm and insect burrows are present.
Trench 2-4					
Alluvial plain Floodplain	fill	0–10.0 feet	reddish brown	sand	Historical-period fill. Layered dark and light sands, containing lenses of pebbles and cobbles. Contains rebar and nails.
	2Ab	10.0–10.5 feet	greenish black	clay loam	A horizon in marsh deposits. Small chunks of charcoal, also small worm and insect burrows are present. Blocky structure.
Trench 2-5					
Hill slope Toe slope	C	0–2.5 feet	pale brown	loamy sand	Historical-period colluvium. Appears to be material washed down-slope for adjacent bluff.
	—	2.5–3.0 feet	black	asphalt/cinder	Layer of either burned asphalt or cinder 3–5 cm thick.
Alluvial fan Toe slope	2C1b	3.0–6.0 feet	dark brown	loamy sand	Historical-period fan deposits. Bedded sands that probably represent material washed out of the bluff as a fan deposit.
	2C2b	6.0–11.0 feet	dark brown	sand	Historical-period colluvium/alluvium. Bedded sands that probably represent material washed out of the bluff as a fan deposit. Contains a few chunks of concrete at 2.9 m below surface.

Facies & Landform, by Trench	Soil Horizon	Depth [a] or Stratum (feet)	Color	Texture	Description
Hill slope Toe slope	2C3b	11.0–11.2 feet	greenish gray	sand	May be historical-period in age. Based on the color, this material appears out of sequence. Typically greenish gleyed sediment occurs below the black marsh soils in this location. May be redeposited from nearby excavation.
	3A2b	11.2–12.0 feet	black	clay loam	A horizon that represents the top of a marshland soil. Two pieces of rusted metal were recovered from this layer, suggesting that it was exposed during historical-period times.
Trench 2-6					
Alluvial fan Toe slope	C	0–2.0 feet	pale brown	loamy sand	Historical-period colluvium/alluvium. Bedded sands with silt laminations probably represent material washed out of the bluff as a fan deposit.
	2A1b	2.0–2.3 feet	dark brown	sandy loam	A horizon that is similar to those on project sites that contain midden and artifacts. No artifacts were found in this trench.
	2AB2b	2.3–5.0 feet	brown	loamy sand	Either a part of the A horizon or the B horizon for this soil.
	3Ab	5.0–5.5 feet	greenish black	clay loam	A horizon that represents the top of a marshland soil.
Trench 2-7					
Alluvial fan Toe slope	A	0–1.5 feet	dark brown	fine sandy loam	A horizon that is similar to those on project sites that contain midden and artifacts. Contained considerable roots. A piece of *Chione* was collected. Also contained historical-period glass.
	B	1.5–2.0 feet	pale brown	fine sandy loam	B horizon mottled with darker brown (possibly rodent burrows rather than mottling) and some roots.
	C1	2.0–4.0 feet	brown	fine sandy loam	C horizon with calcium carbonate nodules.
	C2	4.0–11.0 feet	brown	fine sandy loam	
	C3	11.0–11.5 feet	olive green	fine sand	Gleying indicates saturation of this layer.
Trench 2-8					
Hill slope Toe slope	C1	0–2.0 feet	pale brown	sandy loam	Historical-period colluvium/alluvium. Bedded sands with dark brown silt laminations probably represent material washed out of the bluff as a fan deposit.
	C2	2.0–2.2 feet	dark brown	sandy loam	May be redeposited site material based on color and texture of sediment.

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Facies & Landform, by Trench	Soil Horizon	Depth [a] or Stratum (feet)	Color	Texture	Description
	C3	2.2–8.0 feet	dark brown	clay loam	Historical-period fill or colluvium/alluvium. Toothbrush found at 0.8 m and chunks of concrete at 1.4 m. Heavily bioturbated.
Trench 2-9					
Hill slope Toe slope	C1	1g	brown (10YR 4/3)	sandy loam	Modern fill. Appears to be redeposited A horizon material and sediment washing off of the hill slope to the south. Full of large chunks of asphalt. The abrupt, straight contact with Strata 1h and 3d indicate that this area was mechanically excavated prior to deposition of Stratum 1g. Includes lenses of site material (Stratum 1d) containing artifacts.
	C2	1h	very dark grayish brown (10YR 3/2)	sandy loam	Lens of redeposited A horizon with midden or artifacts.
Alluvial fan Toe slope	C3	5d	pale brown (10YR 6/3)	sand	Flood/alluvial fan deposits. Layered sands deposited either by the alluvial fan in the Lincoln gap or as flood water deposits.
	2Ab	3d	very dark grayish brown (10YR 3/2)	sandy loam	A horizon with midden or artifacts in primary depositional context. Artifacts are fairly dense in the profile, particularly shell. The contact with underlying Stratum 4t is wavy and irregular. May be the result of bioturbation or unconformity. If the latter, it is most likely a mechanical disturbance and would therefore make Stratum 3d redeposited rather than in primary depositional context.
	2Cb	4t	brown (7.5YR4/3)	loamy sand	C horizon consisting sandy material similar to that found in the sand dunes on the bluff tops to the south. Probably part of alluvial fan from the Lincoln gap.
Trench 2-10					
Alluvial fan Toe slope	fill	0–2.0 feet	black	loamy sand	Modern. Appears to be a mix of fill and redeposit A horizon material and sediment washing off of the hill slope to the south. Contains brick, saw-cut bone, and bottle glass.
	fill	2.0–3.5 feet	reddish brown	sand	Modern fill. Contains brick, saw-cut bone and glass.
	fill	3.5–6.0 feet	dark brown	sandy loam	Modern fill. Mixture of silty and sandy material used as fill.
	Ab	6.0–8.5 feet	black	clay loam	A horizon that represents the top of a marshland soil.

Facies & Landform, by Trench	Soil Horizon	Depth [a] or Stratum (feet)	Color	Texture	Description
Trench 2-11					
Alluvial fan Toe slope	fill	0–3.5 feet	brown	sandy loam	Modern fill. Contains brick, metal and marine shell, predominantly oyster.
	fill	3.5–4.5 feet	reddish brown	sandy loam	Modern fill. Heavily bioturbated.
	fill	4.5+ feet	dark brown	clay loam	Modern fill. Contains brick and concrete. Heavily bioturbated.
Trench 2-12					
Alluvial fan Toe slope	C	0–4.0 feet	pale brown	sandy loam	Modern alluvial fan deposits. Thin banded layers of laminated silts and sands. Probably alluvial fan deposits of material washing off of the bluff slope to the south. Heavily bioturbated.
	fill	4.0–4.6 feet	black	sandy clay loam	Possibly modern fill. The color and the clay content in this layer suggests that it was originally a marsh soil, probably an A horizon, that was redeposited. Heavily bioturbated.
	fill	4.6–5.2 feet	greenish gray	sandy loam	Possibly modern fill. Heavily bioturbated.
	fill	5.2–7.5 feet	greenish gray	loam	Possibly modern fill. Heavily bioturbated mixture of greenish and black silts. This description suggests redeposition of native marsh deposits by mechanical means.

[a] Below surface

Table A.1b. Trenches 101–103

Cultural Material Present?	Soil Horizon	Depth (m)	Color	Texture	Description
Trench 101					
—	fill	0–0.3 (south) 0–2 (north)	very pale brown, brownish yellow, very dark brown, yellowish brown (10YR 7/4, 10YR 6/6, 10YR 3/2, 10YR 5/6)	gravelly, loamy sand; gravelly, loamy sandy loam	Fill with numerous historical-period artifacts (glass, ceramics, metal, and construction debris). Also lenses of A horizon soils that have likely come from nearby. Also contains prehistoric materials such as a large metate fragment, shell, and other lithics. Wavy abrupt lower contact.
Yes	A1	0.3–0.5 (south)	dark brown (10YR 3/3)	sandy loam	Intact, contains prehistoric cultural materials including shell, lithics, bone. Upper portion appears truncated. Slopes downward drastically from south end of trench to north where it thins and disappears. Wavy abrupt upper contact, wavy clear contact with lower stratum.
Yes	A2	0.5–0.8 (south)	very dark grayish brown (10YR 3/2)	sandy loam, loam	Thin lens only seen in south end of trench for 1 m. Contains same cultural material as A1, also follows slope of A1. Wavy clear contact with upper and lower stratum.
Yes	A3	0.8–1.6 (south)	dark grayish brown	sandy loam, loam	Thick lens of A horizon soil, also contains sparse cultural materials like those seen in A1 and A2. Wavy clear contact with upper and lower soil stratum.
Yes	AC	1.6–2.2 (south)	very dark brown with mottles of yellowish red (10YR 2/2, 5YR 5/8)	sandy loam, loamy sand	Mixed A and C horizon soils, mottled with oxidized root casts at the base. Some cultural materials likely a result of bioturbation.

Cultural Material Present?	Soil Horizon	Depth (m)	Color	Texture	Description
Trench 102					
Yes	fill	0.0–0.47 (south)	grayish brown, light grayish brown, dark grayish brown, yellowish brown (10YR 5.5/2, 10YR 4.5/2, 2.5Y 6/4)	extremely gravelly loamy sand, loamy sand	Consists of an upper layer of decomposed granite, and a thick deposit of fill containing historical-period and modern refuse: both domestic and industrial materials. Gradually slopes from south end for approximately 8 m, then slopes drastically. Also lenses of A horizon material with some prehistoric material. Abrupt smooth boundary with lower A horizon soils.
Yes	A1	0.47–1.0	grayish brown (10YR 5/2)	sandy loam	Intact deposit sloping gently from south end of trench, then drops off dramatically and thins. Contains sparse cultural deposit with lithics, shell, bone, fire-affected rock. Abrupt smooth lower boundary, abrupt wavy upper boundary.
Yes	A2	1.0–1.5	light gray to light brownish gray, yellowish brown mottles (10YR 6/1.5, 10YR 5/8)	loam	Intact deposit also sloping gently to north, and then drastically drops; similar cultural materials as in A1 horizon.
Yes	AC	1.5–2.2	gray, dark gray, yellowish brown (10YR 4.5/1, 10YR 5/8)	loamy sand, mottles	Intact, transitional with mottles of A and C horizon soils, some containing cultural materials, likely the result of bioturbation.
Yes	Cg	2.2–4.0 (south)	light gray, gray, yellowish brown (10YR 5.5/1, 10YR 5/8)	loamy sand, fine to medium mottles	Intact C horizon with some mottles, some cultural materials, likely the result of bioturbation, hand trench and auger excavated in portion of south end of trench, water table encountered at 3 m. Laminated deposit in northern end of trench.
Trench 103					
No	fill	0–3.0	grayish brown, light grayish brown, dark grayish brown, light yellowish brown (10YR 5.5/2, 10YR 4.5/2, 2.5Y 6/4)	gravelly loamy sand, loamy sand	Fill containing historical-period artifacts such as ceramics, glass, saw-cut bone, construction debris (metal, asphalt, concrete, brick). Mottled with lenses of A horizon soils, likely cut and used as fill. Some prehistoric cultural materials, likely from A horizon soils that were cut and used as fill. Very unstable soils: could not enter trench to profile.

Table A.1c. Trenches 104–108

Intact Cultural Material Present?	Soil Horizon	Depth (m)	Color	Texture	Description
Trench 104					
No	fill	0–3.0	grayish brown, light grayish brown, dark grayish brown, light yellowish brown (10YR 5.5/2, 10YR 4.5/2, 2.5Y 6/4)		Similar to Trench 103, although fill contains slightly more historical-period artifacts such as ceramics, glass, saw-cut bone, construction debris (metal, asphalt, concrete, brick). Mottled with lenses of A horizon soils, likely cut and used as fill. Some prehistoric cultural materials, likely from A horizon soils that were cut and used as fill. Very unstable soils, could not enter trench to profile, groundwater at 3 m.
Trench 105					
No	fill	0–2.5	yellowish brown, mottles of dark gray	sandy silt, loam with clasts of clay	Same as fill in Trenches 103 and 104, also lenses of A horizon soils containing cultural materials.
Yes	A	2.5–3.0	dark gray	sandy silt, loam	Appears to be thin, intact layer of A horizon soil containing cultural materials such as shell, bone, and lithic artifacts, also a mortar or bowl fragment pulled from backdirt while excavating through this layer. Possible feature at 12 m from south end of trench appears to contain mano and fire-affected rock; could not enter trench because of highly unstable sidewalls from fill.
Trench 106					
No	fill	0–2.5	orangish brown, yellowish brown	sandy silty loam, with some mottles of clay	Same fill as in Trenches 103–105. Also lenses of A horizon soils containing prehistoric cultural materials. Very unstable.
Yes	A	2.5–2.75	dark gray	sandy silt, loam	Thin intact A horizon containing cultural materials such as shell, lithics, bone, and ground stone (one whole metate recovered from this layer). Probably represents the bottom of a mechanically cut cultural deposit. Lower boundary is mottled and appears to represent intact stratigraphic profile.

Intact Cultural Material Present?	Soil Horizon	Depth (m)	Color	Texture	Description
No	C	2.75–3.0	dark gray, black	clayey silt, clayey loam	Intact upper-marsh deposit containing large amount of decomposing organic materials such as roots, also oxidized root casts, and some small rounded pebbles. No cultural material noted. Upper boundary is mottled with A horizon. Looks very similar to 2A2b seen in Trench 1-7.
Trench 107					
No	fill	0–1.3	yellowish brown, orangish brown	sandy loam with some mottles of clay	Fill similar to that noted in Trenches 103–106, also contains lenses of A horizon soils. Gently slopes from south end of trench, thickening to 1.6 m.
Yes	A	1.3–2.3	dark gray	sandy silt, loam	Intact A horizon, likely containing cultural materials, gently slopes to the north, where it continued below the depth of the trench. Groundwater at 2.3 m, and trenching halted. Could not enter trench, highly unstable.
Trench 108					
	fill	0–1.3	gray, yellowish brown, very dark grayish brown, very dark gray (10YR 5/1, 10YR 5/4, 10YR 4/2, 10YR 3/1, 10YR 3/2)	loam, loamy sand, sandy loam, clay loam	Fill similar to that in other trenches, moderate amount of historical-period materials and construction debris, also lenses of A horizon soils. Slopes gently to north end of trench where it thickens to 1.6 m.
	A	0.94–1.26	gray (10YR 5/1)	clay loam	Intact A horizon containing sparse cultural materials including shell and lithics, gently sloping to north end of trench.
	Cg	1.26–2.33	dark gray, very dark grayish brown, yellowish brown mottles (10YR 3/1.5, 10YR 5/8)	mottled clay loam	Intact C horizon, likely marsh deposits containing some organic materials and oxidized root casts, no cultural material noted.

Table A.1d. Trenches 109–122

Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
Trench 109				
Fill	0–0.20	brown (10YR 5/3)	sandy loam	Same as fill seen in other trenches, sparse amount of historical-period and modern artifacts. Gently slopes to the north, the depth and thickness of the deposit varies, smooth to wavy contact with lower soil layer
A	0.20–0.60	gray (10YR 5/1)	sandy loam to loam	Intact A horizon containing cultural materials including lithics, fire-affected rock, and shell; clear smooth boundary, top has likely been truncated.
BA	0.60–0.85	light brownish gray (10YR 6/2)	sandy loam	Intact, mixed B and A horizon soil with sparse cultural materials probably moved through bioturbation, smooth boundary.
Bk	0.90–1.30	gray (10YR 6/1)	sandy loam	CaCO-enriched lens within BA horizon, no cultural materials noted, appears in trench at 4 m from south wall; rodent activity noted through this zone.
2Ab1	0.85–1.30	dark grayish brown, brownish yellow mottles (10YR 4/2, 10YR 6/8)	loamy sand to sandy loam	Intact, buried soil horizon containing sparse cultural materials, also subject to bioturbation; abrupt, smooth boundary.
2Ab2	1.30–1.70+	dark grayish brown, brownish yellow mottles (10YR 4/2, 10YR 6/8	loamy sand	Intact, buried soil horizon, saturated sparse cultural materials noted, lower portion of this layer (1.8 m below surface) encountered ground water
Trench 110				
Fill	0–0.75	brownish yellow (10YR 6/6)	sandy loam	Fill material similar to that seen in other trenches, although slightly less historical-period material, mostly construction debris; gently slopes from bluff edge to the west, with thickness varying.
Bk	0.75–0.95	dark grayish brown (10YR 4/2)	sandy loam	CaCO-enriched zone with an abrupt wavy boundary, no cultural material noted.
Bw	0.95–1.15	very dark grayish brown (10YR 3/2)	sandy loam	

Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
2Ab	1.15–1.70	dark grayish brown, yellowish brown (10YR 4/2, 10YR 5/6)	loamy sand to sandy loam	Intact, buried soil horizon containing sparse cultural materials, also subject to bioturbation, abrupt smooth boundary
2ACb	1.70–2.15	dark grayish brown, yellowish brown mottles (10YR 4/2, 10YR 5/6	loamy sand	Intact, buried, mixed A/C soil horizon, containing sparse prehistoric cultural remains, clear smooth boundary.
2Cg	2.15–3.10+	gray, yellowish brown mottles (10YR 4/1, 10YR 5/6)	loamy sand	Intact, buried, gleyed C horizon soil containing sparse cultural materials that may be the result of bioturbation.
Trench 111				
Fill	0–0.60	grayish brown and light yellowish brown (10YR 5/2, 10YR 6/4)	sandy loam to loam	Alternating layers of fill materials that may relate to historical-period or modern cutting and filling episodes. Fill contains metal wire, nails, and pieces of plastic. The horizon slopes gently from the southern end of the trench, then at 3 m dips drastically, representing artificial cut into underlying A horizon soils.
A	0.60–0.70	dark gray with pale brown insect casts (10YR 4/1, 10YR 7/3)	loam	Possibly intact, A horizon containing sparse cultural materials, top has been truncated, gently slopes from south end of trench until 3 m, where it is cut drastically; abrupt wavy boundary.
Bw	0.70–0.97	grayish brown to dark grayish brown, with yellowish mottles (10YR 4.5/2, 7.5YR 5/8)	sandy loam	Contains some cultural materials and has been mechanically cut in the northern portion of the trench.
Bwk	0.97–1.13	dark gray with yellowish brown mottles (10YR 4/1, 10YR 5/8)	loam to sandy loam	No cultural materials noted.
2Ab	1.13–1.72	dark gray to very dark gray with yellowish brown mottles (10YR 3.5/1, 10YR 5/8)	sandy loam	Buried A horizon soil containing sparse cultural materials including shell and lithics. Gently slopes from south end of trench. Thickness varies from about 1.5 to about 0.5 m.
2ACb	1.72–2.02	gray with yellowish brown mottles (10YR 5/1, 10YR 5/8)	loamy sand	Buried A horizon transitional zone with some C horizon characteristics. Some shell noted that may be cultural.
2Cg1	2.02–2.35	dark gray with yellowish brown mottles (10YR 4/1, 10YR 5/6)	loamy sand	Marsh deposits underlying buried A horizon, no cultural materials noted.
2Cg2	2.35–3.18	dark grayish brown (10YR 4/2)	loamy sand	Continuation of marsh deposits, mottles not seen in this layer, no cultural materials noted.

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Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
Trench 112				
Fill	0–1.0	dark grayish brown with yellowish brown mottles (10YR 4/2, 10YR 5/4)	sandy loam	Fill similar to that of other trenches containing sparse historical-period and modern construction debris and other refuse, layer is fairly level across unit, implying artificial cut into the underlying A horizon, abrupt smooth boundary.
A	1.0–2.4	dark gray to very dark gray (10YR 3.5/1, 10YR 2.5/1)	sandy loam to loamy sand	Intact A horizon, that has been mechanically truncated on upper surface. Likely represents upper marsh deposits. A thin lens at approximately 0.9–1.2 m may represent cultural deposit, as it appears very similar to that of adjacent trenches. No cultural materials identified, water encountered at about 2 m below surface.
Trench 113				
Fill	0–2.8	dark greyish brown mottled with light olive brown (10YR 4/2, 10YR 4/2.5	sandy silt to sand	Fill similar to that seen in other trenches containing historical-period artifacts and construction debris, as well as some prehistoric materials in lenses of A horizon soils. Fill gradually slopes to the north, then at approx 3.5 m from south end, makes abrupt drop where it has been mechanically cut.
BA	1.3–1.5	dark grayish brown mottled with yellowish brown (10YR 4/2, 10YR 5/6)	loamy sand	Mixed B/A horizon zone gradually sloping to north, has been mechanically truncated on upper surface. No cultural materials noted while excavating.
2Ab1	1.5–1.9	very dark gray with mottles of yellowish brown	sandy loam	Intact, buried A horizon soil containing cultural materials including lithics, shell, and FAR. Gently slopes from south end of trench to north where it appears to have been mechanically truncated. Likely the same as A1 soil horizon seen in Trench 2.
2Ab2	1.9–2.1	dark gray to very dark gray (10YR 3.5/1)	sandy loam	Intact, buried A horizon, containing cultural materials, gently sloping to north, continued into bottom of trench.
2ACb	2.1–2.4	dark gray (10YR 4/1)	loamy sand	Intact, buried transitional A/C horizon, slopes gently to the north, no cultural material noted.
2Cg	2.4–2.6 (bottom of trench)	very dark gray (10YR 3/1)	sandy clay loam	Intact, C horizon soils, likely marsh deposits, no cultural materials noted.

Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
Trench 114				
Fill	0–2.6	grayish brown, light grayish brown, dark grayish brown, light yellowish brown (10YR 5.5/2, 10YR 4.5/2, 2.5Y 6/4)	gravelly loamy sand, loamy sand	Trench excavated to confirm presence of cultural materials in nearby bucket auger units, no intact A horizon or cultural materials encountered. Fill containing historical-period artifacts such as ceramics, glass, saw-cut bone, construction debris (metal, asphalt, concrete, brick). Mottled with lenses of A horizon soils, probably cut and used as fill. Some prehistoric cultural materials, likely from A horizon soils that were cut and used as fill. Very unstable soils: could not enter trench to profile.
Trench 115				
Fill	0–1.5	orangish brown, brown, light yellowish brown	sandy loam, clay, sand	Fill material containing construction debris such as asphalt, concrete, brick, and unidentifiable metal. Large block of cement in southern section of trench. Water table encountered at 1.5 m, and excavation halted.
Trench 116				
Fill	0–1.25	orangish brown, brown, light yellowish brown	sandy loam, clay, sand	Fill material containing construction debris such as asphalt, concrete, brick, and unidentifiable metal. Large block of cement in southern section of trench.
A	1.25–1.5	very dark brown (10YR 3/2)	loamy sand	Possibly intact A horizon, no cultural material noted, could not profile or sample as water table was encountered at this level, and filled trench.
Trench 117				
Fill	0–1.5	orangish brown, brown, light yellowish brown	sandy loam, clay, sand	Fill material containing construction debris such as asphalt, concrete, brick, and unidentifiable metal. Water table encountered at 1.5 m, and excavation halted.

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Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
Trench 118				
Fill	0–0.1	light olive brown (2.5Y 6/4)	gravelly loamy sand	Thin lens of road base, abrupt wavy boundary.
Fill	0.1–2.6	grayish brown to dark grayish brown with very pale brown mottles (10YR 4.5/2, 10YR 7/3)	sandy loam to loamy sand	Fill material similar to that in other trenches, contains sparse amount of historical-period materials, the depth is highly variable ranging from 20 cm in south end to more than 2 m in north end of trench. In places, has been mechanically truncated, and appears layered. Fill also contains lenses of A horizon soils, and also contains some prehistoric artifacts.
A1	0.20–0.64	dark grayish brown (10YR 4/2)	sandy loam	Intact A horizon sloping gently from south end of trench to north, then abruptly drops where it has been mechanically truncated, and disappears approximately 3 m from south end of trench. Contains sparse amount of prehistoric cultural materials including marine shell, lithics, and burnt bone. Abrupt smooth boundary.
A2	0.64–1.38	very dark grayish brown (10YR 3/2)	loam	Intact, A horizon, slightly darker than overlying A1, slopes gently from southern end of trench where it has been mechanically truncated at approximately 3 m from south end of trench. Contains sparse amount of cultural materials. Clear smooth boundary.
AC	1.38–2.1	very dark gray (10YR 3/1)	loamy sand	Mixed A/C horizon, intact, relatively flat to approximately 5.5 m from south end of trench where it had been mechanically truncated and fill placed. Some prehistoric cultural materials, likely the result of bioturbation. Clear smooth boundary.
Cg	2.1–2.2	dark gray with yellowish brown mottles (10YR 4/1, 10YR 5/8)	loamy sand	Intact C horizon, likely marsh or upper marsh deposits. Relatively flat, then truncated at approximately 7 m from south end of trench. No cultural materials noted.

Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
Trench 119				
Fill I	0–2.0	yellowish brown, very dark grayish brown, grayish brown, brown, and olive yellow (10YR 5/4, 10YR 3/2, 10YR 5/2, 10YR 4/3, 2.5Y 6/6)	loamy sand, sandy loam, sandy clay loam	Layered bands of lighter sandy soils and darker redeposited A horizon soils, appear to have been mechanically placed. Historical-period artifacts including sparse amounts of glass, metal, ceramics and construction debris. Relatively flat with abrupt smooth boundary.
Fill II	1.5–2.7	dark brown with layers of dark gray (10YR 3/3, 10YR 4/0)	sandy loam, silty clay	Fill layer, with lenses of silty clay. Relatively flat, with steep dip at approximately 5 m from south end of trench. Sparse historical-period artifacts including ceramics, metal, and glass.
AC	1.9–2.7	black (10YR 2/1)	clayey loam	Mixed A/C horizon soil layer. Contains sparse cultural materials, probably the result of bioturbation from overlying A horizon removed mechanically at some time in the past. Marine shell and burnt bone, but no lithics. Gently sloping from southern end of trench to approximately 4 m where it has been mechanically truncated.
Trench 120				
Fill I	0–0.97	brown, dark grayish brown, yellowish red, dark gray (10YR 5/3, 10YR 4/2, 5YR 5/8, 5Y 4/1)	sandy loam, clay	Fill layer similar to that seen in other trenches, gently sloping to north, thickness varies from 0.8 m (south end) to 2 m (north end). Contains sparse amounts of historical-period materials such as metal, glass, ceramics and construction debris such as asphalt and concrete. Also contains patches of clay and lenses of A horizon soils likely with prehistoric cultural materials. Abrupt wavy boundary.
Fill II	0.97–2.17	brown, dark grayish brown, light yellowish brown, dark gray (10YR 4/3, 10YR 4/2, 10YR 6/4, 5Y 4/1)	sandy loam, loam, loamy sand, clay	Fill layer similar to Fill I, gently sloping to north, with patches of clay and sparse historical-period materials as well as prehistoric materials and lenses of A horizon soils. Large section approximately 20 cm thick of dark gray clay may represent ponding or standing water from approximately 8.5 to 13 m from south end of trench.

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Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
A	2.17–2.58	dark gray with yellowish brown mottles (10YR 4/1, 10YR 5/8)	sandy loam	A horizon soils similar to that seen in other trenches, containing sparse prehistoric cultural materials such as marine shell, lithics, and bone. Deposit is gently sloping from the south end of the trench, and quickly disappears at approximately 2.5 m, where it appears to have been mechanically truncated.
AC	2.58–2.79	dark gray with yellowish brown mottles (10YR 4/1, 10YR 5/8)	clay loam	Mixed A and C horizon soil, gently sloping to north, contains sparse prehistoric cultural materials, likely the result of bioturbation.
Cg1	2.79–2.90	gray to light gray with yellowish brown mottles (10YR 6/1, 10YR 5/8)	sandy clay loam	Likely marsh or upper marsh deposits containing decomposing organic material and oxidizing root casts. No cultural materials noted. Clear smooth boundary.
Cg2	2.90–3.04+	gray with yellowish brown mottles (10YR 4/1, 10YR 4/6)	sandy clay loam	Likely marsh or upper marsh deposits containing decomposing organic material and oxidizing root casts. No cultural materials noted. Clear smooth boundary, continues to bottom of trench.
Trench 121				
C1	0–0.63	yellowish brown (10YR 5/4)	loamy sand	
C2	0.63–0.78	pale brown (10YR 6/3)	loamy sand to sandy loam	
C3	0.78–0.90	yellowish brown with laminations of dark brown to very dark grayish brown (10YR 5/4, 10YR 3/2)	sandy loam, clay loam	
C4	0.90–0.96	brown with thin laminations of dark brown to very dark grayish brown (10YR 4.5/3, 10YR 3/2)	loamy sand	
C5	0.96–1.04	yellowish brown (10YR 5/4)	loamy sand	
C6	1.04–1.31	yellowish brown (10YR 5/4)	loamy sand	
C7	1.31–1.41	yellowish brown (10YR 5/4)	loamy sand	
C8	1.41–1.49	yellowish brown (10YR 5/4)	loamy sand	
C9	1.49–1.59	yellowish brown (10YR 4/2)	gravelly sandy loam	

Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
C10	1.59–1.67	yellowish brown (10YR 5/4)	loamy sand	
C11	1.67–1.72	yellowish brown (10YR 5/4)	loamy sand	
C12	1.72–2.02	brown (10YR 4.5/3)	loamy sand	
2Ab	2.02–2.40	very dark gray with brown mottles (10YR 3/1, 7.5YR 5/8)	sandy loam to sandy clay	Buried A horizon, possibly upper fresh water marsh or marsh deposit, contains sparse cultural material including lithics. Relatively flat across trench, clear wavy boundary.
2ACb	2.40–2.55	dark gray with brown mottles (10YR 4/1, 7.5YR 5/8)	sandy loam to sandy clay loam	Buried mixed A and C horizon soil, likely marsh deposits with decomposing organic material. No cultural materials noted, abrupt wavy boundary.
2Cg	2.55–3.10	gray with brown mottles and light gray threads (5Y 5/1, 7.5YR 5/8, 10YR 7/1)	sandy clay loam	Gleyed C horizon containing organic materials, likely representative of marsh deposits. No cultural materials noted, and water table encountered at 2.92 m below surface.
Trench 122				
Fill	0–0.25	yellowish brown with layers of brown (10YR 5/6, 10YR 5/3)	sandy loam and loamy sand	Thin lens of fill material similar to that seen in other trenches, containing sparse historical-period materials as well as modern construction debris.
A	0.25–0.4	yellowish brown (10YR 5/4)	loamy sand	Intact, thin lens of A horizon, slightly sloping to north, disappears at approximately 4.5 m from south end of trench. No cultural material noted.
C1	0.44–0.7	light yellowish brown (10YR 5/4)	loamy sand	Intact C horizon, gently sloping to north, then flattens at approximately 4 m from south end. The thickness varies from about 30 cm to 70 cm. No cultural materials noted, clear smooth boundary.
C2	0.76–1.0	light yellowish brown (10YR 6/4)	loamy sand to gravelly loamy sand	Intact, C horizon, gently sloping to north, then flattens at approximately 4 m from south end of trench. Distinguished from C1 by gravel lenses in the upper 10–15 cm near the contact between C1 and C2. No cultural materials noted, clear smooth boundary.

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Soil Horizon, by Trench	Depth (m)	Color	Texture	Description
2Ab	1.01–2.01	dark grayish brown (10YR 4/2)	sandy loam	Intact, buried A horizon gently sloping to north, then flattening at approximately 2.8 m from south end of trench. Sparse cultural materials in this layer including lithics. This lens is similar in composition to other A horizons identified in previous trenches, but appears lighter in color with less cultural material, abrupt smooth boundary.
3Ab	2.01–2.45	very dark gray (10YR 3/1)	silt loam to silty clay loam	Intact, buried A horizon, slopes to the north, then flattens at approximately 1 m from south end of trench. Contains sparse cultural materials including shell and lithics. Similar to 2Ab in Trench 21. Abrupt, smooth boundary.
3ACb	2.45–2.78	very dark gray with brown mottles (10YR 3/1, 7.5YR 5/8)	silt loam to silty clay loam	Intact, buried, mixed A/C horizon may contain sparse cultural materials as a result of bioturbation. Clear, smooth boundary.
3Cg1	2.78–3.15	gray to light gray with brown mottles (10YR 6/1, 7.5YR 5/8)	silty clay loam	Gleyed C horizon, likely marsh deposits containing some decomposing organic material. No cultural material present, clear smooth boundary.
3Cg2	3.15–3.25+	light brownish gray (10YR 6/2)	silty clay loam	Gleyed C horizon, likely marsh deposit, contains some decomposing organic material. No cultural material present, smooth boundary, groundwater encountered at 3.25 m below the surface.

Table A.2. Trenches at LAN-2769

Facies & Landform, by Trench	Soil Horizon	Depth (feet)	Color	Texture	Description
Trench 1-1					
Hill slope Toe slope		0–0.5		asphalt	Parking lot surface.
	Fill I	0.5–5.0	yellowish brown	fine sand	Modern fill.
	Fill II	5.0–8.0+	brown	loamy sand	Modern fill; heavy volume of trash, including brick fragments; concrete and metal, including airplane parts.
Trench 1-2					
Hill slope Toe slope		0–0.5		asphalt	Parking lot surface.
	Fill II	0.5–5.0	brown	loamy sand	Modern fill; contains concrete, brick fragments and wire.
	Fill I	5.0–8.0	yellowish brown	fine sand	Modern fill; sand from the bluff with some brick and wire.
Alluvial plain Floodplain	C1	8.0+	greenish gray	silt	Marsh deposits; bioturburbated greenish gray silt with black mud; contains small chunks of charcoal.
Trench 1-3					
Hill slope Toe slope		0–0.5		asphalt	Parking lot surface.
	fill	0.5–1.5	brown	loamy sand	Modern fill; contains concrete, brick fragments and wire.
		1.5–2.0		asphalt	Buried parking lot surface.
Alluvial plain Floodplain	C1	2.0–2.5	black	loam	Marsh deposits; contains chunks of charcoal and small roots.
	C2	2.5–3.5	green	silt	Marsh or freshwater deposit; color and texture, coupled with the presence of gastropods, suggests this may be shallow freshwater deposit.
Trench 1-4					
Hill slope Toe slope		0–0.5		asphalt	Parking lot surface.
	fill	0.5–1.5	gray	gravel	Road base.
	C1	1.5–3.8	dark brown	sand	Historical-period flood deposit; bedded sand with small, shallow channels.

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Facies & Landform, by Trench	Soil Horizon	Depth (feet)	Color	Texture	Description
Alluvial plain Floodplain	2Ab	3.8–4.5	brown	sandy loam	A horizon with rodent disturbance.
	2Cb	5.0–8.0	green	loam	Marsh deposit.
Trench 1-5					
Hill slope Toe slope		0–0.5		asphalt	Parking lot surface.
	fill	0.5–1.5		gravel	Road base.
	C1	1.5–3.8	dark brown	sand	Historical-period flood deposit; bedded sand with small, shallow channels.
Alluvial plain Floodplain	2Ab	3.8–4.5	brown	sandy loam	A horizon with rodent disturbance.
	2Cb	5.0–8.0	green	loam	Marsh deposit.

Table A.3. LAN-2769 Unit Soils

Facies & Landform, by Unit	Soil Horizon	Stratum	Color	Texture	Description
Unit 1					
Hill slope Toe slope	fill	1a	brown (10YR 5/3)	sandy loam	Redeposited fill or colluvium; contained glass and a probable cow bone. Deposited after parking lot was built, because stratum sits on asphalt in part of the unit.
	fill	1b	light brownish gray (10YR 6/2)	sandy loam	Redeposited fill or colluvium; contained glass, plastic and rubber; deposited after parking lot was built, because stratum sits on asphalt in part of the unit.
	fill	1c	dark grayish brown (10YR 4/2)	very fine sandy loam	Redeposited fill or colluvium; deposited after parking lot was built as it sits atop asphalt in part of the unit; probably redeposited from a horizon upslope.
	fill	1d	brown (10YR 5/3)	very fine sandy loam	Redeposited fill or colluvium; deposited after parking lot was built, because stratum sits on asphalt in part of the unit; may be same as Stratum 1a.
	fill	1e	light grayish brown (10YR 6/2)	sandy loam	Modern alluvium and colluvium.
	A1b	2a	dark grayish brown (10YR 4/2)	sandy loam	A horizon without artifacts; may be disturbed or redeposited..
	A2b	3a	dark gray (10YR 4/2)	sandy loam	A horizon with low artifact density; may be disturbed or redeposited.
	C1b	4a	yellowish brown (10YR 5/6)	sand	Appears to be relatively unweathered hill-slope matrix.
	C2b	4b	dark yellowish brown (10YR 4/4)	sand	Appears to be relatively unweathered hill-slope matrix.

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Facies & Landform, by Unit	Soil Horizon	Stratum	Color	Texture	Description
Units 2 and 3					
Hill slope Toe slope	C1	1f	brown (10YR 5/3)	sandy loam	Modern alluvium and colluvium; contained numerous bottles and some aluminum cans. Appears to be redeposited A horizon material and sediment washing off of the hill slope to the south; may have been result of mechanical sculpting of hill slope to south.
	C2	1g	brown (10YR 6/2)	fine sandy loam	Historical-period/modern alluvium and colluvium; contains chunks of light yellowish brown (10YR 5/4) sandstone. It is likely that this material was deposited during the 1920s when the sewer line was built.
	2Ab	3b	very dark gray (10YR 3/1)	loamy sand	A horizon with low artifact density.
	2ACb	4c	dark yellowish brown (10YR4/4)	gravelly loamy sand	Mostly C horizon mixed by bioturbation with very brown gray A horizon matrix.

Table A.4. LAN-211/H Trench Soils Data

Facies & Landform, by Trench	Soil Horizon	Stratum or Depth	Color	Texture	Description
Trench 11					
Alluvial plain Toe slope		1a			Asphalt paving for parking lot.
		1b	light yellowish brown (2.5Y 6/4)	gravelly sand	Decomposed granite; commonly used on the Hughes Aircraft Company property as base for roads, runways, and parking lots.
		1c	light gray (10YR 7/1)	sandy gravel	Fill in modern trench.
		1d	light gray (10YR 7/1)	sandy gravel	Fill in modern trench.
		1e	light gray (10YR 7/1)	sandy gravel	Fill in modern trench.
		1f	pale brown (10YR 6/3)	sand	Modern fill. A mix of the primary material and black (10YR 2/1) silt loam.
	C1	5a	pale brown (10YR 6/3)	sand and silt	Alternating layers of well sorted course to pale brown sand capped by thin layers (up to 4 cm thick) of dark grayish brown (10YR 4/2) silt; probably flood deposits capped by runoff from nearby slope deposited in shallow standing water.
	C2	5c	pale brown (10YR 6/3)	sandy gravel	Poorly sorted, coarse to fine sand mixed with pebbles and cobbles; possibly stream-deposited gravel bar.
Alluvial fan Toe slope	2A1b	3c	very dark gray (10YR 3/1)	sandy loam	A horizon with midden or artifacts in primary depositional context.
	2A2b	4g	very dark grayish brown (10YR 4/1)	sandy loam	A horizon with low artifact density; artifacts are most likely present as a result of bioturbation of the overlying Stratum 3b.
	2Bt1b	4q	brown (10YR 5/3)	sandy loam	B horizon developed in an alluvial fan deposit; no artifacts noted.
	2Bt2b	4r	dark yellowish brown (10YR 4/6)	sandy loam	B horizon developed in an alluvial fan deposit; no artifacts noted.
	2Cb	4s	brown (10YR 5/3)	very gravelly loamy sand	C horizon developed in an alluvial fan deposit; no artifacts noted.

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Facies & Landform, by Trench	Soil Horizon	Stratum or Depth	Color	Texture	Description
Trench 1-6					
Hill slope Toe slope	C	0–1.8 m (0.0–6.0 feet)	brown	loamy sand	Possible slump; bisected by stream channel 1–1.5 m (3–5 feet) wide
	2Ab	1.8–2.9 m (6.0–9.5 feet)	dark brown	sandy loam	A horizon material; similar to A horizons within the site, but no artifacts were found in the trench.
Alluvial plain Floodplain	2Cb	2.9–3 m (9.5–10.0 feet)	green	silt	Marsh deposit; weak bedding, with increasing clay to the north.

Table A.5. LAN-211/H Unit Soils

Facies & Landform, by Unit	Soil Horizon	Stratum	Color	Texture	Description
Units 1–4					
Alluvial fan Bench	C1	2a	dark brown (10YR 3/3)	fine sandy loam	Modern alluvium and colluvium; appears to be redeposited A horizon material and sediment washing off of the hill slope to the south; may have been result of mechanical sculpting of hill slope to south.
	C2	2b	light grayish brown (10YR 6/2)	fine sandy loam	Historical-period/modern alluvium and colluvium; lenses of sand and thin layers (< 1 cm thick) of clay are present at the upper and lower contacts. Contains rusted nails and wire, suggesting a modern origin. May have been result of mechanical sculpting of hill slope to south.
	C3	2c	pale brown (10YR 6/3)	fine sandy loam	Alluvium and colluvium of undetermined age.
	2A1b	3a	very dark grayish brown (10YR 3/2)	sandy loam	A horizon with midden or artifacts in primary depositional context.
	2A2b	4a	dark grayish brown (10YR 4/2)	sandy loam	A horizon with low artifact density; artifacts are most probably present as a result of bioturbation of the overlying Stratum 3a.
	2A3b	4b	very dark grayish brown (10YR 4/1.5)	sandy loam	A horizon with low artifact density. Artifacts are most likely present as a result of bioturbation of the overlying Stratum 3a.
	2Bt1b	4c	dark grayish brown (10YR 4/2)	sandy loam	One of a series of clay layers (lamellae) developed in alluvial fan deposit (CB horizon); no artifacts noted.
	2CB1b	4d	brown (10YR 5/3)	fine sandy loam loamy sand	Predominantly C horizon with alternating lamellae (Bt horizon) developed in an alluvial fan; no artifacts noted.
	2Bt2b	4e	dark grayish brown (10YR 4/2)	sandy loam	One of a series of clay layers (lamellae) developed in alluvial fan deposit (CB horizon); no artifacts noted.
	2CB2b	4f	brown (10YR 5/3)	fine sandy loam loamy sand	Predominantly C horizon with alternating lamellae (Bt horizon) developed in an alluvial fan; no artifacts noted.
	2Bt3b	4g	dark grayish brown (10YR 4/2)	sandy loam	One of a series of clay layers (lamellae) developed in alluvial fan deposit (CB horizon); no artifacts noted.

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Facies & Landform, by Unit	Soil Horizon	Stratum	Color	Texture	Description
	2CB3b	4h	brown (10YR 5/3)	fine sandy loam loamy sand	Predominantly C horizon with alternating lamellae (Bt horizon) developed in an alluvial fan; no artifacts noted.
	2Bt4b	4i	dark grayish brown (10YR 4/2)	sandy loam	One of a series of clay layers (lamellae) developed in alluvial fan deposit (CB horizon); no artifacts noted.
	2CB4b	4j	brown (10YR 5/3)	fine sandy loam loamy sand	Predominantly C horizon with alternating lamellae (Bt horizon) developed in an alluvial fan; no artifacts noted.
	2Bt5b	4k	dark grayish brown (10YR 4/2)	sandy loam	One of a series of clay layers (lamellae) developed in alluvial fan deposit (CB horizon); no artifacts noted.
	2CB5b	4l	brown (10YR 5/3)	fine sandy loam loamy sand	Predominantly C horizon with alternating lamellae (Bt horizon) developed in an alluvial fan; no artifacts noted.
	2Bt6b	4m	dark grayish brown (10YR 4/2)	sandy loam	One of a series of clay layers (lamellae) developed in alluvial fan deposit (CB horizon); no artifacts noted.
	2CB6b	4n	brown (10YR 5/3)	fine sandy loam loamy sand	Predominantly C horizon with alternating lamellae (Bt horizon) developed in an alluvial fan; no artifacts noted.
Units 5–7 and 10					
Alluvial fan Bench	C1	2c	brown (10YR 4/3)	sandy loam	Modern alluvium and colluvium; appears to be redeposited A horizon material and sediment washing off of the hill slope to the south; may have been result of mechanical sculpting of hill slope to south.
	C2	2d	brownish yellow (10YR 6/6)	sandy loam	Historical-period/modern alluvium; may have been result of mechanical sculpting of hill slope to south.
	2A1b	3b	very dark grayish brown (10YR 3/2)	sandy loam	A horizon with midden or artifacts in primary depositional context.
	2A2b	4o	dark grayish brown (10YR 4/2)	sandy loam	A horizon with low artifact density and mixing of the overlying and underlying strata due to bioturbation.
	2A3b	4p	dark grayish brown (10YR 4/2)	loamy sand	A horizon lacking artifacts; predates occupation of the site.

Facies & Landform, by Unit	Soil Horizon	Stratum	Color	Texture	Description
Unit 9					
Alluvial plain Toe slope		1a	dark brown (10YR 3/3)	fine sandy loam	A horizon with midden or artifacts in primary depositional context.
		1b	light yellowish brown (2.5Y 6/4)	gravelly sand	Decomposed granite; commonly used on the Hughes Aircraft Company property as base for roads, runways, and parking lots.
	C1	5a	pale brown (10YR 6/3)	sand and silt	Alternating layers of C horizon with low artifact density. Artifacts are most likely present as a result of bioturbation of the overlying Stratum 3a. Well-sorted coarse to pale-brown sand capped by thin layers (up to 4 cm thick) of dark grayish brown (10YR 4/2) silt. Probably flood deposits capped by runoff from nearby slope, deposited in shallow standing water.
	C2	5b	pale brown (10YR 6/3)	sandy gravel	Poorly sorted course to fine sand mixed with pebbles and cobbles. Possibly stream-deposited gravel bar.
	2A1b	3c	very dark gray (10YR 3/1)	sandy loam	A horizon with midden or artifacts in primary depositional context.
Unit 11					
Alluvial fan Bench	A1	3d	dark brown (10YR 3/3)	fine sandy loam	A horizon with midden or artifacts in primary depositional context.
	A2	4e	light grayish brown (10YR 6/2)	sandy loam	A horizon with low artifact density. Artifacts are most likely present as a result of bioturbation of the overlying Stratum 3a.

Table A.6. Bucket Augers Containing Fill Soils or in Disturbed Contexts (Categories 3, 4, 5, and 6)

Bucket Auger	Soil Category	Auger Depth (AMSL) in m (feet)			Total Lithic Count	Total Faunal Weight (g)	
		Top	Bottom	Total		Vertebrate	Invertebrate
3	5	4.24 (13.9)	−0.06 (−0.2)	4.30 (14.1)	—	—	—
5	4	3.75 (12.3)	−0.15 (−0.5)	3.90 (12.8)	—	5	< 1
9	4	3.87 (12.7)	0.12 (0.4)	3.75 (12.3)	—	1	—
15	4	3.87 (12.7)	−0.49 (−1.6)	4.36 (14.3)	—	< 1	< 1
16	5	3.87 (12.7)	−0.03 (−0.1)	3.90 (12.8)	—	—	—
20	3	3.51 (11.5)	0.12 (0.4)	3.38 (11.1)	—	75	7
28[a]	4	4.30 (14.1)	0.37 (1.2)	3.93 (12.9)	—	21	3
32	3	2.47 (8.1)	−0.12 (−0.4)	2.59 (8.5)	—	122	9
33	3	2.77 (9.1)	0.03 (0.1)	2.74 (9.0)	1	17	1
34	3	3.26 (10.7)	0.09 (0.3)	3.17 (10.4)	—	64	9
36[a]	3	6.71 (22.0)	1.83 (6.0)	4.88 (16.0)	2	4	2
42	3	3.11 (10.2)	0.03 (0.1)	3.08 (10.1)	1	6	4
48	4	4.08 (13.4)	−0.24 (−0.8)	4.33 (14.2)	—	< 1	—
50[a]	5	2.68 (8.8)	1.01 (3.3)	1.68 (5.5)	—	< 1	—
51	3	3.23 (10.6)	−0.73 (−2.4)	3.96 (13.0)	—	14	< 1
52	3	3.84 (12.6)	1.04 (3.4)	2.80 (9.2)	1	19	2
60	3	3.11 (10.2)	−0.85 (−2.8)	3.96 (13.0)	1	18	7
62	3	3.87 (12.7)	−0.70 (−2.3)	4.57 (15.0)	—	188	10
66	5	2.23 (7.3)	−0.06 (−0.2)	2.29 (7.5)	—	—	—
80	4	3.68 (12.1)	−0.20 (−0.6)	3.87 (12.7)	—	—	1
84[a]	4	3.78 (12.4)	0.37 (1.2)	3.41 (11.2)	—	—	2
87	5	3.81 (12.5)	0.12 (0.4)	3.69 (12.1)	—	—	< 1
88[a]	6	3.29 (10.8)	0.37 (1.2)	2.93 (9.6)	—	—	—
92[a]	5	2.35 (7.7)	0.43 (1.4)	1.92 (6.3)	—	—	—
97	4	4.21 (13.8)	0.09 (0.3)	4.11 (13.5)	—	< 1	2
111	4	2.49 (8.2)	1.12 (3.7)	1.37 (4.5)	—	—	1
114	4	5.09 (16.7)	0.67 (2.2)	4.42 (14.5)	—	—	< 1
123	4	5.58 (18.3)	1.13 (3.7)	4.45 (14.6)	—	< 1	< 1
130	4	2.62 (8.6)	1.25 (4.1)	1.37 (4.5)	—	2	—
134	5	4.63 (15.2)	0.49 (1.6)	4.15 (13.6)	—	—	—
141	4	5.30 (17.4)	1.16 (3.8)	4.15 (13.6)	—	—	< 1
144	4	6.10 (20.0)	2.90 (9.5)	3.20 (10.5)	—	< 1	—
148	4	4.51 (14.8)	1.16 (3.8)	3.35 (11.0)	—	< 1	< 1
150	4	5.03 (16.5)	1.07 (3.5)	3.96 (13.0)	—	1	3
154	4	4.33 (14.2)	2.35 (7.7)	1.98 (6.5)	—	< 1	< 1
160	4	4.54 (14.9)	2.01 (6.6)	2.53 (8.3)	—	—	—

Bucket Auger	Soil Category	Auger Depth (AMSL) in m (feet)			Total Lithic Count	Total Faunal Weight (g)	
		Top	Bottom	Total		Vertebrate	Invertebrate
162	4	4.45 (14.6)	2.01 (6.6)	2.44 (8.0)	—	—	—
164	4	3.54 (11.6)	1.26 (4.1)	2.29 (7.5)	—	< 1	1
166	5	2.56 (8.4)	0.73 (2.4)	1.83 (6.0)	—	—	—
170	4	4.24 (13.9)	2.41 (7.9)	1.83 (6.0)	—	< 1	—
177	5	6.28 (20.6)	1.10 (3.6)	5.18 (17.0)	—	—	< 1
178	4	4.05 (13.3)	0.85 (2.8)	3.20 (10.5)	—	3	< 1
180	5	3.26 (10.7)	1.37 (4.5)	1.89 (6.2)	—	—	—
184[a]	4	3.96 (13)	1.92 (6.3)	2.04 (6.7)	—	< 1	—
186	5	3.90 (12.8)	1.58 (5.2)	2.32 (7.6)	—	—	—
190	4	3.17 (10.4)	−0.49 (−1.6)	3.66 (12.0)	—	< 1	< 1
191	4	3.32 (10.9)	1.19 (3.9)	2.13 (7.0)	—	—	—
194	4	5.91 (19.4)	1.92 (6.3)	3.99 (13.1)	—	< 1	< 1
195	4	3.84 (12.6)	1.10 (3.6)	2.74 (9.0)	—	—	< 1
197	5	3.18 (10.4)	1.65 (5.4)	1.52 (5.0)	—	< 1	< 1
204	4	4.08 (13.4)	1.95 (6.4)	2.13 (7.0)	—	< 1	< 1
208	4	3.32 (10.9)	0.12 (0.4)	3.20 (10.5)	—	< 1	—
213	4	5.73 (18.8)	2.59 (8.5)	3.14 (10.3)	—	—	< 1
214	4	3.72 (12.2)	1.43 (4.7)	2.29 (7.5)	—	< 1	< 1
216	5	2.92 (9.6)	1.55 (5.1)	1.37 (4.5)	—	—	—
224	4	4.36 (14.3)	1.80 (5.9)	2.56 (8.4)	—	< 1	< 1
229[a]	4	3.47 (11.4)	0.06 (0.2)	3.41 (11.2)	—	< 1	< 1
234	5	4.60 (15.1)	2.13 (7.0)	2.47 (8.1)	—	—	—
236	4	3.82 (12.5)	1.35 (4.4)	2.47 (8.1)	—	< 1	< 1
251[a]	3	3.78 (12.4)	0.82 (2.7)	2.96 (9.7)	5	2	6
252[a]	4	4.15 (13.6)	−2.26 (−7.4)	6.40 (21.0)	—	< 1	3
254	5	4.57 (15.0)	1.37 (4.5)	3.20 (10.5)	—	—	—
255	5	4.39 (14.4)	1.49 (4.9)	2.90 (9.5)	—	—	—
259[a]	4	3.90 (12.8)	1.10 (3.6)	2.80 (9.2)	—	24	< 1
266	5	4.94 (16.2)	1.92 (6.3)	3.02 (9.9)	—	—	—
267	5	4.82 (15.8)	2.23 (7.3)	2.59 (8.5)	—	—	—
271	5	4.54 (14.9)	2.56 (8.4)	1.98 (6.5)	—	—	—
274	5	4.57 (15.0)	2.53 (8.3)	2.04 (6.7)	—	—	—
291	4	4.48 (14.7)	1.89 (6.2)	2.59 (8.5)	—	—	—
201 (O2)	4	3.75 (12.3)	0.55 (1.8)	3.20 (10.5)	—	—	—
202 (O2)	4	3.66 (12.0)	1.07 (3.5)	2.59 (8.5)	—	—	—
203 (O2)	4	3.81 (12.5)	0.85 (2.8)	2.96 (9.7)	—	—	—

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Bucket Auger	Soil Category	Auger Depth (AMSL) in m (feet)			Total Lithic Count	Total Faunal Weight (g)	
		Top	Bottom	Total		Vertebrate	Invertebrate
204 (O2)	4	3.63 (11.9)	1.22 (4.0)	2.41 (7.9)	—	—	—
205 (O2)	4	3.75 (12.3)	1.43 (4.7)	2.32 (7.6)	—	—	—
206 (O2)	4	3.47 (11.4)	1.19 (3.9)	2.29 (7.5)	—	—	—
207 (O2)	4	3.99 (13.1)	0.58 (1.9)	3.41 (11.2)	—	—	—
208 (O2)	4	3.93 (12.9)	0.91 (3.0)	3.02 (9.9)	—	< 1	< 1
209 (O2)	4	4.24 (13.9)	0.79 (2.6)	3.44 (11.3)	—	—	—
210 (O2)	3	3.41 (11.2)	1.07 (3.5)	2.35 (7.7)	—	< 1	—
215 (O2)	4	8.26 (27.1)	0.34 (1.1)	7.92 (26.0)	—	—	—
216 (O2)	5	4.94 (16.2)	0.24 (0.8)	4.69 (15.4)	—	< 1	—
217 (O2)	4	5.43 (17.8)	0.73 (2.4)	4.69 (15.4)	—	—	—
218B (O2)	5	5.61 (18.4)	0.73 (2.4)	4.88 (16.0)	—	—	< 1
220 (O2)	5	2.19 (7.2)	0.37 (1.2)	1.83 (6.0)	—	—	—
221 (O2)	5	0.55 (1.8)	−1.07 (−3.5)	1.62 (5.3)	—	—	1
222 (O2)	4	4.88 (16.0)	0.58 (1.9)	4.30 (14.1)	—	—	—

[a] 12-inch buckets; all others are 16 inch.

APPENDIX B

Beads and Ornaments from LAN-211/H and LAN-1932/H

Unit, by Site	Quad.	Lev.	PD	Cat. No.	Material	Description	Type [a]	L [b]	W [b]	Th [b]	Perforation		Mod.
											Size [b]	Type	
LAN-211/H													
4		3	27	12	glass	cobalt cane bead	C1a	3.1	3.2	1.3	1.1	s	n
4		5	130	532	stone	steatite disk	—	5.6	11.1	2.3	—	—	—
4		9	80	4	glass	green cane bead	C3a	3.0	3.2	2.5	1.0	s	n
5		2	50	8	glass	red with green interior	C6a	3.8	3.9	2.3	1.1	s	n
5		4	59	20	glass	green cane bead	C3a	3.2	3.3	2.0	1.0	s	n
5		8	78	10178	*Olivella biplicata*	disk fragment	G2?	4.3	0.0	0.8	1.2	b	n
6		2	51	11	glass	copper blue cane bead	C2a	2.9	2.9	2.5	1.2	s	n
6		3	53	20	glass	clear cane bead	C5a	3.3	3.6	2.6	1.1	s	n
6		4	60	16	glass	cobalt cane bead	C1a	3.6	3.8	4.0	1.2	s	n
6		4	88	19	glass	red wire wound	W6e	7.0	7.0	6.6	2.3	s	n
7		3	61	14	glass	cobalt cane bead	C1a	3.5	3.9	2.4	1.2	s	n
7		3	61	221	*Haliotis* sp.	shell frag with asphaltum	—	10.0	20.0	—	—	—	n
8		1	49	1	glass	green cane bead	C3a	2.9	3.0	2.1	1.2	s	n
8		4	66	1427	stone	steatite disk	—	—	—	1.3	—	—	—
8		5	70	9	glass	red with green interior	C6a	3.5	3.6	2.6	1.3	s	n
8		5	70	13	glass	cobalt cane bead	C1a	3.0	3.1	2.1	1.0	s	n
8		8	82	15	glass	cobalt cane bead	C1a	3.1	3.3	1.9	1.0	s	n
9		1	88	18	glass	copper blue cane bead	C2a	3.0	3.2	2.2	0.9	s	n
9		1	89	17	glass	copper blue cane bead	C2a	3.2	3.3	2.6	1.2	s	n
9	NE	1	89	10180	*Olivella biplicata*	rough disk	H2a	5.1	5.2	0.9	1.1	b	n
9	NE	1	89	10181	*Olivella biplicata*	thin lip oval	E1b	6.3	7.1	2.1	2.2	b	n
9		1	90	5	glass	green cane bead	C3a	3.2	3.6	2.5	1.3	s	n
9		1	90	6	glass	green cane bead	C3a	3.5	3.6	3.2	1.2	s	n
9	SE	1	90	15000	*Olivella biplicata*	rough disk	H2a	4.2	5.5	0.9	1.0	s	n
9	SW	1	90	10194	*Olivella biplicata*	ground disk	H1a	5.0	0.0	0.9	1.0	b, s?	n
9	SE	1	90	10195	*Olivella biplicata*	semiground disk	H1b	4.7	5.0	1.3	1.2	b80v	n
9	SW	1	90	10196	*Olivella biplicata*	cup	K1	4.7	0.0	1.6	1.8	c	y
9		1	90	1016	stone	steatite disk	—	4.0	4.0	1.4	—	—	—
9	SW	1	91	10186	*Olivella biplicata*	rough disk	H2a	5.4	5.6	0.8	1.1	b	n

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Unit, by Site	Quad.	Lev.	PD	Cat. No.	Material	Description	Type [a]	L [b]	W [b]	Th [b]	Perforation		Mod.
											Size [b]	Type	
9	SW	1	91	10187	*Olivella biplicata*	cup with diagonal incising	K1	4.0	4.1	1.8	1.5	c, v	n
9	SW	1	91	10188	*Olivella biplicata*	cup with diagonal incising	K1	3.9	4.0	1.3	1.3	b80v	n
9	SW	1	91	10189	*Olivella biplicata*	tiny saucer	G1	3.4	3.5	1.2	1.3	c, v	n
9	SW	1	91	10190	*Haliotis rufescens*	disk epidermis	—	4.9	5.0	1.4	1.2	b	n
9	SW	1	91	10191	*Olivella biplicata*	tiny saucer	G1	3.3	3.4	1.0	1.4	c, v,	n
9	SW	1	91	10192	*Olivella biplicata*	spire removed, large	A1c	11.2	0.0	19.4	2.2	—	n, Sg
9		2	10	10	glass	copper blue cane bead	C2a	3.6	3.7	3.0	1.1	s	n
9	NW	2	99	10197	*Olivella biplicata*	cup	K1	3.6	0.0	1.9	1.3	c, v	y
9	NW	2	99	10198	*Olivella biplicata*	tiny saucer	G1	3.5	4.0	1.3	1.4	c, v	n
9	NE	2	100	71	Veneridae	unmodified fragments	—	—	—	—	—	—	n
9	NE	2	100	10199	*Olivella biplicata*	rough disk	H2a	4.3	4.9	1.2	1.1	b	y
9	NE	2	100	10200	*Olivella biplicata*	disk	—	4.7	5.8	1.8	1.0	b	n
9	NE	2	100	10201	*Olivella biplicata*	cup	K1	3.6	3.7	2.0	1.6	b70v	y
9	NE	2	100	10202	*Olivella biplicata*	cup	K1	3.9	4.0	1.9	1.8	b80v	n
9	NE	2	100	10203	*Olivella biplicata*	ground disk	H1a	4.4	4.9	0.9	1.1	s	n
9	SE	2	100	10204	*Olivella biplicata*	tiny saucer	G1	3.4	3.5	1.0	1.3	b	n
9		2	101	7	glass	green cane bead	C3a	2.5	2.6	1.8	1.3	s	n
9	NE	2	101	304	Veneridae	unmodified fragments	—	—	—	—	—	—	n
9	SE	2	101	10205	*Olivella biplicata*	full lip fragment	E2	8.5	0.0	2.1	2.0	c, v	n
9	SE	2	101	10206	*Olivella biplicata*	saucer?	G2	8.1	0.0	1.8	2.0	s	n
9	SE	2	101	10207	*Olivella biplicata*	full lip fragment	E2a	10.0	0.0	2.8	2.2	c, v	n
9	SE	2	101	10208	*Olivella biplicata*	rough disk	H2	5.3	5.6	1.3	1.1	b	n
9	SE	2	101	10209	*Olivella biplicata*	rough disk	H2	4.8	4.9	1.0	1.0	s	n
9	SE	2	101	10210	*Olivella biplicata*	cup with diagonal incising	K1	3.6	3.8	1.3	1.2	c, v	n
9	SE	2	101	10211	*Olivella biplicata*	cup	K1	3.8	4.0	1.7	1.7	c, v	n
9	SE	2	101	10212	*Olivella biplicata*	tiny saucer	G1	3.4	3.5	1.0	1.2	c, v	n
9	SE	2	101	10213	*Olivella biplicata*	tiny saucer	G1	3.5	4.2	0.9	1.6	b	y
9	SE	2	101	10214	unidentified shell	waterworn/burnt fragment	—	8.8	0.0	1.6	0.0	—	y
9	SE	2	101	10215	*Haliotis* sp.	worked shell, fishhook?	—	16.1	0.0	3.1	0.0	b	n
9	SW	2	102	10182	stone	steatite disk	—	3.9	4.0	1.3	1.5	b	n
9	SW	2	102	10184	*Olivella biplicata*	cup with diagonal incising	K1	3.5	3.5	1.5	1.2	c, v	n

Unit, by Site	Quad.	Lev.	PD	Cat. No.	Material	Description	Type [a]	L [b]	W [b]	Th [b]	Perforation		Mod.
											Size [b]	Type	
9	SW	2	120	10183	*Haliotis rufescens*	disk epidermis	—	3.5	3.6	1.3	1.2	b	n
9		3	88	3	glass	green cane bead	C3a	3.5	3.6	2.1	1.2	s	n
9	SW	3	103	10185	*Olivella biplicata*	irregular wall disk	—	3.8	3.9	0.6	1.2	b	n
11	S	1	133	10216	*Olivella biplicata*	irregular wall disk	—	4.4	5.3	1.5	0.8	s	n
11	S	3	136	10217	*Olivella biplicata*	semiground disk	H1b	4.0	4.4	0.6	1.1	s	n
11	N	3	137	10218	*Olivella biplicata*	semiground disk	H1b	4.8	5.3	1.0	1.1	s	n
LAN-1932/H													
6		2	16	139	*Olivella biplicata*	full lip	E2a	7.8	9.8	3.6	2.2	b90v	n
6		2	16	140	*Olivella biplicata*	fragment, lip?	E	0.0	4.8	1.8	3.0	c, v	n
7		2	19	141	*Olivella biplicata*	full lip	E2a	6.8	7.4	3.3	2.0	c, v	n
9		2	18	142	*Olivella biplicata*	full lip	E2a	6.7	7.5	2.9	1.9	b80v	n
9		2	20	143	*Olivella biplicata*	full lip	E2a	8.7	9.2	3.0	2.4	b80v	n
10		2	20	144	unidentified shell	disk	—	3.3	3.4	1.3	1.3	b	n
11		2	21	145	*Olivella biplicata*	tiny saucer	G1	2.9	3.4	0.8	1.2	b	n
13		2	23	146	*Olivella biplicata*	thin lip round	E1a	6.0	5.6	2.4	2.2	b80v	n
13		2	23	147	*Olivella biplicata*	tiny saucer	G1	3.9	4.0	1.0	1.4	b60v	y
13		2	23	148	*Olivella biplicata*	wall disk with abraded perforation	—	5.5	6.1	0.9	1.4	p	n
13		2	23	149	*Olivella biplicata*	oblique spire-removed	A2a	9.4	0.0	5.9	2.0	—	n, Sg
14		2	24	150	*Olivella biplicata*	thin lip oval	E1b	7.2	8.1	2.8	2.4	b60v	n
14		2	24	151	*Olivella biplicata*	thin lip round	E1a	5.4	5.7	2.2	2.0	c, v	n
15		2	29	152	*Olivella biplicata*	cup	K1	2.9	3.0	1.7	1.4	c, v	n
16		2	28	153	*Mytilus californianus*	disk	—	3.6	3.7	1.3	1.4	b	n
16		2	28	154	*Olivella biplicata*	cup with diagonal incising	K1	3.3	3.5	1.5	1.4	c, v	n
18		2	26	155	*Olivella biplicata*	cup	K1	3.6	3.7	1.4	1.2	c, v	n
21		2	30	156	*Olivella biplicata*	thin lip oval	E1b	7.1	7.8	3.0	2.2	b80v	n
21		2	30	157	*Olivella biplicata*	cup with "X" incising	K1	3.3	3.6	2.2	1.4	c, v	n
22		2	31	158	*Olivella biplicata*	full lip	E2a	6.8	7.6	2.6	2.4	b80v	n
22		2	31	159	*Olivella biplicata*	disk	—	4.1	4.2	1.7	1.3	b	n
22		2	31	160	*Olivella biplicata*	disk	—	3.0	3.0	1.0	1.3	s	n
23		2	32	93	*Olivella biplicata*	deep large lip	E3b	8.2	9.7	3.2	2.3	c, v	n

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Unit, by Site	Quad.	Lev.	PD	Cat. No.	Material	Description	Type[a]	L[b]	W[b]	Th[b]	Perforation Size[b]	Perforation Type	Mod.
23		2	32	94	*Olivella biplicata*	full lip	E2a	7.1	7.9	3.3	2.4	b80v	n
23		2	32	95	*Olivella biplicata*	thin lip oval	E1b	6.6	6.7	2.4	2.4	b80v	n
23		2	32	161	*Olivella biplicata*	thin lip oval	E1b	5.0	5.8	1.7	2.0	c, v	n
24		2	33	96	unidentified shell	worked shell disk	—	6.3	6.5	1.5	—	—	n
24		2	33	97	*Olivella biplicata*	cup	K1	3.4	3.6	1.5	1.5	c, v	n
24		2	33	98	*Olivella biplicata*	semiground disk	H1b	4.2	4.4	1.0	1.0	s	n
25		2	34	99	*Olivella biplicata*	lip bead	E2a	—	—	—	—	—	n
25		2	34	100	*Olivella biplicata*	wall disk	J	4.0	4.6	0.9	1.2	b	n
25		2	34	101	*Olivella biplicata*	tiny saucer	G1	3.4	4.3	0.8	1.3	b60v	n
25		2	34	102	unidentified shell	disk	—	5.6	0.0	1.2	1.4	b	n
26		2	35	103	*Olivella biplicata*	tiny saucer	G1	3.6	3.8	0.8	1.4	b	n
26		2	35	104	*Olivella biplicata*	tiny saucer	G1	3.4	3.5	1.2	1.5	c, v	n
26		2	35	105	*Olivella biplicata*	fragment, lip?	E2a	8.2	—	1.7	2.0	b	y
27		2	36	1000	glass	green cane bead	C3a	3.1	3.3	3.3	1.0	s	—
27		2	36	106	*Olivella biplicata*	wall disk	J	3.9	4.1	0.9	1.0	b?	n
27		2	36	107	*Olivella biplicata*	cup	K1	3.3	3.4	1.7	1.5	b80v	n
28		2	37	114	unidentified material	natural fragment	—	—	—	—	—	—	—
29		2	38	108	*Olivella biplicata*	thin lip round	E1a	4.3	4.6	2.0	2.3	c, v	n
29		2	38	109	*Olivella biplicata*	cup	K1	4.0	4.1	1.9	1.6	b80v	n
29		2	38	110	*Olivella biplicata*	full lip	E2a	7.3	8.1	2.5	2.1	b80v	n
29		2	38	111	*Olivella biplicata*	full lip	E2a	—	—	—	—	—	n
30		2	40	112	*Tivela stultorum*	natural fragment	—	6.8	—	4.9	—	—	n
30		2	40	113	*Tivela stultorum*	shell with scratches	—	19.1	—	4.0	—	—	n
Trench 10		1	101	6108	canid tooth	drilled	—	22.9	8.8	—	1.58	—	—

[a] *Olivella* beads typed using Bennyhoff and Hughes (1987); glass beads typed using the Buenaventura Mission typology (Gibson 1976).
[b] All dimensions in millimeters.
Key: Cat. No. = catalog number; L = length or diameter; Lev. = level; Mod. = modification types; PD = provenience designation; Quad = quadrant; Th = thickness; W = width or diameter
Perforation key: b = biconical, c = conical, p = perpendicular, s = straight, number indicates percent of perforation drilled from either the ventral (v) or dorsal (d) face
Modification key: n = not burnt, y = burnt, Sg = spire ground

APPENDIX C

A Lithic Research Design for the Ballona Lagoon Archaeological District

Robert G. Elston

This research design is for the study of lithic artifacts recovered during the Playa Vista Archaeological and Historical Project (PVAHP) in the Ballona Lagoon Archaeological District (BLAD). The archaeological record of the Ballona is large and complex, yet important questions remain to be answered there. Many of these questions can be subsumed under four broad topics: chronology, relationships between people of the Ballona and those of the great coast and inland deserts, tool function, and the nature of Ballona settlement and subsistence.

In the following discussion, I first outline our theoretical orientation for Ballona lithic studies, and then discuss a series of key questions regarding Ballona lithics, framing hypotheses and expectations for each. I identify the classes of data required to operationalize each research question and test each hypothesis, and specify the methods of data collection and analysis to be employed.

Theoretical Orientation and Research Questions

As objects of study, lithic artifacts have both positive and negative qualities. For example, they preserve no genetic material nor utter any phonemes. Unlike organic remains, lithic artifacts do not directly reflect diet. Lithic tools may comprise a limited range of functions, and these are often difficult to pin down. Many lithic artifacts were components of composite tools (e.g., projectile points) of which the organic parts have not survived. Compared to organic remains, however, lithics are resistant to decay and transformation, and are much more likely to be preserved in the archaeological record. Lithic tools often exhibit relatively unambiguous evidence of manufacturing processes and maintenance strategies. Stages of lithic tool manufacture and maintenance are often time-transgressive (at scales of days to months), and performed at different places in landscapes, thus contributing to lithic assemblage variability. Tool stone can be linked to its source to inform of its economic value and place in the sphere of annual range and regional relationships.

Lithic artifacts are the material consequences of ideas, decisions, strategies, and behaviors by which people have interacted with, and modified, their environment. Deriving prehistoric behavior from the study of lithic artifacts requires frameworks linking archaeological residues to systems of human culture and adaptation. One is a cultural-temporal framework in which change through time and space can be monitored (e.g., Moratto 1984). Another framework is that of middle range theory (Binford 1977a) constructed from experimental and ethnographic data, allowing assignment of tool function from morphology and wear patterns (e.g., Keeley 1980). A third framework known as technological organization (Bamforth 1991a, 1991b; Binford 1977b, 1979; Bleed 1986; Elston 1986b, 1992a; Johnson and Morrow 1987; Kelly 2001), is emphasized in this research design. Technological organization informs of settlement and subsistence by focusing on strategies for procuring, manufacturing, using, transporting, and discarding raw materials and tools (Nelson 1991:57). By such strategies folks respond to problems encountered in their physical, biological, and social environments (Carr 1994b:1); for example, the distribution, abundance, and predictability of food resources, and constraints on access to them.

The study of technological organization requires several assumptions. First, we assume that variation in the contexts of activities (both within and between sites and localities) is a primary source of variability in archaeological lithic assemblages (artifact density, presence or absence of tool or debitage types, proportions of various artifact classes and raw materials, and so on). We also assume that human individuals are decision makers within a variable environment who try to maximize fitness by improving cost/benefit ratios of choices, including technological ones (Boone and Smith 1998). Finally, we assume that residential mobility strongly conditions the economics of tool stone procurement and use.

Lithic Technology and Temporal-Cultural Boundaries

Lithic technology figured importantly in southern California archaeology from its beginning, used to define and trace, largely on the basis of shared lithic technological and typological traits, spatial and temporal distributions of prehistoric cultures, complexes and phases (e.g., Campbell et al. 1937; Elsasser 1978; Kowta 1969; Moratto 1984; D. B. Rogers 1929; M. Rogers 1939; Treganza and Bierman 1958; Wallace 1962, 1978). Of course, constructing and refining culture histories and temporal frameworks remain essential tasks of archaeology, and since we are interested in change (or lack thereof) through time in the Ballona, we must also define salient technological and stylistic attributes and develop chronological control independent of change in technology or style.

Ballona Chronology

The chronology of human occupation in the Ballona is poorly understood because existing chronological data are patchy (cf. Altschul, Homburg, and Ciolek-Torrello 1992; Altschul et al. 1999; Altschul et al. 2003). To date, evidence of early Holocene occupation in the Ballona has failed to materialize. However, surveys in the 1940s and 1950s identified 15 sites on upper Ballona Creek and two sites on the Del Rey bluff top (LAN-61 and LAN-206) with Millingstone period components (milling stones, cog stones, large tanged projectile points) that could date as early as 7500 B.P. (Ciolek-Torrello and Grenda 2001). Many questions remain about the precise time of initial occupation, the frequency of occupation during the Millingstone period, whether there is gap in bluff-top occupation between 4700 and 3000 B.P., and the timing of bluff-top abandonment and occupation of lowland sites. In contrast to bluff-top sites, lowland sites have many fewer radiocarbon dates, and no obsidian hydration studies of artifacts. Samples of lithic artifacts from securely dated contexts (stratified deposits; discrete, well-dated features) are uncommon. Thus, whereas regional studies have established temporal boundaries for several coastal and interior lithic technologies and artifact types such as microlithics, cog and disk stones, milling stones, mortars, scraper planes, and certain projectile point types (Arnold 1987b; Arnold, ed. 2001; Ciolek-Torrello and Grenda 2001; Koerper, Schroth, Mason, and Peterson 1996; Koerper et al. 1994; Kowta 1969; Moratto 1984; Van Horn 1990; Vaughn and Warren 1987), the lack of fine chronological control in the Ballona makes it difficult to correlate local and regional lithic technologies and types. Absolute age estimates for lithic artifacts may be available through radiocarbon assay and relative dates through stratigraphic position and obsidian hydration.

• *Can obsidian hydration provide relative dates for obsidian artifacts?*

Obsidian hydration is a technique for direct dating of artifact that takes advantage of the propensity for freshly exposed glass surfaces to absorb atmospheric water vapor (hydration) at a rate dependent on the effective hydration temperature (EHT) and glass chemistry (see Gilreath and Hildebrandt 1997 for a recent review). The EHT is the mean annual temperature (MAT) to which the glass has been exposed since the fresh surface was created. Hydration changes the refractive index of the glass to produce a hydration "band" or "rim" visible and measurable in thin section (hydration value), the thickness of which is proportional to hydration time since the creation of the fresh surface. However, the rate at which the hydration rind develops is not linear, and many factors may influence it. For example, EHT varies with climate and depth of burial. Artifacts in the same site that have been repeatedly exposed and buried will experience a different EHT than artifacts deeply buried, or those remaining on the surface. Scavenging, use, and maintenance of older artifacts may create younger surfaces on them that can be confusing. The difficulty of controlling all of the variables affecting hydration rates has led to the development of empirical hydration curves derived from paired hydration values and radiocarbon dates (Basgall 1990). Most of the obsidian in Ballona assemblages is believed to come from the Coso Volcanic Field, south of Owens Valley. The equation describing the curve for obsidian from Coso is:

$$\text{LOG } Y = (2.32\ (\text{LOG}(X * a)) + 1.50$$

Where,

Y = years before present
X = hydration value in microns
a = EHT correction factor for climate zone

The EHT correction factor is an empirically derived number that "corrects" for differences in MAT due to climate; the larger the number, the higher the MAT. Several of these correction factors have been derived (Basgall 1990), including one for Malibu (0.9946) that should apply to obsidian from the Ballona.

As a test, I compiled the obsidian hydration data from Van Horn's (1987) excavation of bluff-top sites as given in Freeman (1991). Box plots of the 156 raw hydration values by site are shown in Figure C.1. The plots suggest that LAN-59 has the smallest values and LAN-61A the greatest (with the exception of three very large values from LAN-63). A one-way ANOVA test on the raw values confirms that the mean hydration value of LAN-59 (4.048) is significantly lower from LAN-61 (undifferentiated), LAN-61A, LAN-61B, and LAN-63 ($p < .05$–.001). When the raw values are converted to years before present using the equation given above, however, the differences between sites as shown in box plots (Figure C.2) seem less. This is confirmed by a one-way ANOVA test in which the only significant difference between sites is that between LAN-59 and LAN-63 ($p = .0083$). The box plots for LAN-63 (see Figures C.1 and C.2) indicates that this is entirely due to the three very large hydration values from this site, almost certainly from unmodified or natural surfaces on the artifacts. Figure C.3 is a histogram of all years B.P. age estimates for bluff-top sites. This plot suggests a bimodal distribution, with several age estimates falling between 6,000 and 3,500 years B.P., the majority in the 3500–1000 B.P. range, and a few between 1000 and 0 B.P. These estimates are quite similar to those derived from radiocarbon dates (Altschul et al. 2003; Van Horn 1987) suggesting infrequent Early period occupation of the bluff-top, intensive use of the bluff-top during the Intermediate period (3000–1000 B.P.), and infrequent occupation thereafter.

This analysis should be viewed with caution since the number of samples from any particular site is small, no hydration values are from lowland sites, and no chemical identification of the obsidian

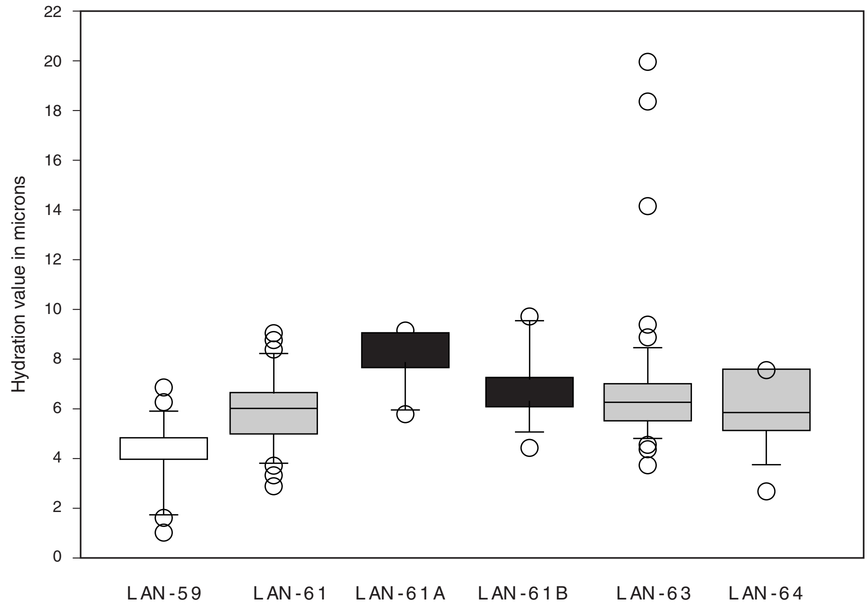

Figure C.1. Box plots of obsidian hydration readings from various bluff-top sites and localities.

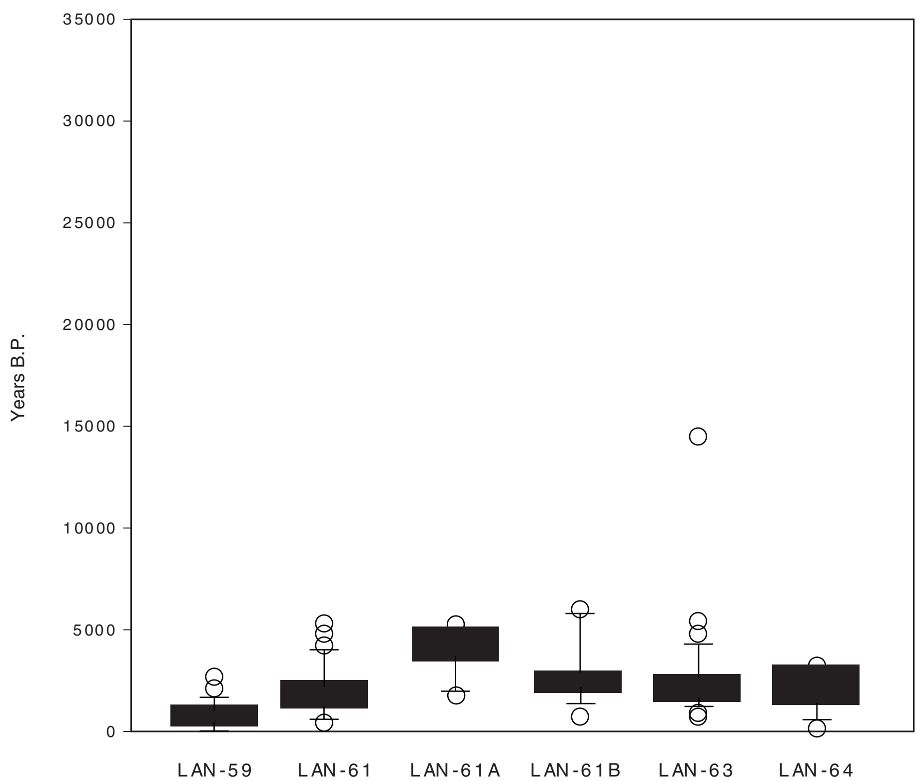

Figure C.2. Box plots of obsidian hydration dates from various bluff-top sites and localities.

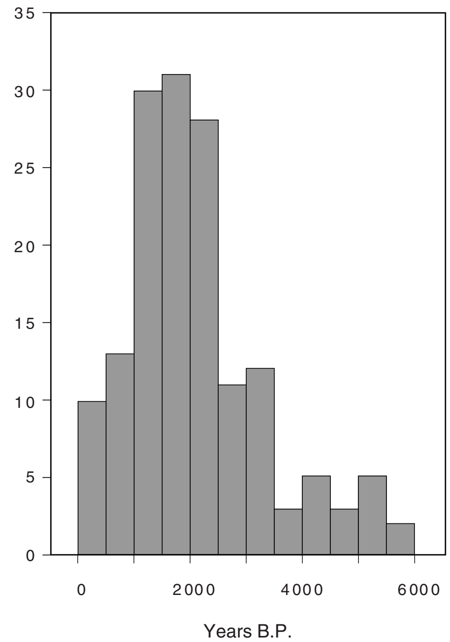

Figure C.3. Bimodal distribution of obsidian hydration dates from bluff-top sites.

source(s) have been made. Nevertheless, it demonstrates the potential of obsidian hydration analysis as a chronological tool in the Ballona.

Data Needs

Additional hydration data are required, both to increase sample size for the bluff-top sites, as well as to obtain the first such data from lowland sites. As a first step, all formed obsidian artifacts (bifaces, projectile points, drills, etc.) and a sample of debitage should undergo X-ray fluorescence for chemical identification of the tool stone source (Gilreath and Hildebrandt 1997; Hughes 1984). Each of these artifacts should then be cut and hydration values observed. If insufficient formed artifacts are recovered, items of debitage can be substituted. Ideally, hydration values can be obtained from all sites, as well as from all significant stratigraphic divisions and discrete features within individual sites. Every effort should be made to obtain chemical identification of the Ballona artifacts for which hydration values have already been obtained (Freeman 1991).

• *Is morphological variability among Ballona projectile points temporally sensitive?*

This question has two parts. One is whether there is local temporal variation among projectile points. The second part of the question is to what degree morphological variability among Ballona points is correlated with that of extra-regional points, particularly those from the California Desert, which many archaeologists believe to be time sensitive.

Variation of the first kind appears to be likely for arrow points, but presently not well demonstrated. Small leaf-shaped Canaliño points and Cottonwood Triangular points are thought to be coeval with the Late and protohistoric periods, 1000–350 B.P. (Towner 1992; Van Horn 1983; 1984; Van Horn and Murray 1985). The temporal placement of the somewhat larger stemmed and corner-notched Marymount points (Van Horn 1983, 1990) is more problematic. Van Horn argues that this type postdates 1500 B.P. because: (1) the points are arrow points; (2) the points are found primarily in the upper parts of the bluff-top middens; (3) the points are typologically equivalent to the Rose Spring Corner-notched type of interior California and the western Great Basin which dates between 1300 B.P. and 700 B.P. (Thomas 1981). However, Altschul (personal communication 2001) observes that Marymount points are not restricted to the upper middens, and could be much older than 1500 B.P. Review of illustrated points (Towner 1992; Van Horn 1983, 1987, 1990; Van Horn and Murray 1985) suggests that considerable variability is rolled into the Marymount type. Treatment of the base and stem ranges from contracting stems and sloping shoulders to deeply corner notched. Larger Marymount points may grade into smaller Gypsum or Elko points, which substantially predate 1500 B.P. in interior California. Similarly, side-notched points are grouped together but differ greatly in size, treatment of the base, and shape and placement of notches. Some resemble Desert Side-notched points of the interior deserts (Thomas 1981), whereas larger specimens resemble Large Side-notched points of the Santa Barbara Extraños phase dating between 5000–4500 B.P. (Moratto 1984). Other large points from the Ballona resemble point styles (Lake Mojave, Pinto, and Gypsum) used in the interior deserts through the early and mid-Holocene. The lack of formally described Ballona point types complicates any attempt at extra-regional correlation with more tightly defined point types of the California Desert and Great Basin.

Another complication in such correlation is that the temporal significance of projectile point morphology in the Great Basin and California has been a matter of some controversy. Archaeologists working in the central and western Great Basin observed what they interpreted as temporally bound morphological change among Great Basin dart and arrow points. During particular intervals, hunters tended to make points that varied little outside a certain formal range. When it occurred, change to a new form was relatively rapid and complete (i.e., Rose Spring replaced by Desert and Cottonwood points), sometimes driven by change in technology (darts to arrows), but more often inexplicable (or unexplained). This formal variation was described in terms of named point "styles," ordered chronologically through seriation and radiocarbon dated stratigraphy (Heizer and Hester 1978). The Berkeley point typology was further refined and formalized by D. H. Thomas (1981) who devised a hierarchical key for Monitor Valley projectile points.

There are problems with this scheme: one is that while the Thomas (1981) key was developed specifically for use in the central Great Basin, it is applied widely through the Great Basin and adjacent parts of California with sometimes little success (cf. Eighmey 1998; Koerper et al. 1994). In addition, the time range of side-notched and corner-notched dart points begins much earlier in the eastern and northern Great Basin than elsewhere (Beck 1995). However, the most serious critique is by Flenniken and his associates (Flenniken and Raymond 1986; Flenniken and Wilke 1989; Titmus and Woods 1986; Wilke and Flenniken 1991), who argue that reworking destroys morphological continuity on dart points. Flenniken and Wilke (1989) later suggested that all Great Basin Archaic dart points began as one of two "prototypes" and all of the various "types" are the result of reworking these two. However, subsequent analysis of archaeological assemblages by other Great Basin archaeologists does not support these claims (Basgall and Hall 2000; Beck 1995; Bettinger et al. 1991; Elston and Budy 1990; Hockett 1995; O'Connell and Inoway 1994). Moreover, Wilke and Flenniken (1991) seem unable to suggest further tests of their hypotheses using archaeological data of the type we are ever likely to observe.

This impasse is far beyond the scope of the Ballona project, but we are well advised to think about other approaches to morphological variability among points and its chronological order (if any). Both ethnographic and archaeological data (see Bartram 1997; Ellis 1997; Elston 1986c:Figure 6; Greaves 1997; Griffin 1997; Hitchcock and Bleed 1997; Keeley 1982; Warren and Crabtree 1986:Figure 5; Wiessner 1983) suggest that projectile construction and point morphology are very much constrained by function and economics. Arrows and darts are composite tools; because the costs of the parts are unequal (Keeley 1982), strategies for conserving or expending different components are likely to vary with type of prey hunted and its economic importance, risks involved, access to tool stone, and so on. Considering these elements from the perspective of design theory (Bleed 1986; Nelson 1997) may allow us to provide, in addition to rejuvenation (Koerper et al. 1994), additional explanations for the considerable morphological variability of coastal dart points.

For example, consider that even though stone points are costly to make, they are less expensive than the fletching, or shaft/foreshaft. Some projectiles are merely a sharpened shaft, or employ a sharpened foreshaft (cf. Bartram 1997; Elston 1986c:Figure 6). But when a stone point is mounted, the shaft/foreshaft must be made to accommodate the particular hafting strategy used (which determines whether points have stems or not, or notches or not, and where these are located), and the hafting strategy may be functionally significant (Christenson 1997). For example, unnotched and contracting stem points can be inserted into sockets or notched shafts with mastic; sinew may be used to bind the shaft to keep it from splitting, but does little to secure the point, which is likely to detach inside the prey once the mastic becomes warmed (cf. Warren and Crabtree 1986:Figure 5). Notched points, secured with both mastic and sinew, are less likely to detach in the prey unless broken. A broken notched point, rejuvenated into an unnotched form, will not function in the same way as the notched point; indeed, it may not fit the shaft element designed for a notched point, and may change the overall balance of the projectile. Thus, in situations where hunting is economically important, we might expect to find less variability in stone points than in situations where game resources are less critical and hunters are relatively indifferent to weapon performance or need for replacement of points with narrow functional requirements.

Data Needs

To determine if point morphology is temporally sensitive requires collection of two kinds of data. First, detailed morphological data must be collected for all Ballona projectile points, following Thomas (1981); the data to be collected are described in the Laboratory Procedures for Lithic Artifacts section (see below). Three independent approaches to projectile point taxonomy will be employed. In one approach, points will be manually sorted into groups on the basis of overall size, shape, and raw material. To see how closely Ballona points resemble "desert" point styles, and independently of the manual sort, we will run all the Ballona point data through keys that distinguish among those types (e.g., Basgall and Hall 2000; Thomas 1981; Vaughn and Warren 1987), and compare the Ballona data to type descriptions of point styles lacking keys. Attributes of both keyed and manually sorted groups will be compared using the t-statistic. A third check for patterned variability will be subjecting the nominal data to cluster analysis following Basgall and Hall (2000).

Having specified what we think is relevant variability among Ballona points, we must test these hypotheses against temporal data: every obsidian point will be chemically identified as to source by X-ray fluorescence (Gilreath and Hildebrandt 1997; Hughes 1984), and cut to observe hydration value(s). Since some point styles (e.g., Marymount) are preferentially made of fused shale or chert, rather than obsidian, it will be critical to analyze projectile points with regard to stratigraphic position and association with radiocarbon dates.

• *Are other Ballona lithic technologies time sensitive?*

Towner (1992) describes four basic flaked stone technologies employed in the Ballona: biface, flake core, bipolar core, and microlith. To these must be added ground stone and drilled stone (Brown and Freeman 1991).

The most unique is microlithic technology. True microliths are rare in North America south of the Arctic, and are associated with manufacture of shell beads in the late Woodland and Mississippian societies of the Southeast and in coastal southern California (Arnold, ed. 2001; Parry 1994; Pope 1994). On the California coast, Arnold (Arnold 1987b; Arnold et al. 2001) has documented two phases of microlithic development. Small flake drills appeared on Santa Cruz Island in the mid-Intermediate period (ca.

A.D. 600–900) prior to the appearance of true microblades. These artifacts, made on ordinary chert flakes, resemble shouldered and shoulderless microdrills recovered from LAN-61 (compare Van Horn and Murray 1985:Figures 24, 25 and 61; and Freeman and Van Horn 1987:Figures 43 and 44; with Arnold et al. 2001:Figure 5.4).

On both the Santa Barbara coast and islands, true microblade technology involving production of fine drills used in shell bead production appears between A.D. 900 and 1200 and slowly intensifies. Microblades tend to be trapezoidal in cross section, struck from multifaced cores with one or two (opposed) platforms. Few specimens recovered from Ballona bluff sites by Van Horn (1987) and Van Horn and Murray (1985) resemble trapezoidal microblades, and a large proportion of Ballona microblade cores are bipolar, rather than faceted. Between A.D. 1300 and 1770, a specialized, highly intensified microblade industry appeared in the Channel Islands. Most microblades of this period were struck from prepared ridges (as crested blades, or *lame à crête*), resulting in faceted dorsal surfaces and triangular cross section; cores produced only one or two microblades before discard or rejuvenation. Some of the microliths described from LAN-63 seem to be faceted, but Freeman and Van Horn (1987) do not describe their sections.

A working hypothesis to explain the Ballona bluff-top microblades is that bead manufacture was a wide spread phenomenon that extended to the Ballona in the period between 600 and 1200 years ago, only to become restricted to the islands after developing into an intensive specialization. The chert outcrops on eastern Santa Cruz Island supplied plentiful and easily defended raw material for microblade cores, part of an economic system in which the production of drill and shell bead making craft specialists was distributed by a few leaders, canoe owners, and traders (Arnold 2001). This, however, does not explain the quartz microliths from Late period LAN-47 described by Towner (1992).

Alternatively, Ciolek-Torrello and Grenda (2001) suggest that Ballona microliths might be related in some way to the lithic technologies of Mojave Desert groups, thus demonstrating a coast-desert connection. There is ample evidence of trade and contact between these areas (Sutton 1996), but while desert projectile points grow smaller in the late prehistoric, large bifaces continued to be manufactured at Rose Spring (and Coso) after the introduction of the bow and arrow (Yohe 1998), and otherwise, there is no evidence of microlithic technology in the Mojave Desert.

Data regarding artifact frequencies (Rosenthal and Benaron 1998; Rosenthal and Taşkıran 1999) from Ballona sites suggest differences between bluff-top and lowland sites that could have temporal signifycance. For example, lowland sites have lots of cores, flake tools, bifaces, and manos, whereas bluff-top sites are rich in microdrills, mortars, metates and hammer stones. On the other hand, these differences might reflect such factors as site function and relative mobility.

The availability of new types of raw materials in protohistoric and historical times, especially glass and metal, should have affected lithic technologies. When such materials become available, they may rapidly replace stone tools. On the other hand, old technologies, such as those for seed processing, may persist indefinitely. Replacement may be complicated, however, by differential access to new materials among groups as in the Channel Islands (Graesch 2001). For example, groups directly contacted by Spanish explorers Cabrillo, Vizcaíno, and Gaspar de Portolá are more likely to have obtained metal than people in distant groups. Or, if Native Americans escaped from Mission peonage were hiding out in the Ballona, they may have found it difficult to obtain metal tools. Another possibility is differential access to new raw materials within groups along lines of status or gender: some people will have them, and others will do without. For example, if males control access to metal, hunting gear (stone knives and projectile points) may employ the new material while women continue to use stone for processing tasks such as hide preparation. Possession of the new materials may enhance the status of the individuals possessing them, or offer technological advantages to a metal-using group in competition with a stone using groups. Because there is so little information about the protohistoric and historical-period Ballona, it is difficult to predict exact technological and social adjustments to new materials, but we will seek evidence of them in the archaeological record.

Finally, certain ground stone technologies are thought to be temporally diagnostic. Milling stones and manos (hand stones) occur between 8500 and 7500 B.P., while globular mortars and pestles appear about 4000 B.P. along with steatite vessels, and "flower pot" mortars and long pestles in the late prehistoric period (Moratto 1984).

Data Needs

Data needs to determine the temporal sensitivity of particular technologies and raw materials are essentially the same as those for projectile points: obsidian hydration data, stratigraphic position, and associated radiocarbon dates.

Regional and Extra-Regional Relations

Questions about the relationships between the people of the Ballona and those of the interior desert arise because a coastal adaptation appears to have been established early in prehistory (cf. Moratto 1984), and yet, the Gabrielino who occupied the Ballona were Takic speakers with linguistic roots in the deserts of southern California (Bean and Smith 1978; Sutton 1994). For example, we would like to know the evidence for cultural continuity, or lack thereof, between the people of the Early Millingtone, Intermediate, and Late periods in the Ballona. Does the Intermediate period represent an incursion of desert people or technological ideas? If so, were these the precursors of the ethnographic Gabrielino, or did Gabrielino arrive about 1000 B.P. to usher in the Late period?

The likely axes of possible large scale movement and contact for people of the Ballona are north and south up and down the coast, and east and west from coast to the interior deserts. In the early Holocene (10,000–8000 B.P.), with the lowest human populations, mobile foragers should have been most free to exploit the most productive resource patches along a north-south axis focused on the coast, coastal estuaries, and adjacent terrestrial areas (Moratto 1984). Although there was evidence of such an early occupation at Malaga Cove a few miles to the south (Walker 1937, 1952), it is so far absent in the Ballona. Between about 8,000 and 7,500 years ago, artifacts thought diagnostic of the interior (Pinto points, scraper planes, and milling stones) begin to appear on the coast, suggesting the establishment of an east-west axis of technological movement, if not of people (Kowta 1969; Warren et al. 1961). Nevertheless, the distribution of enigmatic stone cogs and discs, restricted to the Los Angeles Basin and adjacent coast, suggests that at least the entailed technology and ideas were restricted to a relatively small region on the west side of the Transverse Ranges. Kowta (1969) suggests that as climate continued to become warmer and dryer in the middle Holocene, people of the Transverse Ranges began to move toward the coasts; mixed coastal and inland traditions resulted in the Sayles and Late Topanga complexes. With the expansion of Takic-speaking people from the Mojave Desert to the coast (Sutton 1994), the east-west axis is likely to have been strengthened. Northward movement was restricted by the Chumash, but movement through the Los Angeles Basin and beyond may have been possible for Ballona people finding local conditions difficult for some reason.

The analysis of lithic technology can be expected to yield good answers to technological problems such as the relationship between the Ballona microlithic industry, and that from the Channel Islands discussed above. In contrast, lithic artifacts cannot inform directly of the ethnicity, spoken language, or genetics of the people who used them. It is often impossible to detect archeological differences in the material culture of groups known to have spoken very different languages in ethnographic times (Elston 1994; Jones 1994). As summarized in Table C.1, while there can be many different kinds of outside influences (immigration, invasion, diffusion), and while there can be many responses of natives to such outside influences, the resulting effects on material culture are often equifinal. Outside people may immigrate, acculturate, and assimilate with little or no change in material culture, or they may invade and adopt the native material culture because it is better suited to the environment or conveys a higher status.

Table C.1. Possible Responses of Native Gene Pool, Language, and Material Culture to Outside Influences

Native Population	Outside Influence	Immigrants	Gene Pool	Language	Material Culture
Stable	none	none	unchanged	unchanged	unchanged
Remain	immigration	acculturate / assimilate	mixed	unchanged	unchanged
Remain	diffusion	none	unchanged	different	unchanged
Replaced	immigration/invasion	acculturate/adapt	different	different	unchanged
Replaced	immigration/invasion	adapt	different	different	different
Remain	diffusion	none	unchanged	unchanged	different
Remain	none-innovation /adaptation	none	unchanged	unchanged	different

In either case, the result is the same as if the native population and culture had remained stable. On the other hand, a native population may innovate or adopt different material culture without changing language or genes. Clearly, genetic questions are best addressed through bioarchaeology and genetics, and language questions through linguistics.

And yet, lithic artifacts can provide some information concerning relationships between the lithic technology used by the Ballona people and that of others in the coastal region or those more distant in the interior desert. Two questions address these relations.

• *How much do Ballona lithic technologies resemble those from the California desert and other coastal areas?*

In the discussion of temporal variability in Ballona lithic technology we asked whether Ballona lithic technologies changed through time, and whether any such changes were correlated with similar changes documented in other regions. By seeking correlations, we will be addressing this question as well.

Data Needs

This essentially the approach proposed for analysis of projectile point style described in a previous section. For example, the degree to which projectile point technology and ideas of projectile point form were shared can be estimated by monitoring the presence in the Ballona of artifacts and artifact styles thought to be diagnostic of other regions (e.g., Gypsum or Desert Side-notched projectile points).

• *What does variability in proportions of local and exotic tool stones in Ballona assemblages say about the economics of tool stone procurement?*

The economics of tool stone procurement and use are discussed in some detail in a subsequent section. Suffice it to say here that the proportion of nonlocal tool stone in Ballona lithic assemblages should be affected primarily by distance to source and access to source (Bamforth 1990b; Elston 1990a, 1992a, 2001). All other things being equal, the proportion of exotic tool stones in lithic assemblages should decrease with distance to source. Of course, all things are often not equal. Access to tool stone sources may be affected by the size of annual range or the presence of other people at the source. We assume that the most unimpeded access of Ballona people to distant tool stone sources was in the Early period because mobility was greatest then; proportions of exotic tool stones at that time should most directly reflect distance to source. Through time, increased population, lower residential mobility, and smaller annual range should have affected access to distant tool stone sources, which should be reflected as variability in abundance of exotic tool stone, the form in which it arrives at the Ballona, and in efforts to conserve it. North of the Ballona, growing population increasingly stressed inland terrestrial resources, making exchange of acorns for marine products feasible (Hildebrandt 2001; Hildebrandt and Levulett 1997). It seems reasonable to assume that inland tool stone sources would also have been involved in such exchange. Exotic tool stones obtained primarily by trade will arrive in a fully formed state; flake cores and early stage bifaces of these materials will be rare or absent. Use intensity should vary with stress on lithic resources. When people find themselves with few tools and reduced access to high-quality lithic sources, they may employ strategies of repair and recycling to make supplies of exotic stone go further, use more locally available, lower-quality tool stone as expedient tools for certain tasks, and even substitute other raw materials (i.e., shell) for some tasks previously accomplished with stone tools.

Data Needs

This question requires monitoring the frequencies of exotic tool stones in lithic assemblages, attending the form in which such materials arrive at the Ballona, and measuring the intensity of their use. For bifaces and projectile points, measures of use intensity estimate how much of the tool remains at discard. Artifact weight is one simple measure. For example, intensive tool resharpening and reshaping, or bipolar reduction of expended or broken tools will result in more small tool fragments (Elston 1986b, 1988; Kuijt et al. 1995). Another measure is biface intactness (Kelly 2001): how many of the three-dimensional axes (length, width, thickness) of the artifact can be measured? For example, all three dimensions of an intact biface can be measured; only two dimensions can be measured if the biface has a broken tip, and if the biface has been subjected to bipolar reduction (Elston 1986b), not even thickness can be measured. A third measure is the edge unit (EU) ratio. As discussed in more detail in a subsequent section, under conditions of tool stone shortage, people may be more likely to employ a single flake tool for a variety of tasks or maintain tool margins instead of discarding a tool as soon as its working edge feels a little dull. Either of these techniques should result in more EUs on tools at discard, and higher EU ratio (number of EUs divided by number of tools).

• *Did access to new raw materials in protohistoric and historical times affect trade for exotic lithic raw materials?*

We have mentioned in a preceding section that introduction to stone-using groups of materials such as metal and manufactured glass may impact both lithic technologies and social structure. Use of new materials such as glass were incorporated into native technologies in mission contexts (see Hoover and Costello 1985), but whether these materials were plentiful enough to replace traditional materials in other contexts is questionable. Certainly, traditional use of chert for manufacture of bifaces and shell bead drills was maintained in the Channel Islands (Pletka 2001) in spite of some access to manufactured glass, iron nails and blades, and the apparent abundant availability of steel needles used for bead drilling (Graesch 2001). After the establishment of the west-coast-provisioning port at San Blas in 1768 and the Franciscan mission in San Diego in 1769, European goods were plentiful in California and distributed to Native Americans in the interests of pacification and trade (Graesch 2001). This may have stimulated trade in some contexts. For example, trade in steatite quarried on Santa Catalina Island apparently increased (Graesch 2001), along with shell bead production (Arnold et al. 2001) in the early historical period. It is possible that mainland trade in obsidian underwent a similar early historical increase.

However, this question is complicated by the relatively short length of time between the appearance of European goods and the extirpation of native technologies in later historical-period times; the archaeological record in the Ballona may be too coarse to detect such fine-grained change. Additionally, if the Ballona was used as a hideout in the Mission period, renegade Native Americans were probably not involved in much trade for exotic tool stone. As we have observed, it is difficult to predict how this would have played out in the Ballona, but we will be alert to changes in frequencies of artifact classes by raw material that could signal such changes.

Data Needs

Data needed are frequencies of artifact classes by raw material, stratigraphic position, association with European- or mission-manufactured goods, and radiocarbon dates.

Lithic Technology and Tool Function

The lithic material culture of the Ballona has been characterized as unlike that found elsewhere in coastal California (Altschul et al. 2003), but perhaps this is more apparent than real. Ballona assemblages contain the same range of artifact types as other coastal assemblages. The major differences seem to be in the technique for producing microlithic tools, in the presence of Marymount points, and in the presence of "potato" flakes employed as tools. Van Horn and Murray (1985) suggest that unlike the technique used in the Channel Islands for microblade production, the Ballona technique relies on bipolar reduction, using both linear spalls and bipolar cores as microtools. As discussed above, Marymount points do not seem to be a well-defined artifact type. Potato flakes, which are derived from reducing river cobbles, may owe their existence entirely to the nature of lithic resources locally available in Centinela and Ballona creeks.

Perhaps of greater importance is that the function of certain tool types in the Ballona is unknown, or not well described. Only Towner (1992) has employed use-wear analysis. For example, without any use-wear analysis, Van Horn (1987; Van Horn and Murray 1985) classified large, lanceolate or leaf-shaped bifaces from bluff-top sites as "knives," whereas referring to all smaller tanged and leaf-shaped bifaces as "projectile points." Van Horn and Murray (1985) recovered hundreds of small, linear flakes from the Loyola-Marymount site (LAN-61A, LAN-61B, and LAN-61C), which they classified as "microliths," and interpreted as drills and or gravers. Although noting retouch on these items, they do not report use-wear analysis. Freeman and Van Horn (1987) report a similar assemblage of microliths from the Del Rey site (LAN-63), again without use-wear analysis. In addition, several small retouched linear flakes were interpreted as inset "barbs" for slotted bone or wooden projectiles; the function of other small flake tools was unknown.

Thus, several questions regarding Ballona lithic technology can be asked (Altschul et al. 1991: 26–27).

• *What is the functional nature of the Ballona microlith tradition?*

There are three parts to this question. First, exactly what are the points of technological similarity and difference between Ballona and Channel Island microlith production technology? Second, how much of the difference can be explained by tool stone quality accessible to Ballona knappers? Finally, what was the function of lithic tools in the Ballona?

Data Needs
The first part of the question requires detailed technological analysis of Ballona microlithic technology accompanied by comparison of examples of the Channel Island technology (Arnold 1987b; Arnold et al. 2001; Preziosi 2001). The second part of the question can be addressed by a program of experimental bipolar microlith production using materials employed by Ballona knappers (Kuijt et al. 1995). The third part of the question asks for what tasks were the Ballona microliths employed? Van Horn (Van Horn 1987; Van Horn and Murray 1985) suggests these tools were used for a wide range of tasks, with only a few items actually used to drill shell beads. The answer requires use-wear analysis coupled with use-wear experiments. Towner (1992) observed polish on the distal ends of a small sample of quartz microliths from LAN-47 that support their use as drills, possibly used on beads. Others (Preziosi 2001; Yerkes 1983) have identified specific types of microscopic use wear that should be present on Ballona microliths if they were bead drills.

• *What is the nature of the potato flake technology?*

Potato flakes were made by breaking the end off of an elongate stream cobble, and striking flakes from the cobble end by striking perpendicular to its long axis of the cobble. The resulting flake has an arcuate, cortex-covered platform. Perhaps a more descriptive image is of a salami slice. In any case, this technique produces flakes with a cortex back. It is quite possible that potato flakes are merely one of the possible results of knapping stream cobbles available in the Ballona. Are they just another form of utilized flake tool, or were they used to perform some special function or functions?

Data Needs
The answers to questions concerning potato flake technology require technological analysis of their production, collection of data regarding their proportion in assemblages, and use-wear analysis (see below) to discover if they performed any special set of functions for which other flake tools were not used.

• *What were the functions performed by artifacts previously classified as bifaces, projectile points, scrapers, and flake tools?*

In his analysis of the small sample of lithic artifacts from LAN-47, Towner (1992) noted the absence of impact fractures on medium to large leaf-shaped bifaces, suggesting they were not used as projectile points. Towner (1992) also observed microflaking and striations on four narrowly pointed medium-sized artifacts that confirmed their use as drills. Perhaps some tanged bifaces were employed as knives or scrapers; perhaps leaf-shaped bifaces in other sites were used as dart or harpoon tips. Were flake tools multipurpose? Were "scrapers" sometimes used for cutting? For what tasks were flaked and utilized shells (Erickson 1988; Maxwell 1999d; Troncone and Altschul 1992) employed?

Information about tool function can be obtained through use-wear analysis. While the gross characteristics of a tool edge (e.g., edge angle, plan form, shaped or unshaped; bifacial or unifacial) can provide clues to function, more definitive functional indications are provided by microscopic indications of tool wear, or attrition: the degree to which tool surfaces are rounded, smoothed, and polished, and (especially) by the frequency, size, and orientation of scratches or striae (Ataman 1992; Hayden 1979; Keeley 1980; but see also Brose 1979). The latter are important because their orientation vis-à-vis the tool margin directly indicate the orientation of the tool edge to the working surface, as well as the direction of movement of the tool against the work piece. For example, straight striae perpendicular to the edge indicate the tool was pushed or pulled against the work surface in a scraping motion. Straight bifacial striae parallel to the edge suggest movement of the tool along the axis of the working edge in a cutting or sawing motion. Straight diagonal striae may suggest scraping or whittling, depending on the edge angle, condition of the edge itself, and whether the striae are bifacial or unifacial. Different patterns or sizes of striation occurring on the same tool margin may suggest its use in two or more functional modes (e.g., cutting and scraping). Moreover, from the way striae overlap, it is sometimes possible to determine the order in which different modes were used (e.g., first cutting, then scraping).

Different raw materials vary in their use wear behavior (Elston 2001). Edges of tougher materials such as chert and basalt tend to stabilize rather quickly and develop rounding, smoothing and polish on edge apices and flake scar arrises. Obsidian is relatively soft and easily scratched by grit on the work piece, so striae are often easily seen under even low magnification. On the other hand, until attrition makes the obsidian tool margin thick enough to stabilize, development of substantial fine-grained attrition (smoothing, rounding and polish) cannot develop; in many cases the tool is discarded before stabilization occurs. Quartzite tool margins may develop little observable use wear because of the particulate nature of quartzite The quartz grains are all the same size, highly reflective, and random in orientation. Under magnification, individual quartz grains protrude from edges, giving them a ragged appearance; surfaces are bumpy and uneven. The hard quartz grains resist scratching and rounding, so even when edges become rounded and smoothed, quartz grains never exhibit striae. For this reason, detection of use-wear on quartz crystal (Sussman 1985) and amorphous quartz is highly problematic as well.

Use wear can also be obscured or obliterated by non-use processes such as trampling and aeolian erosion. Because of its relative softness, obsidian tends to suffer the most non-use attrition, but all tool stones exposed to wind-blown sediments will be modified by this process: edges and ridges become rounded; obsidian and basalt surfaces are pitted and etched, while harder chert and quartzite can become polished. Aeolian erosion may completely obliterate fine-grained indications of use attrition.

Residue analysis to discover resources captured or processed with flaked stone tools is more problematic and controversial, but many researchers claim success. The pros and cons of this analysis are discussed in more detail below in the question regarding ground stone tools.

Data Needs

Tool function will be addressed by observation and description of edge damage and use wear of tools from selected proveniences, concentrating on microlithic tools, bifaces, shell scrapers, and smaller samples of abundant flake tools, following standard procedures outlined in Laboratory Procedures for Lithic Artifacts (see below) (Ataman 1992; Cerico et al. 1986; Elston 1986a; Havercroft and Elston 1990; Keeley 1980; Knudson 1979; Pope 1994; Preziosi 2001; Towner 1992; Tringham et al. 1974; Yerkes 1983). Selected flake stone tools will be subjected to residue analysis (cf. Puseman 1994). It is critical that only flaked stone tools discovered in situ during excavation (not in the screen) be employed for residue analysis. Such a tool should not be allowed to contact the excavator's skin, and should be transferred immediately to a sterile plastic bag (WhirlPak) and sealed. A sample of soil in which the artifact was embedded should be placed in a separate sterile bag and sealed. The artifact should not be washed or cleaned, but submitted directly to the residue analyst in the original bag.

• *What can use wear and residue analysis tell us about ground stone tools' function and resource processing?*

Analysis of ground stone tool form, size, weight, use intensity, condition at discard, and residue analysis can inform of mobility, and intensity of resource processing, and under the right conditions, identify which resources were processed.

Ground stone tools that are unshaped, small, and lightweight suggest design for portability rather than intensive use; frequently the degree of wear on such tools is less than on tools designed for heavy in situ use (Bullock 1994b). Condition at discard may also signal mobility, because mobile foragers who gear up with relatively expedient portable milling stones for use on a logistic foray, may leave them intact and little used at logistic camps and processing stations, in order to increase their ability to transport the processed resource (Metcalfe and Barlow 1992). Sedentary foragers, in contrast, are more likely to completely "use up" ground stone tools before discarding them or recycling them into hammer stones or hearth rocks.

It is sometime possible to discover which resources were processed with ground stone tools (more often to the family and genus level; more rarely, to the species level) through pollen/phytoliths/starch washes and animal residue analysis (Cummings and Puseman 1994; Puseman 1994; Sobilik 1996). There is little question that pollen, phytoliths, and plant starches can survive in the pores and interstices of ground stone tools for very long intervals. It must be observed, however, that many researchers are skeptical that blood and other animal products can survive on tools longer than days or weeks, or that if they do survive in some form that they can be correctly identified (Downs 1995; Eisley et al. 1995; Fiedel 1996, 1997). Yet proponents of blood residue analysis, while recognizing some of its deficiencies, defend its overall value (Loy and Dixon 1998; Newman et al. 1997). We conclude that blood reside analysis is worth attempting for selected ground stone artifacts.

Data Needs

Data regarding ground stone tool form, size, weight, use intensity, and condition at discard will be collected following the methods given in Bullock (1994a) and Adams (1996).

It is critical that only ground stone tools discovered in situ during excavation (not in the screen) be employed for residue analysis. Such a tool should not be allowed to contact the excavator's skin, and should be transferred immediately to a sterile plastic bag or wrapped air tight in sterile plastic film or aluminum foil. A sample of soil in which the artifact was embedded should be placed in a separate sterile bag and sealed. The artifact should not be washed or cleaned, but submitted directly to the residue analyst in the original bag.

Ballona Settlement Patterns and Site Function

Early California archaeologists were frequently vexed by the failure of artifacts and artifact assemblages to always conform to normative classes, variously attributing this to individual experimentation, external influences such as acculturation, trade, invasion, and so on (e.g., Elsasser 1978; M. Rogers 1939:20). However, over the last the several decades, archaeologists have become increasingly aware of the value of archaeological variability for informing of prehistoric human behavior (Binford 1989a; Trigger 1989). The fact is that groups of humans do not spend their lives in one place, repeating a limited number of tasks in the same way with identical tools. Rather, people react to their natural and social environments, varying the resources they seek, the amount of time they spend in different places, the number and types of tasks they perform, the materials they use to make tools, the amount of effort they put into tool manufacture and maintenance, how they use space, deal with waste, and so on. This behavioral variation results in dissimilar assemblages within and among archaeological sites that can reflect (among other things) the size and composition of groups, status of individuals, duration and frequency of occupation (i.e., residential mobility), feature and site function, and size and location of annual range.

Questions about the nature of Ballona settlement systems turn on mobility: the consensus is that mobility was high during the Early, Millingstone, and Intermediate periods. Sites were occupied for short periods of time, not very often, and at irregular intervals. Ethnography indicates that people generally should have become less mobile in the Late period. Before asking specific questions about how lithic artifacts can inform of changes in mobility we discuss the theoretical links between mobility, lithic variability, and settlement patterns.

Mobility and the Economics of Tool Stone Procurement and Use

Among pedestrian hunter-gatherers, the dominant cost factor for lithic resources is *mobility*, or strategies employed by foragers to position themselves with regard to resources (Binford 1980; Cashden 1992; Kelly 1983, 1992). Binford (1980) suggested that hunter-gatherer mobility strategies could be viewed as a continuum, with foraging and collecting at opposite poles. This model was never intended to pigeon-hole the strategy of any particular ethnographic or archaeological group, but to conceptualize the ways different mobility strategies at different scales might affect archaeological variability (Kelly 1992:45). Mobility conditions lithic assemblage variability by affecting tool stone supply and demand as well as site function.

Binford distinguishes between residential mobility (moving from base camp to base camp) and logistical mobility (making forays from the residential base and back). Residential mobility tends to be a major component of *foragers* who pursue resources in the vicinity of a residential base then move everyone to a new base when foraging returns fall below a threshold. Lithic assemblages of such short-term camps should contain relatively few artifact types, and little variability between assemblages. *Collectors* establish bases near key resources (water, fuel), move these infrequently, and emphasize logistical mobility to obtain resources at distant points and convene them at the base. Thus, a collecting strategy should produce more archaeological variability in landscapes because people occupy various places for different purposes and for unequal amounts of time. Lithic assemblages from long-term base camps should be the most diverse (contain more classes), whereas those of logistical camps should be less so. As well, variation between assemblages of logistical camps may reflect differences in prey items pursued, amount of field processing, and gender of field party. The distinction between *travelers* (highly mobile foragers focused on high ranked diet items such as large game) and *processors* (less mobile foragers who intensively pursue lower ranked resources such as seeds) is a similar concept, although tied as much to diet as mobility (Bettinger 1991; Bettinger and Baumhoff 1982). Binford (1983) also pointed out that as a strategy for dealing with large-scale resource variability, people may cycle through use of different parts of a large territory on an annual or decadal basis. Kelly (1992:45) argues that permanent migration to new territory is also a mobility strategy, which may be driven by various factors (but usually population growth), and accomplished in many ways.

Utility can be thought of as the amount the tool affects the return rate of the activity in which it is employed (Kelly 2001:123). It is important to recognize, however, that utility is the benefit gained from tool use *minus the cost of obtaining and maintaining it* (Andrefsky 1994, Elston 1990a, 1990b, 1992a, 1992b; Kelly 2001; Kuhn 1994). Cost may also include material or social currency employed in trade for raw materials or finished items. Moreover, the time spent in obtaining lithic tools is time not spent foraging for food, water and fuel, which together comprise opportunity costs. If such costs are too great, people are likely to economize on tool stone procurement by using lower-quality raw materials for many tasks and employing various strategies for extending utility or use-life of tools made of high-quality tool stone.

Mobility affects tool stone cost by affecting supply and demand. High residential mobility offers the advantage of flexibility and quick response to changing conditions (Torrence 1983, 1989). It is often correlated with low population density where competition for resources is low and groups have room to move. A group with high residential mobility should be able to access any tool stone source within its range, but the amount of lithic material that can be accumulated and transported at any particular time is limited (Elston 1990a:158). To meet long term and situational needs, highly mobile foragers, or collectors contemplating logistical forays, are likely to "gear up" with tools of high-quality raw materials between intervals of intensive tool use (Binford 1979; Goodyear 1979). Tools of highly mobile foragers often maximize utility through design flexibility, use of high-quality raw materials, large tool size, and standardized tool form, all of which promote rejuvenation and extension of tool use life. Bifacial technology is a common solution for mobile foragers because bifaces, which are reduced in three dimensions, may approach the optimum weight/utility ratio possible with lithic tools (Kuhn 1994:436), and biface thinning flakes are useful as tool blanks (Kelly 1988). Evidence of technological flexibility should be greatest in assemblages from procurement locations or short-term base camps. These assemblages are expected to mostly comprise debitage from maintenance of high-utility, curated tools (points, bifaces), expedient tools made on that debitage (bifacial thinning flakes), and occasional expedient tools made on broken or expended curated tools (Binford 1977b, 1979).

Low residential mobility can reduce access to, and availability of, raw materials. Scheduling conflicts between subsistence and lithic procurement may be intensified. People occupying sites for longer periods of time may experience shortfalls in tool stone, meeting this contingency by relying on locally available, lower-quality tool stone for most tools, obtaining higher-quality tool stone through trade, more economical use of high-quality tool stone, substituting quantity for quality (increases in simple flake tools), intensively recycling broken or expended chert and obsidian tools (Elston 1988), or substituting bone or shell tools (Erickson 1998; Maxwell 1999d; Troncone and Altschul 1992) in tasks previously performed by stone tools.

Low residential mobility can be a response to seasonal availability of key resources such as stored seeds, caribou, or salmon (Cashden 1992:251). Technological flexibility may become restricted to tool kits adjunct to logistical operations such as hunting (bifaces, projectile points), or tasks such as woodworking or bead manufacture that require specialized tools (scrapers, drills). Homogeneity of outputs may increase with regard to technological types (fewer types of flake or bifacial tools), but decrease with regard to morphology (no particular form favored). The greatest restriction on mobility, however, seems to be other people. Even if a territory is not actively defended by residents, emigrants may find residents already established in all the sweet spots. Moreover, emigrants will have to interact with residents at some level, and this can incur costs of various kinds.

In general, amounts of local tool stones in lithic assemblages are expected to increase with duration of occupation, along with intensive recycling of higher-quality, nonlocal materials, including frequent reworking of broken and expended tools (including smashing), scavenging items deposited in previous occupations, and increased use of bipolar reduction.

Settlement Patterns and Expected Variability in Ballona Lithic Assemblages

In research conducted in a wetland of the western Great Basin, the Stillwater Marsh (Elston 1988; Kelly 2001; Raven 1990; Raven and Elston 1988, 1989), as in the Ballona, important research questions also centered on the nature of residential mobility and the nature of resources offered by the marsh. Were Stillwater foragers in some sense sedentary, focused on marsh resources, and living for extended periods in the marsh? Or were they more mobile, using the marsh only occasionally in logistic forays from an upland base, or altogether mobile, with no long term base anywhere? To aid an extended analysis of data from a regional survey and excavations in the Carson Desert, Kelly (2001:Table 4.2) prepared a table of expectations regarding lithic assemblage variability, which I have modified as Table C.2 to fit the Ballona. This table summarizes expectations of lithic assemblages in two different contexts, *assuming those contexts can be isolated in the archaeological record.*

Table C.2. Diagnostic Responses of Lithic Technology to Variation in Residential Mobility

	High Residential Mobility or Logistical Mobility	Low Residential Mobility
High quality exotic tool stone	more common	less common
Lower quality local tool stone	less common	more common
Bifaces as cores	common	uncommon
Biface/flake tool ratio	high	low
Bipolar knapping/scavenging	uncommon	medium to common
Angular debris	uncommon	common
Biface completeness	medium to high	low
Flake tools	uncommon to medium	common
Flake cores	uncommon	common
Ground stone tools	rare to medium	common
Ground stone tools	small size, light wear	large size, heavy wear
Recycled ground stone	uncommon	common in hearths
Special purpose tools	uncommon	more common
Tool/debitage ratio	high	low
Complete flakes	common	uncommon
Site size/density	small/low	large/high
Site structure	simple	complex
Assemblage size/diversity	shallow slope	steep slope

• *How can we recognize high residential mobility or logistical mobility in the Ballona?*

This question refers to seasonal residential occupation of the kind advanced by Altschul et al. (2003:11), or logistical occupations of the kind postulated by Van Horn (1987) for Early, Millingtone, and Intermediate period forgers of the Ballona. Tool kits of people coming to the Ballona from elsewhere are expected to reflect necessary "gearing up" with tools of high-quality raw materials in anticipation of need. Because the target resources of mobile people would have likely included fish, sea mammals, and terrestrial large game, assemblages should contain bifaces, projectile points, and scrapers. Flake tools will be uncommon, but if made of high-quality tool stone, are likely to be derived from biface thinning flakes, rather than flake cores. Flake cores will be uncommon, as will evidence of bipolar knapping, scavenging and angular debris. Biface completeness will be relatively high because expended or broken tools are likely to be discarded without extensive reworking. If present, ground stone tools will be uncommon, small sized (for greater portability), and lightly worn. Special purpose tools (e.g., drills) will be uncommon. Tool to debitage and biface to debitage ratios will be high because few tools will be manufactured at these sites. Complete flakes will be more common because knappers will have exercised more control in order to conserve tool stone. Site area will be relatively small, and artifact density low. Sites will exhibit little site structure; features will be comprised mostly of hearths or fire-cracked rock clusters; space will be undifferentiated and there will be no evidence of secondary disposal. The assemblage size/richness regression line for a group of short-term residential or logistical sites is expected to be relatively shallow because for most occupations, the same tool kit will be employed.

• *How can we recognize low residential mobility in the Ballona?*

Altschul (1997) maintains that because LAN-63 and other bluff-top sites exhibit strong site structure, they are multiseasonal residential bases used by multiple residential groups. Tool kits of people residing in or adjacent the Ballona for long periods are expected to reflect multiple tasks. Assemblages are likely to contain more locally available tool stone, and relatively less exotic, high-quality raw material. Also reflecting availability of local materials from stream gravels, flake cores and flake tools will be abundant. Because low mobility foragers are expected to focus more on plants, lagoon fish and shellfish, tools kits will contain fewer bifaces and projectile points; biface/flake tool ratios will be lower. Flake tools derived from biface thinning flakes will be uncommon, but bipolar knapping, scavenging and angular debris will be common. To maximize utility of scarce high-quality raw materials, expended and broken tools will be intensively recycled, biface completeness will be low, and bipolar reduction and angular debris will be common. Ground stone tools will be common, large sized (since portability is less of an issue) and heavily worn. Special fabrication tasks are more likely in long-term residential bases, so special purpose tools (e.g., drills, microliths) should be common. Tool to debitage and biface to debitage ratios will be low because many tools will be manufactured at these sites. To compensate for lower utility of local tool stones, many more tools may be used and discarded. Complete flakes will be less common because knappers using abundant local materials will not depend as much on controlled reduction to conserve tool stone. Longer occupations will result in large site areas with high artifact density. Sites will exhibit strong site structure with differentiated use of space and multiple types of features (hearths houses, post holes, earth ovens, ritual space, etc.), and evidence of secondary disposal. The assemblage size/richness regression line for a group of long-term residential sites is expected to be relatively steep because of the multiplicity of tasks performed at such sites.

• *How can we recognize other possible settlement patterns in the Ballona?*

Other possible settlement pattern scenarios are summarized in Grenda and Altschul (1994a) and Altschul et al. (2003). Any of these would blur the dichotomous patterns outlined above. For example, in the *restricted mobility* model, individual domestic units move to different places in and adjacent the Ballona in response to resource conditions. This pattern would produce sites and assemblages with the characteristics of low residential mobility in Table C.1, but there would be little difference between sites. The *primary village* model is essentially the ethnographic model. One site is the chiefly center where most of the people live most of the time, with special purpose or seasonal satellite camps elsewhere in or adjacent the Ballona. This model would produce sites of two different sizes, but in many regards they all are likely to resemble the low mobility pattern in Table C.2 because of dependence on local tool stone, with little need to "gear up" for resource procurement. The primary site should, however, have the richest assemblage containing the most exotic tool stones, special purpose tools, and ritual or high-status items. In the *ranchería* system, high-status groups occupy optimal places in the landscape (sweet spots), and lower status groups occupy marginal locations that must be periodically abandoned because of flooding or drought. This model would produce sites resembling the low mobility pattern in Table C.2. However, the sites located in optimal locations are expected to be larger in area and higher in artifact density because they are occupied more continuously. Sites in sweet spots should also have more exotic tool stone, special purpose tools, and ritual or high status items.

Data Needs
Addressing these models will require analysis of several kinds of data collected from flaked stone and ground stone artifacts. Some classes of data are appropriate to collect for every artifact (e.g., raw material); others (length, width, thickness) only for formed tools. To ensure continuity with past efforts, we will employ, to the extent possible, artifact and data classes of previous researchers (Towner 1992, 1994; Rosenthal and Benaron 1998; Rosenthal and Taşkıran 1999; Van Horn 1987; Van Horn and Murray 1985), with the addition of a few modifications following Andrefsky (1998), Ataman (1992), Bullock (1994a), Elston (1986a, 1986b, 2001), Juell (1990), and Kelly (2001).

Ballona Settlement Patterns, Assemblage Size, Evenness, and Diversity

Archaeological assemblage variability is reflected in several different measures (see papers in Leonard and Jones 1989; Grayson and Cole 1998), including evenness (equability of item frequencies by class), assemblage richness (number of classes represented), or heterogeneity (an index of evenness and richness combined) (Grayson and Cole 1998; Shott 1989). The importance of variability in evenness is obvious. Evenness is what we are looking at when comparing assemblage class frequency histograms. The behavioral implications of an assemblage with perfect evenness (equal proportions of items in each class) are quite different than those for assemblages in which one, two, or more classes contain most items. Evenness and richness can vary independently Magurran (1988) because assemblages can be equally rich (same number of classes), yet one assemblage can be relatively even whereas another is dominated by a single class. Moreover, assemblages can be equally rich and not contain the same classes, or equally even and yet be dominated by different classes. Differences in evenness between assemblages are often attributed to functional or organizational differences between the behaviors that produced the assemblages (cf. Table C.2 above; Shott 1989).

Differences in assemblage richness (number of classes) in archaeological assemblages may reflect variable tool-using and discard activities as influenced by site function, length of occupation and access to tool stone (Elston 1990a, 1992a; Grayson 1984; Grayson and Cole 1998; Jones et al. 1983; Kintigh 1984; Rhode 1988; Shott 1989; Thomas 1983, 1988). Theoretically, the assemblage size-diversity relationship may be positive or negative (in either case, either linear or asymptotic), or null (Shott 1989). The relationship is very often positive, however, because richness is highly correlated with assemblage size: in a sampling universe divided into classes of things, the larger the sample, the more classes are likely to be represented in it. This is because the proportion of each class in the population determines the probability of its being selected in a particular random sample. The greater the proportion of a class in the sampling universe, the greater the probability that the class will be represented in a sample. Classes containing few items have a smaller chance of being represented. The larger the sample, however, the greater the chance it will contain rare classes. For any group of assemblages, this relationship can be expressed by a regression line with a particular origin and slope.

Although assemblage richness is correlated with assemblage size, Thomas (1983, 1988) suggested that regression-line slope may discriminate between groups of sites of different types. For example, we might expect artifact classes to be added over time at a relatively slow rate at short-term logistic camps used for a limited range of activities. People would transport some functional subset of their total artifact repertory to such sites, and only occasionally leave artifacts of other kinds there. The slope of the assemblage size/richness regression line for a group of such sites would be rather shallow. A much wider range of activities are expected to occur at long-term residential bases. People would tend to use a much wider subset of their total tool kit at such sites, as well as manufacture other types of tools for use elsewhere. The slope of the assemblage size/richness regression line for a group of residential sites should be relatively steep. Outliers, sites far above or below a regression line, may indicate some factor other than sample size that is contributing to variability. These posited relationships are only relative, however, and have never been ethnoarchaeogically tested (Kelly 2001:123). There are other reasons why slopes of regression lines for two groups of sites may differ (Shott 1989). For example, the slope for a group of short-term camps occupied for 5,000 years might be steeper than that of a group of long-term sites occupied for only 1,000 years. Palimpsest assemblages accumulated as sites vary in function seasonally, or change function through time because of environmental change or population growth may not show the expected patterns. Prehistoric scavenging and modern artifact collecting may skew assemblage data. Thus, while analysis of assemblage size/richness can be very helpful in the interpretation of assemblage variability when there are a number of sites to compare, it is not a panacea and must be used with care.

• *What are the implications of assemblage evenness among Ballona assemblages?*

More even assemblages (less variation in the frequencies of lithic classes) might be expected in archaeological units representing long-term residential sites where many different kinds of tools were manufactured, used and discarded. Less even assemblages are expected from units occupied for the short term, especially those representing task sites in which relatively few types of resources were procured or processed.

Evenness can be assessed with several techniques (Magurran 1988), one of which employs the Shannon-Weiner information statistic “H” as in H/log classes, which generates values between 0 and 1, with 1 as perfect evenness. Given a contingency table of class frequencies of two or more assemblages, the chi-squared statistic tests whether the variation between classes is random (the null hypothesis). The test of relative importance of the observed variation between classes, or the strength of dependent associations (if any) can be obtained by analysis of the difference between expected and observed values as chi-squared adjusted standardized residuals (Bettinger 1989; Everitt 1977; Haberman 1973). The greater the positive or negative residual value, the greater the positive or negative association between pairs of values in the same row or column. Adjusted residuals greater than ± 1.96 are significant at $p \geq .05$.

• *What are the relationships between Ballona assemblage size and diversity?*

As previously discussed, although assemblage richness (number of classes) is correlated with assemblage size, Thomas (1983, 1988) suggested that regression-line slope may discriminate between groups of sites of different types. To illustrate how this might work in the Ballona, let us assume for the moment that bluff-top sites were multiseasonal habitations (the locus of a wide variety of tasks), while sites on the lagoon are more likely to have been occupied for shorter intervals in the pursuit of particular sets of tasks. If this is true, bluff sites should exhibit more variety in lithic assemblages. That is, bluff lithic assemblages should be richer (i.e., contain more kinds or classes of lithic items) than those of lowland sites.

Table C.3 suggests this might be the case. For this analysis, we use data taken from Tables 7 and 8 in Altschul et al. (1999), from which we have removed debitage and potato flakes, leaving flake tools, microliths, and formed artifacts of various kinds. Average richness of bluff assemblages is a little over twice that of lowland assemblages.

But Table C.3 also shows that the average assemblage size of the bluff sites is an order of magnitude greater than that of lowland assemblages. Because there is usually a strong correlation between sample size and variability or richness, however, we are justified is suspecting the difference in assemblage richness between bluff and lowland sites is a matter of sample size alone.

Table C.3. Average Assemblage Size and Richness: Lowland and Bluff Sites

	Assemblage Size	Richness
Lowland	71.17	6.8
Bluff	963.50	15.33
Difference		8.53

Indeed, the best-fit relationship between log assemblage size and number of classes (Figure C.4) is log-linear and highly significant ($r = 0.904$, $p \leq .0001$). A bivariate plot split by locality (Figure C.5) shows that regression lines for bluff and lagoon assemblages have different slopes and origins. The correlation for bluff ($r = 0.85$, $p = .0306$) is significant, that for lowland ($r = 0.0682$, $p = .1354$) is not, perhaps due to the small sample size of lowland sites. And yet, to what degree are these differences due to sample size alone?

The regression equations for lowland and bluff assemblages are given in Table C.4, along with predicted richness values (numbers of classes) for assemblages (minus debitage and potato flakes) ranging in size from 10 to 3,000 classified artifacts (actual assemblages vary between 3 and 1521 items). The predicted differences range from 1.34 classes in assemblages of 200 items to 7.13 in assemblages of 3,000 items. The average difference between bluff and lowland richness in this simulation is only 2.51. Because this is less than half of the observed average difference (see Table C.4), we are justified in suspecting that the difference in slope of regression lines for bluff and lowland sites is *not* due much to assemblage size. In other words, the difference in slope suggests real differences between the two groups of sites.

Should we reassess our impressions of site location and site function based on these data? Perhaps not. Assemblage size is very unevenly distributed between bluff and lowland sites, with many very small assemblages in the latter. Moreover, the number of assemblages in each group is small (six). Larger numbers of assemblages and larger samples from lowland sites might produce different distributions and regressions.

This exercise also informs of the sample sizes needed to achieve the maximum richness possible, given the total number of artifact classes. Altschul et al. (1999) used 26 artifact classes, of which I eliminated two (debitage and potato flakes) for these analyses. The simulation in Table C.4 suggests that assemblages twice the size of any heretofore obtained (n = 1,521) will probably not include all possible classes. This is advantageous, because no variability can be seen when comparing two or more class-saturated assemblages.

Figure C.5 shows artifact class frequencies split between bluff and lowland sites. As we have just seen, lowland sites have fewer classes of artifacts, but artifact proportions are also very different between the two groups. Lowland sites have lots of cores, flake tools, bifaces, points, and manos, which might fit the model of short term occupation in the lowlands focused on hunting, local tool stone procurement, and plant processing. The bluff sites are notable for the large numbers of microlithic artifacts (specialized tools), milling stones, mortars, and manos (intensive plant processing), which might fit the model of longer-term occupation. Clearly, there are potentially significant differences between these two groups of sites, but in further analysis, we will look at different site groups as well (e.g., bluff top, creek side, lagoon).

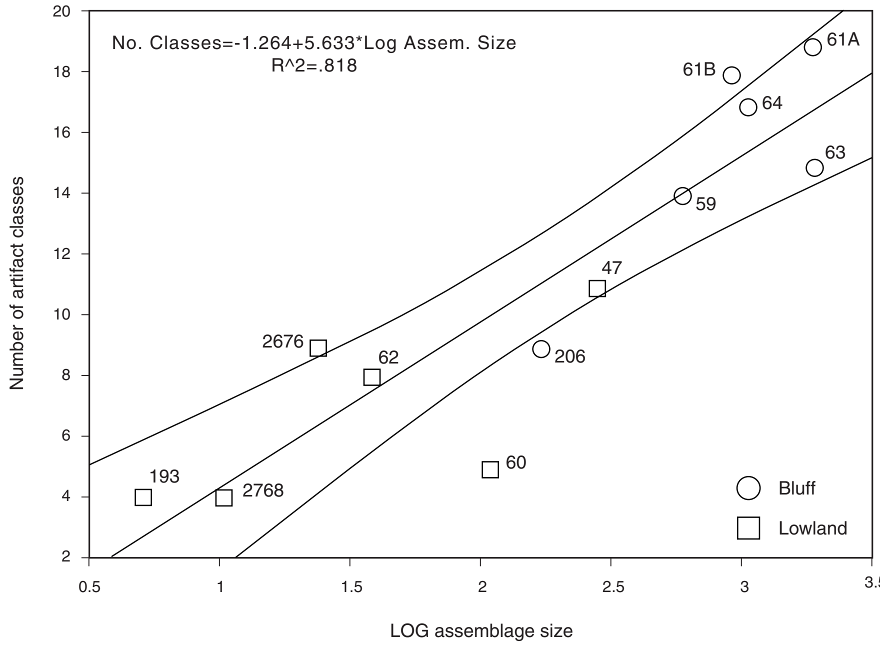

Figure C.4. Bivariate plot numbers of classes by log assemblages size, showing regression line within 95% confidence intervals.

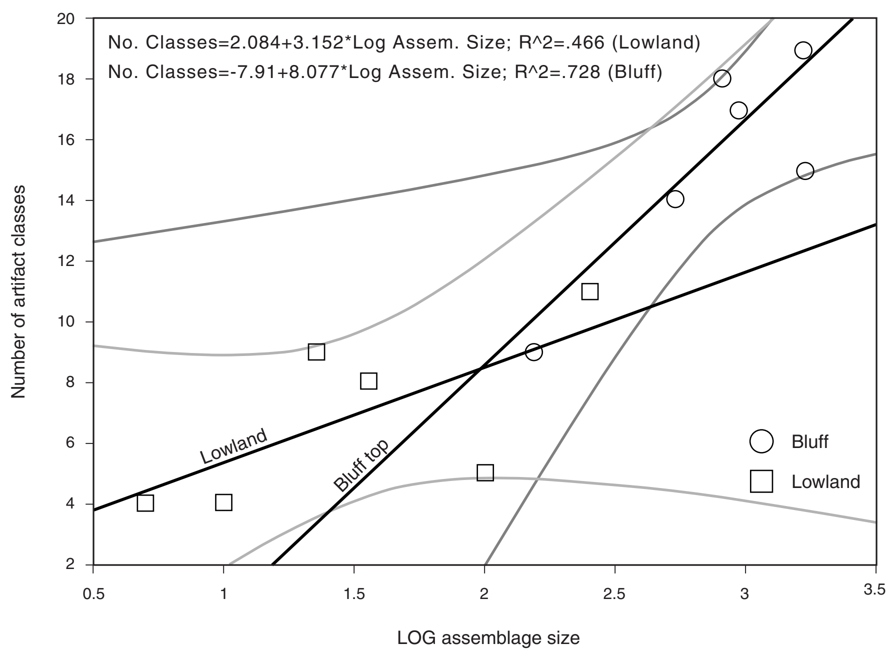

Figure C.5. Bivariate plot of numbers of classes by log assemblage size, split by bluff and lowland sites, showing regression line within 95% confidence intervals.

Table C.4. Regression Equations and Predicted Richness Values for Lowland and Bluff Lithic Assemblages

Regression equations

Lowland site richness = 2.084+3.152 * (Log assemblage size)

Bluff site richness = -7.91+8.077* (Log assemblage size)

Predicted richness values

	Tool Assemblage Size								
	10	100	200	300	400	500	1,000	2,000	3,000
Lowland	5.24	8.39	9.34	9.89	10.29	10.59	11.54	12.49	13.04
Bluff	0.17	8.24	10.68	12.1	13.11	13.89	16.32	18.75	20.17
Difference	-5.07	-0.14	1.34	2.21	2.82	3.3	4.78	6.26	7.13

Note: Average difference is 2.51.

• *Can Ballona archaeological assemblages be grouped through numerical taxonomy?*

Analyses of lithic assemblage evenness and diversity are designed to indicate differences between archaeological units (sites, components, features). As we have seen above, the contrast in geographic situation (lowland, bluff) seems to contribute to differences in assemblage richness. However, these differences vary along a continuum defined by the regression line of log assemblage size and number of classes. There is little to indicate how assemblages might be grouped along this line, nor or other dimensions of variability considered in this analysis. If we want to know which assemblages resemble each other considering more than two variables at a time, we must resort to a multivariate method such as cluster analysis, and if we want to know which variants contribute the most to the groupings, we must employ factor analysis.

Data Needs

Assemblage size/richness, evenness, class frequency and cluster or factor analyses require only simple counts of artifacts and the classes in which they occur.

Laboratory Procedures for Lithic Artifacts

Sampling

Without knowing lithic assemblage sizes, it is impossible to be specific about sampling strategies. However, certain classes of data will collected only from selected artifacts.

Debitage

Artifacts are screened in the field through sets of screens with 1-inch, $^{1}/_{2}$-inch, $^{1}/_{4}$-inch, and $^{1}/_{8}$-inch mesh, and bagged by size. The size sorting will be recorded and maintained through subsequent sorting, counting and weighing. Each lot of debitage will be sorted by raw material (basalt, quartzite, chert, chalcedony, petrified wood, andesite, obsidian, quartz, rhyolite, fused shale, glass). Debitage in each resulting subset will be counted and weighed. Care will be taken to identify and remove tool fragments from debitage for analysis in their appropriate class.

Additional data to be collected from debitage from *selected proveniences* will include sorting by debitage technological type (flake core reduction, biface thinning, pressure, notching, bipolar, and shatter) and by platform characteristics within each type (see Andrefsky 1998:118–122 and references therein).

Flaked Stone Tools

Observations on tools will include basic raw material and dimensions, along with data informing of tool manufacture, function, and maintenance. For example, intensive tool resharpening and reshaping, or bipolar reduction of expended or broken tools will result in more small tool fragments (Elston 1986b, 1988; Kuijt et al. 1995). Another measure of use intensity is biface intactness (Kelly 2001) indicated by how many of the three-dimensional axes (length, width, thickness) of the artifact can be measured. For example, all three dimensions of an intact biface can be measured; only two dimensions can be measured if the biface has a broken tip, and if the biface has been subjected to bipolar reduction (Elston 1986b), not even thickness can be measured. A third measure is the edge unit (EU) ratio. Under conditions of tool stone shortage, people may be more likely to employ a single flake tool for a variety of tasks, or maintain tool margins instead of discarding a tool as soon as its working edge feels a little dull. Either of these techniques should result in more EUs on tools at discard, and higher EU ratio (number of EUs divided by number of tools).

Observations on cores will include raw material, weight, maximum linear dimension, cortex, and technology (unidirectional, bidirectional, multidirectional, bifacial, bipolar).

Observations on hammer stones will include raw material, weight, length, width, thickness, cortex, number of battered facets, and facet location.

Observations on bifaces and drills will include raw material, status (intact, tip missing, base missing, lateral margin missing, medial fragment, tip fragment, basal fragment, lateral fragment, other fragment), cortex, weight, length, width, thickness, which of these dimensional measurement are complete (Kelly 2001), reduction stage (Callahan 1979), fracture type (none, bending, perverse or notching failure, impact), blank type, reduction technique (bipolar, percussion, pressure, percussion and pressure, bipolar).

Observations on projectile points will include all of those for bifaces, as well as those essential for characterizing point morphology (Thomas 1981). First, detailed morphological data must be collected for all Ballona projectile points. In addition to the standard weight, length, width, and thickness, are measures of basal shape, notch placement, notch size, and so on as defined in Thomas (1981). To see how closely Ballona points resemble "desert" point styles, we will run all the Ballona point data through keys that distinguish among those types (e.g., Thomas 1981; Vaughn and Warren 1987), and compare the Ballona data to type descriptions of point styles lacking keys.

Observations on individual flake tools and microliths will include raw material, status, cortex, flake scar count, platform characteristics, weight, length, width, thickness, which of these dimensional measurement are complete (Kelly 2001). For intact flake tools, the number of edge units (EUs) and EU location(s).

Ground Stone Stools

Observations on ground stone tools will follow Bullock (1994a) and Adams (1996), including raw material, weight, length, width, thickness, status, shaped or unshaped, number of worn facets, cups, and pits, wear location, presence of decoration or pigment, type of decoration, repair (presence of drilled holes, grooves, asphaltum); for manos and metates: plan outline (circular, oval, subrectangular, irregular), use wear (minimal, light, moderate, heavy), area of use wear, depth of use wear; for metates: type (slab, block, boulder, trough); for mortars: maximum diameter, maximum thickness, diameter of pit, depth of pit, pit bottom (flat, round, parabolic), pit sides (straight, tapered); for steatite vessels: maximum diameter, diameter of opening, wall thickness; for pestles: shape (cylindrical, tapered), single or double ended.

Obsidian Hydration

All formed obsidian artifacts (bifaces, projectile points, drills, etc.) and a sample of debitage should undergo X-ray fluorescence for chemical identification of the tool stone source (Gilreath and Hildebrandt 1997; Hughes 1984). Each of these artifacts should then be cut and hydration values observed.

Use-Wear Analysis

Flaked stone tool function will be addressed by analysis of edge damage and use wear of tools *from selected proveniences*, concentrating on microlithic tools, bifaces, shell scrapers, and smaller samples of abundant flake tools (Ataman 1992; Cerico et al. 1986; Elston 1986a; Havercroft and Elston 1990; Keeley 1980; Knudson 1979; Pope 1994; Preziosi 2001; Towner 1992; Tringham et al. 1974; Yerkes 1983).

Data collection and analysis will follow standard procedures. The unit of edge wear analysis is not the artifact, but the edge unit (Havercroft and Elston 1990:227–228), also known as employable unit or EU (Knudson 1979:17): an implement segment that was used to perform a specific task (e.g., cutting, scraping, perforating, drilling, etc.). The unit is indicated by edge morphology, deliberate shaping or retouch, use wear attrition, or all of these. Thus, a single tool may have more than one EU, each serving the same or different functions. If made on a flake, the tool is oriented with the dorsal face showing, and proximal (platform) end down. Its margins are traced in pencil on vellum. Such landmarks as prominent arrises and flake scars are also indicated. The drawing is attached to the recording form. Tool margins are carefully examined under low magnification (2–8×), then scanned at 75× and 150× using a stereomicroscope. Higher power magnifications (300–400×) are occasionally used to look at small surface areas and edge apices, but higher power does not necessarily resolve more details on lithic surfaces. For each EU, several attributes are recorded. EU location on the margin, condition, angle of the edge prior to, attrition or shaping edge angle, EU length, and EU plan (straight, concave, convex, irregular, notch, denticulate). In addition, attributes of attrition for each EU are recorded: dominant attrition form (short flake scars, long flake scars, nicks, wear facet); rounding, smoothing, and polish (each graded as heavy, moderate, light, or absent); presence and form of striae (absent, perpendicular, parallel, diagonal, crossed, random); and presence or absence of residue.

While the gross characteristics of a tool edge (e.g., edge angle, plan form, shaped or unshaped; bifacial or unifacial) can provide clues to function, more definitive functional indications are provided by microscopic indications of tool wear, or attrition: the degree to which tool surfaces are rounded, smoothed, and polished, and (especially) by the frequency, size, and orientation of scratches or striae (Ataman 1992; Hayden 1979; Keeley 1980; but see also Brose 1979). The latter are important because their orientation vis-à-vis the tool margin directly indicate the orientation of the tool edge to the working surface, as well as the direction of movement of the tool against the work piece. For example, straight striae perpendicular to the edge indicate the tool was pushed or pulled against the work surface in a scraping motion. Straight bifacial striae parallel to the edge suggest movement of the tool along the axis of the working edge in a cutting or sawing motion. Straight diagonal striae may suggest either scraping or whittling, depending on the edge angle, condition of the edge itself, and whether the striae are bifacial or unifacial. Different patterns or sizes of striation occurring on the same tool margin may suggest its use in two or more functional modes (e.g., cutting and scraping). Moreover, from the way striae overlap, it is sometimes possible to determine the order in which different modes were used (e.g., first cutting, then scraping). The nature of polishes also may indicate the type of material on which the tool was used. For example, Towner (1992) observed polish on the distal ends of a small sample of quartz microliths from LAN-47 that supports their use as drills, possibly used on beads. Others (Preziosi 2001; Yerkes 1983) have identified specific types of microscopic use wear that should be present on Ballona microliths if they were bead drills. Polish analysis is facilitated by comparison of archaeological specimens and experimental tools using materials employed by Ballona knappers (Kuijt et al. 1995).

Residue Analysis

Selected flaked stone and ground stone tools will be subjected to residue analysis by specialist laboratories (cf. Cummings and Puseman 1994; Puseman 1994; Sobilik 1996). It is critical that only tools discovered in situ during excavation (not in the screen) be employed for residue analysis. Such a tool should not be allowed to contact the excavator's skin, and should be transferred immediately to a sterile plastic bag (WhirlPak), or covered with plastic film or aluminum foil and sealed. A sample of soil in which the artifact was embedded should be placed in a separate sterile bag and sealed. The artifact should not be washed or cleaned, but submitted directly to the residue analyst in the original bag.

APPENDIX D

Curation Agreement with the University of California, Los Angeles

AGREEMENT FOR CURATION OF ARCHAEOLOGICAL COLLECTIONS

Archaeological Collections Facility
Fowler Museum of Cultural History
University of California, Los Angeles
P.O. Box 951549
Los Angeles, CA 90095-1549
(310) 825-1864 FAX (310) 206-2826

1. Archaeological materials must derive from Southern California contexts or otherwise relate to Southern California research questions. In certain situations, collections derived from other localities may be accepted on a case-by-case basis. In that event, prior approval must be obtained from the Curator of Archaeology, Archaeological Collections facility (hereafter referred to as the "Facility").

2. The Facility will not accept for curation any human remains, grave associated materials, or items that are known or believed to be sacred items (i.e. anything that may be defined as items of "cultural patrimony" according to state or federal laws). If such items are discovered in collections offered or forwarded to the Facility, the Curator of Archaeology will not accept them into the permanent collection and will refund the appropriate curation fee, less a reasonable service charge and items returned to owner at owner's expense.

3. Archaeological materials requiring special care or equipment (i.e. climate humidity, or temperature controls; insect-proof storage cabinets; et.) cannot be accepted for curation in the Facility at this time.

4. All collections **MUST** be accompanied by provenience data. Such documentation necessarily includes a catalog (both a hard copy and in a Facility accepted database) and originals (or copies) of field notes, level records, and maps as well as charts, slides, photographs, and other documentation as appropriate.

5. Copies of reports describing, analyzing, or interpreting the materials **MUST** be submitted to the Facility as part of the documentation. This submission would be **in addition** to a submission to the appropriate Information Center.

6. Individual items (i.e. modified and/or diagnostic artifacts) must be marked with catalog numbers preferably using the Facility accession numbers (or attached to tags). The Facility will provide accession numbers upon request. Acceptable labeling procedures will be provided upon request, but must follow conservation guidelines and use reversible techniques. Guidelines and techniques are available upon request.

   Individual items must be placed in polyethylene zip-lock bags with acid-free, 100% cotton-bond tags. The tags, at a minimum, should include the site number, unit number, depth, catalog number, and description. It is required that zip-lock bags be at least 4 mil. in thickness. It is requested that museum quality acid-free boxes be used for collection containers. Unsealed bags or containers will not be accepted

   Separate catalog numbers are to be used for each different group of items (i.e., debitage, faunal remains, shellfish remains, soil samples, etc.) from a single level of an excavation unit. That is, one catalog number can be used for all the debitage from the same level of a unit. Groups of items must be placed in separate containers (i.e., zip-lock bag, cardboard box, etc.) with fragile items protected from heavy items.

All catalog numbers in a collection must be accounted for. If an item is initially assigned a number, and is subsequently deleted from a collection, or if a catalog number is otherwise not used, please indicate such on the final catalog submitted with the collection. That is, type "unused number" adjacent to the appropriate space on the catalog and leave all data fields empty. As such, that catalog number will not be considered to have missing items during future collection inventories or research investigations.

7. Individual items and groups of items must be appropriately packaged within the collection to facilitate their retrieval for inventory, examination, or exhibit.

8. Materials must be packed in standard archival (acid-free) boxes (15" X 12" X 10") with lids and must be appropriately grouped and packed with respect to weight and fragility. No box is to weigh more than forty (40) pounds. Labels should be attached to the outside of each box indicating the site number, accession number, box number (i.e., box #1 of 10 etc.), and heaviness of box (ie., light, medium, heavy). Special arrangements, and corresponding fee adjustment, will be made for small collections that do not require the standard box size.

9. Bulky items, such as oversized groundstone and certain historic period materials, not fitting into standard archival boxes, are charged on a per box basis as appropriate by weight (i.e., they will be counted as part of the total number of boxes comprising the collection). Examples include: a 40lb. groundstone item will equal one standard archival box; a two foot long historic artifact weighing 10lb. will equal a quarter standard archival box.

Curation fees are a one-time charge of $400 per standard archival box. The agency or archaeological contractor submitting materials to the Facility for permanent curation is responsible for meeting all curation obligations, including fee payments and signing Curation Agreements. Collections will not be accepted until all conditions are satisfied. **FEES ARE PAYABLE AT OR BEFORE THE TIME A COLLECTION IS SUBMITTED WITH NO EXCEPTIONS.** Checks or money orders may be made payable to Regents of the UC. Please return the signed original Curation Agreement when submitting collections.

Each collection must be properly arranged and cataloged as stated in sections 2, 6, 7, and 8 of this Agreement. The submitter agrees to reimburse the Facility for re-cataloging or significantly reorganizing a collection that does not meet the criteria as outlined in this Agreement. If the agency or its contractor does not wish to prepare the collection for curation, the facility staff has the ability to undertake the task at a rate to be determined by the Curator of Archaeology.

12. It is understood that once a collection is accepted for curation, it becomes the property of the Facility and all rights and privileges regarding ownership of the collection are relinquished at the time of submission (with exception as noted in Section 14 of this Agreement).

13. No charge is made for access to collections for legitimate research or for educational and/or scientific purposes. However, prior arrangements must be made with the Curator of Archaeology before access to the collection(s) is granted. This policy is subject to change at any time and without notice.

14. It is understood that the Facility reserves the right to lend, research, and publish any material for curation or for the documentation of collections. The Facility recognizes and respects the proprietary interest of the submitters to whatever initial publication rights may be involved UP TO TEN (10) YEARS FROM THE DATE THE MATERIAL IS ACCEPTED for curation.

15. A copy of this agreement **MUST BE SIGNED** and included with the collection documentation **BEFORE** acceptance of a collection by the Facility.

16. Special conditions or remarks regarding this collection: (Optional: to be completed by the submitter and/or the Collections Manager as needed).

I agree to the above listed conditions:

Signature of Agency Representative Date

Printed Name Agency and/or Affiliation

Signature of Agency Representative Date

Wendy Teeter, Curator of Archaeology UCLA Fowler Museum of Cultural History
Printed Name Agency and/or Affiliation

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FOR OFFICE USE ONLY

Date Accepted Accession # # Boxes Invoice # Invoice Date

Received By Date Total Fees Paid Check #

Inventory Date Inventory By

Additional Fees Reason(s) For Additional Fees

GI/msword/curation agreement/12/10/96

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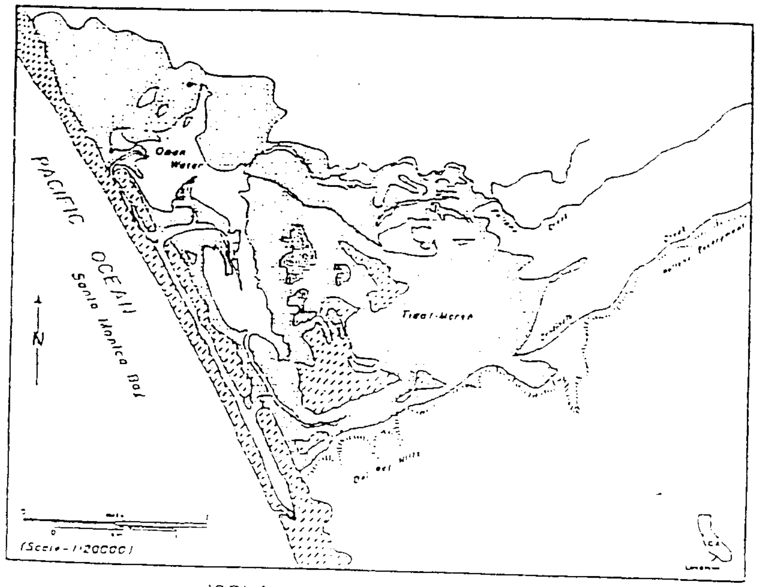
APPENDIX D.ix:
ALTSCHUL, JEFFREY H., ET.AL., STATISTICAL RESEARCH, INC., PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT, DATA RECOVERY PLAN FOR CA-LAN-62 AND CA-LAN-211
STATISTICAL RESEARCH, 1991

PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT



1861 U.S. COAST SURVEY MAP

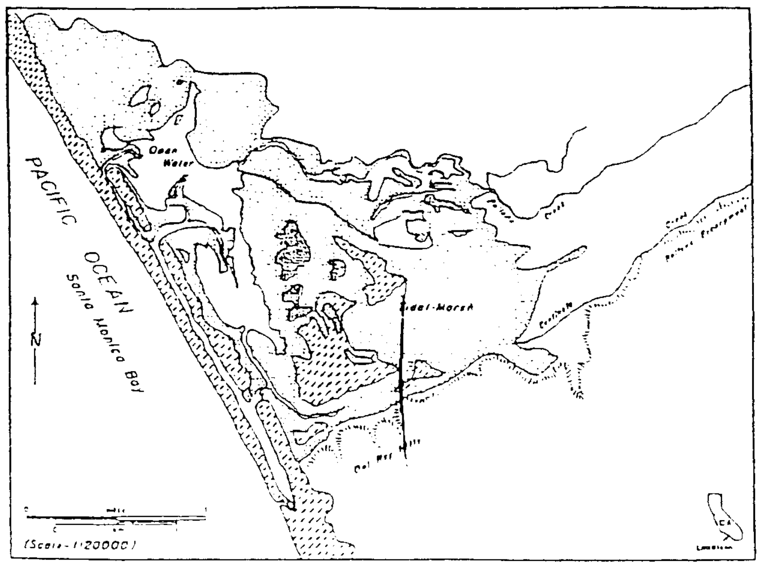
DATA RECOVERY PLAN FOR CA-LAn-62 AND CA-LAn-211

Jeffrey H. Altschul

STATISTICAL RESEARCH
Tucson, Arizona

1991

PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT



1861 U.S. COAST SURVEY MAP

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DATA RECOVERY PLAN FOR
CA-LAn-62 AND CA-LAn-211
PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT

The following is a data recovery plan for sites CA-LAn-62 and CA-LAn-211. The sites, located within the proposed Playa Vista project area, have been determined to be eligible for the National Register of Historic Places as contributing members of the Ballona Lagoon Archaeological District. Portions of both sites will be adversely impacted by the construction of a riparian corridor as part of the Playa Vista project.

Descriptions of the current conditions, previous research, and artifact assemblages of the two sites can be found in Altschul et al. 1991. The sites have been subject to numerous investigations, ranging from outright vandalism to systematic professional studies. The combined information suggests that they were intensively occupied habitations that date at least from the Late Prehistoric Period perhaps into the Ethnohistoric Period.

The size and locations of the sites plotted on Figure 1 needs to be considered as tentative. Since the sites were originally recorded in the late 1940s, the area has been repeatedly subjected to landscape modifications that have buried almost all evidence of cultural deposits. No portions of the sites are visible today, and test excavations have shown that parts of CA-LAn-211 are buried beneath 8 ft of historic fill and parts of CA-LAn-62 are buried by up to 20 ft of fill. At the time the sites were recorded, no systematic survey was conducted to determine whether the sites were indeed discrete cultural deposits or were actually one large occupation. Recent test excavations by Van Horn and others (Archaeological Associates 1986, 1988) have not resolved this issue.

Altschul et al. (1991) argue that CA-LAn-62 and CA-LAn-211 were situated at the mouth of Centinela Creek, or where the fresh water creek emptied into the Ballona Lagoon estuary. They hypothesize that this location would have been ideal for settlement, and conclude that the entire bank of Centinela Creek should be considered a likely location for prehistoric settlement.

RESEARCH QUESTIONS

Altschul et al. (1991:23-28) present a series of research questions to guide archaeological investigations of prehistoric sites during the Playa Vista Archaeological Project. Two dominant themes are outlined: man-land relationships and culture history and cultural dynamics of prehistoric settlement. The general questions outlined in the research design are revised as appropriate for CA-LAn-62 and CA-LAn-211.

Man-Land Relationships

Under the theme, man-land relationships, Altschul et al. (1991:25) point out that there is an apparent shift from terrestrial to aquatic resources between the Late Millingstone Horizon and the Late Prehistoric Horizon. This shift was apparently associated with a change in settlement preference from the bluffs overlooking the Ballona to the lagoon edge. Pertinent research questions that can be addressed with data from CA-LAn-62 and CA-LAn-211 are:

1) Is there definite evidence for this subsistence shift, or do any sites in the lagoon show evidence for terrestrial exploitation?

2) Was the shift from the bluffs to the lagoon sudden, or was there a period of time when both locations were occupied?

3) Was settlement in the Ballona region ever permanent, or was the area only visited seasonally?

4) Is the switch from an emphasis on terrestrial to aquatic resources a reflection of site location or more widespread changes in the environment.

To answer these questions shell, faunal, and floral data are needed. Based on previous excavations at CA-LAn-62 as well as CA-LAn-47, another lagoon edge site located nearby, it can be anticipated that preservation of these materials will be good. To insure that all temporal and functional components are sampled, data must be recovered from each locus identified.

Additionally, artifactual data must be collected. Analysis of use-wear patterns and organic residues on lithic artifacts should lead to functional interpretations. Adequate samples of artifacts must be collected from each temporally and functionally distinct cultural deposit.

Cultural History and Cultural Dynamics of Prehistoric Settlement

Altschul et al. (1991) outline three research domains under the theme cultural history and cultural dynamics of prehistoric settlement. These are chronology, technology, and cultural affiliation.

Chronology

The dating of CA-LAn-62 and CA-LAn-211 has not been resolved. Based on limited excavations, Peck (1948) argued that CA-LAn-62 was a stratified, multicomponent site. Van Horn (personal communication, 1990) believes that both CA-LAn-62 and CA-LAn-211 were occupied late in the prehistoric sequence, with CA-LAn-211 occupied perhaps into the Ethnohistoric Period. Van Horn's conclusions, however, are based more on an intuitive understanding of the sites than data.

To place data recovered from CA-LAn-62 and CA-LAn-211 into a cultural and temporal context, the following questions must be answered:

1) When were the sites occupied? Do they represent a single or multiple occupations? If multiple, are the deposits stratified?

2) Were the occupations at CA-LAn-62 and CA-LAn-211 contemporaneous with occupations at sites on top of the bluffs?

3) When were the sites abandoned? Was it before Portola's entrada in 1769? Was it when the San Gabriel Mission was founded, or did the Ballona contain a pocket of indigenous culture that persisted into the nineteenth century?

To address chronological questions, samples for absolute dates in the form of shell, carbon, and bone need to be collected. In addition, sufficient temporally sensitive diagnostic artifacts, such as projectile points, must be recovered.

Technology

The prehistoric occupation of the Ballona is characterized by lithic assemblages that thus far have not been identified elsewhere along the southern California coast. Two lithic industries have been described for the Ballona, a bipolar microlith tradition and a split cobble tradition, that appear to be unique in the region. Artifacts of both traditions have been recovered from excavations at CA-LAn-62 and CA-LAn-211. Moreover, a projectile point style, the Marymount point, was defined from specimens recovered on the bluffs above CA-LAn-62 and CA-LAn-211. The point bears similarities to those found in the Mojave Desert, but not along the coast. Van Horn (1981) associates the Marymount point with Shoshonean influence. Yet the point style has been dated in the Ballona several hundred years before the time normally accepted for Shoshonean influence on the coast.

Aspects of the material culture from CA-LAn-62 and CA-LAn-211 raise the following research questions (from Altschul et al. 1991:26-27):

1) How prevalent is the microlith tradition? Is the tradition really distinct from the one developed on Santa Cruz Island?

2) Are there other facets of culture that distinguish the Ballona area from other groups living at other lagoons along the coast? If present, can these differences be attributed to a unique cultural tradition or specific resource exploitation strategies?

3) How does the technology of the Ballona area sites compare with inland sites? Does this comparison indicate the types of economic pursuits that Ballona area residents followed and how they interacted with inland peoples? Were the bluff tops and lagoon edge occupied by the same cultural group or was the area visited seasonally by various unrelated groups?

Technological questions will be pursued through artifact analyses. To address these questions relatively large samples of appropriate artifact classes (e.g., microliths and "potatoe" flakes) need to be recovered from controlled contexts. Adequate samples from deposits representing each temporal occupation and functional activity must be obtained.

Cultural Affiliation

Excavations at CA-LAn-59, CA-LAn-61, CA-LAn-63, CA-LAn-64, and CA-LAn-206 indicate that the bluffs overlooking the Ballona were settled by people with ties to the Mojave Desert as early as A.D. 500 (Van Horn 1987). Van Horn (1987) notes that desert influence was several hundred years earlier in the Ballona than other locations along the coast to the north and south. He suggests that a "Shoshonean wedge" may have pushed westward through the Los Angeles Basin from the desert. This movement may have severed or limited cultural interactions between the Ballona and other regions along the coast, thereby accounting for the area's peculiar cultural assemblage.

The fate of the Shoshonean wedge migrants is unknown. Altschul and Ciolek-Torrello (1990) note that there is no evidence of occupation in the Ballona after A.D. 1100. This negative evidence could represent abandonment of the area. Alternatively, it could reflect the paucity of data from archaeological excavations.

According to Kroeber (1925) and Johnstone (1962), the Ballona was occupied by the Gabrielino at the time of European contact. Both CA-LAn-62 and CA-LAn-211 have been suggested as candidates for the Gabrielino village of *Sa'angna* (Archaeological Associates 1986, 1988; King and Singer 1983). To date, no data have been recovered from either site to confirm or reject this hypothesis.

Research questions involving cultural affiliation that can be addressed with data from CA-LAn-62 and CA-LAn-211 are:

1. Were the occupants of CA-LAn-62 and CA-LAn-211 culturally related to the groups residing on the bluff tops?

2. Is there evidence for pre-Gabrielino/pre-Shoshonean occupation of the area? If so, with which cultural group are they related?

3. Can CA-LAn-62 and/or CA-LAn-211 be associated with the named Gabrielino village of *Sa'angna*?

4. How early can Gabrielino traits be identified?

Both CA-LAn-62 and CA-LAn-211 appear to be multicomponent accretional middens. The sites were probably repeatedly occupied over many years. To discern evolutionary changes in cultural affiliation between Gabrielino and Shoshonean material culture, microstratigraphic episodes must be isolated and dated within the midden deposits.

Linking an archaeological site with a named ethnohistoric village is extremely difficult. Although the presence of historic trade goods, historic period shell beads, and other diagnostic artifacts can be interpreted as evidence of ethnohistoric occupation, the issue of a particular placename will most likely remain in doubt. In the absence of diagnostic artifacts, absolute dates are the only means to establish the age of a site. Even if the sites date to the approximate time period, their association with a particular village cannot be resolved.

METHODS

Previous work at CA-LAn-62 and CA-LAn-211 established that the two are primarily accretional shell middens. Although there are strong indications from Peck's (1948) work that at least two components are represented at CA-LAn-62, no evidence of stratified deposits has been found, Likewise, no evidence has been presented to indicate that internal site structure can be recognized. Previous investigators have argued that the same locations were re-occupied repeatedly, thereby destroying or obscuring any evidence of site structure. Based on work elsewhere in southern California, Altschul (1991; Altschul and Shelley 1987; Altschul et al. 1989) has noted that many Late Prehistoric/Ethnohistoric Period sites were organized as dispersed linear settlements along waterways. Distinct middens, often identified as different sites, often represent different activity or residential areas within a single settlement. It is possible that the same settlement structure holds for CA-LAn-62 and CA-LAn-211. Altschul et al. (1991) suggest that the two sites may represent one settlement. If so, then questions of site structure and social organization may be addressed.

To address the research questions posed in the previous section, we need to obtain chronometric, artifactual, and subsistence-related data from each cultural deposit in the impact zone. Further, within each cultural deposit we need to obtain adequate samples for each data set from each stratigraphic unit. Simply put, we need controlled samples from all horizontal and vertical parts of the sites.

Because the historic fill deposits are so thick and broad, it is not feasible to excavate small units from the current land surface through the fill and into the cultural deposits. Moreover, since the boundaries of the sites are not determined, it is conceivable that one could excavate through the fill and not find cultural deposits. To define the full extent of the site, we need to remove the fill from large areas. Such a process would be prohibitively expensive if the fill were removed for the archaeological investigations, then used to backfill the area, only to have to be removed again during construction. The only prudent course of action is to conduct data recovery when the fill is removed during construction.

The key to success for data recovery at CA-LAn-62 and CA-LAn-211 is a plan for quickly identifying cultural deposits and determining their nature and integrity. Our plan is illustrated in Figure 2, and described below. The reader is further directed to the research design (Altschul et al. 1991) for a complete discussion of methods (e.g., excavation of test pits, procedures used in backhoe trenching, analytic methods, etc.).

1. During construction, the riparian corridor will be stripped to a point where cultural materials are first detected. The stripping operations will be closely monitored by an archaeologist. The mechanical excavation will be conducted at a sufficiently slow speed so that cultural materials will not be unduly disturbed.

2. Once fill has been removed, backhoe trenches will be placed within each identified deposit to define its depth and integrity. Areas of the corridor that contain no evidence of cultural deposits will not be trenched. If deposits are found throughout the corridor, then trenches will be placed perpendicular to the corridor's centerline at 30 m intervals. Backhoe trenches will be excavated to the base of the cultural deposit, or a maximum depth of 2 m.

3. To address the research questions, data needs to be obtained from all cultural deposits identified. The quantity of data needed is difficult to specify, although estimates can be made based on previous excavations in the area. For example, at the Admiralty site (CA-LAn-47), an average of 266 faunal remains were recovered per m^3, or about 25 per 10 cm level. For a single component site, such as the Admiralty site, 75 m^3 (obtained from 81 sq m) provided sufficient faunal, macrofossil, pollen, shell remains to characterize the subsistence strategy. This excavation size also produced about 300 shell beads and 6000 lithic artifacts. Of the latter, 70 were projectile points/bifaces and 20 were microliths. Research questions revolving around chronology, technology, and cultural affiliation rest heavily on bead and stone tool data. Recovery totals from the Admiralty site were sufficient to address most questions, although technological issues involving the function of microliths could only be examined in a preliminary fashion.

   Cultural deposits that will be impacted at CA-LAn-62 and CA-LAn-211 are relatively large and probably multicomponent. If we assume that both sites have both Intermediate and Late Prehistoric components as suggested by Peck's (1948) work and we assume that the artifact and subsistence remains densities are approximately the same as the Admiralty site, then we need to excavate twice the amount of fill dug at the Admiralty site to ensure that research questions relating to subsistence, chronology, technology, and cultural affiliation are addressed. Because the area to be impacted at the Admiralty site was extremely small and localized (less than 2% of the total site size, located in one area), issues of site structure and organization were not developed. These questions, however, are pertinent to CA-LAn-62 and CA-LAn-211. Thus, data must be recovered from each deposit within the areas to be impacted by the riparian corridor.

   Given these considerations, we propose to excavate up to 200 sq m at CA-LAn-62 and CA-LAn-211. The area excavated, however, can be considerably reduced, if the deposits have substantially higher artifact and subsistence remain densities than the Admiralty site. This total represents approximately 2.6 percent of the area currently designated as one of the sites within the riparian corridor. It represents about 0.8 percent of Phase 1 area within the riparian corridor between the western boundary of CA-LAn-62 and the eastern boundary of CA-LAn-211.

   It is worth noting that this discussion has not relied on data recovered by Van Horn from CA-LAn-62 or CA-LAn-211 in developing data recovery estimates (Archaeological Associates 1986, 1988). Contrasting the recovery rates from the 1989 excavations at CA-LAn-47 (Altschul et al. 1991) with those from CA-LAn-62 (Archaeological Associates 1986, 1988) is instructive. At CA-LAn-47, 266 faunal remains per 1 m^3 were recovered, whereas the rate at CA-LAn-62 was 51 per 1 m^3. Much of the difference in the rates can be traced directly to differences in screen size.

At CA-LAn-47, 1/8 in hardware mesh was used, whereas at CA-LAn-62, the mesh was 1/4 in in size. Altschul et al. (1991) calculated that over 50 percent of the faunal remains at CA-LAn-47 were less than 1/4 inch in diameter, and that relatively large numbers of species would have been missed had a larger mesh size been used. Similar statements also follow for small, but critically important, artifact categories, such as shell beads and microliths. Because several research questions require relatively small-sized data classes, the excavation fill will be screened through 1/8 in mesh as described in the research design (Altschul et al. 1991).

a. At least one test pit will be judgementally placed in each cultural deposit identified. If the deposit is sufficiently large, additional units will be excavated. The size of the unit will depend on the anticipated depth of excavation. For areas where midden deposits are less than 1 m deep, a 1 x 1 m test pit will be used. For deeper areas, the unit will be increased in size to a 1 x 2 or 2 x 2 m unit.

b. Block excavations will be judgementally placed using the test units as guides. To address the research questions posed, representative samples of artifacts, datable material, and subsistence remains must be obtained. One approach to obtain a representative sample would be to establish a grid over deposits and then select units to excavate through a random process. Because the total sampling fraction for data recovery is so low, on the order of 1 percent, this approach is of limited statistical value (Altschul and Nagle 1988). A better approach is to determine areas that contain high densities of the materials sought through the use of trenches and test pits. These locations can then be sampled at relatively high sampling fractions, under the assumption that they represent behavioral events (such as trash dumping, food processing, or habitation) of greater diversity and/or frequency.

The size and shape of the block excavations will depend on the nature of the cultural deposits. In all cases, a 2 x 2 m unit will be the smallest subdivision of a block. Square blocks will be used when relatively small deposits or concentrated areas of high artifact density are encountered. Blocks will either be 4 x 4 or 6 x 6 m in size, with a smaller blocks being placed in shallow deposits and larger ones placed in deeper deposits. Trench excavations may be used if deposits of homogenous depth and nature encompass the entire impact zone. Trench width will be 2 m; the length will depend on the width of the riparian corridor at that particular location.

Excavation Summary: Our two-tiered strategy is to place test pits throughout the deposits to achieve areal coverage, and then intensify our recovery rate by placing 3 to 5 block excavations in areas with exceptionally high densities of artifacts and subsistence remains. No more than 200 sq m will be excavated in the aggregate (i.e., test pits and block excavations). If the deposits are found to be rich, then the number of units will be decreased, for the needed data can be obtained from smaller volumes.

4. All burials encountered during the construction of the riparian corridor for Phase I will be excavated following procedures set forth in Federal and State law. The construction of the corridor will be monitored by an archaeologist who shall have the right to halt excavation if human remains are encountered. After notifying the proper authorities, the remains will be excavated, examined, and then returned to the Native American designated the Most Likely Descendant by the Native American Heritage Commission for reburial.

5. All individuals identified by the Native American Heritage committee as representatives of Native American groups potentially interested in the project have been notified and allowed to comment on the proposed project.

6. Laboratory processing and cataloguing will follow the procedures outlined in the research design. Laboratory facilities will be established within the Playa Vista project area. To ensure the safety of artifacts while they are analyzed and stored prior to final curation, laboratory facilities will be organized to meet curatorial standards,

7. All applicable analyses described in the research design will be conducted. At a minimum, these will include lithic, shell, bioarchaeological, faunal, paleobotanical, soils, and chronometric analyses.

8. The report will be published in the Statistical Research Technical Series as part of Volume No. 29. This volume contains all work pertaining to the Playa Vista Archaeological Project, and includes as its first part the research design. The series is a professional publication series that is distributed throughout the country to professionals and institutions.

9. All project related material, including notes, artifacts, maps, drawings, photographs, and reports will be curated at a repository meeting Federal standards.

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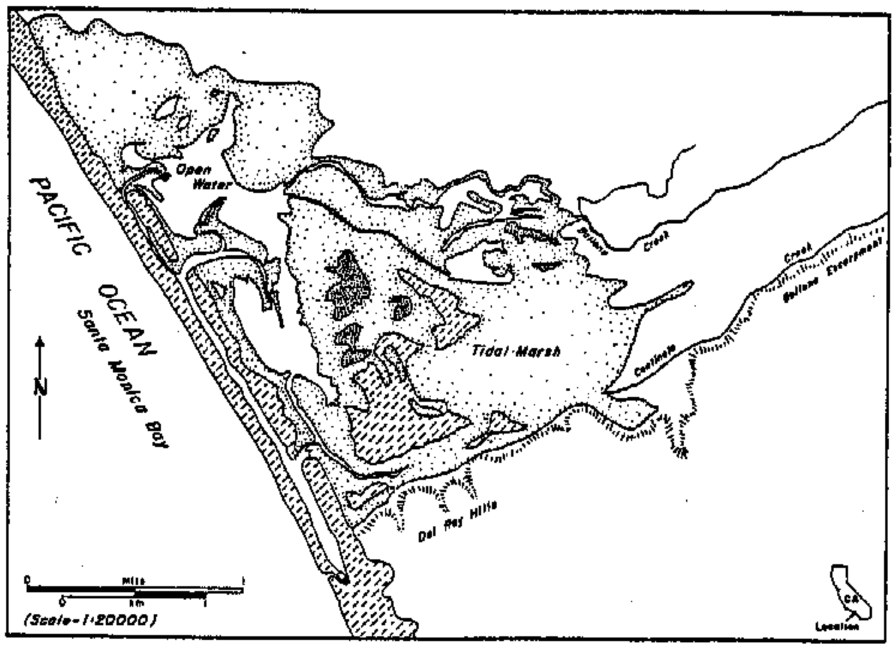
APPENDIX D.x:
ALTSCHUL, JEFFREY H., ET.AL., STATISTICAL RESEARCH, INC., PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT, RESEARCH DESIGN, STATISTICAL RESEARCH TECHNICAL SERIES NO. 29, PART 1

PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT



1861 U.S. COAST SURVEY MAP

RESEARCH DESIGN

Jeffrey H. Altschul
Richard S. Ciolek-Torrello
Jeffrey A. Homburg
Mark T. Swanson

Statistical Research Technical Series No. 29, Part 1

PLAYA VISTA ARCHAEOLOGICAL AND HISTORICAL PROJECT RESEARCH DESIGN

Jeffrey H. Altschul
Richard S. Ciolek-Torrello
Jeffrey A. Homburg
Mark T. Swanson

Contributions by:

Roberta S. Greenwood

Submitted To:

Planning Consultants Research and
Camp Dresser & McKee
1320 Third Court
Santa Monica, California

STATISTICAL RESEARCH
Tucson, Arizona

1991

MANAGEMENT SUMMARY

The Playa Vista Archaeological and Historical Project is a multi-step comprehensive approach designed to achieve compliance with applicable Municipal, State, and Federal laws and regulations protecting cultural resources. This document represents the first step: the completion of a project specific research design that presents current knowledge of the cultural resources in the project area and outlines future steps to mitigate potential impacts of the proposed project.

To complete the research design two tasks were undertaken. First, a thorough archival search was conducted. Background information on the environment, prehistory, and history of the area was collected and synthesized. In addition, data on six previously recorded prehistoric and several historic locations were obtained from knowledgeable individuals, published and unpublished reports, and historic maps. The background information provides the framework for the development of historic contexts from which the potential eligibility for inclusion on the National Register of Historic Places for each particular resource is assessed. The historic contexts developed for Playa Vista are (1) man-land relationships, (2) culture history and cultural dynamics, and (3) historic development of the Ballona.

The second task completed for the research design was a pedestrian survey of the 1087 acre Playa Vista project area. Seventeen temporary site numbers and five isolated find designations were assigned during the survey. Of the 17 sites, 4 appear to be composed of redeposited historic material and 4 others consisted solely of dark soil with shell remains. The remaining 9 sites consist of 3 historic sites and 6 prehistoric sites, 3 of which had been previously recorded. Because much of the surface in the project area is either obscured by fill or disturbed, it is possible that the pedestrian survey may not have located all the sites, especially prehistoric sites. Recommendations are made to continue the inventory using subsurface probing.

Two historic districts are recommended to be eligible for inclusion in the National Register of Historic Places. The proposed Ballona Lagoon Archaeological District consists of sites pertaining to the prehistoric adaptation to this particular microenvironment. For purposes of this project, the district is defined by all previously recorded as well as newly recorded sites lying solely within the project area. The second proposed historic district, the Hughes Industrial Historic District, encompasses all buildings and other features formerly included in the Howard Hughes Industrial Complex. All these resources lie in the project area.

In addition to the two districts, four sites are recommended to be potentially eligible to the National Register as individual properties.

Of the 18 sites potentially eligible for the National Register as sites or as contributing members of an historic district, two will only be subject to re-vegetation and two will be capped with fill, but otherwise avoided. The remaining 14 sites will be exposed to some degree of impact.

Previous archaeological work at CA-LAn-62 and CA-LAn-211 is considered sufficient to deem these sites eligible to be listed in the National Register of Historic Places as contributing members of the Ballona Lagoon Archaeological District. No further evaluation at these sites is proposed, and a data recovery plan for these resources will be developed based on current knowledge. Evaluation plans are offered for all other sites to determine their National Register status, and a preliminary mitigation plan is outlined.

The report is organized in two parts. Part I, which consists of Chapters 1 through 6, presents background information on the prehistoric and historic occupations of the project area, identifies appropriate historic contexts through which the potential eligibility of properties for inclusion in the National Register is assessed, and describes the current knowledge of cultural resources in the project area. Part II, contained in Chapters 7 and 8, focuses on National Register evaluation and compliance issues.

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CHAPTER 1

INTRODUCTION

The Playa Vista project area consists of about 1087 acres located at the western edge of the Los Angeles metropolitan area. This area is bounded by the Del Rey Hills, which include the Westchester and Playa del Rey Bluffs, to the south, the City of Los Angeles communities of Playa del Rey to the west, Del Rey to the northeast, and Venice/Mar Vista to the north, and the Los Angeles County community of Marina del Rey to the northwest (Figure 1). Included within the boundaries of the project area is a complex microenvironment historically composed of freshwater streams, estuaries, salt water marshes, and tidal flats, and commonly referred to as the Ballona. Long an area known for its biotic resources, the Ballona has been attracting human settlement for thousands of years. Not surprisingly, the area is rich in both culture and history. Yet, only traces of these occupations can be discerned. The processes that made the creeks and lagoons of the Ballona attractive together with modern developments, have also been responsible for hiding most of the evidence of occupation from our view.

The proposed project is an integrated mixed-use development of residential, retail, and commercial space. Approximately 560 acres, or 51 percent of the project site, will be open space. Included in that open space are portions of the remnant historic wetlands which will be restored and expanded. Recognizing the importance of the interplay between man and environment in the history of the Ballona, the project includes an in-depth study of the cultural processes located on the project site. In harmony with the overall project goals, the Playa Vista Archaeological and Historical Project has two overarching objectives. The foremost goal is to protect archaeological and historic sites through avoidance, thereby preserving these resources for future generations. In the case of significant sites or portions of significant sites that cannot be avoided, the second objective is to design and implement a mitigation program that will enlighten the public and provide professionals with data that can be used to study the prehistory and history of the Ballona for generations to come.

The Compliance Process

The Playa Vista Archaeological and Historical Project is a phased study designed to comply with federal, state, and municipal regulations protecting cultural resources. Cultural resources that retain scientific and research potential as well as historic significance are afforded special status under the National Historic Preservation Act (NHPA) of 1966, the Archaeological and Historic Data Protection Act of 1974, the National Environmental Policy Act (NEPA), and Executive Order 11593. In addition, protection of cultural resources within the the Playa Vista project area falls under the jurisdiction of State laws and regulations, particularly the California Environmental Quality Act (CEQA) and the California Coastal Act. Because federal laws are more stringent than either state or municipal regulations, by meeting federal guidelines the project will necessarily comply with all other stipulations.

To comply with Federal laws, a five-step process has been developed. The first step is the identification and evaluation of historic properties. The responsible agency, which in the case of Playa Vista is the U.S. Army Corps of Engineers (COE), first reviews all existing information and decides whether historic properties may exist in the proposed area of development. If historic properties exist, then the COE determines how much additional survey effort is needed to locate them. Next, the agency identifies all National Register-listed properties that will be affected by the proposed development as well as the those properties that are not listed, but appear to meet eligibility criteria. For the latter group, the COE and the State Historic Preservation Office (SHPO) together apply the National Register criteria and decide their status.

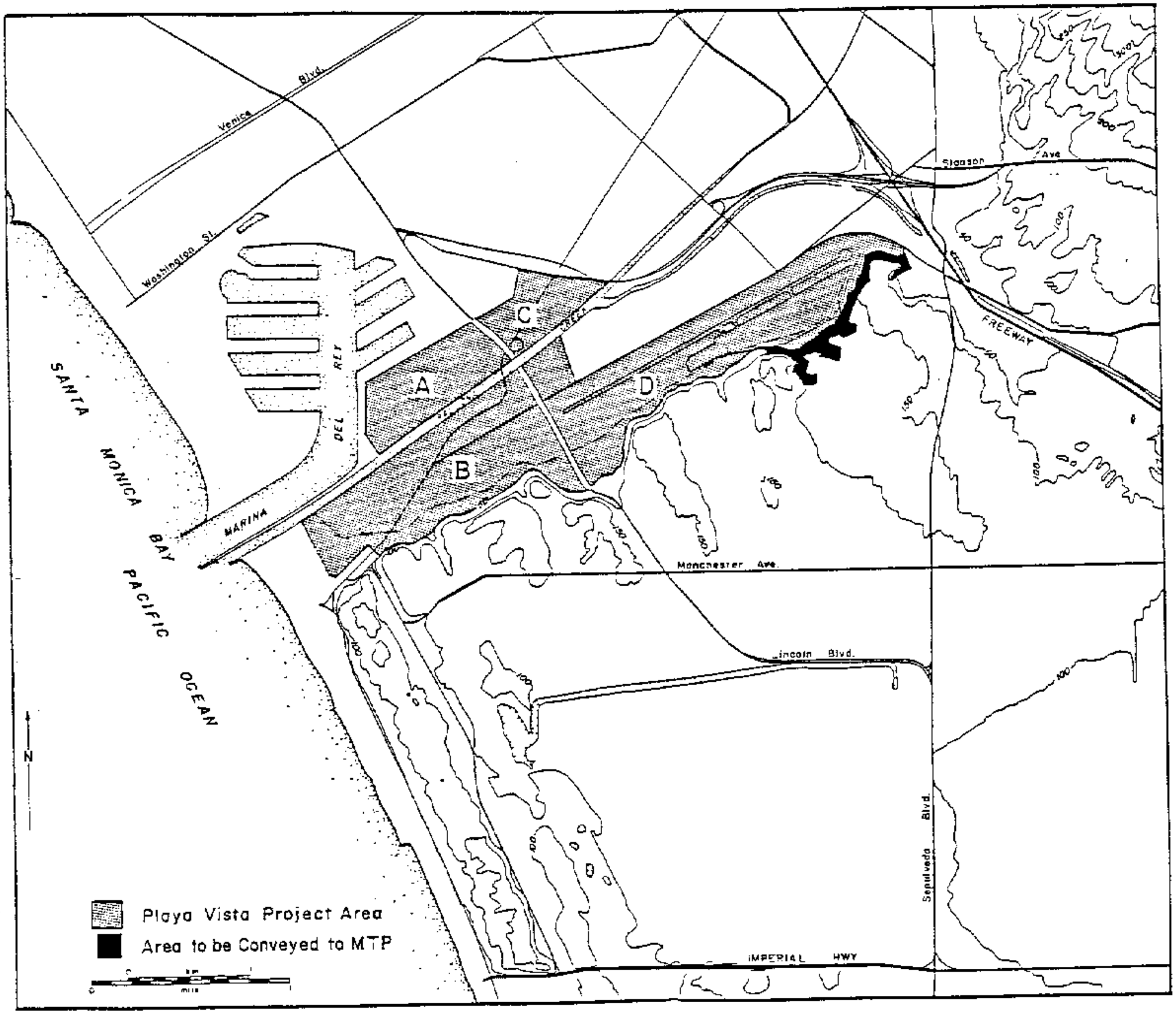


Figure 1. Proposed Playa Vista Project Site, Areas A, B, C, and D.

The second step involves assessing the effects of the planned activity. Working with the SHPO, the agency can either find that there will be (1) no effect, (2) no adverse impact, (3) or an adverse effect on the historic property or properties.

The third step is devoted to consultation. The COE and the SHPO try to find ways to minimize harm to National Register or National Register eligible historic properties. Other parties, such as the Advisory Council on Historic Preservation (Council), local governments, other Federal agencies, or Indian tribes, may also be invited to participate during this phase. Once a solution has been devised, all parties sign a Memorandum of Agreement (MOA) documenting the agreed solution. When a solution cannot be reached, the COE may submit all documentation to the Advisory Council for comment.

The fourth step is comment from the Council on the MOA or documentation. The Council can elect to accept the MOA, request changes to it, or opt to issue written comments on the proposed development.

The final step is to proceed with the activity. With an acceptable MOA, the COE simply proceeds with the activity according the terms of the agreement. Without an MOA, the COE must take into account the Council's comment, but ultimately it alone decides how to proceed.

Report Organization

This report, which documents the results for Step 1 of the Federal process, is divided into two parts. Part I is devoted to current knowledge of the cultural resources in the project area and outlining appropriate historic contexts through which to assess the potential eligibility of cultural resources that may be affected by the development. Part I begins with Chapter 2 in which previous published and unpublished material on the environment, prehistory, and history of the project area is coalesced and presented. Chapter 3 outlines pertinent research questions and associated data requirements and methods. Chapters 4 and 5 present the results of the archival search, with Chapter 4 devoted to the historic period and Chapter 5 to previous research on archaeological sites. Part I concludes with Chapter 6 which describes the results of the cultural resources survey associated with this project.

Part II focuses on the remaining steps of the compliance process. The first section of Chapter 7, presents recommendations for each cultural resource known to be located within the project site and potentially eligible to be nominated for inclusion in the National Register of Historic Places. The second part of this chapter details the proposed impacts of the project on each of the resources recommended to be potentially eligible. Chapter 8 presents evaluation plans for each of the resources recommended to be potentially eligible. The report concludes with a discussion of the thrust of mitigation.

CHAPTER 2
PROJECT BACKGROUND

CURRENT USE OF THE PROJECT AREA

The proposed Playa Vista project area lies south and east of Marina del Rey and north of Westchester and the Ballona Escarpment. This area, roughly centered on the intersection of Lincoln and Jeffersons boulevards, includes the Howard Hughes Industrial Complex to the east, and the outskirts of Playa del Rey to the west (Wyatt 1990; Exhibit NOP-1). The project area has been divided into four areas, labeled A through D (see Figure 1). Channelized Ballona Creek separates Areas A and C in the north, from Areas B and D in the south. Lincoln Boulevard forms the other major division, separating Areas A and B in the west, from Areas C and D in the east. Areas B, C, and D are under the jurisdiction of the City of Los Angeles, while the County of Los Angeles has jurisdiction over Area A. Due to their location within the California Coastal Zone, Areas A, B, and C also fall under the jurisdiction of the California Coastal Commission. In addition, pursuant to the federal Clean Water Act, the U.S. Army, Corps of Engineers has jurisdiction over waters of the United States that occur within all four quadrants.

At present the most notable features within the project area, aside from the Ballona Creek channel and Lincoln Boulevard, include Culver Boulevard, south of and roughly parallel to the Ballona Creek channel and what used to be the Howard Hughes Industrial Complex within the eastern arm of the project area. This complex is now identified as the California Manufacturing Center of the McDonnell-Douglas Helicopter Company and various facilities of the Hughes Aircraft Company.

The Master Plan for Playa Vista includes open space as well as residential, commercial, and retail development for each of the four quadrants. A 40 acre marina and an 8 acre tidal lagoon in Area A, expansion and restoration of wetlands in Area B to create an approximately 233 acre salt marsh and 27 acre fresh water marsh, and a 25 acre open space corridor along the bluffs in Area D are also salient features of the Master Plan.

Of the 1087 acre project area, the developer, Maguire Thomas Partners-Playa Vista (MTP-PV) presently owns all but 54.4 acres. The presently unowned portion is divided between two parcels that MTP-PV is entitled to acquire in separate transactions, one in October 1993 and and the other in February 1994.

ENVIRONMENTAL SETTING

The project area is located in a large, low-lying gap between the Ballona Escarpment and the Del Rey Hills to the southeast and the ocean bluffs of Santa Monica to the northwest. This break in the cliff line along Santa Monica Bay is called the Ballona Gap, named after the creek that flows into it from the west and north. The brackish lagoon that used to be found at the confluence of creek, gap, and ocean, was largely eliminated by the construction of Marina del Rey in the early 1960s (Figure 2). The project area, located to the south and east of the Marina, is between 3 and 22 feet above mean sea level, with much of this height the result of historic fill associated with the construction of the Marina, channelization of Ballona Creek, and various projects associated with the Hughes complex.

Prior to modern development, the environmental character of the Ballona Lagoon was shaped by local hydrology and tectonics. The southern edge of the lagoon is bounded by a sharp escarpment

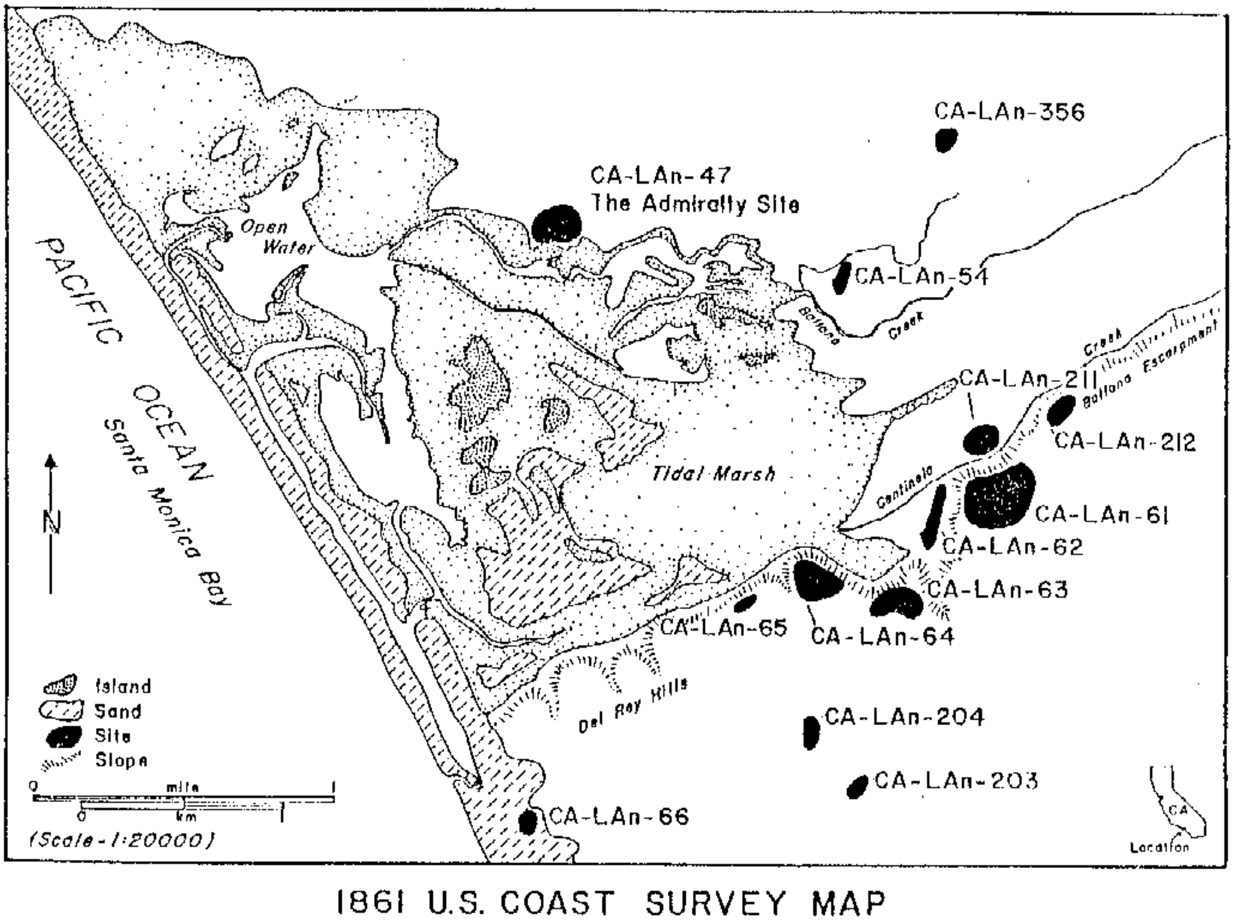


Figure 2. The Ballona Lagoon in 1861 with recorded prehistoric sites.

formed by tectonic activity along a fault line and/or lateral stream migration of the ancestral Los Angeles River sometime in the Pleistocene (Grant and Sheppard 1939). The escarpment rises 150 feet over the lowland. Along the western edge of the escarpment lie the Del Rey Hills, which in turn are part of a larger formation termed the El Segundo Sandhills that stretch along the Ballona Escarpment east to the Palos Verdes Hills (Poland et al. 1959; Page 1950). These hills are interpreted as offshore sand bars that have been reworked by wind and water. The Del Rey hills cap the escarpment, ranging in width between 2 and 5 miles and in height between 85 and 185 feet above mean sea level. The width and height of the hills decrease with distance from the coast.

At the base of the escarpment flowed Centinela Creek, a spring-fed stream that created an estuary along its lower course. The spring was relatively strong and the stream most likely contained a permanent flow. As Kew (1923:157) observed:

> Before the city of Inglewood obtained its water supply from the wells at the Centinela Spring, a stream carrying one hundred and twenty-five inches of water issued from this spring, and flowed down Centinela Creek, forming these channels, which are nearly obliterated. During wet weather it was even possible to row a boat up to the springs from Playa del Rey.

In addition to Centinela Creek, Ballona Creek, whose drainage system encompassed over 110 square miles between the Baldwin Hills on the south to just east of the Beverly Hills, emptied into the Ballona Lagoon at about the present location of Lincoln and Jefferson boulevards. Since the area between the Ballona Escarpment and the Santa Monica Mountains is crossed by a number of fault lines, the flow of underground water was often interrupted along the course of Ballona Creek: a situation that tended to force water to the surface, contributing to surface flow (Poland et al. 1959:12). When the first Spanish settlers grazed cattle in the Ballona Gap, they found areas near the creeks lined with alders, sycamores, and willows.

Periodically, the waters of Ballona Creek were joined with those of the Los Angeles River. An event was recorded in 1815, when at high flood stage, the Los Angeles River shifted from its present-day course, which empties into the ocean at Long Beach, to a more westerly route, where it captured Ballona Creek and diverted it into Santa Monica Bay (Weide 1967). A second major flood in 1825 returned the Los Angeles River to its original course ending at Long Beach. During the floods of 1862 and 1884, part of the Los Angeles River flood waters were diverted through Ballona Creek into the lagoon. Since that time, the Los Angeles River has maintained its current course largely as a result of civil engineering projects.

Certainly throughout prehistory, the course of the Los Angeles River switched many times; events which would have had a profound affect on Ballona Creek and the residents around the lagoon. Even when the Los Angeles River captured the channel of Ballona Creek, the resulting stream was rarely able to flush out the gap. This resulted in an impounded lagoon, created by sand build-up along the beach as the result of ocean currents (Dillon et al. 1988:6). As a result of these natural forces, the soils in the gap are a mixture of unconsolidated silts, gravels and sand associated with stream action, silt and sand associated with the lagoon, and sand associated with beach deposits (Poland et al. 1959).

Prior to modern development the Ballona Lagoon would have been termed an estuarine lagoon (Davies 1973:152). While a lagoon is produced solely by marine action and lies between some sort of barrier feature and the original coast, an estuarine lagoon is formed when a river discharges into a lagoon which still owes most of its form to the sea.

As an estuarine lagoon matures, sediments from upstream are continually deposited at the mouths of the rivers. Eventually, siltation transforms the lagoon from an open expanse of water into an intricate network of estuary channels cutting through newly formed marshes and islands. These marshes usually host a wide diversity of plants and animals. In the 1870's, the Ballona Lagoon was home to a dense population of fish, water fowl, and sea mammals and was renowned for its hunting and fishing.

Van Horn and Murray (1985:5) argue that the change from a marine to estuarine lagoon was complete by around A.D. 1000. This environmental change would have forced basic shifts in the economies of cultures residing along the coast. Documenting the geomorphic processes and the rates of siltation is a major research objective of any work in the Ballona Lagoon.

Three basic microenvironments are present in an estuarine lagoon. Located on the high tidal flats are salt marshes, dominated by various species of pickleweed (*Salicornia* sp.) and salt grass (*Distichlis spicata*). Below the marshes are the tidal slopes which usually host a mud flat environment conducive to shellfish. The third microenvironment was the estuary habitat at the mouths of Ballona and Centinela Creeks. These estuarine environments are usually lined with willows (*Salis lasiolepis* and *Salis laevigala*) and cottonwoods (*Populus tremondii*) (Van Horn and Murray 1985:10). The rivers also would have supplied potable water for people living around the lagoon.

CULTURE HISTORY

Figure 3 presents some of the chronological sequences that have been devised for this portion of coastal California. Unfortunately, no one sequence has won universal acceptance or best fits the Gabrielino cultural remains in the coastal region. Given the small number of absolute dates from the region, it is hardly surprising that there is a lingering debate about the timing of cultural events and processes. This problem is exacerbated in the Gabrielino area, where sites have traditionally been cross-dated by placing their assemblages into better defined Chumash cultural sequences. This practice is problematic, but it is the best that can be done at present. Of the various sequences posited for the coastal region, the Wallace (1955) sequence, because of its general nature, appears to be most useful for this discussion. The cultural units in this sequence, or a variation of them (see also Wallace 1978), are used below.

The earliest commonly accepted dates of human occupation of the Los Angeles Basin derive from the La Brea site upstream of the Ballona Lagoon. Skeletal remains from La Brea Women have been dated to 9000 ± 80 before present (B.P.) (Dillon et al. 1988:10), which place the find contemporaneous with the Horizon I (Wallace 1955) or "Big Game Hunting Tradition" (Wallace 1978). Beyond the skeletal remains, however, few artifacts of this time have been found in Los Angeles County.

At present, not enough evidence exists to characterize all but the most rudimentary facets of early culture. All indications are that the economy was a mixture of hunting and gathering with perhaps a greater overall emphasis on hunting (especially big game hunting) than was true of later periods. The early culture disappears around 6000 B.C. The gradual desiccation associated with the onset of the Altithermal, a warm and dry climatic period dated roughly between 6000 and 3000 B.C., probably eliminated or greatly restricted many large game animals. Subsistence patterns shifted with a greater emphasis placed on plant foods and small animals.

While there is no doubt that a correlation exists between changing climatic conditions and the appearance of what has been termed the Millingstone Horizon, there is some question about cause-and-effect. The extent and consistency of climatic change is difficult to assess. Further, it is quite likely that the actual effects in any one area were conditioned in part by microclimatic and topographic features. Moreover, the rapid spread of new technologies has led many archaeologists to invoke some type of migration of diffusion as the major cause of culture change. Some have argued

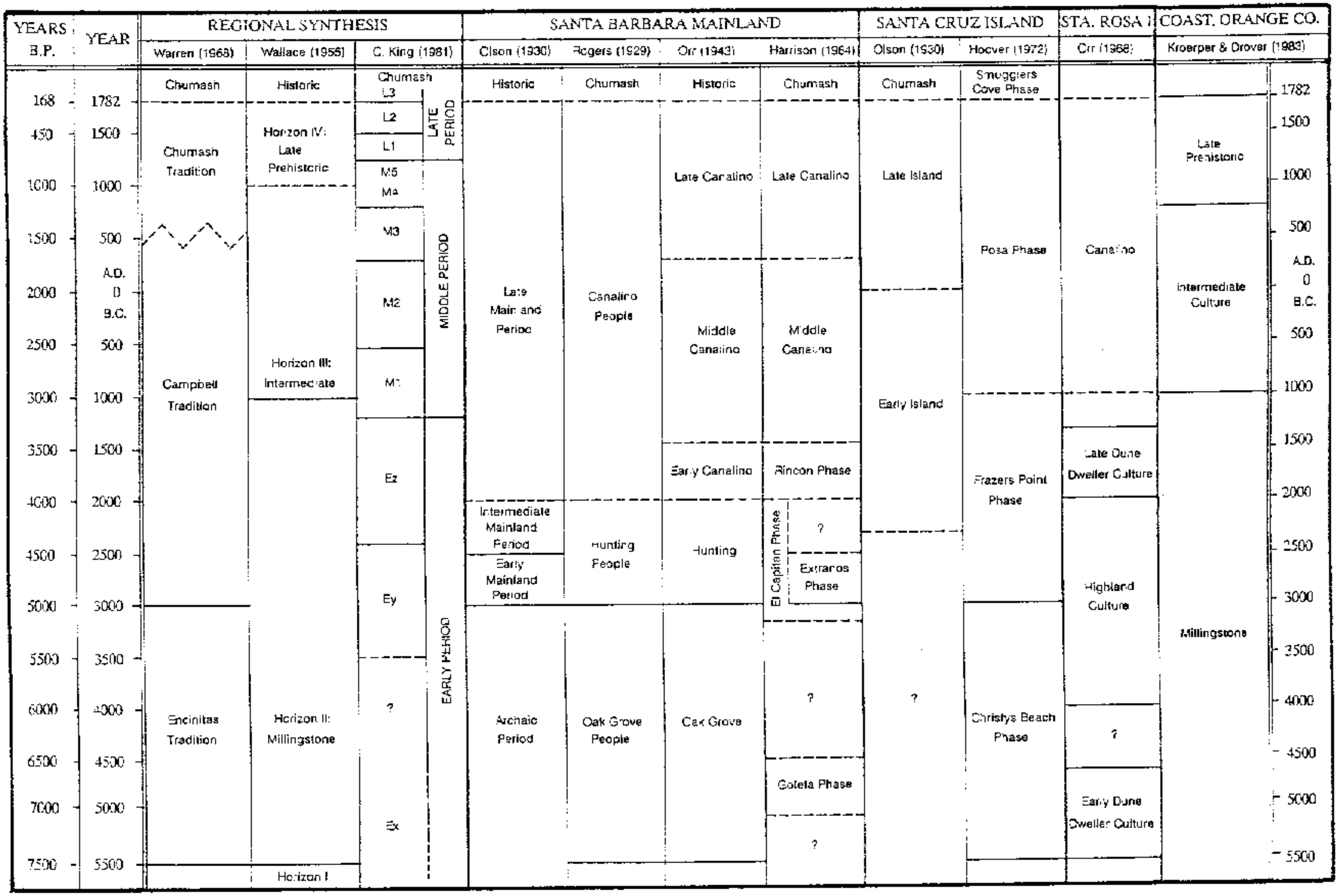


Figure 3. Concordance of Southern California Coastal Chronologies (adapted from Moratto 1984:125, Figure 4.5).

that the resulting culture, termed variously the Encinitas Tradition (Warren 1968), the Millingstone Horizon (Wallace 1955), the Pinto Complex (Warren and Crabtree 1979), and the Sayles Complex (Kowta 1969) was an outgrowth of indigenous cultural development that incorporated the millingstone technology from the outside (i.e., from the east). Others have suggested actual westward migration of desert people primarily in response to environmental desiccation (e.g., Kowta 1969).

The two explanations are not mutually exclusive. There is strong evidence in areas such as Diablo Canyon and Rancho Park North of indigenous development with an overlay and then incorporation of millingstone technology (Altschul et al. 1984). Other coastal regions like Topanga Canyon appear to reflect actual migration.

There is little doubt that major culture change occurred at this time. In their haste to systematize the data, archaeologists have tended to view all such change in southern California as part of the same cultural process. Yet if there is any consensus at all about this period, it is that groups became better adapted to their immediate environments, and subsistence patterns were varied. In all, the evidence suggests that rather than becoming culturally homogeneous, southern California actually supported a greater variety of cultural adaptations than ever before. Archaeologists have only made this situation more confusing by emphasizing the "Millingstone Horizon" (Wallace 1955). Indeed, to understand this period we will have to concentrate on evaluating local adaptations rather than global explanations.

In the Ballona Lagoon and adjacent Del Rey Hills evidence of Millingstone Horizon occupation is restricted to discoidal stones found at four sites. Lambert (1983) suggests that a discoidal found on the surface of CA-LAn-64 indicates that there is an earlier component to this predominantly late Millingstone Horizon site (see Figure 2). Van Horn (1987:135-137), on the other hand, argues that the discoidal found at CA-LAn-63 and the two found in the excavation of CA-LAn-64 either represent heirlooms or that the dating of this particular artifact type is in error. Van Horn (1987:21), however, is at a loss to explain the discoidals from the Marymount site (CA-LAn-61) and the Berger site (CA-LAn-206). These two Del Rey Hill sites were radiocarbon dated to 4710 ± 80 B.P. and 6750 ± 80 B.P., respectively. While Van Horn (1987:266) believes that the Del Rey Hills were abandoned at the beginning of the late Millingstone Horizon, there are currently not enough data to substantiate this claim.

Van Horn's studies revealed evidence, albeit scanty, suggesting that the area experienced renewed human occupation in the first millennium B.C towards the end of the Intermediate Horizon (Wallace 1955). Poor stratigraphic preservation, however, made it difficult for Van Horn and his associates to reconstruct this later occupation and differentiate its materials from the Late Prehistoric Horizon occupation that superseded it in the area. Occupation of the area apparently peaked during this Late Prehistoric Horizon, when the entire escarpment overlooking the Ballona Lagoon was lined with small temporary or seasonal encampments. This occupation apparently ended by A.D. 1000 when the area was again abandoned.

Occupations dating more-or-less continually from 1000 B.C. to A.D. 1000 have been reported from four bluff sites, CA-LAn-59, 61, 63, and 64 (Murray and Van Horn 1983; Van Horn and Murray 1984, 1985; Van Horn 1984, 1987). These occupations have been associated with a point style, termed the Marymount point, that has not been found elsewhere along the coast in Los Angeles County. The co-occurrence of Marymount points with those characteristic of the Pinto Basin and Gypsum Cave is taken by Van Horn (1987) as strong evidence for a connection between the occupants of Del Rey Hills and the Mojave Desert beginning in the late Millingstone Horizon and continuing into the Late Prehistoric Horizon.

This conclusion is supported by the occurrence of a small amount of burned human bone at the Marymount site (CA-LAn-61a), suggestive of cremation as a mortuary practice and the absence of marine shell artifacts. Cremation is generally associated with the desert groups at this time and is not known to have existed among indigenous coastal groups. Van Horn attributes the absence of shell artifacts in the hill top sites as indicative of a people unaccustomed to crafting this material.

In addition to these traits, a split cobble industry unlike that reported elsewhere on the coast is present at the sites on the Del Rey Hills. Van Horn (1987) terms the resulting flake from this technology, a potatoe flake, because it is "peeled" off the core. Finally, the Del Rey Hills sites share a microlith tradition unlike that found anywhere on the coast, and completely dissimilar from the contemporary microlith tradition on the Channel Islands. The Del Rey Hills industry utilized a bipolar flaking technology as opposed to the single faceted flaking technology used on the islands. Unlike Santa Cruz island where microblades were used as drills in a specialized shell bead-making endeavor (Arnold 1987), the Ballona microliths appear to have served a variety of functions, such as gravers for cutting wood or stone among other activities (Van Horn 1987:241).

The Late Prehistoric horizon encampments were well established by the time the bow and arrow was introduced in the region. Van Horn (1987:269-270) has proposed a projectile point sequence for the area beginning about 500 B.C. Prior to the introduction of the bow and arrow (Van Horn's Phase I), dart points such as the Gypsum Cave, side-notched types, and bipointed foliates were most common. Points made from obsidian or fused shale were rare at this time.

Phase IIa is characterized by the introduction of the bow and arrow between A.D. 350 and 500. Canalino style arrowheads were added to the existing inventory of dart points at this time. These new points showed little indication of expert manufacture and were made from locally available Monterey chert and chalcedony. Phase IIb is distinguished by what appears to be an arrowhead manufacturing industry characterized by an improvement in the quality of arrowhead production and the use of fused shale as a common raw material.

Phase III is distinguished by the addition of the Marymount point, a small tanged type made of fused shale, to the arrowhead assemblage. Van Horn suggests that these points were traded as components of arrowheads and were often re-worked when broken. One unusual aspect of the projectile point assemblage is that all the earlier point types apparently continued in use through Phase III.

Van Horn (1987:270) relates other changes in the occupation of the Del Rey Hills to changes in the environment of the Ballona Lagoon. He found oyster in the earliest levels at the Del Rey site (CA-LAn-63) and the Loyola site (CA-LAn-61b). Oyster, however, was completely absent from the later occupied Marymount (CA-LAn-61a) and CA-LAn-61c sites. Chione, which occurs in mudflat situations, dominated the shell fish remains at most of the Late Prehistoric horizon sites in the Del Rey Hills. Van Horn argues that the occurrence of oyster in the earlier levels suggests that the Ballona Lagoon was more of an open lagoon during the earliest phase of occupation and, subsequently, became a more estuarine environment that was more conducive to chione. The Hughes site (CA-LAn-59) was last site abandoned in the hills. The shellfish remains from this site are dominated by Pismo clam which inhabits open sandy shoreline habitats. Van Horn concludes from this association that the mudflats had largely silted in after A.D. 1000, resulting in a much more sandy shoreline than is evident today in the area.

At a more general level, Van Horn (1987:271) concludes that the inhabitants of the Del Rey Hills overlooking the Ballona Lagoon employed a generalized subsistence strategy that involved a broad mixture of local terrestrial and marine resources. Exploitation of marine shell and fish species focused on the lagoon with little evidence of exploitation of deep sea resources. That these residents had access to deep sea resources is indicated by the common occurrence in the Del Rey Hills sites of steatite cooking vessels obtained from Catalina Island. Another unusual aspect of the Del Rey Hills occupation is the virtual absence of evidence of shell artifact manufacture throughout the sequence of occupation. Stone beads and bone fishhooks, awls, beads, and pendants are common if not abundant. Only 1 percent of the beads were made of shell, however, and shell fishhooks are completely absent.

Van Horn argues that the numerous encampments along the escarpment of the Del Rey Hills were temporary or recurrent short-term occupations during various seasons. These encampments were rapidly abandoned around A.D. 1000. Van Horn (1987:272) attributes this final abandonment to an environmental shift that made the area unattractive to the local residents. About this time the lagoon upon which these residents depended underwent the final stages of siltation, an event manifested by the development of a sandy spit at the mouth of the lagoon and the deposition of wind blown sands on the escarpment.

Recent data suggest that Van Horn's conclusion that the Ballona was abandoned around A.D. 1000 is in error. Altschul and Ciolek-Torrello (1990) argue that beginning around A.D. 1000, there is a shift in settlement preference in the area from bluffs to the lagoon edge. These investigators point to a number of sites that have been recorded dating sometime in the period from about A.D. 1000 to 1769 when the Spanish explorer Portola entered the Los Angeles Basin.

Perhaps the best studied site of this period is the Admiralty site (CA-LAn-47), located on the northern edge of present day Marina del Rey, about 1 km north of the Playa Vista project area. The Admiralty site has been the scene of sporadic archaeological interest since its original recording around 1948. Portions of the site have been excavated on three occasions; in 1961 by Keith Johnson of UCLA, in 1988 by Brian Dillon, and in 1989 by Statistical Research.

Temporally diagnostic artifacts recovered at the Admiralty site all suggest that the site was occupied during the Late Prehistoric Horizon. Twelve radiocarbon dates point to a relatively short occupation around A.D. 1100. Corroborating evidence in found in the projectile points. Of the 49 projectile points recovered in the 1989 excavations, the majority have been typed as either Cottonwood Triangular or Desert Side-notched. Shell beads recovered were typed into categories defined by King (1974); including olivella disc, cupped, cylindrical, and lipped as well as abalone discs - all typical of the Late Prehistoric Horizon.

Other artifacts recovered include chipped stone debitage and tools, ground stone tools, worked shell, and small numbers of steatite vessel fragments and bone tools. Previous excavations at the Admiralty site recorded the same basic assemblage of artifacts. The absence of shell fishhooks and obsidian was notable. No prehistoric features were uncovered during our excavations. In 1961, however, Keith Johnson (personal communication, 1989) excavated four burials, one containing two individuals and perhaps a dog at the same site. In 1988, Brian Dillon (Dillon et al. 1988) uncovered a dog burial with no associated artifacts.

Faunal remains were relatively sparse. Small mammals, such as rodents and rabbits, dominate the collection. A small, but significant number of waterfowl were also recovered. A variety of fish, mostly from lagoon settings, were represented, although in much smaller proportions than were recovered from the Del Rey Hill sites. Large mammals, specifically deer and sea mammals, were present, but represented by relatively few bones.

The bulk of the collection was, not surprisingly, composed of shell. Of the 32 species represented, the most commonly encountered were various species of *Chione (C. californiensis, undatella, and fluctifraga*), that are most abundant in tidal flat settings. Common Pacific Littleneck (*Protothaca staminea*) and Native Pacific Oyster (*Ostrea lurida*) were also common.

The Admiralty site collection differs from the Del Rey Hill sites primarily in economic orientation. The residents of the Del Rey Hills focused primarily on terrestrial resources, whereas residents of the Admiralty site looked to the lagoon and the ocean for their food. Culturally, however, there is much to link the two occupations. Projectile point styles in both settings are dominated by point styles that are believed to derive from the desert. Both collections contain a microlith industry that is not only absent elsewhere on the coast, but also lacking in the desert. The presence of this industry at both bluff and lagoon sites suggests that the Ballona area may have hosted a localized cultural tradition. While non-local resources, such as shell beads and lithic raw materials, indicate ties to other areas, these ties may have been rather weak. Groups in the Ballona area, then, may have been culturally isolated leading to a unique cultural expression. Alternatively, the assemblages may simply reflect an emphasis on different resources than found at most other coastal sites.

Why, after 1500 years, would people shift their residences from the hills to the lagoon? One hypothesis that can be forwarded is that the settlement shift reflects a generalized adaptational response to changing local environmental conditions. The transition from open lagoon to sediment choked estuary probably took place over a 3000-year period. At the beginning of the occupation there were clear advantages to living on the bluffs even though most subsistence pursuits were carried out at the edge of the lagoon. As sedimentation continued to build up in the lagoon, the effects of major floods would have been blunted. At some point after A.D. 1000, the advantages of living on the edge of the marsh outweighed the risks of flooding. Although situated much closer to critical subsistence-related resources, this move placed residents in some peril during late winter and early spring. It is possible that the site was not occupied during these seasons, but this suggestion runs counter to both ethnographic practices and most cultural reconstructions (e.g., Johnstone 1962).

Van Horn (1987) argues that the early prehistoric settlements on the bluffs were small temporary camps and processing sites occupied primarily in the winter-spring seasons. Most cultural reconstructions, however, argue that the late prehistoric and protohistoric settlements along this part of the coast were primary villages (Bean and Smith 1978:539) that often rivaled the large and better known coastal Chumash villages in size and wealth of material culture. Work at the Admiralty site has not definitively established whether the site was occupied year-round or seasonally. Altschul and Ciolek-Torrello (1990) argue that the dearth of variety in the recovered remains at the Admiralty site suggest it was more likely a temporary camp or processing site occupied during the winter-spring period. Whether the same is true of other late prehistoric sites in the Ballona Lagoon, such as CA-LAn-54, 62, 193, or 211 is a major research question which data from this project should be able to address.

The shift to the edge of the lagoon may be a response to increased concern over access to resources resulting from demographic pressure, environmental degradation, or both. If demographically inspired, late prehistoric settlements should be larger and closer to critical resources than their predecessors.

As to environmental degradation, while aboriginal adaptations traditionally have been viewed as harmonious with nature, the effects of even small populations on fragile, localized resources, such as a salt marsh, are now being recognized as anything but benign. There is no question that the delicate balance of a lagoon ecosystem can be easily upset by the over-exploitation of resources. Over-exploitation leads to a diminishing resource return and, therefore, should lead to substitution of one resource for another, or in this case abandonment of one lagoon for another. However, if there is no substitute resource and other lagoons are already occupied, then intensification of traditional practices might result. One means of intensification might be to move closer to the resource.

While European exploration of California began in 1542, with the arrival of Juan Rodriguez Cabrillo, it was not until 1769 that the Spanish presence was felt in the Los Angeles Basin. At that time, Portola first made recorded contact with a group of Indians which later became known as the Gabrielino. Portola reported stopping at an Indian village called **Yang'na** on the Los Angeles River near present day downtown Los Angeles. Portola's route to Monterey did not cross Ballona Lagoon.

Although unknown to Portola, there is strong evidence that the Ballona was occupied by indigenous groups well into the Historic Period. Kroeber (1925) has a Gabrielino village called Saan plotted on the north side of Ballona Creek above the delta where this creek meets Santa Monica Bay. Johnstone (1962) places the Gabrielino village of **Sa'angna** in a cluster of archaeological sites south of Ballona Creek. Given their location, these sites are probably the Del Rey Hill sites, which had been abandoned for nearly 1000 years by the time of Johnstone's report. Finally, it is worth noting that an early describer of Gabrielino culture, Hugo Reid, could not recall any Gabrielino village in the Ballona area (Dakin 1978:220-221), although he freely admitted he could not remember them all.

Two years after Portola's expedition, an event that would have drastic ramifications for Native American groups in the Los Angeles Basin occurred. In 1771, Mission San Gabriel was founded. The clerical leaders of San Gabriel encouraged and then forced natives from the Los Angeles area to congregate at the mission. Changes were forced upon the natives beginning with their name, Gabrielino. The results were catastrophic, with large numbers of Indians dying from disease or killed by the Spanish.

As the Gabrielino moved out, Ballona Creek and its lagoon began to attract the attention of Spanish stock raisers who fanned out from San Gabriel and Los Angeles in search of pasturage. By the late 1700s and early 1880s, the area was periodically used for cattle grazing, starting a tradition that would continue into the twentieth century with the local dairy industry. By the early 1800s, the creek and the lagoon were beginning to be associated with two particular settlers: Felipe de Jusus Talamantes and Jose Agustin Antonio Machado (Swanson 1990). From the beginning, the Machado family would be the name most closely associated with the area around the lagoon.

After much haggling with local and national officials, Machado and Talamantes were finally granted Rancho La Ballona in November 1839 by Governor Alvarado in Monterey. By the terms of the grant, the boundaries of the rancho were established to the east by Rancho Rincon de los Bueyes, to the north by Rancho San Jose de Buenos Ayres, to the south by Sausal Redondo, and to the west by the holdings of Jose Sepulveda.

At the conclusion of the Mexican-American War, Alta California was ceded to the United States. One of the conditions of the final peace treaty was that native Californios would be allowed to retain their land holdings. While a good idea in theory, the execution of this condition forced many landholders to weather decades of legal actions. Machado was one of the wealthier people in Los Angeles, and thus was able to succeed in pressing his claim to the land.

The break-up of Rancho La Ballona began in 1857 with the death of Talamantes followed by the death of Machado in 1865. Both men had numerous heirs to the land; 25 for Talamantes and 14 for Machado. The working of the ranch became more and more difficult with the multiplicity of owners, and most sold their land within a decade.

The coming of the railroad in the mid 1880s had great repercussions on life in the Ballona. Speculative schemes, perhaps typified by the original plans for the nearby city of Venice to be a scaled model of the Italian city, were concocted. Most failed quickly. Along the edge of the Ballona, hunting and fishing resorts were established, although none were successful for long.

Commercial and industrial activities started to move into the Ballona area during the early twentieth century. Oil wells and refineries were common. By 1931, 325 oil wells were active in Ballona Lagoon, with refineries and tanks built up on islands of fill (Swanson 1990). Indiscriminant dumping of waste material during WWII eventually led to the restriction of oil pumping in Ballona Lagoon.

In addition to oil related activities, the Ballona hosted a relatively strong agricultural community. Japanese truck farmers were scattered throughout the Ballona floodplain, growing a variety of crops.

Most of these farmers were squatters, with shanty towns established at a pace equivalent to the rate that officials were able to close them down.

The increase in urban development led to the channelization of Ballona Creek, whose unspoiled beauty had first led the movie industry to Culver City. In the early 1920s, the upper course of the creek was channelized, a job that was finished by the U.S. Army, Corps of Engineers in 1935, at the suggestion of the Los Angeles County Flood Control District. No longer the set for filming canoe attacks as in the 1910s, the creek was soon a two-mile long rowing course used by sculling crews from the surrounding universities (Swanson 1990).

During WWII, defense related industries were established surrounding and including the Ballona. After the war, many of these companies switched to products for the general public. In the 1960s, the largest inland man-made marina, Marina del Rey, was constructed in the northern half of the lagoon. Since that time the Ballona has hosted a mixture of light industry, residential communities, and recreational facilities.

PREVIOUS ARCHAEOLOGICAL RESEARCH

Although a large number of sites have been found in the vicinity of the Ballona wetlands, previous archaeological studies in the area have been sporadic and limited in scope. Much of the area has been surveyed since the advent of cultural resource management (CRM) studies in the 1970s, but few new sites were found during the course of these studies. Instead, most of the sites were found at a much earlier date, and subsequently have been obscured by development. Many of these earlier studies were undertaken by interested amateurs. At best, the resulting reports have been of variable quality; at worst they have been poorly documented, second-hand reports of the work of collectors and pothunters.

Table 1 is a summary of previous archaeological projects in the Ballona region that have been recorded at the UCLA information center. Figure 4 plots the location of all sites given permanent site designations. Figure 5 presents the areas known to have been surveyed. It is important to note that Table 1 is not an exhaustive list of projects. Many recent projects, including several testing projects conducted by Van Horn and his associates at sites within the Playa Vista project site, have not been recorded at the information center. In the discussion that follows we have attempted to describe all archaeological projects conducted within the Playa Vista boundaries.

Perhaps the first archaeological work conducted and recorded in the Ballona was performed by Malcom Farmer. Farmer was an active amateur collector, who at the request of Clement Meighan of UCLA, submitted his handwritten notes to that institution in 1936. Farmer recorded sites CA-LAn-67, 68, 69, 70, 71, 72, 73, and 74 (Farmer 1936).

Another early investigator was Stuart Peck (1947), then assistant curator of the museum at UCLA. Gas rationing during WWII forced Peck to curtail his archaeological searches in the desert and focus on an area closer to home. Peck chose to conduct limited excavations from 1945 through 1946 at the Mar Vista site, CA-LAn-193, located on property owned by the Hughes Aircraft Company.

One of the most active amateurs in the area was William Deane. Deane was a local mechanic and collector who was active during the late 1940s and early 1950s (Van Horn 1984a:30). Some of his artifacts were photographed and briefly described by Marlys Thiel who used this information in an unpublished paper (Thiel 1953).

Table 1. Summary of Previous Archaeological Projects in the Vicinity of the Playa Vista Project, recorded at the UCLA Information Center.

UCLA Project No. (EIR #)	Project Type	Report	Site Recorded, Tested, or Excavated	Location
L.-27	Survey		no sites	NE of and paralleling Ballona Lagoon and Grand Canal, SW of Marina del Rey.
L.-78	Survey		no sites	Imperial Hwy.
L.-96	Site Recording		LAn-691	N of Imperial Hwy and 1.2 mi. W of Sepulveda Blvd.
L.-125	Survey		no sites	Sewage plant SE of Imperial Hwy & Vista del Mar.
L.-188	Survey		no sites	Dockweiler Beach State Park, NW of Playa del Rey.
L.-211	Testing	Dillon (1982b)	LAn-61,1018	On Bluff west of Loyola Marymount
L.-253	Survey	Stickel (1988)	LAn-47	NW of Admiralty Way and Lincoln Blvd.
L.-309E	Survey		no sites	Intersection of Sepulveda Blvd. and Lincoln Blvd.
L.-340	Survey		LAn-213	SE of Sepulveda Blvd. and I-405.
L.-436	Survey	Pence (1979)	LAn-54,62,193,203, 204,206,211,212,213,216,1018	Summa Corp. Property Survey (now owned by MTP).
L.-442	Survey		no sites	Within EIR# L.-27, West of Basin B, Marina del Rey.
L.-462	Survey		no sites	NE of Hwy 90 and Mindanao Way.
L.-513	Survey		no sites	South of Manhattan Ave. and east of Pershing Dr.
L.-624	Survey		no sites	Within EIR# L.-27, west of Basin B, Marina del Rey.
L.-630	Survey		no sites	Within EIR# L.-27, west of Basin B, Marina del Rey.
L.-682	Survey		no sites	West of Grand Canal, 0.25 mi. So. of Washington Blvd.
L.-724	Excavation	King (1967)	LAn-194	North of Hwy 90 and 0.5 mi. east of I-405.
L.-729	Excavation	Peck (1947)	LAn-62	South of McDonnell Douglas complex in project area.
L.-737	Survey		no sites	West of Washington St. and Oxford Ave.
L.-748		Schofield (n.d.)	LAn-61	On bluff west of Loyola Marymount.
L.-750	Site Recording	Thiel (1953)	LAn-54,59-65,67, 206,211	On bluff west of Lincoln Blvd.
L.-751	Site Recording	Rozaire&Belous(1950)	LAn-59-66	On bluff So. of Playa Vista, W. and E. of Lincoln Blvd.
L.-839	Site Recording	Farmer (1936)	LAn-59-65,67	On bluff south of Playa Vista project area
L.-846	Survey		no sites	SE of Washington St. and Pacific Ave.
L.-873	Survey		no sites	On bluff west of Pershing St. and Jefferson Blvd.
L.-876			LAn-216	South of Sepulveda Blvd. and I-405.
L.-1143			LAn-1018	South of bluff and east of Lincoln Blvd.
L.-1157	Survey		no sites	Within EIR# L.-27, west of Basin D, Marina del Rey.
L.-1173	Survey		no sites	East of confluence of Ballona and Centinela creeks.
L.-1202	Survey	Dillon (1982a)	LAn-61,1018	On Bluff west of Loyola Marymount
L.-1249	Survey	Aycock (n.d.)	LAn-63, 64	On bluff west of Lincoln Blvd.
L.-1282	Survey		no sites	Dockweiler Beach State Park, NW of Playa del Rey.
L.-1321A&B			LAn-59	On bluff 0.5 mi. west of Sepulveda Blvd. and I-405.
L.-1443	Testing	Van Horn (1983)	LAn-61, 1018	On bluff west of Loyola Marymount.
L.-1444	Testing	Van Horn et al.(1983)	LAn-62A & B	Below and north of bluff and east of Lincoln Blvd.
L.-1509	Survey		no sites	Approx. 1 mi. SE of Sepulveda Blvd. and I-405.
L.-1512	Data Recovery	Archaeo.Assoc.(1986)	LAn-63, 64	On bluff west of Lincoln Blvd.
L.-1609	Survey		no sites	South of confluence of Ballona and Centinela creeks.
L.-1613	Survey		no sites	NW of Manchester Ave. and Hastings Ave.
L.-1614	Survey		no sites	NW of Manchester Ave. and Hastings Ave.
L.-1626	Survey		no sites	Dockweiler Beach State Park.
L.-1975	Survey	Peak&Assoc.(1989)	LAn-1698,1018	Along Lincoln Blvd. within Playa Vista

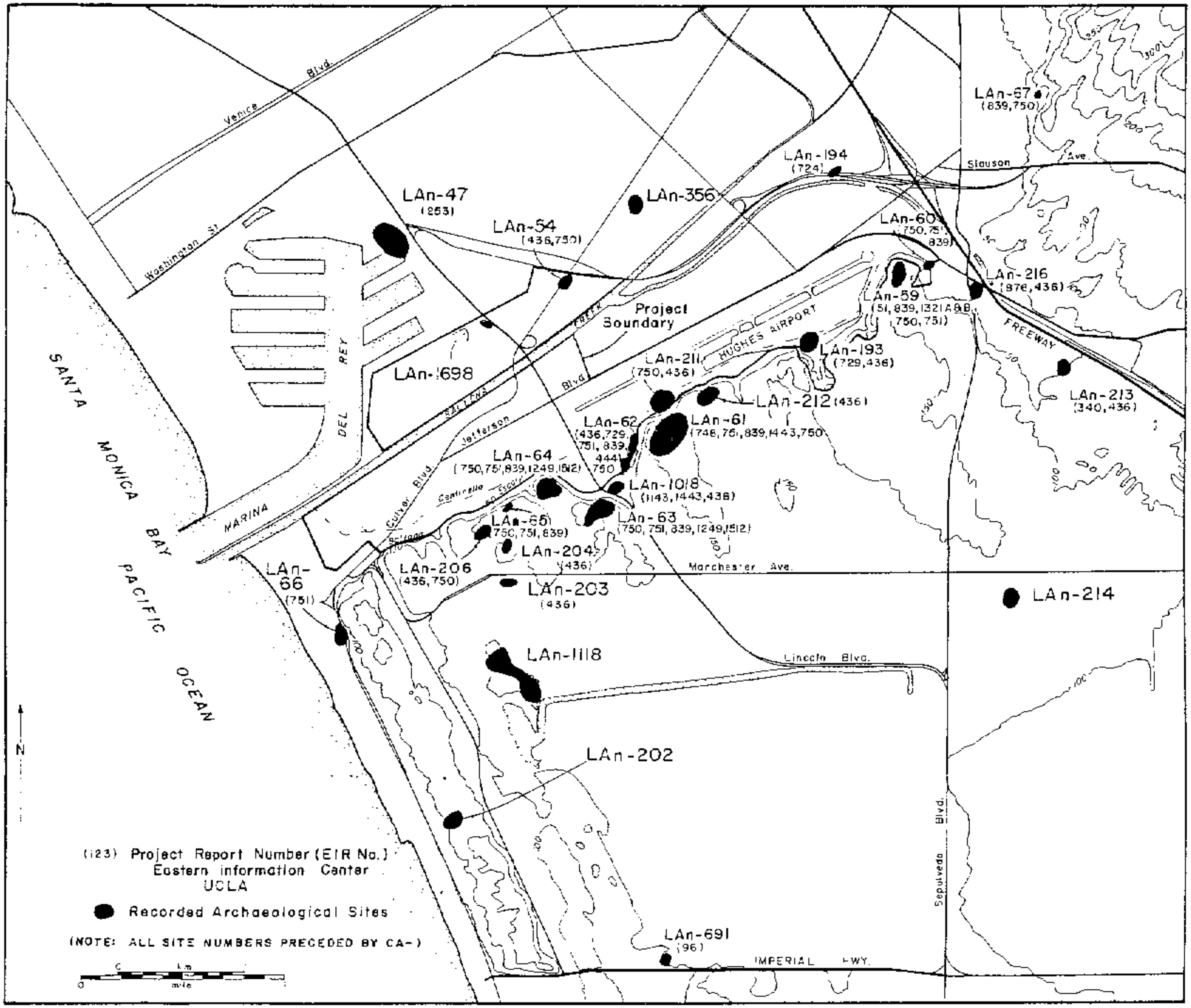


Figure 4. Previously Recorded Archaeological Sites in the Del Rey Hills and Ballona Wetlands. (Relevant UCLA EIR #'s indicated in parentheses).

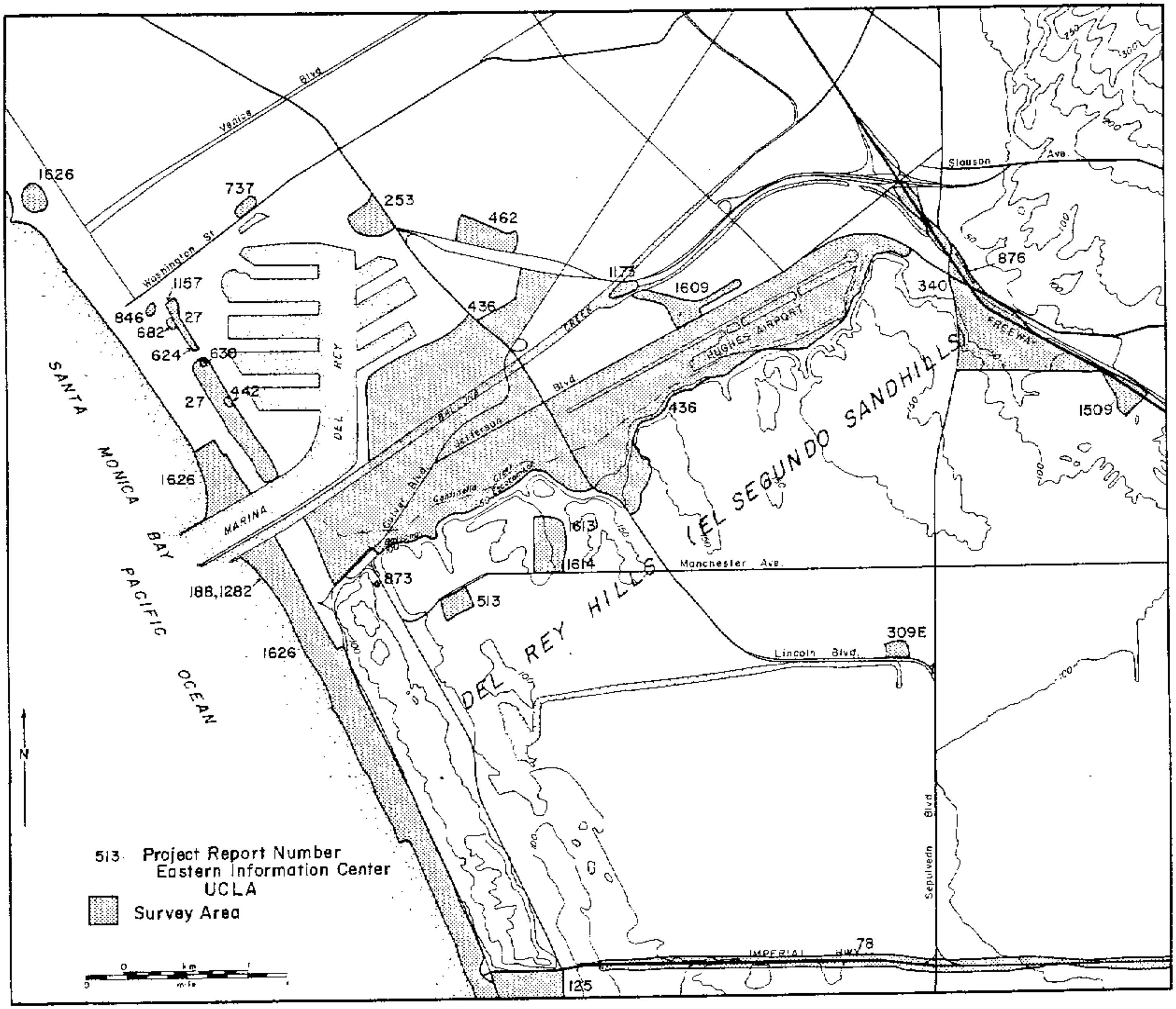


Figure 5. Previous Surveys conducted in the Del Rey Hills and Ballona Wetlands, designated by UCLA EIR #.

In 1950, two other investigators then students at UCLA, Charles Rozaire and Russell Belous, prepared a paper on Ballona Creek archaeology for an anthropology course. The paper is primarily a compilation of primary sources on the geology, environment, and archaeology of the region. The paper does include site forms for 23 sites visited and recorded by these two students (Rozaire and Belous 1950).

The area was essentially ignored by professional investigators until 1979 when R.L. Pence was contracted by Summa Corporation to conduct a reconnaissance survey of the entire parcel now being considered for the Playa Vista development. Pence's survey was cursory in nature, and he states that not all areas were covered systematically. Pence (1979) does briefly describe 17 sites, 16 of which had been previously recorded. The only sites within the project area discussed by Pence were CA-LAn-54, 60, 62, 193, and 211. In 1984, Van Horn (1984) re-surveyed the project area at the request of Engineering Technology, Inc. His findings mirrored those reported by Pence.

Since Pence's survey, there have been a large number of projects conducted in and around the Ballona. Most of these have been small clearance surveys, and only one has been located within the project boundaries. This survey, conducted by Peck and Associates in conjunction with the development of a fiber optics line, was restricted to a narrow corridor along Lincoln Boulevard. One new site, CA-LAn-1698 which consisted of a shell scatter with no observed artifactual remains, was recorded. In addition, CA-LAn-1018, located just outside the southern boundary of Playa Vista, was re-visited.

Beyond surveys, a few testing and data recovery projects have also been completed in the Ballona. Some of the larger projects include excavations at the Admiralty site conducted by Keith Johnson in 1961, Brian Dillon (Dillon et al. 1988) in 1987, and Jeffrey Altschul and Richard Ciolek-Torrello in 1989 (Altschul 1989). Additionally, Chester King (1967) excavated at the Hammack Street site (CA-LAn-194) in 1965.

The most extensive work in the vicinity of the project area has been conducted by Van Horn and his colleagues as part of several large-scale test excavations and data recovery projects at a series of sites in the Del Rey Hills, including CA-LAn-59, 61, 63, 64, and 206 (Murray and Van Horn 1983; Van Horn and Murray 1984, 1985; Van Horn 1984b, 1987). Brian Dillon (1982a, b) also conducted test excavations at CA-LAn-61 and 1018.

Within the project area, test excavations have been conducted at CA-LAn-62 and 211. In early 1983, Chester King and Clay Singer, under contract with the Koll Company, tried unsucessfully to locate CA-LAn-62 with a backhoe (King and Singer 1983). Their attempt was followed in September of 1983 by Van Horn and his colleagues, who had been retained by the Koll Company and the Hughes Aircraft Company, to monitor and study a series of soil corings in the area of CA-LAn-62. These investigators found a portion of the site (CA-LAn-62a), but given the limited nature of their investigations were unable to assess its research potential. In 1987, Van Horn and his colleagues were contracted by Howard Hughes Properties, Inc. to conduct test excavations both at another locus of CA-LAn-62 (b) and a locus of the nearby site, CA-LAn-211 (b) (Freeman et al. 1987). These sites were found to contain intact deposits, although the nature of the occupations could not be inferred.

SUMMARY

One indisputable fact can be derived from the extensive investigations that have been carried out along the bluffs of the Del Rey Hills -- prehistoric occupation was widespread and intensive along this geographic feature. Sites occur all along the edge of the bluff top, on every elevated topographic feature at the base of the slope, and on any level bench protruding from the bluff slope.

Although numerous studies of the Ballona have been conducted over 50 years, the area's archaeology remains poorly understood. Van Horn (1987) presented a series of notions about prehistoric settlement consistent with his work on the bluffs. New data from the lagoon's edge has led to challenges of portions of these ideas. Recently, Altschul and Ciolek-Torrello (1990) offered a model explaining settlement shifts in the Ballona Lagoon from 1000 B.C. until contact. According to these investigators, settlement shifted from the bluffs to the lagoon partly because siltation created a estuarine setting conducive to resource exploitation of the lagoon and partly in response to cultural factors such as demographic shifts and increases in cultural complexity among coastal populations. Data from this project should allow refinement and testing of this model, as well as a deeper understanding of the prehistoric coastal adaptations in southern California.

CHAPTER 3
RESEARCH DESIGN

The Playa Vista Archaeological and Historical Project offers the opportunity to expand and possibly re-write much of our knowledge of the history of human settlement in the Ballona area. To meet this challenge, a comprehensive approach to both prehistoric and historic cultural resources has been developed.

The design presented below is divided into three parts. The first part presents the legal framework through which significant cultural resources are defined and protected. This process necessitates the development of historic contexts that based on our current knowledge of the Ballona prehistory and history represent gaps in that understanding, and which could potentially be addressed with data recovered from archaeological sites in the project area. If a site has the potential to yield data on one or more of these contexts, then mitigative measures need to be devised for the resource.

The second part of the research design, then, outlines the historic contexts we have devised for this particular project. This section is followed by the third part which presents the methods used to obtain data to assess the significance of sites. Together the historic contexts and the methods provide the foundation to complete Step 1 of the Federal compliance process (see Chapter 1).

PROJECT HISTORY

In 1989, Maguire Thomas Partners-Playa Vista (MTP-PV) became the owner of the Playa Vista project area and inherited a proposed development project with a complex history of legal and public involvement. In 1984, the Friends of Ballona Wetlands had filed suit against the California Coastal Commission challenging the certification of a coastal land-use plan for the Ballona. The plan authorized the building of a regional roadway across the wetlands in Area B and the building of a residential development and a golf course within those wetlands (McAlister 1990). Working in close concert with the plaintiffs, MTP-PV crafted an agreement with the Friends of Ballona Wetlands to resolve the issues underlying the old suit. According to the settlement agreement (McAlister 1990:1), MTP-PV agreed to undertake the following actions:

1. Downscaling of commercial development.
2. Elimination of development in contiguous wetlands.
3. Increasing wetlands acreage by transforming dryland upland.
4. Increasing wetland values through multi- functional wetland restoration.
5. Providing at a minimum mid-tidal restoration of the saltmarsh through the commitment by MTP-PV of restoration and maintenance funding up to a maximum of $10 million.
6. Pursuing enhanced wetland restoration to include a full tidal flushing of the saltmarsh by making mitigation credits available to the Ports of Los Angeles/Long Beach and others.

To meet actions 4-6, MTP-PV applied to the U.S. Army, Corps of Engineers for a permit under Section 404 of the Clean Water Act. The permit application requires an environmental assessment, which includes cultural resources, under the National Environmental Policy Act (NEPA). In addition, the actions requiring a Section 404 permit represent an "undertaking" as defined by the National Historic Preservation Act of 1966 (NHPA). Section 106 of the NHPA requires Federal agencies to consider the effects of their actions on historic properties and to provide the Advisory Council on Historic Preservation (ACHP), an independent review board, the opportunity to comment.

The Section 106 process involves steps to identify and evaluate historic properties; to assess the effects of the agency's proposed action on the historic properties; and, if the effects may be harmful, consultation about ways to avoid, reduce, or mitigate them (ACHP 1986). Consultation involves the agency and the State Historic Preservation Office (SHPO), and often includes the ACHP and other interested parties. Consultations usually result in a Memorandum of Agreement (MOA), which specifies particular steps for avoiding or reducing harm to historic properties.

Generally, an MOA accepted by the ACHP serves as that body's comment. In the unusual circumstance when an agreement cannot be reached, the agency requests the ACHP's comments on the undertaking, notifying all other interested parties of its request. The agency must then take into account the ACHP's written comments, and make a final decision about how to proceed, notifying the ACHP about its decision.

On unusually large or complex projects or a class of undertakings that requires numerous individual requests for comment under Section 106, an alternative to a case-by-case review is a Programmatic Agreement. A Programmatic Agreement outlines a review process specific to a particular project that stands in place of the normal Section 106 process. Because of the large amount of previous work on cultural resources on this particular project area and the relatively well-defined project effects, the Corps of Engineers has recommended that an MOA is preferable to a Programmatic Agreement for this project.

In addition to Section 106 compliance, the project falls under the purview of the City and County of Los Angeles and the California Coastal Commission. The project involves discretionary actions by the City and County of Los Angeles, and therefore it is subject to review under the California Environmental Quality Act (CEQA). To this end, environmental impacts, including potential significant impacts to cultural resources, are being evaluated as part of a series of Environmental Impact Reports (EIR). For Playa Vista, the City of Los Angeles will follow the most restrictive requirements for cultural resource assessment, in this case the Section 106 process (Wyatt 1990). This position is consistent with State CEQA guidelines:

> A Public Agency following the Federal clearance process under the National Historic Preservation Act or the National Environmental Policy Act may use the documentation prepared under the federal guidelines in the place of the documentation called for in this appendix. (State of California CEQA Guidelines, Appendix K(VI) 1986).

Portions of the project are also subject to review by the California Coastal Commission as required by the California Coastal Act. Given the extent of projected archaeological subsurface investigations within the coastal zone, the proposed actions require a coastal development permit. To obtain such a permit requires submittal to the commission of a research design subject to peer review and input from appropriate Native American Groups. In lieu of the above material, the Coastal Commission will accept an approved MOA.

An MOA is a legally binding document. The agreement is accompanied by supporting documentation that consists of the following six sections:

1. Description of the undertaking.
2. Description of the properties that may be affected.
3. Description of the efforts used to identify historic properties.
4. Description of the undertaking's effects on historic properties, and how and why the criteria of adverse effect were found to be inapplicable in the case of a no adverse impact determination.
5. Views of the SHPO, local governments, tribes, federal agencies, and the public.
6. Description of alternatives to deal with the undertaking's effects.

Although the MOA and supporting documentation are separate documents, the research design presented herein covers material for sections 1-4. Descriptions of the project as well as previously recorded cultural resources are found in Chapters 1, 2, 4, and 5. Chapter 6 details the effort thus far to identify previously unrecorded sites within the project area. Chapters 7 and 8 present recommendations for evaluating National

Register eligibility of the recorded properties as well as methods for identifying still unrecorded cultural resources.

NATIONAL REGISTER EVALUATION

One of the central points of agreement critical to the success of an MOA is the criteria to be used for evaluating the potential of cultural resources for inclusion in the National Register of Historic Places. Title 36, Part 60 of the Code of Federal Regulations (36 CFR 60) is a series of regulations which cover the National Register of Historic Places. Included in Part 60 are 15 sections. Of primary concern here is 36 CRF 60.4, the section which contains the criteria for evaluating eligibility to the National Register. 36 CFR 60.4 reads as follows:

> National Register criteria for evaluation.
>
> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Determinations of eligibility for all properties, other than areas of the National Park System and National Historic Landmarks, are made in reference to these four criteria. In addition, there is a general stipulation that the property be 50 years old or older (for exceptions see 36 CFR 60.4, Criteria Considerations a-q).

The National Register of Historic Places recognized five categories of significant properties: objects, structures, buildings, sites, and districts. A significant object contains functional, aesthetic, cultural, historical, or scientific value. The object may be movable, yet related to a specific setting or environment. In general, large objects, such as a steamboat, are eligible for listing in the National Register, whereas small objects not designed for specific locations, such as works of art, are not.

A structure is defined as a work made up of interdependent and interrelated parts in a definite pattern of organization (NPS 1982:7). Usually structures are engineering features. For example, a truss bridge may be considered a structure made up of the metal or wooden truss, the abutments, and any supporting piers.

A building is defined as a structure created to shelter human activity (NPS 1982:7). To be considered for the National Register, a building should include all its structural elements. If elements are missing, a property may more appropriately be considered a "site". The designation building may also be used to refer to a group of related buildings, such as a house and barn. This designation is appropriate when all of the individual buildings contribute to the significance of the whole and when no other types of properties are present (NPS 1982:7).

A place where a significant event or series of events occurred is defined as a site. A site may be marked by physical remains as in the case of a prehistoric settlement or it may be the symbolic focus of a significant event that may never have been occupied.

A group of sites, buildings, and/or structures confined to a geographically definable area may be considered a district if the properties are united by past events or aesthetically by plan or physical development (NPS 1982:5). The conceptual basis for historic districts can range widely. Examples include buildings associated with a specific industrial facility, a sample of buildings affiliated with a particular historical developmental trend, or even a group of prehistoric sites related by a common research design.

According to the National Park Service (1986:9) decisions about a property's (either a structure, building, site, or district) significance can reliably be made only within the context of an area's history. Thus, compilation of an area's background history or "historical context" is the logical first step in designing a research design and is crucial to the evaluation of any property. A historic context is a body of information about historic properties organized by its basic elements: theme, place, and time (National Park Service 1986:7-8). A theme is the equivalent of a research problem, and an historic context is developed by placing the problem in an appropriate setting in both time and space. The particular historic context is linked to tangible cultural resources by the concept of property type: a grouping of individual properties based on a set of shared physical or associative characteristics (National Park Service 1986:7). For historic buildings, property types can be based either on shared architectural styles or a common function. For the archaeologist property types can be based upon our prediction of what resources likely existed at a site and our expectations of what their likely condition is today.

Three historic contexts were developed for cultural resources in the Ballona. These are: 1) to elucidate the interplay between prehistoric cultural adaptations and a changing environment; 2) the cultural history and cultural dynamics of prehistoric occupation of the Ballona; and 3) the place of the Ballona in the development of historic Los Angeles.

Sites that can yield information on these issues will be considered significant, and thus, eligible for inclusion in the National Register of Historic Places.

HISTORIC CONTEXT THEMES

Man-Land Relationships

This theme encompasses several issues. First, we need to define the environmental parameters within which culture evolved. Second, we must identify the subsistence strategies utilized through time. Finally, a third issue, related more to evaluating the inventory's completeness than to site significance, concerns an assessment of finding as yet undiscovered buried sites in the project area.

Paleoenvironment and the Issue of Buried Sites

Although few archaeological sites were identified by R.L. Pence (1979) during a surface reconnaissance survey of much of the proposed project area, it is possible that cultural deposits remain buried. Cultural deposits could be buried by either alluvium or obscured by historic land modification activities. The previous survey was not designed to locate buried sites and this potential was not even considered. However, buried cultural deposits have been documented in similar environmental settings at nearby sites on the Ballona Creek floodplain. For example, at the Hammack Street site (CA-LAn-194) located about 500 meters north of the project area on Centinela Creek, Weide (1967) found that the upper three to four feet (ca. 0.9-1.2 m) of sediment represents no more than 100-125 years of alluvial accumulation as indicated by the presence of associated historic artifacts. An earlier undated component represented by chipped stone and groundstone artifacts was found at a depth of about six to seven feet (ca. 1.8-2.1 m) below this upper cultural component. Late prehistoric cultural deposits buried by shallow historic overburden were also found at the Admiralty site (CA-LAn-47), a shell midden located about 700 meters north of the project area near Lincoln Boulevard (Altschul 1989).

Prior to any further landscape modifications, a preliminary subsurface geomorphic study of the proposed project area should be undertaken to investigate the potential for buried archaeological sites. The primary goal of this initial study should be aimed at reconstructing the paleoenvironment in order to determine if additional work is warranted to search for buried cultural deposits. More specifically this study should be geared towards obtaining data for paleotopographic and paleoecologic reconstruction. The Quaternary history of the Ballona Lagoon is characterized by dynamic environmental changes. Most important are the shift from an open lagoon to an estuarine environment and migrations of the Los Angeles River channel. These changes are primarily the result of the lowering of sea level and rapid tectonic uplift and subsidence. These environmental changes, in turn, had profound effects on prehistoric settlement and resource procurement.

The following research questions should be addressed in this preliminary geomorphic study:

1) Are stable land surfaces buried and if so, what are the ages?

2) Can the stratigraphy be related to nearby archaeological sites on the floodplain?

3) What is the rate and timing of sedimentation in the Ballona Lagoon?

4) What depositional environments are represented?

5) Are buried ancestral channels of the Los Angeles River present?

6) What is the potential for finding buried archaeological sites and in what contexts should these be found?

Data Requirements

Although not specifically related to questions of site significance, knowledge of the paleotopography and paleoecology of the Ballona Lagoon is critical for evaluating the types of research questions that can be posed for the archaeological sites. For example, evidence demonstrating that the area was transformed from an open saltwater lagoon to an estuarine environment during the period of prehistoric occupation would suggest that a study of subsistence change in the face of environmental change would be fruitful. Alternatively, if data on paleoenvironmental conditions were not preserved or the conclusions ambiguous, then studies of subsistence would necessarily have to be limited to site-specific comparisons, and not the interplay between man and nature on a regional scale.

To determine whether paleoenvironmental conditions can be discerned, stratigraphic and soils data are required. Stratigraphic data are needed to relate soil horizons or ancestral stream channels from one end of the lagoon to the other. Ideally, a series of trenches would be excavated the entire length and width of the project area. Such an approach, however, would be extremely costly and probably unnecessary. An alternative approach would be to cut a series of skip trenches or place geologic cores systematically across the length and breadth of the project area, and interpolate the stratigraphy between trenches.

Particle size analysis of soil samples from throughout the project area will allow development of a model of depositional environments through time and over space. Soils data can be used to reconstruct an alluvial chronology for the Ballona Lagoon, which can then be correlated with the time of occupation and subsistence focus at each archaeological site.

Beyond issues of paleoenvironmental conditions, the potential for significant sites being deeply buried, and therefore not yielding any surface indications, must be determined. Alluvial stratigraphic data can be used to assess optimal periods of occupation as well as the likelihood that archaeological sites would have been gently buried or destroyed by subsequent flood events.

Prehistoric Subsistence

Altschul and Ciolek-Torrello (1990) point out that there is an apparent shift from terrestrial to aquatic resources between the Late Millingstone Horizon and the Late Prehistoric Horizon (see Figure 3). This shift is associated with a change in settlement preference from the bluffs to the lagoon. Pertinent research questions include:

1) Is there definite evidence for this subsistence shift, or do any lagoon sites show evidence for terrestrial resource exploitation as well?

2) Is the shift from the bluffs to the lagoon sudden, or is there a period of time when both locations were occupied?

3) Was settlement in the Ballona region ever permanent, or was the area only visited seasonally?

4) Is the switch from terrestrial to aquatic resources a reflection of site location or more widespread changes in the environment?

<u>Data Requirements</u>

Data on subsistence take various forms. Perhaps the most direct evidence are the bones of animals and shell remains that are found in cultural deposits. These remains, especially those of animals not endemic to the area, were most likely brought to the site by man. Their use as economic resources is generally inferred on the basis of frequency and evidence of processing, such as butchering marks or burning.

Artifact analysis is another line of inquiry that can often provide data on subsistence. Use-wear analysis of chipped stone may allow for functional interpretations. Analysis of blood-residue on artifacts ranging from projectile points to groundstone is another method of determining the types of animals procured and the methods used to process them.

Subsistence evidence can also be obtained from plant microfossils (pollen and opal phytoliths), although samples will often include microfossils of economic plants as well as regional pollen rain. Pollen data, then, can be used both to study subsistence practices and reconstruct paleoenvironmental conditions. To study subsistence it is best to obtain pollen samples from sealed cultural contexts, such as pollen washes from groundstone or samples obtained from a storage pit. One measure of site significance will be an assessment of a site's potential to contain these types of cultural features.

Culture History and Cultural Dynamics of Prehistoric Settlement

Questions on prehistoric development in the Ballona can be subdivided into chronology, technology, and cultural affiliation.

Chronology

Settlement on the Del Rey Hills appears to begin sometime in the Millingstone Horizon and to end at the start of the Late Prehistoric Horizon (see Figure 3). Excavations below the bluffs suggest that settlement does not begin along the lagoon until A.D. 1000. The only exception to this pattern is Peck's work at CA-LAn-62, although given the small amount of excavation along the edge of the lagoon it is not possible at this time to determine whether the occupation of CA-LAn-62 is an anomaly or the rule. Re-examination of CA-LAn-62 as well as all other sites in the project area is crucial for addressing this issue. In particular, the following questions need to be resolved:

1) When does occupation of the lagoon begin?

2) Are sites along the lagoon contemporaneous with sites on top of the bluffs?

3) When does prehistoric occupation end? Is it with the founding of the San Gabriel Mission, or was the Ballona a pocket of indigenous culture into the nineteenth century?

Data Requirements

In one sense, chronology is the easiest research issue to resolve. Large numbers of shell, bone, and charcoal samples should be recovered that can be used to obtain radiocarbon dates for the sites. Interpreting these dates, however, probably will not be a straightforward exercise. For example, the stratigraphy at the Admiralty site suggested that the site consisted of an undifferentiated midden deposit. No distinct soil lenses were found that would suggest that different parts of the midden were occupied at different times. Radiocarbon dates were obtained for 6 organic humate and 6 shell samples. The humate and shell samples were paired, with a humate and shell sample obtained near the top of the midden and another pair of samples from the bottom of the midden from three test pits dispersed throughout the site. While the humate dates obtained were internally consistent, with the base of the midden dating earlier than the top, the three areas were separated from each other by several hundred years. The results suggested that the midden was composed of discrete dumping or occupational events that over time had blended together into one deposit. The shell dates, in contrast, were all tightly clustered around A.D. 1100. Although the shell dates were not always internally consistent, with some upper levels dating earlier than lower levels of the same test pit, the dates were so close that their confidence intervals actually overlapped. Based on the shell dates, it appears that the entire site was occupied briefly, perhaps for no longer than 50 years.

The shell dates at the Admiralty site were argued to be more consistent with the archaeological assemblage than the humate dates. The point here is not so much which material provides more accurate dates as it is an example of the complex nature of dating middens. Without the relatively large number of paired dates, the investigators would not have been in a position to evaluate the temporal placement of the site. Based solely on humate dating, the site would have been viewed as long-lived and dating much earlier than would have been thought based solely on the artifact assemblage. If only the shell samples had been analyzed, however, the inverse dates may have lead to a dismissal of the results.

All recorded prehistoric sites in the Ballona consist of midden deposits. To study cultural adaptations over time, control over the temporal span of not just sites, but also different parts of the same site, must be established. Relatively large numbers of samples from each site will be needed in this endeavor.

Technology

Sites recorded in the Ballona area are characterized by a material culture unlike that found elsewhere along the coast. The development of a small chipped stone, or microlith industry, apparently not related to the one developed on Santa Cruz Island suggest that cultural adaptation in the Ballona area involved a unique economic adaptation. To evaluate this hypothesis the following questions need to be resolved:

1) How prevalent is the microlith tradition? Is it confined to certain types of sites (e.g., habitation) or is it widespread throughout the Ballona area? Is the tradition really distinct from the one developed on Santa Cruz Island?

2) Are there other facets of culture that distinguish the Ballona area from other groups living at other lagoons along the coast? If present, can these differences be attributed to a unique cultural tradition or specific resource exploitation strategies?

3) How does the technology of Ballona area sites compare to inland sites? Does this comparison give us a clue to the economic pursuits of Ballona area residents and how they were related to inland groups? Were the bluffs tops and lagoon edge occupied by the same cultural group or was the area visited seasonally by various unrelated groups?

Data Requirements

A study of prehistoric technology often comes down to an analysis of artifact production and use. While other aspects of technology, such as architecture, storage, and resource procurement and processing, would be extremely interesting to examine, evidence for these activities often does not survive in the archaeological record. For the Ballona sites only a small fraction of the technological repertoire that undoubtedly prevailed can be studied and compared to other areas. Of this repertoire, there are basically three classes of artifacts that can be usefully compared; lithic (stone), shell, and bone.

There are two aspects of lithic technology that differentiate the sites of the Ballona from other coastal areas. The first revolves around a bipolar (flaked from both ends) microlith tradition that appears to begin around 1000 B.C. Van Horn has argued that this tradition is technologically quite distinct from the tradition evolving over much of the same time period on Santa Cruz Island. To date, not enough work has been conducted on the traditions to characterize their exact points of similarity or difference.

The second reduction strategy that may be peculiar to the Ballona is a split cobble technology that produced as end products "potatoe flakes" (Van Horn and Murray 1985; Van Horn 1987). Although little more than a technology to create expedient tools, the reduction sequence has not been identified at any other coastal sites (Van Horn 1987:65)

Based on morphology, the Ballona lithic industries appear distinct from those surrounding the area. Whether the distinguishing morphological characteristics are mirrored by differences in function is unknown. Martz (1990) has suggested that as part of the Playa Vista Archaeological and Historical Project an attempt should be made to verify that the Ballona microlith industry is not related to the one on Santa Cruz Island. One avenue which may prove useful is microwear analysis (Keely 1980; Bamforth 1980, 1984). Whereas Martz focused her comments solely on the microlith industry, microwear analysis on the potatoe flake industry may also prove useful.

Whereas portions of the lithic assemblages from the Ballona appear distinctive, shell and bone tools reflect technologies that were widespread along the southern California coast. How these various technologies either overlapped or separated the residents of the Ballona from other cultural groups will be a main topic of study.

To address technological issues we need relatively large artifact collections from well dated contexts. Potential to address these issue will be based on the integrity, diversity, and relative richness of the collection.

Cultural Affiliation

According to Kroeber and Johnstone, the Ballona was occupied at the time of European contact by the Gabrielino. Van Horn has argued that the Shoshonean influence in the region is much older than previously recognized. What needs to be addressed now is:

1) What type and intensity of interaction did the indigenous groups of the Ballona have with surrounding groups?

2) Were the occupants of the sites at the base of the bluffs culturally related to groups residing on the bluff tops?

3) Is there evidence for pre-Gabrielino/pre-Shoshonean occupation of the area? If so, how did this population react to the so called "Shoshonean wedge?"

4) Can any sites in the project area be associated with the named Gabrielino village of **Sa'angna**?

5) How far back in time can Gabrielino culture traits be identified?

Data Requirements

Linking a present-day Indian tribe with an archaeological site in the Los Angeles Basin is an extremely sensitive and difficult process. A common problem is to find numerous archaeological sites in an area where one placename is recorded. In the Ballona there are many potential candidates for the Gabrielino village of *Sa'angna*, there is also little to distinguish one site from another. With the exception of the Hammack Street site, where historic artifacts were recovered but dated to a later Spanish rancho, historic artifacts are extremely rare. In the absence of historic artifacts we must rely solely on relative forms of dating, such as shell beads, or absolute dating techniques, primarily radiocarbon analysis and obsidian hydration.

Thus far, radiocarbon dates have succeeded in eliminating potential candidates for the protohistoric village of *Sa'angna*. All sites from the Ballona that have been dated were abandoned by A.D. 1100, or roughly 650 years before *Sa'angna* was supposedly in existence. Assemblages containing a mixture of historic and aboriginal artifacts have a high potential for establishing the link between present-day Gabrielinos and their past.

Beyond the direct historic approach, the sites in the Ballona have the potential to address a wide range of questions concerning prehistoric cultural affiliation. Occupation on the bluffs apparently began during the Millingstone Horizon and continued on a sporadic basis until historic times. Van Horn (1987) argues that the bluffs were never permanently settled, but instead served as the foci for numerous short-term camps. This argument raises the question of where these groups came from and how distinctive technologies could have developed that have not been found elsewhere. Because all prehistoric sites recorded in the Ballona are multicomponent accretional middens, the ability to address issues of prehistoric cultural affiliation rest on the ability to distinguish temporal components within sites. Sites that contain micro-stratigraphic episodes that allow such fine-scale occupations will be deemed highly significant.

Historic Development of the Ballona

Agricultural Use

This theme covers the first historically documented use of the project area by Hispanic settlers in the early 1800s, and many of those that followed in the years to come. Although the project area has been exploited for many purposes, the earliest use was agricultural: the cultivation of foods and the development of livestock. This theme persisted in the project area until very recent times, and is comprised of at least three issues: the development and persistence of the Hispanic tradition; the impact of the Anglo-American influx; and the 20th century development of specialized agriculture tailored to the needs of an urban population.

The Machados and the Hispanic Tradition

The Machado family is the one most closely associated with Rancho La Ballona, a land grant that encompassed the entire project area, as well as much land to the east and north. While the base of Machado ranch operations was located along Ballona Creek east of the project area, rancho development had its impact on the project area.

The following research questions should be addressed in the treatment of this issue:

1) How closely did the Machado operation conform to the generally established pattern of Hispanic land use in California, based on cattle ranching for hides and tallow, vineyards, and some farming, the latter usually performed by Christianized Indians?

2) How extensive was the Machado operation within the project area?

3) In what ways did the Hispanic tradition of land use continue in the face of the Anglo-American influx that followed the Mexican-American War?

Data Requirements

To address this issue, knowledge of the development of Rancho La Ballona is critical. Much of this knowledge can be provided by archival research at the local libraries and examination of the earliest historic maps, particularly those showing the diseno of Rancho La Ballona. Archival information, however, has its limits. Since the center of rancho operations was located east of the project area, the recovery of information specific to the project area, known to be marginal to the rancho, will probably be meager. Still, it may be found. The recovery of any information on early historic Gabrielino sites may shed light on the operation of the rancho, and the nature of the interaction of Gabrielino and Hispanic settlers.

Impact of Anglo-American Influx

With American immigration, new agricultural techniques were introduced that soon swamped the older, less intensive Hispanic land use patterns. Cattle ranching declined, to be replaced in part by dairying. Dry farming expanded where feasible, but the most spectacular growth occurred in the development of citrus fruit cultivation. Among the questions that pertain to this issue are:

1) By what processes did the Anglo-American agricultural tradition replace the Hispanic tradition?

2) How extensive was the Anglo-American agricultural tradition within the project area? Were there any dairies within the project area?

3) How long did the Anglo-American agricultural tradition last in the face of late 19th and 20th century urban sprawl.

Data Requirements

This issue will have to be largely addressed through archival research, primarily the examination of historic maps and the earliest records of the Anglo-American influx, such as Los Angeles County deed and court records, and even county directories. Such records would not only document the fragmentation of the old rancho, but might also shed light on how it was done and by whom. Civil War-era records might even be useful, since an encampment of the California Volunteers was quartered within the old boundaries of Rancho La Ballona. Determining the extent of the Anglo-American agricultural tradition within the bounds of the project area may be too specific a task for archival research. Archaeological information on this tradition would be extremely valuable.

Agriculture for an Urban Area

Agriculture was increasingly restricted to the lower, marshier portions of Ballona by the growth of the surrounding communities in the late 19th and early 20th centuries. The agriculture that remained became more specialized and more efficient, leading to single crop cultivation and the use of railroads to transport food stuffs. It was during this period that Japanese settlement and agricultural practices spread into the area. After the Japanese were relocated during World War II, a few isolated Hispanic families remained behind to pick up the pieces.

1) Why and when did the Japanese move into the area?

2) What crops did they grow and why were they selected?

3) What relationship did the Japanese have with the Hispanics and Anglo-Americans that preceded them? What relationship did the Japanese have with the railroads that shipped their produce?

4) What kind of communities did the Japanese establish?

5) To what extent did the Japanese re-establish a presence in the project area after World War II?

Data Requirements

While archival research will be important in the recovery of information needed to address this issue, interviews with members of the local Japanese community will probably prove much more valuable. Such members can be identified as a result of questioning local newspaper personnel, local residents, and local historical societies.

Industrial and Commercial Development

The first extensive industrial and commercial impacts to the project area came with the development of surrounding urban communities in the late 1800s and early 1900s. First came the railroads, then oil and gas development. Throughout this period there was a persistent but selective use of the project area for recreational purposes, catering to an increasingly urbanized population. Even the film industry moved into the communities around the project area by the 1910s and 1920s, making selective use of the open spaces provided by the Ballona area. Finally, in the 1940s, Howard Hughes built an aviation complex at the east end of the project area. Now portions are used by either Hughes Aircraft or McDonnell Douglas Helicopters, and most of these buildings still stand today.

Advent of Railroads

Railroads made the first serious impact in southern California in the 1870s. They quickly proliferated throughout the area in the decades to follow, tying both growing cities and remaining agricultural lands to an economic system that was both national and international. In dealing with this issue, we would like to determine:

1) When and by whom were the first railroads established within the project area?

2) What was the relationship between the first local railroads and Los Angeles's search for a viable harbor in the last half of the 1800s?

3) What impact did railroads have on the predominantly agricultural communities within the project area?

4) In what ways did railroading change within the project area?

Data Requirements

Much of this information can be obtained from an examination of pertinent historic maps, especially late 19th and early 20th century topographic maps. These maps not only show the locations of the early rail lines, but also usually identify them by name. Much information about early railroads in southern California can be found in the numerous books and other printed information on the Land Boom of the late 1880s, which was predicated on a railroad price war. Railroads also played a crucial role in the search for a suitable Los Angeles harbor, and much information can be found in the literature pertinent to that search. Local residents can also provide information on changes to the railroads within the project area.

Oil and Gas Development

Oil and gas development changed the face of the Ballona in the the 1930s and 1940s as derricks were erected to extract oil and gas across a large band of coastline along the Santa Monica Bay. To evaluate this issue, we need to resolve the following questions:

1) When was the first oil discovered in the Ballona area?

2) What impact did oil and gas development have on the local area?

3) How was land use coordinated between oil extraction and agricultural operations?

4) What role did railroads play in the development of oil and gas?

5) Why did local oil extraction decline?

Data Requirements

Aside from information of a general nature that can be gleaned from reference books on the oil and gas development in southern California, the most specific information can only be obtained from aerial photographs of the project area, many of which are on file at Playa Vista headquarters. Additional information can also be obtained from oil company records as well as local informants, who might remember the dismantling of the derricks.

Recreation Use

Beginning with fish and gun clubs associated with the Ballona, the project area has attracted people for recreational purposes for well over a hundred years. With the development of urban centers, beach-front communities developed as tourist attractions, while even the low, sometimes marshy areas of the lagoon attracted motorists. To fully address this issue, we need to answer the following questions:

1) What were the first recreational uses of the project area?

2) How did the flat, marshy nature of the project area help determine recreational use patterns?

3) How did the demand for beach recreation impact the project area?

Data Requirements

Although historic photographs and maps will undoubtedly be useful in determining the individual features associated with recreation in the project area, the greatest information will probably come from local residents and other knowledgeable informants.

Early Film Industry Use

Perhaps the most exotic commercial development of the project area was the establishment of the film industry in Culver City in the 1910s and the subsequent use of the Ballona area as a movie backdrop. In order to understand this issue, we must address the following questions:

1) What attracted the film industry to the Ballona area?

2) Why did Culver City, immediately northeast of the project area, become a center of the film industry?

3) What impact did the film industry have on the project area?

Data Requirements

Most of this information can be provided by the numerous reference books on silent film and the early film industry in general. Older local residents might also have some recollections about the filming of early movies within the project area.

Howard Hughes

Just before America's entry into World War II, millionaire Howard Hughes, an established film producer and aviator, began buying up the project area for the headquarters of his new aviation empire. The buildings of the Hughes complex are still the most salient features on the landscape today. Among the questions that need to be answered in addressing this issue, are:

1) What role did Hughes's early interest in film have in attracting him to the area?

2) What relationship did Hughes have with the agricultural communities that he displaced?

3) What was the developmental sequence of the Hughes complex? What is the significance of the major buildings?

4) What role did the complex have in the design and production of Howard Hughes' famous "Spruce Goose"?

5) How has the complex changed since Hughes's death?

6) What legacy did Hughes leave to co-workers and local residents?

Data Requirements

Much has been written on the design, construction, and flight of the "Spruce Goose." Much less publicized is the development of the Hughes aviation complex where most of the design and construction work was done. Local informants at the new Hughes Aircraft Corporate Headquarters could be interviewed for pertinent information on the development of the complex, and back issues of the "Hughesnews," the corporate newsletter, could be examined. Former Hughes employees could be a particularly valuable source of information; many of these still work on the site, though they are now employees of either Hughes Aircraft or McDonnell Douglas Helicopters.

The tangible remains of the Hughes aircraft empire are the buildings at the plant. Many of the early buildings, including the production areas and original corporate headquarters, are standing with many still in use. Assessing the historic significance of these buildings depends on their architectural and engineering values as well as their association with historic individuals.

METHODS

Archival Research

Historic

A vast amount of published and unpublished documents and literature concerning ownership and use of the project area exist scattered throughout the greater Los Angeles area. To assemble this material, documents were collected and knowledgeable individuals were interviewed during the summer of 1990. A complete list of sources is provided in Appendix I.

Archival research for the Playa Vista Archaeological and Historical Project covered a span of time from the Spanish colonial period in the late 1700s, to the development of the Howard Hughes aircraft and helicopter complex in the late 1940s and after. The research needed to illumine such a broad period had to be conducted using a number of different techniques, ranging from gathering information from libraries and other data repositories, to interviews with former project area residents and Hughes employees.

To cover the first century of historical development within the project area, information had to be gathered almost exclusively from libraries and university map rooms, although the usefulness of such repositories was in no way limited to this early time period. The public libraries in Marina del Rey, Santa Monica, Westchester, and Culver City, were all canvassed for pertinent information on the development of the La Ballona land grant. Particularly useful were the special collections and maps on file at the University of California, Los Angeles, University of California, Santa Barbara, and Loyola Marymount University.

By the second half of the 1800s, Los Angeles County deed and court records documented the break up of the La Ballona grant. To obtain this information, visits were made to the Los Angeles County Hall of Records and the Los Angeles County Records Center. Of even greater assistance in the determination of property owners, were the Los Angeles County Assessor Map Book Archives, which cover the period from roughly 1902 to circa 1970.

After the 1920s, reliable written information on residential developments within the project area become scarce. To obtain details of this later period, a great reliance had to be placed on interviews with older local residents and former Hughes employees. Personal interviews were used whenever possible, but many interviews were conducted over the telephone. Older residents filled in many data gaps from the 1930s and 1940s, when the project area passed from the long ownership of Joseph Mesmer to become a cog in the Hughes financial empire. Without the information provided by Pepe Lopez, Frances Kitagawa, Edward Perry, and Donna McDonough, most of the information on the local Hispanic and Japanese communities, so important during those years, would not have come to light.

With the development of the Howard Hughes aviation complex at the eastern end of the project area in the 1940s, the entire project area eventually passed to Hughes' landholding corporations. Former Hughes employees, many of whom still work at the complex even though much of it is now under different ownership, were extremely helpful: these were Jack Stubbs, John Tweten, William McCann, Peter Kraeger, Morey Cohenk, Johnnie Mikell, and Robert Schofield. Foremost among these was George Kruska, who for years served as Howard Hughes' flight engineer.

Additional information and photographs covering the Hughes period were provided by Barbara Hugh, Robert Schofield, and other staff personnel at the Hughes Aircraft Company Corporate Headquarters. Materials were also provided by Robert Stutsman of Maguire Thomas Partners. Further information was gathered from extensive displays open to the public at the Spruce Goose Exhibit in Long Beach.

Previously Recorded Cultural Resources

Although a relatively large number of archaeological studies have been conducted in the Ballona, there are to date no published reports. Most of the work pre-dating 1960 consists of notes submitted to various members of the UCLA Department of Anthropology or UCLA student papers that have been placed on file at the UCLA information center. Projects conducted in conjunction with compliance studies, most of which have been performed since the mid-1960s, are better reported. Information from most of these studies have been deposited at the information center. A major component of the archival search for material on archaeological sites, therefore, involved a thorough examination of the UCLA information center documents.

A few compliance studies, most notably the work of Van Horn and his colleagues at Archaeological Associates, Inc., are considered proprietary information. These documents were obtained either from Archaeological Associates or Planning Consultants Research.

The final component of the archival search of previously recorded cultural resources involved discussions and interviews with knowledgeable individuals. Information on previous work in the Ballona was obtained from Dr. David Van Horn, Dr. Charles Rozaire, Dr. Brian Dillon, Keith Johnson, and John Murray.

Survey Methods

A critical aspect in executing the survey design was establishing field methods. Field investigations consisted of two primary tasks, survey and site recording. Consistent methods were established to serve as a guide for ensuring replicable results. The following discussion details the field strategies employed in carrying out these two tasks.

Survey Procedures

The cultural resources survey was conducted by a two-person crew during a five-week period between July and August, 1990. The 1004-acre project area was divided into four irregularly-shaped areas designated as Area A, B, C, and D (see Figure 1). Maps depicting each of the survey areas at a scale of 1 in. = 200 ft. were used by the survey crew to locate the boundaries (e.g. roads, Ballona Creek, fencelines, etc.) of the survey areas in the field. Once the crew located a corner of a survey area, the surveyors established themselves on transects spaced at 20 m intervals. In portions of the project area such as Area D where the vast majority of the property was found covered by redeposited fill, the interval between transects was increased to 30 m. The survey team then proceeded along the appropriate compass bearing until the end of the survey unit was reached. Every effort was made to maintain the interval between transects; each surveyor carried a compass and survey lines were directed by taking readings at regular intervals. While surveying across hilly terrain frequent backsightings to prominent landmarks were taken to ensure each area was covered in its entirety. The person walking the innermost transect marked their line with biodegradable paper as an aid in maintaining the interval between transects on the next sweep back across the survey area.

Once the opposite boundary of a survey area was reached, the end of each transect was marked with flagging tape. Next, the surveyors realigned themselves, re-established the proper spacing between transects, and started walking back on the adjacent sweep in the opposite direction. This process was repeated until each survey area was completed. The number of sweeps varied depending on the size of the survey area. Each sweep was numbered consecutively within each of the four survey areas (e.g. A-1, A-2, A-3, etc). The location of each sweep was drawn on the survey maps.

The surface was inspected for the presence of artifacts or cultural features. Surveyors were free to meander within about 10 m on either side of the centerline of their transect to inspect areas, such as lower colluvial slopes, bluff edges, and stream margins, judged to have a high potential for cultural deposits. A concentrated effort was made to examine subsurface exposures such as animal burrows, eroded areas, stream banks, and road cuts for indications of buried cultural deposits. Areas where the surface was totally or partially obscured by dense vegetation, asphalt, concrete, existing buildings, or redeposited fill were depicted on the field maps.

In addition, the supervisor of survey crew maintained a daily field log with information on environmental conditions, geology, water sources, vegetation, disturbance, and any other pertinent data. A photographic record of each survey area, general project area shots, and any other noteworthy observations were documented during the survey with black and white prints and color slides.

Site Recording Procedures

All archaeological sites were recorded on a State of California cultural resource inventory form. Each cultural resource meeting the definition of an archaeological site outlined below was assigned a permanent state site number and the site inventory forms have been deposited in the repository at the University of California at Los Angeles. Any low density artifact scatters or isolated finds were plotted on the maps and described in a survey log maintained by the survey crew chief. Low density scatters were not assigned a site number.

An archaeological site was defined as a cultural manifestation thought to represent purposeful prehistoric or historic human activity. An activity was considered to have been purposeful if it resulted in a deposit of cultural materials beyond the level of just one or a few accidentally lost artifacts. Loci of human activity not classified as sites were considered isolated finds. A cultural resource meeting the criteria of an archaeological site exhibited at least one of the following:

a. One or more features such as a shell midden or historic structural remain.

b. One formal tool or ornament that is associated with other cultural materials.

c. A single artifact class (e.g. chipped stone) occurring in a density of at least 25 items per 100 square meters.

d. Two or more artifact classes or cultural materials in a density of at least 10 artifacts per 100 square meters.

Historic materials were further qualified as those which are probably older than 50 years in age.

Site boundary estimates were delineated so that all cultural features, formal tools, and activity areas that could be identified on the basis of surface indications were included. Site boundaries were defined to encompass all artifacts occurring in a density of ten or more cultural items per 100 square meters.

When one or more artifacts was identified by a surveyor, a general reconnaissance was made to determine if the locality met the criteria for an archaeological site. If the definition listed above was not met, the cultural manifestation was designated as an isolated find (IF) and assigned a number that was recorded on the IF list. Notes were kept on isolated finds and their locations were plotted on the USGS 7.5 minute quadrangle map. Because the survey crew would not be returning to isolated find locations after they were identified, isolated artifacts were the only ones collected. Exotic items such as prehistoric stone bowl fragments, historic cartridges (ammunition casings), and other anomalous objects were collected for further analysis and are currently housed in the project area.

Cultural resources initially thought to meet the definition of an archaeological site were assigned a temporary site number (e.g. SR1, SR2, etc.). The crew then searched for the approximate boundaries and marked them with flagging tape. If it was determined during this reconnaissance that the cultural manifestation lacked stratigraphic integrity (i.e. cultural deposits that were redeposited), a State of California New Deposit/Redeposit Site Form was completed. Diagnostic artifacts, other noteworthy artifacts, artifact concentrations, and cultural features were marked with flagging tape. Based on this preliminary assessment, the site location was plotted on the USGS 7.5 minute quadrangle map.

The State of California site inventory form was, then, completed. Locational information (both legal and UTM coordinates) and a number of observations were recorded such as the site dimensions and areal extent, estimated depth of cultural deposits, environmental setting (geology, hydrology, landform, elevation, slope gradient, soils and sediment, vegetation), types and extent of disturbance, cultural affiliation, feature descriptions, artifact types and relative densities, and a general site description were recorded on the site form. In addition, the average and maximum artifact density standardized to 10 x 10 m squares was estimated.

Additional responsibilities during site recording included preparing a detailed sketch map and documenting the site with full photographic coverage using 35 mm black and white print and color slide film. Sketch maps were drawn of each site to depict the topography, approximate site size and configuration, the location of artifacts and cultural features, artifact concentrations, and any prominent geographic features such as bench marks, roads, and vegetation that might aid in relocating the site. A north arrow and scale were drawn on each sketch map. Photographs were taken of general site overviews, individual cultural features, artifact concentrations, and miscellaneous observations of interest.

Although a concentrated effort was made to search for artifacts that could be collected at a later date, no artifact collections were obtained while recording sites during the survey. The locations of such artifacts were flagged, described, and plotted on a sketch map. This strategy was designed to provide preliminary data regarding the age, cultural affiliation, site function, trade, and the functions of specific cultural features.

The site recording procedures were aimed at providing information for determining which sites might potentially meet the criteria for inclusion to the State and/or National Register of Historic Places (NRHP). Determination of National Register eligibility at a survey level is difficult at best, especially for surveys with deeply buried sites. Systematic surface collections and subsurface testing are necessary to precisely delineate the site boundaries and depth of cultural deposits, and to determine if the deposits are intact. Recommendations regarding eligibility determinations and the potential of each site for addressing research objectives previously outlined are presented in the Chapter 7.

CHAPTER 4

ARCHIVAL RESEARCH ON THE HISTORIC OCCUPATION OF THE PROJECT AREA

This chapter presents a detailed history of the project area as viewed through archival records. The chapter begins with the era of Spanish exploration and settlement and ends with the current attempt to develop the project area.

SPANISH/MEXICAN PERIOD

During the period between the naval expedition of Juan Rodriquez Cabrillo in 1542 and the first overland trek through what is now Los Angeles County by Don Gaspar de Portola in 1769, the Spanish presence in California was limited to occasional visits along the coast. During this time, the general project area belonged to the Gabrielino Indians, a Shoshonean group that first moved into Southern California around A.D. 500 (Dillon et al. 1988:22).

By late ethnohistoric times, there was at least one Gabrielino village within the Ballona Gap. Variously identified as *Saan* or *Sa'angna*, its location has been the subject of some controversy. Dillon et al. (1988:23) place the village on the north side of Ballona Creek; others have suggested a location where the Ballona Escarpment drops to the ocean (Rios-Bustamante and Castillo 1986:4).

The founding of the San Gabriel Mission in 1771 marked the beginning of the end for the local Gabrielino. The local Indians were encouraged to move to the new mission location, where they were taught the rudiments of agriculture and cattle raising. This process of assimilation accelerated with the founding of the pueblo of Los Angeles in 1781. Soon, the local Indian population was ravaged by European diseases and the drug cults that rose up in response to them. By the end of the 1800s, the population had largely merged with the prevailing Hispanic and even Anglo culture (Dillon et al. 1988:24). By this time, the village of Sa'angna had been abandoned for so long that even its general location remains a question.

As the Gabrielino moved out, Ballona Creek and its lagoon began to attract the attention of Spanish stock raisers who fanned out from San Gabriel and Los Angeles in search of pasturage. By the late 1700s and early 1800s, the area was periodically used for cattle grazing, starting a tradition that would continue into the 20th century with the local dairy industry. By the early 1800s, the area between the lagoon and the pueblo of Los Angeles was being parceled out to Hispanic ranchers who first grazed in favored locations around the pueblo and then finally obtained title to specific parcels of land. In the area around Ballona Gap, the most significant of these early ranchos were: Aguaje de la Centinela, located at the headwaters or spring of Centinela Creek immediately southeast of the project area; Sausal Redondo to the south; Cienega o Paso del la Tijera, three miles east of the project area; Rincon de los Bueyes three miles to the northeast; and Rancho La Ballona, which encompassed the entire area of the Gap (Figure 6). The project area, located wholly within La Ballona, lies on the southern boundary of the rancho, adjacent to Sausal Redondo.

By the early 1800s, the area that would later be Rancho La Ballona were beginning to be associated with two particular settlers: Felipe de Jesus Talamantes and Jose Agustin Antonio Machado (Wittenburg 1973:12). From the beginning, the Machado family would be the name most closely associated with the area around the lagoon.

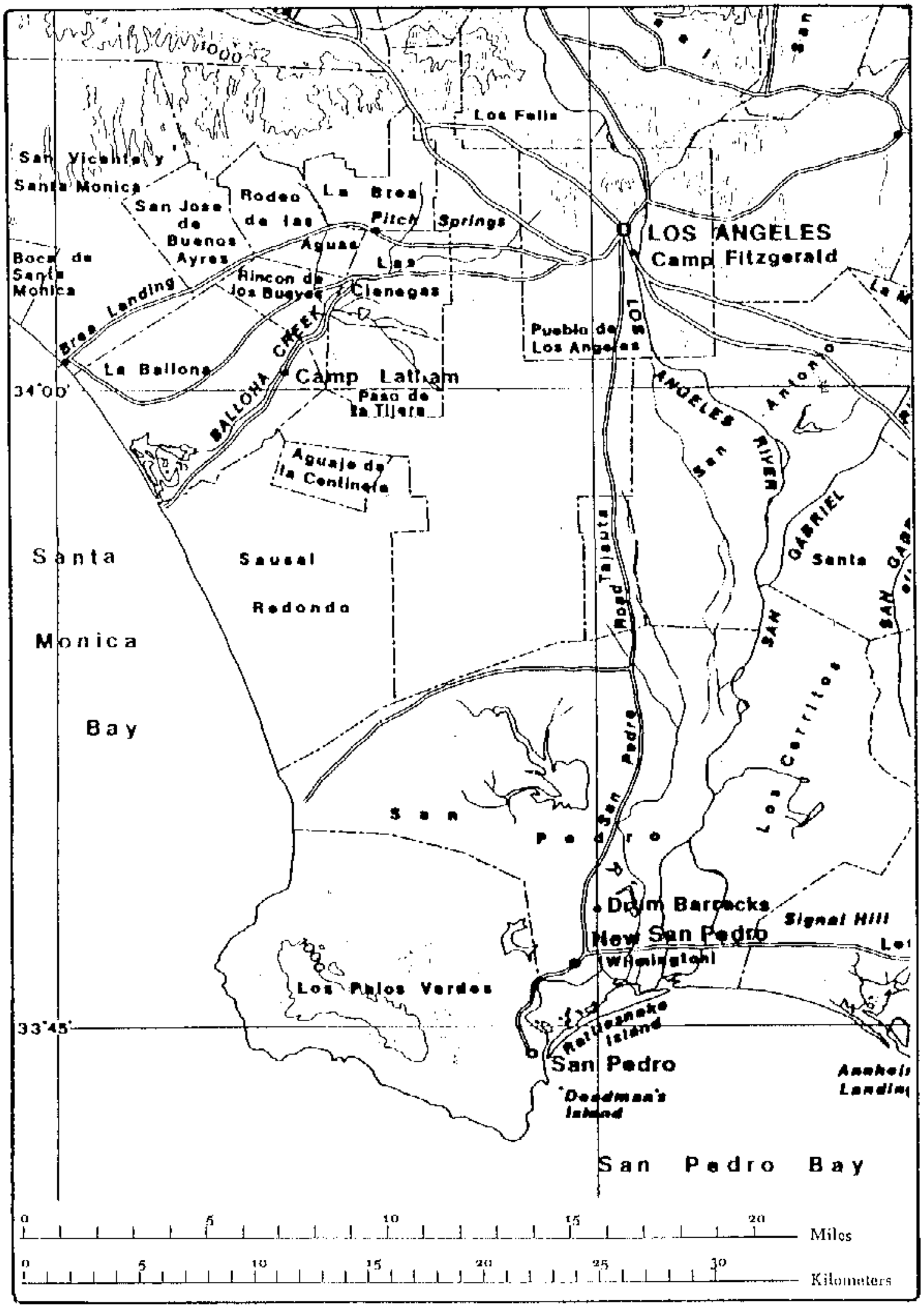


Figure 6. Mexican Land Grants, Hispanic and Early American Settlements (from Robinson 1977:17).

Jose Agustin Antonio Machado was born in 1794 to Jose Manuel Machado y Yanze and Maria de la Luz Valenzuela y Avilas. By that time, Jose Manuel had spent over ten years doing garrison duty at the presidio of Santa Barbara. In 1797, the Machado family moved to Los Angeles, which then had a population of just over 300. Like most inhabitants of the pueblo, the Machados had their own cattle herd, and as the settlement grew, the herds were driven further from town in search of pasture. One area that was particularly prized was the small drainage identified later as Ballona Creek (Wittenburg 1973:6-11).

The banks of Ballona Creek were noted for willows, sycamores, oaks, and tules. The Gabrielino that remained in the area built their huts along these banks or on the bluffs immediately south of the creek (Wittenburg 1973:11-12). By 1819, Agustin Machado, his brother Ygnacio, and Felipe and Tomas Talamantes, were running long-horned cattle in the area (Adler 1969:2). By the following year, this four-some had obtained from the commandante of the Los Angeles pueblo some type of exclusive grazing rights along Ballona Creek (Pennington and Baxter 1976:7). By 1820 or 1821, stock was moved permanently into the area, which assumed the unofficial name of Paso de las Carretas (Wagon Pass) for the easy road that led from Los Angeles to the coast through the Ballona Gap. An alternative name, La Ballona, would later supercede the first (Wittenburg 1973:15).

Only one of the four ranchers, Agustin Machado, actually lived on the land, and even he was a part-time resident. Around 1820 or 1821, he constructed the first adobe within the area, which was located in what is now Culver City between Overland Avenue and Sawtelle Boulevard. This adobe was washed away in a flood about a year after it was constructed (Pennington and Baxter 1976:8; Wittenburg 1973:19). The second adobe, built later in the 1820s, was located near what is now the intersection of Overland and Jefferson Boulevard (Adler 1969:2; Wittenburg 1973:19; Pennington and Baxter 1976:9-10).

During the 1820s, Agustin Machado maintained his primary residence in Los Angeles, where he married and began to raise a family. On a tract of land adjacent to his Los Angeles home, Machado had vines and fruit trees. From this enterprise, which was soon expanded to La Ballona, Machado developed a white wine that became famous throughout coastal California. In addition to vineyards and fruit trees, La Ballona also contained fields of corn, pumpkin, beans, and wheat (Wittenburg 1973:16,21).

Despite the introduction of horticulture, most of the ranch was devoted to the Machado and Talamantes cattle herds. These were tended by Indian vaqueros, who probably lived in huts among the sycamores not far from the Machado house (Robinson 1939). The trade in hides was one of the most lucrative commercial operations in California, and sun-dried hides were traded to New England merchants in return for manufactured goods (Adler 1969:2).

As a result of the hide trade, coastal commerce became an important aspect of the economic life of La Ballona. The most important port for the Los Angeles area was the harbor of San Pedro. Ox-drawn wagons or "carretas" from further up the coast would pass through La Ballona and up the escarpment at Centinela Creek to San Pedro to trade for goods from New England and the Orient (Wittenburg 1973:19).

By the 1830s, Agustin Machado performed most of the supervisory work at La Ballona. During this period, his brother Ygnacio married and set up another establishment at Canada del Centinela. Felipe and Tomas Talamantes spent most of their energies at another neighboring rancho, Rincon de los Bueyes (Wittenburg 1973:18-19). By the end of the decade, Machado began to make moves toward obtaining legal title to the rancho that had been his for almost twenty years.

When the Machados and Talamantes began working La Ballona in the early 1820s, the land legally belonged to the the Spanish Crown through the San Gabriel Mission. Authorization from the commandante of Los Angeles was sufficient to work the land, but did not confer title of ownership. With the collapse of Spanish power in 1821 and the rise of the Mexican Republic in the years to follow came the passage of laws sympathetic to private land ownership. Indian rights to the land were largely forgotten as ranchers lined up to legitimize their holdings; the Gabrielino who remained now had no choice but to work for the rancheros (Wetmore 1875). After the outright secularization of the California missions in the mid-1830s, Machado began moves to acquire La Ballona from the Mexican government (Wittenburg 1973:25).

Rancho La Ballona was finally granted to Agustin Machado and Felipe Talamantes in November 1839 by Governor Alvarado in Monterey. By the terms of the grant, the boundaries of the rancho were established to the east by Rancho Rincon de los Bueyes, to the north by Rancho San Jose de Buenos Ayres, to the south by Sausal Redondo, and to the west by the holdings of Jose Sepulveda (Rancho San Vicente y Santa Monica). The grant was to be confirmed on condition that a house was built on the property and that it be occupied within the year (Wittenburg 1973:26).

The "diseno," or sketch map that accompanied the grant, was actually labeled "El Paso de las Carretas" (Figure 7). The wagon road shown on the map is roughly where modern Washington Boulevard is located (Adler 1969:2). In the center of the rancho is Ballona Creek, labeled as having alders on both sides down to the "estero," or salt marsh. "Tierras de siembra," or cultivated fields, are found on both sides of the creek. Further from the creek, where there were only "lomas muertas," or "dead hills," the land appears to have been used only for grazing.

The diseno indicates a number of structures on the rancho in 1839. All appear to be on the north side of the creek, which is somewhat surprising since Machado's second adobe was supposed to have been located near the intersection of Overland and Jefferson, south of the creek. North of the creek are indications of four houses near the eastern boundary of the rancho, connected by the wagon pass road to the pueblo of Los Angeles. These structures were located northeast of the project area. Almost two "miles" further downstream was a corral, and one mile below that is the depiction of another structure that was not identified. Located at the edge of the salt marsh and just over one-half mile north of the creek, this structure and the corral were probably located just to the north of the project area (Diseno 1839).

AMERICAN TRANSITION, 1848-ca.1860

At the conclusion of the Mexican-American War (1868-48), Alta California was ceded to the United States. One of the conditions of the final peace treaty was that native Californios would be allowed to retain their land holdings under the new American regime. The transition from Mexican law to American would not have been nearly so difficult had the Gold Rush not gotten underway in the same year that California passed under American administration. Soon there were occasions for all sorts of controversies as the details of Mexican land grants were challenged by American institutions set up to confirm land ownership.

The Land Act of 1851 established a Board of Land Commissioners at San Francisco to establish the validity of land grants throughout California. After some protest from Californios living in the south, the board finally agreed to meet in Los Angeles in 1852. In October of that year, the Machados and the Talamantes presented their case for the confirmation of La Ballona (Robinson 1939; Wittenburg 1973:32). In 1854, the board upheld the La Ballona grant, but this did not prevent the years of litigation and controversy that followed (Adler 1969:2).

These matters were complicated by the financial problems of Tomas Talamantes. In 1854, Talamantes obtained a $1500 loan from two Americans, Benjamin D. Wilson and William T.B.

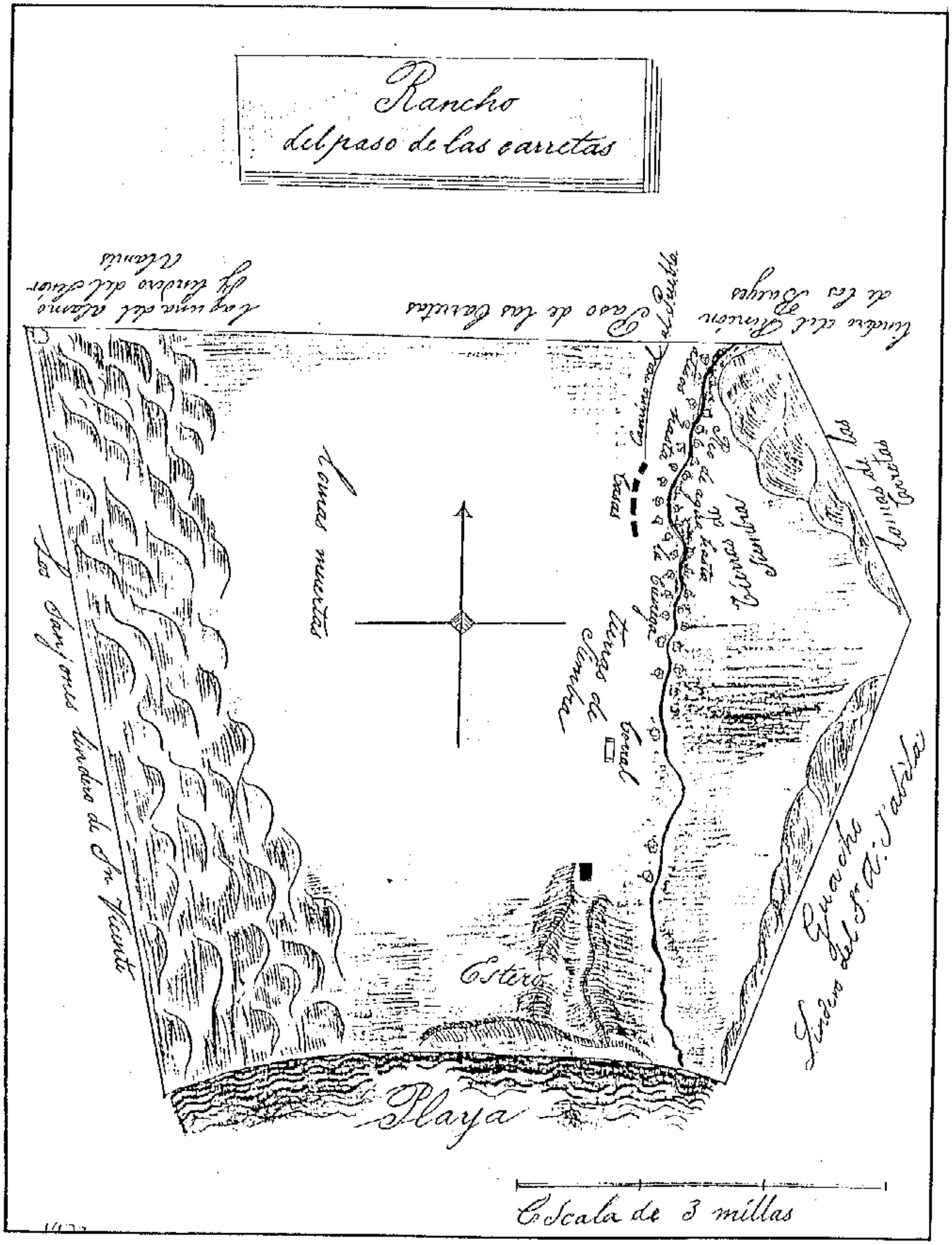


Figure 7. Diseno of Rancho La Ballona, 1839 (from Wittenburg 1973).

Sanford. When Talamantes failed to keep up the interest payments, his undivided fourth share of Rancho La Ballona was sold at public auction in December of 1855 to Benjamin Wilson for $2000. Wilson finally obtained deed to his undivided fourth in January of 1857. Two years later, Wilson sold his still-undivided share of the rancho to three other Americans: John Sanford, James T. Young, and John D. Young. This came on top of the death of Felipe Talamantes in 1856, leaving his undivided fourth of the rancho to 25 heirs and other recipients (Robinson 1939).

While the internal situation of rancho ownership became more complicated, work still continued in the confirmation of the rancho to the four original owners. As required by American law, La Ballona grant had to be surveyed, and this was performed by Henry Hancock in 1858 (Figure 8). Hancock began his survey near the northeast corner of the grant, near Ballona Creek, and then proceeded to move clockwise around the property, which was then designated Lot No. 37, located within Township 2 South, Range 15 West, of the San Bernardino Meridian. Hancock identified the "inner bay" and the outlet of Ballona Creek, but unfortunately did not indicate any improvements within the interior of the grant (Hancock 1858).

As drawn up by Hancock and finally approved years later, La Ballona grant was bounded by Rancho San Vicente y Santa Monica to the northwest (along a boundary now formed by Pico Boulevard), the Pacific Ocean to the southwest, and Rincon de los Bueyes to the north (along a boundary now formed by Manning Avenue). To the east, the boundary was formed by the Baldwin Hills and Rancho Paso de la Tijera, and to the south, the boundary was the Ballona Escarpment, beyond which was Sausal Redondo.

In the first of many controversies, the General Land Office failed to approve Hancock's survey because the configuration of the grant boundaries was not exactly the same as the original diseno, and because the large body of water shown on the Hancock map was not depicted on the original sketch (Wittenburg 1973:34).

It required years of litigation and proofing to straighten the matter out, but it appeared that Machado had sufficient funds to weather the storm. In 1860, Agustin Machado was considered one of the wealthiest citizens in the area: his 14-acre tract in Los Angeles was assessed at $6000, and his one-quarter share of La Ballona was appraised at $13,570. In addition, Agustin bought three leagues of Rancho Santa Rosa in San Diego County as early as 1855, beginning the slow process of moving the center of family operations to the south (Wittenburg 1973:22).

The early 1860s were a watershed period for the project area and all of southern California for a number of reasons, not the least of which was the Civil War. By the 1860s, the remaining Indian groups in the area were on permanent decline; relatively numerous in 1850, there were relatively few by 1870. Already denied access to the land, their remaining number made a living by tending the local vineyards and cattle ranches (Robinson 1977:17).

In 1860, cattle was still king in southern California, with an estimated 78,000 head in Los Angeles County alone. Ranching, however, was starting to give way to vineyards and even orange cultivation. Los Angeles grew tremendously during the early American years, and was recorded as having a population of 4,399 in 1860. Most of this number was still Hispanic, but the American component, both powerful and vocal, was growing fast. The town outlawed bull-fighting in 1860, which was followed in a few years by the establishment of a municipal baseball team. In the country-side, the 1860s saw the gradual disappearance of the carreta, or Hispanic ox-drawn cart, in favor of the American wagon (Robinson 1977:16-20). The Civil War and the ecological disasters that occurred during that same time period would bring about even greater changes.

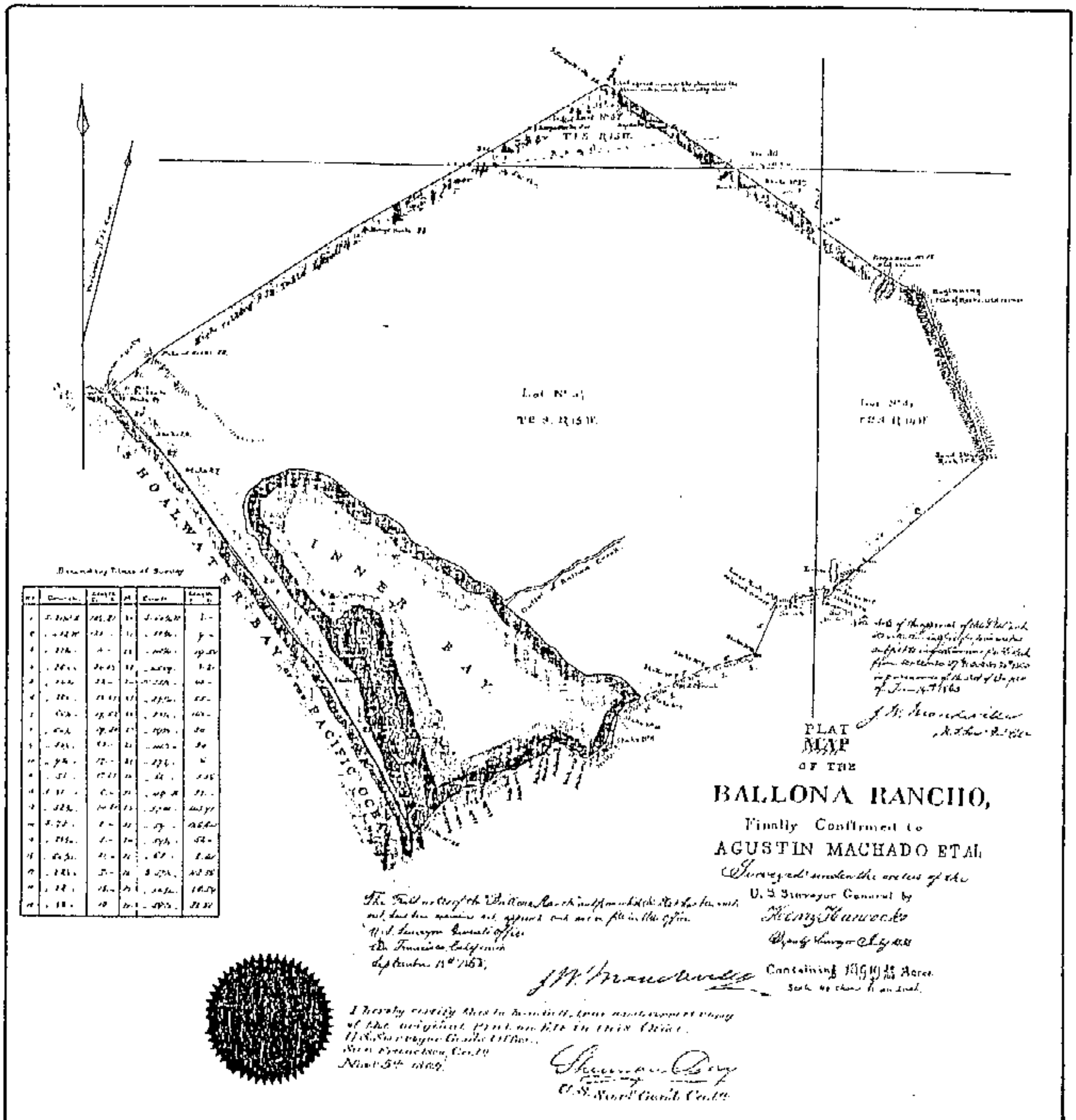


Figure 8. Hancock's Survey of Rancho La Ballona, 1858 (from Wittenburg 1973).

CIVIL WAR YEARS, 1861-1865

The American Civil War, in most ways quite distant from the concerns of the rancho, had some unusual repercussions for the project area. In 1861, pro-Southern sentiment was prevalent in Los Angeles County, giving rise to disturbances that became so troublesome that Federal troops from Fort Tejon arrived in Los Angeles on 14 May 1861 to preserve order. Even though local Unionists now had the upper hand, strong Southern sympathies again manifested themselves with the news of Bull Run and the Texan invasion of New Mexico in the summer of 1861 (Robinson 1977:49-58).

Within the Unionist camp, fears of Confederate conspiracies were particularly strong in the summer and fall of 1861 (Robinson 1977:73-75). To better secure southern California for the Union, detachments of the California Volunteers began to arrive in San Pedro from San Francisco in late September and early October. The first group, consisting of seven companies of the First Infantry Regiment, landed at Phineas Banning's port on 18 September 1861. They were then marched north to a permanent camp on Ballona Creek, which was reached by 19 September 1861. This encampment would soon be named Camp Latham, after a former California governor (Robinson 1977:79). Located between four and five miles inland, on the southeast side of the creek, the camp was situated near or between the intersections of Overland Avenue and Sepulveda Boulevard with Jefferson Boulevard, about a mile and a quarter northeast of the project area on the slope of Baldwin Hills (Robinson 1939; Robinson 1977:17,map; see Figure 6).

Camp Latham was situated in the Ballona Gap because the Unionist community in Los Angeles was concerned that the coastal areas leading to the city might prove a logical location for a Confederate invasion of southern California from some staging point on the uninhabited Catalina Islands. To counter any such threat in the San Pedro area, a more permanent and imposing encampment was established at Camp Drum in October of 1861 near New San Pedro, now Wilmington (Robinson 1977:91-92)

By October of 1861, Camp Latham was the encampment of 1200 men, which was probably the maximum number stationed there at any one time. While the infantry engaged in drills, the cavalry performed maneuvers along the bluff south of the creek. To enforce discipline, the sale of liquor was prohibited within three miles of the camp, but spirits were still commonly smuggled in, once by a Los Angeles fruit peddler who brought in spiked watermelons. To maintain close contact with authorities in Los Angeles, three stages made daily rounds between the camp and the city (Robinson 1977:79-80).

Beginning in mid-March and continuing in April of 1862, the bulk of the California Volunteers marched out of Camps Latham and Drum under General Carleton for destinations in New Mexico. Several hundred Volunteers remained behind at each camp to perform garrison duty in the Los Angeles area (Robinson 1977:90-91). Although Camp Latham had to take a back seat to Camp Drum during this period, it still pulled its share of local assignments. In March of 1862, an expedition was sent out from Latham to help squelch the revolt of the Owens Valley Paiute.

On 4 July 1862, Camp Latham was the scene of a large Unionist celebration of the Fourth of July, which was held in the camp rather than the city because Los Angeles was still considered too "secesh," or sympathetic to secession. During this event, there was a review of the troops, various patriotic orations, and afternoon promenades through the willow grove across Ballona Creek (Robinson 1977:94).

Throughout that summer and into the fall, Camp Latham was considered the closest and most reliable stronghold of Unionist sympathies in the Los Angeles area. It was even the scene of massive voter fraud in the elections of 3 September 1862, when the army seized and stuffed the ballot boxes of the Ballona precinct (Robinson 1977:107-08). The local outrage that this caused was probably instrumental in the final abandonment of Camp Latham in October of 1862, when the remaining California Volunteers were transferred to Camp Drum, renamed Drum Barracks (Robinson 1977:109).

The closing of Latham spelled the end of Civil War activities within the vicinity of the project area, even though the last war years saw a series of natural disasters that would truly alter the old Californio life-style based on ranching. The greatest legacy of the war is the first detailed map of the Ballona wetlands, dated to 1861 and showing topographic and settlement details within the Ballona Gap. This map was compiled by the U.S. Coast Survey (Chase 1861; Figure 9) and was almost surely prepared as a result of the war scare that produced Camp Latham. This map shows the details of the lagoon, the surrounding uplands, and what would appear to be fields and structures in the vicinity of the lagoon. The only details that appear to have been added to the map at a later date are the modern minute demarcations-- and possibly the "race course" that cuts across an older road.

According to the 1861 map, most of what is now Marina del Rey was then a series of marshes and open bodies of water connected to both the ocean and Ballona Creek. Within the project area, there were at least four roads: one paralleled the foot of the bluff, while another extended across the marsh in such a way as to suggest what later came to be known as Culver Boulevard; the other two roads, located between the first two, were much smaller and less significant. No settlement is shown within the general bounds of the project area, even though there is some sort of settlement shown to the north of the project area on the double line marked "118 degrees, 26 minutes." The 1861 map suggests that four structures and one open corral were located within this area. Dotted lines appearing to be fences, radiate from this cluster of structures. This cluster appears to be located in the vicinity of modern Alla Road, near what is now Glen-Alla Park. This area may well be the location of the southwestern-most structure depicted on the 1839 diseno.

The area changed a great deal just a few years after the 1861 map was compiled. Even before Camp Latham was closed, in January of 1862, the area was inundated by what most sources have considered the worst flood recorded in southern California (Sidler 1973). Whole cattle herds were washed out to sea in the Santa Ana River valley by a flood wave estimated to have been a mile wide (Vickery 1977:68). While destruction along Ballona Creek was certainly less than this, it must have been severe. The 1862 flood was then immediately followed by a two-year drought that took a high toll on both cattle and men. The drought probably helped trigger a disastrous smallpox epidemic in the winter of 1862-63. The already dwindling Indian groups of southern California were by far the hardest hit, and it has been estimated that this epidemic alone killed over half of the remaining Indian population in Los Angeles County (Robinson 1977:113-14). By the 1870 census, the county's Indian population had shrunk to a small fraction of its former size, and cattle, 70,000-strong in 1860, had been reduced to 20,000 head (Robinson 1977:133). With such a drastic decline in both cattle and the Indian vaqueros who tended them, the old California ranchos entered a period of terminal decline.

This decline was reflected in the promulgation of local "no fence" laws. By the late 1860s, the age-old antagonism between farmers and cattlemen over fencing laws, had been decided in favor of agriculture. So long as ranching was the major enterprise in southern California, it had been the farmer's responsibility to erect fences to keep the cattleman's herds out of a cultivated field. With the decline of the large herds and the growth of farming, the responsibility shifted to the other foot (Wetmore 1875:5). As cattlemen erected the fences needed to keep their herds out of agricultural lands, they paved the way for the florescence of local vineyards, fruit groves, and even dairies. The decline of ranching and the rise of horticulture and dairies increased pressure to finally partition Rancho La Ballona.

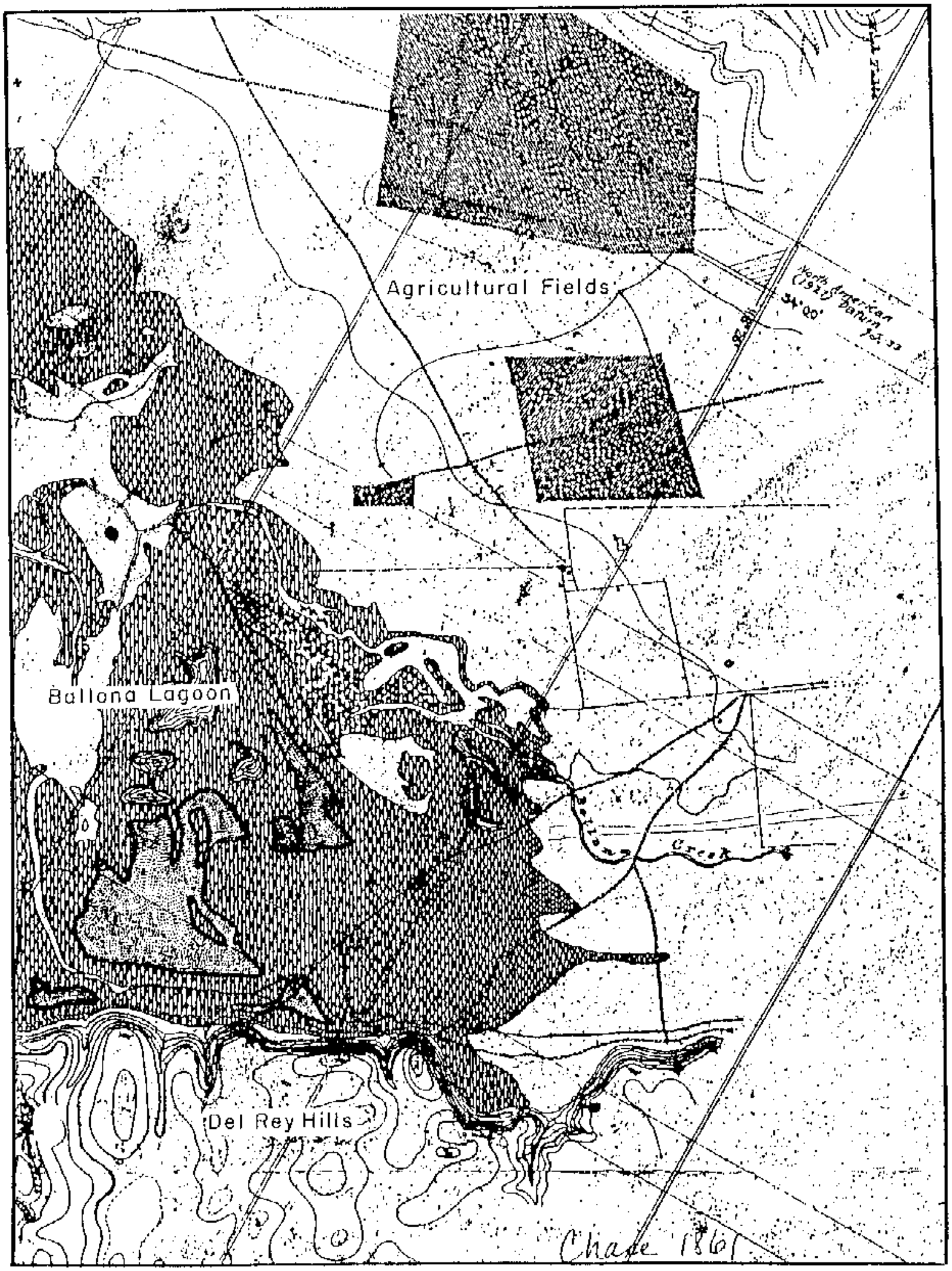


Figure 9. Chase Map of the Ballona Area (from Chase 1861).

PARTITION OF THE RANCHO, 1865-1880s

In the years after 1865, things began to change dramatically for Rancho La Ballona. The 1854 debt of Tomas Talamantes left in its wake his quarter share of the rancho in the hands of three Americans, while the death of Felipe Talamantes in 1856 left his share of the land to 25 family members, friends, and creditors. In 1865, the death of Agustin Machado left his quarter share to be divided among 14 heirs. All of this, plus the still questionable legality of the Ballona boundaries, led to an appeal by the various heirs to have the Los Angeles District Court effect a formal partition of the grant. The partition was first requested by John Sanford, James T. Young, and John D. Young in 1863, in a district court case that later became known as Case 965. Little was done about the partition until after the war, but in 1868, this difficult operation was finally carried out under the direction of surveyor George Hansen (Adler 1969:3; Robinson 1939).

The District Court ruled that the partition survey of La Ballona rancho had to be divided into 23 allotments for the heirs of Felipe Talamantes and Agustin Machado. Each allotment had to contain equal portions of three classes of land. The first class was to be arable land that could be irrigated from Ballona Creek. The second class was to be pasture land. The third class, "overflow lands", represented by the salt marshes. Hansen himself created a fourth class of land after the survey began, since he found much land capable of agriculture without irrigation (Wittenburg 1973:50; Robinson 1939; Culver City 1939).

As per the court's instructions, each allotment was to get equal acreage in each class of land. For whatever reason, by the time of the survey only 17 allotments were made, with the interests of many of the 23 heirs combined with those of others. The largest block of land went to the "Estate of Agustin Machado"; apparently at the time of the initial partition survey, his share of the rancho was not subdivided among his heirs. After Hansen's changes, these 17 allotments had to be spread equitably among the four classes of land: arable first class land; dry-farming second class land; seasonal pasturage third class land; and fourth class land that included the rest-- water courses, the lagoon, and the beach (Adler 1969:3-4). The first class land was located in the east of the rancho, along the upper course of the creek; second class land was located below that, to the southwest; third class land was the northern half of the rancho; while fourth class land was found in the extreme south (Figure 10). The project area was roughly split between second class land to the northeast and fourth class land to the southwest, with the division between the two falling about where Lincoln Boulevard is today. Only a small portion of the project area, the part east of Centinela, fell into the category of first class land.

The divisions within second, third, and fourth classes were effectively simple slices of land. Matters were far more complicated in first class, where Hansen attempted to make the improvement allocations agree with the allocations of land. Most improvements would appear to have been located in first class land, but as we have seen, some must have been situated in second class land north of the project area. Apparently Felipe Talamantes left no improvements, while Ygnacio Machado's improvements were assigned to his four sons. The most significant improvement to the rancho was purchased by James T. Young from Rafael Machado in 1859. This complex included a three-room adobe, a vineyard, a nursery of fruit trees, and fencing around the house and vineyard. Another smaller set of improvements was noted by Hansen and were identified as improvements begun by Tomas Talamantes before August 1859. These included the remains of a small, one-room adobe, a small willow grove, 10 fig trees, a few peach trees, and some fencing (Adler 1969:3; Wittenburg 1973:51).

The complex centered around the three-room adobe is almost surely located within first class land (Adler 1969:3) northeast of the project area. At present, the location of the remains of the one-room adobe begun by Tomas Talamantes is not certain; while probably located in first class land as well, it

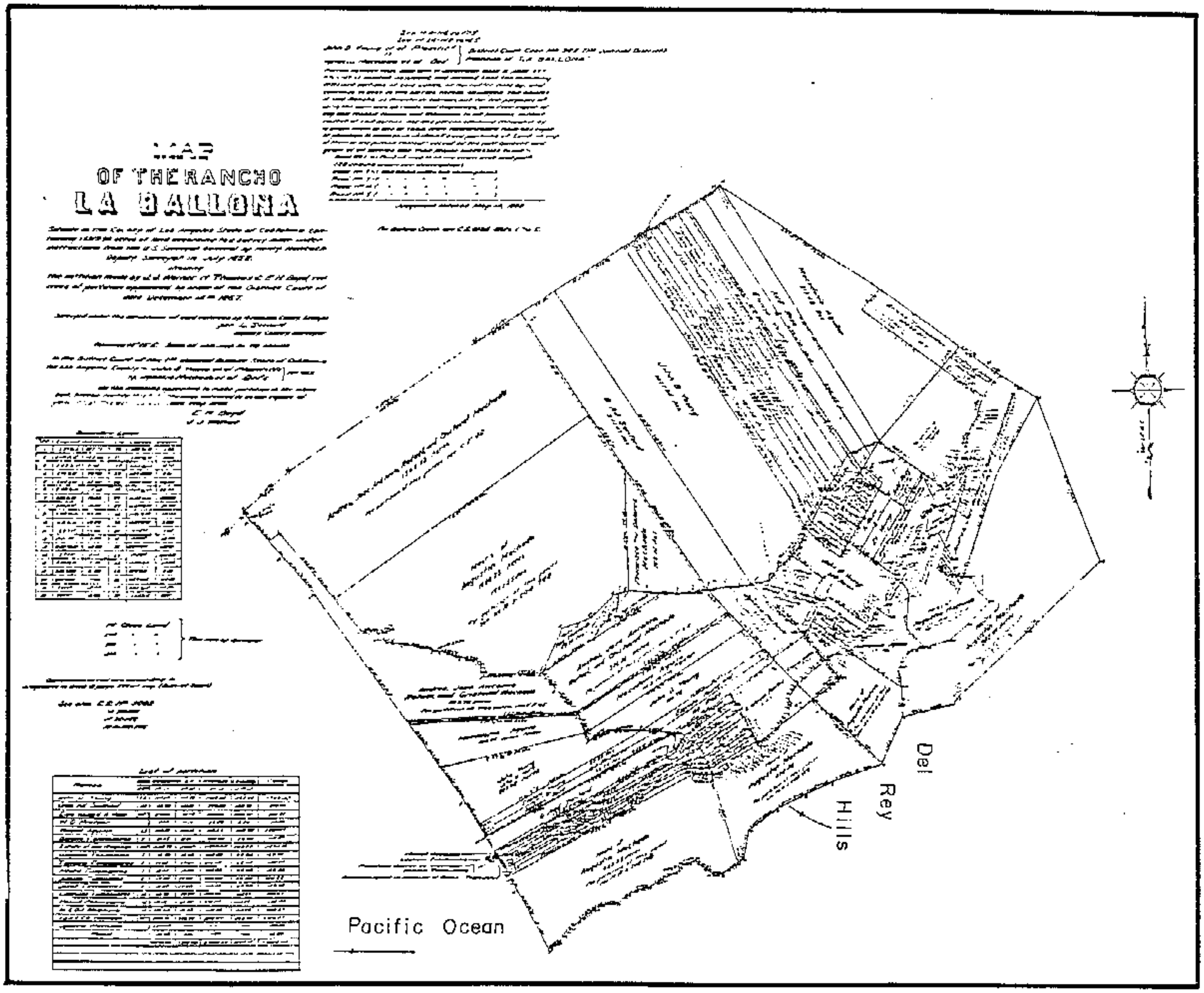


Figure 10. Hansen's Partition Survey of Rancho La Ballona, 1868 (from Wittenburg 1973).

may correspond to some part of the complex noted on the 1861 map. At the very least, it can be said that the Tomas Talamantes improvements were divided among George Sanford, Elenda Young, John D. Young, and Addison Rose: the approximate area of the settlement shown on the 1861 map was similarly divided.

As can be seen by looking at the map, the Hansen partition survey was a nightmare of odd-shaped parcels. In addition to that problem, there were a limited number of roads in the rancho at that time, and none of Hansen's parcels was cut by any of them, making access to parcels difficult (Adler 1969:4). The major road, Paso de las Carretas, was located approximately where Washington Boulevard is today. In Hansen's survey, it was labeled Road Number 3. Roads Number 1 and 2 together comprised the coast road, what is now Centinela Avenue (Adler 1969:4). One interesting feature along Road No. 3 was a zanja or ditch (Adler 1969:4). To this day, the zig-zag course of the ditch has been preserved by Zanja Street, located just over one mile north of the project area.

The Hansen survey had a direct impact on the project area. As a result of the survey, the area north of the present Ballona Creek channel was divided into long slivers of land, each awarded to different individuals. The area south of the channel-- first, second, and fourth class land-- was allotted to the heirs of Agustin Machado (Hurley c.1903/1868; Figure 11). It should be noted that the railroad lines shown in Figure 13 are c.1903 features, and were not in place in 1868. The map itself, though depicting the lines of the 1868 partition within the general project area, was an early 20th century copy of the original.

The awkward Hansen allotments paved the way for a round of buying and selling that would eventually lead to viable parcels. This move was accelerated by the wool boom of 1871-72 (Adler 1969:5), which in turn aggravated a boundary dispute with Rancho San Vincente y Santa Monica (Wittenburg 1973:38-39). The late 1860s and 1870s were periods of great confusion over ownership and land use within both the rancho and the project area itself. During these years, the Plaintiff Index for the County of Los Angeles is full of activity on the part of the Machados, whose lands remained undivided by the 1868 partition. Likewise, the Deed Index for those years is full of land transactions, most of which took place to the northwest and east of the project area between the years 1869 and 1874 (Indentures 10 Aug 1868, 1 Aug 1869, 6 July 1872a and b, 15 May 1874).

During this period, subdivisions were also taking place in Rancho San Vicente y Santa Monica to the northwest. Col. R.S. Baker bought the rancho from the Sepulveda family in 1872, paving the way for the development of the town of Santa Monica (Dillon et al. 1988:28). Baker also kept a houseboat, the "Pollywog," on the Ballona Lagoon to entertain his friends (Moran and Sewell 1979:12).

The lagoon also attracted Will Tell, who filed for pre-emption claim to 150 acres near the mouth of Ballona Lagoon in 1871 (Culver City 1939). On this land, he built a house and had eight to ten boats on the lagoon for hunting and fishing parties. Since Tell was located on lands allotted to the heirs of Agustin Machado by the 1868 partition, Ramona Machado, Agustin's widow, began eviction proceedings against him in the early 1870s, but allowed the process to lapse. Will Tell moved on to Santa Monica some time after 1874. "Will Tell's Seashore Resort" was then temporarily taken over by an Irishman, Michael Duffy, who resurrected the enterprise as a "Hunter's Cottage" (Robinson 1939). The establishment was finally destroyed by a storm in 1884 (Adler 1969:5; Wittenburg 1973:53).

In December of 1873 the final United States patent for Rancho La Ballona was issued to the heirs of Machado and Talamantes, after years of litigation between the Machados and the Sepulvedas as to the exact northeast boundary of the rancho (Wittenburg 1973:44). By this time, of course, none of the original grantees actually owned the land, and their heirs were in the process of selling most of their holdings.

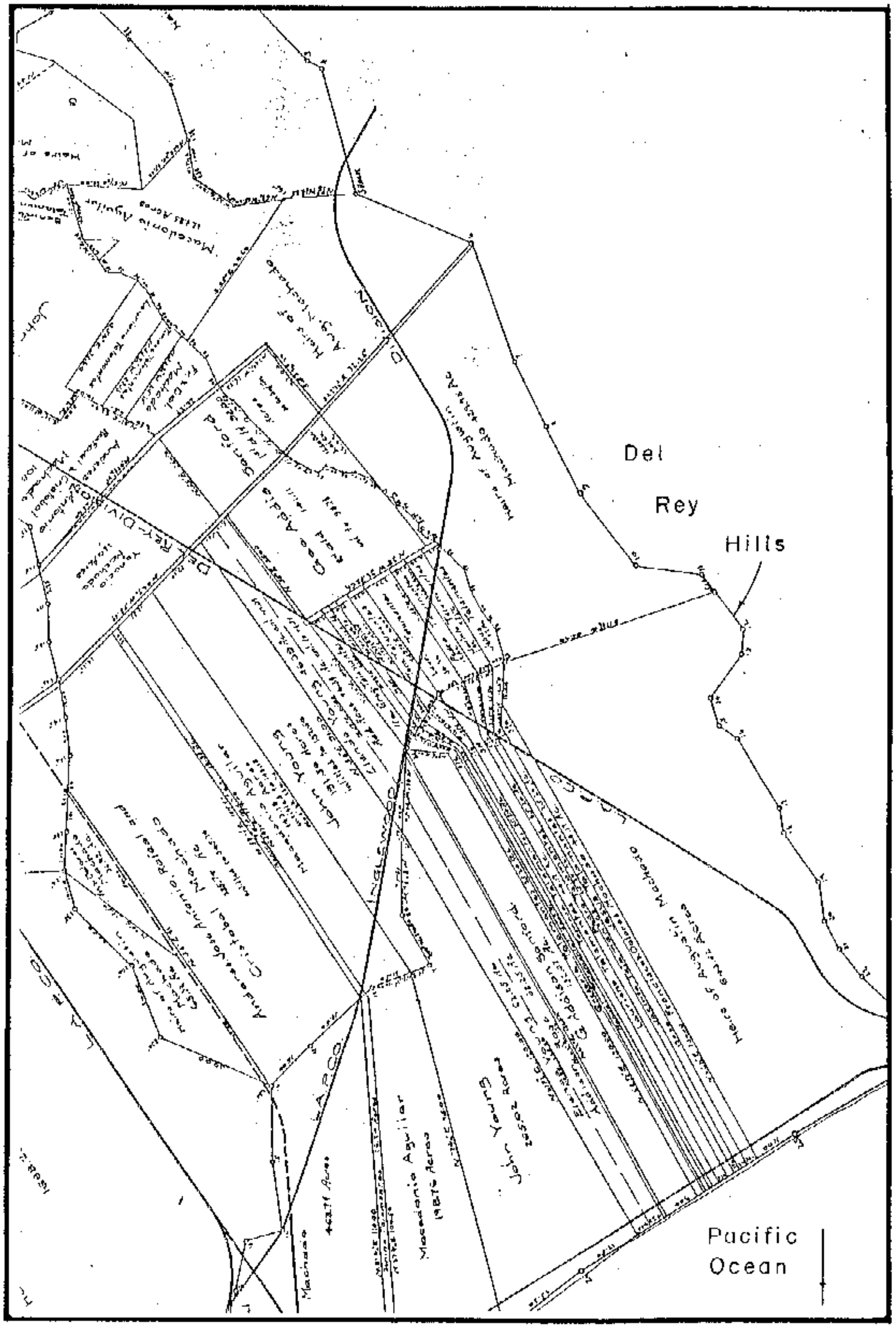


Figure 11. Detail of Hurley Map of Rancho La Ballona, showing 1868 Partitions and Later Railroad Lines from Hurley c. 1903/1868).

This trend was accelerated by the second partition of the rancho, the subdivision of lands belonging to the heirs of Agustin Machado. This subdivision was performed in 1875 (Robinson 1939) by the terms of District Court Case 2000, and had immediate impact on the project area. The area between the present Ballona Creek channel and what is now Jefferson Boulevard, previously undifferentiated property belonging to the heirs of Agustin Machado, was now subdivided 13 ways: first and second class land was divided into blocks, while fourth class land was separated into slivers that extended to the seashore. The area south of what is now Jefferson Boulevard passed intact to Ramona, widow of Agustin Machado (Hurley c.1903/1875; Figure 12). Again, it must be noted that the rail lines depicted on the map were not in place in 1875, but were added later.

By 1880, Rancho La Ballona had been completely dismantled and residents within the area were free to pursue livelihoods based on horticulture and dairying, which carried on the tradition of cattle ranching. The old rancho was now part of La Ballona Township, which extended from the Santa Monica Mountains in the north, to San Pedro in the south, all within Los Angeles County. The township included 13 old ranchos, including La Ballona. Within the old La Ballona Rancho, it would appear that local inhabitants were identified by the post office branch that served them. That post office branch was named "Machado" (Thompson and West 1880:135).

All of this information was compiled in a history of Los Angeles County collected by Thompson and West in 1880. The Thompson and West history provides even more information on the residents of the Machado "community." Five persons are listed as residents of Machado, even though it is far from certain that this was a comprehensive listing. Of the five listed, by far the largest landowner was John D. Young, identified as a farmer with 1350 acres. Thompson and West list him as having been born in Missouri, residing in Los Angeles County since 1853 (Thompson and West 1880:186). The other four residents are listed below:

Phineas Tibbet; farmer; born Ohio; to Los Angeles Co. 1853; 26 acres
Thomas A. Saxon; teacher; born Mississippi, to Los Angeles Co. 1872; 40 acres
J.J. Chapman; farmer; born Los Angeles Co; 57 acres
Dionisio Saenz and son, farmers; born Mexico; to Los Angeles Co. 1864, no acreage given (Thompson and 1880:186).

With the exception of John Young, none of the other residents listed in 1880 are even mentioned in either of the rancho partitions. This would suggest that property was turning over rapidly during this period. Even if the list of people living in "Machado" is incomplete, the extremely short list suggests that most rancho landowners in 1880 did not live on the property.

Unfortunately, we do not know the whereabouts of "Machado." In all likelihood, it was not a distinct community with a coherent center, but a scattering of residences up and down the creek. Its general location was probably near the old ranch house of Agustin Machado and abandoned Camp Latham-- the old center of the rancho-- about one to one and one-half miles northeast of the project area. This core area would later be swallowed up by the development of Culver City, but the name "Machado" would survive. By the early years of the 20th century it was a railroad name applied to the train stop in the vicinity of the rancho settlement depicted in the 1861 map of the Ballona Lagoon. By the 1900s, it would appear that this settlement had shifted to the south and west to take advantage of the California Central, later Pacific Electric, rail line. One-half mile north of the project area, "Machado" was used to designate a rail line stop until at least the 1940s.

As might be expected, the cattle industry had suffered a serious decline by 1880, at which time there were only 2000 head of cattle in all of La Ballona Township. The principal owners were Louis Sentous, 1000 head; F. Machado, 250; B. Marquesas, 200; Anderson Rose, 170; and John D. Young, 60

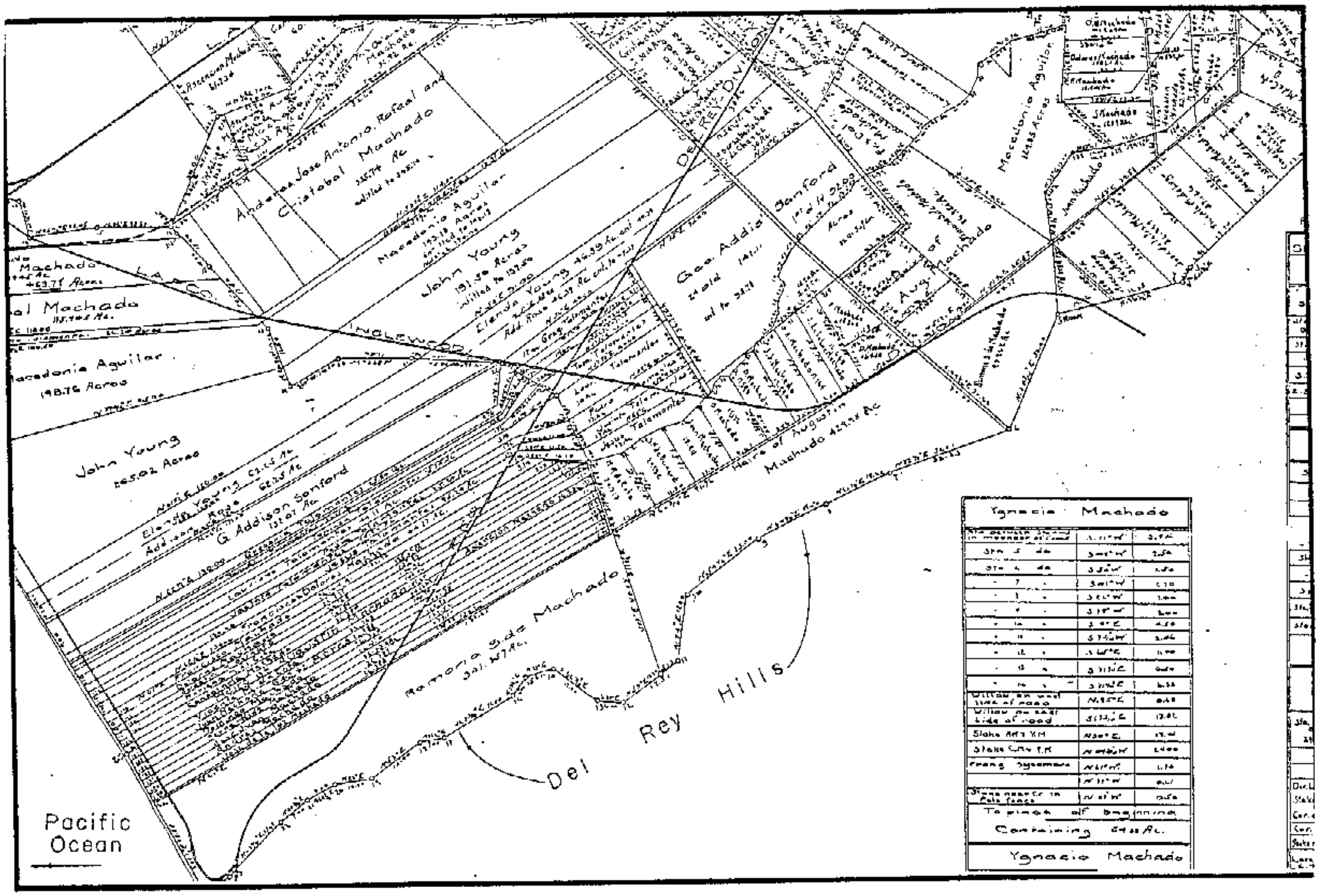


Figure 12. Detail of Hurley Map of Rancho La Ballona, showing 1875 Partition and Later Railroad Lines (from Hurley c. 1903/1875).

head (Thompson and West 1880:136). Sheep ranching, which had a peak of popularity in the early 1870s, had been badly hit by the dry season of 1876. By 1880, the principal sheep owners within the township were Garnier, 10,000 head; Bryant Gates, 5400 head; and Machado (no first name given), 3000 head. Most of these sheep were Spanish Merino and were sheared twice a year (Thompson and West 1880:135-136).

Perhaps the most startling new development to come out of the old ranching way of life was the rise of dairying. No other livelihood practiced within the old rancho symbolized such a complete break from the Hispanic past. For the old Californios, cattle produced meat, tallow, and hides. For the Anglos, cattle were the source of meat and milk. All early sources agree that milk products were not popular in Hispanic California. Butter was often better defined as sour thick milk mixed with its own cream. Butter, such as it was, was not churned but rather mixed by hand. It became rancid quickly. Cheese production was equally poor, with sour milk poured into molds which were not subjected to anything stronger than hand pressure. The results were mixed with large amounts of salt, resulting in a crumbly cheese. A better sort of cheese was formed when sweet milk was coagulated with rennet. This mixture was then formed into thin cakes by pressing the curds between the hands until the whey was expelled. The cakes were then dried, forming a luxury item called "panela" (Forbes 1839:166-67). Even the process of obtaining milk was considered difficult, since it was commonly assumed that a milk cow would only produce if a calf started the process (Forbes 1839:172).

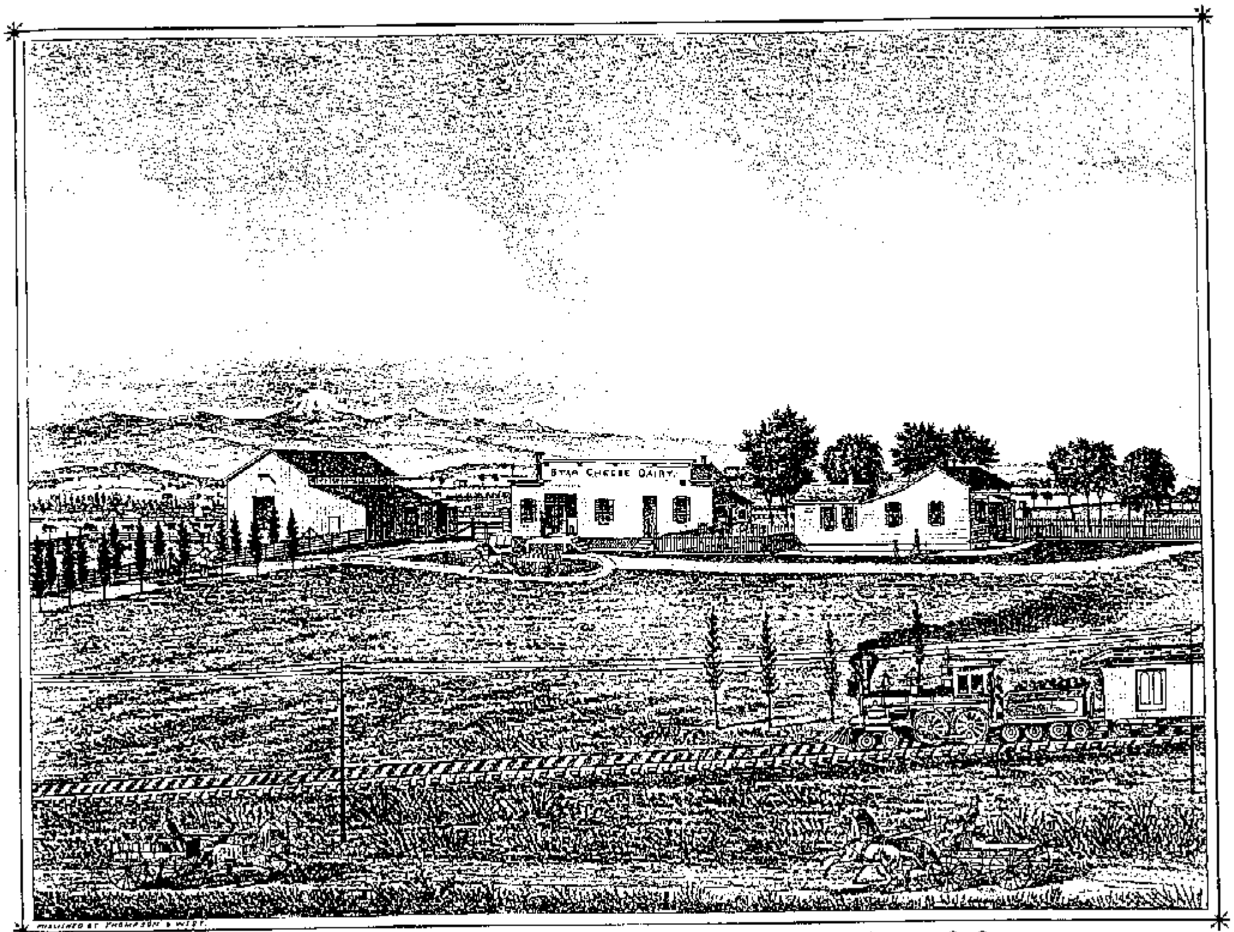
By 1880, over thirty years into the American administration, dairying was coming into its own in southern California and on Rancho La Ballona lands. Anderson Rose, one of the recipients of land from the rancho partitions, milked 80 cows and ran a cheese factory that produced 200 pounds of cheese per day. John D. Young milked 25 cows and marketed the milk. The largest local dairy, with 200 cows, belonged to the "Machado Brothers," who manufactured 150 pounds of cheese a day. It was noted that the Machado dairy had only been in operation for two years, having been established in 1878 (Thompson and West 1880:136). There is no indication that any of these dairies were located within the project area, but it is very likely that the project area was used for grazing.

While no illustrations of any of the Ballona dairies were provided in the Thompson and West history, what might be considered a typical 1880 cheese dairy in Los Angeles County was depicted (Figure 13). The Ballona dairies were probably similar in composition and lay-out.

The Thompson and West history captured Rancho La Ballona at a time when the dissolution of the rancho was almost complete. The original owners had long been dead, and their heirs were well on their way to selling off their parcels of rancho land. This trend accelerated with the Land Boom of the 1880s (Wittenburg 1973:52). By the end of the century, very little of the original rancho belonged to the Machado or Talamantes families.

One of the few Machado heirs to hold on to his first class land was Macedonio Aguilar, and he eventually sold it to form the kernel of what would later be the Palms community and Culver City (Pennington and Baxter 1976:17).

The property owner transition that effected most of the old ranchos helped set the stage for the urban development that would soon engulf the area. To understand the beginning of this development, we must temporarily step back away from the immediate project area and view the development of cities and subdivisions as they began in areas north, south, and east of the Playa Vista project area.



RESIDENCE AND CHEESE DAIRY OF JOHN JAY BULLIS, COMPTON, LOS ANGELES CO, CAL.

Figure 13. Typical Cheese Dairy in Los Angeles County, 1880 (from Thompson and West 1880).

EARLY URBAN DEVELOPMENTS AND THE LAND BOOM, 1870s-1880s

The first urban area to be developed within the vicinity of Rancho La Ballona was Santa Monica, which got its start as a community in the 1870s (Figure 14). The land grant San Vicente y Santa Monica, north of La Ballona, had been awarded to Francisco Sepulveda as early as the 1830s, but until the 1870s settlement on the grant had been restricted to the Santa Monica Canyon area. The mesa where the city is now located was used for grazing (Dillon et al. 1988:27).

After the Sepulvedas sold the grant in 1872, it became subject to development as an outlying community close to Los Angeles, which was just beginning its first period of rapid growth. The City of Santa Monica was proposed as early as 1875. By 1876, it had a rail link with Los Angeles, the Los Angeles and Independence Railroad, that occupied the course now followed by Exposition Boulevard (Wheeler 1881). The development of Santa Monica was closely associated with the success of the Los Angeles and Independence (Adler 1969:5).

In 1876, the Southern Pacific Railroad was the first transcontinental railroad extension to reach Los Angeles. As part of the deal to entice the Southern Pacific into the area, the railroad company was given Los Angeles's first rail line, the Los Angeles and San Pedro Railroad. This led to the increased importance of the San Pedro area as the port of Los Angeles (Adler 1969:5-6). The expansion of the Santa Fe line to southern California in the mid-1880s led to competition and the lowering of rail rates. This directly brought about the Land Boom of the late 1880s that completed the final transition of the Los Angeles area from a sparsely populated Hispanic community to an urban and largely Anglo-American series of settlements.

Following closely on the heels of Santa Monica came the development of Ocean Park, immediately to the south. An offshoot of Santa Monica, it was first developed by Abbot Kinney, who was later to become even more renowned as the developer of Venice, even further to the south and about 1.5 miles northwest of the project area. Abbot Kinney was an Eastern entrepreneur whose family made a fortune marketing cigarettes. Due to poor health, he traveled extensively in search of the right climate, eventually settling in the Los Angeles area (Moran and Sewell 1979:9). After Kinney married in 1884, he set up a new home on the coastal bluffs of Santa Monica. There he bought up land south of the city and convinced the Santa Fe to extend a spur line to the property, which was named Ocean Park in 1885. Here Kinney worked with a partner, Francis G. Ryan, to create a small resort community (Moran and Sewell 1979:11).

Other areas were being developed to the east and southeast. In 1885, Daniel Freeman bought Rancho Aguaje de la Centinela, out of which he planned and developed the City of Inglewood (Conner 1941:24). Within Rancho La Ballona, at the far eastern edge, a development team of Joseph Curtis, E.H. Sweetser, and C.J. Harrison bought a 500-acre tract of Macedonio Aguilar's allotment for 40,000 dollars in 1886. This area, now bordered by Washington Boulevard, Overland Avenue, and Manning Avenue, was subdivided that same year and became known as the Palms (Wittenburg 1973:53; Pennington and Baxter 1976:20; Culver City 1939).

The most ambitious development scheme concocted during the Land Boom was Port Ballona, conceived by Moses L. Wicks, a speculator who had previously worked in Pomona and Glendale (Adler 1969:6). After purchasing property around the inlet of Ballona Lagoon, Wicks managed to interest the Santa Fe Railroad in a harbor site that would compete with the Southern Pacific's monopoly on coastal traffic through San Pedro, Wilmington, and Santa Monica. When the Santa Fe agreed to this scheme, Wicks formed the Ballona Harbor and Improvement Company and raised around 300,000 dollars for the venture (Adler 1969:6). By the time the Santa Fe arrived, Wicks planned to have a town and harbor waiting.

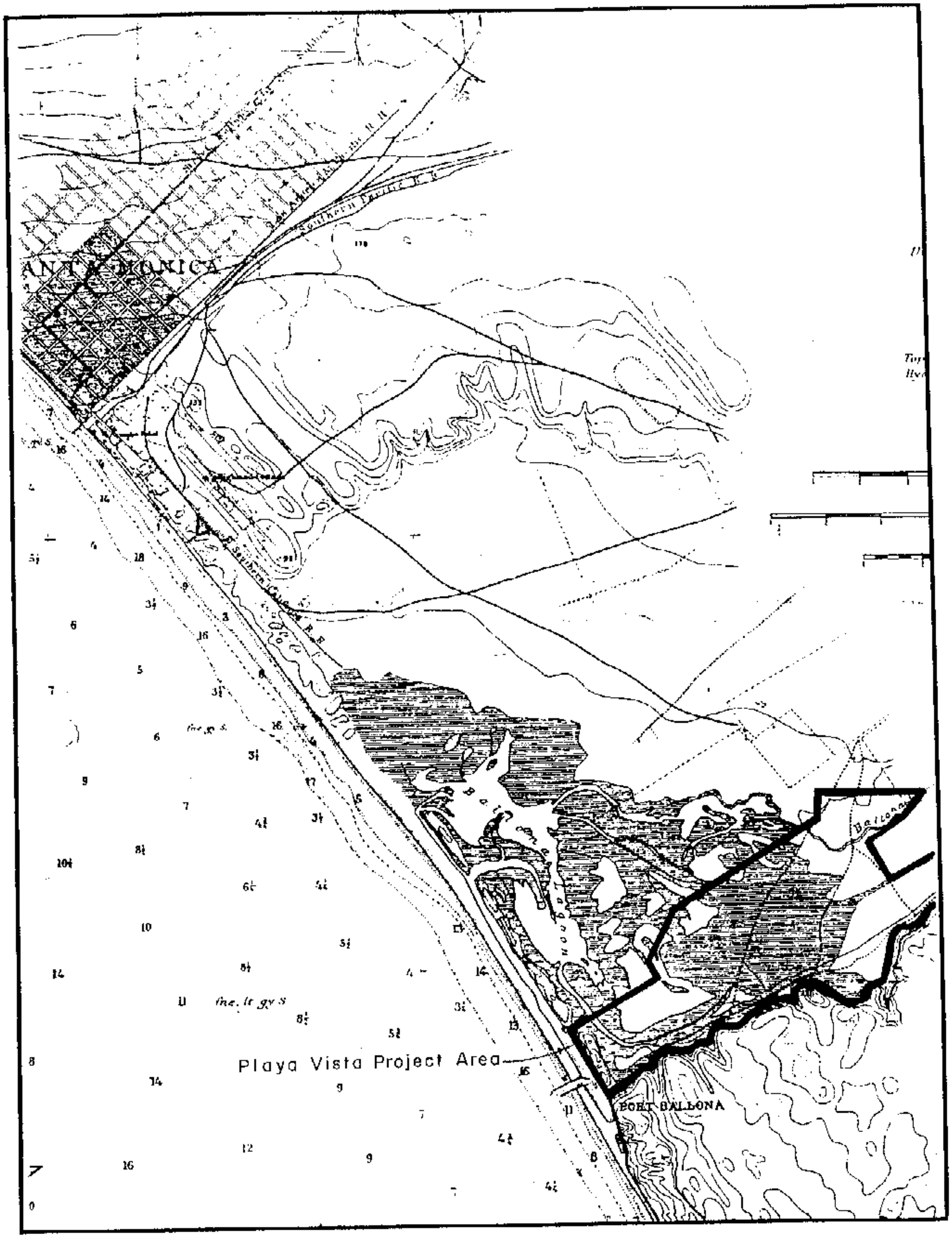


Figure 14. Ballona Lagoon after Development of Santa Monica, 1870s (from Santa Monica Bay 1871-1873).

While plans were laid out for the town, engineer Hugh Crabbe began to dredge the harbor according to specifications that called for a rectangular basin 300 by 600 feet, between 6 and 20 feet deep. The channel to the ocean was to be 200 feet wide, located where the present mouth of Marina del Rey is situated (Figure 15). While the ocean channel was being dredged, California Central Railroad, a subsidiary of the Santa Fe, began construction on two wharves built out onto the surf. All of this was going on when the first train rolled into "Port Ballona" in August of 1887 (Dillon et al. 1988:28).

Almost immediately afterwards, the Land Boom bubble burst and the development of Port Ballona was abandoned. The wharves and dredging were never finished, and the town was never built (Adler 1969:6; Thorn 1887). To make the best of a bad situation, the Santa Fe continued its tracks southward from Ballona toward Redondo, which soon became its ocean terminal (Adler 1969:6). As late as 1894, there were only 11 structures located at the mouth of the lagoon to keep the name of Port Ballona alive (Redondo 1894/1905; Figure 16).

DEVELOPMENT OF COMMUNITIES AROUND PROJECT AREA, c.1900-1940

After the feverish developments of the Land Boom, the 1890s were generally a period of slow growth. It was during this period, however, that the second rail line came through the project area, immediately north of the lagoon. At the instigation of Abbot Kinney, the Santa Fe was induced to complete a line from Inglewood, southeast of the project area, crossing the old "Port Ballona" tracks along the northern edge of the project area, continuing on to Ocean Park (Redondo 1894/1905; see Figure 16). This was done by California Central Railroad, Santa Fe's local subsidiary in 1892. Before the end of the century, this line was known as the Southern California Railroad, which ran on electricity (Adler 1969:6).

The railroad led to further urban developments around the project area. The first detailed surveys of what would later be the Venice area were conducted about this time (Map 1095, 1892; Wright 1893). The new railroad certainly contributed to the development of Ocean Park, which grew steadily throughout the 1890s.

The railroad probably altered somewhat the location of the original rancho-era settlement depicted on the 1861 map. "Machado," about 0.5 miles northwest of the project area, is shown on the Santa Monica Bay map of 1871-1893/1896 (see Figure 15), on the north side of the new rail line. It is not clear whether the name refers to the structure or a train stop for the general area. Even though this map is a composite, put together over a 20 year period, the structure along the railroad tracks almost surely postdates 1892; the structure is not found on Figure 14, compiled before the railroad. The other local features, almost identical to those found on the 1861 map, may or may not have been present at that late date. As was discussed earlier, the community of "Machado" may have migrated slightly to the south and west to take advantage of the new rail line.

Development of Playa del Rey, 1900s

After land development rebounded from the collapse of the Land Boom, one of the first areas to be impacted was the last area to be developed during the Boom. The early 1900s saw a renewed interest in "Port Ballona," with the dedication of a new hotel in 1902 near the mouth of the lagoon. Hotel del Rey, a 50-room establishment, was erected at the cost of 200,000 dollars. Eventually, it was associated with a 100,000-dollar pavilion and an 18-mile speedway for auto-racing. During this time, the lagoon itself was put to use with the addition of a boathouse and adjacent grandstands. There was even an inclined railway with two cars ("Alphonse and Gaston") leading from the beach to an observation platform on the bluff above the town (Culver City 1939).

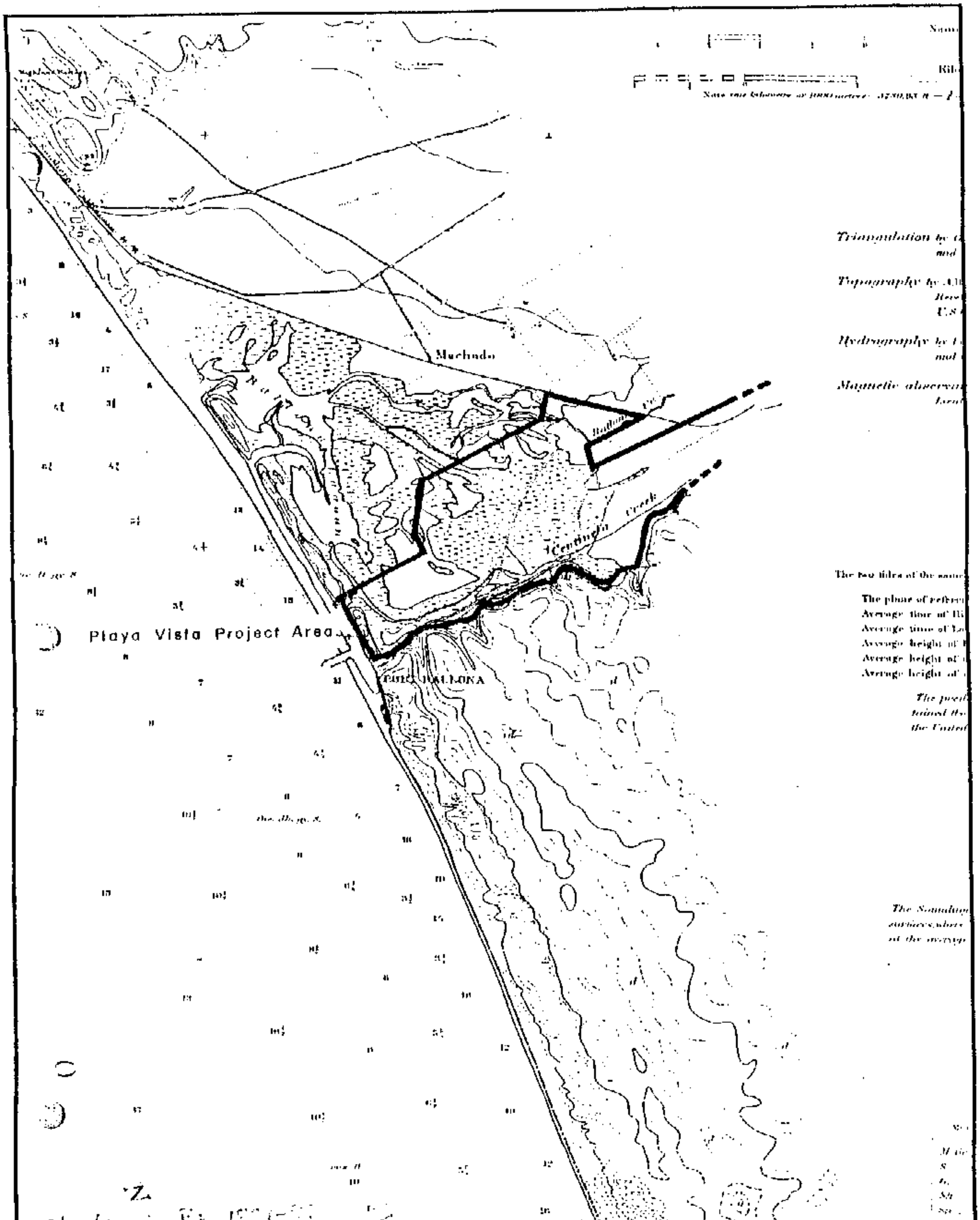


Figure 15. Ballona Lagoon Area, showing Port Ballona. Note that the Santa Fe Line to Port Ballona is not shown (from Santa Monica Bay 1871-93/1896).

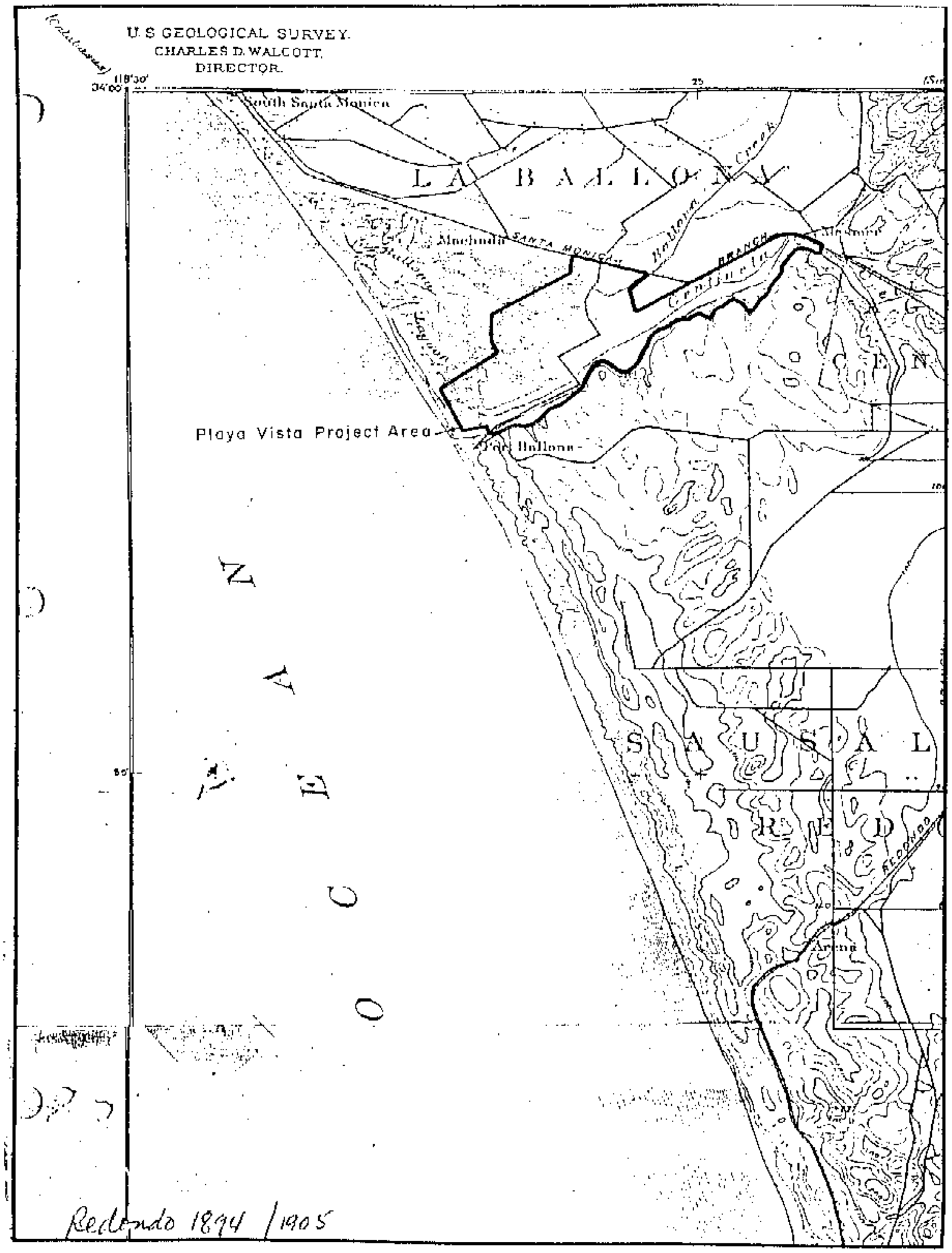


Figure 16. Project Area, showing Port Ballona, 1894. Note that the Sante Fe Line is not shown. (from Redondo 1894/1905).

In 1902, when all this was getting started, Port Ballona changed its name to Playa del Rey, the name used presently (Culver City 1939; Pennington and Baxter 1976:23-24). This was followed by a period of beach town expansion under the auspices of the Beach Land Company, directed by Henry P. Barbour, who purchased most of the town of Port Ballona from Louis and Joseph Mesmer. The Beach Land Company gave a 60-foot right-of-way to the Los Angeles-Hermosa Beach and Redondo Railroad Company (the old Santa Fe line into Port Ballona), which was soon reformulated as the Los Angeles-Pacific Company, and later consolidated into the Pacific Electric Railroad Company in 1911. By that time, Playa del Rey was a stop on the excursion route out of Los Angeles commonly known as the "Balloon Trip" (Culver City 1939). Later, the track from Los Angeles to Redondo Beach, through Playa del Rey, became the "red car" route popular in the 1930s and 1940s (Schofield, personal communication, 1990).

All of this finally led to expansion onto the adjacent bluff. Town streets on the palisade were finally drawn up by 1917 (Wright 1917). Even though Playa del Rey saw a period of stagnation during most of the 1910s, the area again grew in the 1920s, especially on the mesa and along the cliffs above the lagoon, leading to the development of subdivisions like "Palisades del Rey" and "Surfridge" (Culver City 1939).

Development of Venice, 1904-1910s

The development of Venice, about 1.5 miles northwest of the project area and immediately north of modern Marina del Rey, began with the death of Abbot Kinney's business partner, Francis Ryan, in 1889. Kinney did not get along with Ryan's successor, the new husband of Ryan's widow, which finally led Kinney to take an interest in land south of Ocean Park (Moran and Sewell 1979:11). In 1901, Kinney persuaded the Los Angeles Pacific to extend tracks south from Santa Monica to a point beyond Ocean Park, and in 1902, a short rail line was extended from Los Angeles along what would later be Venice Boulevard (Stanton 1978:2). In 1904, the year Ocean Park seceded from Santa Monica (Stanton 1978:28), Kinney was ready to begin his planned community of Venice.

Originally derided as Kinney's Folly, "Venice of America" was vaguely modeled after the Italian city. The development was to have pseudo-Italian facades, and of course, canals. In fact, the low, marshy nature of the land south of Ocean Park gave Kinney the whole idea (Stanton 1978:2-3; Moran and Sewell 1979:12). In addition to a pier and pavilion adjacent to Windward Avenue, the area to the south was to be criss-crossed with canals. In August of 1904, work began on the dredging of the Grand Canal, which was to be one-half mile long, 70 feet wide and four feet deep. Six other canals were added later to form a grid pattern that covered less than one square mile. The canals were dug with teams of horses pulling fresnos (Stanton 1978:2).

The following year, a second series of canals were dug off of the Grand Canal, which by this point had been extended southward to the Ballona Lagoon (Stanton 1978:2). By the end of the program, there were 16 miles of canals, averaging a depth of four feet, with spoils creating berms on either side. Aside from the connection with the lagoon, the original grid was connected to the sea through two 30-inch diameter pipes (Moran and Sewell 1979:20). The original grid of canals was opened to sea water in June of 1905, almost seven months after the first residential lots went on the market (Stanton 1978:2).

Venice proved to be a popular concept, even though it developed in ways that Kinney did not anticipate. Hoping for some kind of cultural center, Kinney was mildly disappointed that Venice simply became an amusement park, with rollercoasters, hamburgers, and beauty contests (Stanton 1978:32). Even if the community proved somewhat disappointing to its founder, it certainly proved successful. As early as 1907, Venice was trying to separate itself from Ocean Park and become an incorporated city in its own right. This was finally achieved in a round about way in 1911, when Venice actually superceded Ocean Park, changed the name of the whole community to Venice, and relocated the municipal government to Kinney's development (Stanton 1978:31; Adler 1969:14). At this time, it would appear from the available maps that residential development had progressed no closer to the project area than the corner of Washington Street, Zanja Street, and the Los Angeles Pacific right-of-way (Wright 1912). Urban development progressed no closer for almost 50 years.

From a peak in the 1910s, Venice began a slow decline attributable to a number of causes. Water in the canals circulated poorly, and in 1912 the State Board of Health condemned the canals as health hazards. While it is not clear what was done to remedy this matter, it is clear that no further canals were dug. Like other communities that grew too fast, the sewage plant was soon overtaxed and the fire protection system was strained. Beach erosion began to take its toll in the pier and pavilion area, which was finally crippled when the whole complex burned in 1920, the year that Kinney died. Finally, the 1920s saw the influx of cars, leading to the demand that canals be filled in to accommodate the added traffic (Stanton 1978:31,41). Citizen demands for better services led to the city's annexation to Los Angeles in 1925. By 1929, the original grid of canals had been filled in to make room for streets; the canals to the south were spared only because of the Depression (Stanton 1978:57,60).

Development of Culver City and Local Movie Industry, 1910s-1920s

Culver City, which now occupies the east portion of the old Rancho La Ballona, began as an off-shoot of the Palms subdivision, first established in 1886. In 1912, the Washington Boulevard Improvement Company subdivided that part of Macedonio Aguilar's pasture land left over from the Palms development (Culver City 1939). The heart of what would later be Culver City was developed the following year by the Culver Investment Company, headed by Harry H. Culver, who had moved to Los Angeles in 1910 to further his career in real estate (Culver City 1939). By 1914, Culver's development was a well-established town, with homes, shops, churches, a lighting system, and a railway station. "Culver City" was finally incorporated in September of 1917 (Culver City 1939).

In 1915, just two years after Harry Culver bought up the lands that would later make the city, movie producer Thomas Ince filmed a Western along the shores of Ballona Creek. Ince was so impressed with the area that he later bought land in what would soon become Culver City. From this beginning would grow the Metro-Goldwyn-Mayer movie lot made famous in the 1920s (Robinson 1939:123; Alexander 1965:48; Wanamaker 1986). The story of film-making in Culver City was one of rapid success, made all the more astonishing since the film industry had only been on the West Coast since about 1908.

The West Coast offered the film industry advantages that New York could not match: space and year-round sunshine. Since early films could only be shot in natural light, this was a crucial advantage. Santa Monica was one of the first West Coast centers of the film industry. By around 1908, local film makers were working all around Santa Monica, filming unannounced in people's front yards and on the streets. They were such a nuisance to the local residents that they were soon restricted to studio lots, much as they had been back in New York. Still, the attraction of California to the industry was enormous. Soon the larger film companies, like Vitagraph, Kalem, and Essanay, had their own studios in Santa Monica (Basten 1974:88). Finally, these were joined by D.W. Griffith and the Biograph Company, which moved out to the West Coast in January of 1910 (Spalding 1930, vol.1:360).

The film industry left Santa Monica almost as quickly as it had come. By 1915, all of the film studios had relocated to other areas of southern California (Basten 1974:88). While most moved to the developing suburb of Hollywood, the Kalem Motion Picture Company established a studio in the Palms in February of 1915 (Culver City 1939). One of the larger of the new studios was "Inceville," established by film producer Thomas H. Ince in 1913. This enormous Western movie set was located along the coast within Santa Inez Canyon, above Santa Monica. Inceville was finally destroyed by fire in the early 1920s (Basten 1974:88,107).

The consolidation and growth of the film industry was represented by the creation of the Triangle Film Corporation in 1915, formed by the troika of D.W. Griffith, Mack Sennett, and Thomas H. Ince. Triangle Films showed its clout by successfully showing films at the unheard-of price of two dollars a seat (Blum 1953:97). By the time of Triangle's formulation, an estimated half of all American films were produced in California (Blum 1953:95). The percentage would rise tremendously in the years to come.

It was during this pivotal time in the film industry, 1915, that Thomas Ince, working at Inceville, found he needed a stream capable of floating three Indian war canoes for a Western he was making. At the time, the Los Angeles River was too dry and the Colorado River, too far away. Ballona Creek was found to be both close and suitable, and the scene with the Indian canoes was shot under the bridge at the Casserini Ranch, not far from Francisco Higuera's homestead on the old Rancho Rincon de los Bueyes, about 3.5 miles northeast of the project area. One of the most important observers of the shooting was Harry Culver (Culver City 1939). In September of 1915, Thomas Ince bought a lot on Washington Boulevard at Sixth Street, immediately south of the Palms subdivision (Culver City 1939). From this beginning in what would soon be Culver City developed the new Ince movie studio.

The film industry went through great changes during the last years of World War I. Public taste in films went through something of a revolution as serials began to fade in popularity in favor of features. Older firms not quick to change began to die, as did Edison, Essanay, and Selig. Triangle Film unraveled about this time, leaving the field open for new firms. In the confusion, rose the second generation of great film-makers, Adolph Zukor, Cecil B. de Mille, and Samuel Goldwyn-- film-makers who would take the industry into the 1920s (Blum 1953:157).

Ince's Culver City lot lasted only two years. In 1917, the property was deeded to New York Motion Picture Corporation. Samuel Goldwyn bought the studio in 1918, and the following year title passed to Goldwyn Pictures Corporation (Culver City 1939; Spalding 1930 vol.1:398). In 1924, Goldwyn Pictures was amalgamated into Metro-Goldwyn-Mayer Corporation, and the Culver City lot became the center of MGM operations (Culver City 1939; Spalding 1930 vol.1:382).

With the film industry established next door, the Ballona wetlands and the adjacent bluffs proved attractive and accessible for filming outdoor scenes. One of the greater films made in the area was "Hell's Angels," produced by Howard Hughes. Filming for "Hell's Angels" began in 1927, with a story-line based on the exploits of World War I aces. Hughes insisted on realistic dog-fights with real World War I planes. Over 100 mechanics worked around the clock to keep Hughes's private air force aloft, and Hughes, even then a perfectionist, shot the aerial scenes repeatedly until they matched his expectations. Most of this aerial shooting was done in the San Fernando Valley and at Mines Field in Inglewood, later the site of the Los Angeles International Airport (Hatfield 1972:7; Schwartz and Maguglin 1983:9-10), but it is believed that some of the filming also took place within the project area.

By the time "Hell's Angels" was ready for release in March of 1929, the impact of the first talking picture, "The Jazz Singer," was already so powerful that silent films were fast becoming obsolete. Hughes decided not to release his film without sound, and this led to enormous complications in the refilming. The heroine of the silent version had a thick Scandanavian accent that was considered insurmountable; Jean Harlow was chosen for the sound version. Sound also had to be added to the aerial fight scenes (Schwartz and Maguglin 1983:11). By the time "Hell's Angels" premiered in 1930, Hughes had spent an unheard-of four million dollars in total production (Display, Spruce Goose Exhibit).

Hughes got more than a film out of his work in the vicinity of the project area. Hughes would remember the area when he expanded his financial empire to include airplane research, design, and production. In the early 1940s, after he made a name for himself as a pioneering aviator, he would return to the area north of the Ballona Escarpment to construct what would later be his corporate headquarters, research center, and assembly plant.

Development of Westchester, 1920s-1960s

One of the last communities to be established around the project area was Westchester, located on the bluff immediately south of the Ballona wetlands. Westchester got its start in the late 1920s with the campus development of Loyola University on top of the bluff overlooking the wetlands (McDonough, personal communication, 1990; Trame, personal communication, 1990). Throughout the 1920s and 1930s, Westchester development was limited to the immediate area between Loyola University and Manchester Avenue. In 1940, Westchester was incorporated. At that time, Mines Air Field, south of the community, was already established as one of the premier air strips in the Los Angeles area (Figure 17).

The community began to expand in the 1940s, keeping pace with development of the Hughes aviation industry below the bluff. By the 1960s, residential development had expanded south of Manchester Avenue and west of Lincoln, there running into Playa del Rey development at the west end of the bluff. Mines Field too developed, gradually expanding until it became the enormous facility of the Los Angeles International Airport. Loyola University also grew; by the 1970s, this previously all-male institution combined with a girls school, Marymount College, to form the co-educational institution now known as Loyola Marymount University (McDonough, personal communication, 1990; Trame, personal communication, 1990).

SLOW GROWTH IN THE PROJECT AREA, 1890s-1930s

Significant historic development of the project area really began with the advent of railroads through the project area in the 1890s, and the subsequent development of neighboring communities that slowly encroached on the Ballona marsh. The vast majority of this area, however, remained undeveloped due to the low and often marshy nature of the land. Only those activities that could make use of such land thrived in this environment. It is not coincidental that the first intensive use made of this area was agricultural.

Much information within this section of the report has been provided by records preserved in the Los Angeles County Assessor's Map Books. These records cover a period from around 1902 to the mid-1960s, and identify most of the property owners between these years within the project area. Just as important, the value of any improvements to the land were noted in many early assessments. In this manner, it was often possible to determine when constructions took place. In order to make sense out of the landowner situation found in the project area by 1902, a recapitulation of local events in the late 1800s is in order.

In 1875, when the last court-ordered partition of Rancho La Ballona took place, the project area was divided along the axis now formed by Jefferson Boulevard. North of that axis were parcels of land divided among the heirs of Agustin Machado; south of the axis were the lands awarded to Ramona Machado, Agustin's widow. It was about this time that Ramona started eviction proceedings against William Tell, squatting on land near the mouth of the lagoon. At that time, it is likely that Tell and his wife were the only people actually living within the bounds of the project area.

The Santa Monica Bay maps of 1871-93 and 1871-93/1896 show the area as looked in the second half of the 19th century (see Figures 14 and 15). The oldest settlement within the vicinity was the small community depicted earlier on the 1861 map, north of the project area. Port Ballona was the only other settlement in the area, occupying the place previously claimed by William Tell. The area west of

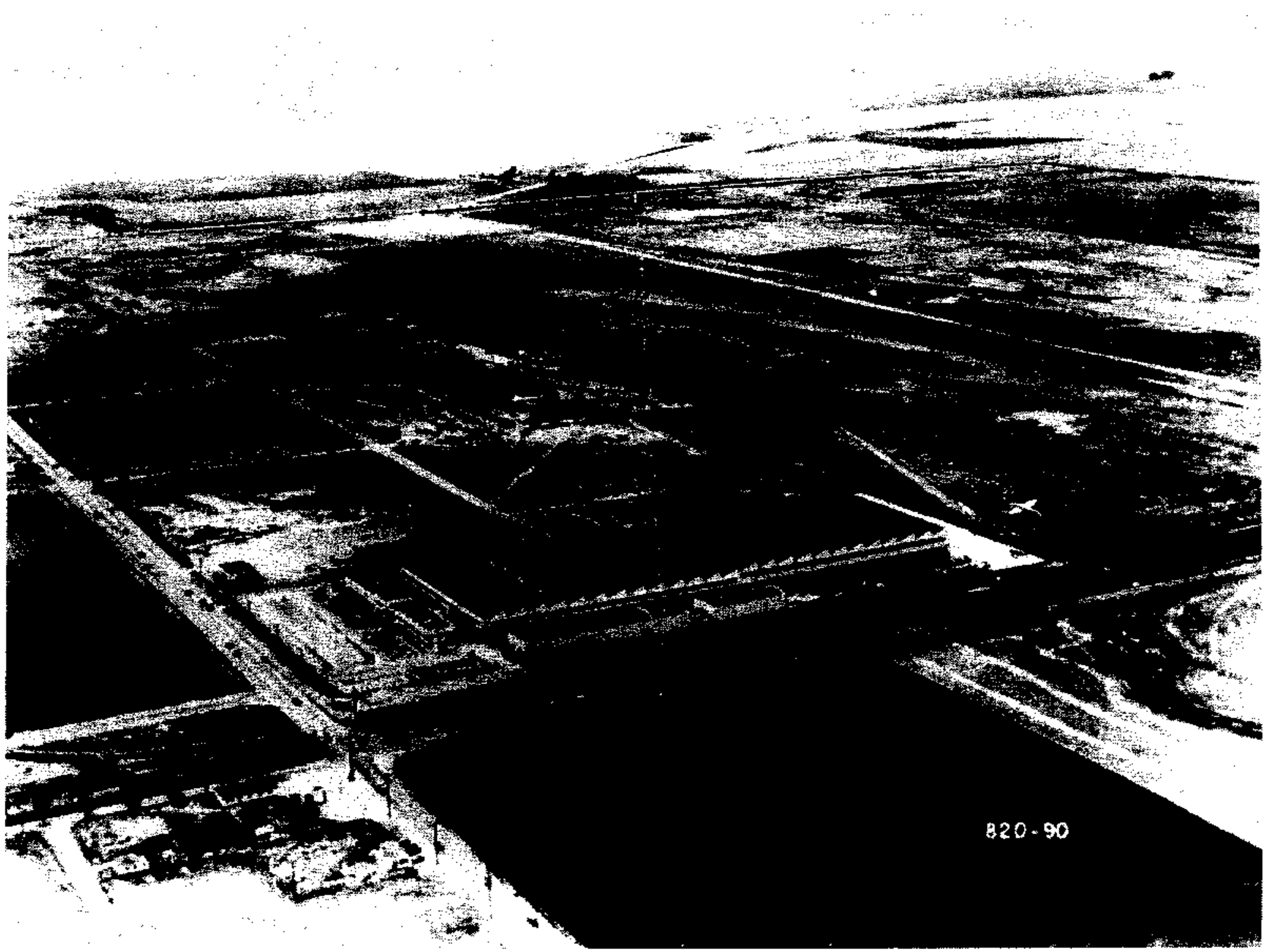


Figure 17. North American Aviation Building at Mines Air Field, 1939 (Photo on file, Schofield).

what is today Lincoln Boulevard was then marshland, interspersed with small bodies of standing water. Ballona Creek meandered into this marshland, losing its channel along the way. Centinela Creek coursed along the southern margin of the project area, adjacent to the bluff. For some reason, the Port Ballona railroad was not depicted, while a few dirt roads are shown traversing the marsh.

The project vicinity was again depicted in the Redondo map of 1894/1905 (see Figure 16). Again, the Santa Fe line to Port Ballona, constructed in 1887 is not shown, while a later line, the Santa Monica branch, constructed in 1892, is depicted. No development is shown within the immediate project area, even though there are a few structures at Port Ballona. The only other possible settlements within the project vicinity are "Machada" (sic) and "Mesmer," the first to the north and the second to the east of the project area. Machado was probably the remnants of the 1861 settlement, attracted to its new, slightly different location by the rail line constructed in 1892. In all likelihood, Machado simply started out as a rail stop, which was the magnet that drew in a small community. Mesmer, located along the same rail line east of the project area, probably got its start about the same way.

By the time of the Joseph Hurley map (c.1903; Figure 18), both the 1875 partitions and the two rail lines are depicted (Map Collection). The 1887 Port Ballona line is now identified as the Los Angeles-Pacific Railroad, Palms Division. The 1892 line, now part of the Los Angeles-Pacific Inglewood Division, ran between the old Rancho Aguaje de la Centinela (now Inglewood) and Ocean Park. The only tract identified by name within the project area was Mesmer, which included the extreme eastern tip of the project area.

It is at this time that further information can be drawn from the historic Assessor Maps for Los Angeles County, the earliest of which date to the first years of the 20th century. At that time, Joseph Mesmer owned almost all of the vast holdings of Ramona Machado within the project area. This included the extreme eastern edge of the project area (land east of Centinela), where Mesmer was assessed 200 dollars for improvements in 1905, the first year this land appears in the assessment records (Map Book 131 and 1/2, 1903-11). The long tract south of what is now Jefferson, between what is now Centinela and Bay Street, also belonged to Joseph Mesmer, who was assessed for 500 dollars-worth of improvements on this land, but was not assessed for trees or vines-- a distinction made only in the earlier years of the existing records (Map Book 101, 1905-13; 139, 1902-12).

Before 1908, it would appear that Joseph Mesmer owned just about all of Ramona Machado's land within the project area, his family probably having bought it from her directly. The only exception was Playa del Rey, which had already been separated. In 1908, land west of Bay Street was sold to the Beach Land Company as part of a Playa del Rey development scheme. Improvements, however, were not forth-coming. The large area west of what is now Lincoln Boulevard was only assessed 50 dollars for improvements and 150 dollars for trees and vines. Sometime between 1908 and 1912/13, Grace Howland came into possession of a block of land situated between what is now Jefferson to the north, and the bluff to the south, bordered by what is now Lincoln to the east. Assessment records indicate that no improvements were made on this block of land (Map Book 101, 1905-13; 139, 1902-12).

Most of the area north of Jefferson had been subdivided into thin slivers of land by the terms of the 1875 partition. Even in the early years of this century, ownership patterns within this area were still too confusing to summarize with any accuracy. It is interesting, however, that after 1905 the thin slivers adjacent to the present channel of Ballona Creek all seemed to belong to Andrew J.W. Keating and later to his heirs (Map Book 101, 1905-13; 139, 1902-12). This is interesting only because this area was soon to be the site of a circular motordrome, about 0.5 km in diameter, depicted on the Santa Monica Bay map of 1871-93/1910 (Figure 19). This circular feature was located on the north side of the Port Ballona rail line, about half way between Port Ballona and the Santa Monica rail line.

While the feature was not actually identified by name on the 1871-93/1910 map, the same area was labeled "motordrome" on the Venice 1923/24 map (Figure 20). At the time of the second map, the

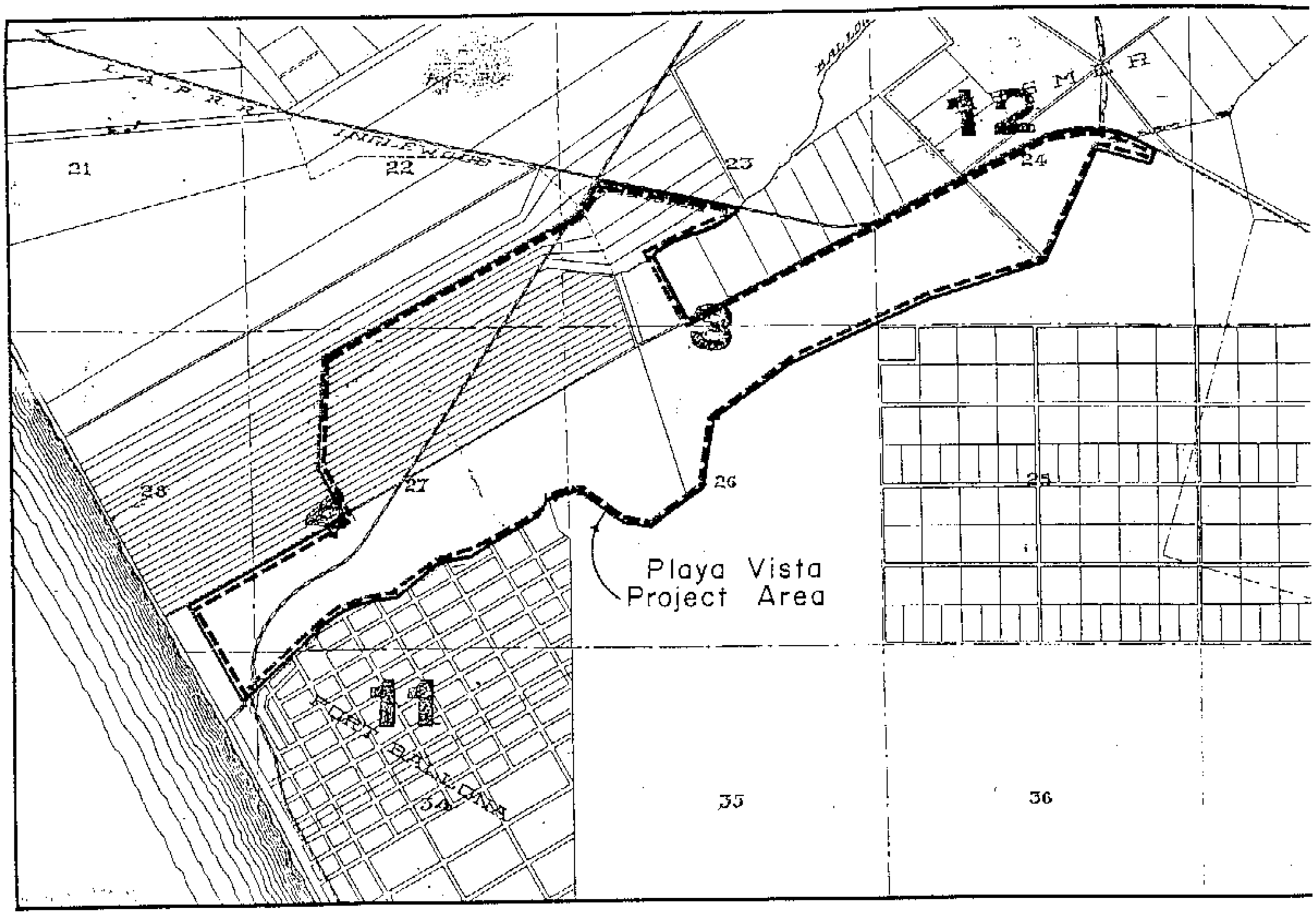


Figure 18. Detail of Hurley Map of Ballona Area, c. 1903 (from Hurley c. 1903).

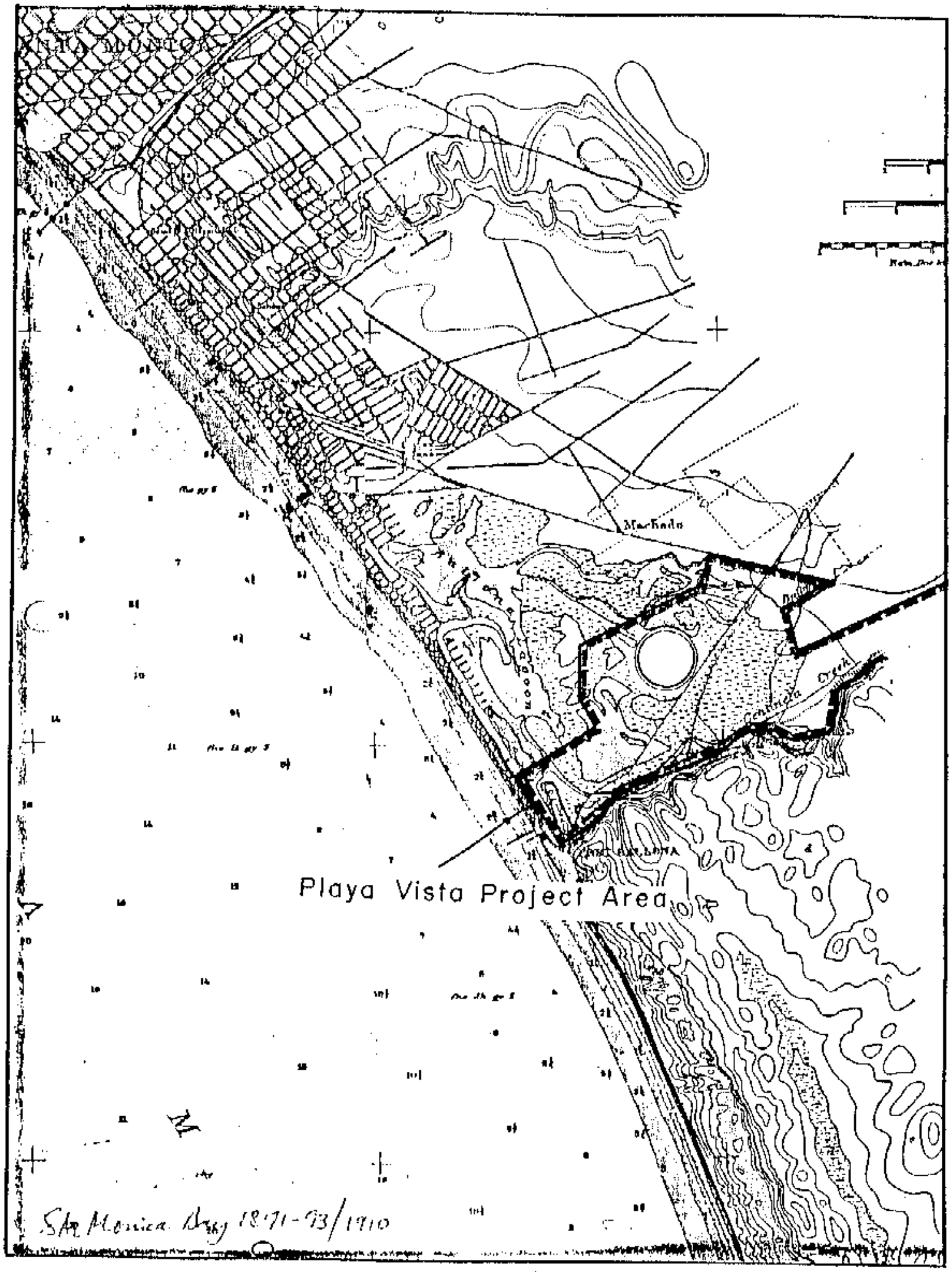


Figure 19. Ballona Lagoon and Mortordrome Location, c. 1910 (from Santa Monica Bay (1871-93/1910).

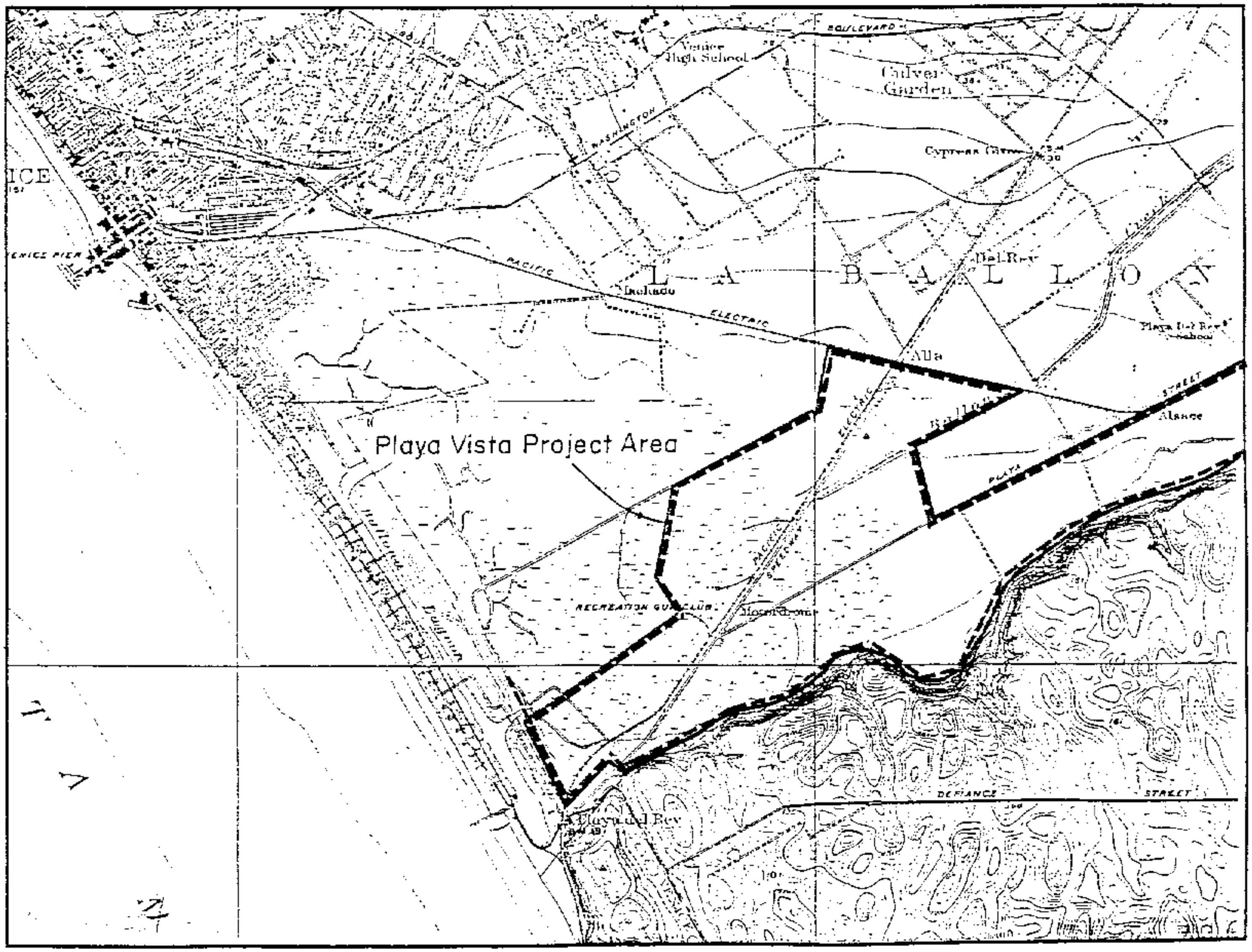


Figure 20. Ballona Lagoon and Old Location of Motordrome, c. 1923-24 (from Venice 1923/24).

motordrome appears to be gone, even though there are spur lines from the Pacific Electric Railroad (the 1887 Port Ballona line) to the motordrome area.

Another feature identified within the same area of the motordrome was the "Recreation Gun Club," marked by the presence of three structures along the rail line on the 1923/24 map. These structures, located near the Pacific Electric bridge over Ballona Creek, was remembered as a duck hunting club (Schofield, personal communication, 1990). The Recreation Gun Club was recognized as one of the three largest hunting outfits that exploited the Ballona wetlands in the early 20th century. The other two were "The Centinela" and "The Del Rey" (Robinson 1939).

The growing popularity of the automobile in the 1910s and 1920s made possible the motordrome race way. It also led to the establishment of the first pattern of local roads recognizable today. Culver Boulevard was perhaps the first major road within the project area. Running parallel to the Pacific Electric tracks on the south side, Culver was first known as Speedway Boulevard in the early 1920s (see Figure 20). During this same period, Jefferson was already in place, then identified as Playa Street. From the available maps, it is obvious that Culver got its start as an auxiliary road to the Port Ballona line, while Jefferson ran along the northern boundary of Ramona Machado's land.

By the 1930s, Culver and Jefferson had assumed their present names, and Lincoln Boulevard was being extended across the project area from the south. By 1934, Lincoln had been taken as far as Ballona Creek (Figure 21). By 1940, it had been pushed all the way across the Ballona wetlands to connect with Lincoln Boulevard in Venice (Figures 22 and 23).

Perhaps the biggest overall change to the general area in the 1930s was the introduction of gas wells, oil wells, and refineries. The Ohio Oil Company hit a wildcat well east of Venice's Grand Canal in December of 1929, and drilling was soon permitted throughout the area south of Washington Street. By 1931, there were 325 oil wells active in Ballona Lagoon (Stanton 1978:60), with refineries and tanks built up on islands of fill (Dillon et al. 1988:31; Figures 24 and 25). These tanks do not appear to show up on the 1930/34 map, but they do appear as small circles on the 1923/1940 Venice quad (see Figure 22). Within the project area, these tanks appear to be limited to the west side of Lincoln, but drilling for gas and oil was conducted throughout the area. As shown in Figure 26, methane gas wells were even dug near what is now the intersection of Imperial and Sepulveda in the 1930s (Schofield, personal communication, 1990).

Searching for oil has had a long and venerable history in southern California, one that predates considerably the establishment of the Ballona oil field. As early as 1865, the Pioneer Oil Company was established with Phineas Banning as president to conduct experiments with oil in the Los Angeles area. As a result of this work, "coal-oil" or kerosene was first exhibited in southern California. Others gathered the oil that floated on Pico Spring and refined it without benefit of distillation. Soon there were borings at la Canada de Brea (Spalding 1930, vol.1:167-8).

Perhaps the the first prospecting for oil in the Los Angeles area occurred in 1874 in the mountains around Newhall, leading to the development of the Ventura-Newhall Field in 1875 and 1876. At that time, all of California's oil production of 175,000 barrels came from this one field (Spalding 1930, vol.1:209).

By 1899, there was an oil boom in southern California, after the discovery that petroleum could be mixed with air, ignited, and the heat used to generate steam. Oil quickly began to replace coal and wood, both of which were more difficult to obtain than the local petroleum. At this time, oil was still shipped in barrels-- there were no pipelines-- and one of the most touted uses for the heating potential of petroleum was the firing of bricks (Spalding 1930, vol.1:322-23).

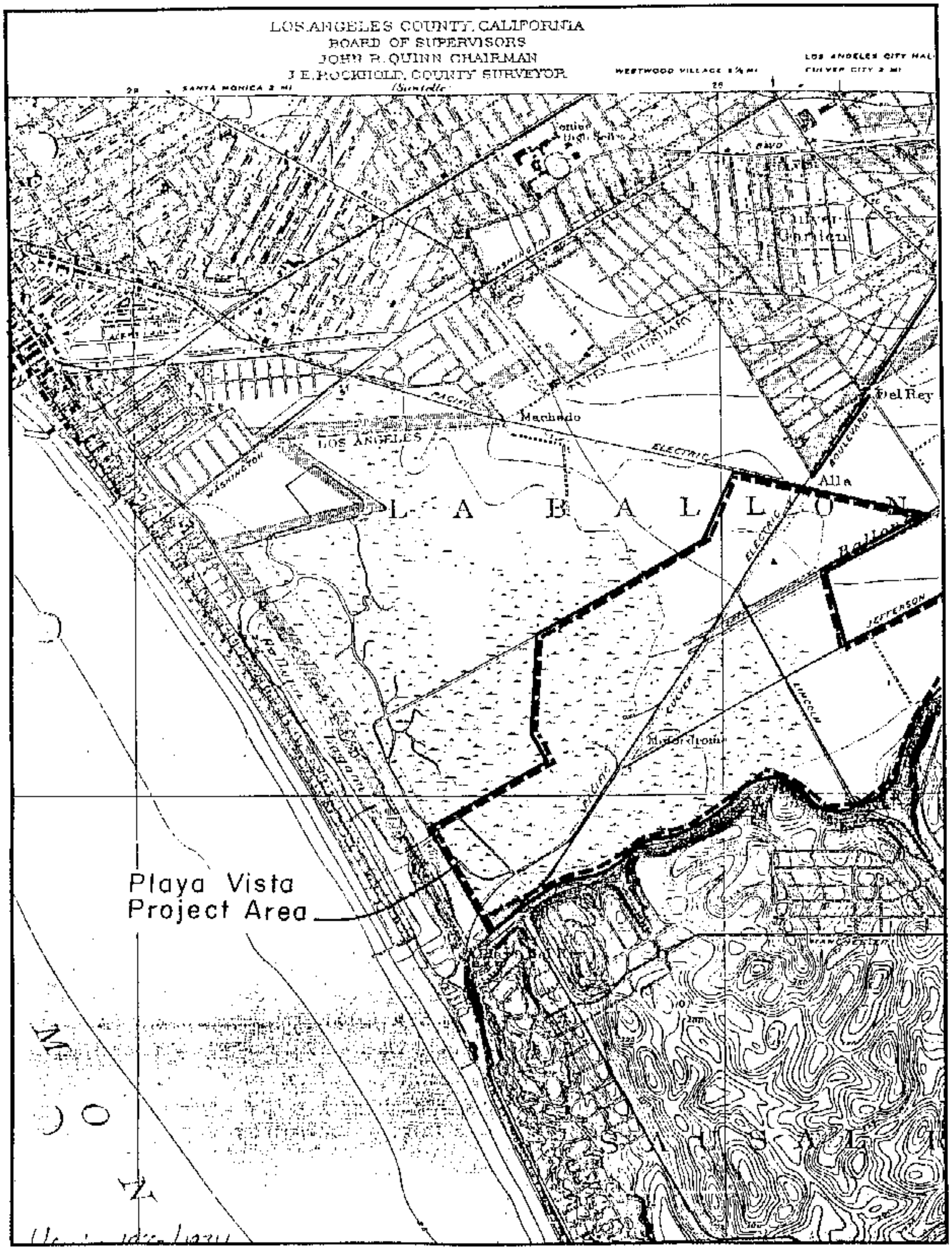


Figure 21. Playa Vista Project Area and Vicinity, 1934 (from Venice 1930/34).

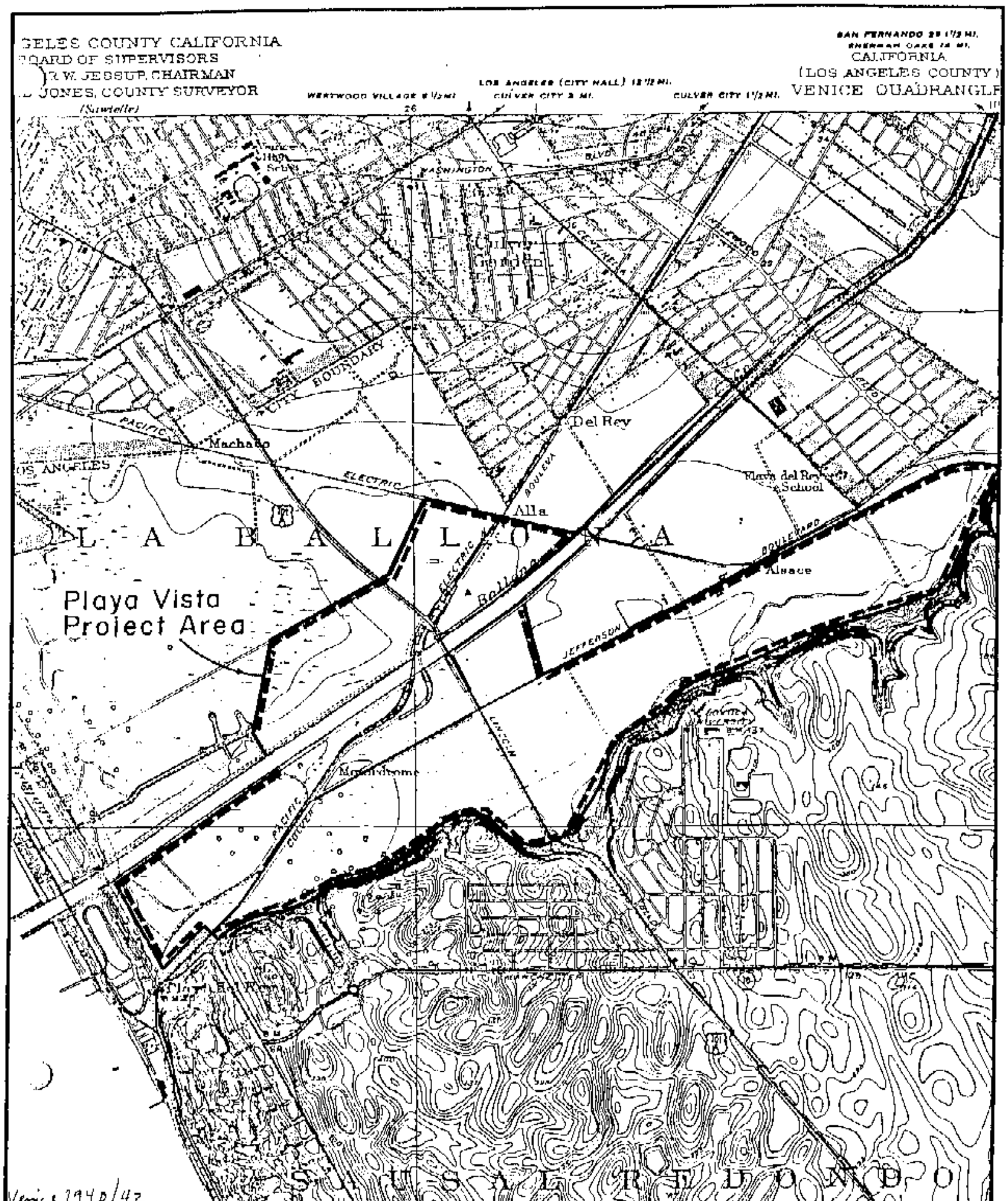


Figure 22. Playa Vista Project Area and Vicinity, 1940 (from Venice 1940/42).

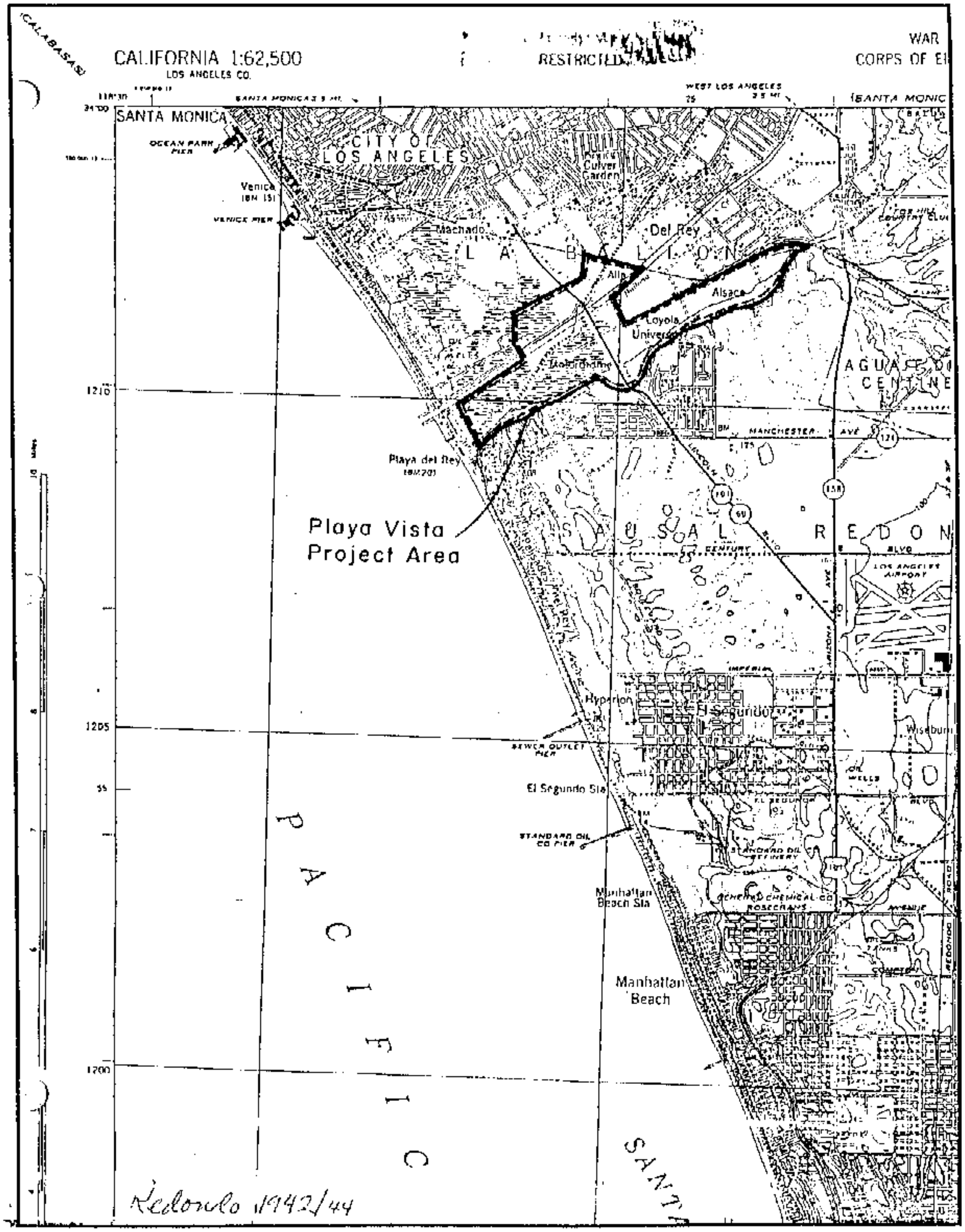


Figure 23. Proposed Project Area and Vicinity, c. 1940 (from Redondo 1942/1944).

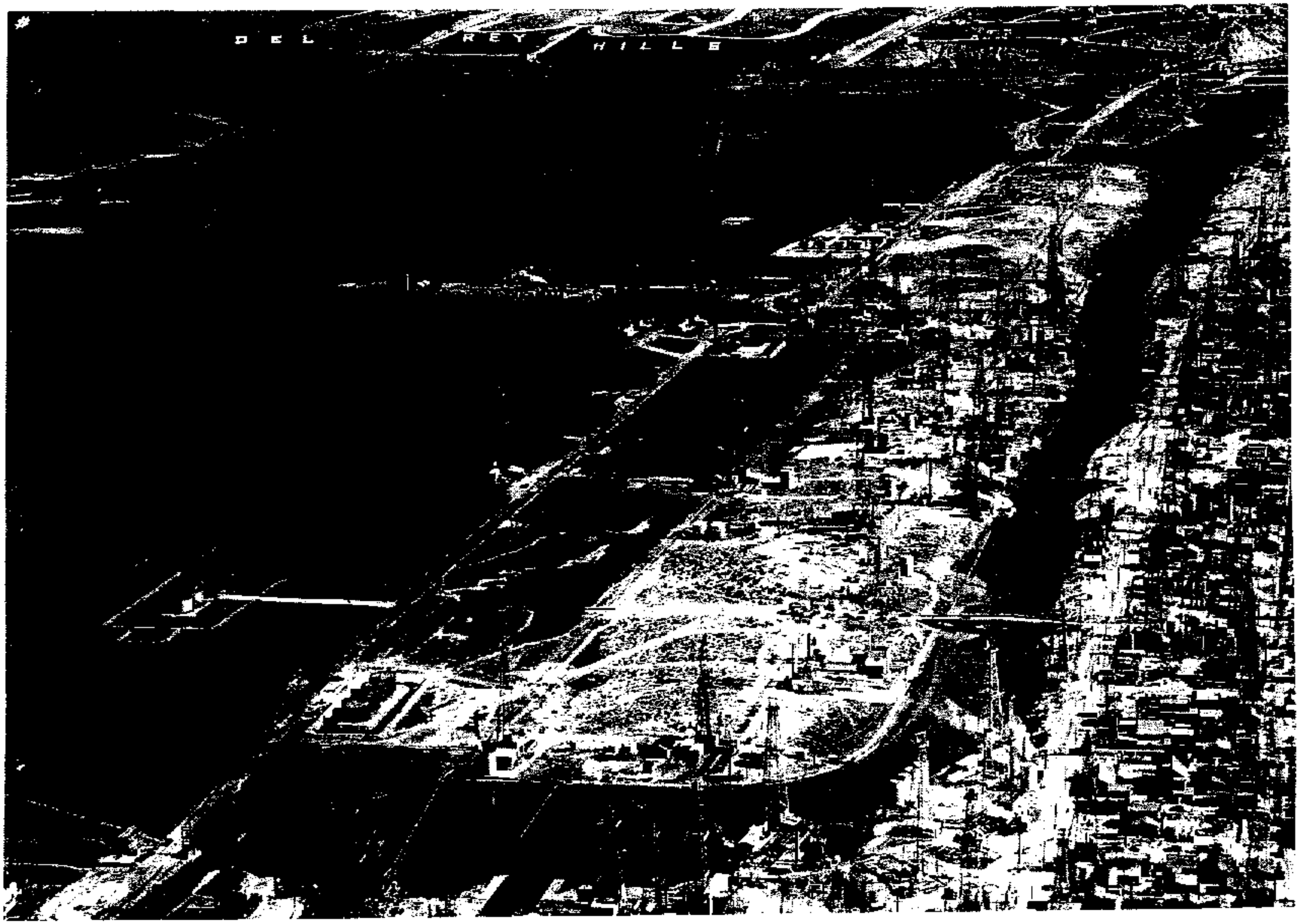


Figure 24. Aerial Photograph of the West End of the Project Area, looking South, 1930 (Photograph on file, Robert Stutsman, B-1274)

Figure 25. Aerial Photograph of the West End of the Project Area, looking Southeast, 1938. Note Channelized Ballona Creek on right of Photograph (Photograph on file, Robert Stutsman, E-8381-22-b).

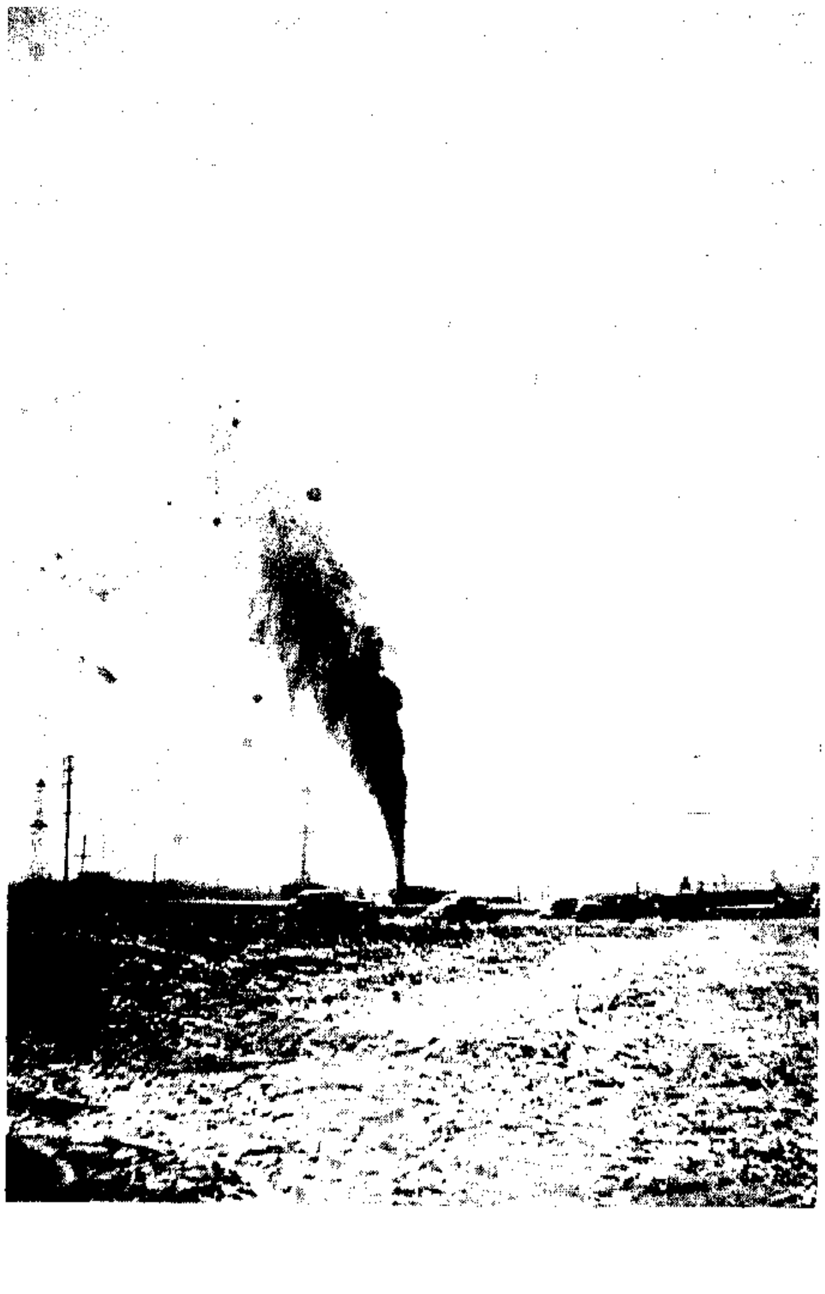


Figure 26. Active Methane and Gas Well, Imperial and Sepulveda c. 1939 (On file, Schofield).

During the early 1900s, oil production shifted from the Los Angeles basin to the San Joaquin Valley, but it shifted back again with the discovery of the Dominguez Field around San Pedro in 1923. By this time, California's annual production of oil was just over a quarter of a trillion barrels, with oil often obtained from depths greater than one mile below the surface (Spalding 1930, vol.1:419).

It was in the wake of these achievements that the Ohio Oil Company discovered oil in the Ballona wetlands. When Ohio Oil's Number 1 well came in on 19 December 1929, the well had attained a depth of 6199 feet, tapping into a pocket of oil sand 285 feet thick, producing an oil flow estimated at between 2500 and 3000 barrels a day (Spalding 1930, vol.1:510). Soon there were wells all over the wetlands, reaching a crescendo of operation in the late 1930s and early 1940s, when the area was known as the Venice oil field. World War II and heightened oil demands served to deplete most of the Ballona wells, and most of the derricks were dismantled in the 1950s and 1960s (Lopez, personal communication, 1990).

The spread of oil drilling in the Ballona wetlands led to a demand for the channelization of the lower course of Ballona Creek. In the early 1920s, the upper course of the creek was channelized to the area of modern Lincoln Boulevard. The channelization was completed by the U.S. Army Corps of Engineers in 1935, at the suggestion of the Los Angeles County Flood Control District. At this time, the crook in the first channelization was taken out, as hundreds of workers straightened and widened the channel and added sloping, rock and concrete walls. The channelization went right through the old location of the motordrome, which appeared to have been abandoned for at least ten years before that time.

The channel is about the only new feature that shows up on a series of maps dated to this time period (Figures 27, 28, 29, and 30). Even before World War II, the channelized lower course of Ballona Creek, subject to tidal fluctuations, became a two-mile-long rowing course used by sculling crews from the surrounding universities (Robinson 1939:126).

One of the more unusual features erected within the project area in the late 1930s, were two shortwave transmission towers, built by Press Wireless and used by three local newspapers (including the Los Angeles Times) as a means of getting around the established and expensive wire services owned by RCA. It is generally believed that these towers were constructed around 1938, when the receiving site for this system was constructed in Palos Verdes (Kraeger, Perkins, personal communication, 1990). The towers were little more than antennae on power poles, reaching a height of about 60 feet. The poles were adjacent to a small transmission building, which was located somewhere near the intersection of Lincoln and Jefferson. Unfortunately, no one seems to remember exactly where the complex was located, but all agree that it was rather isolated (Hudgens, Perkins, Kraeger, personal communication, 1990).

At this time, during the 1920s and 1930s, the vast majority of the western half of the project area belonged to oil and land companies. Area A and the part of Area B north of Jefferson belonged to the Del Rey Company since at least 1927. Assessment records suggest that little was done with the property (Map Book 101, 1934-41). The remaining southern portion of Area B had been owned since 1925 by TG & T Company whose low improvement assessments suggest that it was being taxed only for derricks or other support structures. Only Lot 22, a small parcel wedged between the bluff and the west end of Culver Boulevard, had been subdivided out of this entire area. Owned by Catherine A. McKenna since 1926, Lot 22 assessment records indicate that no improvements were made to the property during this period (Map Book 101, 1934-41).

Gun clubs, oil wells, the Ballona Creek channelization, and radio towers, all made use of the project area, but it was a highly-specialized use limited to specific locations. While much of the wetlands was not suited to any other kind of exploitation, the area east of Lincoln Boulevard was capable of sustaining agriculture. Soon this niche was filled, as Japanese truck farmers moved into the

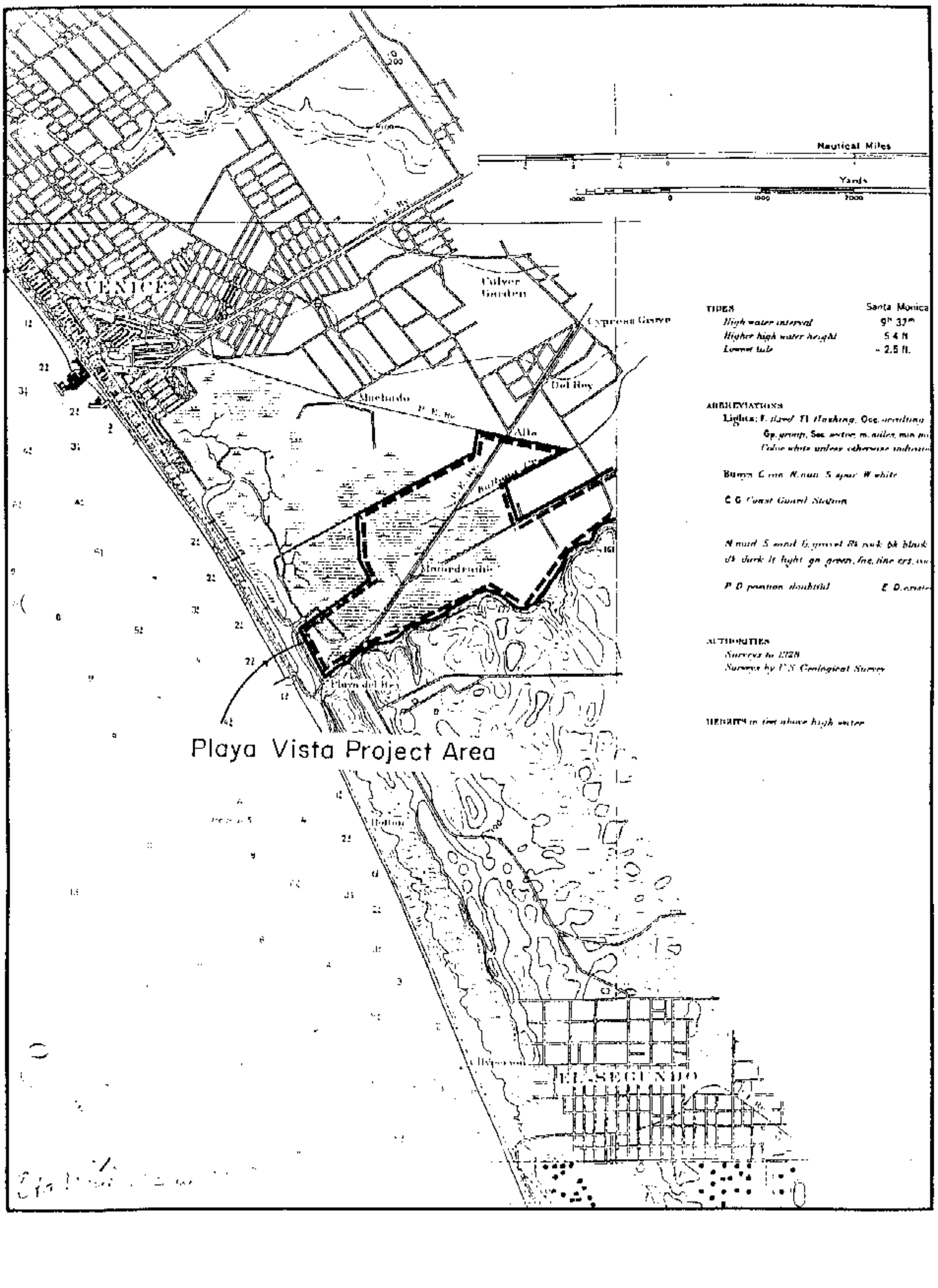


Figure 27. Proposed Project Area and Vicinity, 1928 (from Santa Monica Bay 1928).

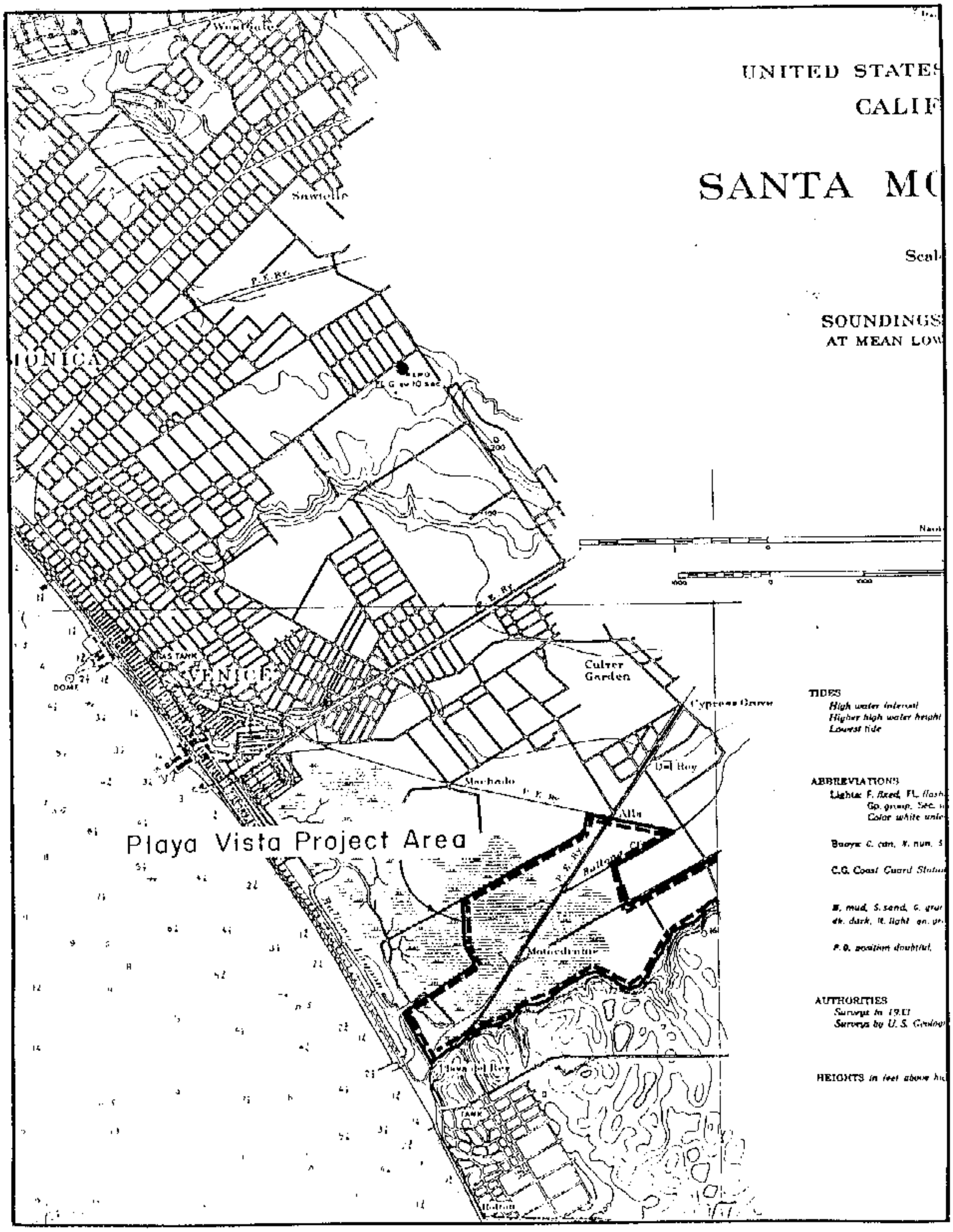


Figure 28. Proposed Project Area and Vicinity, 1933 (from Santa Monica Bay 1933).

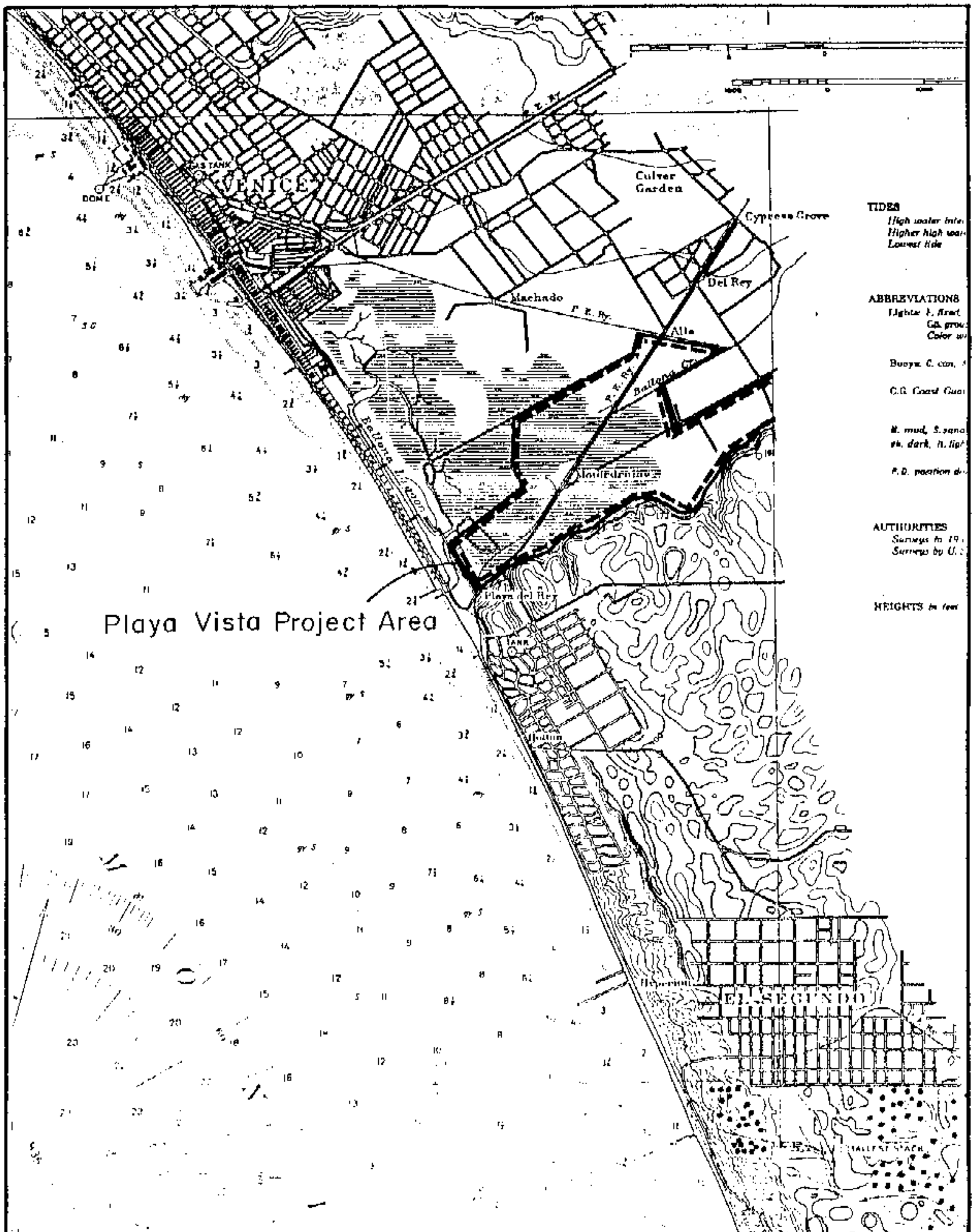


Figure 29. Proposed Project Area and Vicinity, 1934 (from Santa Monica Bay 1934).

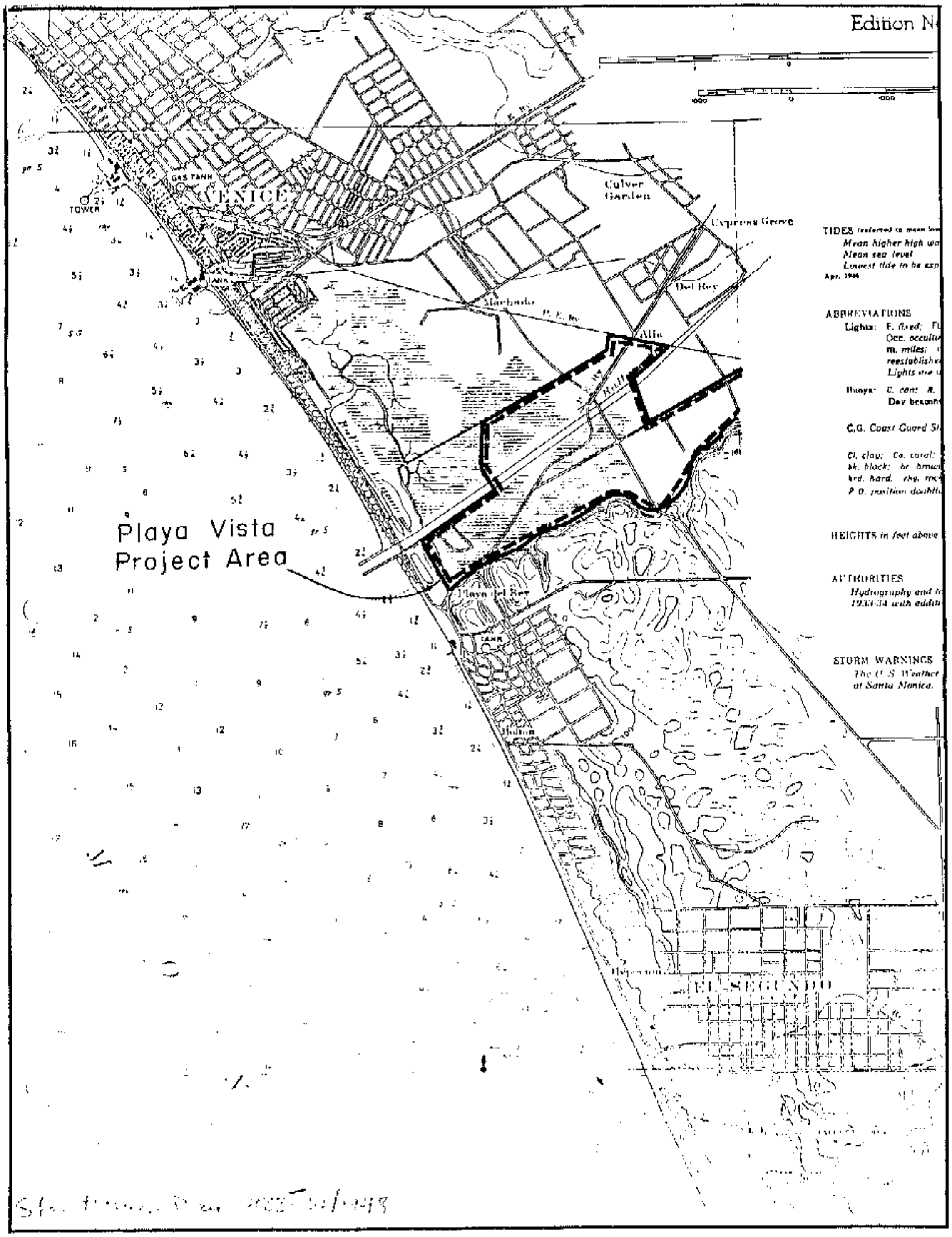


Figure 30. Proposed Project Area and Vicinity, 1948 (from Santa Monica Bay 1933-34/1948).

area around 1920 and began raising celery. During the 1920s and 1930s, most of the area occupied by the Japanese was owned by Joseph Mesmer; only the northern portion of Area C was owned by Santa Monica/Edgemar Dairies.

During the 1920s and 1930s, Japanese farmers spread throughout the arable portion of the project area, leasing most of the area from Joseph Mesmer. East of the project area, many of the Japanese farmers grew beets (Robinson 1939), but within the low, rather marshy project area, the cultivated crop was almost exclusively celery (Kitagawa, personal communication, 1990). With the exception of the specialized uses for the land mentioned above, the Japanese farmers had a monopoly on land use. Only the Santa Monica Dairy Company (later, Edgemar Dairies) with property extending into what is now called Area C at least as far as Culver Boulevard, created any sort of competition for the land, and much of this land was leased to the Japanese (Lopez, McDonough, personal communication, 1990).

The Japanese were successful at growing celery because they were willing to do the intensive labor required for its cultivation. Hothouses required for celery cultivation were constructed at intervals throughout the area. After the celery plants were started in the hothouses, they were then taken to the fields, where they had to be planted by hand (Kitagawa, personal communication, 1990). After the celery was harvested, it was washed in buildings generally known as "celery sheds." These were generally found adjacent to the rail lines, which were used to transport the celery to outside markets. Within the project area, these sheds were usually found near the eastern and northern edge, adjacent to the rail lines and a rail spur identified on contemporary quad maps as "Alsace" (Hughesnews 1981a; Hugh, personal communication, 1990; Figure 31).

Alsace was the name of a stop and loading dock along the Inglewood to Ocean Park rail line (Stutsman, McDonough, personal communication, 1990). Located near the modern juncture of McConnell and Jefferson, it was commonly used as a point of departure for the celery grown by the local Japanese. In 1924, the area had one structure on the north side of Jefferson, then Playa Street (see Figure 20). By 1940, there were two or three structures in this location, and two were large, possibly celery sheds (see Figure 22).

Another community, northwest of Alsace and located at the intersection of the two project area rail lines, was identified on contemporary maps as "Alla." In 1924, there were about 11 structures within the southeast corner of this intersection. By 1940, there were three large sheds within the area, and it seems likely that Alla served the Japanese agricultural community much as did Alsace.

Interestingly enough, very few local residents used or even knew of the names "Alsace," "Alla," or even "Machado," further to the northwest. It is certainly clear that the local Japanese community that inhabited these places in the 1930s did not use the names. Frances Kitagawa, who grew up within the project area on the celery farms, was kind enough to ask within the local Japanese community to see if anyone remembered these names (Kitagawa, personal communication, 1990). Surprisingly, no one recalled them, which would suggest that they were either anachronisms, repeated on maps long after they ceased to have significance, or they were designations used only by the railroad.

Perhaps one reason for the lack of recognition was that Japanese settlement within the project area was diffuse, with its own community centers that did not correspond to the railroad stops. About 10 to 15 families lived scattered along the south side of Jefferson Boulevard between Lincoln and the east end of the project area. Each house had its auxiliary shacks and sheds. One of the largest of these establishments was located where there now stands a eucalyptus grove immediately south of Jefferson, roughly opposite the southern terminus of McConnell Avenue (Lopez, personal communication, 1990). This stand of eucalyptus, and the shed within it, may be all that remains of the area once identified as Alsace.

Figure 31. Detail from an Unidentified Aerial Photograph of the Project Area, looking East, c. 1939 (Photograph on file, Robert Stutsman).

Those areas recognized as the centers of the local Japanese community do not fall within the project area, but were rather found to the north. One such center was the Playa del Rey School, which was not located in Playa del Rey, but rather at the corner of Centinela and Juniette Street. Most of the Japanese children that lived in the area attended this school. Perhaps of more immediate importance to the local community was the Japanese Center, located on Braddock Drive one block west of Centinela, between what is now Marina Freeway and Culver Boulevard. The Center, with its Japanese language school, Buddhist shrine, and Japanese Christian church, was perhaps the primary focus of the community (Kitagawa, personal communication, 1990).

According to Kitagawa, the Japanese covered the area from Edgemar Dairies in the north, to the Ballona bluffs to the south, from Lincoln Boulevard in the west, to a point east well beyond the project area. By this account, all structures found at the base of the bluff in the 1920s and 1930s were occupied or used by Japanese families. This would include the six structures found at the base of the bluff below Loyola University in 1940-- structures depicted in Figure 22. While one source has maintained that there was a small "Mexican" settlement called Little Tijuana at the base of the bluff below Loyola in the 1930s-- a settlement used as one of the backdrops for the filming of "Grapes of Wrath" (Machado, personal communication, 1990), no other sources corroborate this assertion.

Despite the presence or absence of little Tijuana, Hispanic settlement, even settlement with ties to the original Rancho La Ballona, was present within the vicinity of the project area, if not the immediate project area itself. One of the most interesting constants in this era of population change was the Machado "settlement" located along Alla Road near the present Glen-Alla Park, less than 0.5 miles north of the Alla rail stop. Located in this area since at least the 1860s if not before, the Machado settlement near Glen-Alla Park survived the coming of the railroad, the name even surviving as a train stop in the 20th century. The Machado and Alla settlements adjacent to the train tracks may have had a predominantly Japanese population in the 1920s and 1930s, but a branch of the Machado family still lived near Alla Road and Glen-Alla Park as late as the 1920s (Perry, personal communication, 1990). After the Japanese were uprooted in the first months of 1942, the Hispanic tradition would continue with the development of the "Lopez Ranch" immediately north of Jefferson Boulevard.

Throughout the 1920s and 1930s, the Japanese community lived on project area land through the terms of a series of leases from Joseph Mesmer. By the late 1930s, Frank Mizusawa had the largest of these leases, covering lands south of Jefferson, between Centinela and the marsh (roughly Lincoln). Mizusawa held the lease in trust for all Japanese families who lived on the land, many of whom were not citizens and could not legally hold land at that time. At some point in the 1930s, Mesmer approached Mizusawa about the possibility of buying the land outright, an offer that Mizusawa turned down (Kitagawa, personal communication, 1990). This decision marked the beginning of the end for the local Japanese community.

It would appear that Mesmer had fitful development plans for the project area. This to some degree was a response to the tremendous increase in the population of the communities surrounding the project area. Santa Monica increased from 15,000 in 1920 to 51,000 just ten years later. During the same period, Inglewood grew from 3,000 to 30,000; while Culver City grew from 500 to over 5,000. And this development was only a fraction of the growth occurring in Los Angeles, which trebled in size from 1920, with 576,673 inhabitants, to almost 1.5 million by 1930 (Spalding 1930, vol.1:510,521).

As a result of this population growth, by the late 1930s Mesmer was planning new subdivisions in those areas marginal to Japanese fields and settlement. In two areas on either side of the Japanese-- the "Mesmer Tract" east of Centinela; and the long tract between Lincoln and Bay Street, Jefferson and the bluff-- the Joseph Mesmer Company subdivided the land and advertised for buyers (Map Book 332, 1939-46). From all available sources, however, it appears that nothing was ever built on these properties (Hugh, personal communication, 1990).

Mesmer's plans came to an abrupt end by the close of 1940 and the beginning of 1941, when Howard Hughes bought Joseph Mesmer's holdings within the project area (Area D) and obtained the adjacent portion of Area B through arrangement with the Defense Plant Corporation. It would appear that Hughes allowed the Japanese to keep their lease, modified by the addition of the new Hughes buildings on the old "Mesmer Tract" and the airplane runway constructed on the south side of Jefferson. This arrangement did not last long, for the removal of the Japanese community came swiftly on the heels of Pearl Harbor in December of 1941.

After Pearl Harbor, Mizusawa's lease was revoked and the local Japanese community, together with the entire Japanese population of the West Coast, was relocated to detention camps, an operation completed by March of 1942 (Jones 1969:11). The local Hispanic community immediately north of the project area, long overshadowed by the Japanese, came into its own. An example of this development was the case of Pepe Lopez, who once worked for the Japanese and finally assumed the old Japanese lease around May of 1942. Lopez later bought land north of Hughes's property on Jefferson Boulevard, and established a farm of 50 acres (Lopez, personal communication, 1990). Lopez's son now runs a market called "Lopez Ranch," located at 12681 West Jefferson, between Westlawn Avenue and McConnell Avenue.

THE HUGHES DEVELOPMENT

Even if World War II had not intervened, it appeared likely that the days of the Japanese community within the project area were numbered. With the phenomenal population growth of the surrounding area, it was only a matter of time before Mesmer's subdivisions became more than plans on paper. As it turned out, though, these plans were swept away by the acquisition of the property by Howard Hughes in late 1940/early 1941. Long familiar with the area, and recognizing it as one of the few remaining undeveloped tracts of such size adjacent to Los Angeles, Hughes saw the potential this land held for his new aviation headquarters and private airport. Hughes, whose former interest in this area had been associated with movies, now returned to establish a new aviation center. The almost immediate intervention of World War II meant that the change to the project area would be both swift and thorough.

Early Aviation in the General Area

Just as the film industry was attracted to California early in its development, so aviation enthusiasts were quickly drawn to the sunny days and balmy weather that permitted more time aloft and easy outdoor working conditions. It was not coincidental that the very first national aviation meet was held at Dominguez Field, south of the project area, in January of 1910, featuring the latest developments of an industry just seven years old (Spalding 1930, vol.1:360-61; Gillingham 1983:365-67).

Like any industry in its early stages, the Dominguez air show displayed a wide range of plane designs, everything from single-planes and bi-planes, to "multi-planes" with five wings (Gillingham 1983:365-67). Aviation developed and standardized tremendously in the course of the First World War, as governments around the world invested money in new designs and methods of assembly. This development continued after the war, especially in California. In 1921, Donald Douglas began making airplanes in Santa Monica with the backing of ten entrepreneurs fronting 15,000 dollars. Before the end of the decade, the Douglas Company, based in Santa Monica, was a major aviation contractor with the Federal government, working on such planes as the DT-2 Torpedo Plane (Basten 1974:130).

The Douglas Company set up shop at Clover Field, named for an airman killed in the war. Located in Santa Monica on the south side of National Boulevard, Clover Field had a runway almost one mile long. In 1924, the first team of airmen to circle the world set out from Clover Field in four planes, making the journey in 190 days. By 1928, Clover Field became a center of airplane production as the Douglas Company moved its new factory to the northwest corner of the runway (Basten 1974:130-31).

Douglas was one of the leaders in early American aviation, but did not operate alone. By 1928, there were about 25 airplane and airplane motor manufacturers within the greater Los Angeles area, in addition to about 40 aviation schools. It has been estimated that out of about 3,200 commercial planes in the United States at that time, almost one half operated out of the Los Angeles area (Spalding 1930, vol.1:465-67).

The Douglas Company, later the Douglas Aircraft Company, survived this competition to become one of the largest aviation contractors to the Federal government during the Second World War (Basten 1974:180). By this time, however, Howard Hughes had developed an abiding interest in aviation and was giving Douglas Aircraft some of that competition from his new base in Culver City, at the far east end of the project area.

The Beginnings of Hughes Aviation

Howard Hughes's financial empire began with his father, Howard Hughes, Sr., who developed the first successful rotary bit for drilling oil wells through hard rock. In 1908, Hughes, Sr., helped organize the Sharp-Hughes Tool Company in Texas to manufacture his patented bits, and it was from this development that Hughes made a fortune. Hughes, Sr., later became sole owner of the company, changing its name to Hughes Tool Company around 1915 (Barton 1982:21). The Hughes Tool Company passed to Howard Hughes, Jr., upon his father's death, and it formed the financial core of the wide-ranging financial empire that Hughes put together throughout his lifetime (Schwartz and Maguglin 1983:7).

Howard Hughes, Jr., was born in Texas on 24 December 1905. His mother died in the course of a routine operation in 1922, after which Hughes and his father moved temporarily to Los Angeles, where Howard's uncle, Rupert Hughes, was already established as a successful Hollywood screenwriter. It was through this intermediary that Howard Hughes learned about film. With a fortune at his command, he was soon making movies (Schwartz and Maguglin 1983:8).

After his father died in 1924, Hughes married a Houston socialite and moved to Los Angeles permanently in 1926 (Schwartz and Maguglin 1983:8). There he developed further his interest in films, which culminated in the making of "Hell's Angels" by the end of the decade. In 1929, Hughes rearranged his financial holdings by forming the Hughes Industries Company, incorporated in Delaware. This was established as the first umbrella for his burgeoning number of financial ventures (Dates of Events c.1985).

Shortly after the successful run of "Hell's Angels," Hughes began to take a more personal interest in aviation. In 1932, he signed on as an aircraft baggage handler in the Midwest to learn the business incognito and from the bottom up (Hugh 1987). By the mid-1930s, Hughes had formed an aircraft division within the Hughes Tool Company to accommodate his interest in aviation, which manifested itself in the development of the Hughes Racer, the H-1, commonly known as the "winged bullet" (Hughes Aircraft 1990:41; Schwartz and Maguglin 1983:14).

Hughes and his team of technicians worked on the H-1 racer in 1934 and 1935. By the time it was brought out of the hangar in August of 1935, it was universally acclaimed as an aviation marvel. The all-aluminum body was smooth: Hughes had perfected rivets that were flush with the body of the metal. The H-1 racer also had retractable landing gear, a first in aviation history. In every detail, the H-1 racer was designed for speed, and Hughes set a world record with this plane by traveling at a documented 352 miles per hour, by far the fastest time up to that point (Schwartz and Maguglin 1983:15-16).

The late 1930s were a high point in Hughes career as an aviator. After the success of the H-1, Hughes took another plane, the Gamma, and in 1936 set a transcontinental record for flight between Burbank and Newark. Two years later, Hughes set another record for flight around the world (Dates of Events c.1985). The late 1930s also saw the development of Hughes aviation empire; both Hughes Aircraft Co. and later, Hughes Helicopters, trace their beginnings to Hughes's work on the H-1 (Schwartz and Maguglin 1983:14; Hughes Helicopters, Inc. 1984). The H-1 work was conducted at a hangar at Grand Central Terminal in Glendale, and it was at this location that the Hughes Aircraft Company began its history in 1935/36, with a grand total of 18 employees (Observer 8 June 1969).

In 1936, most of Hughes's Texas-based companies were merged into Hughes Industries, which absorbed the Hughes Tool Company and then turned around and assumed that name. The reformulated Hughes Tool Company became the new umbrella for Hughes's many ventures, which included Hughes Aircraft Company and, later, RKO Film Studios, Transworld Airlines (TWA), the Hughes Helicopter Company, and finally several Las Vegas casinos and thousands of acres of land in California, Nevada, and Arizona (Dates of Events c.1985; Schwartz and Maguglin 1983:7). Howard Hughes was a complex man, with wide-ranging interests that showed up in the roster of corporate entities that he either created or acquired. With all of his interests, Hughes chose to spend some of his most productive years at the project area complex that came to be known as the Culver City plant.

Culver City Plant & the War Contracts

Hughes began design work on the D-2 fighter-bomber in late 1939, after the outbreak of war in Europe (Hughesnews 1981a). By 1940, Hughes Aircraft had landed their first, very small government contract (Dates of Events c.1985), and had every reason to expect more work from the government as the war in Europe and China intensified. Hughes was concerned, however, that he would never get the larger government contracts unless he moved to bigger facilities where he would have more production capacity (Barton 1982:49-50). With this in mind, Hughes began to consider coalescing his various aviation concerns around southern California into one large facility. As a result of this move, the Culver City plant came into being.

Construction on the Culver City facility began in late 1940 or early 1941 (Barton 1982:50); either way, Hughes's ownership of the property was not registered with the County of Los Angeles Assessor until January of 1941 (Map Book 332, 1939-46). At that time, Hughes owned Area D south of Jefferson, and the adjacent part of Area B. That part of Area B to the west of Hughes's property, and south of Jefferson and Culver, was held by the Defense Plant Corporation, a government agency that apparently held the land for Hughes. In later years, this land came into Hughes's formal possession. The location for the complex, located at the eastern end of Area D, was selected by Howard Hughes himself (Hugh 1987), with the main entrance coming off of Teale and Centinela (then Florence) Avenue (Hughesnews 1981b).

Construction on the new facility continued through the first half of 1941, and was frequently hampered by a particularly wet winter, turning the construction site into a quagmire (Hughesnews 1981b). The proximity of Centinela Creek, which ran through this part of the project area, complicated matters. The creek was finally redirected south, closer to the bluff, in order to avoid the new buildings. It is likely that the agricultural structures depicted south of Centinela Creek in 1930s were destroyed at this time.

Hughes made use of the rail line north and east of the project area, and added an additional 1,800 feet of track to facilitate movement of steel onto the construction site. These rail spurs ran immediately east of the first two structures to be constructed, structures later known as Buildings 5 and

6 (Hughesnews 1981a). Before construction commenced, an extensive series of pilings were driven 40 to 50 feet into the ground to keep the foundations from sinking into the marsh (Hugh 1987; Hugh, personal communication, 1990).

The buildings of the Hughes complex, usually designated by number, have had different designations through time as new buildings were added to the complex. In order to be consistent and to follow the lead of Hughes employees, the buildings are identified in this report by the numbers they had at the height of the Culver City plant, numbers most of them have kept to this day. With this in mind, the first two buildings constructed on the grounds were Buildings 5 and 6 (Figure 32).

Building 5, the Process Building, was designed with flying buttresses, while Building 6, the Assembly Building, had a saw-tooth roof with windows to admit sunlight to the work area 30 feet below. It was anticipated that design work on the fighter-bomber D-2 would continue in Building 5, while Building 6 was set aside for factory work and assembly. Building 6 also had a mezzanine with a parquet floor along the east wall for use as office space (Hughesnews 1981a). A maintenance tunnel was dug to connect Buildings 5 and 6 (Mikell, personal communication, 1990).

The third structure of the Culver City plant was transported to the project area from Burbank over the weekend of 4 July 1941. This single story frame structure was first placed next to Building 5 on the north side, but in October was moved to a foundation near what would later be Gate 2. This frame structure, often identified as the Engineering III building, served as the first administrative office for the Hughes complex. Although it is now hard to believe, this small structure contained executive offices, the accounting and purchasing departments, First Aid services, and the radio department. This building was moved a few more times, until it finally came to rest at the corner of Jefferson and Centinela. By that time, it was officially known as Building 40, but it was more commonly dubbed the "traveling employment office." It served in this capacity until September of 1980 (Hugh 1987; Hughesnews 1981a).

Hughes Aircraft made the official move to the Culver City facility over the weekend of 4 July 1941. At that time, 300 employees moved from the Grand Central Air Terminal in Glendale and the Union Air Terminal in Burbank to form the consolidated Aircraft Division of Hughes Tool Company (Hughesnews 3 July 1981a). At that time, out of the three buildings on the grounds, only Building 5 was completed. It has since been changed a number of times; the original portion is now the front or east third of modern Building 5 (Hughesnews 1981a).

By October of 1941, the original version of Building 6 was completed, and the three buildings of the initial Hughes aircraft complex were in place and functioning (Hughesnews 1981a; Figure 33). The completion of the new complex led to a doubling of the Hughes employees; by December, the number of personnel had reached 626 (Hughesnews 1981a). Most of this number lived in Culver City and Westchester, and the Hughes complex greatly increased the size of both of these communities (Mikell, personal communication, 1990).

Pearl Harbor and America's entry into World War II on 7 December 1941, led to a second round of construction and growth at the Hughes Culver City plant. The impetus for this round of development came with the design and construction of the "Flying Boat," first conceived by shipbuilder Henry J. Kaiser.

By May of 1942, Kaiser's "Liberty Ships" were being sunk by German U-boats as fast as they could be built, which caused Kaiser to entertain the idea of a fleet of Flying Boats that could avoid the submarine menace (Barton 1982:13-15). Kaiser approached the government about this plan and secured the promise of money for the development of such a scheme (Schwartz and Maguglin 1983:21).

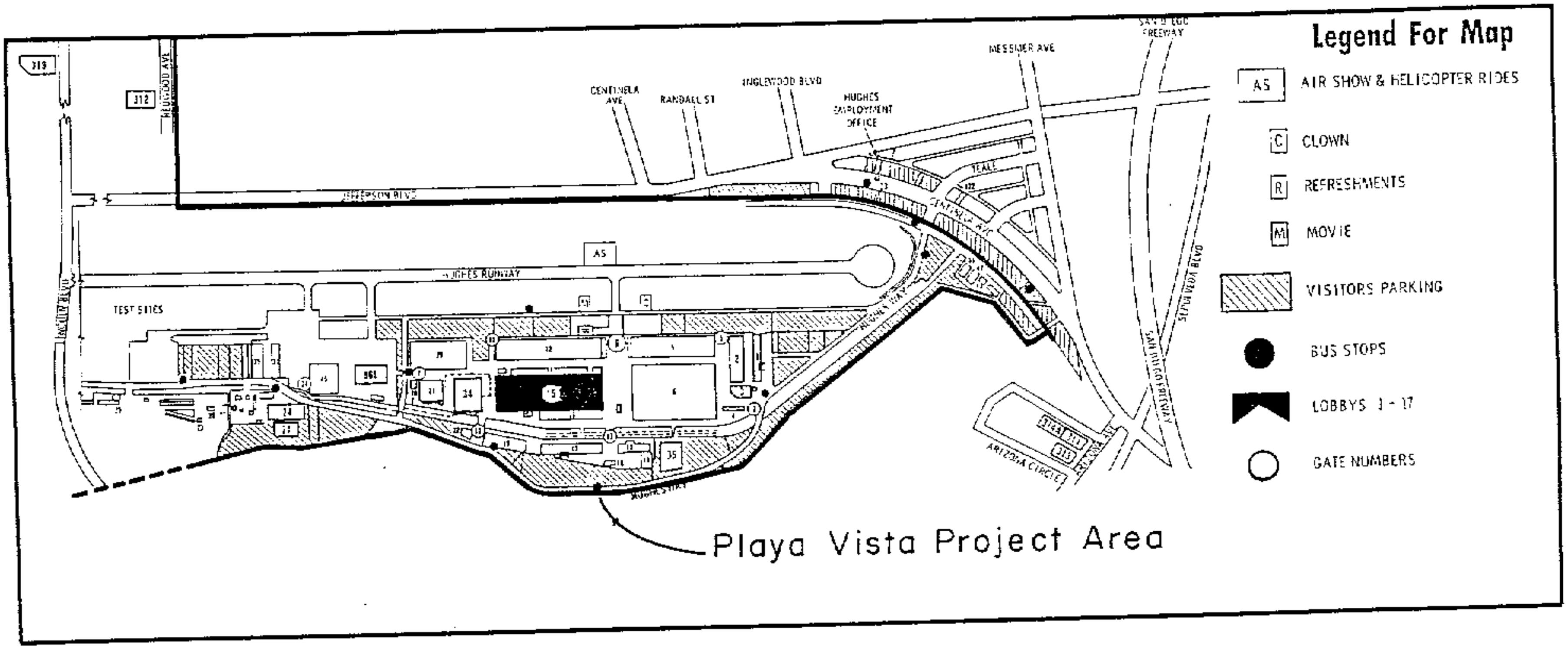


Figure 32. Culver City Plant, 1969, showing all Major Buildings and Their Numbers (from Observor, 8 June 1969).

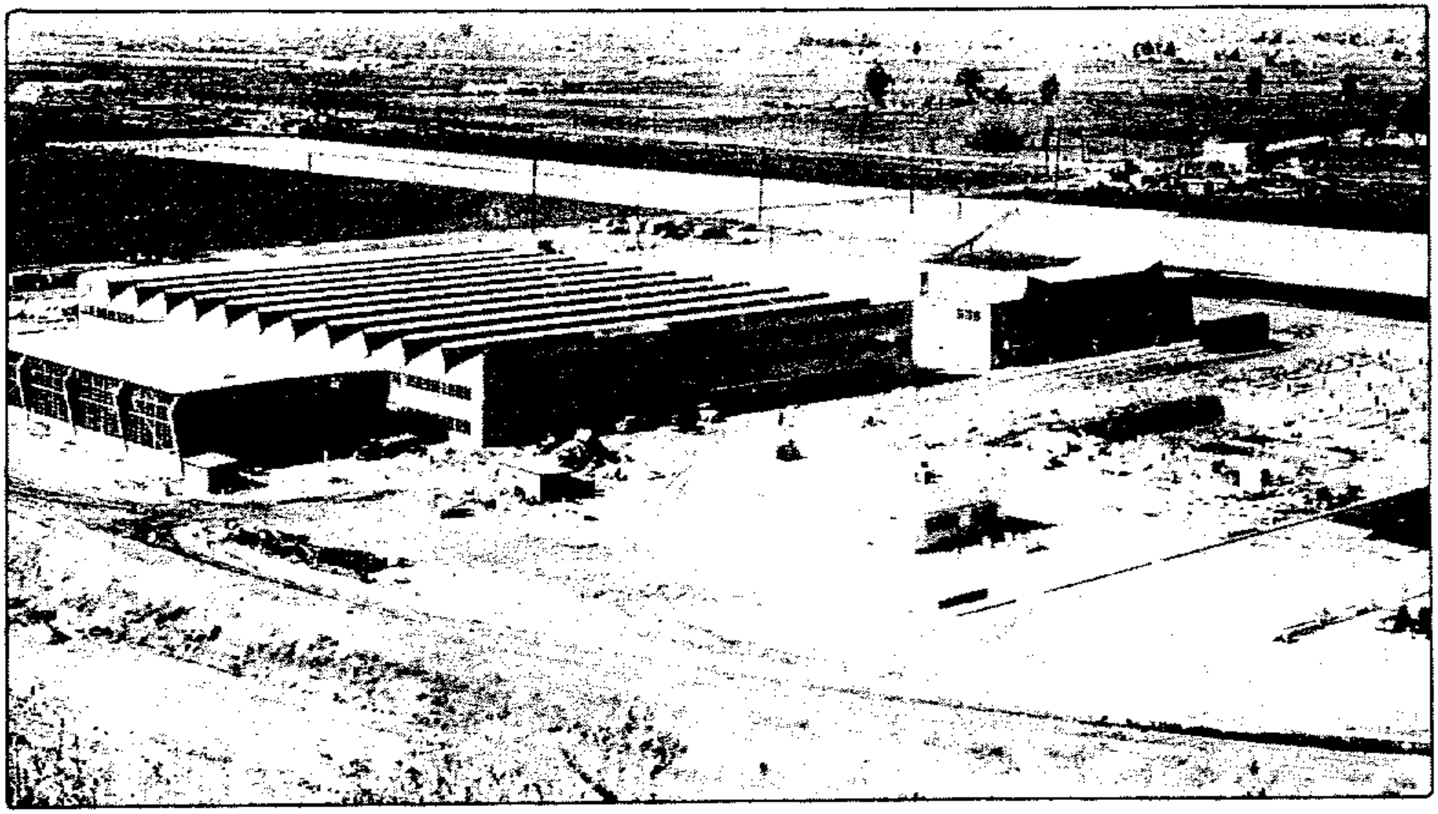


Figure 33. Culver City Plant in October 1941 (from Hughesnews, 3 July 1981a).

The Flying Boat project got its official beginning from a letter of intent from the Defense Plant Corporation, a government agency, in September of 1942. By the terms of this agreement, Kaiser and his contractors were empowered to design and build three large cargo planes, with the stipulation that they be constructed out of processed wood, due to the critical shortage of light metals such as aluminum. Even the buildings that would house the Flying Boats had to be constructed of wood (Hughesnews 1981a; Dates of Events c.1985).

In order to build these Cargo Planes, Kaiser formed a corporation with Howard Hughes on 7 October 1942, designating Hughes as the prime contractor for design and construction of the Flying Boats. By the terms of the formal contract from Defense Plant Corporation to Henry Kaiser and Howard Hughes, 18 million dollars was to be set aside for the project: design and construction of three prototypes for the Flying Boats. Two additional stipulations were placed on the project: no profit could be made; and the project could not take engineers away from other, more critical work (Dates of Events c.1985; Schwartz and Maguglin 1983:21). Hughes Aircraft, already under contract to design and build the XF-11 reconnaissance plane, put other work aside as the complex geared up for the construction of the largest plane that would ever be built.

Before the plane could be built, however, the Culver City plant had to be enlarged to accommodate new design and construction facilities. Buildings 5 and 6 were greatly enlarged as a result of the new war contract. Within Building 5, research and experimentation got underway on the development of "duramold," the processed wood that would be used as the basic construction material of the Flying Boat as well as the structure that would house it (Hughesnews 1981a).

The structure that housed the Flying Boat is known to posterity as Building 15. Construction of this building began in March of 1943 and was completed in August (Hughesnews 1981a). As specified by the government contract, the building was constructed entirely of wood, which was bent and formed under pressure and then laminated (Hugh 1987; Mikell, personal communication, 1990; Figure 34). Building 15 was and probably still is the largest wooden structure ever constructed, with a length of 740 feet, a width of 240 feet, and a height of 73 feet or six stories (Hughesnews 1981a). The enormous exterior was covered with tongue and grove wood planking.

Building 15 was divided into two large bays, identified as north and south (Figure 35). Each was characterized by enormous wooden beams and supports, concrete floors, and a large overhead crane or "traveling hoist" that was moved by hand (Hatfield 1972:23). The center bay, which was really false and just constructed between the two for office space and electrical wiring, was itself three stories high (Mikell, Cohen, personal communication, 1990). In addition to the center bay, Buildings 14 and 16 were constructed along the north and south sides of Building 15. The wood for the Flying Boat was formed in Building 16 (Cohen, personal communication,1990).

There were other wooden buildings constructed for the Cargo Plane/Flying Boat project, the most important of which were Buildings 2 and 3. Two-story Building 2 housed engineering, research, and design. Building 3 was where Hughes and his engineers designed and constructed the cockpit of the Flying Boat. For many years after the Flying Boat was finished, the nose-cone prototype was located in the building's upstairs loft. The rest of the building was later used to construct automatic cannons and machines guns (Mikell, personal communication, 1990).

Building 10, the cafeteria, was constructed in the spring of 1943 to feed the employees working on the Flying Boat. It was designed to hold 400 people, had a sizable veranda, and had a foot-bridge over the "drainage ditch" (Centinela Creek) that separated the cafeteria from the Building 15 complex to the north. Howard Hughes kept an apartment on the second floor above the cafeteria (Hughesnews 1981a; Cohen, personal communication, 1990).

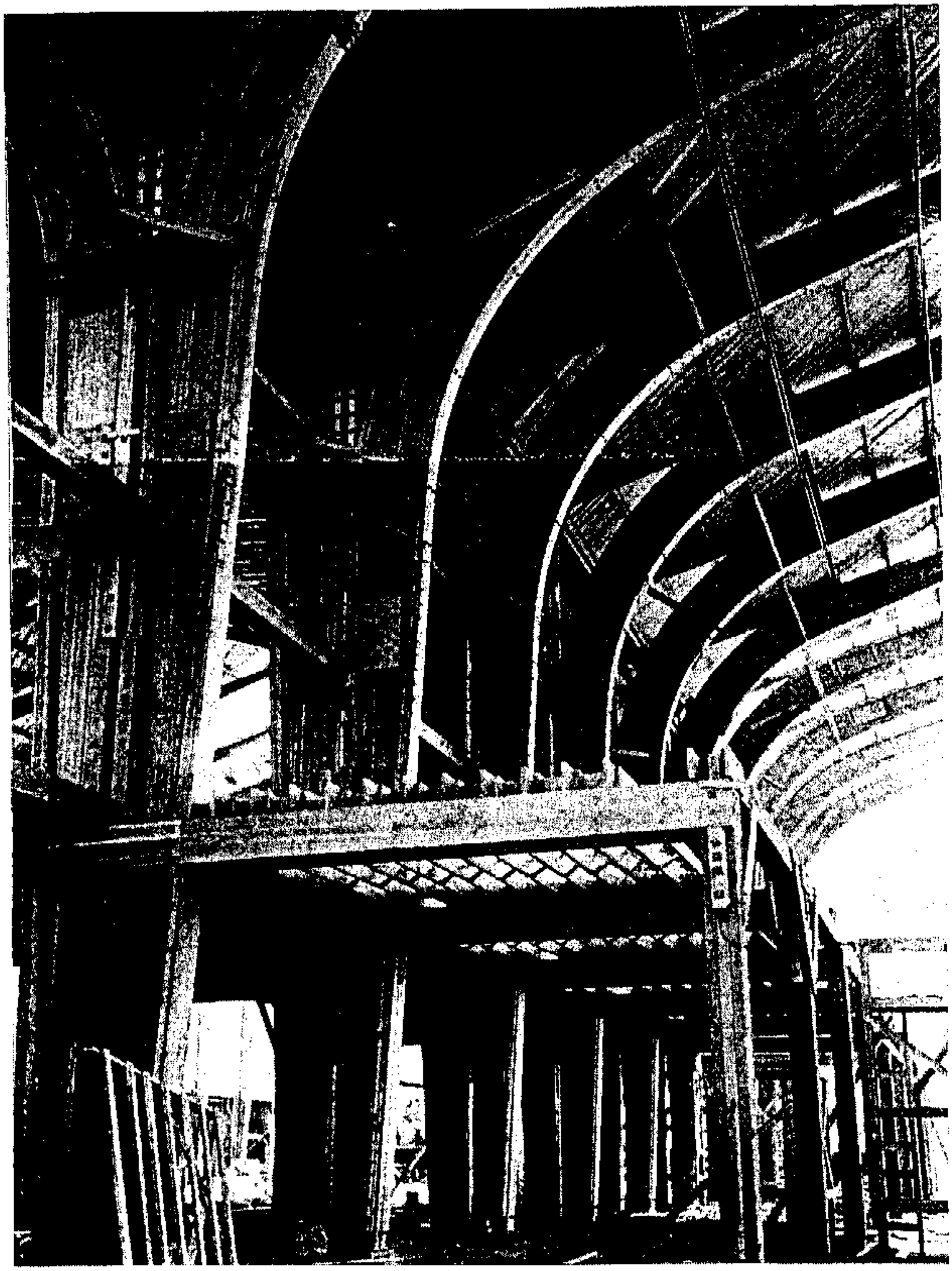


Figure 34. Central Arches of Building 15, between North and South Bays (from Hughesnews, 3 July 1981a).

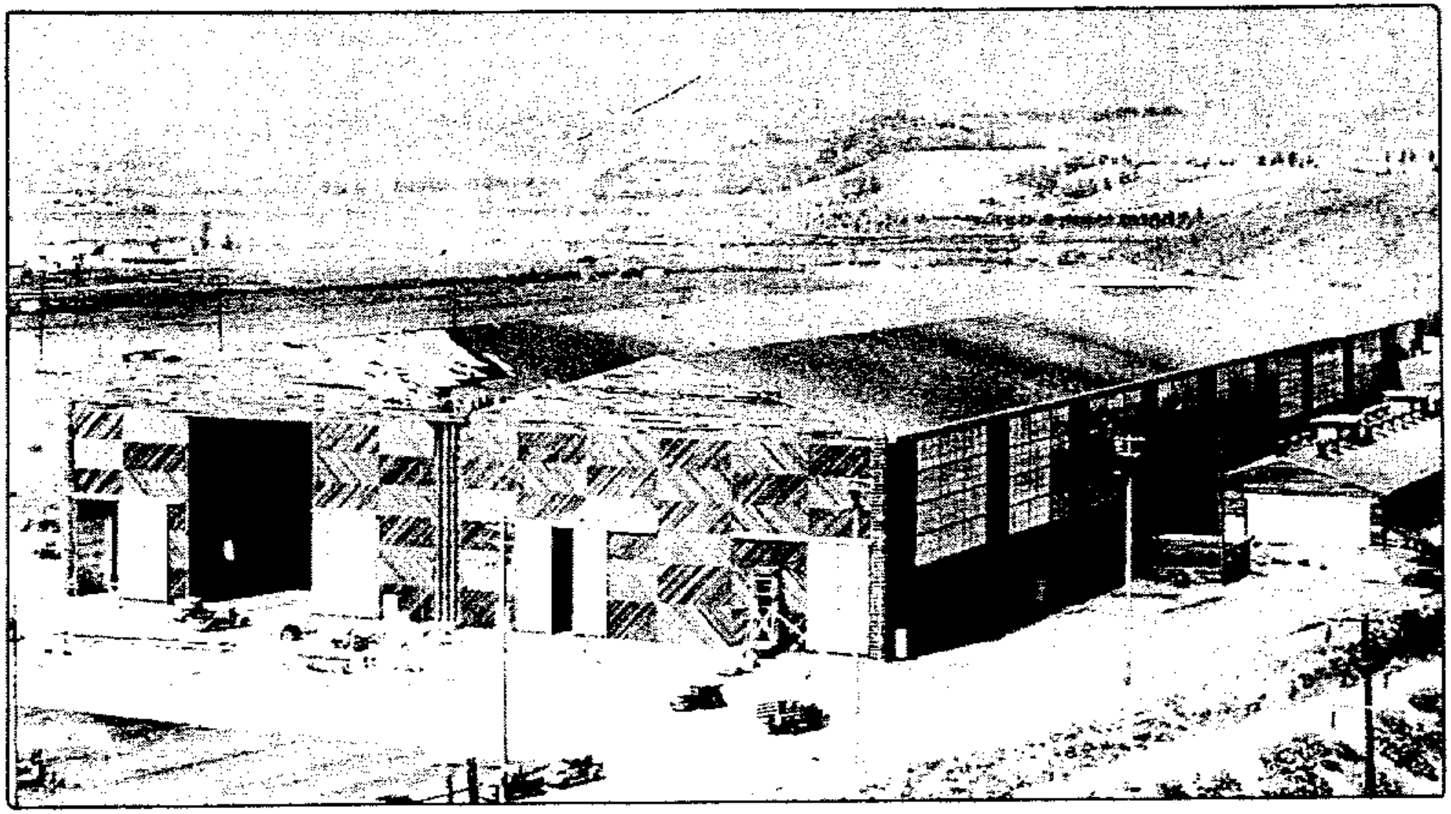


Figure 35. Bays of Building 15 (from Hughesnews, 3 July 1981a).

After Building 15, perhaps the greatest of the war-time constructions at Hughes's Culver City plant was the airplane runway, constructed in 1943. Hughes had to fill in much of the adjacent wetlands to create the runway, and fill was added periodically thereafter to ensure firm support (Hugh, personal communication, 1990). Because Howard Hughes believed that hardtop surfaces were too hard on a plane's landing gear, the first runway was compressed dirt. The grass covering was maintained with a sprinkler system at considerable cost. The original runway was 9,300 feet long and 300 feet wide. At the time, it was the longest privately-owned runway in the world (Hugh 1987; Observer Dec.1986; Mikell, personal communication, 1990).

Most of this new construction was geared for the Cargo Plane Project. By May of 1943, the Culver City plant was devoted to this work. Armaments were temporarily moved to a Hughes facility in Hollywood, while much of the other aircraft work was transferred to a new factory on St. Andrews Street (Hughesnews 1981a).

By this time, the designs for the Flying Boat, designated the HK-1 (Hughes-Kaiser Design Number 1), called for an enormous 200-ton plane, made almost entirely out of wood (Schwartz and Maguglin 1983:22). Most of the duramold wood was birch, but that did not keep the plane from acquiring the nickname "Spruce Goose," which became popular very quickly, and in fact is the most common name for the plane today. Howard Hughes despised the name, however, and it was rarely used in his presence (Schwartz and Maguglin 1983:22).

Despite the priority that Hughes gave to the Flying Boat, it soon became obvious that the government placed it rather low on the list of military priorities. The U-boat challenge was more or less successfully met after 1942, and shipping was no longer so imperiled as to require cargo planes to do the work of the merchant marine. Other projects soon became more critical, leading the government to try to get out of its HK-1 commitments. Hughes himself was a perfectionist, whose demand for testing and lack of standard procedures in production slowed construction of the Flying Boat prototype. By the time the war ended, the boat was still not ready for its maiden flight and had picked up yet another nickname: Flying Lumberyard (Schwartz 1983:3).

Even though neither the Flying Boat nor the XF-11 reconnaissance plane were ready before the end of the war, many other experimental planes made by other companies shared a similar fate. Hughes had only a very small percentage of the war-time aviation contracts, and had a difficult time getting the materials needed to complete the job. Hughes, however, made a significant contribution to the war effort in other ways. The first flexible ammunition feed chutes were designed by Hughes's people, as was the "chaff" used to foil German radar during bombing raids. A number of other innovations in radio, flight, and navigation equipment can be attributed to Hughes Aircraft (Hughesnews 1981a).

Despite these contributions, the close of the war in the summer of 1945 put Hughes Aircraft in an awkward position of not having delivered its two main contracts. Kaiser had pulled out of the project in 1944 (Hatfield 1972:4), and the government had already made attempts to stop the contract. Further negotiations with the government allowed Hughes to finish one Flying Boat-- the prototype then under construction. Finally, Hughes had to appear before a Senate committee to defend himself against charges that he had profited from the war contracts, had lavishly entertained to win the XF-11 contract, and had knowingly constructed a Flying Lumberyard that would never fly. An outraged Hughes commented that during the war he had received less than 1 percent of the government's aircraft contracts, and was now receiving 99 percent of the investigations (Schwartz and Maguglin 1983:25).

There was much truth to the statement. Far from making a profit, Hughes sunk 7 million dollars on the Flying Boat after the government's 18 million ran out (Schwartz and Maguglin 1983:25). The level of entertainment to win the XF-11 was no greater than was expected within the industry, and Hughes promised the public that the Flying Boat would lift off, or he would probably leave the country.

Hughes would test-fly both the XF-11 and the Flying Boat. The first test flight of the XF-11, a twin-engine reconnaissance plane, took place on 7 July 1946. Due to the failure of its unusual propeller, this first prototype crashed that same day, leaving Hughes badly injured. The second prototype was built with a conventional propeller, and this plane was flown successfully on 5 April 1947, again by Howard Hughes (Hugh 1987). This plane was then given to the military, closing out that contract (Schwartz and Maguglin 1983:24-5).

The Flying Boat prototype was finished in 1946, even before the first unsuccessful flight of the XF-11. In June of that year, the Flying Boat was moved in segments from Culver City to Long Beach. Trees had to be trimmed and power lines cut to allow the enormous fuselage to make the journey over public streets to the specially prepared 240-toot long dry dock on Terminal Island, where the plane would be assembled and launched. Due to Hughes's extensive injuries after the XF-11 crash, the test flight of the Flying Boat had to wait until the following year (Schwartz and Maguglin 1983:23).

When the Flying Boat was finally assembled, it was an enormous 200-ton plane with a single hull and eight engines (Schwartz 1983:3). By this time it was formally designated the H-4, "Hercules," since Kaiser was no longer involved in the project. The wing span was almost 320 feet (97.5m) and the tail height, 75 feet (24m). The eight Pratt and Whitney R-4360 engines, each with 3,000 horsepower, were the largest radial reciprocating aircraft engines ever built (Display, Spruce Goose). The propellers alone were 17 feet long (Schwartz 1983:4). By just about any criteria, the Flying Boat was the largest prop plane ever constructed.

After convincing most reporters that he was only going to test out the engines, Howard Hughes actually flew the Flying Boat for almost a mile on 2 November 1947 (Schwartz and Maguglin 1983:26; Figure 36). The "Spruce Goose" never flew again. For decades it was kept in a special hangar at Long Beach. Since 1983, the Spruce Goose or Flying Boat has been protected by a Temcor Aluminum Dome, its permanent home beside the Queen Mary in the Long Beach Harbor (Display, Spruce Goose).

Post-War Adjustments, late 1940s-1950s

Howard Hughes continued to make films throughout the 1940s. Foremost of his later works was "The Outlaw," with Jane Russell, which Hughes worked on for much of the decade (Display, Spruce Goose). It has been said that Hughes spent his days filming "The Outlaw," and his nights pouring over designs of the Flying Boat (Schwartz and Maguglin 1983:22-3). While it does not appear that "The Outlaw" was actually filmed within the project area, the blimp that advertised the movie was kept in Building 15 after the Flying Boat was taken to Long Beach (Kruska, personal communication, 1990).

After the test flights of the war-contract planes, Hughes Aircraft went through a number of re-adjustments, followed by a period of consolidation. In the late 1940s, Hughes Aircraft shifted its emphasis from airplanes to electronics and guided missile design and production (Hughesnews 1981a; Hugh 1987). The work on radar systems was so advanced that by 1950, Hughes Aircraft Company had most of the government contracts for radar and missile work (Dates of Events c.1985). During the Korean War, the government even maintained a NORAD Defense Command Office for electronics surveillance on the third floor of the center bay of Building 15, an installation that was completely restricted and not common knowledge even within the plant (Tweten, personal communication, 1990).

Buoyed by government contracts and the promise of better times to come, Hughes promised all of his aviation workers and staff life-time employment in 1949, a generous move that led to the creation of the "Forty-niners Club," whose members later formed the loyal core of the Hughes staff (Mikell, personal communication, 1990).

Figure 36. The Most Famous Photograph of the Flight of the Flying Boat, 2 November 1947 (from Schwartz and Maguglin 1983:frontpiece).

It was about this time, in 1949, that Howard Hughes ordered two special shades of green from Sinclair Paints. All of the buildings within the complex, hitherto unpainted, were covered with these green paints, which became so closely associated with Hughes and the Culver City plant that they became known as "Hughes green" (Mikell, Stubbs, personal communication, 1990).

In 1949, Hughes Aircraft began serious work on what would soon become the great new interest of the company: helicopters (Observer 29 July 1983). In the tradition of having designed the world's fastest plane and then the world's largest plane, Hughes designed a large experimental helicopter in the early 1950s. The XH-17, designed to be used as a flying crane, could carry over 10,000 pounds a distance of 40 miles (Hughes Helicopters 1984). The rotor diameter was 136 feet, with small jets mounted on the tip of each rotor blade (Hatfield 1972:18-9). The XH-17, with its jet-powered rotor mechanism, took off for its first test flight on 23 October 1952 (Hugh 1987). Work on helicopters continued at Hughes Aircraft, leading eventually to the creation of a separate Hughes company for helicopter design and production.

The creation of Hughes Helicopters in 1959 was preceded by a number of corporate changes in the Hughes financial empire. In December of 1953, Hughes Aircraft Company was divided into the Hughes Aircraft Company, a commercial venture, and the Howard Hughes Medical Institute, a charitable institution (Date of Events c.1985). By 1954 the Medical Institute owned the Hughes Aircraft Company (Observer 8 June 1969). All land and buildings at the Culver City plant were still owned by Hughes Tool Company (Hughesnews 1981a).

Perhaps one of the most important changes within the Hughes empire at this time was the sacking of Noah Dietrich in 1957, who had been Hughes's financial right-hand man since at least the 1930s (Kruska, personal communication, 1990). Dietrich never really approved of Hughes's aviation sideline, and Hughes wanted tighter personal control over finances, hitherto directed largely from Houston by Dietrich (Barton 1982; Stubbs, personal communication, 1990).

All of these changes represented growth for the company and new buildings and additions for the Culver City plant. In 1949, the complex consisted of Buildings 5 and 6, 2 and 3, 15 (and 14 and 16), and Building 10 (cafeteria). The runway was still a grassy field and Building 1 had not yet been built (Hugh 1987; Figure 37). The plant expanded greatly in the coming years.

In June of 1950, a new entrance road was constructed from Lincoln Boulevard to the plant to provide an alternate route into the plant in case the Centinela entrance floods. This alternate route, now Teale Road but then called Hughes Way, was raised several feet above the marshy ground west of the plant (Hughesnews 1981b).

Building 5 was soon expanded to the west, while Building 6 was added to three times in the late 40s and early 50s, with a second floor added in 1956 (Hughesnews 1981a). Buildings 5 and 6 were remodeled in 1959 with the addition of a new facade designed by Hank Gogerty. At that point, the two buildings were known as "Systems Development Laboratories," which produced the Hughes Falcon missiles and aircraft and armament control systems (Hughesnews 8 May 1959).

Building 1, one of the last of the major constructions at the Culver City plant, was added to the complex by 1952 (Hugh 1987; Figure 38). Sometimes referred to as "Mahogany Row" for the fine hard wood interior, Building 1 served as the corporate offices for Hughes and his lieutenants.

By the early 1950s, Hughes's work with jets and helicopters made the grassy runway obsolete. Jets could not land well on grass, and a concrete runway was laid around 1953 by the construction firm of Del Webb (Mikell, personal communication, 1990; Figure 39). An exceedingly long and narrow construction, the concrete runway was 8800 feet long, 88 feet wide, and 1 foot thick (Stutsman, personal communication, 1990; Figure 40).

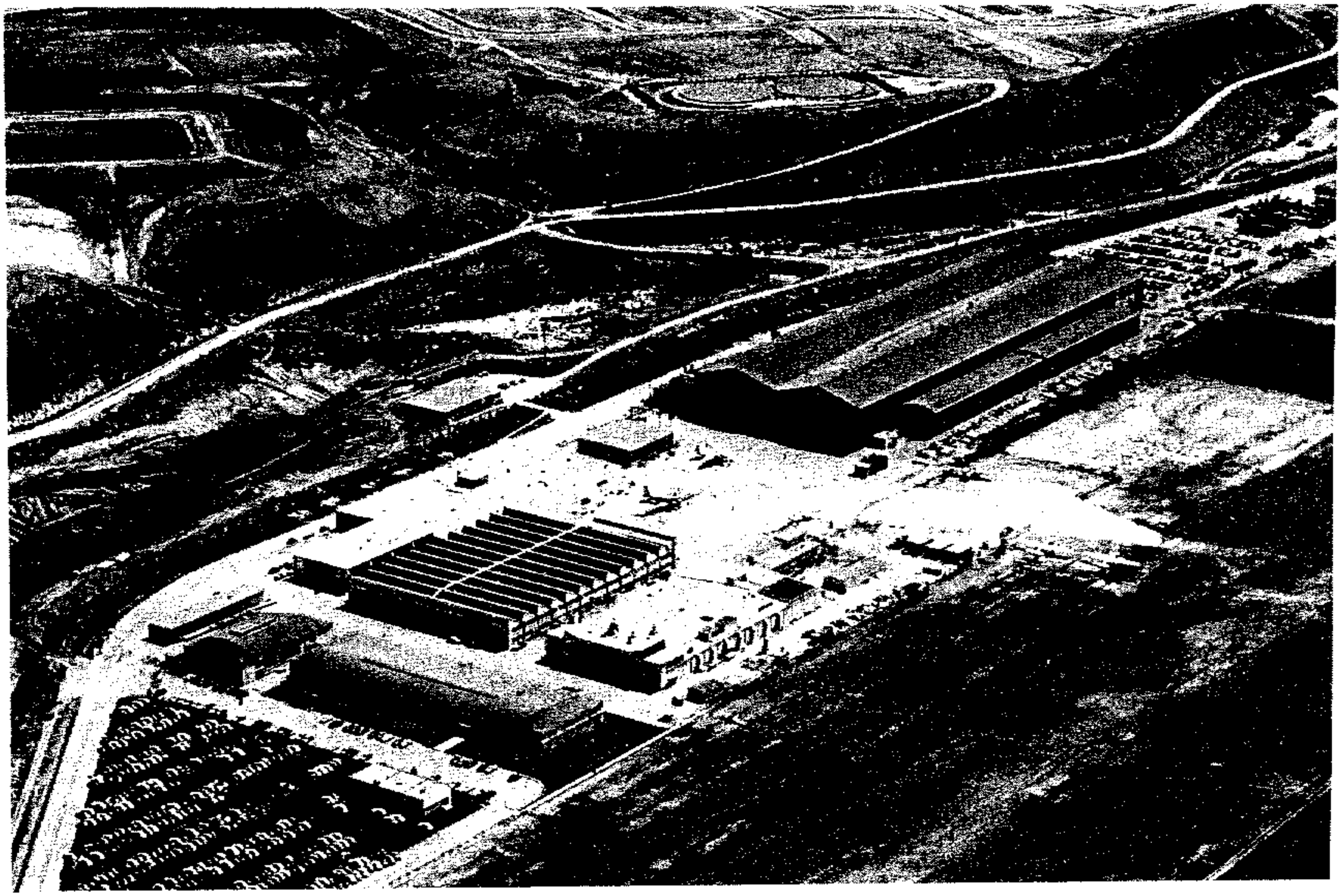


Figure 37. Culver City Plant, June 1949. Note that Building 15 is still not painted (Photograph on file, Robert Stutsman, C-4918).

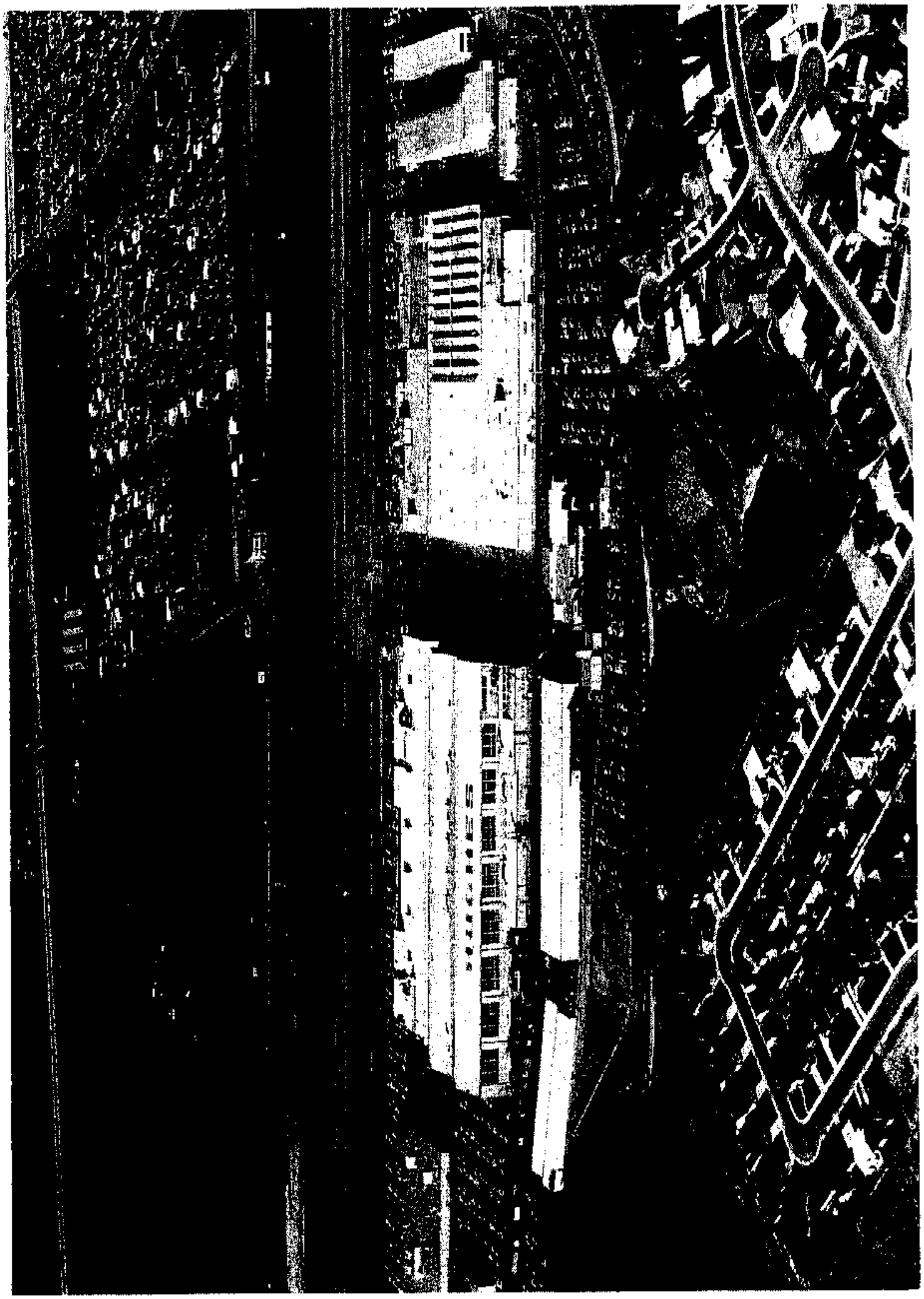


Figure 38. Culver City Plant, December 1952. Note Additions to Building 1, far right (Photograph on file, Robert Stutsman, C-8804).

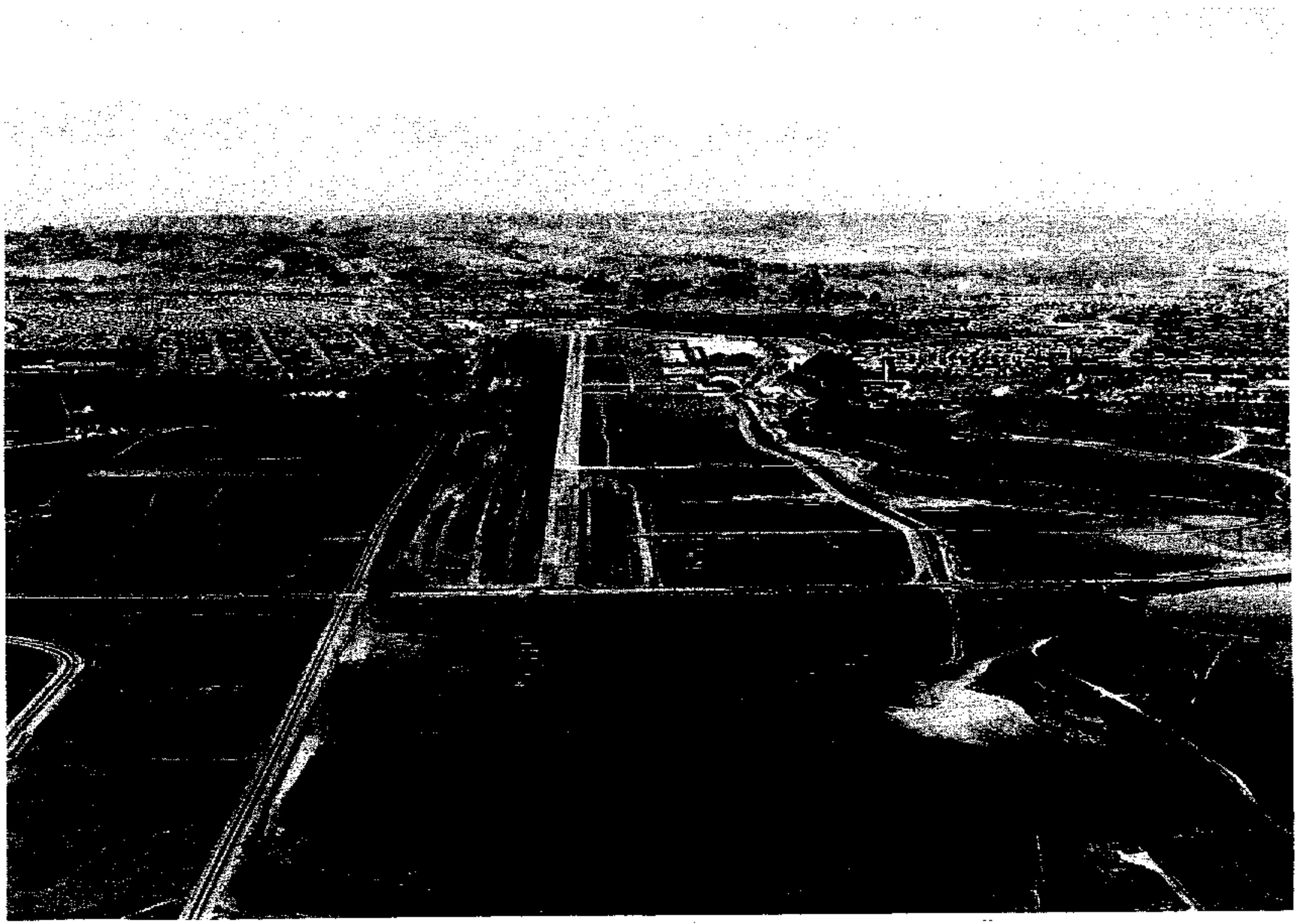


Figure 39. Culver City Plant, November 1954, looking East. Note Work on the West End of the Runway (Photograph on file, Robert Stutsman, C-11620).

Figure 40. Culver City Plant, March 1959, showing Completed Runway (Photograph on file, Robert Stutsman, S-28238).

A number of smaller changes took place at this time within the complex. The on-site railroad spur that was used to transport building materials to the site in 1941, had been completely abandoned by the late 1950s. It was from this spur that Hughes used to distribute Christmas turkeys to employees from the back of a refrigerated railroad car. In the late 1950s, asphalt was laid between the rails, creating a sidewalk from Gate 2 to Centinela (Hughesnews 1981a; Mikell, personal communication, 1990).

Height of the Plant Facility, 1960s-1970s

In the 1960s, the whole vicinity of the project area grew rapidly. This phenomenal growth is best represented by the development of Marina del Rey, the largest privately-owned marina in the world, excavated in the early 1960s immediately northwest of the project area (Figures 41 and 42).

The Culver City plant shared in this growth. From a collection of six major buildings and an equal number of smaller structures in the late 1940s, the Culver City plant grew to enormous size by the 1960s and 1970s, encompassing a total of about 35 structures by the 1970s. This growth was because of, or perhaps in spite of, the continuing corporate changes that finally led to the division of the plant into two separate facilities. The Hughes financial empire continued to expand throughout the 1950s, with Hughes acquiring properties to the south of the project area and in Arizona (Hughesnews 1981a). The Hughes empire finally grew so large that it fell afoul of anti-trust legislation; Hughes was forced to relinquish control over TWA in 1960 (Dates of Events c.1985) and other removals soon followed.

The desire to avoid anti-trust action probably had a role in the voluntary separation of Hughes helicopter work from the rest of Hughes Aircraft Company by 1969. At that time, the portion of the Culver City facility that worked on military and civilian helicopters was designated the Hughes Tool Company-Aircraft Division; the remainder of the facility kept the name Hughes Aircraft Company (Observer 8 June 1969). The Hughes Tool Company-Aircraft Division was later to be called simply Hughes Helicopters, Inc. Hughes Helicopters occupied the block of structures centered around Building 15 (Figure 43); Hughes Aircraft Company occupied most of the structures that flanked this block to the east and west.

During this period, the Culver City plant reached its greatest extent-- despite the division -- and work branched into a number of new fields. In addition to helicopters, Hughes employees now worked on lasers and satellites. The physical plant grew accordingly.

By the 1960s, Hughes owned almost all of the project area (Map Book 400, 1964; Map Book 4111, 1962:43). Only a parcel of land in the extreme east of the project area, belonging to an older resident with a kennel, remained outside of Hughes's reach in the 1970s (Hugh, personal communication, 1990). At this time, the project area belonged to the Hughes Tool Company, which then leased land and buildings to Hughes Aircraft and Hughes Helicopters (Tweten personal communication, 1990).

The physical plant at Culver City is depicted in both a 1969 diagram found in the "Observer," and on the Venice 1964/1981 quadrangle map (see Figure 32; Figures 44 and 45). The larger and more significant of these structures are briefly described or discussed below, starting with the administrative building in the extreme east, continuing westward to the production plant, the test sites, and finally the local farming that Hughes used as a tax break.

Building 1, the administrative nerve center of the complex, was located at the far east of the plant. As mentioned before, it was one of the last of the major buildings to be constructed, and was in place by around 1952. The lobby of this building was noted for the life-size photograph of Howard Hughes beside the H-1 Racer. Built by Del Webb of Long Beach, the two-story Building 1 was the Hughes

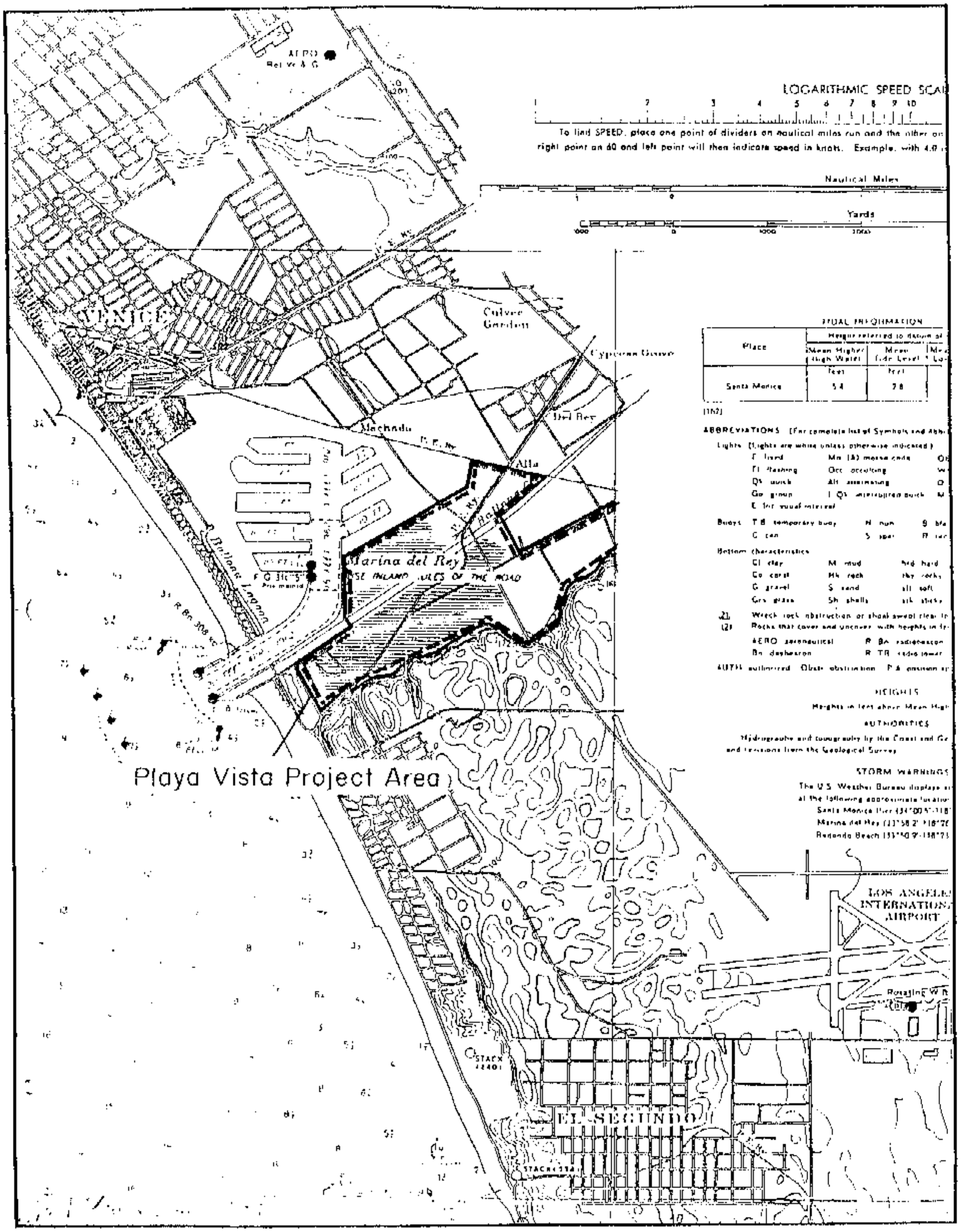


Figure 41. Marina del Rey, 1964 (from Santa Monica Bay 1964).

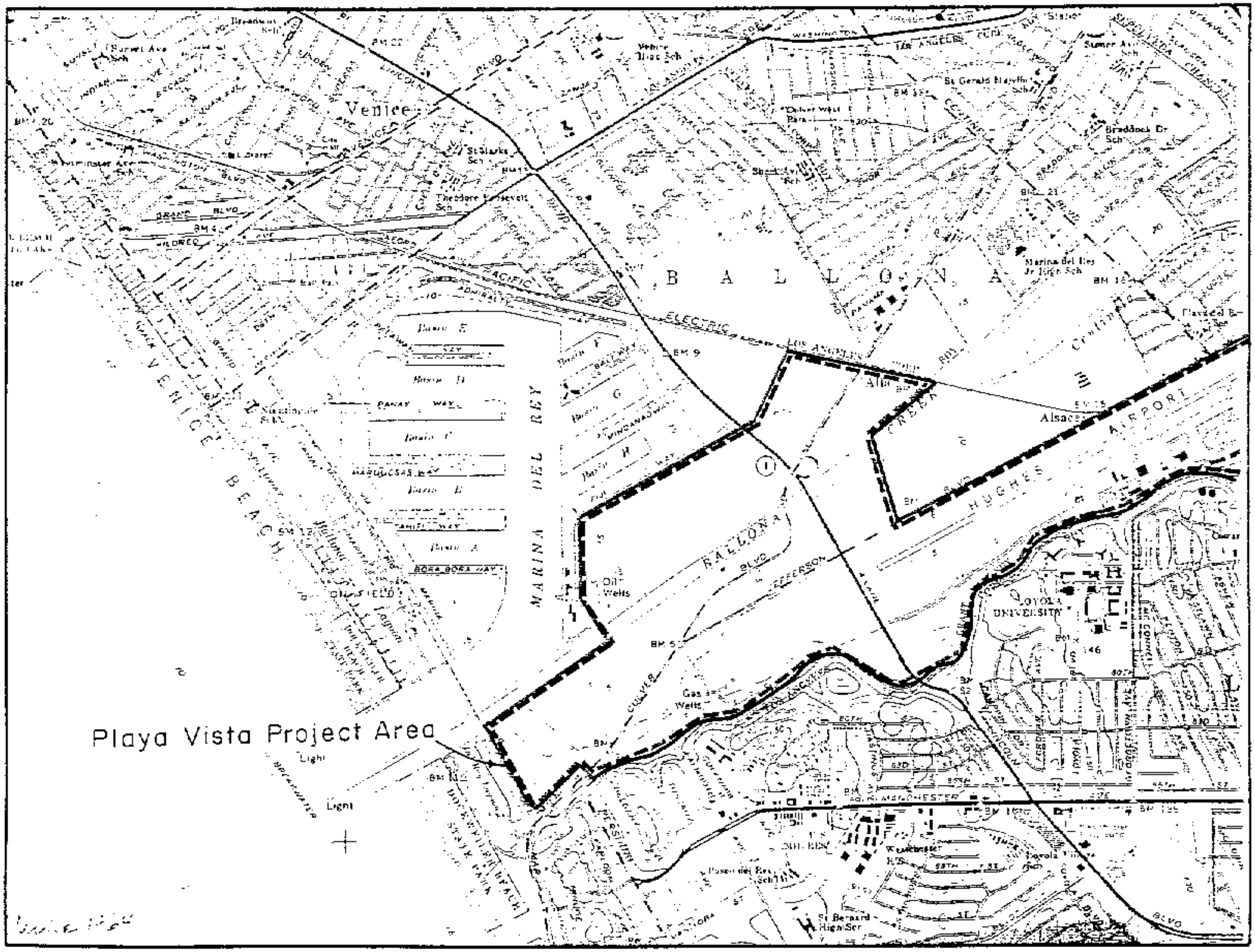


Figure 42. Proposed Project Area and Marina del Rey, 1964 (from Venice 1964).

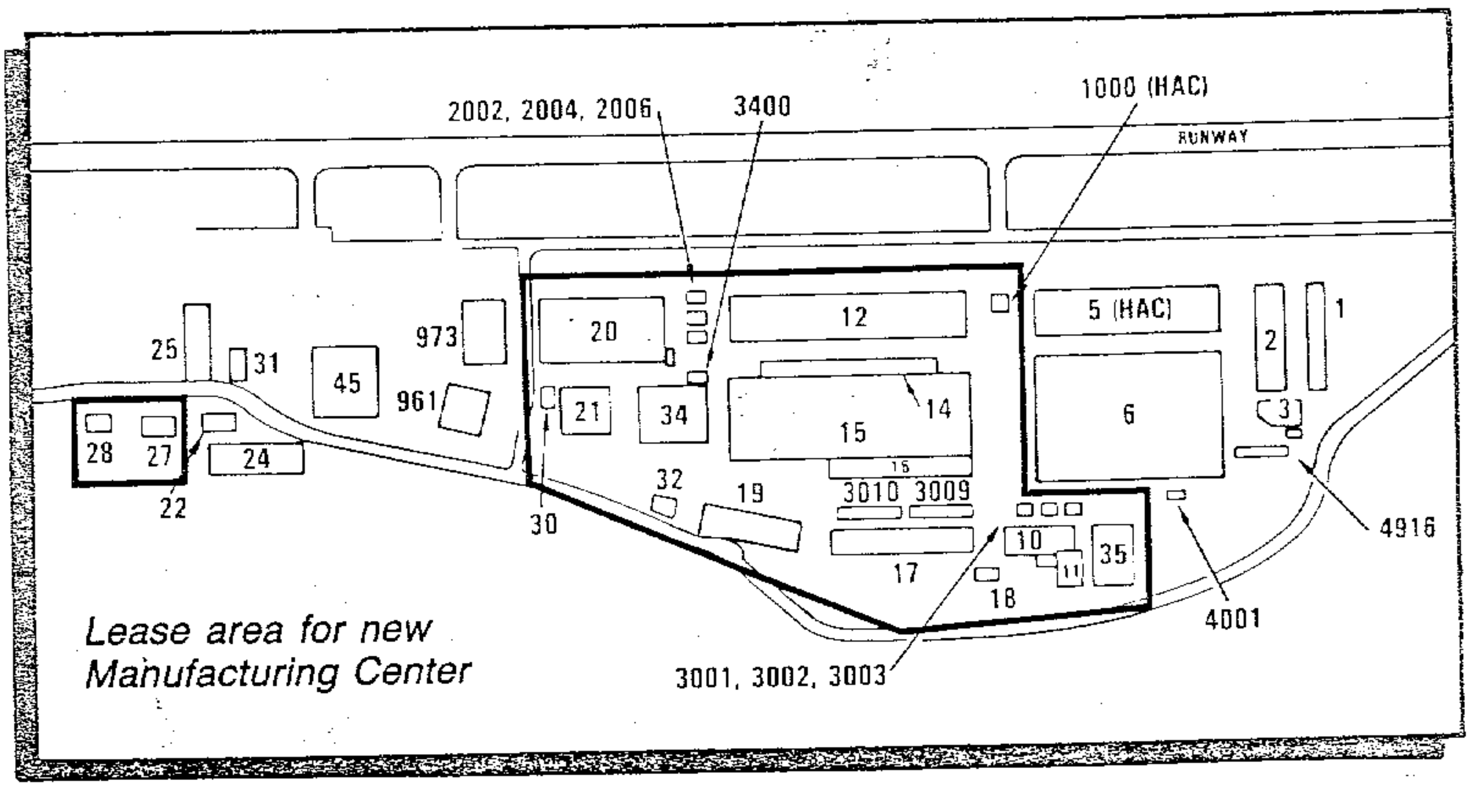


Figure 43. Facilities of Hughes Tool Company--Aircraft Division/Hughes Helicopters, later McDonnell Douglas Helicopters, after 1969 (Observor, 18 November 1985).

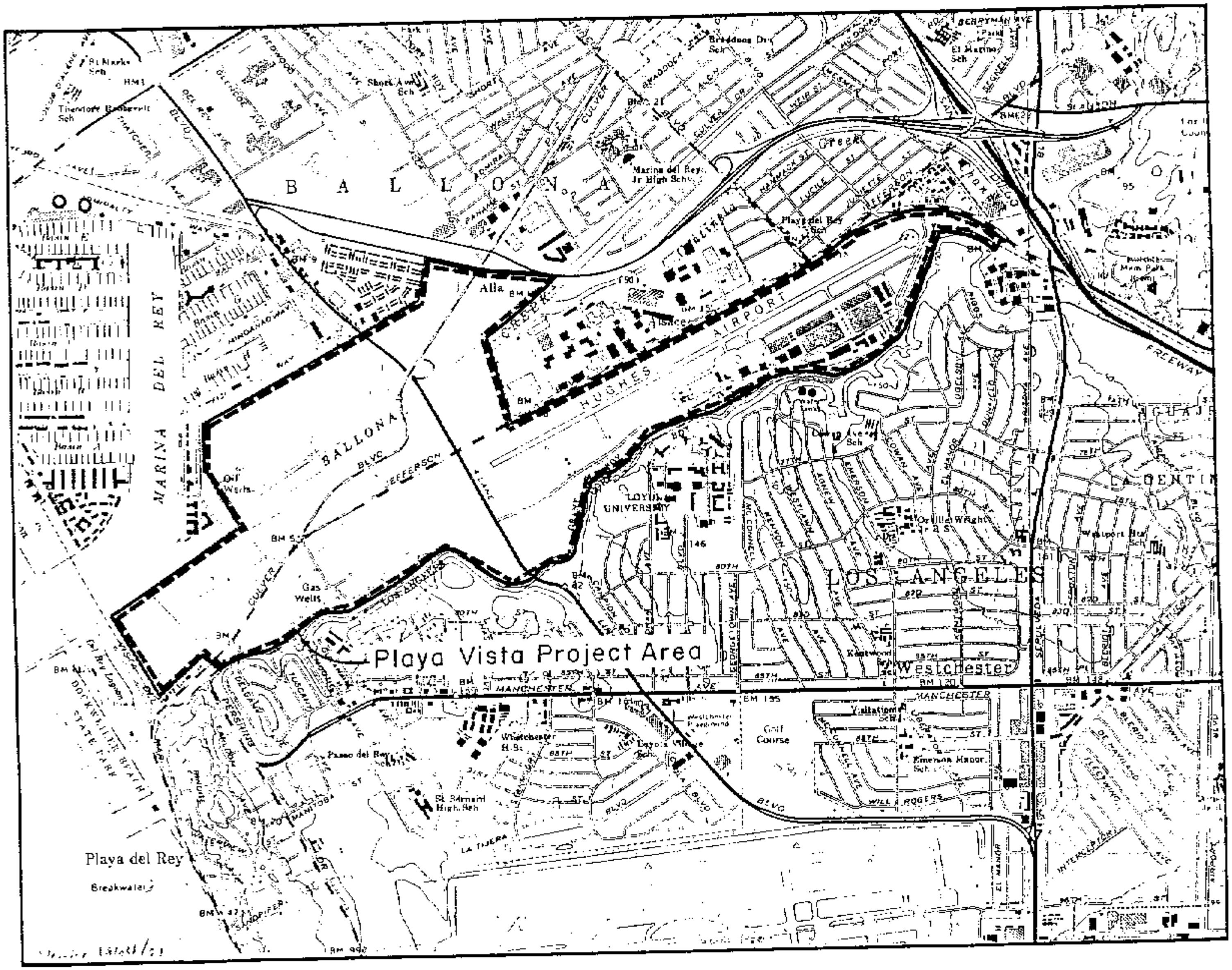


Figure 44. Proposed Project Area and Vicinity, showing Culver City Plant, 1981 (from Venice 1964/1981).

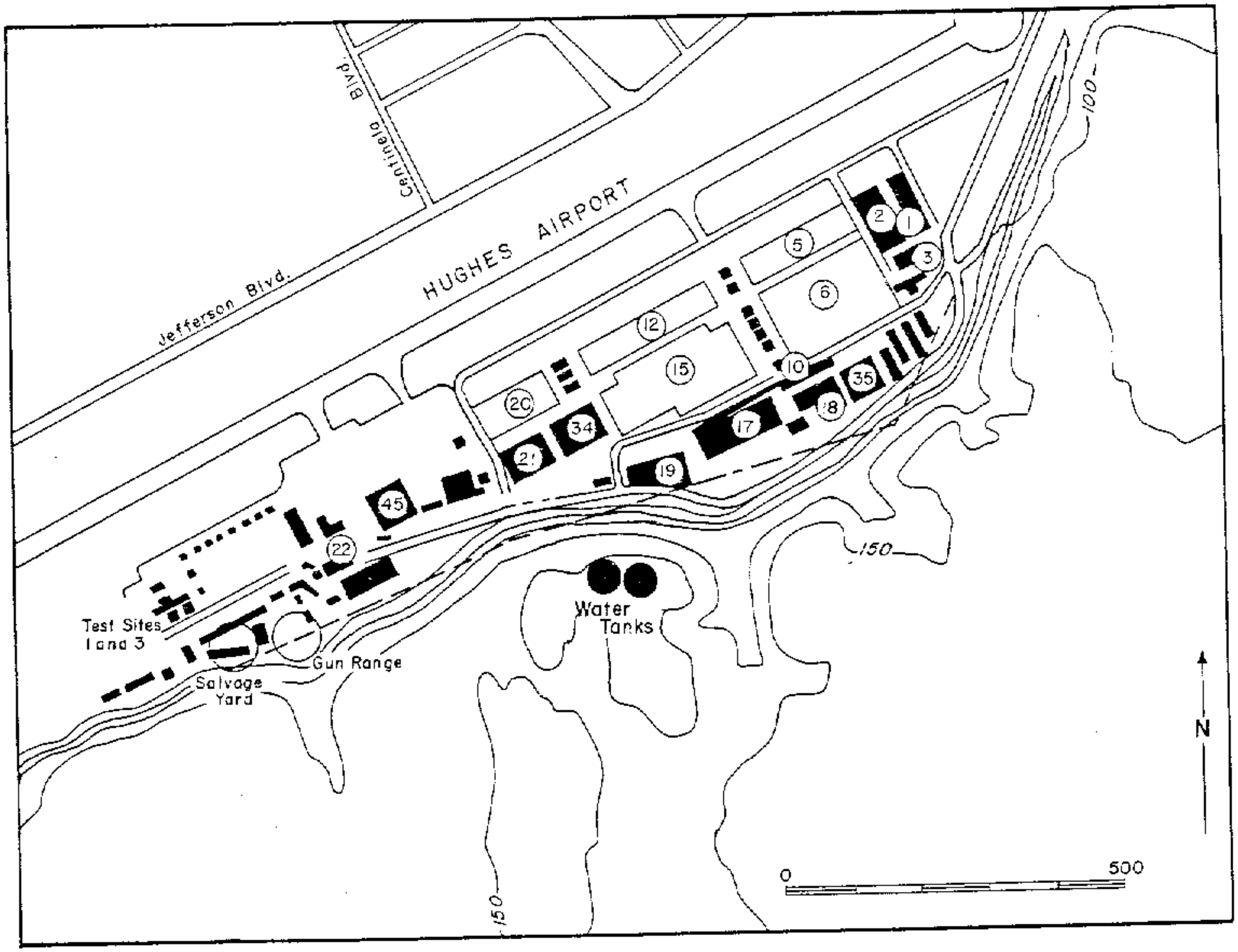


Figure 45. Detail of 1981 Map, showing Building Numbers and Other Plant Areas.

Aircraft Company Corporate Headquarters. Hughes and his aviation lieutenants had their offices here: Charlie Marcus, Jack Real, Hollingsworth, John Richardson, and Leiland Highland, who was head of Hughes Aircraft after Hughes retired from the scene (Mikell, personal communication, 1990). Jack Real came to the Hughes organization around 1969 to assume the presidency of the helicopter company; his office was located on the second floor near the south end of the building (Mikell, personal communication, 1990).

Hughes's office in Building 1 was located on the second floor, southeast corner, flanked by the offices of his secretaries (Mikell, personal communication, 1990). Charlie Marcus, known for his bowtie, was Hughes's patent attorney. He was the only member of the top brass allowed to have an office on the first floor (northeast corner) since he had to walk with a cane. Above Marcus's office, on the second floor, were the numerous lawyers' offices and storage space for corporate documents (Mikell, personal communication, 1990).

Near the center of the building was the International Visitor's Center, a conference room that was decorated with models of Hughes's aircraft and an enormous cherrywood round table. Junior Stall ran the visitor's service, and was also informal head of the "Forty-niners Club," whose members included most of the Hughes top executives (Mikell, personal communication, 1990).

Between the Visitor's Center and Hughes's office was the executive kitchen, staffed with a chef and two waiters. In the afternoons, Hughes liked a mixture of cornbread and buttermilk, one of his more distinctive habits, and one that betrayed his Texas roots (Mikell, personal communication, 1990).

By all accounts, Building 1 was a very formal place. Cover-alls and other work clothes were not allowed. Even the building janitor wore a tie. The grounds around the building were kept immaculate, and the grass was watered and mowed every day, whether needed or not (Mikell, personal communication, 1990).

Buildings 2 and 3, located immediately west of Building 1, do not appear to have been altered during this period. They were used mostly for machine gun and other armament work (Mikell, personal communication, 1990).

Buildings 5 and 6 (now often identified as Buildings 49 and 50) continued with their design and assembly work; Hughes's work on lasers was conducted in Building 5 (Mikell, Cohen, personal communication, 1990). Since more space was needed for engineering and labs than could be found in Buildings 5 and 6, a new structure to meet this need, Building 12, was constructed immediately west of Building 5 and north of Building 15. Hughes radar work was conducted in Building 12 (Tweten, personal communication, 1990).

Building 15, the original home of the Flying Boat and the XF-11, was by now almost wholly devoted to helicopter production. The XH-17 "Flying Crane" was built there in the early 1950s, followed by the Model 269 Osage, forerunner of the Model 300 series, the OH-6A Cayuse, the primary Army observation helicopter for the Vietnam War, the Model 500 series, and the XV-9A "Hot Cycle," an experimental helicopter without transmission or tail rotors. Building 15 was also where they made the 20mm Mark II and Mark IV guns and gun pods for the Navy (Observer, Nov.1986). Helicopter production was heaviest in the late 1960s, with the south bay almost wholly devoted to their manufacture (Tweten, personal communication, 1990). The resulting congestion probably contributed to the removal of the overhead crane, taken out in the 1970s (Cohen, personal communication, 1990). For a while, even the area between Buildings 15 and 6 was occupied by a line of trailers used as engineering classes affiliated with the University of Southern California (Mikell, personal communication, 1990).

South of Buildings 15 and 6 were the caferetia and a few other auxiliary buildings. West of Building 15, there were over ten different structures whose function was to maintain the physical plant or store materials. Some of the more important of these buildings and their functions are mentioned below:

Building 17 plant facilities headquarters
Building 18 fire station and security
Building 19 receiving depot; transportation vehicles (fork lifts)
Building 22 raw stock, supplies
Building 24 storage (the H-1 Racer was kept here)
Building 34 transportation for Hughes Helicopters; later storage
Building 45 hangar for two Boeing planes that transported employees to other Hughes installations in California and Arizona; company helicopters were kept on the apron north of 45 (Mikell, Cohen, personal communication, 1990).

The area beyond Building 45 contained a number of auxiliary structures, finally grading off into a salvage yard, gun ranges, and the company test sites. The most memorable of these auxiliary structures was the Hughes Employee Store, where employees received discounts of all kinds. This store was closed in 1979, keeping pace with the decline of the Culver City plant (Mikell, personal communication, 1990). This store, like many of the auxiliary structures immediately west of the main complex, was later destroyed.

The last of the existing buildings on the western fringe of the complex belonged to the salvage yard, which for years was run by Bill Fry. Within this area were kept the two caterpillars that kept the company gravel roads level. Immediately east of the salvage yard, between the yard and Buildings 22/24, were the gun ranges where machine guns and grenade launchers were tested against bunkers placed near the base of the Ballona bluff (Mikell, personal communication, 1990).

North of the salvage yard and the gun ranges were Test Sites 1 and 3. Test Site 1 was used for explosives and as a rocket test site. Test Site 3 was used to test helicopter rotors (Mikell, personal communication, 1990).

North of the test sites and the rest of the complex, was the Hughes runway, paved in 1953. The first runway control tower was located near Gate 6, immediately west of Building 5. It was later moved to the top of the new engineering facility, Building 12 (Hughesnews 1981a; Cohen, personal communication, 1990).

The further development of the complex made the periodic flooding of Centinela Creek increasingly intolerable. For years after the construction of the first buildings on the complex, each rainy season saw the placement of sandbags near the Centinela "ditch" in case of emergencies. Eventually, a three-foot-high wall was constructed along Building 17 to control flood waters from the ditch (Hughesnews 1981b). As more parking was needed in the area, part of the ditch was covered over by a parking lot, with water transported underground through a large pipe, returning to the open ditch in the vicinity of Building 19 (Hughesnews 1981b). Finally, in 1962, the Centinela Creek Flood Control Channel was constructed by the Army Corps of Engineers in cooperation with the Los Angeles Flood Control District. The new channel was dug east and north of the plant site (Hughesnews 1981b).

Outside of the complex and beyond the auxiliary buildings and test sites, lay the runway and the rest of the large Hughes holdings. Hughes allowed this land to be farmed, since agricultural land was the lowest possible tax bracket, but no one was allowed to live on it for obvious safety reasons (Tweten, personal communication, 1990). After World War II, some former Japanese residents returned to the area and worked with Pepe Lopez for a number of years (Lopez, personal communication, 1990). Celery, however, was no longer the major crop, as the cultivation of lima beams became more popular. Most of the celery sheds within the project area had long been torn down; the few remaining structures had been converted into maintenance shops (Hughesnews 1981a).

Within the project area, the man responsible for Hughes's agricultural work was Angel Jamar. Jamar was essentially "employed" as a tenant farmer, commissioned to cultivate as much land around the runway as he could handle. In return for keeping the land free of weeds, he was allowed to keep his harvests rent-free. Under this arrangement, Jamar grew barley and lima beams within the project area as far north as Ballona Creek and as far west as the wetlands around Lincoln Boulevard. Jamar maintained an equipment shed within the stand of eucalyptus located near the junction of McConnell and Jefferson. It is clear that Jamar did not live on the property, keeping his residence near Inglewood (Mikell, Lopez, personal communication, 1990). After Jamar retired around 1969, his position and the special arrangement with Hughes was continued by Roy Pursche into the 1980s (Stutsman, personal communication, 1990).

As was mentioned earlier in a different context, the peak of the Hughes operation at Culver City coincided with the Vietnam War. Helicopter work, centered around Building 15, reached a peak in 1968 (Observer, April 1987), with about 75 percent of the work devoted to helicopters, and the remaining 25 percent devoted to helicopter armaments (Tweten, personal communication, 1990). During this period, over six thousand commercial and military helicopters left the exit gates of Building 15 (Observer, April 1987). Even with the wind-down of the war in the early 1970s, the concentration of personnel at the Culver City plant continued to grow into the middle 1970s, at which time there were even bus lines first run by Hughes and later by an independent firm that transported workers from the far-flung parking lots to the central complex (Mikell, personal communication, 1990).

The Hughes corporate reorganization, with its momentous changes of 1969, continued into the early 1970s. In 1972-73, Hughes sold the oil/tool division of Hughes Tool Company, allowing HTC to become a public firm. Hughes then organized Summa Corporation, based in Las Vegas, as a holding company for the rest of his financial empire (Dates of Events c.1985). These changes would accelerate after Howard Hughes's death on 5 April 1976.

LATER CHANGES AND PARTIAL DEMOBILIZATION, 1980s

By the time of Howard Hughes's death, Hughes Aircraft had 32 subsidiaries and 12 affiliates (Dates of Events c.1985). Hughes's death only aggravated the changes that continued to be made in his organization. In 1981, the Hughes Corporation was formed as an umbrella organization for both Summa Corporation and Hughes Helicopters, Inc., which was organized that same year (Dates of Events c.1985).

It was about this time that the Playa Vista planned community project was first conceived by Howard Hughes Properties, development arm of the Summa Corporation. Playa Vista was a means of getting a better return out of the large project area that was already too valuable to use as a buffer for the Hughes runway. Erected by the Summa Corporation in the summer and early fall of 1982, the present Playa Vista building was constructed at the southeast corner of Jefferson and Lincoln to serve as the nerve center for this development (Stutsman, personal communication, 1990).

The initial stage of Playa Vista development, which called for the demolition of peripheral structures on the property, had commenced the year before, with the destruction of the residence on the kennel property on the far east edge of the project area--the kennel property that Hughes could never acquire (Stutsman, personal communication, 1990). The few remaining oil wells at the west end of the project area were capped, and a land fill and grading project was begun in 1981 by Summa in the area around Jefferson and Lincoln to raise the land and provide better run-off (Observer 11 May 1984, 18 June 1985).

The community of Alsace had already been virtually eliminated by the development of the Hughes runway, and now came the turn of Alla, on the corner of Culver and the Marina Freeway. Only one platform of a single structure remained within this area in 1981, the platform of the Blue Goose Packing House, alleged to have once been a favored set for Laurel and Hardy films. This platform had been removed by 1984 (Altschul et al. 1990:12-13).

By the mid-1980s, Playa Vista's long term plans benefited from the corporate decision to sell Hughes Helicopters, which was put on the market in 1983 (Observer 1983). Hughes Helicopters was sold on 6 January 1984 to McDonnell Douglas Corporation (Dates of Events c.1985), becoming a subsidiary to that company (Cayuse 1986). The name of Hughes Helicopters was finally changed in 1985 to McDonnell Douglas Helicopters, with McDonnell Douglas becoming a formal tenant of the Summa Corporation.

Further reorganization within the McDonnell Douglas portion of the plant began almost immediately. In 1985, a management team did a consolidation and modernization study of the facility in the wake of the opening of the new Mesa facility for helicopter development and production. McDonnell Douglas Helicopter headquarters were soon moved to the Mesa facility (Observer 27 August 1985; 4 December 1987; Hugh 1987; Tweten, personal communication, 1990). When McDonnell Douglas signed a new lease with Howard Hughes Properties for its share of the Culver City plant in November 1985, the Culver City facility was formally renamed the McDonnell Douglas California Manufacturing Center. The Center was to be parred down to about half of its former size, and would form the nucleus of the Playa Vista office and research park, centered around Building 15 (Observer 18 Nov.1985; November 1986).

Under new management, the old green paints associated with Hughes Helicopters were replaced by two shades of blue, the colors of the McDonnell Douglas Helicopter Company. The first of the California Manufacturing Center buildings to be painted was Building 15, which also received a covering of aluminum siding for the occasion. This occurred around the end of 1984 or the beginning of 1985, the color selection having been approved as consistent with Playa Vista development (Observer 27 August 1985; Tweten, personal communication, 1990). The remaining buildings of the California Manufacturing Center were painted blue in the winter of 1986/87 (Observer, Nov.1986).

While McDonnell Douglas was busy transferring the nucleus of the helicopter company to its new Arizona facility, a similar demobilization was taking place within the Hughes Aircraft Corporation, which was acquired as a subsidiary by General Motors in December 1985 (Hugh 1987). This initiated the further decline of the Culver City plant, as most of the Culver City work was transferred to the new El Segundo complex (Hughesnews 1981a). Only the corporate headquarters of Hughes Aircraft remained behind, and this was transferred to a new building tucked into the bluff adjacent to Lincoln Boulevard, in January 1986 (Hugh 1987). This led directly to the abandonment of Building 1, which still stands, its elaborate woodwork intact (Mikell, personal communication, 1990).

Other structures peripheral to the complex, gradually abandoned in the course of demobilization, have not been so lucky. By the end of 1987, Buildings 4, 24, 41, 42, 43, 961, and 973, had been demolished by the Summa Corporation. Other structures and the ordnance range have met a similar fate (Observer 4 December 1987). Hughes runway was halved in 1985 to four thousand feet to make way for Playa Vista development. The runway was completely closed the following year (Observer, Dec.1986). In 1986 and 1987, the runway pavement was finally pulled up and "stacked" (Observer, April 1987:13), after which an enormous mound of clean dirt fill was brought onto the runway area as part of future Playa Vista plans (Stutsman, personal communication, 1990).

One of the last constructions removed from the project area was a small 40-year-old stable located in the extreme southwest corner of the project area, adjacent to Playa del Rey and the Ballona wetlands west of Lincoln Boulevard (McDonough, Stutsman, personal communication, 1990). The demolition of the stable is perhaps symbolic of a trend to remove human alterations and restore a portion of the Ballona to its natural state.

CHAPTER 5

ARCHIVAL RESEARCH ON PREVIOUSLY RECORDED CULTURAL RESOURCES IN THE PROJECT AREA

Prior to our work, six archaeological sites had been recorded within the Playa Vista project area. The nature, most recently recorded condition, and the history of archaeological research at each site are described below.

CA-LAn-54

CA-LAn-54 was first formally recorded by Hal Eberhart, then survey archaeologist at UCLA, in November of 1949 as a probable village (Pence 1979, Van Horn 1984a:29). The site has also been known as CA-LAn-78 and Deane's Broken Mortar site (Table 2). Eberhart placed the site on both sides of Culver Boulevard southwest of its intersection with Alla Road (Van Horn 1984a) (Figure 46). The Pacific Electric Railroad tracks also crossed the site and the Blue Goose Packing House was built over it as well (Pence 1979). Pence visited the site in 1979 but could ascertain little about its age or function. He found fragments of shell and quartzite debitage but no other artifacts. Pence (1979:n.p.) describes the site as highly disturbed but with a high probability for portions to be intact.

> A portion of the site exists west of the intersection of Culver Blvd. and the onramp of the Marina Freeway. A portion exists east of this same intersection and forms a part of the parking lot of a Skateboard park on that corner. A small portion exists behind the Blue Goose Packing House building on the southern side of the intersection.

Van Horn (1984a:37-8) and his associates revisited the site in July of 1984 and found that the packing house and skateboard park were no longer present. In their places they observed a health and recreational facility on the south side of the intersection of Culver Blvd. and the Marina Freeway and a boat yard on the west side. They also observed a dark soil stratum containing marine shell on the eastern and western escarpments of the on-ramp of the freeway. They believe the site may be preserved under the parking lot of the health facility. The rest of the site, which may have been situated on a low hill overlooking Ballona Creek, has either been cut away by the channelization of the creek or construction of the freeway, or covered with 12-15 feet of fill when the marina was dredged in 1960. The boatyard and a railroad levee are not covered by fill, but Van Horn doubts that the site is preserved in these areas.

Van Horn and Pence agree that if this site remains intact it is significant. CA-LAn-54 is one of the few sites that occur within the playa area, as opposed to the top or base of the Ballona Escarpment. Van Horn also believes that artifacts may yet be found because the midden appears well-developed and marine shell is plentiful.

CA-LAn-60

This site is located below the easternmost extension of the Del Rey Hills escarpment and directly below the CA-LAn-59. It was first described by Malcolm Farmer (1936) in his survey of the Playa del Rey sites. Farmer described it as a camping area covering 46 m by 154 m and about 0.6 m deep. Farmer found shell mixed with ash and soil, chipped stone artifacts, mortar fragments, choppers, and pieces of steatite. The site was also described by Dr. F.H. Racer who wrote in 1939 (quoted in Rozaire and Belous 1950:35):

Table 2. Previous Archaeological Investigations of Sites within the Playa Vista Project Area.

SITE NO./ NAME	INVESTIGATOR/REPORT	TYPE OF WORK
CA-LAn-54 (Area C)		
(CA-LAn-78)	Deane	site collection ("Broken Mortar Site")
	Eberhart	site recording
	Pence (1979)	site recording
	Van Horn (1984a)	site recording
CA-LAn-60 (Area D)		
(LA-85)	Farmer (1936)	site recording ("Playa del Rey Site #2")
	Racer (1939)	site recording
	Rozaire and Belous (1950)	site recording
	Pence (1979)	site recording
CA-LAn-62 (Area D)		
	Farmer (1936)	site recording ("Playa del Rey Site #4")
	Peck (1947)	excavation ("Mar Vista Site")
	Shulene	excavation
	Deane	surface collecting
	Rozaire & Belous (1950)	site recording
	Thiel (1953)	described artifacts and inhumations found by Deane
	Pence (1979)	site recording
	King & Singer (1983)	test excavations
	Van Horn et al. (1983)	test excavations (defined CA-LAn-62a)
	Van Horn (1984a)	site recording
	Freeman et al. (1987)	test excavations (defined boundaries CA-LAn-62b)
	Archaeological Assoc. (1988)	test excavations (more boundary definition of CA-LAn-62b)
CA-LAn-193 (Area D)		
	Nelson/Wilson	site recording, no report
	Beals,1939	site testing, no report
	Eberhart, 1952	site recording, no report
CA-LAn-211 (Area D)		
(CA-LAn-29)	Deane	site recording ("Deane's Site 1")
	Luhrs (1948)	site recording (LA:3)
	Eberhart (1953)	site recording
	Rozaire and Belous (1950)	site recording
	Pence (1979)	site recording
	Van Horn (1984a)	site recording (identified CA-LAn-211b)
	Freeman et al. (1987)	test excavation at CA-LAn-211b
CA-LAn-1698 (Area A)		
	Peak and Assoc. (1989)	site recording

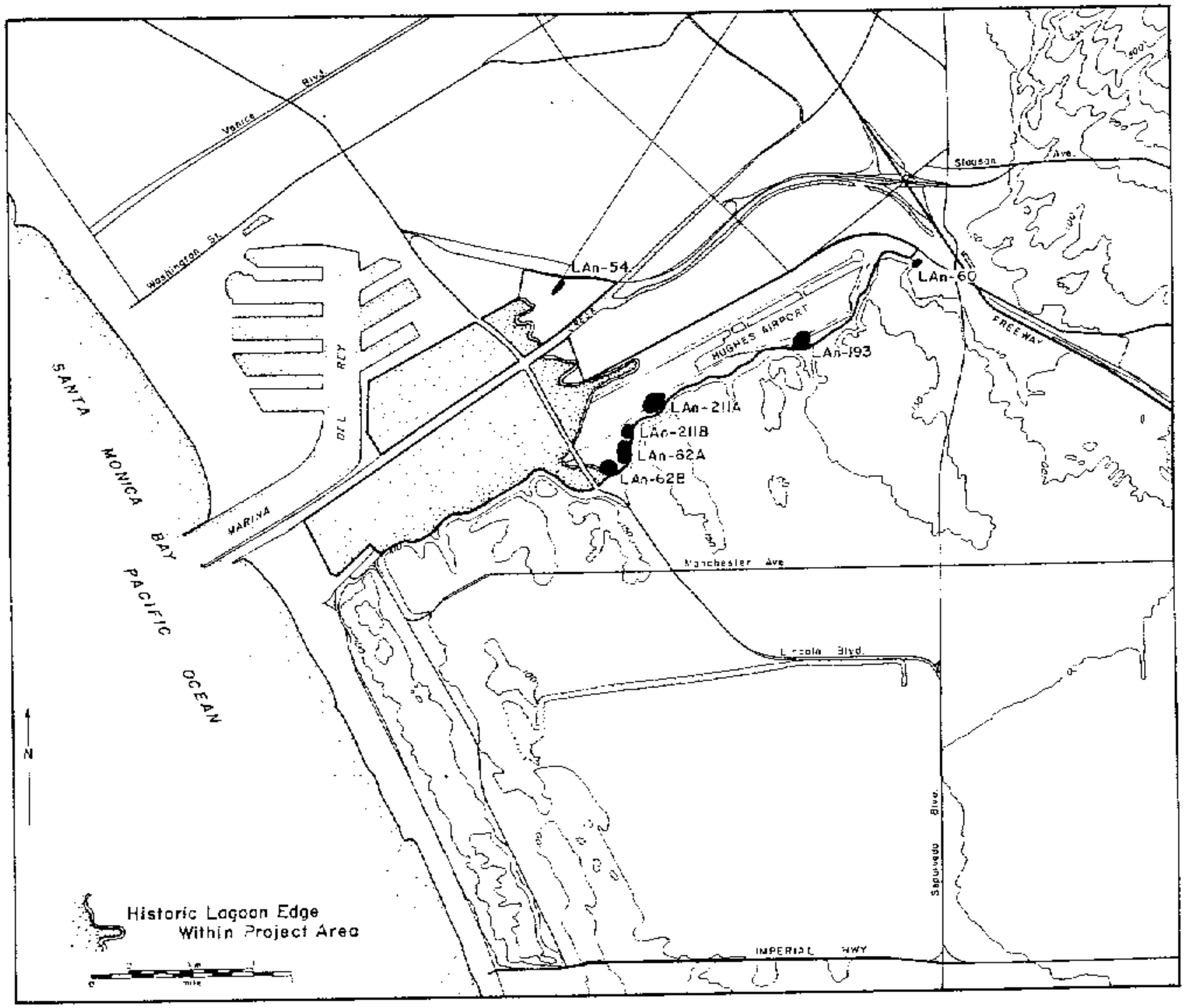


Figure 46. Previously Recorded Sites and the 1861 Ballona Lagoon Edge within the Playa Vista Project Area.

Several years ago a man from Inglewood trucking black earth for green houses uncovered a great number of whole and broken mortars, pestles, and other artifacts.

By the time Rozaire and Belous visited the site, part of it had been bulldozed by the Los Angeles sewer and associated road and a riding academy had been built on top of it. In 1979 Pence recorded the site as being extensively disturbed. Intact midden soils may have been preserved at the toe of the bluff west of the original site location. A local stream that once flowed off the bluff south of the site had been channelized through the site area. The area east of this stream had been filled with 1 to 1.5 m of overburden. Much of the site area was also being severely impacted by off-road vehicles. The parking lot of the Burton-Arnold Company at 6341 Arizona Circle may have covered another portion of the site. Pence (1979) found a unique mushroom shaped artifact that he believed might be related to the cogged stone complex. This artifact was found on the edge of the stream bed, and he concluded that it was either displaced by the stream or off-road vehicles.

Pence concluded that the areas under the buildings or parking lot were well protected. He also suggested that the area at the toe of the bluff and between the bluff and stream might contain intact remains that should be investigated and protected if they retained their integrity.

CA-LAn-62

Van Horn (1984a:30-31) claims that CA-LAn-62 is probably one of the oldest known sites in the Ballona area. Informal collecting has probably taken place at this site since the beginning of modern settlement in the area (Lambert 1983). The site was first formally investigated by Malcolm Farmer who called it the Playa del Rey Site #4. Van Horn also believes that CA-LAn-62 is the Mar Vista site excavated by Peck and reported in 1947. The Mar Vista site was identified by Pence as CA-LAn-193.

According to Van Horn (1984a:31), Peck was the only excavator to conduct formal excavations at CA-LAn-62 prior to the 1980s. Peck described the site as originally comprising an alluvial fan or "cone" which spread out into the playa from the Ballona escarpment. Much of the site was removed in 1942 when the Hughes landing field was extended. Peck's description tends to corroborate Van Horn's interpretation since CA-LAn-62 is located near the landing strip; whereas CA-LAn-193 is located in the area of buildings associated with the Howard Hughes Industrial Complex.

According to Peck, large amounts of cultural material were uncovered during construction of the landing field. Because much of the site was already destroyed, Peck felt that the excavation of three trenches would not cause irreparable harm. As Peck (1947:1) stated, "The next step was to search for a site where an amateur could practice some of the lessons learned and where blunders would not cause the loss of important archaeological data." Sponsored by the Southwest Museum, excavations began in August 1945 and lasted until June 1946. All material recovered was deposited in the Southwest Museum.

Peck was clearly a very modest man, for his work was carefully conducted and skillfully reported. Based on projectile point styles and the similarity of other cultural material, CA-LAn-62 appears to be a late prehistoric or protohistoric site. However, the presence of both cremations and inhumations led Peck to conclude that there were two occupations, with inhumations belonging to an older culture. Peck's work suggests that CA-LAn-62 may have been a village site occupied year-round. If Peck is correct and one of the site components predates the Late Prehistoric Horizon, the scientific potential of the site would be extremely high for it could potentially provide important data on early occupations on the edge the lagoon, as well as provide evidence about later permanent settlements in the area.

Peck was followed by a series of amateurs. Mr. Oscar Shulene carried out the most extensive excavations. Between about 1939 and 1949, he conducted unauthorized excavations and surface collections at various sites in the Ballona area, although after 1947 he concentrated on CA-LAn-62. At that site, Shulene uncovered large numbers of artifacts, some animal bones and tools, and about 15 burials, all flexed inhumations lying on their sides. Shulene allowed Rozaire to examine his private collection in 1950 (Rozaire and Belous 1950). At that time, his collection contained about 200 artifacts (Rozaire and Belous 1950). The final disposition of the Shulene collection is unknown.

William Deane also assembled a large collection from this site in the late 1940s. These artifacts were photographed by Marlys Thiel and described in her 1953 paper along with four inhumations found by Deane. The disposition of this private collection is unknown.

Rozaire and Belous (1950) visited CA-LAn-62 during their survey of the Ballona Creek area and were the first to record it. They report that CA-LAn-62 was the Hughes Aircraft site (Mar Vista site) excavated by Peck, and their description of the site appears to derive from Peck's 1947 report. Their site map, places the site near the base of the bluffs just east of Lincoln Boulevard. Artifacts were collected from the surface and are housed at the Southwest Museum.

Rozaire and Belous were the last trained archaeologists to examine the site prior to modern developments in the area which completely buried it. They depicted the site as a series of backdirt piles wedged between the base of the bluff and a plowed bean field. They also place the site about 650 feet east of Lincoln Boulevard and extend it about twice that distance to the east. They put the western end of the site just east of a storm drain running down the slope of the bluff. Bulldozed overburden was visible even at this early date on top of the midden.

Pence visited CA-LAn-62 in his 1979 survey of the Hughes property. By this time most of the site was covered with alluvium which had hidden all but the northern edge of the site and a portion of the bluff face. Debitage occurred in low density along this northern edge, but extensive deposits were exposed in the bluff face.

Pence's 1979 survey report has resulted in considerable confusion concerning CA-LAn-62 and CA-LAn-193. Pence states that CA-LAn-62 was recorded by Rozaire and Belous in 1950. He goes on to say:

> The site is recorded as being a key site in the area and excavations and pot hunting have yielded a variety of artifactual materials plus burials and cremations. The burials are all flexed lying on their sides. Faunal remains for the site are fish, mammal and shell. The site was potted extensively and a portion of the Los Angeles sewer line was placed through it. It was felt that the site is stratified and that some test excavations should be done to assess its status. The site may have at least two components based on recorded data, a Middle Period component and a Late Period component. Other recorded names for the site are LA-79, Malcolm Farmer's Playa del Rey Site #4, and Stuart Peck's Hughes Aircraft Site.

In reference to CA-LAn-193 Pence (1979) states,

> In 1947 Stuart Peck did some excavation at the site (Peck 1947 [cited in the bibliography as the Mar Vista site report]) and reported a stratified deposit that was 8 to 12 feet deep and covered an area of 154 meters by 77 meters. Peck records cremations which overlie burials plus food remains, shell, points, pestles, fishhooks, beads, awls, and tarring pebbles. His excavations involved a relatively small portion of the site, and he indicates that other materials may be deeply buried. The recorded data would indicate that at least two components exist here, a Late Prehistoric component and possibly a Middle Horizon component. Other designations for this site are LA-136 [cited as the site number of the Mar Vista site in Peck's 1947 report], Site No. 4, and the Redondo Wilmington Site.

From Peace's report it appears that CA-LAn-62 and CA-LAn-193 are the same site, and that Peck excavated at both. This conclusion is in error. It is clear that Peck excavated at the site recorded by Rozaire and Belous as CA-LAn-62. The locations given by Peck and by Rozaire and Belous for CA-LAn-62 and Peck's site are identical. Significantly, Rozaire and Belous (1950) do not include CA-LAn-193 in their report. Indeed, the latter site was not even recorded until 1952, two years after their survey (see below).

Chester King and Clay Singer conducted test excavations at CA-LAn-62 in 1983, but were unable to find intact cultural deposits (Van Horn 1984a:32). King and Singer (1983:1) claim that CA-LAn-62 represents the historic Gabrielino village of *Suangna* but were probably referring to *Sa'angna*, a village depicted in the area by Johnstone (1962). *Suangna* is placed by Johnstone in the San Pedro area. In either case, King and Singer fail to provide any material evidence to support the correlation of this particular site with either historic village.

In 1982, Van Horn and his colleagues also visited CA-LAn-62 and in 1983 carried out a systematic test of one portion of the site using backhoe trenches. By this time no portions of the site were visible from the surface, but Van Horn was more successful in exposing portions of the site. An archaeological deposit, designated CA-LAn-62a, was found buried under the slope of the shoulder of a sewer line built along the face of the escarpment (Van Horn et al. 1983). This deposit extended 85 m north across what was originally a low talus between two natural drainages. At the time Van Horn tested the site, the southern drainage had been replaced by a sewer outfall. No controlled test units were excavated at this time, although a number of shell specimens and artifacts were recovered from the trench backdirt. Van Horn estimated the remains of the deposit to be generally about a meter deep.

Based on the trench profiles and other stratigraphic evidence, Van Horn et al. (1983:6) estimated that CA-LAn-62a once extended about 80 m further west of its present location and that about 75% of this deposit had been removed by grading. Much of the site was apparently used as fill material during the construction of the Hughes air strip and related projects and some material was used to fill the drainage that comprised the northern boundary of the deposit.

Van Horn (1984a:33) claims that this deposit represents the site excavated by Peck and recorded by Rozaire and Belous in 1950. He also argues that this site would not be adversely impacted by future development because it is sealed under the the slope easement under the access road to the new Hughes Aircraft Co. Headquarters building (Van Horn 1984a:44).

It was also at this time that Van Horn and his colleagues identified a second archaeological deposit which they designated as CA-LAn-62b. This deposit was located south of the sewer outfall and southwest of CA-LAn-62a. At this time, they were able to investigate only the eastern periphery of this deposit with a portion of a single backhoe trench (Tr-1, Figure 47) and a 1 x 1 m test pit (Table 3). Within this test pit they found midden extending to a depth of 1.2 m below 2-3 m of historic alluvium containing large numbers of historic artifacts.

There is some confusion as to the precise location of this second deposit. Van Horn (1984a:33) describes it as southeast of Peck's site, which Van Horn designates as CA-LAn-62a, but locates it southwest of Peck's site on his map (Van Horn 1984a:Figure 6) (see Figure 47). He also places it 300 feet east of Lincoln Blvd and 50 feet north of the base of the escarpment. Van Horn's map also depicts the storm drain on the escarpment at the southwestern edge of CA-LAn-62b and southeast of CA-LAn-62b. Clearly, this new deposit is located west of the site recorded by Rozaire and Belous.

Van Horn and his colleagues returned to CA-LAn-62 in early 1987 and carried out more tests in the new deposit. At this time they excavated a series of "wedges" in the site area to define its vertical

Table 3. SUMMARY OF TEST EXCAVATIONS AT LAn-62

DATE	AUTHORS/ EXCAVATORS	LOCUS	UNIT	LENGTH	DEPTH	STRATA	MIDDEN
1983	Van Horn, Dillon & Murray	LAn-62A	Tr-2 - Tr-7				+
		LAn-62B	TP 1	1 x 1 m	2-3 m	fill	1.2 m
			Tr-1				
		Redeposit. Midden	Tr-8 & Tr-9				+
1987	Freeman, White, & Van Horn	LAn-62B	BHT A-F	2-3 m			?
			W-G	20 m	3.2 m	A,C	2+ m
			W-H		5 m	B,water	0
			W-I		5.6 m	A,B,C water @4.3m	0
			W-J		3.2 m	A,B,C	1.8 m
			W-K		2.4 m	A,C	0.5 m
			W-L		2.4 m?	A,C?	0.35 m
			W-M		2+ m	water	0
1988	Archaeological Associates	LAn-62B	BHT 1	11 m	4.6-4.9m		0
			BHT 2a	16.7 m	4.9 m		+
			BHT 2b	5.5 m	4.3 m	lagoon	0
			BHT 3	61.5 m	3.0-4.9m	C	+
			BHT 4	4.6 m	6.7 m		0
			BHT 5	26.8 m	3.0-3.7m		+
			BHT 6		5.5 m	clay	0
			BHT 7a		6.1 m	mud	+
			BHT 7b		6.1 m		0.4 m
			BHT 8		3.0-3.7m		+
			BHT 9		2.4-2.7m		+
			BHT 10		2.7 m		+
			BHT 11		4.6 m		0
			BHT 12		4.6 m	sand	0

Key:

Length = length of excavation unit
Depth = Maximum depth of excavation unit
Midden = numbers refer to thickness of midden;
+ indicates midden of unknown thickness
0 indicates midden absent

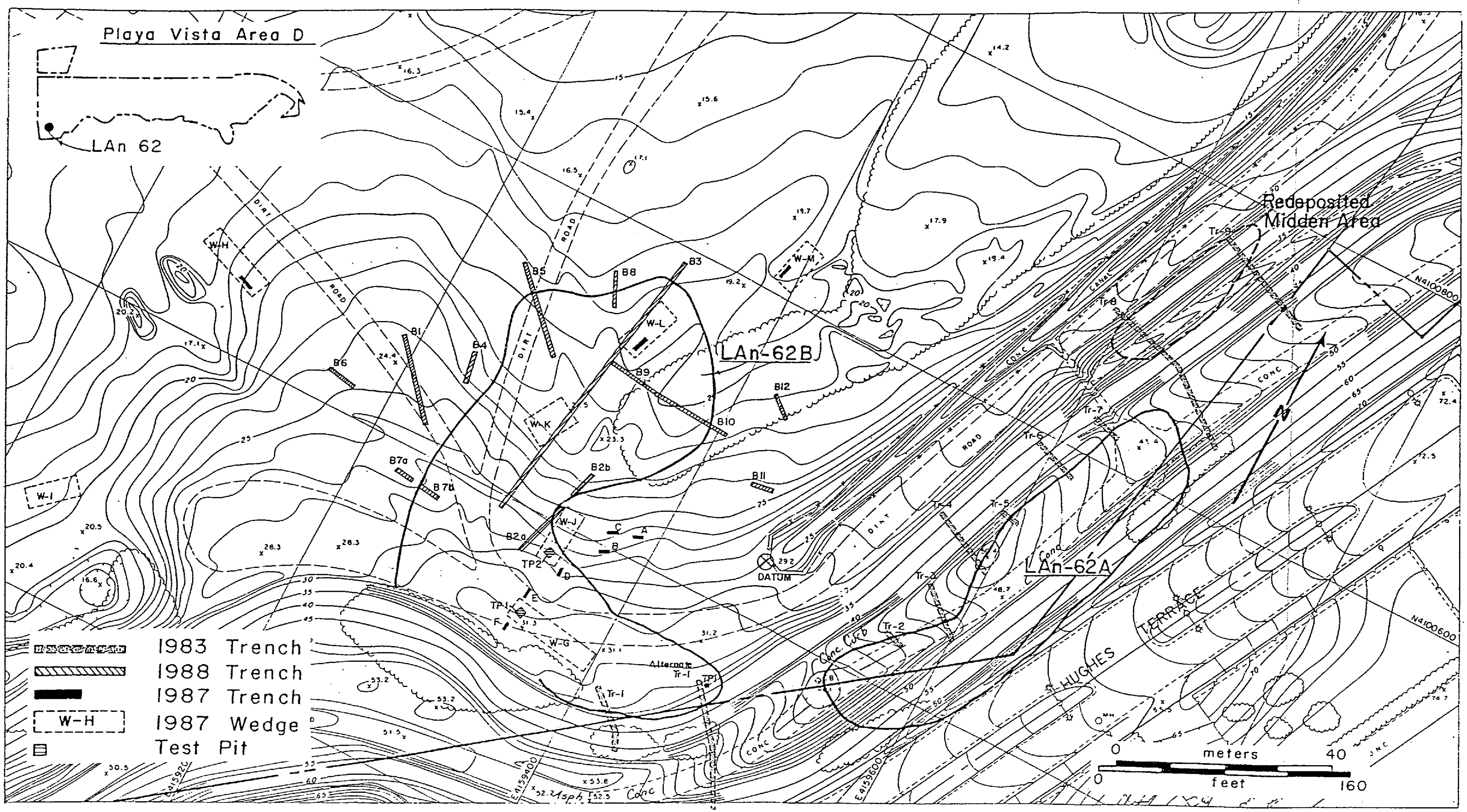


Figure 47. Previous archaeological excavations and proposed site boundaries at CA-LAn-62.

and horizontal boundaries (Freeman et al. 1987). They were surprised to find that the overburden covering the site had increased as a result of the construction of the Hughes Aircraft Headquarters building. Freeman et al. (1987:9) described a Type C fill stratum that was deposited over most of the site when the construction access ramp to the Hughes building was leveled after 1983. Below this they designated a Type B fill stratum consisting of a light brown sandy matrix containing historic material first described by Luhrs (1948). They designated the lowest fill stratum as A, which they described as a dark gray-brown sandy matrix consisting of natural alluvium intermixed with material deposited during construction of the sewer line in the 1920s. These three strata covered a 10 to 40 cm thick interface or mixed fill and midden deposit which separates the Type A fill from the intact cultural deposit.

Cultural deposits were found in four of these wedges covered by between 2.4 and 3.2 m of overburden and extending to an additional 0.35 to over 2 m of depth (Table 3). The thickest midden deposits and the deepest overburden occurred in the two wedges at the southern edge of the site closest to the escarpment. The overburden became shallower and the midden thinner as one moved to the north. No midden was found in the remaining wedges, suggesting to Freeman et al. that these wedges were located beyond the site boundaries. They placed a small test unit into the base of the two wedges with the deepest deposits to obtain controlled samples of the midden.

The test pits indicated that the densities of artifacts and subsistence remains varied throughout the midden. Test Pit 1, placed in Wedge G, was excavated to a depth of 130 cm before digging was terminated due to the cramped working conditions. A clam-shell hand tool was then used to find the bottom of the cultural deposit, which was projected to be about 2 m below the base of the historic fill. Artifacts recovered from Test Pit 1 included 59 chipped stone flakes, one flaked tool, 87 shell fragments, and 66 bone fragments. Test Pit 2 was placed in Wedge J. Excavations were terminated at 140 cm below the base of the fill, with a clam-shell hole indicating that the midden continued for at least another 60 cm. Recovered from Test Pit 2 were 364 flakes of chalcedony, metavolcanic, monterey chert, quartzite, and obsidian; 4 cores; 4 flake tools; 2 Cottonwood Triangular projectile points; 1 steatite fragment; 4 worked bones including a complete bone awl; 4 *Olivella biplicata* beads, including 2 lipped, 1 disc, and 1 cupped; 1 fish vertebra bead; 25 pieces of fire-affected rock; and 1174 shell fragments, consisting mostly of *Chione* sp., *Protothaca* sp., *Ostrea* sp., *Pecten* sp., and *Haliotis* sp. No animal bone was reported from Test Pit 2; more than likely an oversight in reporting than a reflection of the deposit.

Freeman et al. (1987) noted that although no vertical patterns could be discerned in the artifact distribution, there was clear evidence of change in the shell species. Near the bottom of the test unit, oyster (*Ostrea* sp.) and scallop (*Pecten* sp.) were the dominant species, with a marked shift toward littleneck (*Protothaca staminea*) latter in the occupation. Van Horn (1987) attributes this shift, which was also observed at sites on the Del Rey Hills, to the siltation of the Ballona Lagoon during the Late Prehistoric Period. The presence of oyster and scallop dominated strata underlying those characterized by littleneck indicates that at least two temporal components are represented at CA-LAn-62.

Van Horn and his associates returned again to CA-LAn-62 in November of 1988 to further define the boundaries of the site. At this time they excavated 12 backhoe trenches of variable length in the site area (Archaeological Associates 1988:23) (Table 3). They were again surprised by the depth of overburden which had apparently increased by an additional three to four feet in the short span of time since their last test excavations. The 1988 excavations exposed the midden deposits in nine of the trenches, but extended into the midden in only one trench. So the vertical extent of the midden deposits were not defined at this time. Van Horn and his associates, however, were able to better define the site boundaries and the extent of overburden. By 1988 the site was covered by between 2.4 and 6.1 m of overburden (Table 3) and was preserved in a 120 by 240 m area (Figure 47). The overburden was deepest at the southwestern edge of the site (Trench 7) and shallowest at the northeastern edge.

The situation is further complicated by the presence of other archaeological deposits in the immediate vicinity. Site CA-LAn-1018 was first identified by Pence (1979) on a small bench directly above CA-LAn-62 but below the sites, CA-LAn-61 and Ca-LAn-63, located on the bluff top. Identified as "Site A," this site consisted of an extremely dense shell midden and a low density lithic scatter. The midden appeared to be largely intact except for the middle portion which had been bulldozed away. The southern portion was somewhat affected by small erosion channels; the deepest deposits in the northern portion were in the best shape except where a small road had cut through. Pence concluded that this was a significant site that merited preservation.

A scant three years later, however, the site was apparently destroyed. Van Horn (1983:2) visited the site in May 1982 and found that the terrain had by severely disrupted by grading and filling operations. Van Horn conducted an extensive testing program in the area but found only sterile sand. He (1982) concluded that "... grading and discing of CA-LAn-1018 over the years had resulted in complete destruction of the site." Dillon (1982a) reviewed and confirmed these conclusions. Today the site is the location of the Hughes helicopter landing area. Possible traces of the site were again observed in the survey by Peak and Associates (1989). The previously recorded portion of the site originally observed by Pence was obscured by vegetation, but shell fragments were observed on the southeast side of Lincoln Blvd. This evidence suggested to the surveyor that the site may extend across Lincoln Blvd. Alternatively, the shell may represent redeposited remains since they were not observed earlier by Pence or others who examined the site (e.g., Dillon or Van Horn).

A second site was discovered while Van Horn and his associates were monitoring the construction of the nearby parking lot for the Hughes Headquarters building (J.R. Murray, personal communication 1990). This site was apparently located on a second bench midway up the bluff face between CA-LAn-62 and CA-LAn-61. The site was not recorded or tested, but the deposits were sealed by the parking lot pavement.

Although conducted for various short-term interests, Van Horn's work in and around CA-LAn-62 has resulted in a substantial amount of data. Based on this work, Van Horn recommended that the site was significant and should be subject to data recovery prior to construction (Archaeological Associates 1987). Van Horn suggested that excavation of 10 percent of the deposit would be sufficient for data recovery, an amount he estimated at 1000 cubic meters (m^3). Material remains from CA-LAn-62 are currently housed at Archaeological Associates in Sun City, California.

CA-LAn-193

As suggested earlier, there appears to be considerable confusion between CA-LAn-193 and CA-LAn-62. CA-LAn-193 was recorded as being located at the southeastern end of the present Hughes Helicopter plant (Pence 1979; Van Horn 1984a). The site files at the Archaeological Information Center at UCLA and Pence (1979), however, confuse CA-LAn-193 with the Mar Vista site reported by Peck in 1947. The locational and descriptive information about the Mar Vista site make it clear that the site excavated by Peck is CA-LAn-62. According to Peck (1947:1), the Mar Vista site was found in 1942 during construction of an aircraft landing field at the base of the Del Rey Hills and was located a quarter mile northeast of the Roosevelt Highway (Lincoln Blvd) and one and a half miles east of the beach front at Playa del Rey (see Figure 46). CA-LAn-193's location at the helicopter plant is 3 miles east of the beach.

According to both Pence (1979) and Van Horn (1984a:33-34), CA-LAn-193 was recorded as a village site in 1952 by Hal Eberhart. Van Horn, however, does not believe that Eberhart saw the site at that time since it was already covered by asphalt pavement by the early 1950s. R. L. Beals may have been the last to see the site in 1939 when he carried out partial excavations. No report of his findings is available, although artifacts from the excavations are at the UCLA museum. According to Van Horn, the UCLA records also include a note by R.C. Wilson who discussed the site with a local hunter who claimed to have found human remains at the site. Pence (1979) also claims that the site was recorded earlier by R.C. Nelson (no date) at a time when there were no roads, but the railroad was present. Nelson's records are also based on a discussion with a local hunter and the site description is similar to Wilson's. Wilson and Nelson may in fact be the same individuals.

Most reports agree that CA-LAn-193 is a site of considerable significance, but no professional verification is available. In fact, Van Horn (1984a:34) is doubtful whether any professional archaeologist has actually seen the site.

CA-LAn-211

There also appears to be considerable confusion regarding the precise location of this site and two different loci have been identified in the literature as CA-LAn-211. The site records at the Archaeological Information Center at UCLA place the site at the base of the Ballona Escarpment about midway between CA-LAn-62 and CA-LAn-193. According to Pence (1979) this site location (CA-LAn-211a in Figure 46) was recorded by Eberhart in 1953 as a small site. Rozaire and Belous make no mention of the site which is also known as LA-29 and Deane's Site #1. Eberhart recorded little about the site other than it would be impossible to excavate. Deane described the site as "...a very hard packed black soil, many broken pieces of mortars and pestles" (Thiel 1953 in Van Horn 1984a:34). The Thiel report includes photographs of arrow points, shaft straightners, an abalone shell bowl with asphaltum-plugged siphons, and a deer bone whistle which are believed to have been collected by Deane from the site.

Pence visited this site area in 1979 and noted that it had been partially destroyed through the construction of an underground fuel storage complex. An asphalt parking lot had been built over another portion of the site, leaving only a small area of midden exposed between the parking lot and fuel dump. The exposed area contained shell and lithic detritus.

Van Horn (1984a:34) also believes that CA-LAn-211 may have had an historic component based upon W. W. Robinson's 1939 statement that Indians working on the Rancho La Ballona had lived at the base of the Bluff below the present location of Loyola Marymount University. CA-LAn-211 is the only late site known in this vicinity. Van Horn and Murray (Van Horn 1984a:40) found no evidence of historic Indian occupation when they surveyed the site in 1984. J.R. Murray visited the site in 1983 and found only a narrow strip of midden along the base of the escarpment. It was later visited by Van Horn and Charles Rozaire who observed some paving which might cover portions of intact deposit.

Van Horn (1984a:39) apparently described another midden deposit (Ca-LAn-211b) located midway between this locus and CA-LAn-62 (see Figure 4). No mention is made of the fuel complex or parking lot at this second locus. Here they found a narrow, one-meter deep strip of midden stretching about 70 m along the base of the bluff. Van Horn believes that this midden may have once extended further out into the playa but has since been cut away. In January of 1985 (sic) Van Horn (1984a:35) excavated 15 backhoe trenches in the playa across the dirt road from the site for the construction of a retention basin. An additional trench was located beyond the northern edge of the exposed midden. Each of these tests yielded indications of fill in excess of two meters, which suggested to Van Horn that the site did not extend beyond the foot of the bluff. The retention basin was subsequently constructed north of this site locus confirming that it is a distinct deposit from that described by Eberhart and Pence. The retention basin does not extend as far east as the original locus of CA-LAn-211.

CA-LAn-211b was apparently recognized at an earlier date. In 1948 D. Luhrs recorded site LA:3 (L.A. County Museum of Natural History) which consisted of a deposit covering an estimated area of 400 by 150 feet. Luhrs commented that there was:

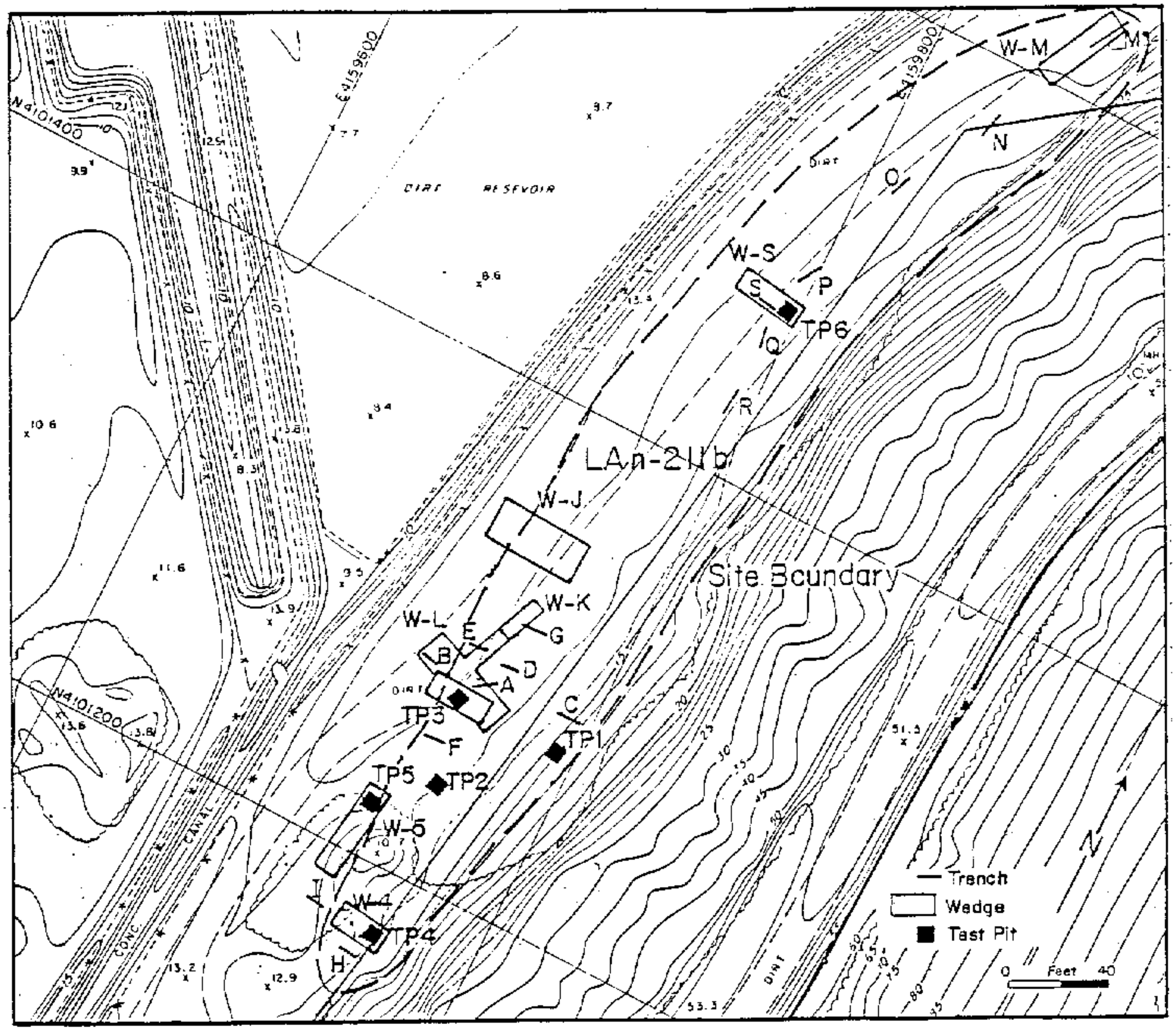


Figure 48. Previous Archaeological Investigations at CA-LAn-211b
(adapted from Freeman et al. 1987).

...a considerable quantity of abalone shells, clam, oyster. Fragments of stone bowls, pestles, hammering stones. Human toe bones, evidence unmistakable potting 2'-5' deep (thru overburden of varying depths) and approximately 25' long. Piles of abalone shell and broken stones on pits and dump. Black soil 6'± to 10' deep on hillslope. The Centinela Creek flows 20' to the north. Major portion of the site is on what appears to be estuary or stream terrace (quoted in Van Horn 1984a:29).

Eberhart was probably unaware of this second locus as the site record was kept at the Los Angeles County Museum. Rozaire and Belous also did not mention either locus.

Van Horn and his associates carried out extensive tests at CA-LAn-211b in 1987 (Freeman et al. 1987:30). A total of 16 backhoe trenches and five wedges were excavated within the narrow strip of the midden at the base of the bluff (Figure 48). The results of these tests revealed that the exposed midden they observed in 1984 was in fact a recent secondary deposition of mixed cultural and natural material. However, they also found an intact deposit buried at considerable depth below this secondary deposit (about 1.2 m below the fill, or about 3 m below the surface) .

They found three distinct types of fill over this original deposit. The oldest fill stratum, A, was generated during construction of the sewer line on the slope of the escarpment above the site. Excess backdirt from the sewer line excavation was pushed over the slope where it built up a shoulder at the base of the bluff (Freeman et al. 1987:31-32). This fill stratum consists of a distinctive beige sand broken with streaks of darker humus. The second fill or B stratum consist of a mixture of soils which include a well-developed midden containing marine shell and artifacts, possibly derived from the nearby CA-LAn-62a. The third fill or C stratum appears to be a very recent deposit of construction material and vegetation.

Most trenches were excavated to a depth of 2.4 m. An intact cultural deposit was found in several of these excavation units at a depth between 1.5 and 2+ m below the fill strata. They then excavated six 1 x 1 m test units into these cultural deposits. Recovered from the test units were lithic debitage, cores, flake tools, projectile points, animal bone, shell fragments, and shell beads. The great depth of the cultural deposits places doubt on Van Horn's conclusion about the northern boundary of the site, based on the 1985 test excavations for the retention basin. Intact cultural deposits may be present at a depth below 2 m in the area between the base of the hill and the retention basin.

On the basis of these extensive tests, Freeman et al. (1987:47-48) conclude that CA-LAn-211b may be a multicomponent site that occurs in two distinct deposits. They defined a northern deposit covering an area of about 350 sq. yds. and a southern deposit covering over 1000 sq. yds. The test units indicate that these deposits range in thickness from 0.40 - 1.4 m. The results of two of the six units located in the southern deposit indicate that the site was first occupied between 500 B.C. and 1000 A.D. and was also occupied after A.D. 1000. The former date is suggested by the presence of temporally diagnostic artifacts, such as a denticulated potatoe flake, abundance of abalone shell, and absence of Olivella shell beads. The later occupation is indicated by a Cottonwood triangular projectile point. This later occupation is significant as only one other archaeological site, the Hughes site (CA-LAn-59) located on top of the bluffs, was clearly occupied at this time in the Ballona area.

CA-LAn-1698

This site was recorded in September, 1989 by Neal Neuenschwander of Peak & Associates (1989), although it was not formally listed on the UCLA site files until after we conducted the 1990 survey of the Playa Vista Project Area. It is recorded a moderate scatter of shell within a dark soil (midden) matrix, covering an area of about 50 m x 64 m. The purported midden was observed in a cutbank exposure and was estimated to be 1.5 m in depth. The site is located on a small rise adjacent to a small channelized drainage on the west side of Lincoln Boulevard and south of the intersection of Fiji Boulevard. The modern channel of Ballona Creek is 420 m to the southeast. The vegetation community is a coastal salt marsh.

In our 1990 survey the area encompassing CA-LAn-1698 was noted as a redeposited shell scatter. The area of redeposited fill is actually much larger than that recorded as CA-LAn-1698, extending from Lincoln Boulevard west for 200 m and south of a drainage ditch about 50 m. The entire area has been raised and now lies about 3 m above the surrounding terrain. The fill was clearly placed in the area as evidenced by evenly spaced furrows made by heavy machines. All types of economic and non-economic species of shell are found in the fill intermixed with modern material. No prehistoric artifacts or organically enriched soil was observed.

Robert Stutsman, property manager of Playa Vista for MTP - PV and previously for the Summa Corporation, stated that the deposit identified as CA-LAn-1698 was created in the last decade as part of dredging the drainage ditch that adjoins the area to the north. This statement is consistent with evidence observed in the field. It is our opinion that CA-LAn-1698 is not a prehistoric deposit. We suggest that the UCLA information center remove the site designation. Further, we recommend that no future work is needed at this site.

CHAPTER 6
SURVEY RESULTS

INTRODUCTION

The results of the cultural resources survey of the Playa Vista project area are described in this chapter. The discussion is arranged by survey area, beginning with a brief overview of the existing conditions followed by a description of each cultural resource identified. All isolated artifacts recovered during the survey are discussed at the end of the chapter.

In total, 589 acres (59%) of the 1004-acre project area were either obscured by redeposited fill or covered by an abandoned runway, improved roads, parking lots, buildings, or dense vegetation. The remaining 416 acres (41%) consist of areas where the present ground surface appeared relatively undisturbed at the time of the survey. The various episodes of construction and fill that have affected the project area greatly hampered our ability to identify cultural resources that may have once been exposed.

Seventeen discrete loci of previously unrecorded cultural material and 5 isolated finds were identified (Figure 49). Figure 50 shows the cultural loci in relation to areas that were either obscured or visibly disturbed at the time the survey was conducted. Table 4 summarizes some of the data compiled for each locus during the Playa Vista survey. The loci are comprised of four shell midden deposits (SR 1, 14, 15, 16), six shell scatters (SR 8, 9, 10, 11, 12, and 13) that may represent cultural deposits, three historic sites (SR 2, 3, and 17), and four concentrations of historic cultural material that may be redeposited (SR 4, 5, 6, and 7). Five of the loci (SR 2, 3, 8, 9, and 10) were found in Area B; two (SR 7 and 11) were observed in Area C; ten (SR 1, 4, 5, 6, 12, 13, 14, 15, 16, and 17) were identified in Area D; and none were found in Area A.

AREA A

Area A, located in the northwest portion of the project area, is bounded by Lincoln Boulevard to the east, Fiji Way to the north and west, and the Ballona Creek flood control channel to the south. Elevation generally ranges between 10 and 15 ft. (3.0-4.6 m) above mean sea level (MSL). Of the estimated 139 total acres within Area A, about 82 acres of the existing ground surface along the periphery were obscured by redeposited fill, whereas the surface of the remaining 57 acres appeared relatively undisturbed (Figure 51). The perimeter areas have been covered by deposits representing multiple dumping episodes, primarily sandy spoils dredged during the 1930s when Ballona Creek was channelized or in the 1960s when Marina del Rey was constructed. The dredge spoils in the northwest corner of Area A have erroneously been identified as a prehistoric site, and designated CA-LAn-1698 (see Chapter 5).

In the southwest portion of Area A is a series of gas wells on elevated platforms connected by linear man-made berms. These gas wells, probably no older than 20 or 30 years old, are still in use. The only known disturbance in the central portion of Area A is the result of plowing activity associated with previous agricultural use. The southwestern half of Area A was part of the Ballona lagoon tidal flats in the late 1800's and early 1900's. Much of the central part of Area A is barren, apparently the result of salic soil conditions that have inhibited the growth of all but halophytic plants. The only vegetation consists of various grasses and shrubs (see Figure 51).

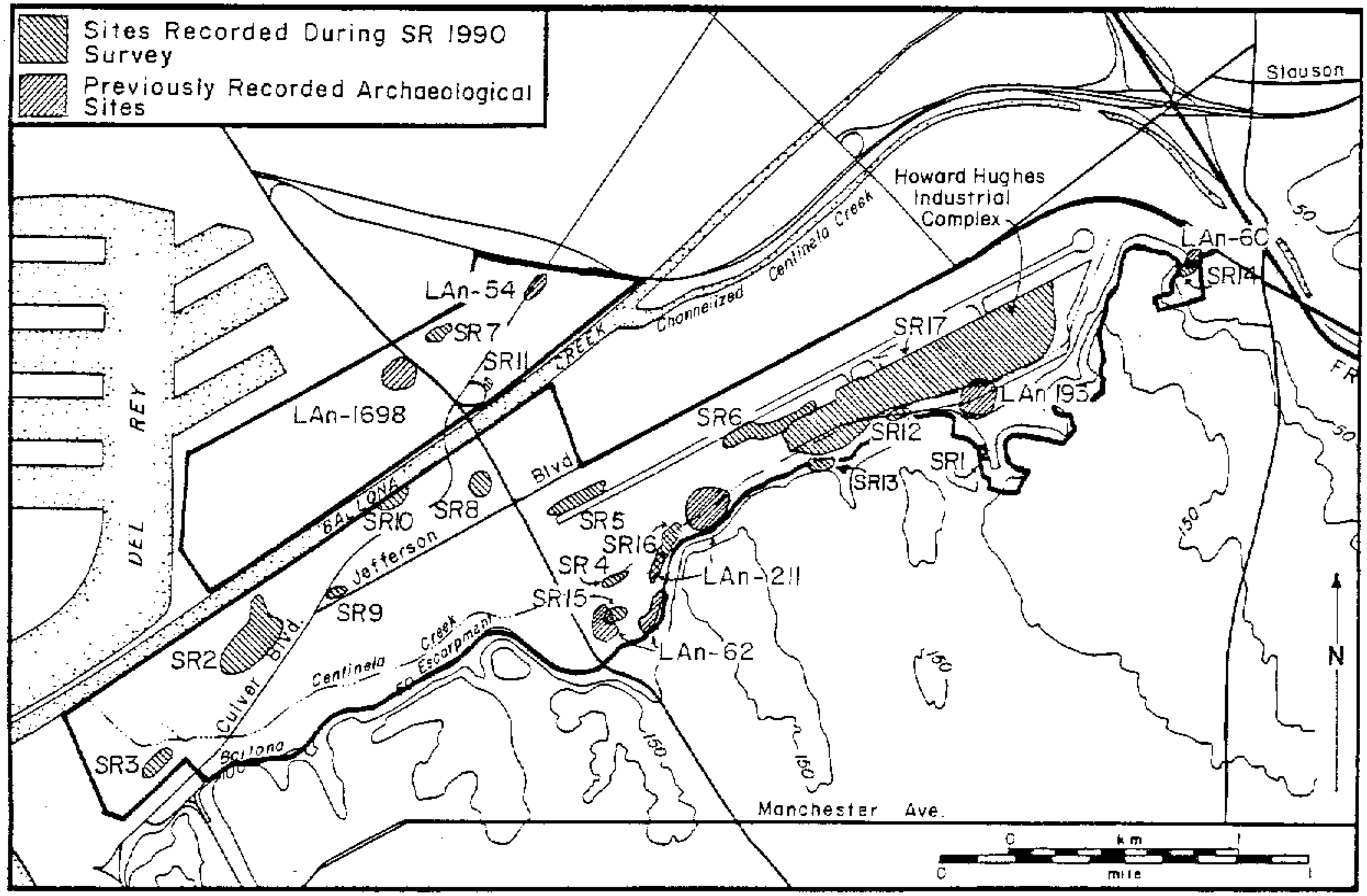


Figure 49. Map Showing the Boundary of the Playa Vista Project Area with Previously Unrecorded Cultural Loci (SR #) and Isolated Finds and Recorded Cultural Sites (LAn #) Identified During the Cultural Resources Survey, August-September 1990.

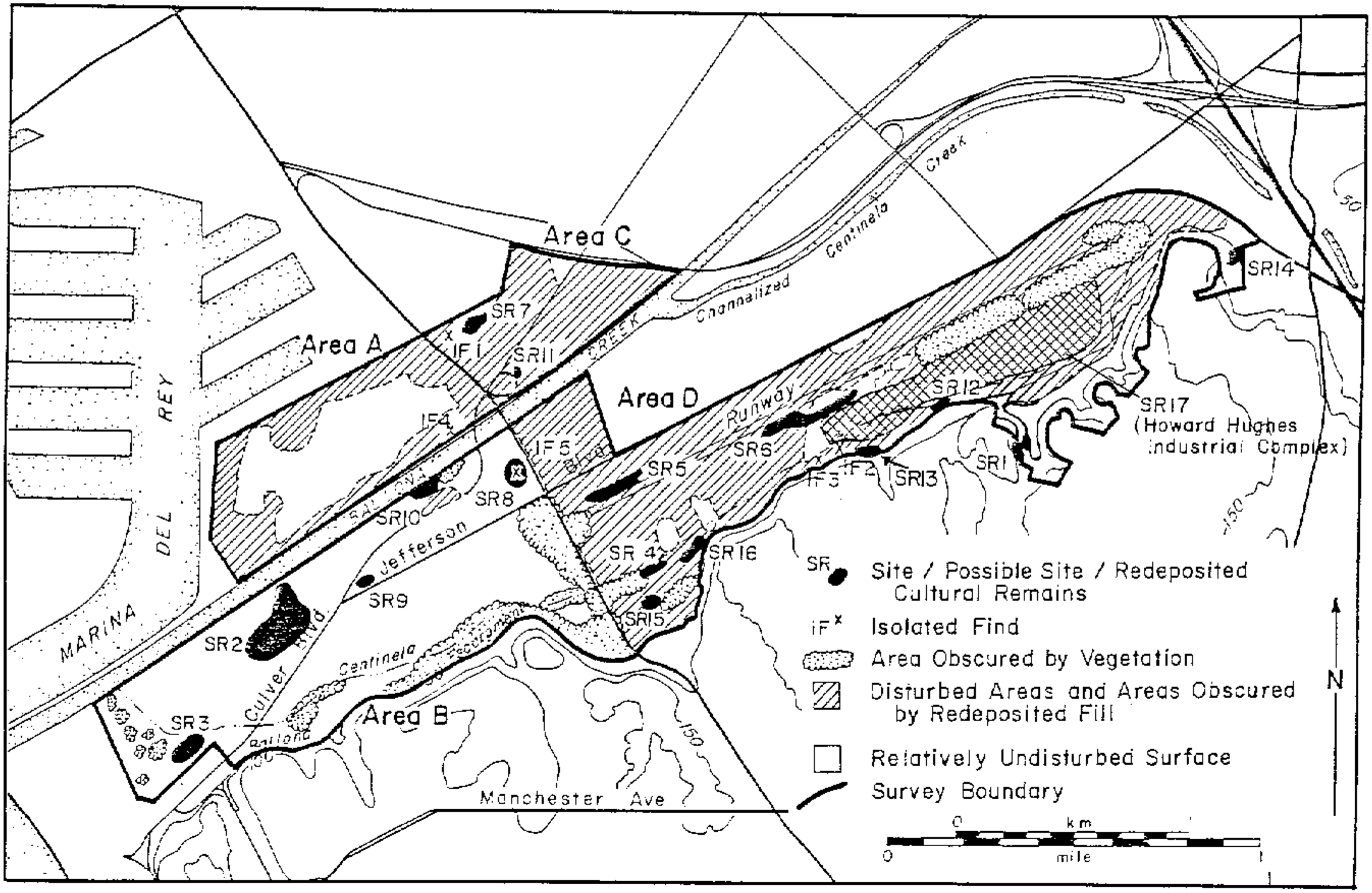


Figure 50. Map Showing the Locations of Previously Unrecorded Cultural Loci and Isolated Finds Identified during the August-September 1990 Cultural Resources Survey in Relation to Existing Surface Conditions.

Table 4. Summary of Previously Unrecorded Cultural Loci Assigned A Temporary Designation.

Temp No.	Description	Survey Area	Site Size (in meters)	Depth of Deposits	Artifacts	Shell
SR 1	shell midden	SE part of Area D	165 x 50	undetermined	decortification flakes split cobbles retouched flakes fire-cracked rock	*Chione californiensis* *Chione undatella* *Chione fluctifraga* *Pecten* sp. *Saxadomus nuttalli* *Cerithidia california* *Protothaca staminea* *Crepidula onyx* *Tagelus californianus* *Polinicies lewisii* *Ostrea lurida*
SR 2	oil well complex	NW part of Area B	150 x 150	undetermined	undetermined	none
SR 3	horse stables with riding ring	SW part of Area B	190 x 50	undetermined	undetermined	none
SR 4	historic trash deposit	SW part of Area D	45 x 12	undetermined	clear, amethyst, green, and brown glass misc. ceramic, metal, wood, and plastic items	*Tivela stultorum*
SR 5	historic trash deposit	west part of Area D	210 x 30	ca. 1 m	earthenware porcelain ironstone clear, green, and brown glass misc. iron, aluminum, wood, rubber, and plastic items	none
SR 6	historic trash deposit	central part of Area D	480 x 30	undetermined	earthenware ironstone porcelain clear, green, and brown glass	none

Table 4. Summary of Previously Unrecorded Cultural Loci Assigned A Temporary Designation (continued).

Temp No.	Description	Survey Area	Site Size (in meters)	Depth of Deposits	Artifacts	Shell
SR 7	historic trash deposit	west part of Area C	100 x 25	undetermined	earthenware clear and brown glass brass lipstick case wood fragments rubber tire fragment plastic radio front	none
SR 8	shell scatter	north part of Area B	115 x 90	undetermined	undetermined	*Chione californiensis* *Cerithidia californica* *Tagelus californianus* *Pecten* sp.
SR 9	shell scatter	central part of Area B	90 x 55	undetermined	undetermined	*Cerithidia californica* *Ostrea lurida* *Chione californiensis*
SR 10	shell scatter	north part of Area B	150 x 60	undetermined	undetermined	*Ostrea lurida* *Chione californiensis* *Chione undatella*
SR 11	shell scatter	south part of Area C	30 x 12	undetermined	undetermined	*Ostrea lurida* *Chione californiensis* *Cerithidia californica*
SR 12	shell scatter	south part of Area D	90 x 3?	undetermined	debitage stone bowl fragment	*Chione californiensis* *Chione undatella* *Protothaca staminea* *Ostrea lurida*
SR 13	shell scatter	SE part of Area D	75 x 3 ?	undetermined	debitage	*Chione californiensis* misc. unidentifiable fragments
SR 14	shell midden	east part of Area D	55 x 30	75 cm +	debitage cores choppers scrapers misc. animal bone	*Chione californiensis* *Chione undatella* *Chione fluctifraga* *Pecten* sp. *Ostrea lurida* *Tagelus californianus*

Table 4. Summary of Previously Unrecorded Cultural Loci Assigned A Temporary Designation (continued).

Temp No.	Description	Survey Area	Site Size (in meters)	Depth of Deposits	Artifacts	Shell
SR 15	shell midden	SW part of Area D	45 x 30	undetermined	debitage cores misc. animal bone	*Trachycardium quadragenarium* *Haliotis cracherodii* *Chione californiensis* *Chione undatella* *Chione fluctafraga* *Pecten* sp. *Ostrea lurida* *Protothaca staminea*
SR 16	shell midden	SW part of Area D	240 x 30	undetermined	debitage cores misc. burned animal bone	*Chione californiensis* *Chione undatella* *Protothaca staminea*
SR 17	Howard Hughes Industrial Complex	SE part of Area D	1250 x 250	undetermined	undetermined	

No cultural loci were identified on the surface of Area A. It is possible that cultural deposits have been buried by alluvium or modern fill. Marine shells, including species of economic importance to prehistoric populations (e.g., *Pecten* sp., *Chione* sp., and *Tagelus californianus*), were found in the dredged spoils, but these remains were clearly redeposited. One specie (*Cerithidia californica*) that was not important economically was also observed. A single historic isolated find (IF 5), a steel bullet-like projectile found in the southwest part of Area A, was the only artifact collected.

AREA B

Area B, situated in the southwest portion of the project area, encompasses a large degraded tidal marsh historically important to the ecology of the region. This 337-acre survey area is bounded by Lincoln Boulevard to the east, Ballona Creek channel to the north, Playa del Rey to the west, and the Ballona Escarpment to the south. Culver Boulevard and Jefferson Boulevard intersect Area B. The elevation of the vast majority of Area B is less than 5 ft. (1.5 m) above MSL, while the extreme western end is between 5 and 7 ft. (1.5-2.1 m) above MSL, and the southern section along the colluvial slope of the bluff ranges between 5 and 50 ft. (1.5-15.2 m) above MSL. Area B is the least disturbed of the four survey areas. The ground surface was visible with the exception of roads intersecting Area B, a few drainage ditches extending between the tidal flats and the Pacific Ocean, a small area of redeposited fill in the north central section of Area B, and densely vegetated zones along the eastern and southern perimeter. Obscured and/or disturbed areas comprise about 48 acres, and deposits in the remaining 289 acres consist of relatively undisturbed areas.

Figure 51. General Overview of Area A of the Playa Vista Project Site.

Of the five cultural loci identified in Area B, one is an historic site (SR 2), located in the western section, one is a multi-component site (SR 3) situated at the west end of the area, and three (SR 8, 9, and 10) are light shell scatters clustered in the northern portion. Each of the latter contains an abundance of shell that was not of economic importance. Further, no artifacts were found in association with any of the shell deposits. Although these shell scatters are not clearly attributable to prehistoric cultural activity, we cannot categorically rule out a cultural origin based solely on surface observations. In addition to these sites, an isolated find (IF 5), two shotgun cartridges, was also identified and collected from the northeast section of Area B within the boundary of SR 8.

SR 2

Environmental Setting. SR 2 is situated in the northwest part of Area B approximately 150 m west of the intersection of Jefferson Boulevard and Culver Boulevard The site is located in the tidal mud flats of the Ballona wetlands about 1.1 km northeast of the Pacific Ocean and immediately south of the existing Ballona Creek channel. Elevation ranges from about 2 to 7 ft. (0.6-2.1 m) above MSL. Vegetation in the adjacent areas is dominated by pickleweed. The site appears relatively intact except for dismantling activity associated with salvaging materials from various cultural features.

Site Description. SR 2 is a historic oil well complex encompassing a 400 x 200 m area (Figure 52). This oil well complex was part of the Venice oil field (also called the Playa del Rey field according to Poland et al 1959:190) (Figure 53). The Venice oil field was in operation from 1929 (Spalding 1930, vol. 1:510) until the early 1940s. The site consists of several earthen oil well pads connected by a series of linear earthen berms. Four oil derricks and a number of storage tanks are visible in an oblique aerial photograph dated February, 1933 (Figure 54). Because the site is located in the tidal flats, an area that was frequently inundated, it was necessary to build the earthenworks to keep the wells above water. Figure 54 clearly shows much of the site surrounded by water. About 15 other oil derricks are visible in Figure 53 to the southeast of SR 3 between Culver Boulevard and the Ballona Escarpment. Because these nearby derricks were located in a slightly higher landscape position, an area that was not subject to inundation as frequently as SR 2, it was probably not necessary to build earthenworks to operate them. No surface indications of these other derricks were found during the Playa Vista survey.

Thirteen cultural features were identified (see Figure 52). Feature 1, located near the center of SR 2, includes five concrete blocks placed at the end of small linear berms elevated about 40 cm above the tidal flats (Figure 55). The concrete blocks are spaced about 2.5 m apart. Each of the blocks have recessed semi-cylindrical openings that apparently served as supports for a 9-inch (ca. 23 cm) diameter pipe. The pipe was probably used in transporting brine water from the pumps to the Los Angeles Hyperion outfall sewer located to the southeast (see Poland et al 1959:190). Figure 56 shows a pipeline crossing the salt marsh towards the Pacific Ocean, and this pipeline was probably connected to the one associated with Feature 2. Paralleling the blocks immediately to the south is a concrete slab that is about 1 x 10 m in size. Along the center of long axis of the slab is a groove that may have held a 6-inch (ca. 15 cm) diameter pipe.

Feature 2, located immediately southeast of Feature 1, is a rectangular reservoir created by a 21 x 13 m berm (Figure 56). The berm has rounded corners and ranges between 30 and 50 cm in height above the tidal flats. This reservoir probably served as a temporary holding pond for brine water removed while drilling for oil in order to minimize contamination of the tidal marsh. Standing water is visible in Feature 2 in Figure 54.

Feature 3 is located at the eastern edge of SR 2 on the east side of one of the linear berms. This feature consists of a five concrete blocks that probably functioned as footings for the oil derricks. The blocks were dumped in this part of the site. Each of the blocks are pyramid-shaped; they are about 2.0 m long and 0.6 x 0.6 m wide at the top, tapering to about 1.0 x 1.0 m wide at the base. The lower 0.8 m section of each block was cast directly in the ground and the upper 1.2 m section was made in wooden forms as indicated by the

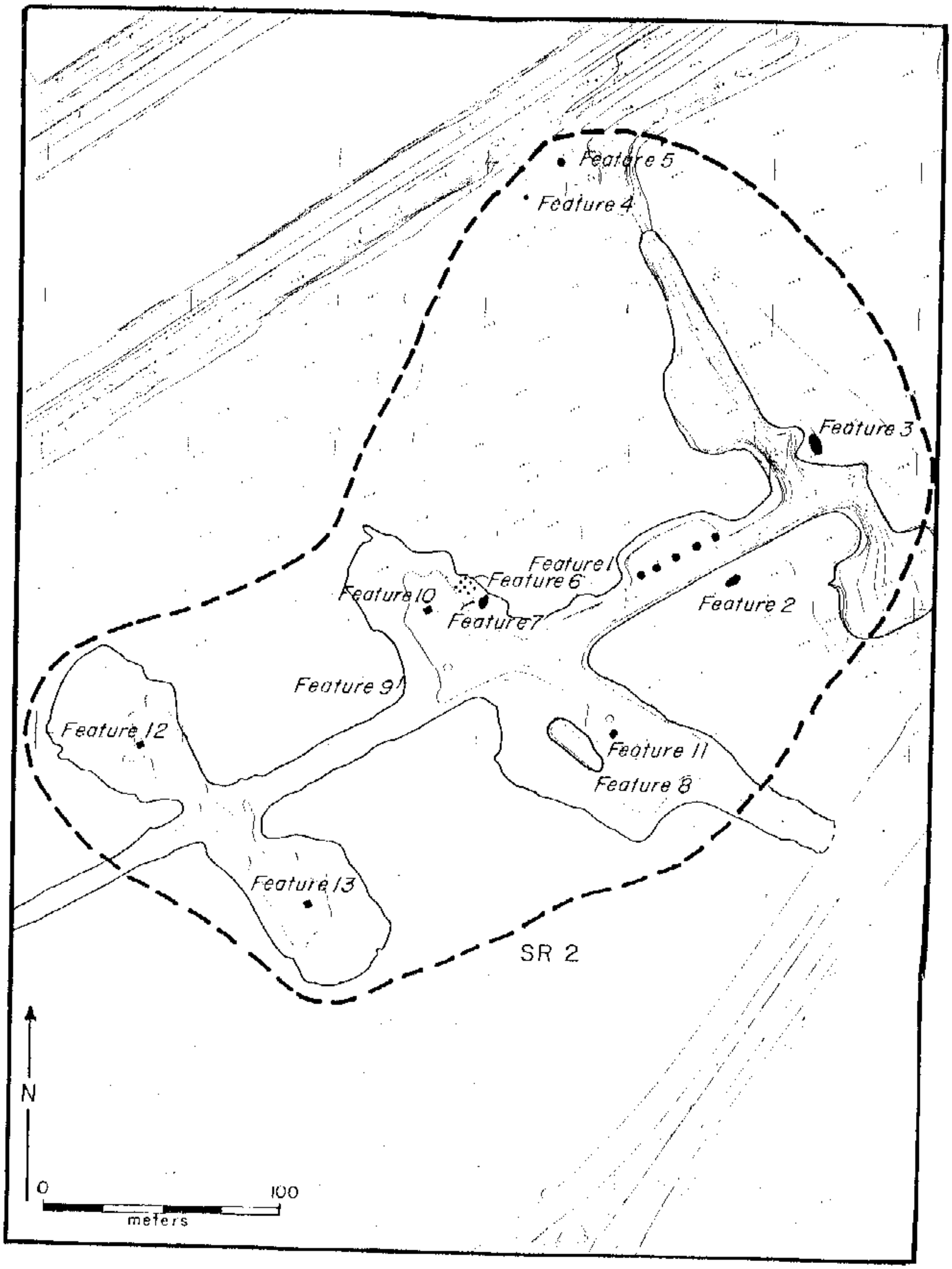


Figure 52. SR 2, Area B.

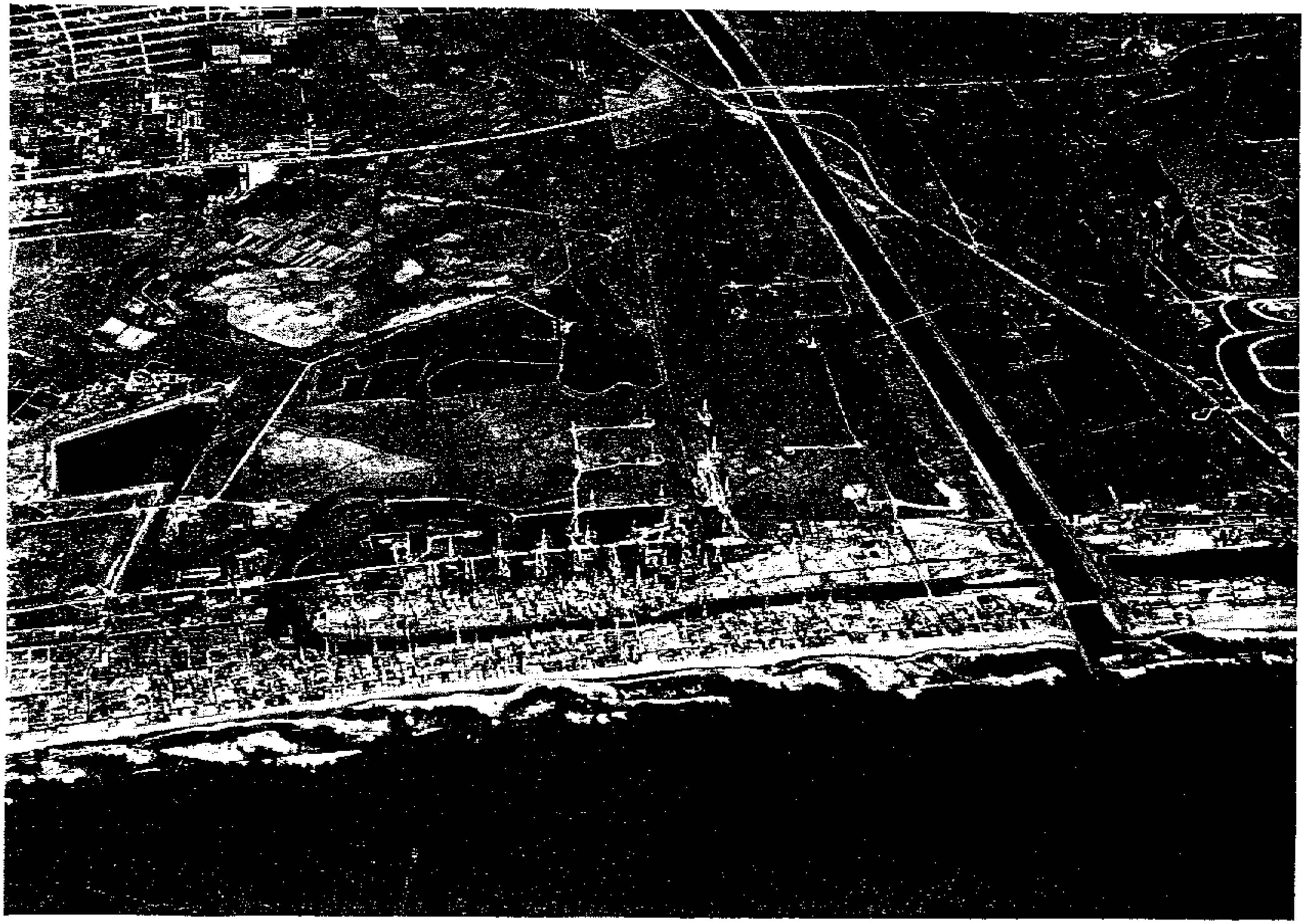


Figure 53. Oblique Aerial Photograph of Oil Derricks in the Venice Oil Field, February 6, 1938, Facing Southeast (Note: SR2 is located in the Right Central Portion of the Photograph between Ballona Creek and Culver Boulevard)(Photograph on file, UCLA Department of Geography, Air Photo Collections).

Figure 54. Oblique Aerial Photograph of SR2, February 19, 1933, Facing Northwest Toward the Pacific Ocean (Photograph on file, UCLA Department of Geography, Air Photo Collections).

Figure 55. Feature 1, a Series of Concrete Block Supports for a Pipeline at SR2, Facing North.

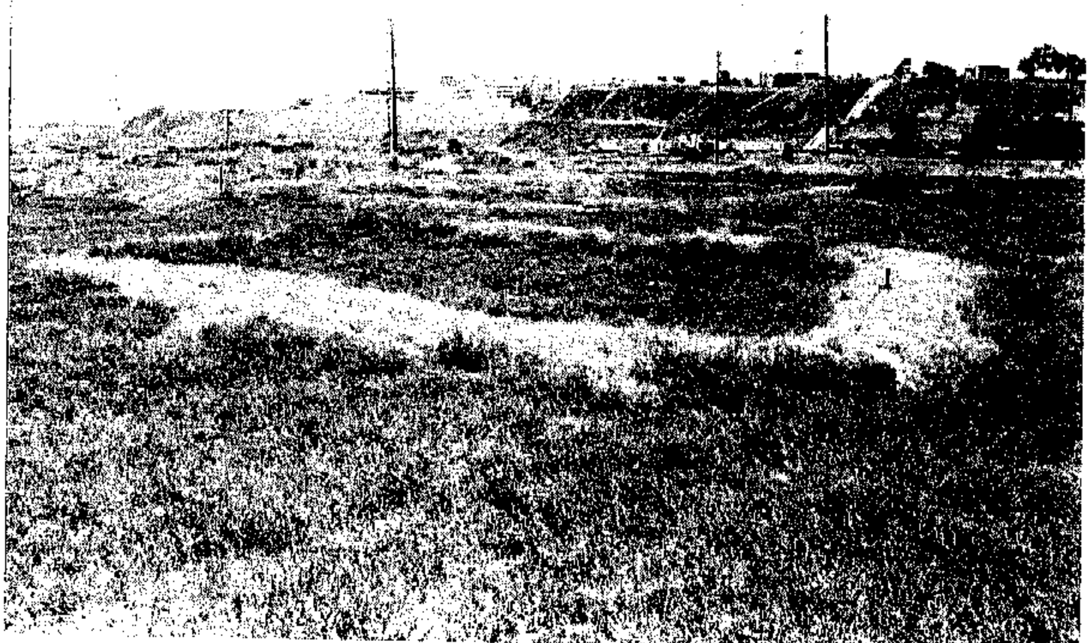


Figure 56. Feature 2, Berm around a Reservoir at SR2, Facing Southeast.

horizontal impressions on the concrete. The concrete was reinforced with 3/4 in. (ca. 1.9 cm) rebar. Two 1 in. (ca. 2.5 cm) diameter bolts protruding about 7.5 in. (ca. 19 cm) above the top of each block were probably for attaching the oil derricks.

Features 4 and 5 are large concrete ramps located in the north section of SR 2 near the end of one of the berms. One of the ramps is depicted in Figure 57. These ramps are just south of the existing Ballona Creek channel. Both ramps are approximately 2.5 x 2.0 m in plan and 1.2 m tall. The ramp slopes at about a 30 degree angle.

Feature 6 is the remnant of a pier in the north central portion of the site (Figure 58). The pier was built next to where one of the derricks was constructed. Nine posts (similar to telephone poles) projecting about 1.4 m above the ground were arranged in three lines of three posts. The posts were spaced at 2.5 m intervals. The wooden platform of the pier has been dismantled.

A heavily corroded automobile located in the tidal flat southeast of Feature 6 was designated as Feature 7. The automobile is so badly decomposed, the result of salt water and intensive oxidation, that the age and make cannot be determined. The engine, transmission, tires, window, and other miscellaneous parts have been stripped, but most of the vehicle remnants were observed.

Feature 8, located in the south central part of SR 2, is a 35 x 8 m berm situated on an earthen platform. The berm is subdivided into two sections, one of which is about 25 x 8 m and the other 10 x 8 m in size. A tar-coated wooden support structure is located within the smaller of the two berm sections. Miscellaneous trash such as automobile parts have been dumped within the bermed confinement. The function of Feature 8 is unknown.

Feature 9 is the linear berm complex extending throughout the site area (see Figure 52). The interconnected berms are raised between 1.0 and 1.3 m above the surrounding mud flats. The berms were used as roads to permit access to the oil derricks and other features during high tide.

Features 10 through 13 are the platforms that supported the four oil derricks. Most of the oil derricks in the general area including the ones at SR 2 were dismantled in the 1960s (Pepe Lopez, personal communication, 1990). The platforms are about 40 x 24 m in plan, each marked with a small berm along the edge. These small berms probably functioned as confinements to limit contamination of the salt marsh. The easternmost platform (Feature 11) also supported four oil storage tanks. A small pipeline once crossed the tidal flat from Feature 13 northeastward to the storage tanks associated with Feature 11 (see Figure 53). Although not clearly visible in Figure 53, the other oil wells were probably also connected by pipelines to these same storage tanks.

Interpretation. SR 2 is the only site documented during the Playa Vista survey that was associated with the oil industry. Although the site is only one of many oil-related sites in the Venice oil field, it is the only one with visible surface indications that was built in the tidal flats of the Ballona Lagoon. Because SR 2 was located in an area that was regularly inundated during high tide, the construction of this particular oil well complex required a network of earthenworks consisting of berms and platforms to facilitate the operation. Even though other oil wells were drilled in wetlands, it was uncommon for them to be built in the most active portions of the tidal flats. Consequently, SR 2 is interpreted as representing a specialized technology for drilling oil in the salt marsh environment of the Ballona Lagoon.

SR 3

Environmental Setting. SR 3 is located at the perimeter of the Ballona Lagoon in the southwest portion of Area B. The site is slightly over 100 m northwest of Culver Boulevard and about 350 m southeast of the Ballona Creek channel. The elevation of SR 3 varies from 2.4 to 3.7 ft. (0.7-1.1 m) above MSL. A small canal connecting the Pacific Ocean with the Ballona Lagoon marks the northern site boundary and a fenceline

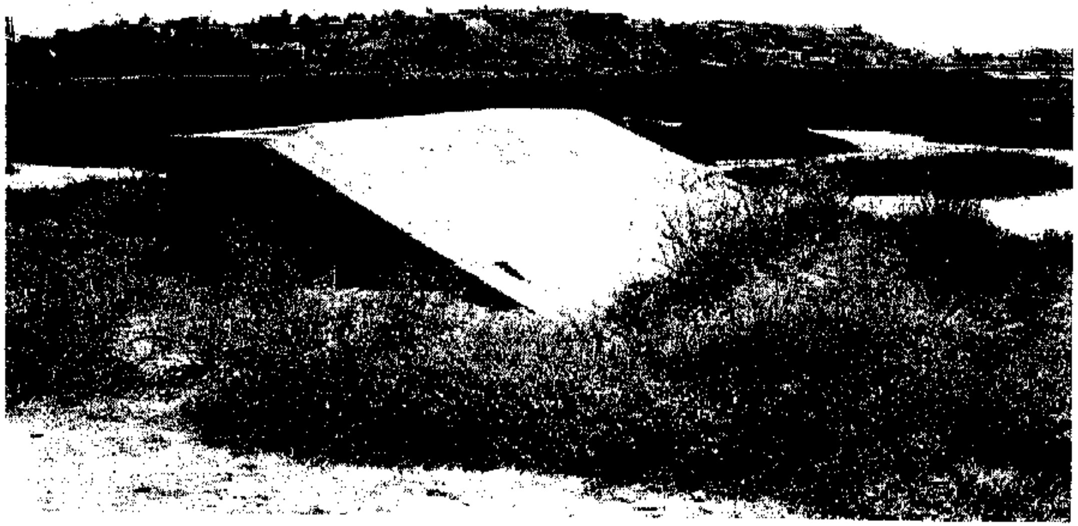


Figure 57. Feature 4, Concrete Ramp at SR2, Facing South Toward the Ballona Escarpment.

Figure 58. Feature 6, Wooden Pier Remnant at SR2, Facing Southeast Toward the Ballona Escarpment.

delineating the boundary of Area B divides the southern part of SR 3 from Playa del Rey. The base of the bluff along the the Ballona escarpment is about 100 m to the south and the Pacific Ocean is about 700 m to the southwest. Vegetation growing on the site includes miscellaneous grasses and date palms. Pickleweed is dominant in the adjacent salt marsh.

Site Description. The historic component of this site consists of horse stable and an associated riding ring (Figure 59). The site encompasses a 150 x 60 m area. SR 3, first constructed in the mid to late 1940s, was a local tourist attraction called the Cox Stable (Donna McDonough, personal communication, 1990). The Cox Stable was in operation until ca. 1988 when the standing structures were dismantled (Donna McDonough, personal communication, 1990).

Although the structures were recently removed, the outlines of four features were identified at the time of our visit. Features 1 and 3 are remnants of the old horse stables in the west part of SR 3. Many of the individual stalls could be discerned by the outline of some of the posts and the distribution of manure contained within them. Feature 1 is about 27 x 8 m in size and contained six stalls (see Figures 59 and 60). Feature 3 is about 42 x 26 m in size. It was divided into two rows of stalls, but the outline of only two individual stalls were observed. Feature 2, located about 2 m southeast of Feature 3, is a rectangular corral extending over a 22 x 8 m area. It was partitioned into seven smaller sections of unequal size. Feature 4 is the riding ring located in the east portion of SR 3 about 25 m east of Feature 3 (Figure 61). It is approximately 80 x 65 m in size and roughly oval in shape.

Historic artifacts are sparsely distributed across the site. The only historic remains observed while recording SR 3 include scattered wire nails and a few standing posts from old fencelines and gates. A possible prehistoric component is represented at SR 3 by a quartzite core tool, probably a scraper. In addition to the tool, economic marine shell was observed. It is possible that prehistoric deposits and features exist in the area that are currently being obscured by historic features.

Interpretation. Based on interviews with local residents, SR 3 functioned as a horse stable and riding ring. This commercial enterprise was in operation from the 1940s until a couple of years ago. The site may also contain a prehistoric component. Test excavations are needed to assess this possibility.

SR 8

Environmental Setting. SR 8 is located within the historic Ballona Lagoon in the north section of Area B. Lincoln Boulevard marks the eastern boundary, truncating part of this locus. Jefferson Boulevard is located about 50 m to the south and the existing channel of Ballona Creek is about 60 m to the north. The terrain is extremely flat with the elevation ranging from 3.9 to 4.2 ft. (1.2-1.3 m) above MSL. Vegetation consists of miscellaneous marsh grasses.

Site Description. This locus is a very sparse shell scatter extending over a 115 x 90 m area. The scatter consists of species that were of economic importance (*Chione californiensis, Taegelus californianus, and Pecten* sp.) to aboriginal populations as well as one species (*Cerithidia californica*) that was not. Although no artifacts were observed, much of the ground is obscured by thick weedy growth so it was not possible to adequately assess the nature of SR 8 at the survey level of investigation.

An isolated find (IF 5), two shotgun cartridges, was also noted near the western edge of SR 8. Although it is not possible to accurately date these artifacts, these remains indicate that hunting activity was probably undertaken in the are during historic times.

Interpretation. It is unknown whether or not SR 8 is the product of aboriginal activity. This shell scatter does not appear to have been redeposited.

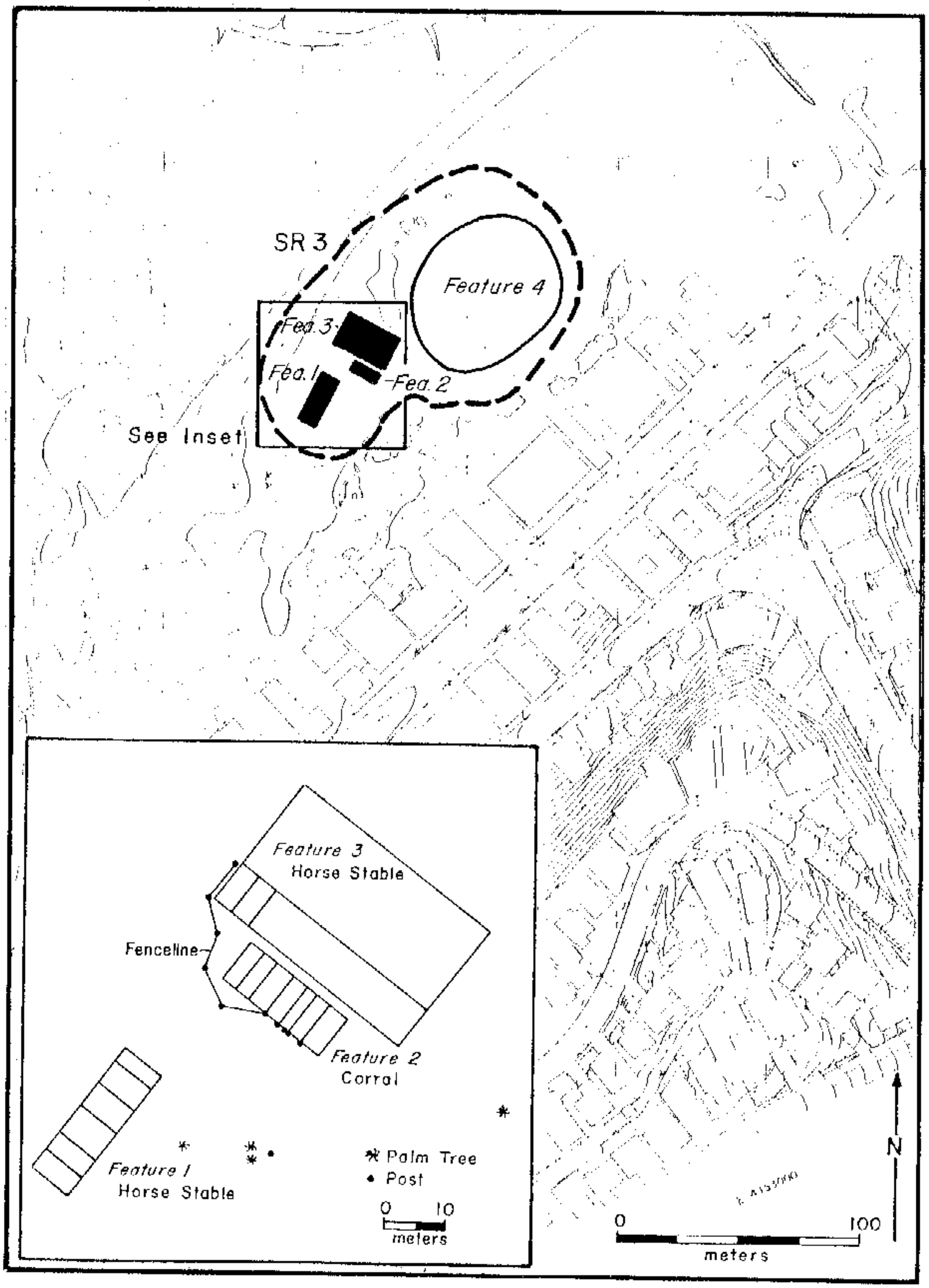


Figure 59. Plan Map of SR3 located in the Southwest Corner of Area B within the Playa Vista Project Area.

Figure 60. Feature 2, Remnant of Horse Stable at SR3, Facing North.

Figure 61. Feature 4, Riding Ring at SR3, Facing East Toward Ballona Creek.

SR 9

Environmental Setting. SR 9 is located in the historic Ballona Lagoon in the central part of Area B. This locus is sandwiched between Culver Boulevard and Jefferson Boulevard and the intersection of these two roads is about 80 m to the west. The gently undulating topography ranges in elevation between 5.5 and 6.3 ft. (1.7-1.9 m) above MSL. Vegetation is limited to various marsh grasses.

Site Description. This locus is an extremely light shell scatter extending over a 90 x 55 m area. The majority of shell consists of oyster (*Ostrea lurida*), and lesser amounts of Venus clam (*Chione californicus*); both of which were commonly used by aboriginal populations. Shells of *Cerithidia californiensis*, a non-economic specie, were also observed. These remains appear to be distributed on a relatively undisturbed surface.

Interpretation. Because no associated artifacts were found and because some noneconomic marine shell is intermixed with economic shell, it is uncertain if SR 9 can be attributed to cultural activity. Further investigation is necessary before making a determination (see Chapter 7).

SR 10

Environmental Setting. SR 10 is located in the historic Ballona Lagoon in the north part of Area B. The existing Ballona Creek channel marks the north boundary. Culver Boulevard is about 45 m to the south, just south of a large deposit of modern trash and a linear berm, and Lincoln Boulevard is approximately 400 m to the east. The terrain slopes gently downward to the south and the elevation ranges between 6.3 and 8.3 ft. (1.9-2.5 m) above MSL. Disturbance appears moderate; the northern section may have been truncated when Ballona Creek was channelized and portions of the SR 10 appear to have been lightly graded. A small unimproved road intersects the locus in a southwest-northeast direction. Despite the various impacts, the shell found at SR 10 does not appear redeposited. Vegetation is dominated by miscellaneous marsh grasses and a dense growth of Russian thistle (tumbleweed) is growing nearby.

Site Description. Similar to SR 8 and 9, SR 10 is also a light shell scatter. SR 10 encompasses a 150 x 60 m area. The only observed species (*Ostrea lurida*, *Chione californiensis*, *Tagelus californica*, and *Chione undatella*) include types that were used by aboriginal peoples. All of the shell occurs on a surface that appears relatively intact. No artifacts were found in association.

Interpretation. Although the general area is somewhat disturbed, and some modern trash is scattered in the vicinity, there are no clear indications that the shell within SR 10 was redeposited during historic times. Consequently, without further investigations we are unable to determine with certainty if SR 10 represents a cultural deposit.

AREA C

Area C, located in the north central portion of the project area, is bounded by the Ballona Creek flood control channel to the southeast, Lincoln Boulevard to the southwest, a development to the northwest, and Highway 90 to the northeast. Culver Boulevard bisects Area C in a southwest-northeast direction. A overview of Area A is shown in Figure 62. Although elevation ranges between about 5 and 23 ft. (1.5-7.0 m) above MSL, most of the terrain 10 ft. above MSL (3.0 m) has been artificially built up by historic fill, particularly in areas near Ballona Creek where the fill is thickest. Consequently, the elevation is highest in the area immediately north of Ballona Creek, sloping downward to the north of Culver Boulevard. Of the 66 acres in Area C, all but about 3 acres were found obscured by redeposited fill (Figure 63). A relatively undisturbed surface was found exposed in only two small parcels of Area C, one in the north central section and one in the south central

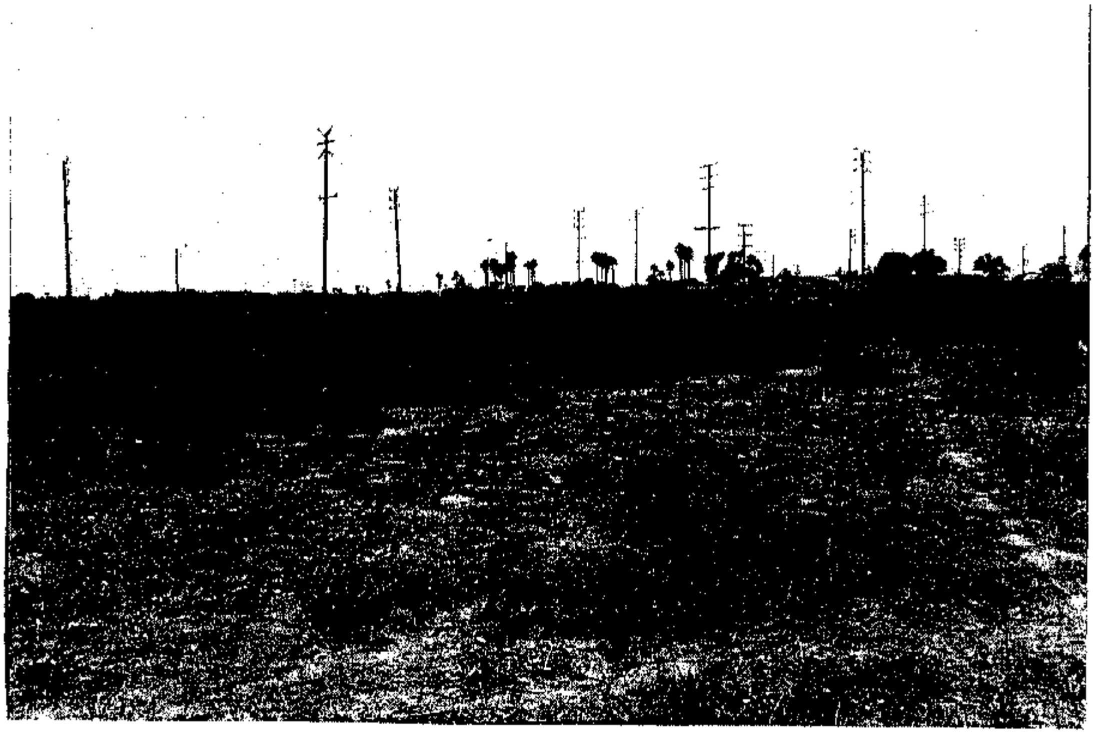


Figure 62. General Overview of Area C, Facing West with Lincoln Boulevard in the Background.

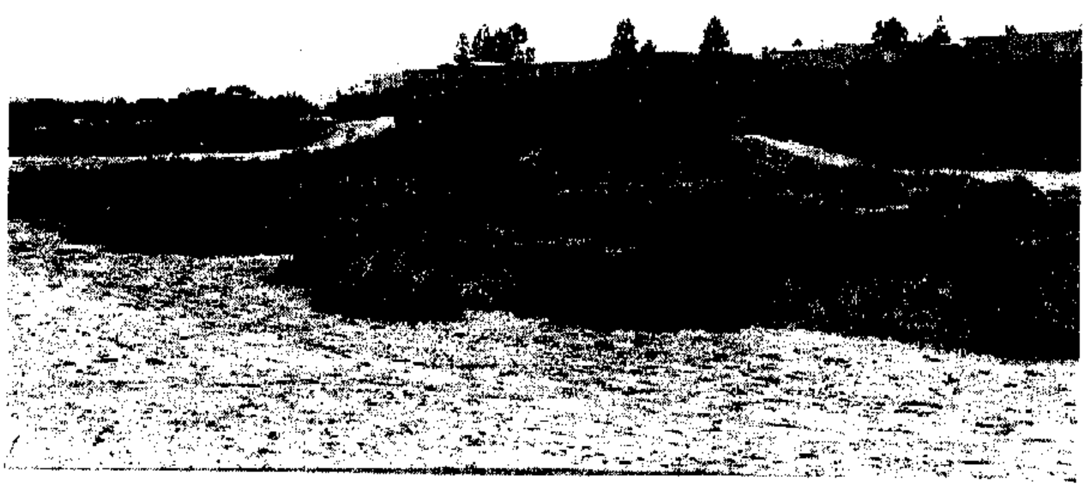


Figure 63. Redeposited Fill in the Northwest Portion of Area C, Facing Northwest.

section. Most of the fill consists of compact sand and gravel mixed with shell that was dredged when Ballona Creek was channelized or when Marina del Rey was constructed. Three baseball fields were constructed on top of the fill deposit in the southern half of Area C.

Two cultural loci (SR 7 and SR 11) were identified on the surface of Area C. SR 7 is an historic artifact scatter located in the northwest part of Area C and SR 11 is a shell scatter located in the south central section of Area C. In addition, an isolated historic find (IF 1), a wooden spoked wheel hub was found in the west part of Area C.

It is worth mentioning that no evidence of LAn-54 was found. The area where the site is recorded is now covered with roads, buildings, or redeposited fill. Subsurface tests will be needed to determine the condition and integrity of this site.

The two previously unrecorded sites are discussed below.

SR 7

Environmental Setting. SR 7 is located in the west part of Area C. Lincoln Boulevard is located about 110 m to the southwest and Culver Boulevard is located approximately 180 m to the southeast. Elevation ranges between 12.7 and 14.9 ft. (3.9-4.5 m) above MSL. The gently undulating terrain is the result of historic dumping. An artificial ridge occurs along the northern edge of this locus and a ditch is located immediately to the north. The general area appears heavily disturbed by plowing activity and grading. A man-made depression, created by heavy equipment in the recent past, is located in the southeast part of SR 7.

Site Description. SR 7 is a historic artifact scatter extending over a 100 x 25 m area. Artifacts include a variety of ceramic, glass, metal, wood, and rubber items, none of which appear to pre-date the late 1930's. Many of the artifacts are small and heavily fragmented, the result of modern plowing activity. This cultural deposit appears to have been redeposited along with the earthen fill that has been dumped in this location.

Interpretation. Historic materials at SR 7 have been redeposited as part of filling activities.

SR 11

Environmental Setting. SR 11 is located in the south part of Area C. The loop from Culver Boulevard connecting to the northbound lane of Lincoln Boulevard is immediately to the southwest. Culver Boulevard is about 40 m to the northwest and the Ballona Creek channel is about 100 m to the southeast. The terrain is relatively flat and low-lying with the elevation ranging from 4.6 to 6.0 ft. (1.4-1.8 m) above MSL. A thick deposit of historic fill is located just over 10 m to the northeast. Although the surrounding areas have been disturbed by road construction, channelization, and dumping activity, the deposits at SR 11 appear relatively intact. Some concrete and asphalt have been dumped in the immediate area, however this activity has caused little disturbance. The surface is somewhat obscured by weedy vegetation.

Site Description. SR 11 is a sparse shell scatter encompassing a 30 x 12 m area. A dense shell scatter is located within the cloverleaf just over 30 m away, but these nearby remains were clearly redeposited, and therefore not including as part of SR 11. Oyster (*Ostrea lurida*) and Venus clam (*Chione californiensis*), both of which are known to have been utilized by aboriginal people were observed at SR 11. *Cerithidia californica*, a noneconomic species, was found here as well. No artifacts or cultural features were identified on the surface.

Interpretation. It was not possible to determine whether or not SR 11 represents a cultural deposit. Although no artifacts were found, much of the surface was obscured by vegetation at the time of our visit. Consequently, further work is necessary before assessing the nature of SR 11.

AREA D

Area D covers approximately 462 acres, encompassing the area bounded on the south by the Ballona Escarpment, on the west by Lincoln Boulevard, on the north by Jefferson Boulevard, and on the east by Centinela Avenue. There is also a small rectangular portion that extends north of Jefferson to the Ballona Creek channel and east of Lincoln Boulevard approximately 200 m. Elevation ranges from about 5 to 150 ft. above MSL. This range is somewhat deceptive, however, as most of the area is relatively flat, lying in the alluvial fan below the escarpment. Only on the slopes of the bluffs, which constitute less than 5 percent of Area D, does the elevation increase, and here it does so dramatically.

Prior to development, Centinela Creek flowed through Area D from east to west. According to Charles Rozaire (personal communication, 1990), the spring-fed creek followed the course presently occupied by Teale Street. Along the length of the creek, a riparian vegetative community was established, consisting of a variety of trees and shrubs that would have been important to the diet of prehistoric residents.

The most prominent feature in Area D today is the Howard Hughes Industrial Complex. Built just prior to World War II, this complex has served as the production center, testing facility, and corporate headquarters. Much of the original landscape in Area D has been altered to fit the needs of the Hughes Aircraft Division, with fill covering most of the area north of the bluffs (Figures 64 and 65). Of the 462 acres in Area D, only 67 acres, or 15 percent, have been left undisturbed. Not surprisingly, undisturbed areas are largely confined to the bluff slopes. Much of the slopes, however, have been planted or invaded with ice plant (*Carpobrotus edulis*) which has obscured the surface. For the most part, then, the only intact surfaces examined in Area D were patches of undisturbed/unvegetated soil along the base and on the slopes of the bluffs.

SR 1

Environmental Setting. SR 1 is located on the edge of the Ballona Escarpment in the south central portion of Area D. The site lies on a parcel that is currently not owned by MTP-PV but which the company is entitled to acquire at a later date. The Howard Hughes Industrial Complex is located immediately downslope to the north (Figure 66). Two large, circular water reservoirs (no longer in use) are located to the northwest. SR 1 extends from the margin of the bluff onto the slopes of a side canyon that has cut into the bluff (Figure 67). Elevation ranges from about 60 to 150 (18.2-45.7m) ft. above MSL. A wide band along the bluff edge has been disturbed by recent discing; an activity designed for fire prevention purposes (Figure 68). Although the slopes appear stabilized by a dense growth of miscellaneous grasses, sheetwash erosion has probably impacted parts of the area.

Site Description. SR 1 is a sparse to moderately dense shell midden deposit. Because this locus extends onto the bluff crest, property not part of the Playa Vista project area, we could not conduct a reconnaissance of the entire potential site area. Consequently, the site boundaries could not be reliably estimated during the survey. Within the Playa Vista Project Area, the site extends over a 100 x 50 m area (see Figure 66).

Artifacts consist of a sparse scatter of noncortical debitage, split cobbles, retouched flakes, and fire-cracked rock. All of the chipped stone artifacts were made from volcanic raw material, mostly basalt. A wide variety of shell was also found on the slopes. Most of the observed species would have been available nearby in the Ballona Lagoon. These include *Chione californiensic, Chione undatella, Chione fluctifraga, Pecten* sp., *Saxadomus nuttalli, Cerithidia californica, Protothaca staminea, Crepidula onyx, Tagelus californianus, Ostrea lurida, and Polinicies lewisii*. All of these species but *Cerithidia californica* were probably important to the economy of the aboriginal people of the southern California coast.

Figure 64. Large Mound of Redeposited Fill in the North Central Section of Area D, Facing West.

Figure 65. Pile of Fill Dumped at SR 5, Historic Sheet Trash Deposit in Area D, Facing Southeast Toward the Ballona Escarpment.

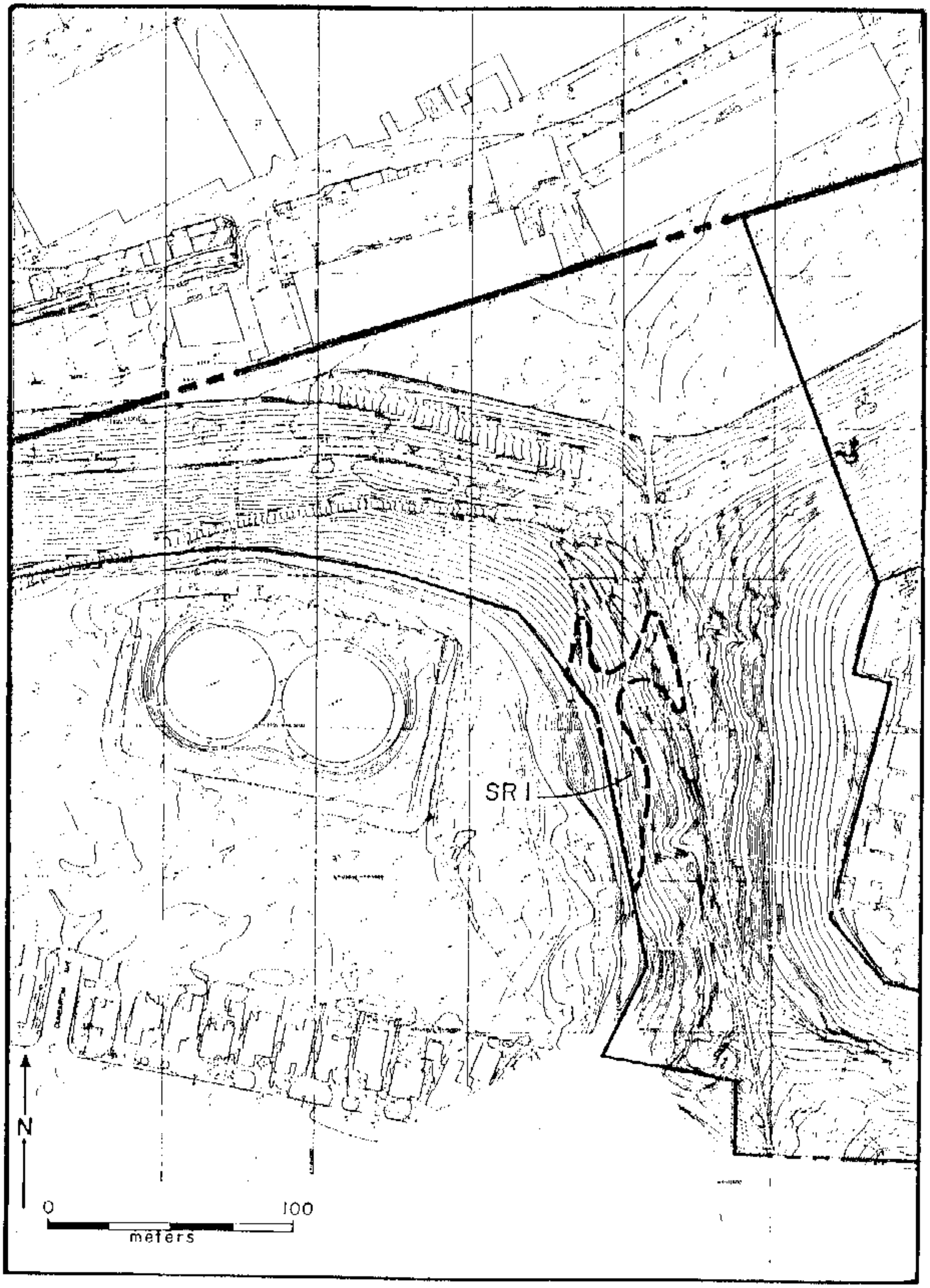


Figure 66. SR 1 on the side of Bluff adjacent to Area D.

Figure 67. SR 1 on the Bluff Edge, Facing West in Area D (Note: the site is above the trail in the right portion of the photograph extending onto the adjacent slope below).

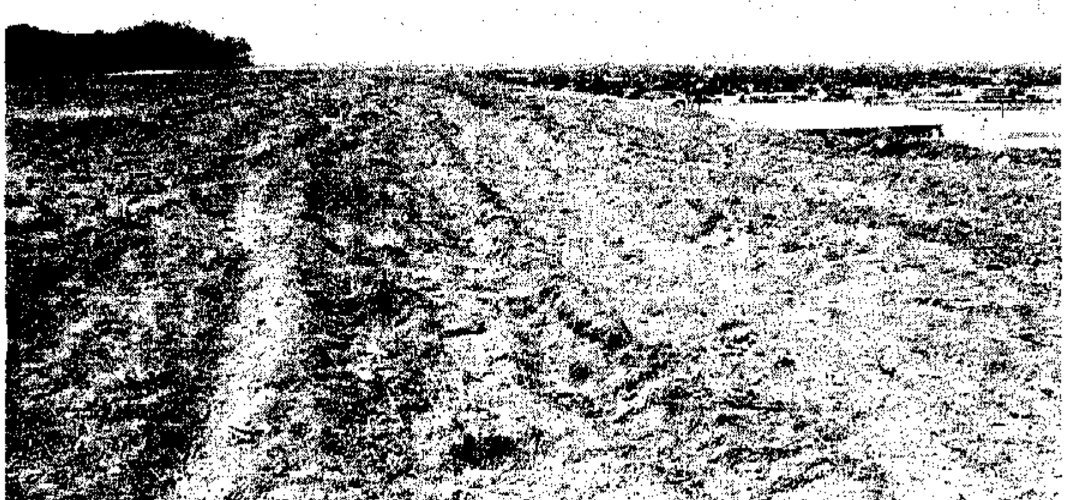


Figure 68. Portion of SR 1 that has been Plowed Along the Bluff Edge adjacent to Area D, Facing Northwest.

It is presently unknown how much of these remains were redeposited from above. A midden deposit was exposed immediately below the bluff edge along the edge of a trail leading up the slope (see Figure 67). The sedimentary matrix appeared consolidated and evidence of structural development was found, indicating the possibility that these deposits are *in situ*. Alternatively, these deposits may have washed downslope at some time in the past, and then were incorporated into a weakly developed soil. The material located further downslope almost assuredly is a secondary colluvial deposit.

Interpretation. SR 1 is the only site identified during the Playa Vista survey that was found on the edge of the Ballona Escarpment. No diagnostic artifacts were recovered so the age of occupation represented at SR 1 is undetermined. Because we did not have access to much of the potential site area, it was not possible to estimate its size. The depth of cultural deposits and the degree of stratigraphic integrity is also unknown.

SR 4

Environmental Setting. SR 4 is located in the southwest part of Area D. Teale Street is located immediately north on the opposite side of a ditch and Lincoln Boulevard is located about 180 m to the southwest. The base of the Ballona Escarpment is located just over 150 m to the east. Elevation is about 7 ft. (2.1 m) above MSL. The general area has been heavily disturbed by ditch and road construction and dumping activity. Vegetation consists of weedy growth.

Site Description. This locus appears to be a secondary deposit of historic trash. A wide variety of material (see Table 4) was found including several types of glass, ceramics, wood, metal, and even some clam (*Pismo*) shell. Although some artifacts, for example the sun-colored amethyst glass, date roughly between 1880 and 1914, the vast majority dates between the 1930s and 1950s, with some material dating as late as the 1960s. Most of the artifacts consist of household refuse. All the material was fragmented in small pieces and mixed so that materials from all ages were found together throughout the deposit, an indication of possible redeposition.

Interpretation. SR 4 appears to represent a secondary deposit intermixed with earthen fill. Further investigations are needed to demonstrate this hypothesis.

SR 5

Environmental Setting. SR 5 is located in the west part of Area D to the southeast of the Playa Vista Project headquarters approximately 60 m west of Lincoln Boulevard and 75 m southeast of Jefferson Boulevard (Figure 69). A fenceline marks the northern boundary and the old Hughes runway is about 100 m to the south. The topography is gently undulating and the elevation ranges between about 9 and 12 ft. (2.7-3.7 m) above MSL. The entire area consists of historic fill. A ditch has been cut through the middle of SR 5 (Figure 70). The surface is covered by miscellaneous weeds, predominantly Russian thistle (tumbleweed).

Site Description. This locus represents a secondary deposit of historic trash encompassing a 210 x 30 m area (see Figure 69). Artifacts were observed buried to a depth of approximately a meter in the profile of the trench cutting through SR 5 (Figure 71). The relatively thick deposit lacks any stratigraphic integrity as indicated by the homogenous vertical distribution of artifacts. For example, relatively recent plastic items were often found underlying older remains dating to the late 1800s or early 1900s.

A wide range in artifact types was noted (see Table 4). Most of these items represent household refuse such as miscellaneous glass, ceramics, metal, rubber, wood, and plastic. Although a representative analysis of the surface remains was not conducted, ceramic types observed at the site were flow blue, various transfers including Willow pattern, possible American Majolica, annular ware, stoneware, double-thick whiteware with rolled rim (possible commercial service), earthenware with molded brim and slip dots, and California colored dinnerware. Makers' marks were found on many of the ceramic artifacts. Two such marks identified by

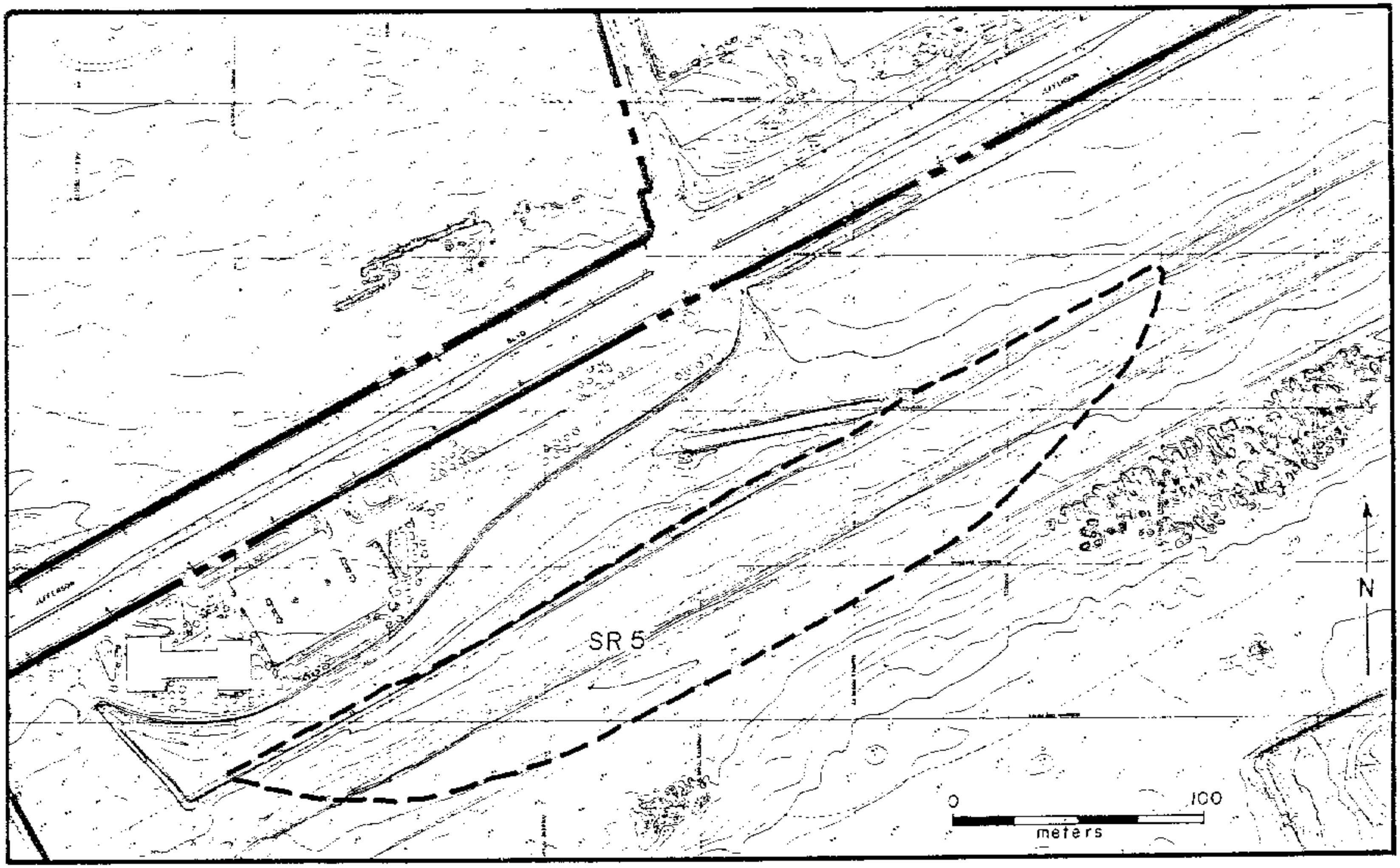


Figure 69. SR 5 within Area D adjacent to the sides of the Bluff.

Figure 70. Trench Cut through SR 5 in Area D, Historic Sheet Trash, Facing Northeast.

Figure 71. North Trench Profile showing Historic Trash at SR 5 in Area D.

Roberta Greenwood (personal communication, 1990) are Wallace China, a Los Angeles-area company (Vernon), founded in 1931 and totally liquidated in 1964, and Syracuse China (two different marks); a company using this name has been in existence since 1879, and has date-coded since 1895. It is of some interest that in the later years, Syracuse China specialized in products for the railroads. Only two of the many glass monograms observed were identified. These were Thatcher Manufacturing Co. (1900-ff) and Owens-Illinois Pacific Coast Co., Oakland plant (1932-1943).

Interpretation. SR 5 is the most extensive historic deposit noted during the survey, both in terms of its vertical and horizontal distribution. This cultural stratum is so thick that it may represent a landfill. The origin of the material at SR 5 is uncertain. Further investigations are needed to characterize the deposit and determine its origin.

SR 6

Environmental Setting. SR 6 is located in the central part of Area D. It is located about 150 m south of Jefferson Boulevard and to the northwest of the Howard Hughes Industrial Complex. The general area is heavily disturbed by ditch construction and grading activity. Several large deposits of historic fill are located to the north. Vegetation consists of sparse weedy growth.

Site Description. This locus is a secondary deposit of historic trash extending over a linear area that is about 480 x 30 m in size. Like SR 4 and 5, most of the artifacts appear to date between the 1930s and 1950s. A sizable quantity of debris at SR 6 is even more recent. Most of the artifacts consist of miscellaneous ceramics and glass; no wood, metal, or plastic items were observed on the surface.

Interpretation. SR 6 is most likely a locus of redeposited historic trash. Further investigations are needed to demonstrate this hypothesis.

SR 12

Environmental Setting. SR 12 consists of a narrow band of midden deposit located at the base of the Ballona Escarpment and a paved parking lot of the Howard Hughes Industrial Complex. The locus is approximately 75 m southwest of the entrance the helicopter factory and about 150 m northwest of water storage tanks at SR 12. Elevation ranges from 10 to 15 ft (3.0-4.7 m). Historically, Centinela Creek flowed about 60 m to the north.

The surface is largely obscured, with a thick cover of ice plant (*Carpobrotus edulis*) on the bluff slopes and a paved parking lot extending nearly to the edge of the escarpment (Figure 72). Between the parking lot and the bluff there is about a 1 m band of unvegetated, undisturbed soil. The soil consists of dark, organic silty sand. Although originally a mixture of aeolian (wind blown) and alluvial sediments, the soil has been culturally enriched and appears intact.

Site Description. The site consists of two narrow bands of dark, organic soil nestled along the edge of the bluff. The eastern band is approximately 20 m wide, whereas the western band is 45 to 50 m wide. The two bands are separated by about 20 m. Both bands are composed of dark organic silty sand with shell intermixed. Only the western band, however, contained artifacts. Even here the artifact density was low, with between 3 to 5 basalt flakes found in the entire deposit.

Interpretation. Cultural midden deposits are clearly present in the western locus of SR 12. These deposits appear intact, although it is possible that they represent secondary deposits that were bulldozed off the top of the bluff. If the deposits are intact then it is probable that the upper portions of the midden lying north of the bluffs were destroyed when the area was graded for the parking lot. Judging from the slope of the bluffs and the level of the parking lot, we would estimate that between 30 and 50 cm would have been destroyed. Whether intact deposits exist under the parking lot is a question that can only be addressed by subsurface tests.

Figure 72. SR 12, Shell Scatter and Possible Midden Deposit exposed in the South Section of Area D at the Base of the Ballona Escarpment.

Figure 73. Dark Soil Horizon (Possible Midden Deposit) exposed in Area D at the Base of the Ballona Escarpment below SR 1 (Note: LAn-193 may exist below this parking lot).

SR 12 lies about 250 to 300 m west of the plotted location of LAn-193. Given that no professional archaeologists has probably ever seen LAn-193 and that its location was most likely based on second hand information from amateurs (Eberhart recorded the site in 1952, and the area was paved by 1950), it is quite possible that what was recorded as LAn-193 is actually SR 12. Alternatively, the entire area between SR 12 and LAn-193 may be one cultural deposit, in which case LAn-193 is at least three times larger than originally recorded. Soils between the purported location of LAn-193 and SR 12 are consistently dark, although no shell or artifacts were found outside of SR 12 (Figure 73). Only subsurface testing can resolve these issues.

SR 13

Environmental Setting. At the juncture between the bluffs and remnants of the original portion of the Howard Hughes Industrial Complex lies SR 13. Much like SR 12, SR 13 represents a narrow band of undisturbed, unvegetated soil at the extreme lower edge of the bluff slope. The locus is situated immediately north of a chainlink fence that surrounds a series of abandoned Hughes buildings. The site is about 300 m northeast and below Loyola Marymount University. The historic course of Centinela Creek flowed about 50 m to the north of the site. Elevation ranges between 10 and 15 ft (3.0 to 4.5 m) above MSL. The bluff slopes are covered with ice plant (*Carpobrotus edulis*). Disturbance weeds and grasses have become established in disturbed areas.

Site Description. In the vicinity of SR 13, the base of the bluff slope has been truncated leaving a unobscured profile that is approximately 1 m in height and 100 m in width. For a 75 m extent, soil exposed in the profile consists of a dark, organic silty sand. The soil extends from the top of the exposure to the bottom, indicating that the midden is at least 1 m thick and probably more. In the midden deposit, economic marine shell (*Chione californiensis)*, animal bone, and lithic artifacts were observed. Artifacts included a burnt stone bowl fragment, fire cracked rock, and chert and basalt flakes.

Interpretation. SR 13 is an intact, thick midden deposit. The soil is homogeneous, suggesting that it is in situ, as opposed to having been sloughed off the bluff top. Without diagnostics, it is difficult to estimate the age of the site. If middens from other parts of the Ballona Lagoon are representative, however, then an occupation of several hundred years to several millennium may be expected.

SR 14 (CA-LAn-60)

Environmental Setting. SR 14 is located on the eastern slopes of the Ballona Escarpment on a parcel that MTP-PV is entitled to acquire at a later date (Figure 74). The locus is situated near the lower edge of the escarpment's talus slope, about 120 m below and east of LAn-59. Elevation ranges from 30 to 70 ft (9.1 to 21.3 m) above MSL. Grasses cover the site, but not to the extent that the surface was obscured. To the east the site extends onto a bench formed of calcified sand. The escarpment drops off vertically from the edge of the bench. Cultural material was not found east of this prominent landform.

A deep ravine borders the site to the north and cuts through the northeastern edge of the deposit, leaving a small "island" deposit. Based on historic maps and interviews with residents, it appears that the ravine is a relatively recent feature, having been formed within the last decade (Robert Stutsman, personal communication, 1990).

Site Description. The site encompasses a roughly oval area 55 by 30 m in dimension. Within the site boundaries the surface soil was considerably darker than the surrounding area. On the surface we observed economic marine shell, animal bone, and artifacts. Marine shell observed were various species of Venus clam (*Chione californiensis, Chione undatella*, and *Chione fructifraga*), scallop (*Pectan* sp.), oyster (*Ostrea lurida*), and Pacific Gaper (*Tagelus californianus*). Artifacts noted were chert and basalt flakes, cores, choppers, and scrapers.

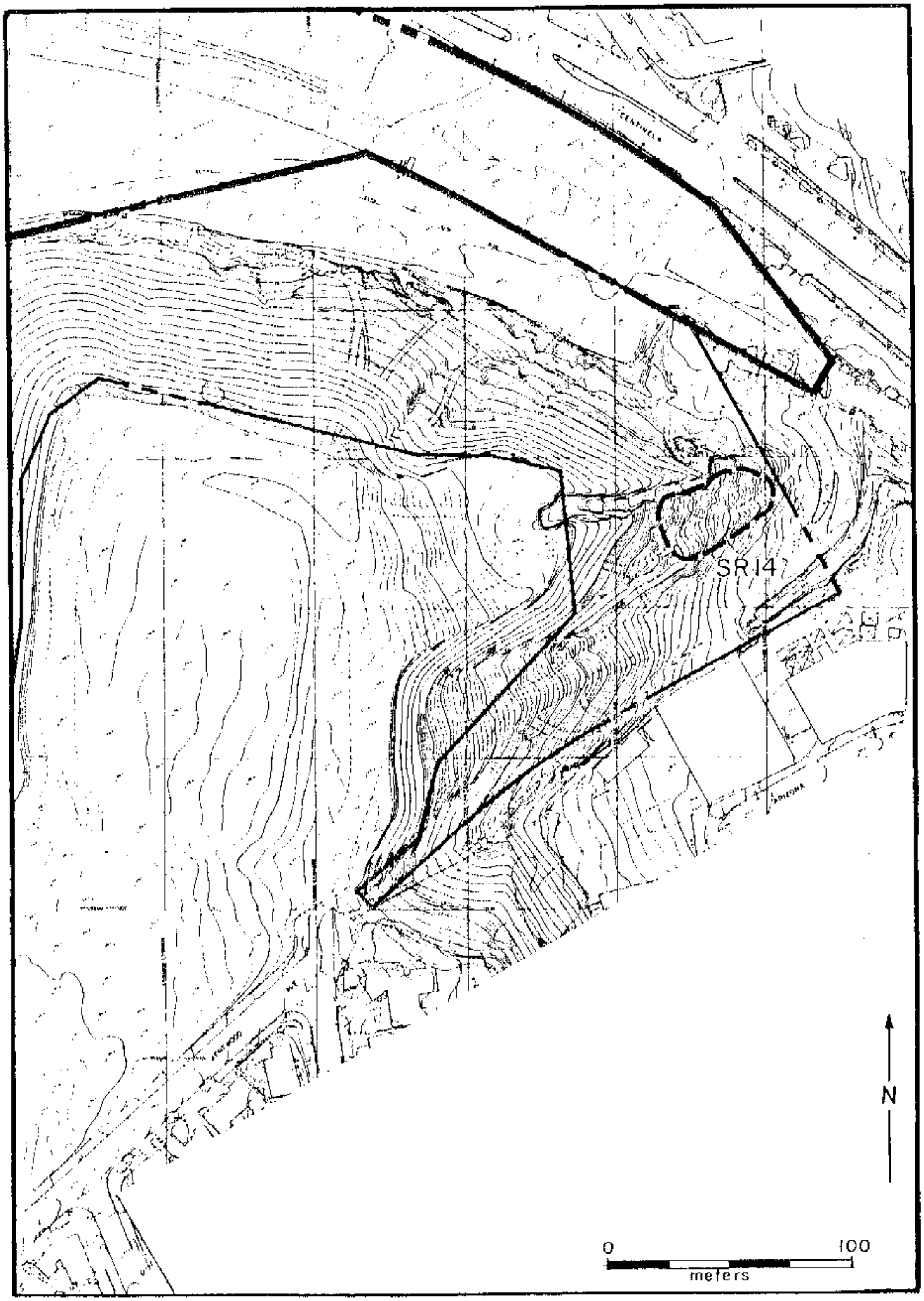


Figure 74. SR 14 within Area D.

The gullying action associated with the development of the ravine has created a soil profile of the western edge of the island deposit. The profile extends approximately 1 m below the present surface and is 4 m wide. Two soil strata were observed: the upper 75 cm consists of dark, organic sandy silt with shell and artifacts, whereas a light tan aeolian sand with no cultural material is found below.

Interpretation. SR 14 lies in the approximate location of the recorded site LAn-60. Although LAn-60 was purported to be destroyed at the time of recording, there are clearly intact cultural deposits that still remain. The midden is 75 cm thick on its northeastern boundary. It is quite possible that the deposits are much thicker near the center of the site.

SR 15 (CA-LAn-62)

Environmental Setting. SR 15 is located at the base of the bluffs about 300 m east of Lincoln Boulevard, and directly below the current Hughes corporate headquarters (Figure 75). The current setting of the site bears almost no resemblance to the landscape that had naturally evolved. Today, the area varies in elevation between 15 and 25 ft (4.5-7.6 m) above MSL. In its natural state, however, this area was the mouth of Centinela Creek, and was probably no more than a few feet above sea level. Evidence of major land modification abounds. For the construction of the Hughes corporate headquarters a large earthen ramp was built connecting the building site with the alluvial fan. After construction, the ramp was dismantled and the excess fill dumped at the base of the bluff directly over SR 15 (Figure 76). An artificial bench overlooks SR 15 from the west, while a concrete conduit borders the site to the east. Numerous dirt roads criss-cross the site. Castor bean (*Ricinus communis*) is the predominant vegetative specie, with buffalo gourd (*Cucurbita foetidissima*) also present.

Site Description. SR 15 is the only portion of LAn-62 that is still visible on the surface. Cultural materials were found in a rather circumscript area, measuring about 45 by 30 m in dimension. Most of the material noted at SR 15 was found in the backdirt of trenches that Van Horn (1987) had previously excavated. Even with such a limited view, it is clear that LAn-62 is a very rich site. Soil from the backdirt indicate that the midden is a very dark, sandy silt. Shell remains were more prevalent at SR 15 than any other site recorded during the survey. Almost all the shell were species of economic marine valves, including Venus clam (*Chione californiensis, Chione undatella*, and *Chione fluctagraga*), oyster (*Ostrea lurida*), scallop (*Pectan* sp.), Common Pacific Littleneck (*Protothaca staminae*), Black Abalone (*Haliotis cracherodii*), and Giant Spiny cockle (*Trachycardium quadragenarium*). In addition, burned animal bone and lithic debitage and cores were prevalent.

Interpretation. SR 15 is a small portion of LAn-62 (see Chapter 5). The site represents a major prehistoric occupation. Van Horn (personal communication, 1990) is of the opinion that LAn-62 was occupied later than the LAn-61, a site located on the bluffs directly above LAn-62. Van Horn's inference, however, still requires testing. Further, the exact boundaries of the site are still open to question (see Chapter 5). While the southern and western edges appear to be relatively well defined, the northern and eastern borders have not been delineated with any precision. It is also possible that LAn-62 and LAn-211 are linked, representing one large cultural deposit. Given the location of the sites at the mouth of Centinela Creek, such a conclusion is plausible.

SR 16 (CA-LAn-211)

Environmental Setting. SR 16 is situated at the base of the bluffs about 120 m northeast of SR 15 (see Figure 75). Elevation ranges from 5 to 10 ft (1.5-3.0 m) above MSL. The northernmost section of the site borders the historic bank of Centinela Creek. As one moves south and west, however, the site hugs the bluffs, whereas the creek flows in a southwesterly direction over relatively flat land toward its mouth near Lincoln Boulevard. At the south end of SR 16, the cultural deposit is about 75 m southeast of the creek.

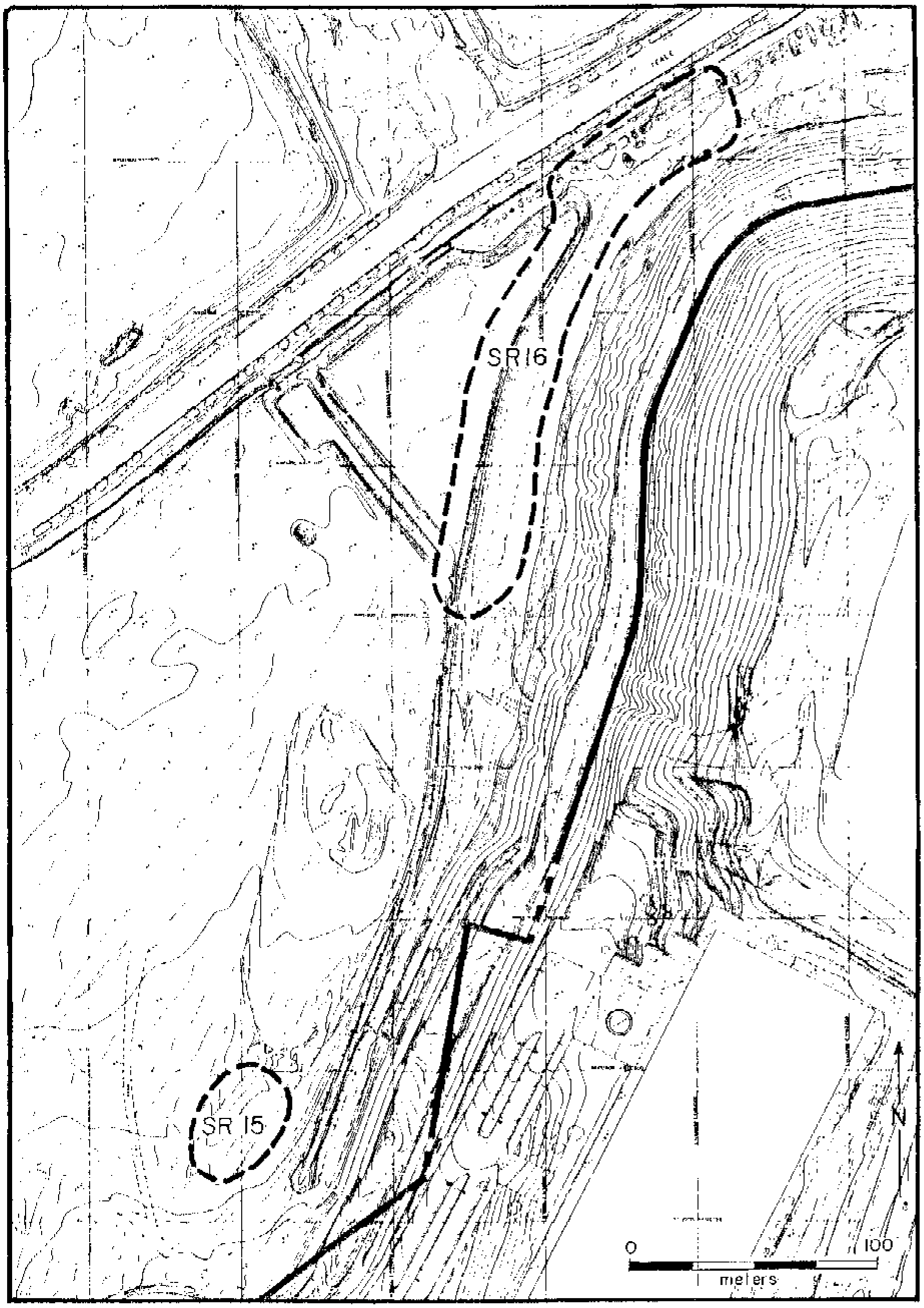


Figure 75. SR 15 and SR 16 within Area D.

Figure 76. Present Condition of SR 15 (CA-LAn-62) within Area D, Facing South Toward the Hughes Corporate Headquarters.

Figure 77. SR 16 (CA-LAn-211) within Area D viewed from the Slope of the Ballona Escarpment, Facing Northwest. (Note: the known portion of the site is sandwiched between the catchment basin in the center of the photograph and the base of the bluff.

The site is artificially constricted by a concrete catchment basin to the northwest and the bluffs to the east (Figure 77). The area has been heavily disturbed, as evidenced by numerous piles of fill and a more-or-less continuous scatter of modern debris. A dirt road bisects the site as do drainage ditches and associated fencelines. Vegetation is composed primarily of disturbance plants, such as castor bean (*Ricinus communis*) and buffalo gourd (*Cucurbita foetidissima*).

Site Description. Lithic debitage and cores, animal bone, and economic marine shell (*Chione californiensis, Chione undatella, and Protothaca staminea*) were observed on the surface of the dirt road, extending from the northern border of LAn-62 to the southern edge of the UCLA boundary for LAn-211 (referred to now as LAn-211a). The 240 m wide area encompassed by SR 16 corresponds to what Van Horn has called LAn-211b (Van Horn 1984b). As Van Horn's investigation of LAn-211b demonstrates, however, cultural material on the surface of SR 16 may not relate to intact cultural deposits (see Chapter 5). Some or all of the material may have originally been deposited on the bluff top, and was recently re-deposited at the base of the bluff when the former area was graded for development.

Van Horn, however, did find intact cultural deposits capped by a sterile soil in the area of SR 16. We found several of Van Horn's trenches and noted in the backdirt dark, organic midden soil with basalt and chert debitage. Van Horn's trenches were placed at the edge of the bluff between 5 and 10 m east of the dirt road. SR 16, then, is at least 20 m wide. It is unknown how much further east the site extended. Unfortunately, the eastern portion of the site was destroyed in the 1980s when the catchment basin was built in connection with the construction of the Hughes Aircraft Company headquarters which is located on the bluff above the site.

It is worth noting that no cultural material was found in the area where LAn-211 was originally recorded. In this instance the lack of surface material cannot be taken as evidence that the site does not exist. Today, the area is strewn with large, broken concrete blocks and metal debris. Large piles of fill have been placed at the base of the bluffs, covering whatever deposits may have been present. Only subsurface tests can determine the nature and extent of LAn-211.

Interpretation. It is clear that a cultural midden developed in the general vicinity of SR 16. The area encompassed by SR 16 links the recorded sites of LAn-62 and LAn-211. While it is possible that the break between LAn-62 and LAn-211 is more apparent than real, we need to be cautious. At least some of the surface material at SR 16 probably originated from LAn-61 on the bluff top above the site. Inferences based on surface material must be demonstrated by data derived from subsurface contexts. Further subsurface testing, therefore, is necessary.

SR 17 (Howard Hughes Industrial Complex)

Environmental Setting. The Howard Hughes Industrial Complex, SR 17, occupies most of the southeastern quadrant of the project area in Area D. SR 17 currently bears little resemblance to its natural setting. Since Centinela Creek has been channelized, large portions of the site have been paved or built on, with most of the balance covered with fill from various dumping episodes. Vegetation consists solely of disturbance species, including a variety of grasses and weeds.

Site Description. The Howard Hughes Industrial Complex was described in detail in Chapter 4 (see Figure 32). Most of the buildings remain in excellent shape. The original buildings of the complex, Buildings 5 and 6, are currently part of the McDonnell Douglas Helicopter Factory as is Building 15, where the Spruce Goose was built. Indeed, most of the buildings of the Culver City Plant are still in use. Exceptions to this rule include the original Hughes corporate headquarters, the runway (Figure 78), and Buildings 23, 28, and 29. While closed and abandoned, the corporate headquarters building is in remarkably good shape and has retained its architectural integrity. The only buildings that have been allowed to decay are the machine shops (Buildings 23, 28, and 29) located on the western edge of the complex (Figure 79). Even these buildings, however, retain their structural integrity. The same cannot be said of the runway, however, which was demolished in the recent past.

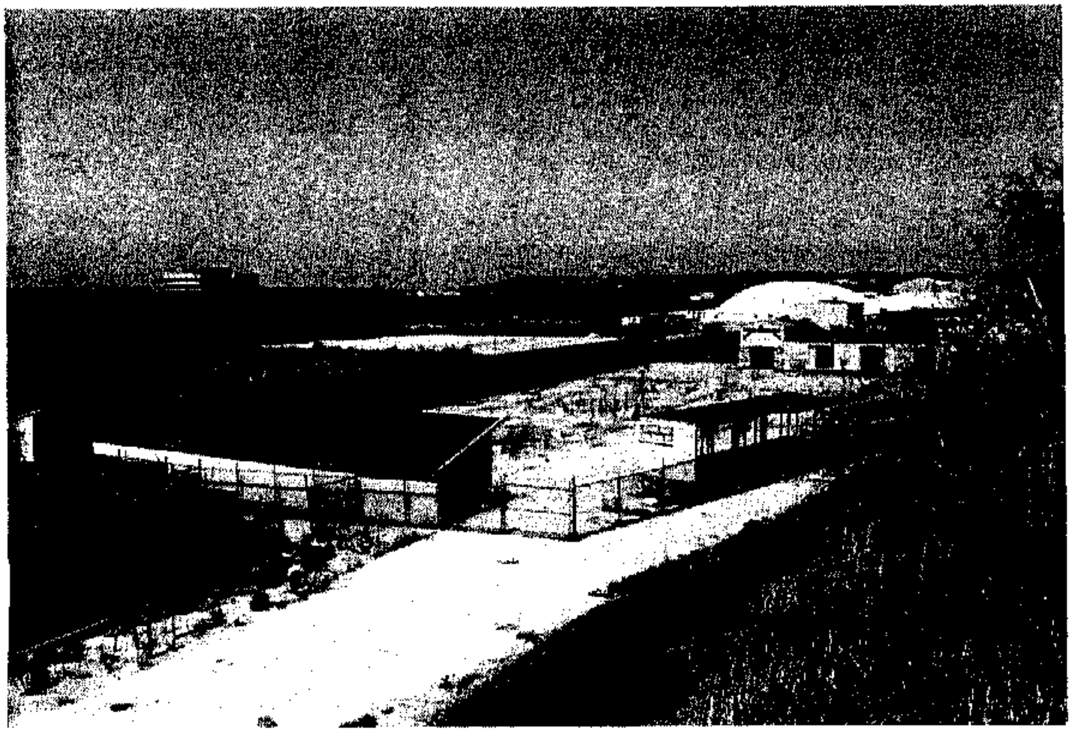


Figure 78. West Portion of SR 17, the Howard Hughes Industrial Complex within Area D, Facing North.

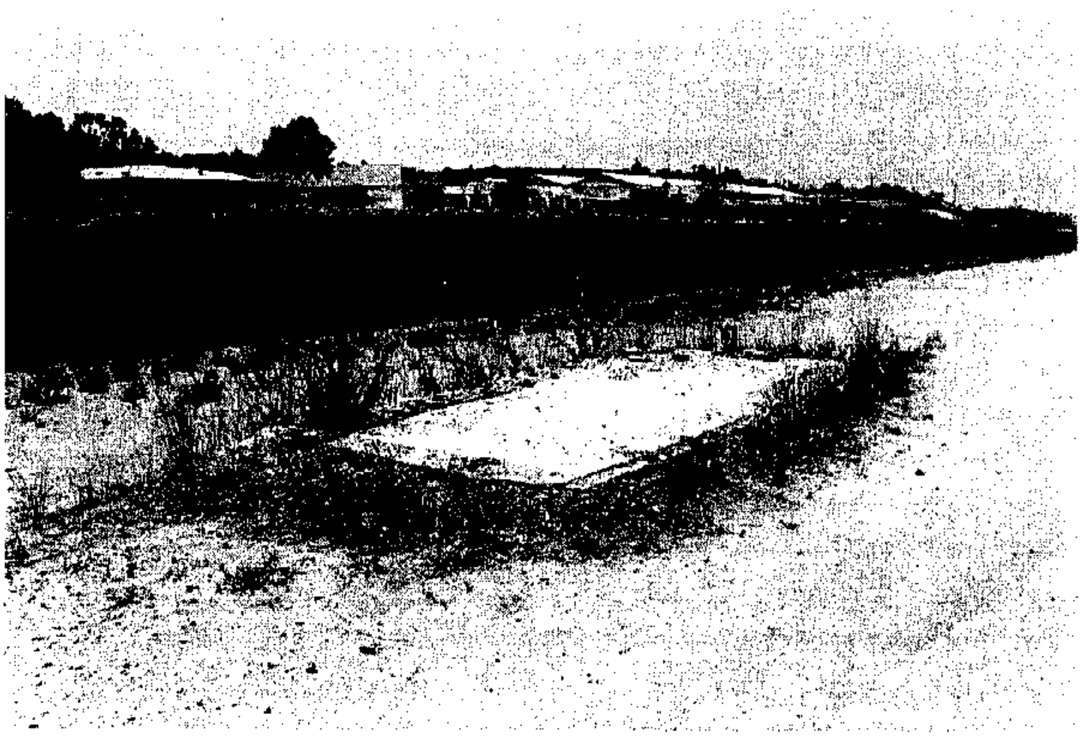


Figure 79. Small Portion of the Hughes Runway remaining intact within Area D, Facing South.

Interpretation. The Howard Hughes Industrial Complex is composed of a set of buildings related by their association with a single company, a famous person, and a single industry. Most of the buildings are in excellent shape and some contain interesting architectural features and other characteristics. For example, many of the buildings are still painted, Hughes green, a hue selected by Howard Hughes specifically for the Culver City Plant. Building 15, with its huge bays designed particularly for construction of the flying boat (or Spruce Goose as it is better known) is still an impressive architectural feat. The Howard Hughes Industrial Complex represents a unique example of one the first large-scale aircraft production centers.

ISOLATED FINDS

Five isolated find locations were identified during the survey and these are summarized in Table 5. Two prehistoric artifacts, IF 2 (Figure 80) and IF 3 (Figure 81), were recovered and are being stored on the Playa Vista project site. Both are groundstone fragments found in Area D near the base of the Ballona Escarpment. The number of isolated prehistoric artifacts is actually lower that might be expected considering the size of Playa Vista project area, particularly given the abundance of rich subsistence resources that would have been available in this wetland environment. The paucity of isolated prehistoric artifacts is probably explained by natural and cultural factors (e.g. dense vegetation, alluviation, and redeposited fill) that limited our ability to observe the surfaces that were occupied.

Three historic isolated finds, IF 1, 4, and 5, were found in Areas C, A, and B respectively. These remains include a wooden spoked wheel hub (IF 1), a steel bullet-like object (IF 4), and two shotgun cartridges (IF 5). Although the precise age of these artifacts could not be determined, they all probably relate to either farming or hunting activity. A tremendous amount of historic refuse was found scattered throughout much of the project area. The vast majority of these remains, however, were clearly of recent origin, and therefore not formally recorded. The areas where recent materials were concentrated were simply plotted on the field maps and described in the notes.

Table 5. Summary of Isolated Cultural Finds within the Playa Vista Project Area, 1990.

IF No.	UTM Location*	Survey Area	Description
1	368510 E 3760075 N	NW Corner of Area C	Wooden spoked wheel hub with portions of wooden spokes remaining. Because the hub is metal, it is probably from a truck or car, not a wagon.
2	369160 E 3759940 N	Southern portion of Area D at base of bluff	Pecked sandstone fragment, unknown function. Does not appear to be a mano or metate fragment. It may be from a large discoidal.
3	369160 E 3759945 N	Southern portion of Area D at base of bluff below Loyola Marymount University	Sandstone bowl fragment.
4	367575 E 3760375 N	Southeast portion of Area A in redeposited fill	Steel bullet-like projectile (?) that is 42 cm long and 6.8 cm in diameter.
5	367820 E 3759890 N	Northeast corner of Area B within shell scatter (SR 8)	2 shotgun cartridges. One is a 16 gauge *Leader 1901* and the other is a 12 gauge cartridge from the Defiance Company.

* Note: All UTM coordinates are in Zone 11.

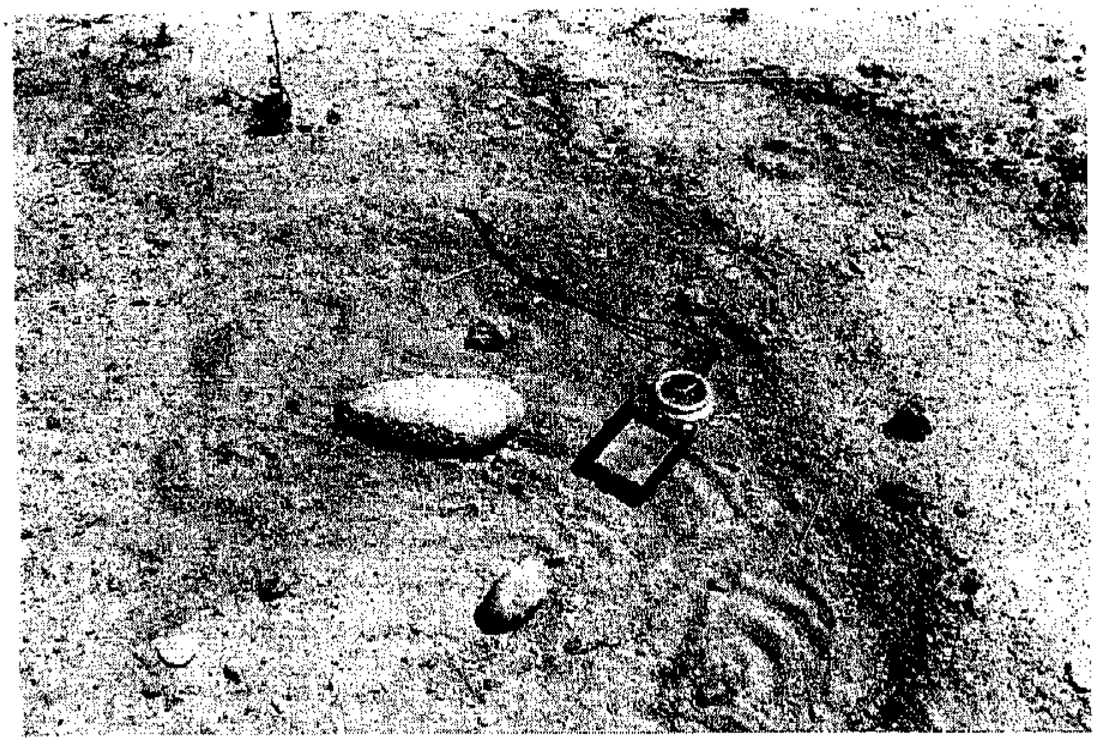


Figure 80. IF2, Pecked Stone Fragment Recovered from Area D near the Base of the Ballona Escarpment below Loyola-Marymount University (Note: compass included as a scale).

Figure 81. IF3, Stone Bowl Fragment Recovered from Area D near the Base of the Ballona Escarpment below Loyola-Marymount University (Note: compass included as a scale).

CHAPTER 7

NATIONAL REGISTER EVALUATIONS AND IMPACT ANALYSIS

A pedestrian survey of the 1004 acres Playa Vista project area resulted in the discovery of 17 loci of cultural material and 5 isolated finds. The relatively large number of areas given temporary site numbers appears rather impressive at first glance. It must be remembered, however, that of these 17 deposits, 4 appear to be composed of redeposited historic material and 4 consist of areas characterized by dark organic soil and shell, but with no artifacts. Whereas these 8 areas may prove to have been loci of cultural activities, they do not at present qualify as sites. Thus, only 9 sites were recorded by the survey: 3 historic and 6 prehistoric (see Table 4).

A pedestrian, or walk-over, survey presupposes that surface material can be used to sucessfully identify cultural resources. In many areas, such as deserts or regions of limited vegetation, such an assumption is usually valid. But in heavily vegetated regions or areas where modern development has altered the land so that surface material does not necessarily relate to buried deposits, the link between the surface manifestations and subsurface remains is broken. Of the 1004 acres of the Playa Vista project area, 589 acres or 59 percent, have either been disturbed or the surface is presently obscured by vegetation. Even this figure is misleading for most of the undisturbed area lies to the west in Areas A and B that were historically part of the salt marsh. In Area D where most of the prehistoric sites have been recorded, 86 percent of the surface is either obscured by fill or disturbed, and in Area C the figure rises to 96 percent. Perhaps of even greater concern for evaluating Area D is the fact that many of the midden deposits on the bluff tops have been graded with excess material apparently bulldozed over the side. Midden deposits on the surface of Area D, then, may not represent in situ cultural deposits.

The inability to use surface indications as predictors of subsurface conditions presents a problem in assessing potential impacts. From previous work it is clear that intact cultural deposits exist along the base of the bluffs. What cannot be determined at this time is how extensive these deposits are or their conditions. Previous work has shown that most, if not all, relatively flat areas on or near the bluffs, including bluff tops, benches, and the base of the bluffs, were intensively occupied prehistorically. There are few, if any, flat areas near the bluffs that upon testing have not produced prehistoric remains.

As one moves away from the bluffs, the patterns become blurred. Charles Rozaire (personal communication, 1990) informed us that when he and his UCLA colleagues visited the area in the late 1940s, surface indications of prehistoric deposits were restricted to the bluff edge. At that time, the area between the bluff edge and Centinela Creek had been plowed, and even with relatively good surface visibility no cultural remains were observed. The UCLA survey, however, was not systematic. The survey was only conducted in areas not fenced, and no attempt was made to determine the edge of the lagoon. Areas that we have hypothesized to have been settled, therefore, were not investigated in detail, and no archaeological excavations or subsurface testing efforts were conducted as part of the UCLA survey.

The scarcity of intact historic deposits was somewhat unexpected. No evidence of non-industrial occupations, such as those associated with the early Spanish settlement or even the relatively recent transient Japanese farming community, was found. Whether the remnants of these occupations have been destroyed or are obscurred by recent fill deposits or vegetation cover is unknown. Two historic sites were found in Area B, a capped oil well complex and a riding ring and stable. Further east in Areas C and D, it appears that most of the historic material observed on the surface was brought into the project area as fill used during the construction of various buildings, structures, roads, or runways associated with Hughes aviation activity. The Howard Hughes Industrial Complex, which is located at the east end of Area D, represents the most substantial set of historic properties within the Playa Vista project area.

NATIONAL REGISTER EVALUATIONS

As stated in Chapter 3, properties can be nominated for inclusion on the National Register of Historic Places in the form of objects, structures, buildings, sites, and districts. Within the Playa Vista project area, two basic types of properties have been identified: historic buildings and archaeological sites. All the identified historic buildings are associated with Howard Hughes' aviation endeavors. While it is possible to evaluate each building and structure on its own merits, given their affiliation with both an individual and an industry, it is more appropriate that these resources be considered as an historic district. Considering these buildings and structures as part of a district will also streamline the evaluation process. Because the general historic contexts and themes apply to each resource, these will not have to be reiterated as would be the case if each was evaluated individually. The historic context developed for the Hughes aviation activities under the general theme of commercial and industrial development will provide the background for evaluating whether individual structures or buildings are contributing members of the district.

Unlike the historic buildings, the archaeological sites cannot be related to a single occupation or cultural entity. As a group, however, they do reflect adaptation to a particular microenvironment. Whereas each site individually might provide data that can bear on the historic contexts presented in Chapter 3, it is as a group that these sites provide the best opportunity for addressing the specified research questions. Given their related research potential, the prehistoric archaeological sites will also be considered as a district.

Statistical Research temporary sites, SR2, 4, 5, 6, and 7, are not considered part of either of the districts described above. Further, the historic component of SR3 is not part of either district. These resources will be evaluated as individual sites below.

The Ballona Lagoon Archaeological District

Since the 1940s, the prehistoric sites on top and at the base of the Ballona Escarpment have attracted archaeologists and collectors. Unfortunately, the latter group appears to have been much more active than the former. What we know about the prehistory of the Ballona is derived from a small number of poorly distributed reports and photographs of artifact collections.

Only in the last decade have archaeologists begun to systematically excavate sites in the area, always as a result of impending destruction due to development. What has emerged is a sketchy outline of prehistoric utilization of marine and terrestrial resources over thousands of years. All occupations appear focused on resources that would have been available in or near the lagoon. All recorded sites consist of midden deposits, representing numerous occupations and reoccupations that occurred over periods of hundreds, if not thousands, of years. Instead of viewing each archaeological site as a separate property, it is more accurate to view the entire lagoon and escarpment as a locus of prehistoric settlement. From this perspective, it is the study of adaptation to the lagoon that is significant: a site's ability to contribute to that study is in essence the best measure of that property's National Register eligibility.

The proposed district is restricted to the Playa Vista project area. Although some sites in the surrounding area might also justifiably be included in the district, they are outside the scope of the present project. Since we do not have access to these properties, they cannot be evaluated. Their status as contributing or non-contributing members of the district, therefore, cannot be assessed. As these properties become available for study, investigators and property owners may choose to extend the Ballona Lagoon Archaeological District to include them. For now, however, it is best to exclude them from the district.

Sites formally recorded at UCLA within the proposed district are CA-LAn-54, CA-LAn-60, CA-LAn-62 (the Mar Vista site), CA-LAn-193, CA-LAn-211, and CA-LAn-193. Site CA-LAn-1698 also lies within the proposed district. As stated in Chapter 6, however, this site is the result of recent dredging activities and not prehistoric cultural behavior. Therefore, it is not included as a potentially contributing member of the district.

In addition to formally recorded sites, Statistical Research temporary sites SR1, 3, 12, 13, 14, 15 (probably part of CA-LAn-62), and 16 (probably part of CA-LAn-211), all of which contain cultural midden deposits, are located within the proposed boundaries of the district. Finally, temporary sites SR8, 9, 10, and 11, which consist of shell scatters that could be cultural in origin, are located within the proposed district boundary.

Previous work has demonstrated that data retrieved from these sites can be used to address many of the questions listed under the historic context themes, man-land relationships and cultural history and cultural dynamics. Specifically within the project area, test excavations at LAn-62 and 211 have recovered artifactual and subsistence related remains in substantial numbers (see Chapter 5). Based on artifacts recovered, both sites appear to be multicomponent, dating from at least the Late Prehistoric Period and perhaps earlier. Preservation is excellent at the two sites as evidenced by complete bone and shell tools recovered during the test excavations. Based on previous work it is clear that both sites will yield large quantities of floral, faunal, and shell remains from intact deposits from which research questions relating to prehistoric subsistence can be addressed; adequate samples of projectile points, shell beads, obsidian artifacts, charcoal, shell, and bone to investigate chronological questions; sufficient quantities of potatoe flakes and microliths to investigate the technology of these peculiar Ballona lithic industries; and substantial numbers of diagnostic artifacts, such as projectile points, shell beads, and historic trade goods (if present) to examine questions of cultural affiliation (see Chapter 3, pages 25-28). These two sites, therefore, should be considered contributing members of the district.

The most problematic aspect of the district concerns the issue of buried sites. The banks of Centinela and Ballona creeks as well as the eastern edge of the lagoon are mostly covered with redeposited fill. Pedestrian survey cannot identify sites under these conditions. It is possible that some of the recorded sites along the bluff edge are actually different parts of the same site. It is also probable that other cultural deposits remain undetected.

The present listing of archaeological sites for the Ballona Lagoon Archaeological District must not be considered an exhaustive list. Further inventory should be conducted within the Playa Vista project area using subsurface testing techniques, such as mechanical coring or trenching.

The Hughes Industrial Historic District

The Hughes Industrial Complex can be nominated on any of the first three National Register criteria (see Chapter 3). The complex is associated with World War II military aircraft production (Criterion A), with the life a famous person (Criterion B), and with distinct and unique architectural features, such as the hangers bays used to build the Flying Boat and the original Hughes corporate headquarters (Criterion C).

The Hughes Industrial Historic District corresponds to the buildings both in use as well as abandoned but still standing that were once part of the Howard Hughes Industrial Complex (Figure 82). Unlike the prehistoric district, the number, nature, and integrity of all the historic buildings can be

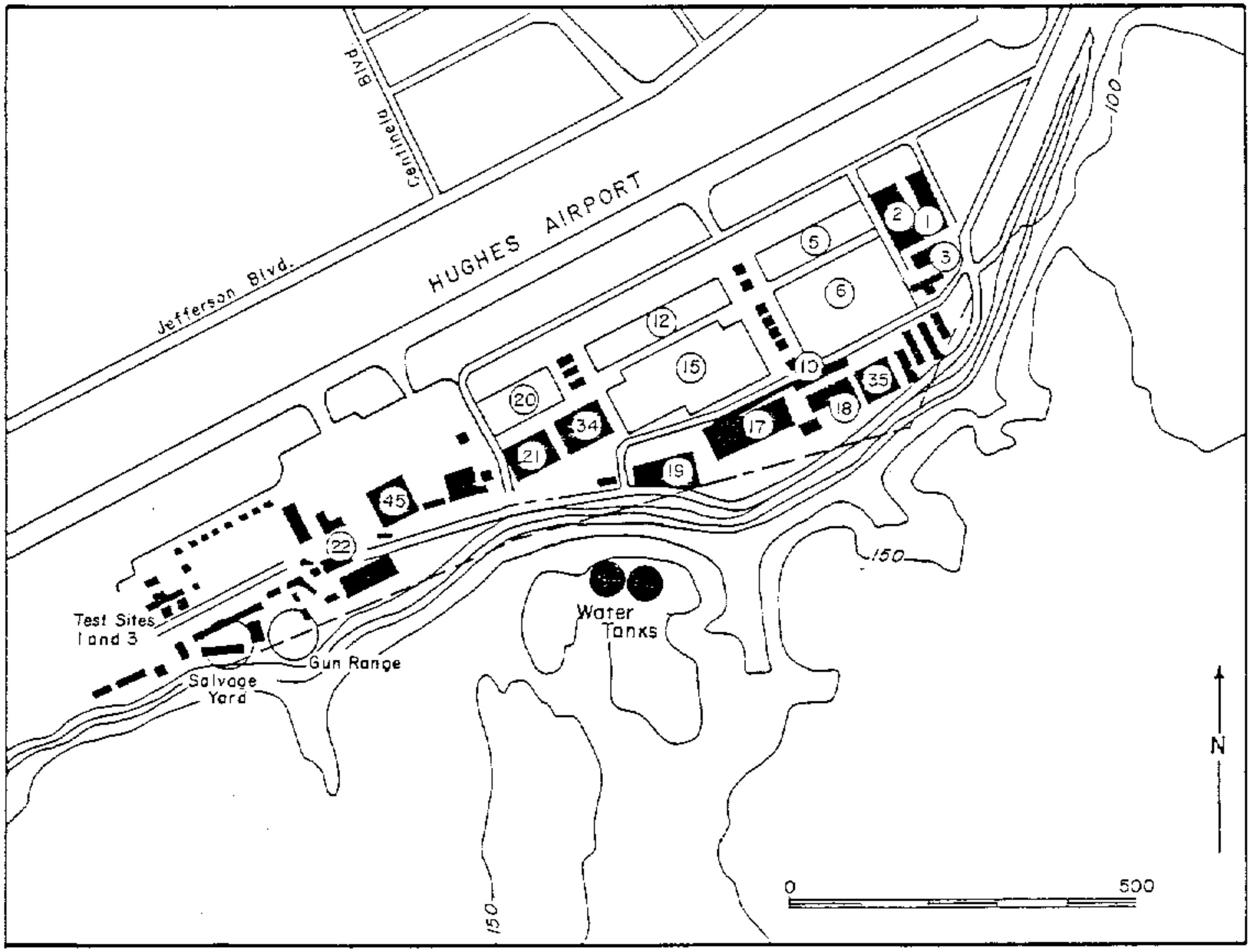


Figure 82. The Hughes Industrial Historic District.

determined. Mitigation measures for these structures can be developed based on information obtained during the survey and archival research.

Individual Site Evaluations

SR 2

SR 2 is the remnants of a small oil well complex that was part of the Venice Oil Field. The remaining material culture, consists of the capped wells and earthern berms. Because of the site's location in the tidal lagoon, the layout and construction of the complex is unique in the project area. It is possible that the site represents an unusual adaptation of oil-field technology, and as such could provide data bearing on the historic theme, commerical and industrial development. Further archival research is necessary to evaluate the potential eligibility of SR 2 for listing in the National Register of Historic Places.

SR 3

The historic component at SR 3 is the remains of a horse stable and riding ring. Today, only the ring is preserved. The historic component, built in the 1940s, does not meet the criteria for eligibility to be listed on the National Register. No further work is recommended.

SR4, SR 5, SR 6, and SR 7

Temporary site numbers were assigned in the field to all cultural deposits observed. As discussed in Chapter 5, temporary sites SR 4, 5, 6, and 7, appear to represent redeposited fill. The origin of the fill is unknown, although it is possible that the fill events are associated with activities of the Hughes Helicopter Company. To evaluate the nature and integrity of the deposits we recommend that sites SR 4, 5, and 6 be evaulated. In the case of SR 7 the fill is clearly redeposited with evidence of recent earth moving activity visible. This site does not meet the eligiblity requirements of the National Register, and no further work is recommended.

IMPACT ANALYSIS

In the preceeding section we recommended that certain sites are potentially eligible for inclusion in the National Register of Historic Places as individual sites or as contributing members of historic districts. The next logical step is to evaluate the sites. Prior to presenting evaluation plans, however, it is instructive to examine the proposed impacts. The development poses no threat to certain sites or portion of sites that will be avoided either by being encompassed by open space or because they will be covered by modern fill. In cases where only a portion of a site will be affected by development, testing will focus only on those areas of potential impact. A small number of sites may be completely impacted, and in these instances evaluation of the entire site area will be required.

The types of potential impact at each site are summarized in Table 6. Table 6 also contains information on the portions of each site that will impacted by the proposed development in addition to the overall extent of impact. It should be pointed out, however, that not all impacts are equally destructive. In particular, depending on the method chosen, re-vegetation could be viewed as a minor impact.

For a full understanding of proposed impacts at each site, the information in Table 6 must be coupled with the data presented in Figure 83 (back pocket). Based on bore holes extracted as part of a geotechnical study, data has been compiled on the thickness of existing fill at selected locations in the

Table 6. Impact Analysis for Each Site.

	Temporary Designation Site Number	Type of Impact * Residential	Retail	Office	Parking Lot/Road	Riparian Corridor	Wetland Restoration/ Revegetation	Extent of Impact **
Area A	CA-LAn-1698 ***	N, S, W						3
Area B	SR 2						A****	0
	SR 3				S			4
	SR 8	N, E						3
	SR 9				A			4
	SR 10	E, S, W			N			3
Area C	SR 7	A						4
	SR 11	A						4
	CA-LAn-54	E			W			4
Area D	SR 1						A	3
	SR 4	W			E			4
	SR 5	A			A			4
	SR 6	A	A		A			3
	SR 12					S		?
	SR 13					S		?
	SR 14 (CA-LAn-60)						A	3
	SR 15 (CA-LAn-62)					S		1
	SR 16 (CA-LAn-211)	N, E, W			E, W	S		3
	SR 17 (Howard Hughes Industrial Complex)		A	A	A	S		4
	CA-LAn-193	S, W	N, E	N, E		S		3

* Sections of site that will be impacted are denoted as follows: A = all, N = north, E = east, S = south, and W = west.

** The approximate percentages of site that will impacted by development are as follows: 0 = no impact, site will be avoided, 1 = 1-25%, 2 = 26 - 50%, 3 = 51 - 99%, and 4 = 100%, ? = undetermined

*** Although formally recorded, this site is considered recent in origin and not eligible for the National Register.

**** To keep water from the restored wetlands away from the site, the oil heads will be capped and the earthern berms enlarged.

Playa Vista project area. Data on the existing and proposed surface elevations for each bore hole location are also shown in Figure 83. In most cases the proposed surface elevation will be raised above the existing elevation by depositing additional fill. Excavation, however, will be required in certain areas, especially along the lower sections of the proposed riparian corridor. In areas where the excavation will not penetrate the sediment underlying the historic fill, buried cultural deposits should not be impacted aside from compaction that might result from the weight of the overlying fill.

Although the bore hole data are useful for estimating the thickness of historic fill above some of the archaeological sites, the stratigraphic relationship between the cultural deposits and the nearest bore hole locations is not known in many instances. Few of the bore holes were actually placed within known or assumed site boundaries as depicted in Figure 83, and therefore, the fill thicknesses as indicated in the bore holes may have little relevance to nearby sites. The only bore holes include those fortuitously placed at sites include SR 3, SR 10, SR 5, SR 7, and SR 17, and SR 13, and all of these sites but SR 10 and SR 13 are historic. Consequently, the reliability of the bore holes for estimating the fill thickness above a number of sites can not be accurately assessed without coring additional bore holes.

Table 7 summarizes the data from the bore holes nearest to each site. In generalizing the fill thickness for specific sites, the bore hole data are probably more accurate for sites located away from the bluff. For sites located along the base of the bluff where the riparian corridor is proposed, the estimated fill thicknesses are less certain, and in some cases, the stratigraphy documented in particular bore holes is known to correlate poorly with the fill thickness of the nearest site. The topography along the base of the bluff undulates greatly, largely as a result of artificial fill. Consequently, the thickness of the existing fill also varies greatly, sometimes over short distances. For example, the closest bore hole to CA-LAn-62B is R-2, a bore hole located about 30 m to the southwest and about 50 m east of Lincoln Blvd. The thickness of the existing fill in R-2 was recorded as 4.5 ft. (ca. 1.4 m), but previous archaeological investigations indicated that the fill is up to 20 ft. (ca. 6 m) thick at CA-LAn-62B. Although this example is probably the most dramatic in terms of the discrepancy between the fill above a site and the location of the nearest bore hole, it should be stressed that extreme caution is needed before making generalizations between areas where the sediment was sampled to sites where it was not. Because almost no systematic subsurface archaeological investigations have been undertaken, we have little or no basis for evaluating the depth of the fill above other archaeological sites located along the base of the bluff.

The remainder of this impact analysis describes the types of disturbance that will affect particular properties within the Playa Vista project area. After summarizing the impacts of each quadrant, the expected impacts in areas where archaeological sites are known or thought to exist are highlighted.

Area A

A marina along with a mix of residential, hotel, retail, and recreational uses are proposed for Area A. Although the entire area will be developed, adverse impact to cultural resources will probably be negligible. Only one cultural resource, CA-LAn-1698, has been documented in the area, and it is believed to be of recent origin. Based on the results of the archival research, field survey, and preliminary interpretations of paleo-environmental conditions, we believe that the likelihood of encountering sites buried beneath the present surface is extremely small.

The one recorded cultural resource, CA-LAn-1698, is located in a proposed residential area. Remains of shell are visible on the surface, and in an area that will be subject to grading. It is probable that CA-LAn-1698 will be completely destroyed. As stated above, however, the shell scatter is not prehistoric in origin, having been created in the last decade. Because the site in not eligible for the National Register, the proposed construction will have no significant impact.

Table 7. Geotechnical Data for Sites Within the Playa Vista Project Area

Area	Site Number/ Temporary Designation	Distance (m)/ Direction to Nearest Bore Hole	Bore Hole Designation	Thickness of Existing Fill (ft.)	Elevation (Ft.) Range of Fill	Thickness (Ft.) of Fill to Be Added	Thickness (Ft.) Of Fill to Be Excavated
A	CA-LAn-1698	140/SW	A-11	10	0.3 to .3	15.0	0
B	SR2	230/East	B-1	0	0	0	0
	SR3	0	B-15/16	0	0	0	0
	SR8	60/North	B-5	0	0	21.8	0
	SR9	100/North	B-1	0	0	17.2	0
	SR10	0	B-3	0	0	18.4	0
C	SR7	0	C-6	5.4	7.2-12.6	12.9	0
	SR11	45/NE	C-9	3.7	16.3-20.0	4.5	0
	CA-LAn-54	10/SE	C-16	9.0	9.2-18.2	7.1	0
D	CA-LAn-60 (SR14)	140/NW	D-26	3.0	21.3-24.3	0	0.3
	CA-LAn-62a,b (SR15)	30/SW	R-2	4.5	9.5-14.0	0	11.5
	CA-LAn-193	60/West	R-6	12.3	2.7-15.0	0.7	0
	CA-LAn-211a	20/SW	R-3	6.0	4.0-10.0	0	6.4
	CA-LAn-211b (SR16)	20/SE	R-3	6.0	4.0-10.0	0	6.4
	SR1*	0	0	0	0	0	0
	SR4	90/SE	D-10	7.8	5.2-13.0	0.5	0
	SR5	0	D-7	8.5	1.5-10.0	15.0	0
	SR6	40/NW	D-1	4.7	6.3-11.0	16.9	0
	SR12	140/SW	R-5	3.0	12.0-15.0	0.4	0
	SR13	0	R-5	3.0	12.0-15.0	0.4	0
	SR17 (Howard Hughes Industrial Complex)	0	R-6	2.7	16-3-19.0	0.7	0

*No information is available for SR1, a shell midden located on the bluff slope.

Area B

Except for about 78 acres in the northeast section, Ballona Creek, the wetlands and a freshwater marsh are proposed for about 290 acres or 79 percent of Area B. In the area proposed for residential, neighborhood retail, and park space, three shell deposits were observed (SR 8-10). Although no cultural material was associated with the shell, at this time it is impossible to determine whether these deposits are natural or cultural in origin. Residential units are currently planned to be built on SR 8 and 10, whereas a road will pass over SR 9. Prior to construction, about 20 ft of fill will be placed on top of SR 8 and 10. The road placed through SR 9 will totally destroy the site.

One site, SR 2, has been recorded in the proposed wetland restoration area. SR 2 is a complex of oil wells and associated berms and ponds, with no associated artifacts. As part of the proposed wetland restoration, the entire site will be raised by adding earthen fill to the existing berms and other features. All portions of the site, therefore, will be impacted.

In the southwest corner of the Area B a plant nursery and parking lot are proposed. These improvements will be protected from the marsh by an earthen berm. The three proposed additions will adversely impact all of SR 3, a prehistoric artifact scatter.

Area C

Area C consists of about 79 acres proposed for various residential, retail, office, and recreational uses. Two potential cultural resources were identified in the area. At SR 7 we observed marine shell in a fill deposit originating from an unknown off-site location. Because SR 7 represents redeposited modern material, it is of no historical value. In contrast, SR 11 is a shell scatter of either natural or cultural origin. Additional work will be needed at SR 11 to determine its origin and significance. Present plans call for SR 11 to be destroyed by a street.

CA-LAn-54 was also recorded in Area C, at the intersection of Culver Boulevard and the Marina Freeway. The site area is entirely obscured by a relatively thick fill deposit. The area is proposed for residential and road construction. Current plans project that an additional 7 ft of fill will be placed on the southern and eastern parts of CA-LAn-54. Other sections of the site may be impacted by road construction.

Area D

Area D, with 475 acres, is the largest of the four development areas of the Master Plan for Playa Vista. Residential, office, retail, civic, community, park, and open space and habitat uses are proposed for Area D. Buildings, utilities and roadways will cover most of the area north of the proposed new alignment of Teale Street. South of Teale Street, a riparian corridor will be established. This corridor requires the excavation of a streambed for a channel that will flow gently downstream to the west until it reaches the proposed wetland restoration area west of Lincoln Boulevard. Given the size of the area devoted to the proposed riparian corridor, it will be extremely difficult, if not impossible to avoid all known cultural resources. The riparian corridor crosses large sections of the Mar Vista site (CA-LAn-62), CA-LAn-211, CA-LAn-193, SR 12, and SR 13. Additionally, we suspect that undiscovered, buried cultural deposits may exist along the corridor. Based on present boring data it is likely that sections of CA-LAn-62b, CA-LAn-211a, and CA-LAn-211b will be impacted. The area including SR 12, SR 13, and CA-LAn-193 will be covered with between 0.4 and 0.7 ft of fill. This mantle will offer some protection to these resources but will not likely be sufficient for avoidance.

Table 8 provides the total area of the sites in the riparian corridor and the projected portions of those sites that will be adversely impacted. The accuracy of these data, however, are highly

Table 8. Site size along the Base of the Bluff in Area D and the Extent of Cultural Deposits Suspected to lie within the Impact Area of the Riparian Corridor.

Site No./ Temporary Site Designation	Estimated Total Site Size		Estimated Size within the Riparian Corridor		Percent within the Riparian Corridor
	Square Meters	Acres	Square Meters	Acres	
CA-LAn-62a	1,802	0.45	0	0	0
CA-LAn-62b (SR 15)	4,123	1.02	2,032	0.50	49.3
CA-LAn-211b (SR 16)	6,445	1.59	3,484	0.86	54.1
CA-LAn-211a	22,354	5.52	2,148	0.53	9.6
SR 13	2,323	0.57	2,148	0.53	92.5
SR 12	3,135	0.77	2,845	0.70	90.7
CA-LAn-193	14,574	3.60	3,426	0.85	23.5
Total	54,756	13.53	20,380	5.04	37.2

questionable since no subsurface excavation has been conducted at SR 12, SR 13, CA-LAn-193, or CA-LAn-211b. At CA-LAn-62a, CA-LAn-62b, and CA-LAn-211a limited subsurface work has been performed, but even the horizontal or vertical extents of these sites have not been adequately characterized.

Of the nearly 55,000 square meters (sq m) of suspected cultural deposits along the bluffs in Area D, about 20,380 sq m will be adversely affected by the riparian corridor. Based on Van Horn's excavations at CA-LAn-62 and CA-LAn-211, cultural deposits at these two sites vary in thickness between 1 and 2 m. If we assume that cultural deposits average 1.5 m in thickness throughout the riparian corridor, then the construction of the channel will impact roughly 30,000 cubic meters (m^3).

Two prehistoric sites, SR 1 and SR 14, have also been identified within Area D, but outside the proposed riparian corridor. Both sites lie on the slopes of the bluff face in areas that are proposed for revegetation.

Evaluating impacts for SR 1 and SR14 is complicated by property rights. At present, neither site is on land owned by MTP-PV. The sites are located on two distinct parcels that MTP-PV is entitled to acquire in separate actions. The parcel that encompasses SR 1 will be conveyed to MTP-PV in October 1993. Prior to that time the current owner's rights are restricted to the construction of slope support systems and/or storm drain and sanitary sewer improvements as may be required in connection with the subdivision and residential development of the property on the bluff top. Even after conveyance of the property the current owner retains an easement across the property to construct slope support, storm drain and sanitary sewer improvements as needed. Whether such actions will adversely impact SR 1 is not known.

The property including SR 14 (CA-LAn-60) will be conveyed to MTP-PV on February 13, 1994. Until that time the current owner maintains much the same rights as that described for SR 1. MTP-PV, therefore, cannot assure that the current condition of the site will be maintained until ownership is secured.

The Howard Hughes Industrial Complex (SR 17) will be completely destroyed as part of the Playa Vista project. Although parts of the complex have already been dismantled or abandoned and left to decay, most of the buildings retain their architectural integrity and are still being used.

Three historic artifact scatters, SR 4, SR 5, and SR 6, lie in portions of Area D slated for residential and retail development. The west half of SR 4 will be impacted by a road and the east half by residential construction. Less than a foot of fill will be placed on SR 4. In contrast, an additional 15 to 16 ft of fill will be placed on SR 5 and SR 6. Impacts to the site will be primarily restricted to areas crossed by roads.

CHAPTER 8

EVALUATION AND MITIGATION PLANS

In the preceding chapter specific sites were recommended to be potentially eligible to the National Register of Historic Places (NRHP) either as individual sites or as contributing members of historic districts. Examining proposed impacts further showed that a smaller number of sites would either be completely or partially adversely affected by the proposed undertaking. For this latter group the process must take another step. These sites must be evaluated to determine whether they are eligible for listing in the NRHP, and if so, plans must be devised to mitigate the proposed adverse impact. This step in the process form the basis of the Memorandum of Agreement (MOA) that is being developed for the project.

This chapter presents the procedures and plans that will be used in evaluating potentially eligible sites. The chapter is divided into three parts. In the first part we describe the methods and procedures that will be used in both field and analytic phases. We have attempted to be as comprehensive as possible. All methods and techniques that we envision may be used either during evaluation or, if necessary, data recovery are described. Although the direction of the research will evolve, possibly requiring new techniques and methods, the scope of this discussion is purposely broad so that the reader can evaluate the entire research thrust.

The second part of the chapter provides evaluation plans for all sites deemed potentially eligible for listing in the NRHP or as potential contributing members of an historic district. For each site a plan utilizing an appropriate set of the techniques previously described is outlined. The third section describes in a preliminary way plans for mitigation.

Field and Analytical Methods and Procedures

Mapping

Detailed topographic maps have already been prepared for the entire Playa Vista Project Area by professional surveyors from Psomas and Associates. These maps were produced using a 1 ft. contour interval with the exception of steeper terrain where the interval was increased to 5 ft. These maps were made at a variety of scales: 1:480 (1 in. = 40 ft.), 1:1200 (1 in. = 100 ft.), 1:2400 (1 in. = 200 ft.), and 1:4800 (1" = 400'). In addition, a grid arranged in 200 ft. squares and oriented to true north was superimposed over the topographic maps. The high quality and diversity of these maps will give us some flexibility in selecting base maps at appropriate scales for use in preparing particular site maps.

Tasks related to mapping include laying out excavation units (test pits and backhoe trenches) and plotting these units on the topographic maps. For consistency, we will set up a horizontal grid using metric measurements for the entire project area. The last four digits of the Universal Transverse Mercator (UTM) grid coordinates will be used in designating the location of all excavation units. In order to use the UTM grid system we will need to determine the northing and easting coordinates for a set of control points (or benchmarks) that will serve as datums for the duration of the project. Ideally, we hope to select benchmarks that will not be disturbed by later construction activity.

Because of the topographic variability, particularly in the southern portion of the project area along the base of bluff, we will use a theodolite or a similar surveying instrument to tie excavation units in to particular benchmarks. A theodolite will enable us to precisely and efficiently determine the absolute elevation above mean sea level for the surface of each excavation unit and each excavation level. The use of absolute elevations is important for two reasons: first, it will make it easy to compare the topographic setting between sites across the entire project area; and secondly, it will prevent confusion that might result from simply using relative measures such as depth below surface for excavation levels. Because the landscape at certain locations has been greatly altered during recent times, especially in areas where much of our work will be focused, the existing surface commonly bears little resemblance to occupational surface(s) that were previously utilized by prehistoric populations. Most of these modifications are related to fill being redeposited in some areas, and thereby partially or totally obscuring the previous surface. In these instances the depth below the existing surface is really an artificial measure. The use of absolute elevation readings should solve potential problems that could arise from using a relative measurement system.

Surface Collection

Surface collections will be made at sites where the occupation surface is not totally obscured by historic overburden or vegetation. At sites where the artifact density is diffuse, all observed remains will be point-provenienced and collected. If the artifact density is moderate to high, a total surface collection is not warranted since an adequate artifact collection for evaluating the site can be obtained with a sample. In these instances, after gridding the area into 25 x 25 m blocks, we plan to use a systematic sampling procedure whereby only a 10 x 10 m square is collected from each 25 x 25 m block. This sampling method would result in a 16 percent sample.

Mechanical Excavation

Mechanical excavation will be a major component of the testing program. The following types of heavy equipment will be needed: a backhoe with a front end loader, and Giddings soil tester or some other similar type of coring device. These machines will be used in documenting the stratigraphy and delineating the site boundaries.

Backhoe Trenches

A series of backhoe trenches will be excavated during the testing phase as a means of stratigraphic documentation. The trenches will also facilitate the collection of various samples, such as soil, pollen, phytolith, and flotation. Trenches will be limited to those areas where archaeological sites are believed or known to exist. This effort will be concentrated in areas with the greatest potential for buried cultural deposits. We plan to use a backhoe with a 3 ft. (ca. 0.9 m) wide bucket. A backhoe, such as John Deere 510 C or its equivalent, should be sufficient to complete the work. An archaeologist will monitor the entire backhoe operation. The monitor will watch each bucket load that is removed to prevent needless damage to cultural features or human burials that might be exposed. All federal, state, and city regulations pertaining to excavation will be strictly adhered to during the backhoe trenching. Because the depth of the overburden is reportedly as thick as 20 ft. (6.1 m), some places (for example, at CA-LAn-62B) cannot be trenched without stripping off the overburden.

Each backhoe trench will be dug to a depth between 1.5 and 2 m below the bottom of the overburden. In areas where cultural deposits are identified, we will need to define the maximum depth, even if it is below 2 m. To achieve this goal we may need a special permit from the City of Los Angeles to excavate below 7 ft. (ca. 2.1 m). Nonetheless, we plan to reach the bottom of all cultural deposits unless this depth poses an undo risk. For example, the walls of trenches excavated in sandy sediment and/or saturated deposits can easily cave in. In these instances we may be precluded from excavating to the needed depth because of safety concerns. It is important that the bucket be placed into the trench and removed with care to prevent any unnecessary disturbance to the profile. The trench profiles need to be relatively smooth to minimize the manual effort of troweling while searching for cultural deposits, and features, and artifacts.

Several factors limit where backhoe trenches can be placed, at least without a monumental effort to strip off the overburden. Consequently, much of the trenching will probably be postponed until the grading activity associated with construction begins. Because much of the surface that was once available for occupation by aboriginal populations is deeply buried by historic fill, it will not be possible to delineate site boundaries with trenching alone. An important determining factor in where trenching can be conducted along the corridor relates to the location of the lower boundary of the toe slope below the bluff. Because of municipal restrictions limiting excavation into the bluff, the toe slope cannot be modified in any way. Consequently, in certain instances in may not be possible to define or estimate site boundaries with trenches.

If hazardous materials such as noxious, caustic, corrosive, and toxic chemicals, are encountered during the stripping operation, all workers will vacate the immediate area and notify their supervisor. The supervisor will then contact the appropriate authorities so that the contaminant can be tested for its chemical composition as soon as possible.

Some areas within the proposed corridor are now covered with asphalt slabs and other modern debris such as piles of concrete chunks. A backhoe or other type of heavy equipment will be used to remove some portions of the asphalt and debris so that trenches can be excavated. Other sections of the corridor are covered by buildings, a paved road, and a water retention basin. Several of these modern features are still in use and cannot be disturbed during the initial testing program. In these instances we may need to return at a later date for trenching.

Coring

Coring will be used primarily to delineate site boundaries. In addition, an east-west transect of cores will be extracted for geologic purposes in documenting the evolution of the Ballona lagoon. Coring is particularly useful for documenting the vertical dimension (that is, the stratigraphy) of cultural and natural deposits, but it is less useful for identifying the horizontal variability within a particular stratum. Coring has the advantage of being essentially nondestructive and less costly relative to other methods of subsurface testing such as trenching.

We plan to use a CME continuous soil sampling system, Giddings soil tester, or another similar type of coring device. These types of coring devices can be used to remove 2 in. (5.1 cm) or 3 in. (7.6 cm) sections. Because the core sections can be removed in solid segments within acrylic casings, the core remains intact and can be used to obtain other samples such as soil and pollen samples. This characteristic of coring is in marked contrast to augering, in which case the sediment becomes mixed to some degree, making it difficult or impossible to avoid contamination. The depth and vertical orientation of all core sections will be noted by measuring the depth of the bore hole after removing each segment. This process involves inserting a tape measure into the bore hole after each extraction and recording the results. By doing so, the effects of compaction can be taken into account. Sediment with a lower bulk density is subject to greater compaction during coring.

The extent to which coring will be used will depend largely on how reliably cultural deposits can be identified. If the boundary between particular strata and/or soil horizons, particularly those at the top and bottom of cultural deposits, is distinctive, then these boundaries can probably be identified in the cores. If, on the other hand, the boundaries are gradual or diffuse, then coring may be insufficient defining site boundaries. For example, if one is trying to delineate the boundary of a shell midden, and the midden contains a sufficient density of shell and/or artifacts, and these materials are embedded within a distinct sedimentary matrix, then in all likelihood, coring should provide an adequate means for delineating site boundaries.

Decisions regarding whether to core or trench or use a combination of the two at a particular site will ultimately depend on the extent of sampling, objectives, access, and the impact that development will have on specific properties. Because the primary objectives of the entire subsurface testing program center on the delineation of site boundaries and assessing the integrity and research potential of specific cultural deposits, the strategy will be finalized while in the field on a site by site basis. To meet the above objectives, it is not possible to devise a logical sampling design without first knowing what one is looking for. Some flexibility in the subsurface testing program is critical if the objectives are to be met in a meaningful, timely, and efficient manner.

Trench Profiling

Activities related to profiling are relatively straight forward. The specific tasks and procedures involved in documenting the stratigraphy are described in the following discussion.

Troweling

The profile of at least one side of each backhoe trench will be carefully troweled in searching for artifacts, cultural deposits, and features and in preparing profiles to be photographed and drawn. All cultural features and noteworthy artifacts that are found while troweling will be marked with flagging tape or pin flags to ensure they will be recorded.

Photography

A representative sample of trench profiles will be photographed to provide a permanent record of the findings. These profiles will be documented with 35 mm film, including both color slide and black and white print film. Photographs will be taken of all cultural features that are identified. In addition, the most important profiles will be photographed by taking a series of overlapping close-up shots to provide full coverage. A scale and a menu board identifying the trench number, date, and any other needed information will be included in each photograph. The subject of each photograph will be noted on photographic record forms for each respective roll number.

Illustration

A representative sample of trench profiles will also be illustrated. These profiles will be drawn at a 1:50 scale (1 cm = 50 cm) on metric graph paper. The location of all strata, soil horizon boundaries, cultural features, noteworthy artifacts, and visible disturbances (e.g. animal burrows and root molds) will be depicted. In addition, the location of all soil, pollen/phytolith, and flotation samples will be plotted on the profile drawings.

Stratigraphic Description

Each trench profile will be described with findings of cultural significance identified. All cultural deposits and features will be described in detail. The depositional history of each stratum will be noted. When possible, strata thought to represent redeposited overburden will be distinguished from those resulting from aeolian, alluvial, and colluvial deposition or any admixture thereof. (These stratigraphic assessments may sometimes need further confirmation through specialized sediment analyses in a laboratory.) In addition, a representative sample of soil profiles will be formally recorded using the master horizon designations and subscripts suggested by the USDA Soil Conservation Service. Each soil horizon will be described in terms of its Munsell color, texture, structure, consistency, boundary type, and any special features that are observed such as concretions and mottles.

Sample Collection

A variety of samples will be obtained from the backhoe trenches. These samples include soil, pollen/phytolith, flotation, and artifacts. In addition, all sizable pieces of charcoal will be saved. Each type of sample will be collected using specific column sampling procedures. The specific location of the sampling column within a particular trench profile will be chosen by selecting the least disturbed portion of the trench profile. For example, zones that have been visibly altered by bioturbation processes will be avoided as much as possible to minimize the effects of contamination.

Soil samples will be taken vertically at 5 cm intervals by skipping every other 5 cm level (e.g. 0-5 cm, 10-15 cm, 20-25 cm, etc.). A 200-gm soil sample will be extracted using a stainless steel scoop. When a stratigraphic or soil horizon boundary is found to intersect the 5 cm sampling location, subsamples of each zone will be taken. Each soil sample will be placed in a tear-resistant bag made of unfilled, bleached muslin, a cloth bag that will allow the sample to dry.

Special soil samples will occasionally be saved for radiocarbon dating. Organic-rich samples, from both on- and off-site locations, will be collected. In these instances a 2-kg sample will be removed with a clean trowel, sealed in aluminum and then placed in a Zip-loc bag. These samples will be taken from the top and bottom of A horizons. If a particularly thick A horizon or peat deposit is encountered, samples will be taken at relatively tight intervals, possibly every 10 cm.

Pollen samples will be collected in a similar manner to the soil samples except that a larger sample, approximately 500 gm will be saved. Pollen samples will also be removed with a scoop. The scoop will be rinsed with distilled water after each sample is extracted to minimize the possibility of contamination. Whirl-Pak bags, a type of sterile polyethylene bag that is air and moisture tight, will be used for pollen samples. Pollen samples will be placed in the bag as quickly as possible and the bag will not be left open any longer than necessary to limit contamination with pollen rain.

Flotation samples will be collected from trench profiles in areas where cultural deposits are encountered. These samples will be taken from a 25 by 25 cm column in 10 cm intervals, and then placed in plastic bags. In addition, a flotation sample will be obtained from all cultural features identified in the trenches. All noteworthy artifacts (for example, projectile points, groundstone, and shell tools or ornaments) and charcoal fragments exceeding about 1 gm in size will be collected.

Manual Excavation

The manual excavation process entails the following tasks: excavating the fill, transporting it to the screens, screening, documenting the profiles, collecting samples, and backfilling the test pits. The various procedures involved in carrying out these tasks are reviewed in this section.

Excavation

All test pits will be laid out using metric coordinates tied in to a comprehensive grid system encompassing the entire Playa Vista project area. Each excavation unit will be designated by the northing and easting coordinates of the southeast corner of the test pit. A variety of unit sizes will be excavated during the testing phase including 1 x 1 m, 1 x 2 m, and 2 x 2 m test pits.

It is a distinct possibility that human skeletal remains will be encountered during the excavation. If human burials are found, they will be treated in accordance with all federal and state laws. Any such remains will be treated with utmost care and respect.

Test pits will be dug in arbitrary 10 cm levels and each level will be numbered consecutively from the surface to the bottom of the pit. If natural stratigraphic breaks are discerned while excavating, then the arbitrary levels will be subdivided. For example, the uppermost stratum within Level 1 would be designated as Level 1A and the lower stratum as Level 1B. The elevation range (m above MSL) of each excavation level will be noted on the level form and included as part of the provenience information on each artifact bag. After each excavation level has been completed, a double-headed nail that has been dipped in yellow paint will be placed in each corner. These yellow nails will aid in drawing the profiles and in cross-referencing the stratigraphy depicted in photographs with the arbitrary 10 cm levels.

Transporting Fill

At sites where we plan to waterscreen, the fill will be loaded into wheelbarrows and transported to the waterscreening area. At other sites where we plan to dry-screen, however, wheelbarrows will not be needed since the fill can be shoveled directly into the screen. Because waterscreening will be used at most sites, the transportation process will be time-consuming unless the waterscreens are placed in close proximity to the excavation areas. To minimize the labor required in transporting the fill, we plan to set up a waterscreening operation in the southwest portion of Area D, the area where most of the excavation effort is anticipated. While working in excavation areas closer than about 150 to 200 m from the waterscreens, wheelbarrows can be transported manually to the screens. Wheelbarrows will be transported to the screens by vehicle while working in more distant areas.

Screening

To greatly increase the efficiency of the screening process, the bulk of the excavated fill will be waterscreened. A few sites, particularly those located far from the waterscreening operation and those containing sandy deposits, will be dry-screened on-site. Regardless of whether waterscreening or dry-screening is used at a particular site, 1/8 in. (0.3175 mm) mesh hardware cloth will be used at all prehistoric deposits. Because small remains such as shell beads and fish vertebrae are expected at many of the cultural deposits, the 1/8 in. mesh, a relatively small mesh size, is required to ensure that important chronological and subsistence data are not lost.

In contrast, screens with 1/4 in. (6.35 mm) mesh hardware cloth will be used when excavating historic deposits. This size is considered appropriate since our main objective in excavating these deposits is to retrieve chronological indicators such as glass and ceramics, and the 1/4 in. mesh should be sufficient for this purpose.

Profiling

At least two contiguous profiles of each test pit will be illustrated. These profiles will be be prepared in a similar manner to the trench profiles, except that the scale will be adjusted as needed to depict the stratigraphy. Because of the smaller size of the test pits, the profiles will be drawn at a scale of 1 cm = 10 cm or 1 cm = 20 cm. Schematic composites linking the stratigraphy of test pits placed across each cultural deposit will be also be prepared.

Sample Collection

Several types of samples will be collected from various test pits. Each of these samples will be collected in a similar manner to those obtained from the backhoe trenches (see previous discussion). Samples will be saved from portions of the test pit profiles that appear relatively undisturbed. Each sampling location will be depicted on the profile drawings. A 25 x 25 cm flotation column will be removed from the profile of the southwest corner of each test pit unless this part of the profile is visibly disturbed. If disturbed, the column will be repositioned nearby to an intact portion of the profile. Soil samples and pollen/phytolith samples will be saved from a representative sample of test pits.

Backfilling

After the test pits have been excavated and fully documented each pit will be backfilled. Most of the excavation units will be backfilled with a front end loader. Some pits, particularly those placed where there is difficult access for heavy equipment, will be backfilled manually.

Field Check-In Procedures

It will be the responsibility of the crew chiefs to collect all artifact bags and other samples from their crew members at the end of each day. The crew chief will ensure that these materials have been completely and accurately documented. Errors or omissions will be rectified at that time. The crew chief will then complete the provenience and bag inventory sheets. Upon completion, these records, artifact bags, and other samples will be turned over to the laboratory director who will then be responsible for these materials.

The crew chief will check these materials in according to the following procedures. All artifact bags will be sorted according to provenience. Likewise, all project notes will be arranged according to the site number and provenience. Artifact bags will be given an item number. The item number is a consecutive and unique number that will be assigned in a unique sequence for each site. This provides each bag with its own unique number, which will later be used to link the contents of the bag to the provenience data. A specimen sheet will be used to record the item number, the appropriate provenience number, and the bag contents according to broad artifact classes.

Empty bags will be submitted and recorded for those proveniences yielding no artifacts. Even though artifacts may not be recovered from certain proveniences, these proveniences will be included on the specimen log. The empty bags will be labeled with the appropriate provenience information, but will not have any information under material type. These bags will be clearly labeled as containing "0" artifacts under artifact number. This will ensure that all proveniences have at least one bag associated with them. Based on previous experience, this method is helpful in later differentiating between those proveniences lacking artifacts from those proveniences for which the artifact bags were simply mislabeled.

Laboratory Organization and Procedures

A field laboratory will be set up on the Playa Vista property. The laboratory will be organized to ensure rapid and accurate processing of all project materials. After the initial processing, materials will be analyzed and then temporarily stored at the field laboratory until the completion of the project. At this time materials will be transferred to the permanent curatorial facility to be selected later.

Laboratory processing will be completed in a timely manner to ensure that the project schedule is maintained. The basic inventory and processing is expected to approximately keep pace with the field work, with a slight lag time. Upon completion of the basic inventory, those materials to be analyzed will be supplied to the various specialists.

The analyses of the materials will be conducted by a number of specialists, some of whom maintain their own laboratory facilities. When possible, materials will be analyzed either at the field laboratory or at a laboratory in the Los Angeles area. Some materials, however, such as soil, pollen, and radiocarbon samples, may have to be sent outside of Los Angeles for analysis. In these instances inventory control over the collections is essential so that the location of materials and the progress of the analyses can be closely tracked. To accomplish this objective, a relational database system will be used.

The specialists will be responsible for their portions of the laboratory work. Each respective specialist will be provided with an inventory of all materials submitted for their analysis. In addition, the appropriate contextual data will be supplied to the various specialists so they will have the background information necessary for their analysis. Upon completion of their analysis, specialists will return all remaining samples and copies of the analysis sheets to the field laboratory. It should be noted that some items may be destroyed (e.g. charcoal to be radiocarbon dated) as part of the analytical procedure. In these instances a complete inventory of such items will be provided and this information will be compiled as part of a data compendium.

Laboratory Check-in Procedures

Although it is responsibility of the crew chief to submit properly completed field records and bagged artifacts to the laboratory director, some mistakes can be expected. By having the field laboratory set up in close proximity to areas where the field crews will be working, there is a built-in mechanism to correct errors that are made. There will be continual feedback as needed between the crew chiefs and the laboratory director. Consequently, mistakes relating to bags being filled out incorrectly should be relatively easy to solve. Once materials have been received in the laboratory, they will be inventoried before being cleaned, sorted, and cataloged. This inventory list will be checked against items received to ensure that all materials have been accounted for. After materials have been checked in, the proper care of these materials becomes the responsibility of the laboratory director. The laboratory director will organize and maintain the records.

Washing

Although most of the materials recovered in the field will have already been water screened before they are transferred to the laboratory, some materials will probably require further cleaning before they can be analyzed. Certain fragile items will not be washed at all to prevent any unnecessary deterioration. Cleaning will be conducted in a way that minimizes physical and/or chemical destruction.

Lithics will be routinely subjected to washing with the exception of in situ groundstone and samples to be submitted for blood residue analysis. Only specimens that have not been recovered by waterscreening are candidates for blood residue analysis. Any samples to be submitted for this type of analysis will be collected and placed immediately into polyethylene bags with a minimum amount of handling.

Well preserved bone and shell will be washed, but these items will only be immersed in water for only a short period before being slowly air-dried. Bone and shell that are too poorly preserved to withstand washing will be dry-brushed. Any human skeletal remains that might be recovered will always be cleaned by dry brushing.

A code will be included to indicate the cleaning procedure applied to each item. This code will be entered into the computer catalog.

Sorting

Artifacts from a given provenience will be sorted in the laboratory according to major artifact classes (for example, chipped stone, groundstone, shell, animal bone, etc.). Artifacts will then be rebagged as needed. Based on experience at similar sites to those expected in the Playa Vista project area, sorting is one of the most time-consuming laboratory procedures. To ensure that materials are reliably, consistently, and efficiently sorted, only a few of the laboratory technicians will be responsible for undertaking this particular task. Experience, patience, and concentration are required so that small materials, especially shell beads, are observed and correctly sorted.

Additional bags will be filled out and new item numbers will be assigned for each artifact class. The appropriate information will then be recorded in the computerized catalog record.

Cataloging

All artifacts will be cataloged according to methods outlined by the curatorial facility. Because this facility is yet to be selected, the cataloging procedures cannot be specified at present. Once a curation agreement has been finalized, it will be the responsibility of the laboratory director to ensure that the cataloging requirements are met. Nonetheless, many of the general procedures can be stated, and these are reviewed in the following discussion. If any of these procedures are in conflict with those specified by the curatorial facility, the procedures will be remedied as needed.

All bags will be labeled with a site number, provenience information, and a provenience number (the provenience number serves as an abbreviation for the provenience information). Each bag will also be given a unique item number, a number that will begin with one and run consecutively through the project. In general, most artifacts will be stored in plastic bags that can be sealed with a string. Provenience and catalog data will be recorded on acid-free cardstock stamped with the appropriate information. This cardstock will serve as a label for each bag.

The items numbers generally will be assigned to all artifacts from a single bag that will then be sorted according to the various artifact classes. For example, a bag of chipped stone artifacts will be assigned a single item number. Individual items, for example projectile points, may be assigned their own unique item number. All objects that are removed for special treatment, or illustration, will receive their own unique item number. This will facilitate tracking of these items using the computer database. It will also assist in retrieving specific items if the collections are re-examined by analysts in the future.

Artifacts will be counted by the cataloger, and this number will be recorded on the bag label. This information will subsequently be entered into the computerized catalog record. Although this number may not always agree with the final counts made later by the analyst (for example, the lithic analyst commonly tosses out materials determined not to have been culturally modified), it will be helpful to have approximate counts to assist in designing an adequate sampling procedure in deciding which particular artifacts will be submitted for analysis.

Flotation

Flotation samples will be processed using a water-separation technique. The primary requirement of the system used is to ensure that the fragile plant materials contained in the flotation samples are immersed in the water as briefly as possible. We will use a mechanically assisted flotation device whereby a jet of water within the flotation tank is directed toward the bottom of a fine mesh screen containing the flotation sample. The mesh size of the screen used to capture the heavy fraction will be only as large as necessary to permit the sediment to pass through. For example, with clayey or silty sediment the mesh size will be as small as 0.4 mm, but with sand and gravel, the openings often needs to be increased to between 0.6 mm and 1.0 mm (Wagner 1988:21). The light fraction will be captured by decanting the overflow into a fine-mesh sieve or cloth.

After the flotation sample has been processed, the light fraction double-bagged in durable paper bags to allow moisture to evaporate from the samples. Processed samples will be air-dried before storage in polyethylene bags. All bags will be labeled with two cards, one attached to the exterior and one placed inside.

Temporary Storage of Materials

Materials will be separated and boxed in the laboratory prior to analysis. They will be carefully packed in way to prevent the various samples from being unnecessarily damaged. Materials will be sorted and boxed initially by material class. Within each material class, the items will be sorted and boxed according to site, feature, and provenience unit, and in case of samples taken from off-site locations, simply the provenience information. These materials will be inventoried at that time and the appropriate data then be entered into the computerized catalog record. The catalog record will include the item number, the artifact class, the number of artifacts, and some cases, comments will be added.

Data Entry

The basic provenience data will be maintained in a separate file with a single number being assigned to each separate provenience. This number will serve as a unique abbreviation for the provenience data. As previously mentioned, the provenience number will be assigned and recorded in the field by the appropriate supervisor who will place this number on all bags, documents, and other project materials related to that provenience. Written provenience information will also be recorded on all project materials. This system will provide a check for ensuring that the proper provenience information is recorded along with the appropriate project materials. At a minimum provenience data will include the site number, location of the collection unit, usually in grid coordinates, test pit or collection unit number, feature number, and when relevant, the level and elevation information.

One advantage of using a relational database is that by assigning a unique number to identify each provenience, provenience information can be entered once into the database, and the number used to cross-reference all other appropriate data to that provenience. This not only saves data entry time, but it reduces the number of errors by limiting the amount of information that must be recorded to define a provenience.

Most analyses will be conducted using forms designed for computerized data entry. The resulting data will then be entered into specialized database files designed for each analysis. For example, the lithic analysis will at a minimum be comprised of data files consisting of debitage, tools, cores, basal grinding stones, handstones, and miscellaneous groundstone.

The project database will be maintained on MS-DOS computers at Statistical Research's field laboratory. Backup copies of the database files will be kept on a regular basis to ensure that a minimum of effort is lost in case of system failure. Since the database will be updated on a daily basis, incremental copies of daily changes and additions will be kept at the end of each day in which data entry or other modifications of the database occur. The entire database will be backed up weekly on tape backup.

Upon completion of the project, the information from the database will be translated into ASCII. This database will include all provenience information, a catalog record for the project, and all important analytical database files. Appropriate documentation will be included with the database. The result will be a set of files that can be used on any computer with a relational database.

Sample Transmittal

The laboratory director will be responsible for transmitting those samples (for example, radiocarbon, flotation, and soil samples) that will not be analyzed in the field laboratory to the appropriate specialists. An inventory of all samples shipped out for analysis will be kept.

Maintenance of Documentation

The documentation for the project will include the original field and laboratory notes, maps, photographs and other materials. The records will be maintained at either the field office or laboratory by the project director, assistant project director, and laboratory director. Particularly critical information will be duplicated and stored elsewhere to prevent the loss of irretrievable data, the possible result of a fire or other natural disaster.

Field and Laboratory Records

The original field and laboratory records will be maintained as part of the permanent project records. The field records will be organized by site in a series of notebooks. Each notebook will be further subdivided by collection unit (for example, by feature, test pit or surface collection unit). The crew chiefs, assistant project director, and project director will responsible for compiling and organizing these records.

Laboratory records will be maintained by the lab director. The laboratory records will include a listing of all project materials, records of any special processing conducted on project materials, and a complete listing of any project materials sent to specialists for analysis. Whenever possible, these records will be maintained in the computer database.

Photographic Collection

The photographic record will be maintained by the project director. This collection will include all black-and-white prints and negatives, and color slides, along with appropriate documentation. All photographs will be recorded with basic provenience information and orientation from which the photograph was taken. Menu boards, a metric scale, and a north arrow will be included whenever necessary. High quality, stable chemical processing will be used for all photographic materials. The photographic record will be maintained in notebooks using archival quality slide and film holders. Each set of photographs will be accompanied by a copy of the photographic record. Individual slides and prints will be labeled with their catalog numbers.

Map Collection

The map collection will be maintained by the the project director. Plan maps and profile drawings will be kept with the appropriate field notes in notebooks arranged by site. Larger maps such as site maps and other miscellaneous maps of the proposed development areas will be stored in map cases or portfolio holders.

Analytical Procedures

A number of analytical tests will be conducted in documenting the various artifacts, subsistence remains, and environmental indicators that are recovered. We anticipate collecting many more samples during the testing phase than will analyzed in their entirety, at least prior to completing the testing report. After completing the fieldwork, an appropriate sampling procedure will be designed for analyzing the various materials. This sampling design will be aimed largely at documenting the diversity of materials in relation to the stratigraphic integrity of certain cultural deposits so that the research potential of specific archaeological sites can be assessed.

Lithic Analysis

Lithic analyses will be conducted to meet five goals. The first is simply to describe the lithic reduction technologies present. The second is to examine the use of various types of raw materials, and potential sources of this raw material. The third is to delineate changes through time in the reduction technologies and/or raw materials. The fourth is to examine intersite variations in the distribution of lithic artifact classes and the covariations of the reduction technologies and raw materials. The fifth is to examine the intrasite variation in the distribution of lithic artifact classes, reduction technologies, and raw materials.

Lithic analyses will proceed from general assemblage characteristics to specific attributes of particular tool classes. At the most general level the entire collection will be characterized by the raw materials used. Reduction strategies will then be examined through a study of the debitage and tool types produced. At the most refined level the analysis will examine specific tool categories.

Because of their durability, stone artifacts generally require less care than do more fragile items. Chipped stone artifacts will be washed, unless there are pigments or other visible residues adhering to the artifacts. In such cases, the artifact will be cleaned by dry brushing, with extreme care to avoid removing the pigments. Similarly, groundstone artifacts will be washed unless specimen is encountered that could yield pollen. A pollen wash following standards and procedures set by the palynological laboratory will then be followed.

Most stone artifacts will be labeled in lots, with the item number being assigned to each lot. Large or unique artifacts, as well as any artifact which receives special treatment or is illustrated, will receive its own unique item number.

The lithic analysis is designed to conform, as nearly as possible, to the categories used by previous analysts who have previously worked at nearby sites (Towner 1991; Van Horn 1982, 1983, 1984a, 1987; Van Horn and Murray 1984, 1987). Any differences that occur will be due either to the special needs of the Playa Vista Archaeological and Historical Project, or to differences of opinion regarding which particular attributes should be recorded, and how these should be coded.

Specialized Lithic Raw Material Analyses

In addition to raw materials that will be described macroscopically during the lithic analysis, some samples will be subjected to more rigorous analysis.

Petrography

Petrographic analysis will be conducted as a means of determining the type of lithic raw material. This analysis will focus on raw materials, that cannot be accurately identified macroscopically, particularly those materials that have implications for trade or long distance travel.

Reliable petrographic analysis relies on the preparation of high-quality thin sections. The proper pretreatment consists of oven-drying the sample, impregnating the sample with an epoxy resin, and grinding the thin section with a diamond saw. The sample is then examined with a microscope and described. Characteristics such as the arrangement and size of voids, the crystalline structure and mineralogy, diapheny, type of weathering rind, and presence of particular inclusions are examples of diagnostic criteria that can be used in isolating a particular raw material source.

Obsidian Sourcing

Based on the recovery of obsidian at other sites in the Ballona area, we expect that obsidian will be found during the Playa Vista Archaeological and Historical Project. Because obsidian is not known to occur in close proximity to the project area, and because obsidian sources can be pinpointed with some accuracy, it may be useful to identify the sources of obsidian that are recovered to better understand aboriginal travel and trade networks. Obsidian sourcing can be reliably determined only by using trace element analysis to identify the suite of elements that are diagnostic of a particular source. The trace element analysis will be conducted at the Department of Geology, University of California, Davis. This work will be performed on a Kevex 0700 energy dispersive X-ray fluorescence unit, using a rhodium (Rh) tube with a 0.05 mm rhodium filter at 30 kilovolts and 0.05 milliamps to analyze for rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), niobium (Nb), lead (Pb), and thorium (Th). The unit has a Si(Li) detector and is used in conjunction with a Kevex 8000 multichannel analytical spectrometer.

Blood Residue Analysis

A sample of groundstone, pecked stone and chipped stone artifacts will be collected and submitted for blood residue analysis. This technique will used in determining if particular lithic artifacts were used in hunting, butchering, or otherwise processing faunal resources for subsistence. Lithic samples will be treated with a 1 to 5 cc solution of ammonium hydroxide and the solution will be placed into a tightly sealed plastic container that will then be put inside a Whirl-pak bag. A chemstrip will be used to detect the presence of blood residues such as serum albumin and hemoglobin. In order to test whether or not positive readings are the result of contaminants (for example, bacteria, alkaline soil, or manganese), soil samples from both on- and off-site will also be analyzed as control samples.

Shell Analysis

A sample of the shell subsistence remains and all shell tools and ornaments will be analyzed. Because many of the sites to be tested in the Playa Vista project area are shell middens or scatters, the analysis of bivalves and gastropods, particularly subsistence remains, will be a major component of the testing report. Subsistence remains will be described in terms of their taxa, with the primary goal being to determine which particular marine and brackish water habitats were exploited and to what degree these environments were relied on. We will also compare the results to other sites that have been previously excavated in the area.

The analysis of shell ornaments and artifacts will be aimed at adequately describing these remains and determining their function. Because of certain types of shell beads are good chronological indicators, much of the analysis is expected to focus on them. Shell beads will analyzed according to commonly used criteria, and the collections as a whole will be examined in reference to previously established seriations.

Human Skeletal Remains

If human skeletal remains are encountered during the Playa Vista Archaeological and Historical Project applicable Federal and State laws will be followed. The remains will be analyzed by a qualified physical anthropologist as close to the project area as possible. The types of analyses that are warranted will depend on the sample size. For example, if a sufficient sample size is obtained, then it may be possible to reconstruct mortuary patterns and study the population as a whole using techniques such as non-metric trait analysis for determining biological distance from other populations, dietary reconstruction, and analysis of pathologies as an indicator of adaptive efficiency. If the sample size is small, then the study of human skeletal remains will be limited to descriptive analyses such as determinations of age, sex, and general health conditions. In addition to physical attributes, grave goods will be used to examine topics such as social organization and craft specialization. After the analysis all human skeletal remains and associated grave goods will be reburied in a place and a manner acceptable to representatives of the Gabrielinos.

Faunal Analysis

Similar to the analysis of shell subsistence remains, the primary goals of the faunal analysis are to identify the species present, determine their relative abundance, and then reconstruct the relative importance of various food sources derived from terrestrial, freshwater, and marine environments. The faunal material will be identified to the lowest possible taxon, preferably to the genus or species. Identifications will be made using a number of published references, unpublished data. When necessary, comparative collections will be consulted to identify certain animal bones that cannot be determined by other means. Butchering marks and other types of bone modification will also be recorded. Bone tools will be analyzed, concentrating on a determination of their function.

Paleobotanical Analyses

Flotation and pollen/phytolith samples will be be collected from the soil for the purpose of extracting paleobotanical remains. These samples will be used in an attempt to determine which plants were utilized by aboriginal populations who once exploited the wetland environment of the Ballona.

Macrobotanical

These samples will be obtained through the flotation of soil samples and through the recovery of large items noted during screening. After the flotation samples have been processed in the laboratory, a portion of those producing carbonized plant remains will be analyzed. The samples will subsampled by first dividing the total sample volume into a series of five particle sizes that will be summed in the final presentation. The largest particle size class will be completely sorted, and the contents identified. For the remaining four particle size classes, a standardized subsample will be taken. This subsample will consist of the amount of volume "that can be packed, but not piled, contiguously under a field of view for each particle size" (Bohrer and Adams 1977:40). As the sorting of each subsample proceeds, the number of taxa identified will be charted against the increasing sample size. When no new taxa have been identified after the examination of two consecutive subsamples, the subsample will be considered complete. This subsampling strategy is modeled after the "species area curve" approach developed by ecologists to evaluate when field sampling of plant diversity may reasonably be curtailed (see Mueller-Dombois and Ellenberg 1974:52-53).

Pollen/Phytoliths

We plan to use a heavy liquid extraction technique in processing both pollen and phytoliths. Phytoliths will then be isolated from 5-gram samples using a standardized procedure developed by Bozarth (1985), based on heavy-liquid flotation and centrifugation. A modified heavy-liquid flotation procedure will be employed to concentrate the pollen (Johnson and Fredlund 1985; Fredlund 1986). The standard procedure consists of five steps: 1) the removal of base soluble organics, colloidal organics, and clays through treatment with sodium pyrophosphate (0.1 molar solution), centrifugal separation, and decantation (checked through a 7-micron mesh filter membrane to ensure no pollen is decanted), 2) removal of carbonate with dilute hydrochloric acid, 3) heavy-liquid fractionation of pollen and other silt-size organic particles from the heavier clastic mineral fraction in a zinc bromide solution (three flotations at specific gravity 2.00 are used typically), 4) dehydration of light, pollen bearing fractions with butanol, and 5) storage of the residue in silicon fluid (viscosity ca. 2000 c.s., refractive index ca. 1.45).

Permanently mounted microslides of the residues suspended in the silicon fluid will then be systematically searched using a Leitz research-grade photomicroscope. A minimum of two slides are studied for each sample. A known number of exotic spores will be introduced into each sample during the initial stage of pollen extraction. One tablet of *Lycopoduim* will be added to each sample as a means of estimating the total number of native pollen and spores recovered per unit volume of sample, and to verify extraction techniques in case the sample does yield pollen.

Soil Analyses

Soil samples will be obtained for at least two types of geomorphic analysis during the testing phase, particle size analysis and pH testing. A sufficient quantity will be collected so that other analyses, such as mineralogical studies, can be conducted if this information is later deemed necessary. Many more samples will be collected than will actually be analyzed. By assembling an ample collection, there will be flexibility in devising an appropriate sampling scheme.

Particle Size Analysis

Samples will be collected in the field for particle size analysis. This technique will be used to aid the stratigraphic interpretations. For example, particle size analysis may be helpful for correlating between stratigraphic units, determining depositional environments, and reconstructing the degree of pedogenic development. A selected sample will be taken from appropriate soil horizons and from sedimentary strata. Each sample will consist of approximately 200 grams of soil. Particle size analysis will be conducted at the soil laboratory at Statistical Research's main office in Tucson using the pipette and sieve methods described by Day (1965).

Soil pH Testing

Soil pH, a measure of the activity of ionization H (H+) in the soil solution, is defined as the negative logarithm to base 10 of the H ion activity. Whether a soil is acidic, neutral or basic largely determines the solubility of various compounds, the relative bonding of the ions to exchange sites, and the activity of various microorganisms.

Because soil pH affects the preservation of certain materials, pH determinations are often helpful for explaining why particular types of material are poorly preserved or even absent from a particular cultural deposit. Subsistence remains such as shell and animal bone and paleoenvironmental indicators such as pollen are only preserved under specific acidic or alkaline conditions. For example, basic soils tend to destroy or degrade pollen, whereas acidic soils can quickly destroy shell and bone. Soil pH is also useful in interpreting the stratigraphy of cultural as well as natural deposits.

Soil pH will be determined by using a 1:1 soil to distilled water solution. The solution will be stirred periodically for one hour so that the solution can come to an equilibrium with the CO_2 in the air at existing concentrations in the laboratory. After one hour, two pH readings will be recorded and averaged. The readings will be taken using a electrode and a portable pH meter with an accuracy of at least 0.1 pH unit. The pH meter will be routinely calibrated with standard pH buffer solutions with pH values of 4, 7, and 10.

Chronometric Analyses

During the course of the testing phase, we anticipate that several types of chronometric samples will be collected, mostly radiocarbon samples. A sample of obsidian artifacts that are recovered may be analyzed using obsidian hydration. These two types of chronometric samples each require specific treatment procedures, and these are described in this section.

Radiocarbon

Radiocarbon samples in the form of charcoal, shell, and soil humates will be collected. These samples will be collected in the field, and wrapped in aluminum foil to protect them from contamination. The samples will be air-dried under controlled conditions in the laboratory and then initially processed to remove contaminants such as roots. After completing this pretreatment procedure, appropriate samples will be submitted to the Balcones Research Center, Radiocarbon Laboratory of the University of Texas. An additional radiocarbon laboratory might be used for dating especially critical samples as means of corroborating some samples. Samples submitted for radiocarbon dating will be destroyed in the analysis process. The destruction of these samples will be recorded in the database by the laboratory director. Samples not submitted for dating will be stored as voucher specimens that can be analyzed at a later date.

Obsidian Hydration

Obsidian hydration is a dating method based on measurements of the thickness of a hydrated layer formed on freshly flaked surface of obsidian. The thickness is then related to age calibrations that have been previously developed by cross-dating methods. Obsidian hydration is sometimes applied in dating and correlating cultural deposits such as shell middens. This technique may be particularly useful at deposits containing indistinct stratigraphic layers, especially those where little charcoal is recovered.

Historic Analyses

Two types of historic analyses will be conducted, historic artifact analysis and architectural evaluations. The tasks involved in these two endeavors are briefly outlined in this section.

Artifact Analysis

The potentially diagnostic artifacts gathered from the surface of historic cultural deposits and all cultural residues recovered in the screens will be washed, air-dried, and sorted by a specialist. The initial separation will be made according to material categories such as glass, ceramic, bone, metal, etc. All ceramics will be retained for curation. Amorphous, deteriorated metals and excess quantities of recent construction materials which do not warrant further attention or curation will be quantified and recorded, but then discarded. All faunal remains will be saved and transferred to a zooarchaeologist. Diagnostic container glass such as neck finishes, bases or embossments will be saved; miscellaneous wall fragments will be sorted and weighed by color, recorded, and then discarded.

For analysis, the typological scheme is based upon function, rather than raw material. With the latter approach, for example, buttons might be separately inventoried under the different categories of shell, bone, metal, glass, plastics, rubber, and ceramics; similarly the reader who wanted to know whether toys were present within the assemblage would have to laboriously search under the various rubrics of metal, glass, ceramics, plastics, etc. In contrast, by using a functional typology, all buttons will be grouped as a subclass under clothing, although they will be separately described. All structural materials such as nails, doorknobs, bricks, framing, hardware, or pane glass will be discussed in the category of architectural remains.

The level of analysis, as opposed to inventory, will be focused and limited to the requirements of site assessments. That is, we will evaluate the integrity and scientific research potential of the specific historic cultural deposits based on the artifacts and their context. The basic avenues of study will include chronology, domestic or commercial association of the deposits, technology and place of manufacture, and evidence of ethnic or national affinity. Thus, the study of the recovered cultural material will focus on those classes of data with the greatest potential for addressing the research questions.

Ceramics, for the early years, and bottle glass in subsequent decades are particularly sensitive indicators of chronology, diet, status, and sometimes, the ethnic or national identity of the consumers. The identification of the wares will be supplemented with reference to economic scaling and trends of contemporary fashion. Within the ceramic assemblage, relevant data will be sought with reference to the shifting proportions of items imported successively from Mexico, China, England, Japan, continental Europe, and the eastern United States, and from the vessel forms represented. The assemblages will be compared to each other, and through time. Faunal remains, as well, have the potential to reveal information related to diet, chronology, measures of self sufficiency, and the persistence of traditional ethnic customs.

Architectural Evaluation

Structure is a more encompassing term in cultural resource management than "building." In terms of complying with the regulatory guidelines, the process of architectural assessment includes features such as sheds, oil/gas facilities, the runway, and other aspects of the built environment which meet or approach the National Register of Historic Places condition of 50 years of age. The 50-year cut-off can, of course, be waived for buildings or objects of exceptional or unique importance.

The architectural/historical significance of structures on the property will be evaluated against the criteria of age; present integrity; values in architecture, engineering, or technology; association with notable individuals or events; or whether considered as a group, they represent a distinguishable entity even though individual components may lack distinction.

The approach to field assessments will combine visual inspection, careful recording,and historical research adequate to support an opinion about significance. Archival research will include a visit to the Los Angeles County Assessor's office to compile information on the age and other information on particular structures. A State of California architectural inventory form will be completed.

A photographic survey will play an essential role in documenting historic structures. This survey will be aimed at recording information on interior and exterior architectural details, elements, and forms so that architectural styles can be evaluated. The front, sides, rear, and other angles of all buildings will be photographed in addition to selected features such as entranceways, windows, and roofs. Details, such as moldings, mullions, eaves, gables, caps, and miscellaneous ornamentation, etc., will be recorded. Other information on the plan, foundation, exterior and interior wall materials, coursing, roof material.

Archival Research

Prehistoric Archival Research

A number of tasks related to prehistoric archival research remain to be completed. Several institutions, such as the Los Angeles County Museum, Loyola Marymount University, the Southwest Museum, and the University of California, Los Angeles (UCLA) need to be visited to determine if artifact collections obtained from the Playa Vista project area are being curated. If information on such collections are found, then we need to assess the research potential of these collections. In addition, we need to periodically consult the UCLA Information Center to check the archaeological site survey records and obtain data on newly discovered sites within or near the Playa Vista project area.

Historic Archival Research

Historic archival research has already been conducted for the Playa Vista Archaeological and Historical Project as a whole. What remains is research on specific questions raised by the previous research, as well as research on specific sites within the project area. Additional information remains to be gathered on the fate of the local railroads, most of which have been removed over the past 50 years. Much information remains to be gathered on the use and final disposition of the local oil wells, derricks, and related features, most of which were constructed in the 1930s and dismantled by the 1960s. The function of the different earthenworks and berms associated with the oil wells is not certain at present. Such information, however, could be gathered by interviewing older local residents and employees of the remaining oil and gas works in the vicinity. Another topic for more research is the development and final disposition of the Japanese-American settlements within the project area. Even though we known that most of the Japanese celery farms were located on the south side of what is now Jefferson Boulevard, more specific locations could be pinpointed with more detailed interviews with the older Japanese-American residents remaining in the area.

EVALUATION PLANS FOR EACH POTENTIALLY NRHP ELIGIBLE SITES

All potentially eligible sites that will be adversely impacted by the Playa Vista development will be evaluated in terms of their NRHP eligibility. Assessments of archaeological properties will be based on their potential for addressing specific research questions presented in Chapter 3, whereas standing buildings will be evaluated in terms of their architectural and historical significance. Evaluations will use a variety of methods such as surface collections, limited excavation, backhoe trenching and profiling, coring, archival research, and architectural evaluations. The combination of techniques to be employed varies from site to site, depending on the type of site, the expected depth to which sites are buried, and the Playa Vista development plans. The tasks to be completed at each site during the testing phase are summarized in Table 9. Activities related to these tasks are described in a discussion of each site where testing is recommended. Evaluation plans are presented by site type.

Shell Scatters - SR 8, 9, 10, and 11

Evaluations of shell scatters will be directed toward collecting data to determine which, if any, are the product of cultural activity. More specifically, we want to know if any of these shell scatters represent subsistence remains discarded by aboriginal populations, natural shellfish populations that once inhabited the lagoon, or remains that were simply dredged during recent times and then redeposited. Even though several of the scatters, such as SR 8 and 10, are to be avoided by placing fill on them, there is still a need to determine whether the loci can be considered eligible to the National Register of Historic Places as contributing members of the Ballona Lagoon Archaeological District.

By systematically collecting representative surface and subsurface shell samples, we should be able to distinguish biocoenose shell assemblages (shellfish populations that lived in the place of deposition) from thanatocoenose shell assemblages (shellfish that were transported to the place of deposition after death). A biocoenose assemblage differs in that it is dominated by immature individuals because of the high mortality rate in natural populations. In contrast, a thanatocoenose assemblages should be biased towards larger, more mature individuals, the result of cultural selection in procuring food resources. However, because biocoenose and thanatocoenose populations can sometimes co-occur in archaeological deposits located in a coastal marsh, extreme care must be exercised in isolating the two to avoid making erroneous interpretations. Stratigraphic evidence will provide additional information in assessing the nature of the shell scatters. If the shell scatters simply represent redeposited spoils dredged either when Ballona Creek was channelized or when the marina was constructed, then we expect to find stratigraphic evidence in the trench profiles to support this argument.

After conducting a thorough reconnaissance across each locus to search for artifacts and to identify shell concentrations, we plan to make controlled surface collections, and then excavate a series of backhoe trenches and hand units. All artifacts identified during the preliminary reconnaissance will be identified with pinflags, point-provenienced, and then collected. The specific surface collection procedures will be chosen after the reconnaissance has been completed. This selection will be based on our initial impression of the quantity of shell distributed on the surface at each locus. We will conduct a total surface collection at loci containing less than about 100 shells or shell fragments. Loci where the number of shells or shell fragments exceeds 100 will be sampled. In these instances, after gridding the entire locus into 25 x 25 m squares, we will systematically collect all shell contained within a 10 x 10 m square from the southwest corner of each 25 x 25 m square. This process will be continued until the boundary of the locus is reached.

Table 9. Summary of Tasks to Be Completed During Testing Phase of the Playa Vista Archaeological and Historical Project.

	Temporary Designation/ Site Number	Surface Collection	Excavation	Backhoe Trenching	Coring	Other
Area A	CA-LAn-1698*					Archival
Area B	SR 2					
	SR 3	X		X		
	SR 8	X	X	X		
	SR 9	X	X	X		
	SR 10	X	X	X		
Area C	SR 7*					
	SR 11	X	X	X		
	CA-LAn-54		?	?	X	
Area D	SR 1**	X				
	SR 4	X	X	X		Profile existing exposures
	SR 5	X	X	X		Profile existing exposures
	SR 6	X	X	X		
	SR 12		?	?	X	
	SR 13		?	?	X	
	SR 14 (CA-LAn-60)**	X				Profile existing exposures
	SR 15 (CA-LAn-62)***					
	SR 16 (CA-LAn-211)***					
	SR 17 (Howard Hughes Industrial Complex)					Architectural evaluation
	CA-LAn-193		?	?	X	

* SR 14 (CA-LAn-60) and SR 7 are not eligible to the National Register, and thus will not be evaluated.

** Excavations at SR 1 and SR 14 (CA-LAn-60) may be precluded by the City of Los Angeles due to regulations restricting modifications to the slopes of the Westchester Bluffs.

*** Previously evaluated

Up to five 20 m long backhoe trenches will be excavated at each scatter. The specific number to be dug will depend on the size and the findings of previous trenches as the work is in progress. The trenches will enable us to evaluate whether or not cultural deposits are buried, document the stratigraphy, and facilitate the collection of soil samples, pollen samples, flotation samples, and any other needed samples. If after the trenching a deposit is determined to be cultural or potentially culturally, two 1 x 1 m units will be manually excavated. These controlled units will provide sufficient information upon which to base National Register recommendations and plans for data recovery.

Prehistoric Artifact Scatter - SR 3

Since the earliest known historic use of SR 3 is relatively recent, no additional historic archaeological investigations are warranted. Because a quartzite core and some marine shell were observed, however, there is a potential for buried prehistoric cultural deposits, particularly in light of the fact that vegetation and historic material such as horse manure obscures much of the surface. The topography is relatively well drained since it is substantially higher in elevation than the tidal flats located further east, and therefore, the area could have been occupied by aboriginal populations.

Additional work will include a reconnaissance across the area to search for additional artifacts. Any such materials should be point-provenienced and collected. Next, two to four 20 m long backhoe trenches will be judgmentally placed to determine if buried cultural deposits exist as well as to characterize their extent and nature. If buried cultural deposits are found, two 1 x 1 m test units will be manually excavated.

Midden Deposits - CA-LAn-54, CA-LAn-60, CA-LAn-193, CA-LAn-211a, SR 1, 12, 13, 15 (CA-LAn-62b), and SR 16 (CA-LAn-211b)

CA-LAn-54

CA-LAn-54, a previously recorded shell midden, could not be identified from surface indications during the cultural resources survey of the Playa Vista project area. Consequently, testing will be aimed at searching for and delineating the site boundaries. Cores will be used to accomplish these goals. Initially, cores will be extracted at 30 m intervals along two transects placed at right angles to one another (that is, in a cruciform pattern). The cruciform will be centered on the approximate centerpoint of the site as indicated on the Venice quadrangle map (scale = 1:24,000) on file at the UCLA Information Center. Based on its plotting, one of the transects will be positioned along the long axis of the site to maximize our chances to discover its location. If cultural deposits are identified in the cores, the coring program will then be expanded to more fully delineate the site boundaries.

Because the site is presumed to be deeply buried, we do not anticipate using either mechanical or manual excavation during evaluation. Should cultural deposits be found within 2 to 3 ft of the surface, however, our strategy would change. Backhoe trenches would be used to augment the data retrieved from cores and to delineate more fully the stratigraphy of the site. Between two and four 1 x 1 m test units would be manually excavated to provide controlled samples of the cultural deposit.

CA-LAn-60 (SR 14)

The site has been severely eroded by water action over the last decade. The site is currently cut by an erosional gulch that has and continues to destroy a significant portion of the deposit. The Playa Vista Master Plan proposes to maintain the bluff in this area, and as such will greatly aid in the preservation of the site. Prior to actions that may be needed to maintain the bluffs, we suggest profiling the existing exposures and obtaining a surface collection. Stratigraphic descriptions can then be used in evaluating the integrity and nature of the cultural deposits.

Although MTP-PV has broad access rights to this site even prior to its acquisition of title in 1993, the site will remain subject to certain overriding rights of the adjoining landowner. The effects of these rights on evaluating the site cannot be determined at this time.

SR 1

SR 1 lies entirely on the slopes of the Westchester Bluffs. The site recorded in 1990 is probably part of a much larger site that extends on to the bluff top. The deposits that are located on the Playa Vista Project Area are most likely material discarded from the occupation on the bluff. Without access to the entire site, however, this hypothesis cannot be demonstrated.

Ideally, the entire site would be evaluated. This approach is not feasible because access to the portion of the site outside of the Playa Vista project area is restricted. Moreover, until acquisition of title by MTP-PV in 1994, access to the portion of the site within the project area is also restricted and subject to overriding rights of the adjoining landowner. Within the project area, there are also impediments to evaluation. The City of Los Angeles does not permit any subsurface excavation on the slopes of the Westchester Bluffs. This regulation precludes the use of any form of manual or mechanical excavation, including minimal impact procedures such as coring. Evaluation of the site, then, will consist solely of surface collection, and where possible, profiling of stratigraphic exposures.

Sites Along the Base of the Bluff

CA-LAn-62 (SR 15) and CA-LAn-211 (SR 16)

Since the late 1940s, CA-LAn-62 and CA-LAn-211 have been examined periodically by professional and amateur archaeologists. In the 1980s, Van Horn conducted test excavations at these sites on three separate occasions (Archaeological Associates 1986, 1987; Van Horn 1983, 1984: Van Horn et al. 1983). Based on these investigations the rough horizontal and vertical dimensions of the cultural deposits have been established. Moreover, controlled manual excavations at both sites demonstrate that each retains a high degree of integrity. Although a cultural assessment of the sites is difficult due to the small number of controlled test units excavated, Van Horn (Archaeological Associates 1986, 1988; personal communication, 1990) believes both contain Late Prehistoric Period components and may date into the Protohistoric Period.

Both CA-LAn-62 and CA-LAn-211 have already produced information on the historic contexts developed in Chapter 3 (see Chapter 7). Future work will almost assuredly produce additional valuable data on these and other research topics. Therefore, without further evaluation, these sites are recommended to be eligible for listing on the National Register of Historic Places as contributing members of the Ballona Lagoon Archaeological District.

CA-LAn-193, SR 12, and SR 13

Three of the sites - SR 12, SR 13, and CA-LAn-193 - in the project area are believed to be diffuse to rich shell midden deposits located along the base of the bluff at the southern boundary of Area D, where the riparian corridor is proposed. Because all or part of these sites are buried, some relatively deeply, testing will consist of coring to delineate site boundaries and determine the depth of cultural deposits. Without removing the overburden, and then excavating backhoe trenches, coring is the only viable approach for estimating site boundaries. The coring data will be sufficient for evaluating the integrity of the deposits and assessing the potential impact of the proposed development at specific properties. Depending on the density, coring may provide information for estimating the density of shell and artifacts. Although we expect that sites containing a sufficient quantity of shell can be delineated reasonably well with coring, the reliability of this strategy at less rich deposits is less certain.

The coring strategy will be undertaken in a similar manner to that described for CA-LAn-54 above. After extracting cores at between 20 to 30 m intervals along a cruciform centered on the presumed centerpoint of each site, the coring will be expanded to more fully delineate the spatial extent of each site. A representative sample of cores will be saved for detailed stratigraphic description and specialized sediment and/or pollen analyses.

Although at this time, coring is the only proposed evaluation method, we may find that in certain areas the fill is not as deep as anticipated. In this case, we may elect to excavate one or two backhoe trenches to test the accuracy of the core data and to obtain a wide horizontal profile of the midden.

Historic Artifact Scatters - SR 4, 5, and 6

Each of these three sites contains deposits of historic artifacts of unknown age, association, and variability in a context that needs further examination. The stratigraphy of SR 5 and SR 6 is visible in the existing profiles along the trench profiles for approximately 400 meters. Although both sites were estimated to extend northward about 30 meters perpendicular to the trench profile based on surface observations, this estimate may not fully represent the extent of the subsurface deposit.

Several research problems will be addressed by field testing: the physical dynamics of the deposition (secondary, redeposited, or a primary area of discard subsequently disturbed by surface modification); evidence of potential association with Japanese or Mexican communities; origin from residential, industrial, or commercial consumption; indications of early settlements whose locations are yet unknown; chronology of the cultural materials; and temporal span of these discarded remains. Significance will ultimately be assessed by the criteria of age, integrity, and potential of the assemblages to contribute to broad regional historical topics.

The first step at each site will be to conduct a general reconnaissance and obtain a surface collection of diagnostic artifacts, primarily marked or identifiable ceramics and glass. These artifacts will be point-provenienced before they are collected. At SR 5 and SR 6, where the deposit is exposed in a trench profile, block samples will be cut from the trench face in 10 or 20 cm increments, at intervals of 40 to 50 meters. The objective is to recover a sufficient sample to yield meaningful conclusions about the context and its research potential. The dispersion of sample units along the 400 meters of exposed cultural material is intended to reveal whether there may be horizontal, as well as vertical, stratigraphy. To determine the horizontal extent of deposits presently visible only in the trench face, backhoe trenches will be cut perpendicular to the existing trenches; these will also provide profiles in areas that are perhaps less disturbed.

Should the sampling at SR 5 and SR 6 prove to be redundant, the level of effort will be reduced to that necessary to document adequately negative evidence. The strategy for SR 4 will include a mapped surface collection, one backhoe trench, and additional field work only if the assemblage is chronologically or culturally distinctive.

Howard Hughes Industrial Complex - SR 17

The immediate question to be addressed is whether the Howard Hughes Industrial Complex is potentially eligible to the National Register of Historic Places as an historical district. To compile the documentation needed for a Determination of Eligibility, data are needed about the individual structures, including the runway; their values in engineering, architecture, and technology; importance to local history; role in the development of the aircraft industry; and association with important individuals and events. It is possible that, taken together, the structures and related facilities constitute a distinguishable entity even though individual components may lack distinction. Which particular structures may be contributing or non-contributing elements within the district must be determined.

These objectives will be met through a combination of site-specific historical research, detailed recording and photography, and evaluations of the architecture and technology represented.

MITIGATION PLAN

The Playa Vista cultural resources mitigation plan has two components: (1) a program for sites determined to be eligible to the National Register and (2) a course of action for discoveries made during construction. The components of the plan, formally outlined in the Memorandum of Agreement, are described below.

Mitigation through Data Recovery, Analysis, and Curation

Mitigation for National Register eligible sites can consist of avoidance or data recovery, analysis, and curation. In Chapter 7, potential project-related effects were evaluated for each identified cultural resource. Two sites, CA-LAn-62 and CA-LAn-211, are deemed eligible for inclusion in the National Register of Historic Places as contributing members of the Ballona Lagoon Archaeological District based on previous research. All remaining potentially eligible sites need to be evaluated.

Upon completing the field and analytic evaluation of a site or group of sites, a report will be prepared presenting the testing results and offering recommendations of National Register eligibility. Given the size and scope of the Playa Vista project, the evaluation phase will be conducted in segments corresponding to development schedules. The first part of Playa Vista to be developed, termed Phase 1, consists of two separate parcels in the east and west sections of Area D (see Figure 83). Sites CA-LAn-62, CA-LAn-211, and SR 5 are located within Phase 1. Because both CA-LAn-62 and CA-LAn-211 are considered eligible for listing in the National Register of Historic Places, no evaluation is needed for these resources. Instead, a treatment plan has been developed to mitigate potential impacts to these sites and will be submitted with the MOA. SR 5 will be evaluated. A report detailing the investigations at SR 5 will be prepared and a recommendation concerning the site's potential National Register eligibility will be offered. If the site is determined to be eligible for the National Register, then a separate treatment plan will be submitted to the COE and SHPO.

Depending on the overall timing of the project, data recovery will have to be conducted at significant sites within the Phase I area prior to evaluating sites in the remaining portions of the project site. Phase 1 evaluation and/or data recovery will be followed by the evaluation of all other potentially significant cultural resources identified within the Playa Vista project area. The only possible exceptions to plan are SR 1 and SR 14 (CA-LAn-60) which are located on land not currently owned by Maguire Thomas Partners-Playa Vista. Permission will be sought to evaluate these sites with the others. If permission is denied, however, evaluation of these sites will have to be postponed until ownership is secured.

For sites deemed eligible for listing in the National Register of Historic Places, the evaluation report will also contain a treatment plan. The plan will refine the overarching research questions posed in the research design for that particular site, set forth data needed to address them, describe the field and analytic methods to be employed to obtain the data, and discuss reporting methods and standards.

Discoveries

Because of the nature of historic activities in the project area, it is likely that not all cultural resources have been identified. To rectify this situation we propose to place a transect of cores and/or backhoe trenches from the historic mouths of Centinela and Ballona creeks upstream to the edge of the project area in areas that are likely to be impacted by construction. A limited set of additional transects will be opened along the historic lagoon edge and into the wetlands. These latter transects are designed to delineate the timing of geomorphic events and periods of stabilized surfaces.

Even with these additional efforts toward identification, it is possible that previously unknown resources will be discovered during construction. If cultural resources are found, they will be evaluated in accordance with the research design and treatment plan. Prehistoric resources will be considered as potentially contributing members of the Ballona Lagoon Archaeological District. Historic resources will be evaluated as individual sites.

If resources are found that are not covered in the treatment plan, construction will temporarily be halted. The COE and SHPO will be notified immediately of the discoveries. The temporary halt to construction will allow the COE and the SHPO the opportunity to assess the resources and offer recommendations as to treatment.

Other Mitigation Programs

Popular Report

Although the protection of cultural resources either through avoidance or data recovery is mandated by public law, the results of such work are rarely presented in a form that the public can understand and enjoy. In the course of meeting compliance requirements, the Playa Vista Archaeological and Historical Project will produce a series of technical volumes that will be aimed at professional archaeologists. The material will also be condensed into a form that interested laymen can appreciate. The popular report will be distributed to newspapers and local magazines.

Native American Involvment

Gabrielino Native Americans have been requested to provide comment on the research design. All individuals listed with the Native American Heritage Commission as having affiliations with the Los Angeles coast area were contacted as were other Native Americans who expressed an interest in the project.

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Cohen, Morey (Hughes employee, 28 yrs, Building 15)
6152 Tony Avenue
Woodland Hills, CA 91367
(818) 887-4421
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Crockett, Mary Lou
7573 S. Sepulveda
Los Angeles, CA 90045
(213) 641-3383
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4975 Overland Ave.
Culver City, CA 90230
(213) 559-1676

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418 E.L. Adobe Place
Fullerton, CA 92635
(714) 871-3607
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Bldg C1, MS C115
P.O. Box 45066
Los Angeles, CA 90045
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1110 Berkeley Drive
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2524 Ardsheal Drive
La Habra Heights, CA 90631
(213) 697-8096
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Evergreen Air Center, Inc.
Pinal Air Park
Marana, AZ 85653
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227 North Broadway
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222 North Hill St.
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Charles Von der Ahe Library
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Loyola Boulevard at W. 80th St.
Los Angeles, CA 90045
(213) 338-3048
contact: Justine V. Clancy, Head
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(213) 670-5436

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(213) 645-3948
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Lieutenant, Plant Protection
McDonnell Douglas Helicopter Co.
6775 Centinela Avenue
Culver City, CA 90230
(213) 305-3988
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Perkins, Jan
524 Bonita Canyon Way
Brea, CA 92621
(714) 441-9675
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721 Oxford Ave.
Venice, CA 90291
(213) 821-6288
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Hawthorne, CA 90250
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home: (213) 398-0704
work: (213) 305-3343
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13250 Jefferson Boulevard
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University Archivist
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Campus Box 286
Loyola Blvd. at West 80th
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11947 Juniette Street
Culver City, CA 90230
work: (213) 305-3099
home: (213) 827-3170
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APPENDIX D.xi:
DORAME, ROBERT, THE GABRIELINO TONGVA INDIANS OF CALIFORNIA TRIBAL COUNCIL, PROCEDURES FOR THE TREATMENT AND DISPOSITION OF HUMAN REMAINS, ASSOCIATED GRAVE GOODS AND PATRIMONIAL ITEMS AT GABRIELINO TONGVA ANCESTRAL SITES

Robert F. Dorame, Council Chairman
5450 Slauson Avenue, Suite 151 PMB
Culver City, CA 90230-6000

Voice 562-925-7989
Fax 562-920-9449
gabrielino-tongva@earthlink.net

Gabrielino Tongva Indians of California
Tribal Council

FAX

To: Jeff Ashuel & Don Grenda
Fax: 520-298-7044
Phone: 909-335-1896

From: Robert Dorame, MLD
Pages: 1

cc: Playa Vista
Native American Heritage Commission

Subject: Extraction of Gabrielino Tongva Human Remains, Playa Vista Development

To summarize our conversations of January 15 and 16, we have agreed that no evasive testing of Gabrielino Tongva human remains will be permitted and only macroscopic analysis will be conducted by Phillip Walker, Physical Anthropologist, who has been engaged to oversee the human remains removal and related excavation at Playa Vista.

All soils disturbed within the area where the remains were found must be carefully observed and screened in the event associated grave goods or patrimonial objects are found.

All culturally sensitive material will be re-interred with the human remains in a designated area, set aside in perpetuity by the legal land-owner, DBA Playa Vista.

I appreciate your consideration and acceptance of our requests on this issue and look forward to receiving a report on the results. Thank you for keeping us abreast of this situation.

I remain,

Robert F. Dorame
Council Chairman
Most Likely Descendant

THE GABRIELINO TONGVA INDIANS OF CALIFORNIA TRIBAL COUNCIL

PROCEDURES FOR THE TREATMENT AND DISPOSITION OF HUMAN REMAINS, ASSOCIATED GRAVE GOODS AND PATRIMONIAL ITEMS AT GABRIELINO TONGVA ANCESTRAL SITES

By Robert Dorame, Tribal Chairperson

The borders of the Gabrielino Tongva Nation's territory extend clockwise along the Santa Susana Mountains and San Gabriel Mountains through Cucamonga to Redlands, south through Riverside, veering southwest past Lee Lake to Aliso Creek and up the coast of the Pacific Ocean to the Malibu area. In addition, San Clemente, Santa Catalina and San Nicolas Islands are included in Gabrielino Tongva territory. Individual Gabrielino Tongva tribes affiliate with territories loosely based on ancient village sites. Members of tribes many times have lineal descendancy to more than one village site, due to marriages between tribes within the nation.

LAND DEVELOPMENT AND GABRIELINO TONGVA CULTURAL RESOURCES

The required Environmental Impact Report (EIR) must include the consultation of a Gabrielino Tongva Indian cultural consultant monitor prior to submission of the draft EIR to the appropriate federal, state and private entities to ensure all steps have been taken to identify culturally sensitive and non-sensitive areas. Sensitive areas are defined as places that hold religious significance and places that are likely to contain human remains, associated grave goods and patrimonial objects (groundstone, projectile points, shell, shellbeads, charmstones, coggedstones, carved bone etc.). Also village areas and gathering areas are considered sensitive.

If a culturally sensitive area is identified, an archaeological survey must be completed prior to hand or mechanical excavations. The survey must be conducted by a qualified archaeologist who is knowledgeable and experienced in Gabrielino Tongva territory. (If an archaeologist has little or no experience in Gabrielino Tongva territory, their credentials must be submitted to the Gabrielino Tonva cultural consultant monitor for review and approval.) A qualified, experienced Gabrielino Tongva cultural consultant monitor, retained by the

developer and/or landowner is required to participate in the archaeological survey.
In addition, following the completion of the survey, the Gabrielino Tongva cultural consultant monitor must be on site at all times when any land altering activity is in progress to ensure appropriate measures can be taken in a culturally sensitive

area that is unavoidable or if additional culturally sensitive areas are encountered during the course of the project. This includes proposed contained archaeological units.

HUMAN REMAINS

The Gabrielino Tongva cultural consultant monitor, active in his or her Indian community, registered with the Bureau of Indian Affairs and preferably listed with the Native American Heritage Commission must be present during all grading and mechanical excavations on Gabrielino Tongva land. A letter of recommendation from the consultant's tribal government is critical to insure authenticity of lineal descendancy within the tribe.

In the event that human remains, associated grave goods or religious items are encountered during excavation, all construction must be halted until the proper authorities, to include the local coroner, land owner, and the Gabrielino Tongva cultural consultant monitor are notified and a formal review of the find is evaluated. The county coroner has the legal responsibility (Senate Bill 297, Chapter 1492, Statutes of 1982 and Section 7050.5 of the California Health and Safety Code) for determining whether or not the remains are Native American and notification of the Native American Heritage Commission in the event that the remains are identified as Native American.

EXCAVATION OF GABRIELINO TONGVA REMAINS

Excavation of Native American remains in Gabrielino Tongva territory shall be performed by a county-certified archaeologist in the presence of a Gabrielino Tongva cultural consultant monitor. The excavation shall be done with care and respect. No invasive techniques of any kind including chemicals or plaster may be used on the remains. All human remains encountered will be carefully wrapped in cloth with appropriate offerings. The use of plastic storage bags will not be permitted.

Careful measurements, drawings and/or sketches shall be made to aid in the reburial of the remains by the cultural consultant monitor or a tribal elder.

Absolutely no photography or video taping of human remains is allowed. All material (grave goods i.e. groundstone, projectile points, shell, shellbeads, charmstones, coggedstones, carved bone, etc.) associated directly with the burial(s) must be carefully measured and sketched to include the relationship to the human remains prior to any removal of grave goods or human remains.

All removal of human remains, associated grave goods and patrimonial objects shall be conducted by individuals approved by the Gabrielino Tongva cultural consultant monitor. All work in the immediate area of the remains will cease until the excavation is complete. Human remains and grave goods that are unearthed will be kept in a secure location as close as possible to where they were unearthed until at which time they are to be reintered. All unidentified faunal fragments unearthed will be treated as human until positive identification can be made by a qualified forensic specialist.

REBURIAL POLICY

The first choice for reburial of human remains is to inter ancestral remains where they were found. If this is not feasible, the second choice is to rebury the ancestral remains in an area as close to the original burial site as possible. These areas being free of future development, and free of subsurface infrastructure ensuring that there is no possibility of disturbance in the final resting areas. The reburial site must be secure against vandalism and desecration. The Gabrielino Tongva community must have access to the reburial area in perpetuity. The reburial of ancestral remains will take place in a timely manner when it is reasonable that no additional burials will be disturbed during the course of the project. This will be decided in consultation with the Gabrielino Tongva cultural consultant, the archaeologist and the landowner/developer.

All costs for the repatriation and reburial of Gabrielino Tongva ancestors shall be borne by the landowner and/or the developer.

STATISTICAL RESEARCH, INC.

Cultural Resource Management Consultants

21 W. Stuart Ave.
P.O. Box 390
Redlands, CA 92373
(909) 335-1896 FAX: (909) 335-0808

6099 E. Speedway Blvd.
P.O. Box 31865
Tucson, AZ 85751
(520) 721-4309 FAX: (520) 298-7044

To: Jeff Altschul, Ph.D.

From: Steven Shelley, Ph.D
Richard Ciolek-Torrello, Ph.D.
Donn Grenda, Ph.D.
Anne Stoll
Benjamin Vargas

Date: October 15, 2003

Jeff:

This memo outlines our proposed hand excavation plan for LAN 62. It details the locations of our hand excavation units, and outlines the rationale for their placement.

Our recent mechanical stripping of fill and trenching to determine location and depth of the site deposit has exposed the site in several locations. One large area is exposed in the southwestern portion of the site and several small areas at the eastern end of the site. Intact site deposits were visible in a number of other locations, but could not be examined because trenches filled with water rapidly. Thus, most of the site remains unexposed and cannot be exposed by current methods due to high groundwater. Based on our excavations, we have recalculated the area of site within the area of proposed effect (APE). We now calculate the site area in the APE to be 35,972 m^2, an increase of about 6,000 m^2. A one percent excavation sample of this area is 360m^2. We have allocated this sample as follows:

> One 10-by-20-m block will be placed in the southwestern portion of the site where the largest site area is exposed (Figure 1). The area where this block is located has yielded rich deposits in past test excavations. It is also potentially the thickest remaining midden deposit at LAN 62. Three 4-by-4-m blocks are placed along the eastern extension of the site as shown in Figure 2. These are placed in areas where current excavation and previous trench excavations show the site to be thickest. In total this is 248 m^2 that is allocated for initial hand excavation. The remaining 112 m^2 of hand excavation is held for discretionary placement when we learn more about the site.

These four blocks will require dewatering prior to excavation, because ground water is present within a few feet of the current ground surface. We expect to place additional excavation units within the large currently exposed site area and request that the entire area be dewatered (see Figure 1). This area is where we anticipate placing most of the discretionary excavation sample that is now held in reserve. It may be necessary to dewater any additional units placed outside of this area at the time of excavation.

Gabrielino Tongva Indians of California
Recovery and Reburial Procedures

There are certain rules and methods developed by the Gabrielino Tongva Indians of Californic that are required when removing Gabrielino Tongva Remains from the earth. Conditions may occur that could alter one or more issues on this list. Consultation with the most likely descendent (MLD) and the Native American monitors assigned to the site should then be scheduled to determine other procedures that may be acceptable to the Gabrielino Tongva people.

Excavation:

1. Consultation between the MLD and the archaeological firm must take place when remains are unearthed and prior to any action taken.
2. A 50 foot perimeter for each uncovered burial will be required to safeguard further destruction until the area is examined for additional remains and associated grave goods.
3. In the event blade machines are operating in an adjacent area, a maximum of 2" cuts or less will be permitted in all cultural areas.
4. Additional monitors must be required if more than one area is being excavated at the same time. Each excavated burial will be monitored exclusively.
5. Wooden tools are preferred; electric chisels or other power tools should be avoided.
6. If remains are pedestaled, they will be placed on plywood for removal. If remains cannot be pedestaled due to soil conditions, remains must be carefully placed in cloth bags.
7. Soils adjacent to burials will be saved for reburial in plastic containers.
8. No photography, digital or video is allowed. Drawings of remains will be permitted to retain the orientation of the ancestors for re-interment purposes only. If the Coroner photographs the remains, the photos may not be published for any purpose.

Soil Removal and Handling:

1. 30-40cm of soil surrounding ancestors must be retained for reburial.
2. Soils surrounding ancestors may be dry-screened outside this measurement using 1/16th mesh.
3. Water-screening of soil may be permitted with 1/8 mesh with consultation of NA monitor.

Testing:

1. No DNA testing is allowed.
2. No invasive testing is allowed.
3. Macroscopic analysis is permitted.
4. Shell associated with each burial may be used for dating purposes.
5. When remains are unearthed, the 1'x1' test pits will be allowed to determine the extent of the burial area.
6. All windrows within a 50 foot area must be dry or wet screened.

Storage:

1. Natural Cotton bags and sheeting or cotton drop cloths will be used to store remains until time of re-interment. Deer hides maybe used to cover the bagged and wrapped remains until time of reburial and may become the burial wrapping. Rabbit skins may be used for females.
2. Until scope of project is completed, storage of ancestors should be in close proximity to location of excavation or a protected area must be provided by the landowner or archaeologist.
3. Bone fragments will be bagged in natural cotton.

Reburial:

1. If at all possible, remains should stay within the same location or in as close proximity to the removal as possible, preferably within a ½ mile radius of the original grave site. When no appropriate location can be identified within this radius, a secure location will be valued over distance.
2. If the preponderance of remains are uncovered in or excavated from one area, the re-interment should be in that area.
3. The reburial site should offer the best long-term protection against any additional disturbances.
4. Each reburial requires approximately 4' x 5 ½' when fully articulated and should be at a depth of 6 – 10 feet. The purpose of this depth is to insure difficulty in disturbing the reburial and to allow adequate room for a concrete cap or steel wire mesh buried approximately 4' below the surface of the ground. a backhoe is recommended for excavation of the burial pit.
5. All isolated bone fragments that are uncovered on site will be buried together in an individual burial pit with one or more deer skins, other indigenous animal skins, sea weed or the natural cloth used for all bagged fragments.
6. All associated grave goods and artifacts will be reentered with the ancestors.
7. No drawings or any other images of ancestral remains may be used for publication without consultation and the approval of the Native American Monitors and the appointed MLD for the site.

Costs:

1. The landowner(s) will be responsible for all costs related to the proper storage and reburial of remains excavated on their property to include all burial materials required in this document.
2. Landowner(s) will be financially responsible for providing reburial plots that are acceptable and approved by the MLD.

Revised 05/01/03

APPENDIX D.xii:
DORAME, ROBERT, GABRIELINO/TONGVA INDIAN NATION, CONSULTING AND MONITORING GUIDELINES

GABRIELINO/TONGVA INDIAN NATION

CONSULTING AND MONITORING GUIDELINES

submitted by

ROBERT DORAME
Cultural Reasources - NAGPRA Program Director
Gabrielino/Tongva Indian Nation

Coastal Band of

Gabrielino Tongva Indians

ROBERT DORAME

13229 Rose Avenue, Los Angeles CA 90066

fax 310-920-9449 —————— pager 310-998-1707

027835

ROBERT F. DORAME
2025 Barry Avenue
Los Angeles, CA 90025
Pager: (310) 998-1707

THE GABRIELINO/TONGVA NATION, A NON-FEDERALLY RECOGNIZED TRIBE: OUR RECOMMENDATIONS TO NAGPRA

In 1990 , The *Native American Graves Protection and Repatriation Act* was passed by Congress. This Act mandated that state and Federal Institutions possessing Native American human remains and associated grave goods must be returned to federally recognized tribes (NAGPRA ACT 25 USC Section 3001 PL 10-601).

Thus far the Gabrielino/Tongva Nation has failed to meet the B.I.A. established criteria for Federally Recognized Tribes. Consequently, the Act fails to provide for the repatriation of remains and associated grave goods to the Gabrielino/Tongva People.

In an effort to rectify this gross injustice, the Gabrielino/Tongva people propose a coalition comprised of various heads of Families, Chiefs, Captains and Capitanas. The objective of this coalition will be to petition the NAGPRA Review committee to grant the Gabrielino Nation the same rights that have been granted to the Federally recognized Tribes . Specifically this would include the repatriation of; culturally affiliated human remains, associated and unassociated funerary objects, sacred objects,and objects of cultural patrimony.

In defense of this position we intend to present to the NAGPRA Committee, by November 1995, evidence that oral, archaelogical, authropological, ethno-historical, geographic and cultural traditions exist. Consequently, the Gabrielino/Tongva Nation is entitled to full sovereignty of repatriation for Grave and Associated Burial Goods.

Organized Panel: The Gabreilino/Tongva Nation, a Non-Federally Recognized Tribe. Our Recomendations to NAGPRA.

Robert F. Dorame (Gabrielino/Tongva)
Martin Alcala (Gabrielino/Tongva)
John C. Lassos (Gabrielino/Tongva)
Lupe V. Smith (Gabrielino/Tongva)

027836

Goals

The Gabrielino people in past years have been deprived of their Constitutional rights. We seek equal representation in all private State and Federal land developments. We respectfully request that MTP consider the following goals.

1) **A designated and ample portion of the land to be set aside and preserved for the Gabrielino/Tongva people.** Specifically these areas should include the land that is at the highest risk to the natural environment and archaeological findings.

2) **On preserved land the Gabrielino/Tongva people will establish a working Cultural Center.** The Center would include an area to house native documents and conduct tribal affairs meetings. The Center would house Gabrielino/Tongva artifacts. The Center will be staffed by Native American docents (guides/hosts) who would be funded by the City of Los Angeles. In addition, Gabrielinos would conduct tours and classes pertaining to their culture.

3) **School children of all races would partake in the learning of Native American activities which would include ongoing demonstrations of Gabrielino crafts and culture.** These classes would also include the re-education of the Gabrielino people regarding their heritage. The staff would include senior citizens interested in teaching Native American history.

4) **The Cultural Center will be a major site for the dissemination of information with an emphasis on Native Americans.**

5) **The Cultural Center will establish a twelve (12) step program for any indigenous Native American.**

6) **The Cultural Center will also create a major tourist attraction.** This will be the first of its kind in the County of Los Angeles. The tourists attracted to the Center will generate funds necessary to create a self sustaining operation and provide jobs to Gabrielino/Tongva people.

027837

ARCHAEOLOGICAL PROCEDURES FOR THE TREATMENT AND DISPOSITION OF HUMAN REMAINS AND ASSOCIATED GRAVE GOODS DISCOVERED AT GABRIELINIO /TONGVA ANCESTRAL SITE

Gabrielino / Tongva territory extends from what is now known as Santa Susana mountains on the north to Aliso creek on the south and from the Mojave desert on the east to the Pacific Ocean. Gabrielino / Tongva territory also includes Santa Catalina Island, the San Clemente island, San Nicholas Island and Santa Barbra Island. The Gabrielino / Tongva are the only Native people with legitimate claims to this Territory.

LAND DEVELOPMENT AND GABRIELINO/ TONGVA CULTURAL RESOURCES

1. Archaeological survey, including a Gabrielino tribal consultant, should precede any significant land altering activity in Gabrielino/Tongva Territory. This should be completed before any grading or excavation with machines such as backhoes, skiploaders, or tractors equipped with earth moving blades, are allowed. If done properly and prior to construction activities, archaeological survey can identify sensitive areas and help reduce the destruction of associated burial sites. Timely recognition of sensitive sites can provide developers with reasonable alternatives.

2. In order to prevent the continued destruction of Gabrielino/Tongva heritage, all mechanical grading and mechanical excavation in sensitive areas must be monitored by qualified archaeologists and authorized representatives of the Gabrielino/Tongva Nation. Sensitive areas are defined as places where archaeological research suggest that sites are likely to contain remains and associated grave goods.

3. In order to insure the quality of archaeological research in Gabrielino/Tongva Territory, archaeologists working in this territory should be familiar with Gabrielino culture, history and prehistory. In this territory, archaeologists should be willing to work with the Gabrielino/ Tongva Nation. The Gabrielino/Tongva Nation requests that the credentials of the proposed archaeological consultants be presented for review prior to any work being undertaken. The Gabrielino/Tongva Nation reserves their right to express their concern if they feel qualified archaeologists are not being used on the project

4. Any non spiritual or non sensitive artifacts discovered in Gabrielino/Tongva Territory should be made available to qualified scholars and the designated representative of the Gabrielino/Tongva Nation. All spiritual sensitive artifacts should not be examined but should be repatriated to the Gabrielino Indian people and the nation they represent.

HUMAN REMAINS

1. A representative of the Gabrielino/Tongva Nation should be present during all significant grading and mechanical excavation on Gabrielino/Tongva Territory. If for some reason a representative is not present, the project Archaeologist should immediately contact the Most Likely Descendant.

2. In the event that human remains, grave goods or religious items are encountered during excavation or development, all construction should be halted until the proper authorities are notified and a formal review of the find is evaluated by appropriate authorities and the Most Likely Descendant.

3. Often there is some question as to weather the bone fragments encountered during an excavation are human. If the species of the remains is not readily apparent, the bones or bone fragments should be carefully excavated by a qualified archaeologist. They should be then properly bagged, labeled, and documented in accordance with the best archaeological procedures . County coroners have the legal responsibility (Senate Bill 297, Chapter 1492, Statues of 1982 and Section 7050.5 of the California Health and Safety Code) for determining whether or not the remains are human.

4. The County Coroner's office should be immediately notified by telephone. The Gabrielino/Tongva monitor should immediately call the Most Likely Descendant or his or her representative. If the identification of the human remains occurs outside the field, the Project Archaeologist or his/or her representative should immediately notify the Most Likely Descendant. If the coroner determines that the remains are recent, and therefore a potential police matter, the remains and their disposition fall entirely under the jurisdiction of the Coroner's Office.

EXCAVATION OF GABRIELINO/TONGVA REMAINS

1. Excavation of Native American remains in Gabrielino/Tongva Territory should be done by County certified archaeologists, in the presence of a Gabrielino monitor consultant. The excavation should be done with care and respect. No invasive techniques of any kind, including chemicals or plaster, should be used on the remains.

2. Careful measurements, drawings and photographs should be taken. This data will be helpful when it is time for a Gabrielino/Tongva representative to rebury the remains. Photographs and negatives will be reviewed by the most likely Descendant representatives. Those photos deemed to be disrespectful to their ancestors must be turned over to the Gabrielino/Tongva Nation. Photographs of human remains shall not be included in public documents.

3. All remains should be carefully wrapped in cloth or leather to protect them until reburiel. The remains should be stored in a respectful manner and in a safe place, under the supervision of the Most Likely Descendant.

4. All material associated directly with the burial (grave goods) should be carefully measured, drawn, and analyzed by qualified archaeologists. After a maximum of 120 days, all grave goods should be returned intact and unharmed to the most likely Descendant for reburial.

5. The remains of our ancestors will be reburied with the appropriate, traditional ceremonies conducted by a proper representative of the Gabrielino/Tongva Nation. The ancestor will be positioned in his/her resting place in the same position and orientation as he/she was in originally.Additional offerings from the Native American community may be interred with the ancestor

6. The first choice for reburial is to inter the ancestral remains where they were originally found. If this is not feasible, the second choice is to rebury the remains in a place that is as close as possible to where they were originally found. The third choice is to rebury the remains in a permanent site to which the Gabrielino/Tongva people will always have access. The site must be secure against vandalism and desecration. It is the policy of the Gabrielino/Tongva Nation to rebury their ancestors as close as possible to where they lived their lives and where they were originally buried.

7. Reasonable costs for the repatriation and reburiel of Gabrilino/Tongva ancestors shall be borne by the developer.

GUIDELINES FOR NATIVE AMERICAN MONITORS GABRIELINO/TONGVA INDIAN NATION

1) It is at the discretion of the project manager to hire Native Americans based on letters of recommendation and professional background achievements as Native American monitors and consultants.

2) Native American monitors are required to be active in the Gabrielino/Tongva Nation community.

3) Native American monitors chosen must abide by the guidelines established by the Native American Heritage Commission. Statutes set by NAHC, Senate Bill 297 (Chapter 1492, Statutes of 1982) and Senate Bill 447 (Chapter 404, Statutes of 1987).

4) Monitors must understand and be familiar with the area being monitored in terms of the cultural and religious aspects of the Gabrielino people and their ancestral practices.

5) Monitor/consultants are required to understand the techniques used by archaeologists to collect on-site data such as excavation, auger holes, trenches, shovel pits, controlled grid surfaces, etc.

6) Monitors are required to be competent in reading topographical maps and standard blueprints.

7) Monitors encountering human remains or associated burial and funerary objects, including sacred objects, must follow the guidelines adopted by the Gabrielino/Tongva Nation with respect to the disposition and repatriation of such encounters.

8) In the event human remains are unearthed during a project, proper notification of authorities will be provided as outlined in the Archeological Procedures for the Treatment and disposition of Human Remains and Associated Grave Goods Discovered at Gabrielino/Tongva Ancestral Sites.

9) If and when artifacts are unearthed and an archaeologist is unavailable, monitors should properly identify archeological material. Monitors must place the material in plastic bags and list the site number, date, description of found material, and monitor's name. The depth of related materials found will be listed in centimeters or meters.

10) Monitors are required to work with project archaeologists and their field personnel. It is imperative that a monitor attempt to establish a good working relationship with the archaeological team.

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11) Monitors are to abide by OSHA guidelines which includes proper apparel be worn at site at all times. This includes a hard hat, fluorescent vest, construction boots and have access to safety goggles. Due to the hazardous condition on site, monitors will meet regularly with the project manager.

12) Monitors are required to have pen, paper, clipboard, black Sharpie, pen, and trowel for proper identification of site findings and assisting archaeologists in removal of archaeological material.

13) **The Gabrielino/Tongva Nation does not endorse the removal or excavation of soils by Native American monitors.**

14) Monitors are required to complete a daily log, listing activities occurring each day including soil observation and cultural materials encountered during excavation etc.

15) Monitors are required to either photograph or draw all essential areas during construction and development of Native American sites. Each photograph taken will be will be indicated by a "P" on the daily log. Drawings are indicated by a "D".

16) Candidates for monitoring which have families with two or more dependents will be considered first. Single individuals experiencing financial hardship will be considered second,. All applicants may address the Gabrielino/Tongva most likely descendant closest to the site area (living) in turn he or she will address the application to the Tongva nation and its members.

17. Monitors must not be under the influence of alcoholic beverages or take any form of unprescribed drugs during working hours. Failure to comply will result in the immediate dismissal from monitoring duties.

18. The most likely descendent and the Gabrielino/Tongva Nation reserves the right to dismiss any monitor from their duties at any time due to their misconduct.

19) The most likely descendent will schedule and direct monitors to their work sites. This includes dates and times of entry and departure. The most likely will update the progress of current activities and reschedule all monitors as needed.

20. Receipts for all expenses incurred such as; gasoline, telephone, film, food, copy services, should be attached to the daily log.

21. Monitors must provide their own transportation to and from working sites.

22. Resumes from potential monitors/consultants should be addressed to the most likely descendent of the Gabrielino/Tongva Nation and project manager prior to commencement of work load.

23. Workloads may vary due to project's interruptions, therefore employment in most cases is not steady.

24. Contracts established by the project manager and Gabrielino/Tongva Monitor/Consultant signatures are legal and binding, therefore all work must be completed by the original signatures.

25. All monitors must comply with contract to begin and finish work according to guideline procedures.

Written and Compiled by Robert F. Dorame

Gabrielino/Tongva
Native American Indian Consultant
and Monitor

8/29/95

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GABRIELINO/TONGVA
DAILY FIELD REPORT

Site ______________________ Excavator ______________________ Unit: ______________________
Date ______________________ Monitor ______________________ Level ______________________

1. Excavation Techniques ______________________

2. Soil Characteristics ______________________

3. Cultural Materials ______________________

4. Remarks ______________________

5. Map: Indicate North

Key

Scale:
▭ = ___

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GABRIELINO/TONGVA INDIAN NATION

PHOTOGRAPHIC RECORD	Job Number ______________ Job Name ______________

YEAR	FILM TYPE	CAMERA TYPE, And CAMERA NUMBER	ASA	ROLL NO.

NO.	DAY	TIME	EXP	SUBJECT	FACING	SITE NO.	F.S. No.	INITIALS

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APPENDIX E: GLOBAL CLIMATE CHANGE

APPENDIX E.i:
CLIMATE CHANGE EMISSIONS FOR THE VILLAGE AT PLAYA VISTA, CITY OF LOS ANGELES, MESTRE GREVE ASSOCIATES, December 4, 2008

Climate Change Emissions For The
The Village at Playa Vista
CITY OF LOS ANGELES

Prepared For:
CHRISTOPHER A. JOSEPH AND ASSOCIATES
11849 W. Olympic Blvd, Suite 101
Los Angeles, CA 90064

Submitted By:

MESTRE GREVE ASSOCIATES
Fred Greve P.E.
Tanya Moon
27812 El Lazo Road
Laguna Niguel, CA 92677
949•349•0671
Fax 949•349•0679

December 4, 2008
Report #08-111

Table Of Contents

1.0 Background Information

1.1 Project Description

The Village at Playa Vista project comprises approximately 111 acres and consists of two components. The first component is the development of 2,600 dwelling units, 175,000 square feet of office spaces, 150,000 square feet of retail spaces, and 40,000 square feet of community serving uses. The proposed project would also include an Equivalency Program, in which a maximum of 125,000 square feet of office development may be exchanged for up to 56,832 square feet of retail uses or up to 200 assisted living units, or a combination thereof. The second component is the construction of a Riparian Corridor and restoration and maintenance of a portion of the Westchester Bluffs adjacent to the Riparian Corridor (the "Habitat Creation/Restoration Component"). The project site is located adjacent to Jefferson Boulevard to the north, Bluff Creek Drive to the south, Campus Center Drive to the east, and Dawn Creek to the west in the City of Los Angeles. The Proposed Project Site is presented as Exhibit 1.

1.2 Greenhouse Gases and Climate Change

The Earth's climate has always been in the process of changing, due to many different natural factors. These factors have included changes in the Earth's orbit, volcanic eruptions, and varying amounts of energy released from the sun. Differences such as these have caused fluctuations in the temperature of the climate, ranging from ice ages to long periods of warmth. However, since the late 18th century, humans have had an increasing impact on the rate of climate change, beginning with the Industrial Revolution.

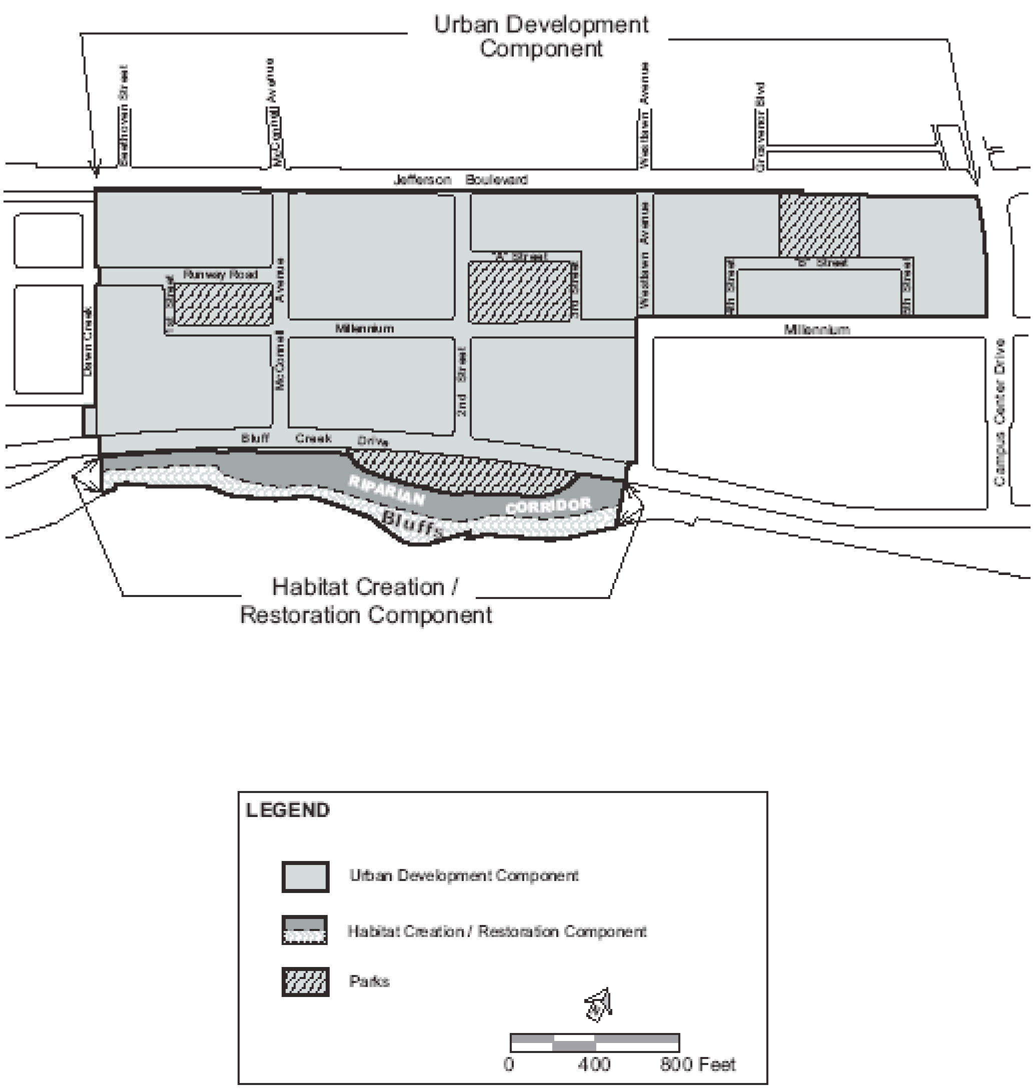
Many human activities have augmented the amount of "greenhouse gases" ("GHGs") being released into our atmosphere, specifically the burning of fossil fuels, such as coal and oil, and deforestation. The gases increase the efficiency of the greenhouse effect, which is the process of trapping and recycling energy (in the form of heat) that the Earth emits naturally, resulting in higher temperatures worldwide. The Intergovernmental Panel on Climate Change stated in February 2007 that warming is unequivocal, expressing very high confidence (expressed as a nine out of ten chance of being correct) that the net effect of human activities since 1750 has been one of warming. According to NOAA and NASA data, the average surface temperature of the Earth has increased by about 1.2 to 1.4 ºF since 1900. The warmest global average temperatures in human record have all occurred within the past 15 years, with the warmest two years being 1998 and 2005.[1]

This process of heating is often referred to as 'global warming,' although the National Academy of Sciences prefers the terms 'climate change' as an umbrella phrase which includes global warming as well as other environmental changes, in addition to the increasing temperatures. Some of these effects include changes to rainfall, wind, and current patterns, as well as snow and ice cover, and sea level.

[1] EPA, 2007, epa.gov/climatechange/basicinfo.html

Depending on which GHG emissions scenario is used, climate models predict that the Earth's average temperature could rise anywhere between 3 to 10.5 ºF by the end of this century. The degree of change is influenced by the assumed amount of GHG emissions, and how quickly atmospheric GHG levels are stabilized. At this point, however, the climate change models are not capable of accurately predicting all specific local temperature or climate impacts, but rather, can only predict global trends.[2] Therefore, predicting exact climate changes at the Proposed Project Site is beyond the capability of climate change models at this time.

Exhibit 1 Proposed Project Site



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2 EPA, 2007, epa.gov/climatechange/basicinfo.html.

Global GHG emissions are measured in million metric tons of carbon dioxide equivalent ("MMT CO_2EQ") units. A metric ton is approximately 2,205 lbs. Some GHGs emitted into the atmosphere are naturally occurring, while others are caused solely by human activities. The principal GHGs[3] that enter the atmosphere because of human activities are:

- **Carbon dioxide (CO_2)** enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), agriculture, irrigation, and deforestation, as well as the manufacturing of cement.

- **Methane (CH_4)** is produced and enters the atmosphere in a number of ways, both natural and man-made (anthropogenic). Decomposition occurring in landfills accounts for the majority of anthropogenic CH_4 emissions in California and in the United States as a whole. Livestock and other agricultural processes such as enteric fermentation, manure management, and rice cultivation are also significant sources of CH_4 in California. Methane is also emitted through the production, transportation and burning of coal, natural gas, and oil.

- **Nitrous oxide (N_2O)** is released most often during the burning of fuel at high temperatures. This GHG is caused mostly by motor vehicles, which also include non-road vehicles, such as those used for agriculture.

[3] Black carbon is a form of particulate air pollution that is most often produced from the burning of biomass, cooking with solid fuels, and diesel exhaust. Some studies have implicated black carbon as a source of global climate change; however, the potential impact of black carbon on climate change is currently under substantial dispute.

Black carbon is not assessed in this report for three primary reasons. First, no regulatory authority has classified black carbon as a greenhouse gas and it is not regulated under AB 32 or any other law implemented to address global climate change. Second, the tools are simply not available to quantify black carbon emissions at this time. Emissions factors for black carbon have not been published by the California Air Resources Board, the U.S. Environmental Protection Agency, or other reputable bodies. Finally, no guidance on the importance, evaluation, or mitigation of black carbon has been provided by the agencies leading regulation of the climate change issue. Therefore, while the Proposed Project will generate some black carbon, the quantities are indeterminable at this time. The potential impact of the black carbon emissions on climate change is also unknown at this time, however, it is anticipated that the Proposed Project would have a very small impact on climate change based on its size relative to the global nature of this issue.

- **Fluorinated Gases** are emitted primarily from industrial sources, which often include hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Though they are often released in smaller quantities, they are referred to as High Global Warming Potential Gases because of their warming forcing power. Fluorinated gases are often used as substitutes for ozone depleting substances.[4]

These gases have different potentials for trapping heat in the atmosphere, called global warming potential ("GWP"). For example, one pound of methane has 21 times more heat capturing potential than one pound of carbon dioxide, nitrous oxide has 310 times more heat capturing potential than one pound of carbon dioxide, and sulfur hexafluoride has 3,200 times more heat capturing potential than one pound of carbon dioxide. When dealing with an array of emissions, the gases are converted to carbon dioxide equivalents ("CO_2EQ") for comparison purposes. The GWPs for common GHGs are shown in Table 1.

Table 1
Global Warming Potentials (GWP)

Gas	Atmospheric Lifetime (years)	Global Warming Potential (CO_2EQ)
Carbon Dioxide	50 - 200	1
Methane	12 ±3	21
Nitrous Oxide	120	310
HFC-23	264	11,700
HFC-134a	14.6	1,300
HFC-152a	1.5	140
PFC: Tetrafluoromethane (CF_4)	50,000	6,500
PFC: Hexafluoroethane (C_2F_6)	10,000	9,200
Sulfur Hexafluoride (SF_6)	3,200	23,900

Source: EPA 2006. Non CO_2 Gases Economic Analysis and inventory. http://www.epa.gov/nonco2/econ-inv/table.html), December 2006

1.3 Emission Inventories

To put perspective on the emissions generated by a project and to better understand the sources of GHGs, it is important to look at emission inventories. The United Nations has taken the lead in quantifying GHG emissions and compiling the literature on climate change. The United Nations estimate for CO_2 equivalents for the world and for the top ten CO_2 producing countries is presented in Table 2.

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4 No industrial uses are planned for the Proposed Project site, so no significant emissions of fluorinated gases are expected.

Table 2
Top Ten CO_2 Producing Nations between 1990-2004
(Emissions in Million Metric Tons (MMT) CO_2EQ)

Country	**Emissions**	**Percent of Global**
1. United States	7067.57	25.3%
2. China	4057.31	14.5%
3. Japan	1355.17	4.9%
4. India	1214.25	4.3%
5. Germany	1015.27	3.6%
6. Canada	758.07	2.7%
7. United Kingdom	665.33	2.4%
8. Brazil	658.98	2.4%
9. Italy	582.52	2.1%
10. France	562.63	2.0%
Total Global	**27,940.70**	**100.0%**

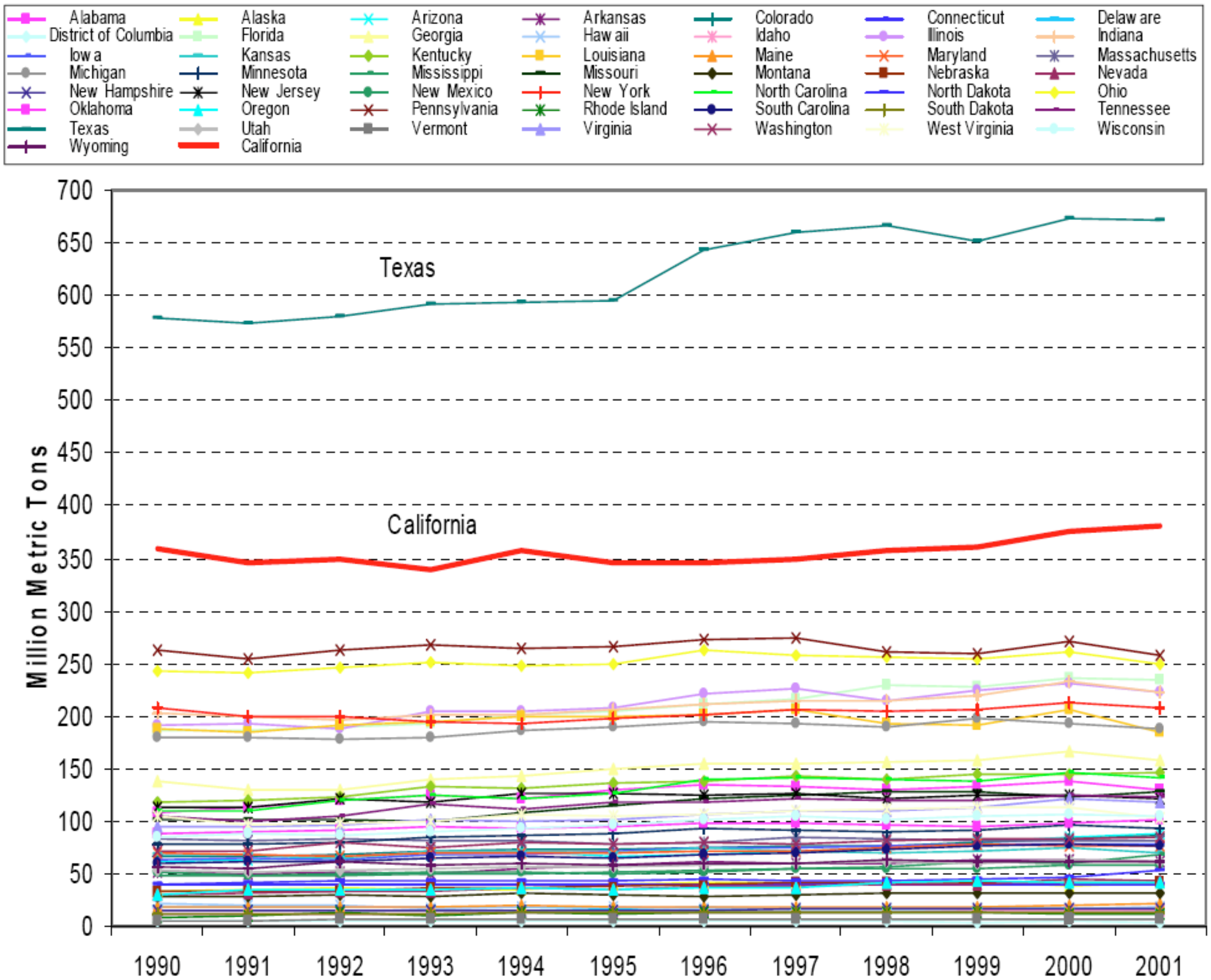
Source: United Nations Framework Convention on Climate Change, "National Greenhouse Gas Inventory Data for the Period 1990–2004 and Status of Reporting," October 19, 2006.

As shown in Table 2, global CO_2 emissions total about 27,941 MMT CO_2EQ (based on data collected between 1990 and 2004). The United States released 7,068 MMT CO_2EQ in 2004, which is approximately 25% of the earth's total emissions.

Within the United States, California has the second highest level of GHG production with Texas having the highest. In 2001, 81% of total GHG emissions in California are CO_2 produced from the burning of fossil fuels.[4] In relation to other states, California is the second highest producer of CO_2 due to the burning of fossil fuels, as shown in Exhibit 2.

[5] California Energy Commission, "Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004," December 2006.

Exhibit 2
CO_2 Production Through Fossil Fuels by State



Source: California Energy Commission, "Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004," December 2006.

1.4 Sources of Greenhouse Gases in California

The California Energy Commission ("CEC") categorizes GHG anthropogenic generation by source into five broad categories. The categories are:

- **Transportation** includes the combustion of gasoline and diesel in automobiles and trucks. Transportation also includes jet fuel consumption.

- **Agriculture and forestry** GHG emissions are composed mostly of nitrous oxide from agricultural soil management, CO_2 from forestry practice changes, methane from enteric fermentation, and methane and nitrous oxide from manure management.

- **Commercial and residential** uses generate GHG emissions primarily from the combustion of natural gas for space and water heating.

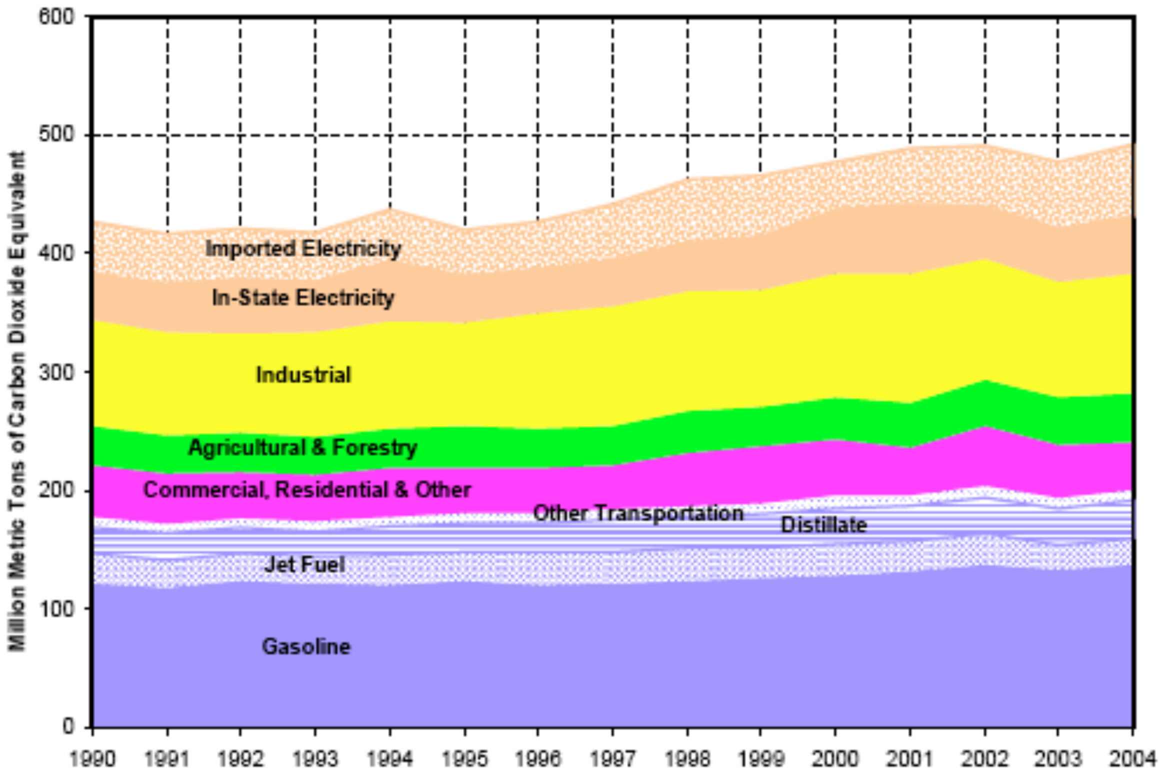
- **Industrial** GHG emissions are produced from many industrial activities. Major contributors include oil and natural gas extraction; crude oil refining; food processing; stone, clay, glass, and cement manufacturing; chemical manufacturing; and cement production. Wastewater treatment plants are also significant contributors to this category.

- **Electric generation** includes both emissions from power plants in California as well as power plants located outside of the state that supply electricity to the state.

The amount of GHGs released from each of these categories in California from 1990 to 2004 is shown in Exhibit 3. A more detailed breakdown of California GHG emissions in both 1990 and 2004 are depicted in Table 3.

Exhibit 3

CA Greenhouse Emissions by Sector (In MMT CO_2EQ)



Source: California Energy Commission, "Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004," December 2006.

Table 3
California GHG Emissions and Sinks Summary
(Million metric tons of CO2 equivalence)

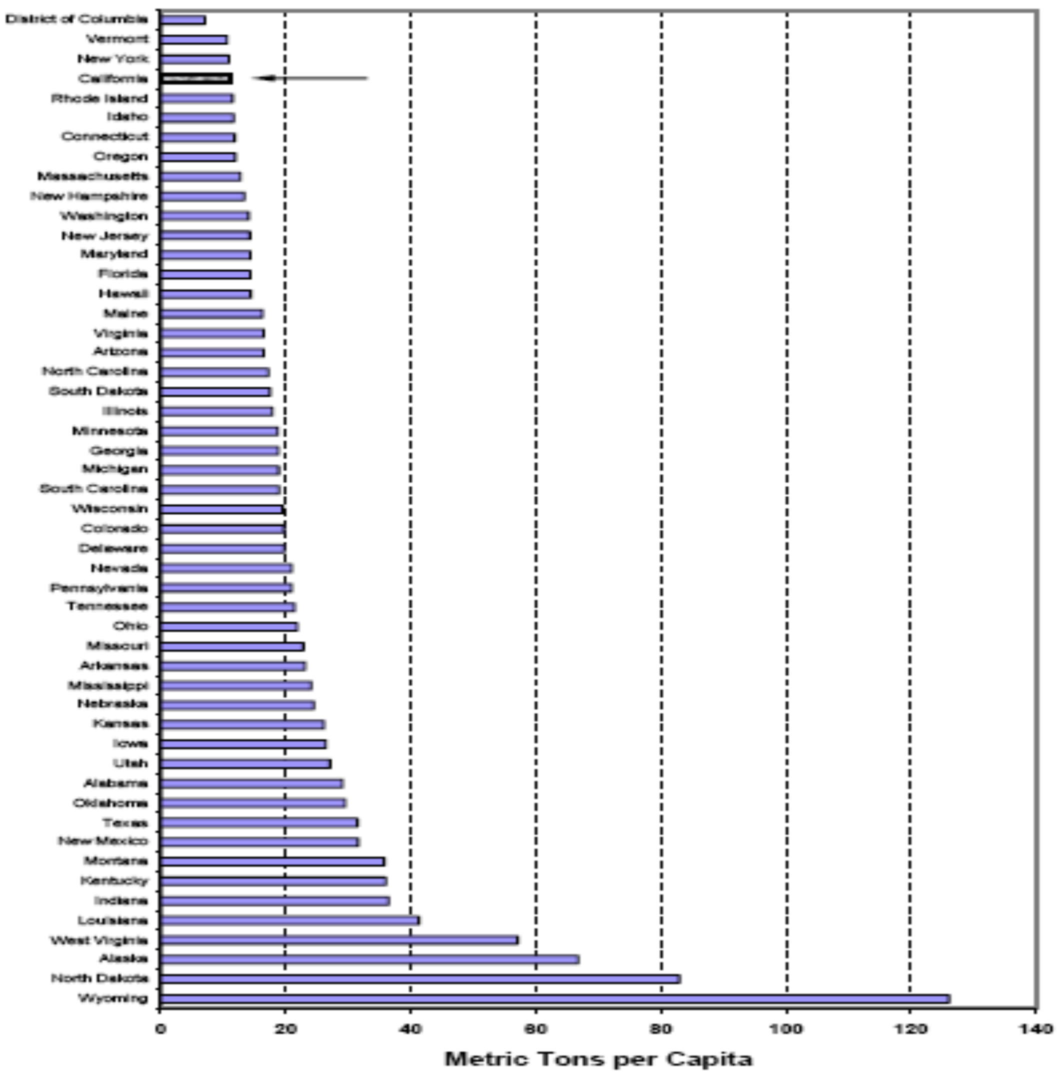
Categories Included in the Inventory	1990	2004
ENERGY	**386.41**	**420.91**
Fuel Combustion Activities	**381.16**	**416.29**
Energy Industries	157.33	166.43
Manufacturing Industries & Construction	24.24	19.45
Transport	150.02	181.95
Other Sectors (Residential and Commercial/Institutional)	48.19	46.29
Non-Specified	1.38	2.16
Fugitive Emissions from Fuels	**5.25**	**4.62**
Oil and Natural Gas	2.94	2.54
Other Emissions from Energy Production	2.31	2.07
INDUSTRIAL PROCESSES & PRODUCT USE	**18.34**	**30.78**
Mineral Industry	4.85	5.90
Chemical Industry	2.34	1.32
Non-Energy Products from Fuels & Solvent Use	2.29	1.37
Electronics Industry	0.59	0.88
Product Uses as Substitutes for Ozone Depleting Substances	0.04	13.97
Other Product Manufacture & Use Other	3.18	1.60
Other	5.05	5.74
AGRICULTURE, FORESTRY, & OTHER LAND USE	**19.11**	**23.28**
Livestock	11.67	13.92
Land	0.19	0.19
Aggregate Sources & Non-CO2 Emissions Sources on Land	7.26	9.17
WASTE	**9.42**	**9.44**
Solid Waste Disposal	6.26	5.62
Wastewater Treatment & Discharge	3.17	3.82
EMISSION SUMMARY		
Gross California Emissions	**433.29**	**484.4**
Sinks and Sequestrations	**-6.69**	**-4.66**
Net California Emissions	**426.60**	**479.74**

Source: California Air Resources Board (CARB), 2007. Draft California Greenhouse Inventory by IPCC Category, August 2007 (available at http://www.arb.ca.gov/cc/inventory/data/tables/rpt_Inventory_IPCC_Sum_2007-11-19.pdf). [Note: does not include aviation, which Exhibit 3 considers.]

Examination of Exhibit 3 and Table 3 indicates that the single largest source of California's GHGs is the transportation sector, such as automobiles, trucks, and airplanes, producing about 40% of the state's total emissions in 2004. The electric generation sector is the second largest GHG contributor in the state.

While California has the second highest rate of GHG production in the nation, it should also be noted that California has one of the lowest per capita rates of GHG emissions. As shown in Exhibit 4, California has the fourth lowest per capita rate of CO_2 production from fossil fuels in the United States.[5] Wyoming produced the most CO_2 per capita, while the District of Columbia produced the lowest.

Exhibit 4
CO_2 Emissions From Fossil Fuels Per Capita (2001)



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6 According to the California Energy Commission, "Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004," December 2006, due to the limited availability of data for state-by-state comparisons, only CO_2 emissions from fossil fuel combustion for the 1990 to 2001 period are considered in this exhibit. CO_2 emissions from fossil fuel combustion compose 58 to 90 percent of the total GHG emissions of individual states; on a national average, they composed 80 percent of total GHG emissions in 2004.

2.0 Regulatory Framework

Federal Plans, Policies, Regulations, and Laws. The federal government began studying the phenomenon of global warming as early as 1978 with the National Climate Protection Act, 92 Stat. 601, which required the President to establish a program to "assist the Nation and the world to understand and respond to natural and man-induced climate processes and their implications." The 1987 Global Climate Protection Act, Title XI of Pub. L. 100-204, directed the U.S. EPA to propose a "coordinated national policy on global climate change," and ordered the Secretary of State to work "through the channels of multilateral diplomacy" to coordinate efforts to address global warming.

In 1988, the United Nations and the World Meteorological Organization established the Intergovernmental Panel on Climate Change to assess "the scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts, and options for adaptation and mitigation."

In 1992, the United States ratified a nonbinding agreement among 154 nations to reduce atmospheric GHGs. On March 21, 1994, the United States joined other countries around the world in signing the United Nations Framework Convention on Climate Change ("UNFCCC"). Under the Convention, governments gather and share information on GHG emissions, national policies, and best practices; launch national strategies for addressing GHG emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries; and cooperate in preparing for adaptation to the impacts of climate change.

The Kyoto Protocol is a treaty made under the UNFCCC. Countries can sign the treaty to demonstrate their commitment to reduce their emissions of GHGs or engage in emissions trading. More than 160 countries, accounting for 55 percent of global emissions, are under the protocol. United States Vice President Al Gore symbolically signed the Protocol in 1998. However, in order for the Protocol to be formally ratified, it must be adopted by the U.S. Senate, which has not been done to date.

In its 2007 *Massachusetts v. EPA*[6] decision, the United States Supreme Court held that GHGs fall within the Clean Air Act's definition of an "air pollutant," and directed the EPA to consider whether GHGs cause a substantial endangerment to public health. If so, the EPA must regulate GHG emissions from automobiles under the Clean Air Act. As of this writing, USEPA has yet to issue a determination.

In December 2007, President Bush signed a bill raising the minimum average miles per gallon (the corporate average fuel economy (CAFE) standard) for cars, sport utility vehicles, and light trucks to 35 miles per gallon by 2020 and mandating increased use of ethanol and other biofuels over the next 15 years. This increase in CAFE standard will create a substantial reduction in GHG emissions from automobiles, which is the largest single emitting GHG sector in California.

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7 *Massachusetts v. Environmental Protection Agency,* 127 S. Ct. 1438 (2007).

As of this writing, however, there are no adopted federal plans, policies, regulations or laws setting a mandatory limit on GHG emissions.

California State Plans, Policies, Regulations, and Laws.[7] California has distinguished itself as a national leader in efforts to address global climate change by enacting a range of legislation and regulations, engaging in multi-national and multi-state collaborative efforts, and preparing a wealth of information on the impacts associated with global climate change.

Assembly Bill 32, the California Global Warming Solutions Act of 2006 (Health and Safety Code § 38500 et seq.). In September 2006, Governor Arnold Schwarzenegger signed AB 32, the California Global Warming Solutions Act of 2006. In general, AB 32 directs the California Air Resources Board ("CARB") to do the following:

- On or before June 30, 2007, CARB shall publish a list of discrete early action measures for reducing GHG emissions that can be implemented by January 1, 2010;
- By January 1, 2008, establish the statewide GHG emissions cap for 2020, based on CARB's calculation of statewide GHG emissions in 1990 (an approximately 25 percent reduction in existing statewide GHG emissions);
- Also by January 1, 2008, adopt mandatory reporting rules for GHG emissions sources that "contribute the most to statewide emissions" (Health & Safety Code § 38530);
- By January 1, 2009, adopt a scoping plan that indicates how GHG emission reductions will be achieved from significant GHG sources through regulations, market mechanisms, and other strategies;
- On or before January 1, 2010, adopt regulations to implement the early action GHG emission reduction measures;
- On or before January 1, 2011, adopt quantifiable, verifiable, and enforceable emission reduction measures by regulation that will achieve the statewide GHG emissions limit by 2020; and
- On January 1, 2012, CARB's GHG emissions regulations become operative.
- On January 1, 2020, achieve 1990 levels of GHG emissions.

In December 2007, CARB issued a final quantification of 1990 emissions at 427 million metric tons of CO_2 equivalent emissions.[8]

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[8] CARB's "California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit", public released on November 16, 2007.

AB 32 takes into account the relative contribution of each source or source category to protect adverse impacts on small businesses and others by requiring CARB to recommend a *de minimis* threshold of GHG emissions below which emissions reduction requirements would not apply. AB 32 also allows the Governor to adjust the deadlines mentioned above for individual regulations or the entire state to the earliest feasible date in the event of extraordinary circumstances, catastrophic events, or threat of significant economic harm.

CARB "Early Action Measures" (June 30, 2007). On June 21, 2007, CARB approved its early action measures to address climate change, as required by AB 32. The three measures include: (1) a low carbon fuel standard, which will reduce the carbon-intensity in California fuels, thereby reducing total CO_2 emissions; (2) reduction of refrigerant losses from motor vehicle air conditioning system maintenance through the restriction of "do-it-yourself" automotive refrigerants; and (3) increased CH_4 capture from landfills through the required implementation of state-of-the-art capture technologies. Other early action measures are under consideration.

CARB Mandatory Reporting Regulations (December 2007). Under AB 32, CARB propounded regulations to govern mandatory GHG emissions reporting for certain sectors of the economy, most dealing with approximately 94 percent of the industrial and commercial stationary sources of emissions. Regulated entities include electricity generating facilities, electricity retail providers, oil refineries, hydrogen plants, cement plants, cogeneration facilities, and industrial sources that emit over 25,000 metric tons of CO_2 from stationary source combustion.

Senate Bill 375 (September 2008). In September 2008, SB 375 was signed by Governor Schwarzenegger. SB 375 is a comprehensive global warming bill that helps to achieve the goals of AB32. It requires the Metropolitan Planning Organization to include and adopt, in their regional transportation plan, a sustainable community strategy that will meet the region's target for reducing GHG emissions.

Senate Bill 97 (2007). By July 1, 2009, the Governor's Office of Planning and Research (OPR) is directed to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, as required by the California Environmental Quality Act. The Resources Agency is required to certify and adopt these guidelines by January 1, 2010. OPR is required to periodically update these guidelines as CARB implements AB 32. In addition, SB 97 states that the failure to include a discussion of GHG emissions in any CEQA document for a project funded under the Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006, or projects funded under the Disaster Preparedness and Flood Prevention Bond Act of 2006 shall not be a cause of action under CEQA. This last provision will terminate by its terms on January 1, 2010.

Executive Order S-01-07 (2007). Executive Order S-01-07 calls for a reduction in the carbon intensity of California's transportation fuels by at least 10 percent by 2020. As noted above, the low-carbon fuel standard ("LCFS") was adopted by CARB as one of its three "early action measures" on June 21, 2007.

Senate Bill 1368 (2006) (Public Utilities Code §§ 8340-41). SB 1368 required the California Public Utilities Commission ("PUC") to establish a "GHG emission performance standard" by

February 1, 2007, for all electricity providers under its jurisdiction, including the state's three largest privately-owned utilities. Pub. Res. Code § 8341(d)(1). These utilities provide approximately 30 percent of the state's electric power. After the PUC acted, the CEC adopted a performance standard "consistent with" the PUC performance standard and applied it to local publicly-owned utilities on May 23, 2007 (over one month ahead of its June 30, 2007 deadline). Cal. Pub. Res. Code § 8341(e)(1). However, the California Office of Administrative Law ("OAL") found four alleged flaws in the CEC's rulemaking. The CEC overcame these alleged flaws and adopted reformulating regulations in August 2007.

Senate Bill 107 (2006). Senate Bill 107 ("SB 107") requires investor-owned utilities such as Pacific Gas and Electric, Southern California Edison and San Diego Gas and Electric, to generate 20 percent of their electricity from renewable sources by 2010. Previously, state law required that this target be achieved by 2017.

Western Regional Climate Action Initiative (Arizona, California, New Mexico, Oregon, Utah, Washington)(2007). Acknowledging that the western states already experience a hotter, drier climate, the Governors of the foregoing states have committed to three time-sensitive actions: (1) by August 26, 2007, to set a regional goal to reduce emissions from the states collectively, consistent with state-by state goals; (2) by August 26, 2008, to develop "a design for a regional market-based multi-sector mechanism, such as a load-based cap and trade program, to achieve the regional GHG reduction goal;" and (3) to participate in a multi-state GHG registry "to enable tracking, management, and crediting for entities that reduce GHG emissions, consistent with state GHG reporting mechanisms and requirements."

Executive Order S-3-05 (June 1, 2005). Executive Order S-3-05 calls for a reduction in GHG emissions to 2000 levels by 2010; 1990 levels by 2020; and for an 80 percent reduction in GHG emissions below 1990 levels by 2050. It also directs the California Environmental Protection Agency ("CalEPA") to prepare biennial science reports on the potential impact of continued global warming on certain sectors of the California economy.

California's Renewable Energy Portfolio Standard Program (2005). In 2002, California established its Renewable Energy Portfolio Standard Program, which originally included a goal of increasing the percentage of renewable energy in the state's electricity mix to 20 percent by 2017. The state's most recent 2005 Energy Action Plan raises the renewable energy goal from 20 percent by 2017, to 33 percent by 2020.

Title 24, Part 6, California Code of Regulations (2005). In 2005, California adopted new energy efficiency standards for residential and nonresidential buildings in order to reduce California's energy consumption. This program has been partially responsible for keeping California's per capita energy use approximately flat over the past 30 years.

Assembly Bill 1493 (2002) (Health and Safety Code § 43018.5). Assembly Bill 1493 ("AB 1493") required CARB to develop and adopt the nation's first GHG emission standards for automobiles. Not only have litigants challenged their legality in federal court, but also USEPA denied California's request for a Clean Air Act waiver to implement its regulations. As of this writing, California and other states who seek to adopt California's GHG emissions standards for automobiles are challenging USEPA's denial in federal court.

Climate Action Registry (2001). California Senate Bills 1771 and 527 created the structure of the California Climate Action Registry ("Registry"), and former Governor Gray Davis signed the final version of the Registry's enabling legislation into law on October 13, 2001. These bills establish the Registry as a non-profit entity to help companies and organizations establish GHG emissions baselines against which future GHG emission reduction requirements could be applied. Using any year from 1990 forward as a base year, participants can record their annual GHG emissions with the Registry. In return for this voluntary action, the State of California promises to offer its "best efforts" to ensure that participants receive consideration for their early action if they are subject to any future state, federal, or international emissions regulatory scheme.

South Coast Air Quality Management District Plans, Policies, Regulations and Laws. The South Coast Air Quality Management District ("SCAQMD") adopted a "Policy on Global Warming and Stratospheric Ozone Depletion" in April 1990. The policy commits the SCAQMD to consider global impacts in rulemaking and in drafting revisions to the Air Quality Management Plan. In March 1992, the SCAQMD Governing Board reaffirmed this policy and adopted amendments to the policy to include the following directives:

- Phase out the use and corresponding emissions of chlorofluorocarbons (CFCs), methyl chloroform (1,1,1-trichloroethane or TCA), carbon tetrachloride, and halons by December 1995;

- Phase out the large quantity use and corresponding emissions of hydrochlorofluorocarbons (HCFCs) by the year 2000;

- Develop recycling regulations for HCFCs (e.g., SCAQMD Rules 1411 and 1415);

- Develop an emissions inventory and control strategy for methyl bromide; and

- Support the adoption of a California GHG emission reduction goal.

The legislative and regulatory activity detailed above is expected to require significant development and implementation of energy efficient technologies and shifting of energy production to renewable sources. The SCAQMD's Working Group is developing a proposed set of GHG CEQA significance thresholds; however, nothing is published at this time.

City of Los Angeles Plans, Policies, Regulations, and Laws.

In May 2007, the City of Angeles "*Green LA, An Action Plan to Lead the Nation in Fighting Global Warming,*" outlining the goals and actions the City has established to reduce the generation and emission of GHGs from both public and private activities, which sets forth a goal for the City of Los Angeles to reduce CO_2 emissions to 35 percent below 1990 levels by 2030. The Action Plan focuses on reducing CO_2 emissions from power generation, but also emphasizes the reduction of water consumption and waste, an increase in greening and open space, and a reduction in emissions from transportation. To achieve this, the City will:

- Increase the generation of renewable energy;
- Improve energy conservation and efficiency; and
- Change transportation and land use patterns to reduce dependence on automobiles.

3.0 Analysis Overview

This assessment reviews the estimated GHG emissions of the Proposed Village at Playa Vista Project. The analysis quantifies, when possible, GHG emissions through 2010, 2020, and 2040 from construction and operations of the Proposed Project and the three equivalency scenarios. The analysis goes on to assess potential cumulative effects of these emissions.

4.0 Short term Construction Emissions

On-site Construction

Temporary impacts will result from Proposed Project construction activities. The primary source of GHG emissions generated by construction activities is from use of diesel-powered construction equipment and other combustion sources (i.e., generators, worker vehicles, materials delivery, etc.). The GHG air pollutants emitted by construction equipment would primarily be carbon dioxide.[9]

Typical emission rates for construction equipment were obtained from URBEMISv9.2.4, which was released in 2007. Carbon dioxide (CO_2) emissions were calculated utilizing URBEMIS9.2.4. URBEMISv9.2.4 specifically calculates emissions for ROG, CO, NOx, SO_2, PM_{10}, $PM_{2.5}$ and CO_2. While the URBEMISv9.2.4 model does not include other GHG emissions generated by the proposed project (such as CH_4, N_2O, and Fluorinated Gases), CO_2 emissions comprise approximately 99.6 percent of emissions from burning diesel fuel.[10] Consequently, non-CO_2 GHG emissions represent a very small percentage (approximately 0.4 percent) of the total short-term construction GHG emissions and would not represent a significant source of GHG emissions generated by the proposed project during construction, even when combined with CO_2 emissions. Therefore, non-CO_2 construction GHG emissions have not been quantified in this analysis.

The Proposed Project Site comprises a total of approximately 111 acres, of which approximately 23 acres are open space parks and riparian/habitats. Subsequent to the City Council approval of the Proposed Project and certification of the EIR in September 2004, construction of the Proposed Project began, and continued until the September 13, 2007 appellate court decision

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9 When one gallon of diesel fuel is burned it produces 22.384 pounds of CO_2, 0.000534 pounds of CH_4, and 0.0001928 pounds N_2O. Based on the global warming potential of 21 for CH_4 and 310 for N_2O relative to CO_2, the total pounds of CO_2-equivalent (CO_2EQ) emissions from diesel fuel is 22.455 CO_2EQ/gallon, which is 99.6 percent of the total emissions. Bay Area Air Quality Management District (BAAQS), *Source Inventory of Bay Area Greenhouse Gas Emissions*, November 2006.

10 *Id*.

enjoining further construction on the site and mandating the superior court to vacate the 2004 approvals. Between September 2004 and September 13, 2007, a substantial portion of the infrastructure improvements were completed within the Proposed Project Site, including all streets and utilities in the northern half of the Site, and sewer, storm drains, curb and gutter, and the riparian corridor in the southern half. All mass grading was complete and surcharge was placed for the entire Proposed Project Site. Remaining construction is limited to 1) surcharge removal, 2) installation of water, electric, and gas lines, and the pavement of roadways in the southern half of the Site, 3) completion of streetscape (sidewalks, street lights, etc.) and parks, and 4) building construction. This analysis accounts for the GHG emissions associated with all construction activities associated with the Proposed Project, whether they occurred between September 2004 and September 13, 2007 or would be associated with completion of the Proposed Project.

The number of heavy equipment operated utilized for each construction phase (i.e., grading, trenching and installation of utilities, building construction, etc.) were obtained from the Draft EIR Appendix E-1. Individual construction activities were grouped into the following five major construction phases, and the number of equipment used was based on a conservative "worst case" average of the grouped activities.

Site Grading includes clearing, stripping, scarifying, compacting, fill, mass excavation, and grading. Grading emissions for the Proposed Project were estimated utilizing URBEMISv9.2.4. The number of heavy equipment operated during a peak grading period include 2 graders, 3 rubber tired dozers, 2 tractors/loaders/backhoes, 2 water trucks, and 20 dump trucks all operated 8 hours per day. These heavy equipment could operate simultaneously at any one time.

Trenching includes the installation of storm drain, sewer, potable and reclaimed water, gas and electric utilities, following the completion of the mass grading. The heavy equipment utilized include 1 loader, 1 tractor/loader/backhoe, 1 trencher, and 1 water truck.

Building Construction is the construction of the buildings proposed by the project. Equipment is planned to be utilized during a peak construction period include 1 crane, 2 cement trucks, 1 forklift, 1 loader, 1 tractor/loader/backhoe, 4 other equipment and 17 trucks.

Asphalt paving includes installation of streets, sidewalks and landscape. The majority of diesel engine exhaust emissions are generated from the paving equipment and asphalt material haul trucks. Based on the construction information from the Draft EIR Appendix E-1, the asphalt paving for the project would occur over 85,087 square yards or approximately 17.6 acres. The heavy construction equipment required includes 1 grader, 1 dozer, 1 loader, 2 rollers and 4 other equipment.

Architectural coatings include painting exterior and interior walls as well as coatings applied to windows and window casings. Architectural coating emissions for the Proposed Project were estimated utilizing URBEMISv9.2.4.[11]

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[11] URBEMIS v.9.2.4 default assumptions.

Off-Site Roadway Improvements

Off-site construction includes street improvements at seven locations in the vicinity of the project site. The locations of the street improvements are along Centinela Avenue Corridor, and the intersections of Centinela Avenue/Culver Boulevard, La Tijera Boulevard/ Centinela Avenue, Inglewood Boulevard/Culver Boulevard, Washington Place/Centinela Avenue, Overland Avenue/Culver Boulevard, and Sawtelle Avenue and Culver Boulevard. The construction data were obtained from the Draft EIR Appendix E-1. The off-site construction emissions were estimated utilizing URBEMISv9.2.4.

Total Construction Emissions

Using the estimates from URBEMISv.9.2.4 of emissions from off-site street improvements as well as on-site mass site grading, trenching, building construction, asphalt paving, and architectural coatings for the Proposed Project, the peak air pollutant emissions were calculated and presented in Table 4. These emissions represent the total CO_2 emissions for construction. Worksheets showing the specific data used to calculate the grading emissions are presented in Appendix A.

Table 4
Peak Construction Emissions

Activity	Construction Emissions CO_2 (Carbon Dioxide) Tons	CO_2 MMTs
ON-SITE		
- Site Grading/Construction Equip.	2,611	0.002
- Trenching	39	0.000
- Building Construction Equip.	54,703	0.050
- Asphalt Paving Construction Equip.	124	0.000
- Architectural Coating	104	0.000
OFF-SITE		
- Street Improvements	270	0.000
Total Emissions:	**57,851**	**0.053**

Other GHG emissions (such as CH_4, N_2O, and Fluorinated Gases) are not calculated in URBEMIS v.9.2.4; however, CO_2 emissions comprise approximately 99.6 percent of emissions from burning diesel fuel. See Section 4.0, footnote 9.
MMT = million metric tons
Numbers may not add up due to rounding.

5.0 Estimate of Proposed Project Greenhouse Gas Emissions

The analysis considers direct and indirect emissions of the operation of the Proposed Project after build out resulting from motor vehicle trips, on-site combustion of natural gas, off-site emissions from the generation of electricity consumed by the Proposed Project, as well as emissions generated by potable and recycled water usage associated with the Proposed Project.

To calculate greenhouse emissions, the Proposed Project's daily vehicle trip generation provided in the Draft EIR (August 2003) was utilized. See Appendix B for summary of traffic trip data from the Proposed Project. Other emissions will be generated from the Proposed Project through combustion of natural gas as well as off-site GHG emissions from the generation of electricity. The natural gas and electricity consumption for the entire Proposed Project were obtained from Tables 156, 157 and 158 of the 2003 Draft EIR.[12] Greenhouse gas emissions also will be generated by potable and recycled water usage associated with the Proposed Project. The treatment and conveyance of water is a major source of electricity consumption in California. Potable and recycled water usage for the Proposed Project also was obtained from the 2003 Draft EIR. The 2003 Draft EIR's Table 163 and Table 164 stated that, on an average daily basis, the entire project requires 0.503 million gallons per day (MGD) of potable water and 63,624 gallons of reclaimed water usage.

Table 5
Projected Daily Trips, Energy, and Water Consumption from Proposed Project

PROPOSED PROJECT	**PROPOSED PROJECT**
- Trips	24,220 dt
- Electricity Usage	53,010 KWh/day
- Natural Gas Consumption	484.73 kcf/day
- Potable Water Consumption	0.503 mgd
-Reclaimed water usage	63,624 gpd

Notes: KWh=kilowatt-hour
mgd = million gallons per day
gpd = gallons per day
dt = daily trips

Table 6 analyzes the projected emissions from the Proposed Project. More specific data utilized in calculating the emissions are provided in the appendix. CARB's EMFAC2007 emissions database provided the appropriate emission rate and vehicle trip length for each category of vehicle. The emission rates utilized for natural gas and electrical usage were obtained from the EPA's AP-42, Tables 1.4.3 and Table 3.1-2a, respectively. The electrical consumption required to deliver water depends on how far the water must be pumped to the user. Generally, the LADWP water comes from a variety of sources, ranging from local groundwater supplies to distant areas.[13] Roughly half of the water services the LADWP area comes from the Metropolitan Water District of Southern California (a consortium of local water districts) and that most of that water comes from the Colorado River aqueduct.[14] Other significant sources for LADWP include local wells, which would both have a lower (but an unknown) energy consumption rate. As a conservative case assumption, the average electrical consumption rate for potable water is assumed to be 2,000 KWh/acre-foot, which represents the typical energy requirement for water coming through the Colorado River Aqueduct.[15] For recycled water, the

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12 The daily electricity consumption of 53.01 MWh from the 2003 DEIR Table 156 was utilized for the Proposed Project.

13 City of Los Angeles Department of Water and Power, "2005 Urban Water Management Plan".

14 City of Los Angeles Department of Water and Power, "2005 Urban Water Management Plan".

15 Wilkinson, Robert, Director, Water Policy Program, Bren School of Environmental Science and Management, UCSB, and Gary Wolff, Principal Economist and Engineer, The Pacific Institute, "2005 Integrated Energy Policy Report to the California Energy Commission." Wilkinson, Robert, Director,

rate of 400 KWh/acre-foot is typically used.[16]

However, emission rates for most sources of N_2O, another GHG, are not available. N_2O is a very minor emission in the combustion process. N_2O emissions will be very small and likely will account for only 0.1% or less of the GHG emissions for this type of project. N_2O is a very minor emission in the combustion process. As a result, N_2O emissions are not included in this report. To determine the total carbon dioxide equivalent of GHG emissions from the Proposed Project, the source emissions were calculated by multiplying the CH_4 and CO_2 emissions in pounds per day by GWP constants of 21 and 1, respectively. The total CO_2 equivalent is the sum of these CH_4 and CO_2 numbers.[17] The CO_2 equivalents were then converted to metric tons (MT) per year.

Table 6
Total Estimated Proposed Project Greenhouse Gas Emissions – Year 2010

Source	MT/Year Total CO_2EQ	MMT/Year Total CO_2EQ	Percent of Total Emissions
PROPOSED PROJECT			
- Vehicular Trips	24,440	0.024	58%
- Natural Gas Consumption	9,634	0.010	23%
- Electrical Usage	7,679	0.008	18%
- Potable water usage	56	0.000	0%
- Potable water usage	15	0.000	0%
Total Emissions :	**41,825**	**0.042**	

Note: The vast majority of the CO_2 equivalency estimated to be emitted from the proposed project are CO_2 emissions.
MMT=Million metric tons per year.
Numbers may not add up due to rounding.

The Proposed Project is projected to emit a total of 41,825 metric tons per year of carbon dioxide equivalent GHGs. Table 6 shows that 58% of the Proposed Project's GHG emissions (as expressed in CO_2 equivalents) generated by the Proposed Project are projected to be from motor vehicles. Natural gas consumption and electric usage are the next biggest contributors and account for 23% and 18% of the GHG emissions, respectively.

Water Policy Program, Bren School of Environmental Science and Management, UCSB, and Gary Wolff, Principal Economist and Engineer, The Pacific Institute, "2005 Integrated Energy Policy Report to the California Energy Commission."

16 Wilkinson, Robert, Director, Water Policy Program, Bren School of Environmental Science and Management, UCSB, and Gary Wolff, Principal Economist and Engineer, The Pacific Institute, "2005 Integrated Energy Policy Report to the California Energy Commission."

17 This analysis of operational GHG emissions from the Proposed Project includes assessments of methane (unlike the construction analysis) because emissions factors for methane are available for operational GHG emissions from sources such as CARB's EMFAC2007 and EPA's AP-42, Tables 1.4.3 and Table 3.1-2a.

Projected Greenhouse Gas Emissions of the Proposed Project

The GHG emissions also were projected for future years beyond 2010 and are presented in Table 7. The change in the GHG emissions corresponds to changes in the projected EMFAC2007 CO_2 emission rates.

Table 7
Project Trend Of GHG Emissions
(metric tons per year of CO_2 equivalents)

Year	MT CO_2EQ	MMT CO_2EQ
2010	41,825	0.0418
2020	41,574	0.0416
2030	41,771	0.0418
2040	42,134	0.0421

Table 8 compares the GHG emissions from the Proposed Project to total emissions in California, the United States, and globally. This comparison shows that the Proposed Project's emissions represent a very small fraction of total GHG emissions

Table 8
Relative Contribution of Proposed Project Emissions to Global GHG Emissions

	MMT CO_2eEQ	Year	Percent Contribution of Proposed Project GHG Emissions
Project Emissions	0.0418	2010	
State of California	480	2004	0.0086%
United States	7,068	2004	0.0006%
World	27,941	2004	0.00015%

Sources: United Nations Framework Convention on Climate Change, "National Greenhouse Gas Inventory Data for the Period 1990-2004 and Status of Reporting," October 19, 2006; California Energy Commission, "Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004," December 2006.

The emissions generated by this Proposed Project, therefore, will contribute a very small amount to the overall climate change issue. By way of comparison, the global data from the United Nations indicates that the project would contribute less than 0.00015% to the GHG burden for the planet. Even when compared to California's GHG emissions, the Proposed Project's individual contribution is quite small (approximately 0.0089% of 2004 California emissions).

Equivalency Program Emissions

The Proposed Project also includes an Equivalency Program in which a maximum of 125,000 square feet of office development may be exchanged for up to 56,832 square feet of retail uses or up to 200 assisted living units, or a combination thereof. Within the Equivalency Program, there are three equivalent scenarios: 1) All Retail, 2) All Assisted Living, and 3) Retail/Assisted

Living. The analysis compares daily trips, energy, and water consumption of the three equivalency scenarios and quantifies the greenhouse gas emissions that result from each scenario.

Table 9
Projected Daily Trips, Energy, and Water Consumption from Equivalency Scenarios

	All Retail in Equivalency Program	All Assisted-Living in Equivalency Program	Retail/Assisted Living in Equivalency Program
- Trips	23,931	24,178	24,070
- Electricity Usage	40,090 KWh	43,174 KWh	43,172 KWh
- Natural Gas Consumption	481.93 kcf	518.24 kcf	515.98 kcf
- Potable Water Consumption	0.488 mgd	0.527 mgd	0.514 mgd
-Reclaimed water usage	56,999 gpd	62,347 gpd	56,999 gpd

Notes: KWh= kilowatt-hour, kcf = thousand cubic feet, mgd = million gallons per day, gpd = gallons per day
Sources: Trips: Appendix B,2008 Report from Raju & Associates Technical Report Summarizing ADTs from 2003 Traffic Study; Electricity & Natural Gas: 2003 Draft EIR, Tables 156, 157 and 158; Water: 2003 Draft EIR, Tables 163 and 168

As indicated in Table 9, the All Retail equivalency scenario will generate the fewest trips (23,931) and use the least amount of energy (40,090 KWh of daily electricity usage, 481.93 thousand cubic feet of daily natural gas consumption, 0.488 million gallons per day of potable water consumption, and 56,999 gallons per day of reclaimed water consumption). The All Assisted Living equivalency scenario is anticipated to generate 24,178 daily trips, 43,174 KWh of daily electricity usage, 518.24 thousand cubic feet of daily natural gas consumption, 0.527 million gallons per day of potable water consumption, and 62,347 gallons per day of reclaimed water consumption. The Retail/Assisted Living equivalency scenario is anticipated to generate slightly fewer daily trips (24,070) and slightly less energy and water consumption (43,172 KWh of daily electricity usage, 515.98 thousand cubic feet of daily natural gas consumption, 0.514 million gallons per day of potable water consumption, and 56,999 gallons per day of reclaimed water consumption).

Table 10
Total Estimated Emissions From Equivalency Scenarios – Year 2010

Source	MT/Year Total CO_2EQ	MMT/Year Total CO_2EQ	% of Total Emissions
All Retail in Equivalency Program			
- Vehicular Trips	24,149	0.024	58%
- Natural Gas Consumption	9,578	0.010	23%
- Electrical Usage	7,679	0.008	19%
- Potable water usage	55	0.000	0%
- Non-potable water	13	0.000	0%
Total Emissions :	**41,474**	**0.041**	
All Assisted-Living in Equivalency Program			
Vehicular Trips	24,398	0.024	57%
Natural Gas Consumption	10,300	0.010	24%
Electrical Usage	8,269	0.008	19%
- Potable water usage	59	0.000	0%
- Non-potable water	15	0.000	0%
Total Emissions :	**43,041**	**0.043**	
Retail/Assisted-Living in Equivalency Program			
Vehicular Trips	24,289	0.024	57%
Natural Gas Consumption	10,255	0.010	24%
Electrical Usage	8,269	0.008	19%
- Potable water usage	58	0.000	0%
- Non-potable water	13	0.000	0%
Total Emissions :	**42,884**	**0.043**	

The vast majority of the CO_2 equivalency estimated to be emitted from the proposed project is CO_2 emissions.
Numbers may not add up due to rounding.

Of the three scenarios in the Equivalency Program, the All Retail scenario would generate fewer emissions than if the program were not applied, while the All Assisted Living scenario would generate the highest emissions. If the Equivalency Program is utilized, then a range of between 41,474 and 43,041 total carbon dioxide equivalent GHGs would be emitted.

Projected Greenhouse Gas Emissions of the Equivalency Scenarios

The GHG emissions also were projected for future years beyond 2010 and are presented in Table 11. The analysis indicates that between 2010 and 2020, the GHG emissions in CO_2 equivalent will drop and then rise slightly thereafter. The rise and fall in the GHG emissions are directly proportional to the rise and drop in the projected EMFAC2007 CO_2 emission rates.

Table 11
Project Trend Of GHG Emissions
(metric tons per year of CO_2 equivalents)

Year	MT CO_2EQ
All Retail in Equivalency Program	
2010	41,474
2020	41,226
2030	41,420
2040	41,779
All Assisted-Living in Equivalency Program	
2010	43,041
2020	42,791
2030	42,987
2040	43,350
Retail/Assisted Living in Equivalency Program	
2010	42,884
2020	42,635
2030	42,831
2040	43,191

Table 12 compares the GHG emissions from the Equivalency Program to total emissions in California, the United States, and globally. This comparison shows that all of the Equivalency Program's emissions represent a very small fraction of total GHG emissions.

Table 12
Relative Contributions of Proposed Equivalency Program Emissions to Global GHG Emissions

	MMT CO_2eEQ	Year	Percent Contribution of All Retail Equivalency Program	Percent Contribution of All Assisted-Living Equivalency Program	Percent Contribution from Retail/Assisted-Living Equivalency Program
All Retail in Equivalency Program	0.0415	2010			
All Assisted-Living in Equivalency Program	0.0430	2010			
Retail/Assisted Living in Equivalency Program	0.0429	2010			
State of California	480	2004	0.0086%	0.0090%	0.0089%
United States	7,068	2004	0.0006%	0.0006%	0.0006%
World	27,941	2004	0.00015%	0.00015%	0.00015%

Sources: United Nations Framework Convention on Climate Change, "National Greenhouse Gas Inventory Data for the Period 1990-2004 and Status of Reporting," October 19, 2006; California Energy Commission, "Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004," December 2006.

Like the Proposed Project without the Equivalency Program, the emissions generated by any of the three Equivalency Program scenarios, therefore, will contribute a very small amount to the overall climate change issue. By way of comparison, the global data from the United Nations indicates that the equivalency programs with the most emissions (All Assisted-Living and Retail/Assisted Living) would (like the Proposed Project) contribute approximately 0.00015% to the GHG burden for the planet. Even when compared to California's GHG emissions, the contribution from any of the equivalency programs would be quite small -- approximately 0.0091% (or less) of 2004 California emissions.

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Appendix A

8/20/2008 12:04:35 PM

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Documents and Settings\Environmental Svcs\Desktop\URBEMIS_PROJECTS\PlayaVista.urb924
Project Name: Playa Vista Construction

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	CO2
2005 TOTALS (tons/year unmitigated)	2,610.81
2005 TOTALS (tons/year mitigated)	2,610.81
Percent Reduction	0.00
2006 TOTALS (tons/year unmitigated)	12,306.49
2006 TOTALS (tons/year mitigated)	12,306.49
Percent Reduction	0.00
2007 TOTALS (tons/year unmitigated)	12,186.93
2007 TOTALS (tons/year mitigated)	12,186.93
Percent Reduction	0.00
2008 TOTALS (tons/year unmitigated)	12,229.27
2008 TOTALS (tons/year mitigated)	12,229.27
Percent Reduction	0.00
2009 TOTALS (tons/year unmitigated)	12,179.51
2009 TOTALS (tons/year mitigated)	12,179.51
Percent Reduction	0.00
2010 TOTALS (tons/year unmitigated)	6,067.24
2010 TOTALS (tons/year mitigated)	6,067.24
Percent Reduction	0.00
	57.580

Summary per activity

	CO_2 Tons	CO_2 MTs	CO_2 MMTs
Grading	2,611	2,369	0.002
Trenching	39	36	0.000
Building	54,703	49,626	0.050
Paving	124	112	0.000
Arch Coating	104	94	0.000
Total:	**57,580**	**52,237**	**0.052**

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	CO2
2005	2,610.81
Mass Grading 01/01/2005-12/31/2005	2,610.81
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,493.21
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	117.60
2006	12,306.49
Building 01/01/2006-07/01/2010	12,122.42
Building Off Road Diesel	3,991.82
Building Vendor Trips	1,685.51
Building Worker Trips	6,445.09
Trenching 01/01/2006-03/01/2006	39.27
Trenching Off Road Diesel	36.59
Trenching Worker Trips	2.68
Coating 02/01/2006-07/31/2010	21.13
Architectural Coating	0.00
Coating Worker Trips	21.13
Asphalt 04/01/2006-05/30/2006	123.67
Paving Off-Gas	0.00
Paving Off Road Diesel	105.38
Paving On Road Diesel	13.06
Paving Worker Trips	5.23
2007	12,186.93
Building 01/01/2006-07/01/2010	12,163.78
Building Off Road Diesel	4,007.18
Building Vendor Trips	1,692.32
Building Worker Trips	6,464.29
Coating 02/01/2006-07/31/2010	23.15
Architectural Coating	0.00
Coating Worker Trips	23.15
2008	12,229.27
Building 01/01/2006-07/01/2010	12,206.05
Building Off Road Diesel	4,022.53
Building Vendor Trips	1,699.02
Building Worker Trips	6,484.50
Coating 02/01/2006-07/31/2010	23.22
Architectural Coating	0.00
Coating Worker Trips	23.22
2009	12,179.51
Building 01/01/2006-07/01/2010	12,156.39
Building Off Road Diesel	4,007.18
Building Vendor Trips	1,692.67
Building Worker Trips	6,456.54
Coating 02/01/2006-07/31/2010	23.12
Architectural Coating	0.00
Coating Worker Trips	23.12
2010	6,067.24
Building 01/01/2006-07/01/2010	6,053.86
Building Off Road Diesel	1,995.91
Building Vendor Trips	843.13
Building Worker Trips	3,214.82
Coating 02/01/2006-07/31/2010	13.37

Architectural Coating	0.00
Coating Worker Trips	13.37

Phase Assumptions

Phase: Mass Grading 1/1/2005 - 12/31/2005 - Default Mass Site Grading/Excavation Description

Total Acres Disturbed: 106

Maximum Daily Acreage Disturbed: 53

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 0 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

2 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

20 Other General Industrial Equipment (238 hp) operating at a 0.51 load factor for 8 hours per day

3 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

2 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Trenching 1/1/2006 - 3/1/2006 - Trenching

Off-Road Equipment:

1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

1 Trenchers (63 hp) operating at a 0.75 load factor for 8 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 4/1/2006 - 5/30/2006 - Paving Description

Acres to be Paved: 17.58

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

3 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day

Phase: Building Construction 1/1/2006 - 7/1/2010 - Office, Retail and Residential

Off-Road Equipment:

2 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

17 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

4 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Skid Steer Loaders (44 hp) operating at a 0.55 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 2/1/2006 - 7/31/2010 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	CO_2
2005	2,610.81
Mass Grading 01/01/2005-12/31/2005	2,610.81
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,493.21
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	117.60
2006	12,306.49
Building 01/01/2006-07/01/2010	12,122.42
Building Off Road Diesel	3,991.82
Building Vendor Trips	1,685.51
Building Worker Trips	6,445.09
Trenching 01/01/2006-03/01/2006	39.27
Trenching Off Road Diesel	36.59
Trenching Worker Trips	2.68
Coating 02/01/2006-07/31/2010	21.13
Architectural Coating	0.00
Coating Worker Trips	21.13
Asphalt 04/01/2006-05/30/2006	123.67
Paving Off-Gas	0.00
Paving Off Road Diesel	105.38
Paving On Road Diesel	13.06
Paving Worker Trips	5.23
2007	12,186.93
Building 01/01/2006-07/01/2010	12,163.78
Building Off Road Diesel	4,007.18
Building Vendor Trips	1,692.32
Building Worker Trips	6,464.29
Coating 02/01/2006-07/31/2010	23.15
Architectural Coating	0.00
Coating Worker Trips	23.15
2008	12,229.27
Building 01/01/2006-07/01/2010	12,206.05
Building Off Road Diesel	4,022.53

Building Vendor Trips	1,699.02
Building Worker Trips	6,484.50
Coating 02/01/2006-07/31/2010	23.22
Architectural Coating	0.00
Coating Worker Trips	23.22
2009	12,179.51
Building 01/01/2006-07/01/2010	12,156.39
Building Off Road Diesel	4,007.18
Building Vendor Trips	1,692.67
Building Worker Trips	6,456.54
Coating 02/01/2006-07/31/2010	23.12
Architectural Coating	0.00
Coating Worker Trips	23.12
2010	6,067.24
Building 01/01/2006-07/01/2010	6,053.86
Building Off Road Diesel	1,995.91
Building Vendor Trips	843.13
Building Worker Trips	3,214.82
Coating 02/01/2006-07/31/2010	13.37
Architectural Coating	0.00
Coating Worker Trips	13.37

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 1/1/2005 - 12/31/2005 - Default Mass Site Grading/Excavation Description

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: ***Village at Playa Vista***
Study Year: ***2010***
County: ***LA***

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*24,220*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00045	6.09	
Emissions (Lb/Dy)	10.9	147391.7	
Subtotal	10.90	147391.7	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	229.0	147,391.7	147,620.7
Emissions (MT/YR)	**37.9**	**24,402.4**	**24,440.3**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	;as ft³/DU/M(	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.			**484,728**	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	58,167.4		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.4	58,167.4	58,190.8	
Emissions (MT/YR)	**3.9**	**9,630.3**	**9,634.1**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Y	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)	365,000	**40,092**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,306.4			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,306.4	46,382.4		
Emissions (MT/YR)	**12.6**	**7,666.5**	**7,679.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	503,195	564	2,000	3088.03
Recycled water	63,624	71	400	78.09

Source of Energy Consumption: Village at Playa Vista Draft EIR, Tables 163 and 164, August 2003. Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	339.7	340.2
Recycled Water Emis. (Lb/Dy)	0.0	90.2	90.3
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	339.7	340.2
Recycled Water (Eq. Lb/Dy)	0.1	90.2	90.3
Potable water (MT/YR)	**0.1**	**56.2**	**56.3**
Nonpotable water (MT/YR)	**0.0**	**14.9**	**15.0**

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	233.7	252,295.3	252,624.4
Metric Tons/Year	54	41,770	41,825

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: ***Village at Playa Vista***
Study Year: ***2020***
County: ***LA***

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*24,220*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00023	6.03	
Emissions (Lb/Dy)	5.6	145986.2	
Subtotal	5.60	145986.2	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	117.5	145,986.2	146,103.8
Emissions (MT/YR)	**19.5**	**24,169.7**	**24,189.1**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.			**484,728**	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	58,167.4		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.4	58,167.4	58,190.8	
Emissions (MT/YR)	**3.9**	**9,630.3**	**9,634.1**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	SCE KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)	365,000	**40,092**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,306.4			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,306.4	46,382.4		
Emissions (MT/YR)	**12.6**	**7,666.5**	**7,679.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	LADWP kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	503,195	564	2,000	3088.03
Recycled water	63,624	71	400	78.09
Source of Energy Consumption: "Village at Playa Vista Draft EIR", August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	339.7	340.2	
Recycled Water Emis. (Lb/Dy)	0.0	90.2	90.3	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.6	339.7	340.2	
Recycled Water (Eq. Lb/Dy)	0.1	90.2	90.3	
Potable water (MT/YR)	**0.1**	**56.2**	**56.3**	
Nonpotable water (MT/YR)	**0.0**	**14.9**	**15.0**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	122.3	250,889.9	251,107.5
Metric Tons/Year	36	41,538	41,574

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista*
Study Year: *2030*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = *24,220* Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00016	6.08	
Emissions (Lb/Dy)	3.8	147215.8	
Subtotal	3.76	147215.8	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	78.9	147,215.8	147,294.7
Emissions (MT/YR)	**13.1**	**24,373.2**	**24,386.3**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 156, August 2003.				
			484,728	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	58,167.4		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.4	58,167.4	58,190.8	
Emissions (MT/YR)	**3.9**	**9,630.3**	**9,634.1**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	SCE KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 156, August 2003.					
		Total (Ft2)	365,000	**40,092**	Total
Contaminant	CH4	CO2	CO2E		Emission Factor Source: EPA AP-42 Table 3.1-2a
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155			1MW=10.5MMBtu/hr
Emis. (Lb/Dy)	3.6	46,306.4			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,306.4	46,382.4		
Emissions (MT/YR)	**12.6**	**7,666.5**	**7,679.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	LADWP kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	503,195	564	2,000	3088.03
Recycled water	63,624	71	400	78.09

Source of Energy Consumption: "Village at Playa Vista Draft EIR", August 2003. Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	339.7	340.2
Recycled Water Emis. (Lb/Dy)	0.0	90.2	90.3
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	339.7	340.2
Recycled Water (Eq. Lb/Dy)	0.1	90.2	90.3
Potable water (MT/YR)	**0.1**	**56.2**	**56.3**
Nonpotable water (MT/YR)	**0.0**	**14.9**	**15.0**

**TOTAL PROJECT EMISSIONS **

	CH4	CO2	CO2E
lbs/day	83.7	252,119.4	252,298.5
Metric Tons/Year	30	41,741	41,771

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista*
Study Year: *2040*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = *24,220* Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00013	6.17	
Emissions (Lb/Dy)	3.2	149418.9	
Subtotal	3.20	149418.9	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	67.2	149,418.9	149,486.2
Emissions (MT/YR)	**11.1**	**24,738.0**	**24,749.1**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 156, August 2003.				
			484,728	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	58,167.4		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.4	58,167.4	58,190.8	
Emissions (MT/YR)	**3.9**	**9,630.3**	**9,634.1**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	SCE KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 156, August 2003.					
		Total (Ft2)	365,000	**40,092**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,306.4			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,306.4	46,382.4		
Emissions (MT/YR)	**12.6**	**7,666.5**	**7,679.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	LADWP kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	503,195	564	2,000	3088.03
Recycled water	63,624	71	400	78.09

Source of Energy Consumption: "Village at Playa Vista Draft EIR", August 2003. Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	339.7	340.2
Recycled Water Emis. (Lb/Dy)	0.0	90.2	90.3
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	339.7	340.2
Recycled Water (Eq. Lb/Dy)	0.1	90.2	90.3
Potable water (MT/YR)	**0.1**	**56.2**	**56.3**
Nonpotable water (MT/YR)	**0.0**	**14.9**	**15.0**

**TOTAL PROJECT EMISSIONS **

	CH4	CO2	CO2E
lbs/day	72.0	254,322.5	254,489.9
Metric Tons/Year	28	42,106	42,134

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-All Retail*
Study Year: *2010*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*23,931*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00045	6.09	
Emissions (Lb/Dy)	10.8	145633.0	
Subtotal	10.77	145633.0	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	226.2	145,633.0	145,859.2
Emissions (MT/YR)	**37.5**	**24,111.2**	**24,148.6**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			481,927	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	57,831.2		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.3	57,831.2	57,854.5	
Emissions (MT/YR)	**3.9**	**9,574.6**	**9,578.5**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		**40,090**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,303.7			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,303.7	46,379.7		
Emissions (MT/YR)	**12.6**	**7,666.1**	**7,678.7**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	487,571	546	2,000	2992.15
Recycled water	56,999	64	400	69.96
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	329.1	329.7	
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.5	329.1	329.7	
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9	
Potable water (MT/YR)	**0.1**	**54.5**	**54.6**	
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	231.0	250,177.9	250,504.1
Metric Tons/Year	54	41,420	41,474

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-All Retail*
Study Year: *2020*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = *23,931* Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00023	6.03	
Emissions (Lb/Dy)	5.5	144244.3	
Subtotal	5.53	144244.3	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	116.1	144,244.3	144,360.4
Emissions (MT/YR)	**19.2**	**23,881.3**	**23,900.5**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			481,927	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	57,831.2		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.3	57,831.2	57,854.5	
Emissions (MT/YR)	**3.9**	**9,574.6**	**9,578.5**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		**40,090**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,303.7			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,303.7	46,379.7		
Emissions (MT/YR)	**12.6**	**7,666.1**	**7,678.7**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	487,571	546	2,000	2992.15
Recycled water	56,999	64	400	69.96

Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.

Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	329.1	329.7
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.5	329.1	329.7
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9
Potable water (MT/YR)	**0.1**	**54.5**	**54.6**
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	120.9	248,789.2	249,005.3
Metric Tons/Year	36	41,190	41,226

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-All Retail*
Study Year: *2030*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*23,931*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00016	6.08	
Emissions (Lb/Dy)	3.7	145459.2	
Subtotal	3.71	145459.2	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	78.0	145,459.2	145,537.2
Emissions (MT/YR)	**12.9**	**24,082.4**	**24,095.3**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			481,927	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	57,831.2		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.3	57,831.2	57,854.5	
Emissions (MT/YR)	**3.9**	**9,574.6**	**9,578.5**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		**40,090**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,303.7			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,303.7	46,379.7		
Emissions (MT/YR)	**12.6**	**7,666.1**	**7,678.7**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	487,571	546	2,000	2992.15
Recycled water	56,999	64	400	69.96
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	329.1	329.7	
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.5	329.1	329.7	
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9	
Potable water (MT/YR)	**0.1**	**54.5**	**54.6**	
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	82.7	250,004.1	250,182.0
Metric Tons/Year	29	41,391	41,420

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-All Retail*
Study Year: *2040*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*23,931*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00013	6.17	
Emissions (Lb/Dy)	3.2	147636.0	
Subtotal	3.16	147636.0	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	66.4	147,636.0	147,702.4
Emissions (MT/YR)	**11.0**	**24,442.8**	**24,453.8**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			481,927	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.1	57,831.2		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	23.3	57,831.2	57,854.5	
Emissions (MT/YR)	**3.9**	**9,574.6**	**9,578.5**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		**40,090**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.6	46,303.7			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	76.0	46,303.7	46,379.7		
Emissions (MT/YR)	**12.6**	**7,666.1**	**7,678.7**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	487,571	546	2,000	2992.15
Recycled water	56,999	64	400	69.96
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	329.1	329.7	
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.5	329.1	329.7	
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9	
Potable water (MT/YR)	**0.1**	**54.5**	**54.6**	
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	71.2	252,180.9	252,347.3
Metric Tons/Year	28	41,751	41,779

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-All Assisted Living*
Study Year: *2010*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*24,178*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00045	6.09	
Emissions (Lb/Dy)	10.9	147136.1	
Subtotal	10.88	147136.1	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	228.6	147,136.1	147,364.7
Emissions (MT/YR)	**37.8**	**24,360.0**	**24,397.9**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			518,242	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	62,189.0		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	25.0	62,189.0	62,214.1	
Emissions (MT/YR)	**4.1**	**10,296.1**	**10,300.2**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,174	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,866.3			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,866.3	49,948.2		
Emissions (MT/YR)	**13.6**	**8,255.9**	**8,269.5**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	526,719	590	2,000	3232.40
Recycled water	62,347	70	400	76.52
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	355.6	356.1	
Recycled Water Emis. (Lb/Dy)	0.0	88.4	88.5	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.6	355.6	356.1	
Recycled Water (Eq. Lb/Dy)	0.1	88.4	88.5	
Potable water (MT/YR)	**0.1**	**58.9**	**59.0**	
Recycled water (MT/YR)	**0.0**	**14.6**	**14.7**	

*****TOTAL PROJECT EMISSIONS *****

	CH4	CO2	CO2E
lbs/day	233.7	259,635.4	259,971.6
Metric Tons/Year	56	42,986	43,041

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: ***Village at Playa Vista Equiv.-All Assisted Living***
Study Year: ***2020***
County: ***LA***

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = *24,178* Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00023	6.03	
Emissions (Lb/Dy)	5.6	145733.1	
Subtotal	5.59	145733.1	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	117.3	145,733.1	145,850.4
Emissions (MT/YR)	**19.4**	**24,127.7**	**24,147.2**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			518,242	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	62,189.0		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	25.0	62,189.0	62,214.1	
Emissions (MT/YR)	**4.1**	**10,296.1**	**10,300.2**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,174	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,866.3			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,866.3	49,948.2		
Emissions (MT/YR)	**13.6**	**8,255.9**	**8,269.5**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	526,719	590	2,000	3232.40
Recycled water	62,347	70	400	76.52
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	355.6	356.1	
Recycled Water Emis. (Lb/Dy)	0.0	88.4	88.5	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.6	355.6	356.1	
Recycled Water (Eq. Lb/Dy)	0.1	88.4	88.5	
Potable water (MT/YR)	**0.1**	**58.9**	**59.0**	
Recycled water (MT/YR)	**0.0**	**14.6**	**14.7**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	122.5	258,232.4	258,457.4
Metric Tons/Year	37	42,753	42,791

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-All Assisted Living*
Study Year: *2030*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = *24,178* Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00016	6.08	
Emissions (Lb/Dy)	3.8	146960.5	
Subtotal	3.75	146960.5	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	78.8	146,960.5	147,039.3
Emissions (MT/YR)	**13.0**	**24,331.0**	**24,344.0**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			518,242	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	62,189.0		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	25.0	62,189.0	62,214.1	
Emissions (MT/YR)	**4.1**	**10,296.1**	**10,300.2**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,174	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,866.3			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,866.3	49,948.2		
Emissions (MT/YR)	**13.6**	**8,255.9**	**8,269.5**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	526,719	590	2,000	3232.40
Recycled water	62,347	70	400	76.52

Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.
Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	355.6	356.1
Recycled Water Emis. (Lb/Dy)	0.0	88.4	88.5
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	355.6	356.1
Recycled Water (Eq. Lb/Dy)	0.1	88.4	88.5
Potable water (MT/YR)	**0.1**	**58.9**	**59.0**
Recycled water (MT/YR)	**0.0**	**14.6**	**14.7**

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	83.9	259,459.8	259,646.2
Metric Tons/Year	31	42,956	42,987

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: ***Village at Playa Vista Equiv.-All Assisted Living***
Study Year: ***2040***
County: ***LA***

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = *24,178* Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00013	6.17	
Emissions (Lb/Dy)	3.2	149159.8	
Subtotal	3.20	149159.8	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	67.1	149,159.8	149,226.9
Emissions (MT/YR)	**11.1**	**24,695.1**	**24,706.2**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			518,242	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	62,189.0		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	25.0	62,189.0	62,214.1	
Emissions (MT/YR)	**4.1**	**10,296.1**	**10,300.2**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,174	Total

Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr
Emis. (Lb/Dy)	3.9	49,866.3		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	81.9	49,866.3	49,948.2	
Emissions (MT/YR)	**13.6**	**8,255.9**	**8,269.5**	

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	526,719	590	2,000	3232.40
Recycled water	62,347	70	400	76.52

Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003. Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	355.6	356.1
Recycled Water Emis. (Lb/Dy)	0.0	88.4	88.5
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	355.6	356.1
Recycled Water (Eq. Lb/Dy)	0.1	88.4	88.5
Potable water (MT/YR)	**0.1**	**58.9**	**59.0**
Recycled water (MT/YR)	**0.0**	**14.6**	**14.7**

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	72.3	261,659.1	261,833.9
Metric Tons/Year	29	43,321	43,350

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: ***Village at Playa Vista Equiv.-Retail/Assisted Living***
Study Year: ***2010***
County: ***LA***

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*24,070*	Composite Mix		
	CH4	CO2	CO2E	
Composite Mix				
Factors (lbs/trip)	0.00045	6.09		
Emissions (Lb/Dy)	10.8	146478.9		
Subtotal	10.84	146478.9		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	227.5	146,478.9	146,706.4	
Emissions (MT/YR)	**37.7**	**24,251.2**	**24,288.9**	

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			515,982	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	61,917.8		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	24.9	61,917.8	61,942.8	
Emissions (MT/YR)	**4.1**	**10,251.2**	**10,255.3**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,172	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,864.1			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,864.1	49,946.0		
Emissions (MT/YR)	**13.6**	**8,255.6**	**8,269.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	514,107	576	2,000	3155.00
Recycled water	56,999	64	400	69.96
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	347.0	347.6	
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.6	347.0	347.6	
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9	
Potable water (MT/YR)	**0.1**	**57.5**	**57.6**	
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	232.7	258,688.7	259,023.7
Metric Tons/Year	55	42,829	42,884

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: ***Village at Playa Vista Equiv.-Retail/Assisted Living***
Study Year: ***2020***
County: ***LA***

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day = ***24,070*** Composite Mix

	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00023	6.03	
Emissions (Lb/Dy)	5.6	145082.1	
Subtotal	5.56	145082.1	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	116.8	145,082.1	145,198.9
Emissions (MT/YR)	**19.3**	**24,020.0**	**24,039.3**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			515,982	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	61,917.8		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	24.9	61,917.8	61,942.8	
Emissions (MT/YR)	**4.1**	**10,251.2**	**10,255.3**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		**43,172**	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,864.1			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,864.1	49,946.0		
Emissions (MT/YR)	**13.6**	**8,255.6**	**8,269.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	514,107	576	2,000	3155.00
Recycled water	56,999	64	400	69.96

Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003. Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	347.0	347.6
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	347.0	347.6
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9
Potable water (MT/YR)	**0.1**	**57.5**	**57.6**
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	121.9	257,291.9	257,516.2
Metric Tons/Year	37	42,598	42,635

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-Retail/Assisted Living*
Study Year: *2030*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*24,070*	Composite Mix		
	CH4	CO2	CO2E	
Composite Mix				
Factors (lbs/trip)	0.00016	6.08		
Emissions (Lb/Dy)	3.7	146304.1		
Subtotal	3.73	146304.1		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	78.4	146,304.1	146,382.5	
Emissions (MT/YR)	**13.0**	**24,222.3**	**24,235.3**	

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			515,982	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	61,917.8		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	24.9	61,917.8	61,942.8	
Emissions (MT/YR)	**4.1**	**10,251.2**	**10,255.3**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,172	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,864.1			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,864.1	49,946.0		
Emissions (MT/YR)	**13.6**	**8,255.6**	**8,269.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	514,107	576	2,000	3155.00
Recycled water	56,999	64	400	69.96
Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003.				Emission Factor Source: Wilkinson 2005.
Contaminant	CH4	CO2	CO2E	
Factor (lbs/MMBtu)	0.0086	110		
Factor (lbs/MWH)	0.0903	1155		
Potable water Emis. (Lb/Dy)	0.0	347.0	347.6	
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9	
Global Warming Potential (GWP)	21	1		
Potable Water(Eq. Lb/Dy)	0.6	347.0	347.6	
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9	
Potable water (MT/YR)	**0.1**	**57.5**	**57.6**	
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**	

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	83.5	258,513.9	258,699.8
Metric Tons/Year	31	42,800	42,831

• MESTRE GREVE ASSOCIATES PROJECT EMISSIONS WORKSHEET •

v. 07.07

Project: *Village at Playa Vista Equiv.-Retail/Assisted Living*
Study Year: *2040*
County: *LA*

1. VEHICULAR EMISSIONS

Emission Factor Source: EMFAC2007

Number of Trips Per Day =	*24,070*	Composite Mix	
	CH4	CO2	CO2E
Composite Mix			
Factors (lbs/trip)	0.00013	6.17	
Emissions (Lb/Dy)	3.2	148493.5	
Subtotal	3.18	148493.5	
Global Warming Potential (GWP)	21	1	
Emissions (Eq. Lb/Dy)	66.8	148,493.5	148,560.4
Emissions (MT/YR)	**11.1**	**24,584.8**	**24,595.8**

2. ON SITE EMISSIONS DUE TO NATURAL GAS COMBUSTION

Unit Type	Gas ft³/DU/Mo.	DU	Gas ft³/day	
Source: Village at Playa Vista Draft EIR, Table 158, August 2003.				
			515,982	**Total Gas Usage/Day**
	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 1.4.3
Factor (lbs/10^6 ft³)	2.3	120,000.0		
Emissions (Lb/Dy)	1.2	61,917.8		
Global Warming Potential (GWP)	21	1		
Emissions (Eq. Lb/Dy)	24.9	61,917.8	61,942.8	
Emissions (MT/YR)	**4.1**	**10,251.2**	**10,255.3**	

3. OFF SITE EMISSIONS DUE TO ELECTRICAL GENERATION

0

Unit Type	KWH/Unit/Yr	LADWP KWH/Unit/Yr	Number of Units or Ft2	Electrical Use (KWH/Day)	
Source: Village at Playa Vista Draft EIR, Table 157, August 2003.					
		Total (Ft2)		43,172	Total
Contaminant	CH4	CO2	CO2E	Emission Factor Source: EPA AP-42 Table 3.1-2a	
Factor (lbs/MMBtu)	0.0086	110			
Factor (lbs/MWH)	0.0903	1155		1MW=10.5MMBtu/hr	
Emis. (Lb/Dy)	3.9	49,864.1			
Global Warming Potential (GWP)	21	1			
Emissions (Eq. Lb/Dy)	81.9	49,864.1	49,946.0		
Emissions (MT/YR)	**13.6**	**8,255.6**	**8,269.1**		

4. EMISSIONS DUE TO ELECTRICAL GENERATION FROM POTABLE AND RECYCLED WATER

Unit Type	Gallons/Day	acre-foot/year	kwh/acre-foot	Electrical Use (KWH/Day)
Mixed use				
Potable water	514,107	576	2,000	3155.00
Recycled water	56,999	64	400	69.96

Source of Energy Consumption: Village at Playa Vista Draft EIR, Table 168, August 2003. Emission Factor Source: Wilkinson 2005.

Contaminant	CH4	CO2	CO2E
Factor (lbs/MMBtu)	0.0086	110	
Factor (lbs/MWH)	0.0903	1155	
Potable water Emis. (Lb/Dy)	0.0	347.0	347.6
Recycled Water Emis. (Lb/Dy)	0.0	80.8	80.9
Global Warming Potential (GWP)	21	1	
Potable Water(Eq. Lb/Dy)	0.6	347.0	347.6
Recycled Water (Eq. Lb/Dy)	0.1	80.8	80.9
Potable water (MT/YR)	**0.1**	**57.5**	**57.6**
Recycled water (MT/YR)	**0.0**	**13.4**	**13.4**

***TOTAL PROJECT EMISSIONS ***

	CH4	CO2	CO2E
lbs/day	71.9	260,703.3	260,877.7
Metric Tons/Year	29	43,162	43,191

Title : Los Angeles County Avg Annual 3 CYrs 2010 to 2020 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/03/31 10:45:20
Scen Year: 2010 -- All model years in the range 1966 to 2010 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day

	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCAT	LDT1-CAT	LDT1-DSL	LDT1-TOT	LDT2-NCAT	LDT2-CAT	LDT2-DSL	LDT2-TOT	MDV-NCAT	MDV-CAT	MDV-DSL	MDV-TOT	LHDT1-NCAT	LHDT1-CAT	LHDT1-DSL	LHDT1-TOT	LHDT2-NCAT	LHDT2-CAT	LHDT2-DSL	LHDT2-TOT	MHDT-NCAT	MHDT-CAT	MHDT-DSL	MHDT-TOT	HHDT-NCAT	HHDT-CAT	HHDT-DSL	HHDT-TOT	OBUS-NCAT
Vehicles	34488	3424340	7832	3466660	11521	408544	10168	430233	7842	1345110	1864	1354820	6245	586484	1755	594484	868	72728	12818	86415	201	15869	10989	27059	1224	10810	41045	53078	395	1984	24869	27248	53
VMT/1000	557	115800	168	116525	269	14618	320	15208	185	49557	55	49797	131	21646	54	21831	24	3535	722	4282	5	761	535	1301	11	565	2771	3347	5	211	4993	5210	0
Trips	137003	21617900	41802	21796700	46210	2571620	62019	2679850	31857	8513720	10868	8556440	27057	3706690	10794	3744540	28706	2404880	161240	2594830	6633	524721	138233	669587	55875	493662	1150890	1700430	18019	90619	125849	234487	2431
Methane Emissions																																	
Run Exh	0.22	3.25	0	3.46	0.11	0.49	0	0.6	0.07	1.78	0	1.86	0.06	1.01	0	1.07	0.01	0.18	0	0.19	0	0.03	0.01	0.04	0	0.04	0.03	0.08	0	0.05	0.35	0.41	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.03	0
Start Ex	0.05	0.56	0	0.61	0.02	0.07	0	0.09	0.01	0.26	0	0.27	0.01	0.16	0	0.18	0.01	0.12	0	0.13	0	0.02	0	0.02	0.04	0.04	0	0.08	0.02	0.02	0	0.05	0
Total Ex	0.27	3.8	0	4.08	0.13	0.56	0	0.69	0.09	2.04	0	2.13	0.07	1.18	0	1.25	0.02	0.3	0	0.33	0	0.05	0.01	0.06	0.04	0.08	0.03	0.16	0.03	0.08	0.38	0.48	0
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0.27	3.8	0	4.08	0.13	0.56	0	0.69	0.09	2.04	0	2.13	0.07	1.18	0	1.25	0.02	0.3	0	0.33	0	0.05	0.01	0.06	0.04	0.08	0.03	0.16	0.03	0.08	0.38	0.48	0
Lbs/trip	0.004	0.000	0.000	0.000	0.006	0.000	0.000	0.001	0.006	0.000	0.000	0.000	0.005	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.003	0.002	0.006	0.004	0.000
Trip Length	4.1	5.4	4.0	5.3	5.8	5.7	5.2	5.7	5.8	5.8	5.1	5.8	4.8	5.8	5.0	5.8	0.8	1.5	4.5	1.7	0.8	1.5	3.9	1.9	0.2	1.1	2.4	2.0	0.3	2.3	39.7	22.2	0.0
Carbon Dioxide Emissions (000)																																	
Run Exh	0.33	51	0.07	51.4	0.16	8	0.12	8.28	0.11	27.2	0.02	27.33	0.1	16.25	0.02	16.37	0.02	2.69	0.41	3.13	0	0.58	0.31	0.9	0.01	0.42	4.6	5.03	0	0.16	10.28	10.44	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0	0.02	0	0	0	0.01	0	0	0.02	0.02	0	0	0.31	0.31	0
Start Ex	0.03	1.73	0	1.76	0.01	0.26	0	0.27	0.01	0.85	0	0.85	0.01	0.51	0	0.51	0.01	0.1	0	0.11	0	0.02	0	0.02	0.01	0.02	0	0.03	0	0	0	0.01	0
Total Ex	0.36	52.72	0.07	53.15	0.17	8.25	0.12	8.55	0.12	28.04	0.02	28.18	0.11	16.75	0.02	16.88	0.02	2.82	0.42	3.26	0.01	0.61	0.32	0.93	0.02	0.45	4.61	5.08	0.01	0.16	10.59	10.76	0
Lbs/trip	5.255	4.877	3.349	4.877	7.358	6.416	3.870	6.381	7.534	6.587	3.681	6.587	8.131	9.038	3.706	9.016	1.393	2.345	5.210	2.513	3.015	2.325	4.630	2.778	0.716	1.823	8.011	5.975	1.110	3.531	168.297	91.775	0.000
Trip Length	4.1	5.4	4.0	5.3	5.8	5.7	5.2	5.7	5.8	5.8	5.1	5.8	4.8	5.8	5.0	5.8	0.8	1.5	4.5	1.7	0.8	1.5	3.9	1.9	0.2	1.1	2.4	2.0	0.3	2.3	39.7	22.2	0.0

Title : Los Angeles County Avg Annual 3 CYrs 2010 to 2020 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/03/31 10:45:20
Scen Year: 2020 -- All model years in the range 1976 to 2020 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day

	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCAT	LDT1-CAT	LDT1-DSL	LDT1-TOT	LDT2-NCAT	LDT2-CAT	LDT2-DSL	LDT2-TOT	MDV-NCAT	MDV-CAT	MDV-DSL	MDV-TOT	LHDT1-NCAT	LHDT1-CAT	LHDT1-DSL	LHDT1-TOT	LHDT2-NCAT	LHDT2-CAT	LHDT2-DSL	LHDT2-TOT	MHDT-NCAT	MHDT-CAT	MHDT-DSL	MHDT-TOT	HHDT-NCAT	HHDT-CAT	HHDT-DSL	HHDT-TOT	OBUS-NCAT
Vehicles	417	3834160	1911	3836490	132	466950	4675	471758	186	1534260	660	1535110	1307	682007	954	684268	86	85581	18479	104146	2	18467	13273	31742	32	12990	49502	62524	5	1360	29788	31153	1
VMT/1000	6	123238	37	123281	3	16168	128	16300	4	52919	18	52941	24	23273	24	23322	2	4022	905	4930	0	867	624	1491	0	662	3098	3760	0	106	6766	6872	0
Trips	1595	23837400	9237	23848200	509	2880680	26142	2907330	717	9477450	3570	9481740	4958	4207450	5389	4217790	2846	2829870	232448	3065160	78	610628	166962	777668	1454	593237	1388050	1982740	211	62125	150742	213078	40
Methane Emissions																																	
Run Exh	0	1.75	0	1.75	0	0.31	0	0.31	0	1.29	0	1.29	0.01	0.71	0	0.72	0	0.09	0	0.1	0	0.01	0	0.02	0	0.02	0.02	0.04	0	0.02	0.16	0.18	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0
Start Ex	0	0.22	0	0.22	0	0.03	0	0.03	0	0.14	0	0.14	0	0.1	0	0.1	0	0.08	0	0.08	0	0.01	0	0.01	0	0.03	0	0.03	0	0.01	0	0.01	0
Total Ex	0	1.97	0	1.97	0	0.34	0	0.34	0	1.43	0	1.43	0.02	0.8	0	0.82	0	0.18	0	0.18	0	0.03	0	0.03	0	0.05	0.02	0.07	0	0.03	0.19	0.22	0
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1.97	0	1.97	0	0.34	0	0.34	0	1.43	0	1.43	0.02	0.8	0	0.82	0	0.18	0	0.18	0	0.03	0	0.03	0	0.05	0.02	0.07	0	0.03	0.19	0.22	0
Lbs/trip	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.002	0.000
Trip Length	3.8	5.2	4.0	5.2	5.9	5.6	4.9	5.6	5.6	5.6	5.0	5.6	4.8	5.5	4.5	5.5	0.7	1.4	3.9	1.6	0.0	1.4	3.7	1.9	0.0	1.1	2.2	1.9	0.0	1.7	44.9	32.3	0.0
Carbon Dioxide Emissions (000)																																	
Run Exh	0	54.17	0.01	54.18	0	8.92	0.05	8.97	0	29.58	0.01	29.59	0.02	17.72	0.01	17.75	0	3.13	0.52	3.65	0	0.68	0.36	1.03	0	0.51	5.14	5.65	0	0.08	13.95	14.03	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0	0.03	0	0.01	0	0.01	0	0.01	0.02	0.03	0	0	0.37	0.37	0
Start Ex	0	1.86	0	1.86	0	0.28	0	0.28	0	0.94	0	0.94	0	0.57	0	0.57	0	0.13	0	0.13	0	0.03	0	0.03	0	0.02	0	0.02	0	0	0	0	0
Total Ex	0	56.03	0.01	56.04	0	9.2	0.05	9.25	0	30.52	0.01	30.53	0.02	18.29	0.01	18.32	0	3.28	0.52	3.81	0	0.71	0.36	1.07	0	0.54	5.16	5.7	0	0.08	14.32	14.4	0
Lbs/trip	0.000	4.701	2.165	4.700	0.000	6.387	3.825	6.363	0.000	6.441	5.602	6.440	8.068	8.694	3.711	8.687	0.000	2.318	4.474	2.486	0.000	2.325	4.312	2.752	0.000	1.821	7.435	5.750	0.000	2.575	189.993	135.162	0.000

Title : Los Angeles County Avg Annual CYr 2030 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/04/01 14:56:47
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day

	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCAT	LDT1-CAT	LDT1-DSL	LDT1-TOT	LDT2-NCAT	LDT2-CAT	LDT2-DSL	LDT2-TOT	MDV-NCAT	MDV-CAT	MDV-DSL	MDV-TOT	LHDT1-NCAT	LHDT1-CAT	LHDT1-DSL	LHDT1-TOT	LHDT2-NCAT	LHDT2-CAT	LHDT2-DSL	LHDT2-TOT	MHDT-NCAT	MHDT-CAT	MHDT-DSL	MHDT-TOT	HHDT-NCAT	HHDT-CAT	HHDT-DSL	HHDT-TOT	OBUS-NCAT
Vehicles	0	4001890	254	4002150	0	515172	1558	516730	0	1702440	160	1702600	0	767721	378	768098	0	100631	22856	123487	0	21913	15982	37894	0	15341	58504	73845	0	918	34052	34970	0
VMT/1000	0	127668	5	127673	0	17701	39	17740	0	58541	4	58545	0	25948	8	25957	0	4786	1096	5882	0	1041	755	1796	0	788	3630	4418	0	79	7530	7609	0
Trips	0	24723600	1198	24724800	0	3134460	7346	3141810	0	10376500	745	10377300	0	4663490	1825	4665310	0	3327520	287497	3615020	0	724575	201028	925602	0	700594	1640440	2341040	0	41914	172322	214235	0
Methane Emissions																																	
Run Exh	0	1.14	0	1.14	0	0.2	0	0.2	0	1.06	0	1.06	0	0.57	0	0.57	0	0.04	0	0.05	0	0.01	0	0.01	0	0.01	0.02	0.03	0	0.01	0.11	0.12	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0
Start Ex	0	0.09	0	0.09	0	0.02	0	0.02	0	0.08	0	0.08	0	0.05	0	0.05	0	0.05	0	0.05	0	0.01	0	0.01	0	0.02	0	0.02	0	0.01	0	0.01	0
Total Ex	0	1.24	0	1.24	0	0.22	0	0.22	0	1.15	0	1.15	0	0.62	0	0.62	0	0.1	0	0.1	0	0.02	0	0.02	0	0.03	0.02	0.05	0	0.02	0.13	0.15	0
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1.24	0	1.24	0	0.22	0	0.22	0	1.15	0	1.15	0	0.62	0	0.62	0	0.1	0	0.1	0	0.02	0	0.02	0	0.03	0.02	0.05	0	0.02	0.13	0.15	0
Lbs/trip	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.001	0.002	0.001	#DIV/0!
Trip Length	#DIV/0!	5.2	4.2	5.2	#DIV/0!	5.6	5.3	5.6	#DIV/0!	5.6	5.4	5.6	#DIV/0!	5.6	4.4	5.6	#DIV/0!	1.4	3.8	1.6	#DIV/0!	1.4	3.8	1.9	#DIV/0!	1.1	2.2	1.9	#DIV/0!	1.9	43.7	35.5	#DIV/0!
Carbon Dioxide Emissions (000)																																	
Run Exh	0	55.83	0	55.83	0	9.75	0.01	9.77	0	32.92	0	32.92	0	19.84	0	19.84	0	3.79	0.63	4.42	0	0.83	0.43	1.26	0	0.62	6.02	6.64	0	0.06	15.5	15.56	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0	0.03	0	0.01	0	0.01	0	0.01	0.03	0.03	0	0	0.42	0.42	0
Start Ex	0	1.91	0	1.91	0	0.3	0	0.3	0	1.03	0	1.03	0	0.63	0	0.63	0	0.16	0	0.16	0	0.04	0	0.04	0	0.03	0	0.03	0	0	0	0	0
Total Ex	0	57.73	0	57.74	0	10.06	0.01	10.07	0	33.95	0	33.95	0	20.47	0	20.47	0	3.98	0.63	4.61	0	0.87	0.43	1.3	0	0.65	6.05	6.7	0	0.06	15.92	15.98	0
Lbs/trip	#DIV/0!	4.670	0.000	4.671	#DIV/0!	6.419	2.723	6.410	#DIV/0!	6.544	0.000	6.543	#DIV/0!	8.779	0.000	8.775	#DIV/0!	2.392	4.383	2.550	#DIV/0!	2.401	4.278	2.809	#DIV/0!	1.856	7.376	5.724	#DIV/0!	2.863	184.770	149.182	#DIV/0!

Title : Los Angeles County Avg Annual CYrs 2030 and 2040 Default Title
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/08/01 10:48:54
Scen Year: 2040 -- All model years in the range 1996 to 2040 selected
Season : Annual
Area : Los Angeles County Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 59 Los Angeles (SC)
Emissions: Tons Per Day

	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCAT	LDT1-CAT	LDT1-DSL	LDT1-TOT	LDT2-NCAT	LDT2-CAT	LDT2-DSL	LDT2-TOT	MDV-NCAT	MDV-CAT	MDV-DSL	MDV-TOT	LHDT1-NCAT	LHDT1-CAT	LHDT1-DSL	LHDT1-TOT	LHDT2-NCAT	LHDT2-CAT	LHDT2-DSL	LHDT2-TOT	MHDT-NCAT	MHDT-CAT	MHDT-DSL	MHDT-TOT	HHDT-NCAT	HHDT-CAT	HHDT-DSL	HHDT-TOT	OBUS-NCAT
Vehicles	0	4080260	34	4080300	0	578135	452	578587	0	1916060	19	1916080	0	873774	93	873866	0	119764	27257	147021	0	25995	18961	44955	0	18500	69896	88396	0	704	36952	37655	0
VMT/1000	0	128944	1	128944	0	19969	10	19979	0	65929	0	65929	0	29650	2	29652	0	5683	1296	6979	0	1232	893	2124	0	952	4373	5325	0	78	8100	8179	0
Trips	0	25097500	137	25097600	0	3517620	1804	3519420	0	11633800	77	11633900	0	5288920	376	5289290	0	3960210	342862	4303070	0	859557	238502	1098060	0	844864	1959890	2804760	0	32133	186993	219126	0
Methane Emissions																																	
Run Exh	0	0.96	0	0.96	0	0.16	0	0.16	0	1.04	0	1.04	0	0.55	0	0.55	0	0.03	0	0.04	0	0.01	0	0.01	0	0.01	0.02	0.03	0	0.01	0.11	0.12	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0
Start Ex	0	0.05	0	0.05	0	0.01	0	0.01	0	0.06	0	0.06	0	0.04	0	0.04	0	0.04	0	0.04	0	0.01	0	0.01	0	0.02	0	0.02	0	0	0	0	0
Total Ex	0	1.01	0	1.01	0	0.17	0	0.17	0	1.1	0	1.1	0	0.59	0	0.59	0	0.08	0	0.08	0	0.02	0	0.02	0	0.03	0.02	0.05	0	0.01	0.13	0.15	0
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	1.01	0	1.01	0	0.17	0	0.17	0	1.1	0	1.1	0	0.59	0	0.59	0	0.08	0	0.08	0	0.02	0	0.02	0	0.03	0.02	0.05	0	0.01	0.13	0.15	0
Lbs/trip	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.000	#DIV/0!	0.001	0.001	0.001	#DIV/0!
Trip Length	#DIV/0!	5.1	7.3	5.1	#DIV/0!	5.7	5.5	5.7	#DIV/0!	5.7	0.0	5.7	#DIV/0!	5.6	5.3	5.6	#DIV/0!	1.4	3.8	1.6	#DIV/0!	1.4	3.7	1.9	#DIV/0!	1.1	2.2	1.9	#DIV/0!	2.4	43.3	37.3	#DIV/0!
Carbon Dioxide Emissions (000)																																	
Run Exh	0	56.89	0	56.89	0	11.1	0	11.11	0	37.54	0	37.54	0	22.94	0	22.94	0	4.51	0.74	5.26	0	0.98	0.51	1.49	0	0.74	7.25	8	0	0.06	16.72	16.78	0
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0	0.04	0	0.01	0	0.01	0	0.01	0.03	0.04	0	0	0.45	0.45	0
Start Ex	0	1.93	0	1.93	0	0.34	0	0.34	0	1.15	0	1.15	0	0.71	0	0.71	0	0.2	0	0.2	0	0.04	0	0.04	0	0.03	0	0.03	0	0	0	0	0
Total Ex	0	58.81	0	58.81	0	11.44	0	11.45	0	38.69	0	38.69	0	23.65	0	23.65	0	4.74	0.75	5.49	0	1.03	0.51	1.54	0	0.79	7.29	8.07	0	0.06	17.17	17.24	0
Lbs/trip	#DIV/0!	4.687	0.000	4.687	#DIV/0!	6.504	0.000	6.507	#DIV/0!	6.651	0.000	6.651	#DIV/0!	8.943	0.000	8.943	#DIV/0!	2.394	4.375	2.552	#DIV/0!	2.397	4.277	2.805	#DIV/0!	1.870	7.439	5.755	#DIV/0!	3.734	183.643	157.352	#DIV/0!

Title : Los A
Version : Emf
Run Date : 20
Scen Year: 20
Season : Anr
Area : Los A
I/M Stat : Enh
Emissions: Tor
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	OBUS-CAT	OBUS-DSL	OBUS-TOT	SBUS-NCAT	SBUS-CAT	SBUS-DSL	SBUS-TOT	UB-NCAT	UB-CAT	UB-DSL	UB-TOT	MH-NCAT	MH-CAT	MH-DSL	MH-TOT	MCY-NCAT	MCY-CAT	MCY-DSL	MCY-TOT	ALL-TOT
Vehicles	2697	3384	6134	45	664	4652	5360	29	1031	3286	4346	2334	39415	3838	45587	94838	43405	0	138243	6239660
VMT/1000	124	202	327	2	25	172	198	3	112	358	474	21	461	46	528	641	378	0	1019	220046
Trips	123160	94899	220490	178	2655	18608	21440	117	4123	13142	17382	233	3943	384	4560	189658	86802	0	276459	42517200
Methane Emis																				
Run Exh	0.01	0	0.01	0	0	0	0.01	0	0.01	0.01	0.03	0.01	0.03	0	0.03	0.19	0.08	0	0.27	8.06
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
Start Ex	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.01	0	0.05	1.48
Total Ex	0.01	0	0.02	0	0.01	0	0.01	0	0.02	0.01	0.03	0.01	0.03	0	0.03	0.22	0.09	0	0.31	9.57
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0.01	0	0.02	0	0.01	0	0.01	0	0.02	0.01	0.03	0.01	0.03	0	0.03	0.22	0.09	0	0.31	9.57
Lbs/trip	0.000	0.000	0.000	0.000	0.008	0.000	0.001	0.000	0.010	0.002	0.003	0.086	0.015	0.000	0.013	0.002	0.002	#DIV/0!	0.002	**0.00045**
Trip Length	1.0	2.1	1.5	11.2	9.4	9.2	9.2	25.6	27.2	27.2	27.3	90.1	116.9	119.8	115.8	3.4	4.4	#DIV/0!	3.7	5.2
Carbon Dioxid																				
Run Exh	0.09	0.34	0.43	0	0.02	0.29	0.31	0	0.09	1.12	1.21	0.02	0.34	0.08	0.43	0.09	0.08	0	0.16	125.42
Idle Exh	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.37
Start Ex	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0.02	3.58
Total Ex	0.1	0.34	0.44	0	0.02	0.3	0.32	0	0.09	1.12	1.21	0.02	0.34	0.08	0.43	0.1	0.08	0	0.18	129.37
Lbs/trip	1.624	7.166	3.991	0.000	15.066	32.244	29.851	0.000	43.658	170.446	139.224	171.674	172.458	416.667	188.596	1.055	1.843	#DIV/0!	1.302	**6.086**
Trip Length	1.0	2.1	1.5	11.2	9.4	9.2	9.2	25.6	27.2	27.2	27.3	90.1	116.9	119.8	115.8	3.4	4.4	#DIV/0!	3.7	5.2

Title : Los A
Version : Emf
Run Date : 20
Scen Year: 20
Season : Anr
Area : Los A
I/M Stat : Enh
Emissions: Tor
****

	OBUS-CAT	OBUS-DSL	OBUS-TOT	SBUS-NCAT	SBUS-CAT	SBUS-DSL	SBUS-TOT	UB-NCAT	UB-CAT	UB-DSL	UB-TOT	MH-NCAT	MH-CAT	MH-DSL	MH-TOT	MCY-NCAT	MCY-CAT	MCY-DSL	MCY-TOT	ALL-TOT
Vehicles	2080	4470	6551	2	721	5402	6126	0	1594	3192	4786	52	48071	5106	53229	63279	93945	0	157224	6985100
VMT/1000	75	239	314	0	27	200	227	0	174	348	522	0	569	59	629	418	727	0	1145	235734
Trips	94991	125329	220360	9	2884	21610	24503	0	6375	12769	19145	5	4809	511	5325	126546	187871	0	314417	47077500
Methane Emis																				
Run Exh	0	0	0	0	0	0	0.01	0	0.02	0.01	0.03	0	0.01	0	0.01	0.12	0.15	0	0.27	4.73
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0	0.05	0.68
Total Ex	0.01	0	0.01	0	0	0	0.01	0	0.02	0.01	0.03	0	0.01	0	0.01	0.14	0.17	0	0.32	5.44
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0.01	0	0.01	0	0	0	0.01	0	0.02	0.01	0.03	0	0.01	0	0.01	0.14	0.17	0	0.32	5.44
Lbs/trip	0.000	0.000	0.000	0.000	0.000	0.000	0.001	#DIV/0!	0.006	0.002	0.003	0.000	0.004	0.000	0.004	0.002	0.002	#DIV/0!	0.002	**0.00023**
Trip Length	0.8	1.9	1.4	0.0	9.4	9.3	9.3	#DIV/0!	27.3	27.3	27.3	0.0	118.3	115.5	118.1	3.3	3.9	#DIV/0!	3.6	5.0
Carbon Dioxid																				
Run Exh	0.06	0.4	0.45	0	0.02	0.33	0.35	0	0.14	1.03	1.17	0	0.43	0.1	0.53	0.06	0.16	0	0.22	137.57
Idle Exh	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0.45
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.01	3.86
Total Ex	0.06	0.4	0.46	0	0.02	0.35	0.37	0	0.14	1.03	1.17	0	0.43	0.1	0.53	0.07	0.16	0	0.23	141.88
Lbs/trip	1.263	6.383	4.175	0.000	13.870	32.392	30.200	#DIV/0!	43.922	161.328	122.225	0.000	178.831	391.389	199.061	1.106	1.703	#DIV/0!	1.463	**6.028**

Title : Los A
Version : Emf
Run Date : 20
Scen Year: 20
Season : Anr
Area : Los A
I/M Stat : Enh
Emissions: Tor
****

	OBUS-CAT	OBUS-DSL	OBUS-TOT	SBUS-NCAT	SBUS-CAT	SBUS-DSL	SBUS-TOT	UB-NCAT	UB-CAT	UB-DSL	UB-TOT	MH-NCAT	MH-CAT	MH-DSL	MH-TOT	MCY-NCAT	MCY-CAT	MCY-DSL	MCY-TOT	ALL-TOT
Vehicles	1849	5626	7475	0	737	6448	7185	0	2184	3255	5439	0	67122	6761	73882	60109	118564	0	178673	7532420
VMT/1000	65	278	343	0	27	240	267	0	238	355	594	0	805	79	884	432	876	0	1307	253015
Trips	84451	157749	242200	0	2949	25791	28741	0	8736	13022	21758	0	6715	676	7391	120207	237104	0	357311	50662400
Methane Emis																				
Run Exh	0	0	0	0	0	0	0	0	0.01	0.01	0.02	0	0.01	0	0.01	0.12	0.18	0	0.31	3.52
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.03	0	0.05	0.38
Total Ex	0	0	0	0	0	0	0.01	0	0.01	0.01	0.02	0	0.01	0	0.01	0.15	0.21	0	0.36	3.93
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0.01	0	0.01	0.01	0.02	0	0.01	0	0.01	0.15	0.21	0	0.36	3.93
Lbs/trip	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.001	#DIV/0!	0.002	0.002	0.002	#DIV/0!	0.003	0.000	0.003	0.002	0.002	#DIV/0!	0.002	**0.00016**
Trip Length	0.8	1.8	1.4	#DIV/0!	9.2	9.3	9.3	#DIV/0!	27.2	27.3	27.3	#DIV/0!	119.9	116.9	119.6	3.6	3.7	#DIV/0!	3.7	5.0
Carbon Dioxid																				
Run Exh	0.05	0.46	0.51	0	0.02	0.4	0.42	0	0.2	0.98	1.17	0	0.62	0.13	0.75	0.06	0.19	0	0.25	149.34
Idle Exh	0	0	0	0	0	0.02	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0.51
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.02	4.12
Total Ex	0.05	0.46	0.52	0	0.02	0.41	0.44	0	0.2	0.98	1.18	0	0.62	0.13	0.75	0.07	0.2	0	0.27	153.97
Lbs/trip	1.184	5.832	4.294	#DIV/0!	13.564	31.794	30.618	#DIV/0!	45.788	150.515	108.466	#DIV/0!	184.661	384.615	202.950	1.165	1.687	#DIV/0!	1.511	**6.078**

Title : Los A
Version : Emf
Run Date : 20
Scen Year: 20
Season : Anr
Area : Los A
I/M Stat : Enh
Emissions: Tor
****

	OBUS-CAT	OBUS-DSL	OBUS-TOT	SBUS-NCAT	SBUS-CAT	SBUS-DSL	SBUS-TOT	UB-NCAT	UB-CAT	UB-DSL	UB-TOT	MH-NCAT	MH-CAT	MH-DSL	MH-TOT	MCY-NCAT	MCY-CAT	MCY-DSL	MCY-TOT	ALL-TOT
Vehicles	2085	7343	9428	0	983	7730	8714	0	3240	2996	6236	0	118660	11183	129843	68962	140916	0	209877	8130960
VMT/1000	81	365	446	0	37	287	324	0	353	327	681	0	1454	134	1589	507	1037	0	1544	271695
Trips	95224	205897	301122	0	3932	30922	34854	0	12960	11985	24945	0	11871	1118	12989	137909	281803	0	419713	54758800
Methane Emis																				
Run Exh	0	0	0	0	0	0	0	0	0.01	0	0.01	0	0.01	0	0.01	0.15	0.22	0	0.36	3.3
Idle Exh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.03	0	0.06	0.29
Total Ex	0	0	0	0	0	0	0.01	0	0.01	0	0.01	0	0.01	0	0.01	0.17	0.25	0	0.42	3.62
Diurnal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hot Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Running	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Resting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0.01	0	0.01	0	0.01	0	0.01	0	0.01	0.17	0.25	0	0.42	3.62
Lbs/trip	0.000	0.000	0.000	#DIV/0!	0.000	0.000	0.001	#DIV/0!	0.002	0.000	0.001	#DIV/0!	0.002	0.000	0.002	0.002	0.002	#DIV/0!	0.002	**0.00013**
Trip Length	0.9	1.8	1.5	#DIV/0!	9.4	9.3	9.3	#DIV/0!	27.2	27.3	27.3	#DIV/0!	122.5	119.9	122.3	3.7	3.7	#DIV/0!	3.7	5.0
Carbon Dioxid																				
Run Exh	0.06	0.61	0.67	0	0.03	0.48	0.51	0	0.29	0.8	1.09	0	1.12	0.22	1.34	0.07	0.22	0	0.3	163.91
Idle Exh	0	0	0	0	0	0.02	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0.57
Start Ex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.02	4.43
Total Ex	0.07	0.61	0.68	0	0.03	0.5	0.53	0	0.29	0.8	1.09	0	1.12	0.22	1.35	0.08	0.23	0	0.32	168.91
Lbs/trip	1.470	5.925	4.516	#DIV/0!	15.259	32.339	30.413	#DIV/0!	44.753	133.500	87.392	#DIV/0!	188.695	393.560	207.868	1.160	1.632	#DIV/0!	1.525	**6.169**

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Centila.urb924

Project Name: Playa Vista Off-site Improvement Centila Avenue

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.10	0.78	0.38	0.00	0.44	0.05	0.48	0.09	0.04	0.14	63.53
2006 TOTALS (tons/year mitigated)	0.10	0.78	0.38	0.00	0.06	0.05	0.11	0.01	0.04	0.06	63.53
Percent Reduction	0.00	0.00	0.00	0.00	86.38	0.00	77.69	86.35	0.00	57.85	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.10	0.78	0.38	0.00	0.44	0.05	0.48	0.09	0.04	0.14	63.53
Demolition 06/01/2006-06/14/2006	0.02	0.14	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.44
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.02	0.13	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.48
Demo On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
Demo Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Fine Grading 06/15/2006-06/28/2006	0.04	0.29	0.15	0.00	0.43	0.02	0.45	0.09	0.02	0.11	23.65
Fine Grading Dust	0.00	0.00	0.00	0.00	0.43	0.00	0.43	0.09	0.00	0.09	0.00
Fine Grading Off Road Diesel	0.04	0.28	0.13	0.00	0.00	0.02	0.02	0.00	0.02	0.02	21.59
Fine Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09
Asphalt 06/16/2006-06/29/2006	0.02	0.13	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.40
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.12	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	7.75
Paving On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62
Building 06/16/2006-07/14/2006	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Off Road Diesel	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 06/19/2006-06/21/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/14/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 87025

Building Volume Daily (cubic feet): 870.2

On Road Truck Travel (VMT): 48.34

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

4 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/15/2006 - 6/28/2006 - Phase 2, Grading

Total Acres Disturbed: 2.27

Maximum Daily Acreage Disturbed: 2.27

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 46

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

4 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 6/16/2006 - 6/29/2006 - Subphase-Paving

Acres to be Paved: 1.34

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

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1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 6/16/2006 - 7/14/2006 - Phase 3, Building Construction

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 6/19/2006 - 6/21/2006 - Subphase-Architectural Coating

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.10	0.78	0.38	0.00	0.06	0.05	0.11	0.01	0.04	0.06	63.53
Demolition 06/01/2006-06/14/2006	0.02	0.14	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.44
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.02	0.13	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.48
Demo On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
Demo Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Fine Grading 06/15/2006-06/28/2006	0.04	0.29	0.15	0.00	0.06	0.02	0.08	0.01	0.02	0.03	23.65
Fine Grading Dust	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.01	0.00	0.01	0.00
Fine Grading Off Road Diesel	0.04	0.28	0.13	0.00	0.00	0.02	0.02	0.00	0.02	0.02	21.59
Fine Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09
Asphalt 06/16/2006-06/29/2006	0.02	0.13	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.40
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.12	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	7.75
Paving On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62
Building 06/16/2006-07/14/2006	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Off Road Diesel	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 06/19/2006-06/21/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/15/2006 - 6/28/2006 - Phase 2, Grading

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Architectural Coating 6/19/2006 - 6/21/2006 - Subphase-Architectural Coating

For Residential Architectural Coating Measures, the Residential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Residential Architectural Coating Measures, the Residential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Int#11.urb924

Project Name: Playa Vista Off-site Int 11 Centinella-Culver

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.03	0.25	0.11	0.00	0.01	0.01	0.03	0.00	0.01	0.02	21.29
2006 TOTALS (tons/year mitigated)	0.03	0.25	0.11	0.00	0.00	0.01	0.02	0.00	0.01	0.01	21.29
Percent Reduction	0.00	0.00	0.00	0.00	81.01	0.00	36.48	80.79	0.00	12.70	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.03	0.25	0.11	0.00	0.01	0.01	0.03	0.00	0.01	0.02	21.29
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.01	0.00	0.02	0.00	0.00	0.01	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Building 06/16/2006-06/30/2006	0.01	0.11	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.45
Building Off Road Diesel	0.01	0.11	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.45
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt 06/19/2006-06/21/2006	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Paving Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Coating 06/19/2006-06/21/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/7/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 3294.7

Building Volume Daily (cubic feet): 729

On Road Truck Travel (VMT): 41.85

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

Total Acres Disturbed: 0.12

Maximum Daily Acreage Disturbed: 0.12

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 6/19/2006 - 6/21/2006 - Subphase-Paving

Acres to be Paved: 0.07

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 6/16/2006 - 6/30/2006 - Phase 3, Building Construction
Off-Road Equipment:
1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day
1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day
1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day
1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 6/19/2006 - 6/21/2006 - Subphase-Architectural Coating
Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100
Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50
Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250
Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100
Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250
Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.03	0.25	0.11	0.00	0.00	0.01	0.02	0.00	0.01	0.01	21.29
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Building 06/16/2006-06/30/2006	0.01	0.11	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.45
Building Off Road Diesel	0.01	0.11	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.45
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt 06/19/2006-06/21/2006	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Paving Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Coating 06/19/2006-06/21/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading
For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:
PM10: 84% PM25: 84%
For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:
PM10: 5% PM25: 5%
For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:
PM10: 61% PM25: 61%
For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:
PM10: 69% PM25: 69%
For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:
PM10: 44% PM25: 44%
The following mitigation measures apply to Phase: Architectural Coating 6/19/2006 - 6/21/2006 - Subphase-Architectural Coating
For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:
ROG: 10%
For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:
ROG: 10%

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Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Int#14.urb924

Project Name: Playa Vista Off-site Int 14 La Tijera-Centinela

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.08	0.63	0.30	0.00	0.17	0.04	0.21	0.04	0.04	0.07	52.04
2006 TOTALS (tons/year mitigated)	0.08	0.63	0.30	0.00	0.02	0.04	0.07	0.01	0.04	0.04	52.04
Percent Reduction	0.00	0.00	0.00	0.00	85.92	0.00	69.12	85.87	0.00	41.47	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.08	0.63	0.30	0.00	0.17	0.04	0.21	0.04	0.04	0.07	52.04
Demolition 06/01/2006-06/14/2006	0.02	0.14	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.30
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.02	0.13	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.48
Demo On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
Demo Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Fine Grading 06/15/2006-06/28/2006	0.03	0.18	0.09	0.00	0.17	0.01	0.18	0.04	0.01	0.05	14.77
Fine Grading Dust	0.00	0.00	0.00	0.00	0.17	0.00	0.17	0.04	0.00	0.04	0.00
Fine Grading Off Road Diesel	0.03	0.18	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	13.45
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Building 07/03/2006-07/31/2006	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Off Road Diesel	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt 08/01/2006-08/14/2006	0.01	0.10	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.93
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.29
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Coating 08/01/2006-08/14/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/14/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 27989

Building Volume Daily (cubic feet): 729

On Road Truck Travel (VMT): 41.85

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

4 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/15/2006 - 6/28/2006 - Phase 2, Grading

Total Acres Disturbed: 0.88

Maximum Daily Acreage Disturbed: 0.88

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 18

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

4 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 8/1/2006 - 8/14/2006 - Subphase-Paving

Acres to be Paved: 0.22

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

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1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 7/3/2006 - 7/31/2006 - Phase 3, Building Construction
Off-Road Equipment:
1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day
1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day
1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day
1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 8/1/2006 - 8/14/2006 - Subphase-Architectural Coating
Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100
Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50
Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250
Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100
Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250
Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.08	0.63	0.30	0.00	0.02	0.04	0.07	0.01	0.04	0.04	52.04
Demolition 06/01/2006-06/14/2006	0.02	0.14	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.30
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.02	0.13	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.48
Demo On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
Demo Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Fine Grading 06/15/2006-06/28/2006	0.03	0.18	0.09	0.00	0.02	0.01	0.04	0.00	0.01	0.02	14.77
Fine Grading Dust	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.03	0.18	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	13.45
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Building 07/03/2006-07/31/2006	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Off Road Diesel	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt 08/01/2006-08/14/2006	0.01	0.10	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.93
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.29
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Coating 08/01/2006-08/14/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/15/2006 - 6/28/2006 - Phase 2, Grading
For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:
PM10: 84% PM25: 84%
For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:
PM10: 5% PM25: 5%
For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:
PM10: 61% PM25: 61%
For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:
PM10: 69% PM25: 69%
For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:
PM10: 44% PM25: 44%
The following mitigation measures apply to Phase: Architectural Coating 8/1/2006 - 8/14/2006 - Subphase-Architectural Coating
For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:
ROG: 10%
For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:
ROG: 10%

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Int#77.urb924

Project Name: Playa Vista Off-site Int 77 Inglewood-Culver

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.10	0.74	0.36	0.00	0.06	0.05	0.11	0.01	0.04	0.06	60.52
2006 TOTALS (tons/year mitigated)	0.10	0.74	0.36	0.00	0.01	0.05	0.06	0.00	0.04	0.04	60.52
Percent Reduction	0.00	0.00	0.00	0.00	84.50	0.00	49.79	84.36	0.00	20.75	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.10	0.74	0.36	0.00	0.06	0.05	0.11	0.01	0.04	0.06	60.52
Demolition 06/01/2006-06/14/2006	0.02	0.14	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.30
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.02	0.13	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.48
Demo On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
Demo Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Fine Grading 06/15/2006-06/28/2006	0.03	0.24	0.12	0.00	0.06	0.01	0.08	0.01	0.01	0.03	19.90
Fine Grading Dust	0.00	0.00	0.00	0.00	0.06	0.00	0.06	0.01	0.00	0.01	0.00
Fine Grading Off Road Diesel	0.03	0.24	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.31
Fine Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
Asphalt 07/03/2006-07/21/2006	0.02	0.14	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.27
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.14	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.44
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
Building 07/03/2006-07/31/2006	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Off Road Diesel	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 08/01/2006-08/14/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/14/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 14496.1

Building Volume Daily (cubic feet): 729

On Road Truck Travel (VMT): 41.85

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

4 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/15/2006 - 6/28/2006 - Phase 2, Grading

Total Acres Disturbed: 0.33

Maximum Daily Acreage Disturbed: 0.33

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 38

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 7/3/2006 - 7/21/2006 - Subphase-Paving

Acres to be Paved: 0.18

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

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1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 7/3/2006 - 7/31/2006 - Phase 3, Building Construction

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 8/1/2006 - 8/14/2006 - Subphase-Architectural Coating

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.10	0.74	0.36	0.00	0.01	0.05	0.06	0.00	0.04	0.04	60.52
Demolition 06/01/2006-06/14/2006	0.02	0.14	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	12.30
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.02	0.13	0.06	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.48
Demo On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
Demo Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
Fine Grading 06/15/2006-06/28/2006	0.03	0.24	0.12	0.00	0.01	0.01	0.02	0.00	0.01	0.01	19.90
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.03	0.24	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.31
Fine Grading On Road Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81
Fine Grading Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
Asphalt 07/03/2006-07/21/2006	0.02	0.14	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	10.27
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.14	0.07	0.00	0.00	0.01	0.01	0.00	0.01	0.01	9.44
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
Building 07/03/2006-07/31/2006	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Off Road Diesel	0.02	0.21	0.08	0.00	0.00	0.01	0.01	0.00	0.01	0.01	18.05
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 08/01/2006-08/14/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/15/2006 - 6/28/2006 - Phase 2, Grading

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Architectural Coating 8/1/2006 - 8/14/2006 - Subphase-Architectural Coating

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Int#99.urb924

Project Name: Playa Vista Off-site Int 99 Washington-Centinela

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.04	0.31	0.15	0.00	0.02	0.02	0.04	0.00	0.02	0.02	25.28
2006 TOTALS (tons/year mitigated)	0.04	0.31	0.15	0.00	0.00	0.02	0.02	0.00	0.02	0.02	25.28
Percent Reduction	0.00	0.00	0.00	0.00	83.46	0.00	44.18	83.29	0.00	16.97	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.04	0.31	0.15	0.00	0.02	0.02	0.04	0.00	0.02	0.02	25.28
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.02	0.00	0.03	0.00	0.00	0.01	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Asphalt 07/17/2006-07/28/2006	0.01	0.10	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.93
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.29
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Building 07/17/2006-07/28/2006	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Off Road Diesel	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 07/28/2006-08/01/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/7/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 9292.9

Building Volume Daily (cubic feet): 729

On Road Truck Travel (VMT): 41.88

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

Total Acres Disturbed: 0.22

Maximum Daily Acreage Disturbed: 0.22

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 7/17/2006 - 7/28/2006 - Subphase-Paving

Acres to be Paved: 0.22

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 7/17/2006 - 7/28/2006 - Phase 3, Building Construction

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 7/28/2006 - 8/1/2006 - Subphase-Architectural Coating

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.04	0.31	0.15	0.00	0.00	0.02	0.02	0.00	0.02	0.02	25.28
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Asphalt 07/17/2006-07/28/2006	0.01	0.10	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.93
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.29
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Building 07/17/2006-07/28/2006	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Off Road Diesel	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 07/28/2006-08/01/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Architectural Coating 7/28/2006 - 8/1/2006 - Subphase-Architectural Coating

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Int#100.urb924

Project Name: Playa Vista Off-site Int 100 Overland-Culver

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.04	0.31	0.14	0.00	0.01	0.02	0.03	0.00	0.02	0.02	25.14
2006 TOTALS (tons/year mitigated)	0.04	0.31	0.14	0.00	0.00	0.02	0.02	0.00	0.02	0.02	25.14
Percent Reduction	0.00	0.00	0.00	0.00	80.91	0.00	31.42	80.63	0.00	10.19	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.04	0.31	0.14	0.00	0.01	0.02	0.03	0.00	0.02	0.02	25.14
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.01	0.00	0.02	0.00	0.00	0.01	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Asphalt 07/17/2006-07/28/2006	0.01	0.09	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.79
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.29
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Building 07/17/2006-07/28/2006	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Off Road Diesel	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 07/28/2006-08/01/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/7/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 9292.9

Building Volume Daily (cubic feet): 729

On Road Truck Travel (VMT): 41.95

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

Total Acres Disturbed: 0.12

Maximum Daily Acreage Disturbed: 0.12

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 7/17/2006 - 7/28/2006 - Subphase-Paving

Acres to be Paved: 0.04

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 7/17/2006 - 7/28/2006 - Phase 3, Building Construction

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 7/28/2006 - 8/1/2006 - Subphase-Architectural Coating

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.04	0.31	0.14	0.00	0.00	0.02	0.02	0.00	0.02	0.02	25.14
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Asphalt 07/17/2006-07/28/2006	0.01	0.09	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.79
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.09	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.01	6.29
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Paving Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Building 07/17/2006-07/28/2006	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Off Road Diesel	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 07/28/2006-08/01/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Architectural Coating 7/28/2006 - 8/1/2006 - Subphase-Architectural Coating

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Tanya's Stuff\Ts Work\Playa vista GHG\URBEMIS off-site constr\PlayaVista off-site Int#102.urb924

Project Name: Playa Vista Off-site Int 102 Sawtelle-Culver

Project Location: Los Angeles County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006 TOTALS (tons/year unmitigated)	0.03	0.26	0.12	0.00	0.01	0.02	0.02	0.00	0.01	0.02	21.76
2006 TOTALS (tons/year mitigated)	0.03	0.26	0.12	0.00	0.00	0.02	0.02	0.00	0.01	0.01	21.76
Percent Reduction	0.00	0.00	0.00	0.00	75.90	0.00	22.18	75.50	0.00	6.50	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.03	0.26	0.12	0.00	0.01	0.02	0.02	0.00	0.01	0.02	21.76
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.01	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Asphalt 07/17/2006-07/21/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.41
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.15
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Paving Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Building 07/17/2006-07/28/2006	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Off Road Diesel	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 07/17/2006-08/23/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Phase Assumptions

Phase: Demolition 6/1/2006 - 6/7/2006 - Phase 1, Demolition

Building Volume Total (cubic feet): 2500

Building Volume Daily (cubic feet): 729

On Road Truck Travel (VMT): 41.95

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

Total Acres Disturbed: 0.06

Maximum Daily Acreage Disturbed: 0.06

Fugitive Dust Level of Detail: Default

38.2 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Paving 7/17/2006 - 7/21/2006 - Subphase-Paving

Acres to be Paved: 0.04

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Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 7/17/2006 - 7/28/2006 - Phase 3, Building Construction

Off-Road Equipment:

1 Concrete/Industrial Saws (10 hp) operating at a 0.73 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Architectural Coating 7/17/2006 - 8/23/2006 - Subphase-Architectural Coating

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2006	0.03	0.26	0.12	0.00	0.00	0.02	0.02	0.00	0.01	0.01	21.76
Demolition 06/01/2006-06/07/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.36
Fugitive Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Demo Off Road Diesel	0.01	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.60
Demo On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
Demo Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Fine Grading 06/08/2006-06/14/2006	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40
Fine Grading Dust	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Off Road Diesel	0.01	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.09
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Asphalt 07/17/2006-07/21/2006	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.41
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.01	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.15
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Paving Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23
Building 07/17/2006-07/28/2006	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Off Road Diesel	0.01	0.10	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	8.60
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 07/17/2006-08/23/2006	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Architectural Coating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 6/8/2006 - 6/14/2006 - Phase 2, Grading

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

The following mitigation measures apply to Phase: Architectural Coating 7/17/2006 - 8/23/2006 - Subphase-Architectural Coating

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

APPENDIX E.ii:
RESIDENTIAL AND MIXED-USE SUSTAINABLE PERFORMANCE GUIDELINES

PART VI

SUSTAINABLE GUIDELINES

VI.1 Overview

VI.1.1 Introduction

Playa Vista is committed to sustainable design. Playa Vista recognizes the compelling economic, environmental, marketing and mitigation rationale for incorporating sustainable principles. The bottom line is that sustainable development makes sense not only for Playa Vista, but development everywhere.

The Village at Playa Vista Residential & Mixed Use Sustainable Guidelines are a key part of Playa Vista's commitment to sustainable development. All residential units in The Village must comply with these Guidelines. The Guidelines have been updated from the Phase 1 edition, first published in 1998, to reflect regulatory, entitlement and technical changes. They were awarded an Honor Award in the Westside Urban Forum's Westside Prize.

What Is Sustainable Design?

The international definition of sustainability is meeting the needs of the present without compromising the ability of future generations to meet their own needs. The growing adoption of sustainable practices is a response to the depletion of the earth's resources and the pollution and global warming caused by an economy based upon the continued reliance on non-renewable resources.

Sustainably designed buildings are better for both the environment and the occupants. Sustainable design incorporates designs, technologies and practices to significantly improve the efficiency, quality and environmental responsiveness of traditional development. Sustainable design at Playa Vista will result in a number of key benefits:

- Efficiency in the use of energy (15 percent more efficient than required by California's 2005 Title 24 Building Efficiency Standards) and water (both indoor and landscaping). Renewable energy resources will be used, including passive solar design strategies and active pool and spa solar heating systems. Appliances will be both water and energy efficient, as defined by the U.S. Environmental Protection Agency's Energy Star designation. Reclaimed water will be used for all landscaping. Low flow toilets, faucets and showerheads will be installed.
- Improved Indoor Air Quality through ventilation and the use of environmentally friendly, low or non-toxic materials such as low or zero VOC (volatile organic compound) paint, finishes and adhesives.
- Waste Minimization through recycling solid waste during both construction and after occupancy and the use of appropriate materials and construction strategies. Each dwelling unit will have two bins and each high density building will be equipped with two chutes, one for trash and one for recyclables, to make recycling easy for occupants and to conform to the waste minimization policy of the City of Los Angeles. Construction materials including concrete, steel, drywall, insulation, cabinets, and carpet will contain a high percentage of recycled content or be made from certified sustainably grown lumber.
- Enhanced Comfort through appropriate glazing (window) selection, optimized building insulation, natural ventilation and proper space conditioning system sizing.
- Consumer Savings through a reduction in energy and water bills and reduced maintenance costs.

Builder Impacts

- Economics: Sustainable design is cost effective when a total system approach is used. These guidelines minimize the impact on construction costs by offsetting cost increases in some components with decreases in others, in particular the size of space conditioning systems. The result is that Playa Vista's residential buildings will be more environmentally friendly with only a modest, if any, increase in first costs.
- Marketing: Sustainable design gives Playa Vista a market advantage. The sophisticated buyers of Playa Vista will understand the advantages of purchasing or renting a dwelling with sustainable design

features. Playa Vista's buyers may:

1. Qualify for energy efficient mortgages because of lower utility bills.

2. Realize health advantages through cleaner indoor air.

3. Live in units that are both more durable because of the materials utilized and more flexible for remodeling and upgrading to meet quickly changing technology.

- Design and Engineering: To insure success, sustainable strategies need to be incorporated from the earliest design stages. Architects, engineers and landscape architects must work together as a team to integrate a building's systems rather than design an independent series of architectural, structural, mechanical, electrical, plumbing and landscape components.
- Materials Procurement: Builders will purchase materials and products that are efficient, low in toxicity, contain a high percentage of recycled content and, ideally, are purchased from local manufacturers.

Sustainable Mandates

Playa Vista must meet the requirements of both State and City of Los Angeles statutes as well as the specific requirements in The Village at Playa Vista Conditions of Approval and Mitigation Monitoring and Reporting Program. A number of these mandates address sustainable design.

State and City Mandates

- California Building Energy Efficiency Standards (Title 24): Energy efficiency standards for all new buildings. Title 24 is enforced by the local jurisdiction; in Playa Vista's case this is the City of Los Angeles.
- AB 939 (State): The State required that every city reduce its flow of waste to landfills by 50 percent by 2000. The City of Los Angeles has set additional goals of 62 percent by 2010 and 70 percent by 2020.
- Recycling Space Allocation, Ordinance No. 171687 (City): Requires the designation of space for the collection and loading of recyclables.
- Landscaping, Ordinance No. 170978 (City): Requires the design and installation of drought tolerant landscaping, and the planting of one tree for every four surface parking spaces such that these trees will shade 50 percent of the parking lot within 10 years.

The Village at Playa Vista Conditions of Approval and Mitigation Measures

- Construction Waste: Develop and implement a city-approved plan to recycle construction waste.
- Energy: Exceed Title 24 to the extent feasible; employ passive heating and cooling strategies; use Energy Star rated energy efficient appliances; design to accommodate renewable energy systems; and install automatic lighting timers on outdoor lights, charcoal or electronic air filtration systems on central space conditioning units, solar pool and hot tub systems, and double pane windows where a line of site exists to Jefferson Blvd. or Bluff Creek Dr.
- Recycled Building Materials: Incorporate recycled content materials where economically feasible.
- Water Efficiency: Use reclaimed water to irrigate landscaping; install landscaping with at least 50 percent native or drought tolerant plants and irrigation systems that include sprinkler control systems and minimize excess irrigation; and install Energy Star rated dishwashers and clothes washers, and water efficient toilets, showerheads and plumbing fixtures.
- Recycling: Install recycling bins for the commingled collection of metals, glass, cardboard, paper and newspaper and insure their maintenance.
- Air Quality: Use building materials, architectural coatings and cleaning solvents that comply with South Coast Air Quality Management District regulations.

Related Mandates

Sustainable design is a broad topic. There are a number of additional topics with sustainable benefits that are not covered in these Guidelines but that nonetheless must be followed. These topics include, among others:

1. Construction Health and Safety.

2. Fugitive Dust.

3. Handicapped Access.

A number of agencies, including the Federal Safety and Health Administration (OSHA), the South Coast Air Quality Management District and the City of Los Angeles, issue regulations governing these topics.

VI.1.2 Guidelines Summary & Compliance Process

Guidelines Summary

The Village at Playa Vista Residential Sustainable & Mixed Use Guidelines contains over 100 specific measures. There are ten categories, each of which is addressed in a separate chapter:

1. Construction Waste
2. Building Materials
3. Energy
4. Water
5. Recycling & Solid Waste
6. Power, Signal & Control
7. Adaptability
8. Landscape
9. Stormwater Management
10. Transportation

Each chapter has separate sections that detail the guidelines and mandatory and optional measures for that topic. Application details are also included as appropriate.

There are both mandatory and optional measures. The mandatory measures are required by The Village at Playa Vista Conditions of Approval or Environmental Impact Report Mitigation Monitoring and Reporting Program, City of Los Angeles or other regulation, or other Playa Vista standards. The source of each mandate is indicated in the chapters with each measure.

The optional measures also have sustainable value but are less central to meeting the Sustainable Guidelines' goals. Each builder must implement the minimum number of optional measures indicated for each category.

The majority of the measures impact all residential buildings. Some, however, are specifically for high density structures (stacked units equal to or greater than 25 dwelling units per acre), while others are only for low density buildings (on grade units and single family detached homes less than 25 dwelling units per acre). Measures that only impact one of these building types are so labeled.

Each measure is applicable only if the builder has control. If the builder installs appliance or finish packages directly or through buyer options, these must meet the Guidelines requirements. If the occupant independently installs the relevant items, the corresponding measures do not apply.

The Self Certification Form on the following pages summarizes each measure, indicates whether it is mandatory or optional, and identifies those measures applicable only to high or low density buildings. The matrix presents only a summary of each measure. The full language, and therefore the full meaning of each measure, as well as additional explanatory information is in the chapters that follow. Please review these to insure that each measure is understood.

The Sustainable Guidelines can be implemented with the least cost by integrating them into a project's design beginning at the programming phase. Sustainable design is an integrated process and cannot simply be "superimposed" during the final design. Some measures need to be understood by the design team before schematic design even takes place. Playa Vista therefore strongly recommends that each builder and design team review the Guidelines prior to design and develop a compliance strategy.

Compliance Process

Playa Vista has established a self-certification process for the Residential & Mixed Use Sustainable Guidelines. The process has been incorporated into the required Playa Vista design review process.

- As part of the final construction documents submittal for review by the Playa Vista Design Review Committee, each builder must submit a completed Residential & Mixed Use Sustainable Guidelines Self

Certification Form. Indicate the mandatory and optional measures that will be included in the project in the right-hand column. Insure that a sufficient number of optional measures are chosen in each category to meet the minimum number required. Date and sign the matrix where indicated in the box at the top of the first page.

- As a project progresses, development teams may substitute new optional measures for any of those previously selected, so long as the required minimum number of optional measures is still implemented. If this occurs, the builder must submit a revised Self Certification Form. In a cover letter, list the measures deleted and added.
- To obtain a letter from Playa Vista recommending sign-off by the Department of City Planning for a Temporary or Final Certificate of Occupancy, each builder must submit a letter certifying that all measures marked in the most recently submitted Self Certification Form have been installed in the project and certifying compliance with The Village at Playa Vista Residential & Mixed Use Sustainable Guidelines. The letter must refer to the relevant Self Certification Form by date and must be signed by a senior project manager.

PLAYA VISTA

THE VILLAGE AT PLAYA VISTA
RESIDENTIAL & MIXED USE SUSTAINABLE GUIDELINES

SELF CERTIFICATION FORM
(Full language measure in individual chapters)

Project Number: ______________________ **Firm:** ______________________________
Submitted By: ________________________ **Title:** ______________________________
Signature: ___________________________ **Date:** ______________________________

CONSTRUCTION WASTE (Chapter 1)
Mandatory Measures
1. Construction materials recycling to Playa Vista plan

Options Measures *(▲ see Notes for requirement)*
1. Prefabricated systems for all walls, floors or roof structural components
2. Out-to-out dimensions on two-foot increments

MATERIALS (Chapter 2)
Mandatory Measures
1. Recycled content insulation
2. Recycled content gypsum board
3. Low VOC paint, finishes & adhesives
4. Manufactured wood product moisture protection on exterior roof & wall surface areas

Optional Measures *(2 required)*
1. Materials manufactured or reprocessed within 500 mile radius
2. Recycled light gauge, rebar & structural steel
3. Rough construction from certified sustainably harvested wood
4. Recycled content roofing materials
5. Finish materials from reclaimed or remilled wood, excluding flooring
6. Kitchen & bathroom cabinets, linen closets & counter blanks of certified sustainably harvested lumber or plywood, OR fiberboard or particle board with no added urea-formaldehyde
7. Recycled content architectural materials, i.e. countertops, glass tile, carpet & carpet pad
8. Rapidly renewable material flooring such as bamboo, cork or linoleum
9. Hardwood flooring from certified sustainably harvested wood
10. Common area carpet system that allows replacing worn sections without removing majority of carpet
11. Zero VOC paint & finishes

ENERGY (Chapter 3)
OVERALL ENERGY REQUIREMENT
Mandatory Measure
1. On whole building performance basis, 15% more efficient than 2005 Title 24

Optional Measures *(None)*
BUILDING ENVELOPE
Mandatory Measures
1. Passive heating & cooling

2. Low slope cool roofs ☐
3. Double pane windows in walls with line of site of Jefferson Blvd. & Bluff Creek Dr. ☐

Optional Measures *(None required)*
1. 50% reduction in summer window solar gain ☐
2. Shading or glazing modifications on sliding glass doors ☐
3. 70% light-colored exterior walls ☐

SPACE CONDITIONING

Mandatory Measures
1. Energy efficient mechanical systems ☐
2. Medium efficiency air filtration ☐
3. No equipment on walls, balconies or patios *(high density structures only)* ☐
4. Outside equipment noise minimization & rust protective coatings ☐
5. For subterranean garages, mechanical ventilation with high efficiency fans & carbon monoxide sensors ☐

Optional Measures *(None required)*
1. Water source heat pump system *(high density structures only)* ☐
2. High efficiency pulse boilers *(high density structures only)* ☐
3. High efficiency gas furnaces & cooling equipment or air-to-air heat pumps *(low density structures only)* ☐
4. Cross-ventilation for each dwelling unit ☐
5. Fans to assist natural ventilation ☐
6. Operable inlet air dampers for natural ventilation ☐
7. Premium efficiency electric motors ☐
8. Variable speed motors or drives for pumps & fans ☐
9. Solar space heating system ☐

LIGHTING

Mandatory Measures
1. Energy efficient lighting ☐
2. Super T8 lamps & electronic ballasts ☐
3. Common area fluorescent, hard-wired compact fluorescent or HID lamps ☐
4. Automatic light shutoff in office common spaces ☐
5. Photocell controls on all common area exterior, site & landscape fixtures ☐
6. No exit signs or other lighting with radioactive elements ☐
7. Outdoor lighting and building sign limitations ☐

Optional Measures *(None required)*
1. Porch & patio hard-wired compact fluorescent lamps ☐
2. Residential unit hard-wired compact fluorescent lamps ☐
3. Residential unit exterior fixture photocell & motion controls ☐

WATER HEATING

Mandatory Measure
1. Energy efficient water heating ☐
2. High efficiency plumbing fixtures ☐

Optional Measures *(None required)*
1. Centralized water heating system *(high density structures only)* ☐
2. Waste heat recovery ☐
3. Tankless gas water heaters ☐
4. Heat pump water heaters ☐
5. Condensing water heaters ☐
6. Solar water heating ☐
7. Water efficient appliances ☐

RENEWABLE & ALTERNATIVE ENERGY SOURCES

Mandatory Measures
1. Solar heating for pools & hot tubs ☐
2. Conduit to roof, unobstructed roof areas & roof framing plan for future photovoltaics ☐

Optional Measures *(None required)*
1. Solar heating for domestic hot water ☐

2. Photovoltaic (solar) landscape lighting ☐
3. Photovoltaic (solar) common area lighting ☐
4. Microturbine or fuel cell with waste heat recovery ☐
5. Dedicated space for on-site distributed energy system ☐

CONTROLS & FEEDBACK
Mandatory Measures *(None)*
Optional Measures *(None required)*
1. Enhanced feature setback thermostats ☐
2. On-demand energy & water feedback & control ☐
3. Widow & sliding door sensors ☐
4. Occupancy sensors ☐
5. Daylighting sensors ☐
6. Central system digital controls *(high density structures only)* ☐
7. Remotely readable utility metering ☐
8. Power emergency utility wireless communication ☐

APPLIANCES
Mandatory Measures
1. Energy Star rated dishwashers ☐
2. Energy Star rated refrigerators ☐
3. Energy Star rated clothes washers ☐
4. Energy efficient clothes dryers with automatic shut off ☐

Optional Measures *(None required)*
1. Ducted kitchen exhaust system ☐
2. Make-up air for exhaust fans over 100 CFM ☐

WATER (Chapter 4)
Mandatory Measures
1. Low flow toilets, showerheads & faucets ☐
2. Energy Star rated appliances (see Appliances) ☐
3. Office and retail water faucet automatic shutoff ☐

Optional Measures (▲ see *Notes for requirement)*
1. Low flush toilets ☐
2. Waterless or low flush urinals ☐
3. Hot water demand system ☐

RECYCLING & SOLID WASTE (Chapter 5)
Mandatory Measures
1. Recyclables & trash dual container kitchen system ☐
2. Recyclables & trash dual chute building system & underground bins *(high density structures only)* ☐
3. Recyclables & trash lidded self rolling containers *(low density structures only)* ☐
4. Household hazardous waste disposal ☐

Optional Measures (▲ see *Notes for requirement)*
1. Recycled steel & rubber in recyclables & trash chutes *(high density structures only)* ☐
2. Trash compactors in each unit & smaller self rolling containers *(low density structures only)* ☐

POWER SIGNAL & CONTROL (Chapter 6)
Mandatory Measures
1. Fire detection & signal in each unit, fire dept. automatic call & enunciator panel indicating alarm location ☐
2. Unit wiring to Playa Vista standard ☐
3. Gas service seismic shutoff ☐

Optional Measures *(3 required for high density structures, 2 for low density structures)*
1. Automatic signal to building manager linked to ventilation operation *(high density structures only)* ☐
2. Visual alarm in each unit & common space & unit enunciator ☐
3. Power service sized for expansion ☐

4. Separate lighting & convenience circuits ☐
5. Mounting space for surge protection, power conditioning & battery backup ☐

ADAPTABILITY (Chapter 7)
Mandatory Measures
1. City of Los Angeles disability residential standards ☐

Optional Measures *(4 required)*
1. Reinforced shower & water closet walls for grab bars ☐
2. Accessible door sizes & swings ☐
3. Adequate mechanical & electrical system service access *(high density structures only)* ☐
4. Electronic or written construction, product & system documentation ☐
5. Adjustable kitchen counter heights ☐

LANDSCAPE (Chapter 8)
Mandatory Measures
1. Playa Vista Landscape Guidelines ☐
2. City of Los Angeles water conservation ordinances ☐
3. 50% minimum native or drought tolerant plants ☐
4. Shade producing trees & vines ☐
5. Tree shaded parking lots ☐
6. Reclaimed water for landscape irrigation ☐
7. Drip or soaker-based irrigation to water all plants, including lawns ☐
8. Automatic sprinklers set to irrigate early morning or evening ☐
9. Slow release fertilizers on new landscaping ☐

Optional Measure (▲ see *Notes for requirement)*
1. 75% native or drought tolerant plants ☐
2. Weather-based evapotranspiration (ET) irrigation controllers ☐

STORMWATER MANAGEMENT (Chapter 9)
Mandatory Measures
1. Roof drain biofiltration systems ☐
2. No runoff into underground parking *(high density structures only)* ☐
3. Minimal imperviousness *(low density structures only)* ☐
4. Driveway runoff to adjacent bioswale ☐
5. No roofs or gutters with copper, zinc, tar papers or other petroleum based sealers; inert roofing materials ☐
6. Parking lot filters, porous pavement & swale/biofilters ☐

Optional Measure (▲ see *Notes for requirement)*
1. Walkway or roof runoff to vegetated areas *(low density structures only)* ☐

TRANSPORTATION (Chapter 10)
Mandatory Measures
1. 240 volt circuit capacity & conduit for electric vehicle charging in garage ☐
2. Electric vehicle charging stations if required by regulation ☐
3. Secure bicycle storage *(high density structures only)* ☐

Optional Measures *(None)*

NOTES
▲ = Implement a total of three measures from the five "Optional Measures" lists with this symbol—Construction Waste; Water; Recycling & Solid Waste; Landscape; & Stormwater Management
High density structures = Equal to or greater than 25 dwelling units per acre (stacked units)
Low density structures = Less than 25 dwelling units per acre (on grade units & single family detached homes)

VI.2 Details & Complete Measure Language

VI.2.1 Construction Waste

Guidelines

Construction and demolition waste totals approximately one-third of all solid waste. Reducing construction waste therefore makes a significant contribution towards Los Angeles' waste reduction goals. At Playa Vista, construction and demolition waste recycling has become an important and successful strategy.

Builders can reduce construction waste through a number of strategies, including:

- Selecting appropriate material sizes and quantities and careful attention to purchasing practices.
- Using separate collection bins for each recyclable material to create clean materials ready for marketing.
- Daily cleanup to reduce material loss and clutter.

Mandatory Measure

1. Playa Vista is required to recycle demolition and construction waste according to a plan approved by the City of Los Angeles Department of City Planning and Bureau of Sanitation. The City approved the Playa Vista Construction Materials Recycling Plan in June 1999; all builders are required to recycle construction materials as outlined in the approved Plan.
2. The Plan focuses on complying with California's mandated goal of diverting 50 percent of waste from landfills by the year 2000 and providing builders full reuse, recycling and solid waste services. Playa Vista has greatly exceeded this goal by recycling approximately 92 percent of all demolition and construction waste since construction began in 1998. (Source of mandate: mitigation measures #N(3)-4)

Optional Measures

Minimum number of optional measures required: Three total from the following five categories: Construction Waste; Domestic Water; Recycling & Solid Waste; Landscape; & Stormwater Management.

1. Utilize prefabricated systems such as panelized wall systems, open web floor trusses, roof truss systems and precast floor deck systems for all structural components of the walls, floors, or roofs. Precut dimension lumber or precut engineered wood products that are delivered to the site and field assembled to not qualify as prefabricated assemblies.
2. Design out-to-out dimensions for roof, floor or wall sheathings based on two- foot increments to permit pre-constructed panel & dimensional lumber minimization.

Application

The Playa Vista Construction Materials Recycling Plan's key elements form the core of the construction and demolition waste strategy. These include:

- At a minimum, the reuse and recycling of:

  1. Metal
  2. Wood (which can be given to non-profit groups as a tax-deductible donation)
  3. Dry wall
  4. Corrugated cardboard
  5. Concrete and asphalt

6. Ceramics
7. Glass

- Source separated and commingled waste collection.
- A minimum of two bins at all times at each construction site, one for recoverables and one for waste materials, and extra bins during waste surge periods.
- A single hauler with an on-site coordinator and staging area to maximize recycling and ensure efficient operations.
- Separate processing of any hazardous wastes encountered.
- Builder education. All recycling information, including bin labels, is printed in both English and Spanish.
- Ongoing program monitoring including monthly recovery reports submitted to the City of Los Angeles.
- A public relations effort, including a case study, to promote the program's success and benefits. .

VI.2.2 Building Materials

Guidelines

"Green" building materials have become widely available in response to concerns about human health and the environment. These materials frequently save energy, improve indoor air quality, contain recycled content or are sustainably grown.

When purchasing green materials, it is important to carefully compare products. For example, indoor air quality is more important than recycled content. A product may contain 100 percent post-consumer fibers yet have a higher level of toxic chemicals than a non-toxic product with only 40 percent recycled content.

Use building materials with some or all of the following characteristics:

- Zero or low VOC (volatile organic compounds).
- No or low toxicity.
- Durability.
- High recycled content.
- Certified sustainably grown.
- Rapidly renewable.
- Recyclable.
- Locally manufactured.

Mandatory Measures

1. Recycled content insulation (fiberglass minimum 30 percent, cellulose 85 percent). (Source of mandate: mitigation measure #N(3)-5.)
2. Recycled content gypsum board (wallboard minimum 25 percent, facing paper 100 percent). (Source of mandate: mitigation measure #N(3)-5.)
3. Low VOC paint, finishes and adhesives (less than 250 grams of VOCs/liter). (Source of mandate: mitigation measures #B-5v, B-8.)

4. Manufactured wood product moisture protection on exterior roof and wall surface areas. Protect joints and rough openings with joint filler and surface areas with a waterproof coating. (Source of mandate: Playa Vista standard.)

Optional Measures

Minimum number of optional measures required: Two.

1. A minimum of 15 percent of architectural building materials manufactured or reprocessed within 500 air miles of the building site to reduce shipping costs, pollution and energy consumption. Calculated by total materials cost, exclusive of costs for concrete, mechanical, electrical, plumbing systems, labor, overhead and fees.
2. A minimum of 25 percent of total building materials from recycled light gauge, rebar or structural steel. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.
3. A minimum of 20 percent of total building materials and 70 percent of rough construction wood from certified sustainably harvested products. Wood product shall originate in forests that are certified well managed by an agency accredited by the Forest Stewardship Council (FSC). Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.
4. Recycled content roofing materials. Seventy percent of primary roofing material (not including felt underlayment) shall incorporate at least 10 percent recycled content. Material options include but are not limited to metal (steel and aluminum), composite materials (plastic and rubber, wood and plastic), rubber and fluid applied roofing. Typical recycled content: metal (minimum 30 percent), wood (25 percent) and rubber pad (25 percent). Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.
5. A minimum of 5 percent of finish materials (inside face of drywall) from reclaimed or remilled wood, excluding flooring. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.
6. Kitchen and bathroom cabinets, linen closets and counter blanks made of Forest Stewardship Council (FSC) certified sustainably harvested lumber and plywood or fiberboard or particleboard with no added urea-formaldehyde.
7. A minimum of 20 percent of architectural materials, i.e. countertops, glass tile, carpet & carpet pad, that contain at least 20 percent post-consumer recycled content or a minimum of 40 percent post-industrial recycled content. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.
8. Rapidly renewable material flooring such as bamboo, cork or linoleum.
9. Hardwood flooring from FSC certified sustainably harvested wood.
10. Common area carpet system that allows replacing of worn sections without removal of the majority of the carpet.
11. Zero VOC paint and finishes.

Application

Hundreds of products are made from recycled or renewable materials and have good indoor air quality characteristics; more such products are being released all the time. The following discussion focuses on those materials that will be used in the largest volumes at Playa Vista.

Concepts

Recycled Content includes two sub categories: Post-industrial waste is industrial waste or finished material that is not marketed. Post-consumer wastes are products at the end of their intended use such as plastic and glass bottles, newspapers and corrugated cardboard.

Framing

Recycled Steel contains a minimum 25 percent recycled content and is itself recyclable. Its high thermal conductivity requires unique insulating measures to minimize heat transfer through exterior walls.

Forest Stewardship Council certification ensures that lumber is harvested from well-managed forests that ensure regeneration of desired species so that, over the long, term timber growth equals or exceeds harvesting rates in both quantity and quality. FSC certified engineered wood products (EWPs) use less wood for equal or greater load bearing characteristics. Examples include glulams, laminated trusses, I-joists, laminated veneer lumber and oriented strand board.

Insulation

Cellulose insulation made with recycled paper can achieve a high R-value in walls as it fills the entire cavity. State law mandates that fiberglass insulation have a minimum of 30 percent post-consumer glass. Other insulation options include cotton fiber and soy-based polyurethane foam.

Roofing Materials

Metal roofing alternatives include sheet metal, metal shingles, shakes and tile made from post-consumer aluminum and steel. Copper and zinc roofs, downspouts and gutters are prohibited (see 9. Stormwater Management for details). Cement composites contain recovered materials such as fly ash and wood fiber. Concrete-based materials can have a significant recycled content and can be recycled. Other options include shingles made from post-consumer rubber, plastic or glass, roofing mats (walkway pads) and roof membranes made from post-consumer plastic, and roofing felt paper from post-consumer paper.

Paints, Finishes and Adhesives

Paints, finishes and adhesives must meet the South Coast Air Quality Management District low VOC standard. The current standard is 250 grams/liter (2.08 pounds/ gallon). Low VOC adhesives are less toxic and include acrylic latex glues, contact cements and vinyl tile and sheet flooring adhesives. These adhesives are competitively priced and widely available.

Finish Materials

Urea formaldehyde-free medium density fiberboard or particleboard prevents indoor air pollution and can be used to manufacture countertops, cabinets and other applications requiring flat, paintable, machineable panels.

Bamboo is very durable and is a renewable resource as it grows to maturity in four to five years. Cork is combined with linseed oil and other natural materials to make flooring tile, and is harvested on an ongoing basis without harming the tree. Linoleum is also manufactured from renewable resources. Ceramic and glazed tile can be purchased with up to 70 percent recycled glass. Carpet is available with recycled wool, scrap yarn, nylon or plastic bottles.

VI.2.3 Energy

Guidelines

California residential energy use is divided into four categories: space conditioning (heating and cooling), water heating, lighting and appliances. Energy efficiency strategies can reduce resident's utility bills and lessen the impact on the environment.

Incorporating energy efficiency increases comfort, lowers energy use, reduces maintenance costs and can improve aesthetics and indoor acoustics. These benefits add value. Just as importantly, careful energy efficiency choices can frequently lead to first cost savings. Any additional costs that do result are typically quickly recovered through lower utility bills.

A whole-building or integrated design approach is recommended. Under this- approach, the entire design team works closely together to capitalize on synergies and optimize the finished project.

To illustrate the whole-building approach, consider windows: typical window placement and selection is primarily based on aesthetics and window costs, with minimal thought to the heating, cooling and lighting impacts. However, building performance can be substantially improved and result in increased winter passive heating, minimized summer heat gains, optimized daylighting and facilitated natural ventilation through the following strategies:

- Paying attention to window placement, size and architectural/ landscape shading elements.
- Specifying high performance windows to better control heat gains and losses.
- Minimizing air infiltration through careful installation.

Increased investment in windows might be more than paid for by the dollars saved through downsizing the space conditioning system. Furthermore, the consumer benefits through reduced utility bills, improved daylighting and increased comfort.

(a) Overall Energy Requirement

Guidelines

One of the key goals for the Playa Vista Residential & Mixed Use Sustainable Guidelines was to establish an overall energy requirement. The objective was to design the most energy efficient residential buildings possible while minimizing first cost impacts. The original performance goals were established through detailed engineering analysis and modeling of prototypical high and low density buildings. These goals have been modified for this update to reflect the increased efficiency requirements of the 2005 Title 24 Building Energy Efficiency Standards. The current energy performance requirement is 15 percent more efficient than 2005 Title 24 for air-conditioned buildings, and 5 percent more efficient for non air-conditioned buildings. Both of these performance goals are exclusive of exterior lighting use.

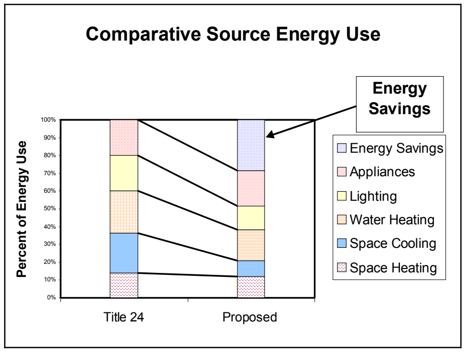


Figure VI-1 Comparative Source Energy Use

Because of the energy performance requirement, builders do not have to implement any energy-related optional measures. However, optional measures are offered that will help meet the energy performance threshold.

The key recommendations are:

- Optimize building envelopes, glazing orientation, shading and natural ventilation prior to specifying mechanical systems. An efficient envelope can result in the installation of lower capacity, and therefore less expensive, HVAC systems.

- Consider central and shared component systems such as central domestic water heating systems in multi-unit buildings.
- Consider both first-cost and operating savings at the “whole building” level.

Mandatory Measure

1. Overall energy use must be 15 percent more efficient than the 2005 California Energy Efficiency Standards (Title 24) for air conditioned buildings and 5 percent more efficient than the 2005 Title 24 for non air conditioned buildings. The lower goal for non air-conditioned buildings reflects the fact that many of the energy savings opportunities outlined in the guidelines are related to space cooling. The savings must be calculated on a whole building performance basis from a combined measurement of building envelope, heating and cooling, water heating and interior lighting. The required savings is measured on an ownership basis: for apartments, the target must be achieved for the building as a whole; for condominiums, the target must be achieved for each individual unit. Appliances and parking built below concrete slabs are not part of Title 24 and therefore are not part of the overall energy requirement. (Source of mandate: mitigation measures #B-7b, M-1, M-6.)

Optional Measures (None)

(b) Building Envelope

Guidelines

In Playa Vista’s mild coastal climate, optimizing the building envelope poses unique challenges. Improving insulation (R-values) alone provides only minimal savings. A whole building approach must be taken that also factors in building mass (increasing interior “thermal mass” can shift peak cooling loads to later in the evening and help address electricity shortages), window location, window shading, roof and exterior wall solar reflectivity, ventilation and other factors. Optimal designs require good engineering and computer building energy simulation modeling.

Natural ventilation can provide comfort when outside air conditions and architecture permit and can minimize or eliminate the need for mechanically assisted heating and cooling. Well designed building envelopes play an important role in facilitating natural ventilation through thoughtful window placement that, among other benefits, allows cross ventilation and catches prevailing winds. Conversely, poor envelope designs preclude effective natural ventilation and often necessitate mechanical cooling, even on mild days.

Windows should be designed to allow ambient daylight to enter a space while limiting unwanted heat gain from direct sunlight. East and west facing windows should be minimized as it is difficult to control morning and afternoon solar heat gains. Vertical louvers or side fins can be installed to reduce incoming solar radiation on these exposures, but their effectiveness is often limited. Windows on northern exposures receive minimal direct solar radiation and can be effective sources of daylighting. Larger northern glazing areas are therefore suitable. Although southern exposures receive the most direct light, windows with well designed horizontal overhangs and other shading elements can provide seasonally effective shading that minimizes direct solar gains in summer while allowing direct solar radiation in the winter for passive solar heating when the sun is low in the sky. Low emissivity glazing also reduces solar heat gain, making larger windows possible.

Light colored or “cool” roofs save cooling energy by reducing heat gain through roofs, and diffusely reflecting materials prevent undesirable reflective glare from impacting neighboring buildings.

Mandatory Measures

1. Employ passive heating and cooling design strategies. Possible strategies include building orientation; natural ventilation; high insulation values; increased interior thermal mass; energy efficient windows; cool roofs; and window shading and landscaping that provide seasonal shading, especially of south and west exposures. (Source of mandate: mitigation measures #B-7g, M-1, M-2, M-10.)
2. Install cool roofs on all low-slope roofs (less than 2:12) by using a roofing product listed by the Cool Roofs Rating Council (www.coolroofs.org). This is the same roof type required for all commercial buildings by Section 118(i) of the 2005 Title 24 Building Energy Efficiency Standards. (Source of mandate: mitigation measure #M-2.)

3. Install double pane windows having a line of sight (300 measured from the horizontal plane) of Jefferson Blvd. and Bluff Creek Dr. The design must provide an airborne sound insulation system achieving a Sound Transmission Class of 50 (45 if field tested) as defined in the American Standard Test Methods E90 and E413. (Source of mandate: mitigation measure E-4, condition of approval 2.)

Optional Measures

Minimum number of optional measures required: Not applicable.

1. Provide a 50 percent reduction in summer window solar gain by limiting aperture area (e.g.,15 percent of floor area) or through the use of fins, insets and overhangs.
2. Provide shading or glazing modifications on sliding glass doors.
3. Use 70 percent light-colored exterior walls. High reflectivity, high emissivity paints and paint additives can further reduce exterior solar heat gains.

Application

Energy Use

The following chart shows the heating and cooling energy for a typical Playa Vista high density building with and without efficient glazing. The dramatically reduced need for cooling energy more than offsets the small increase in heating energy.

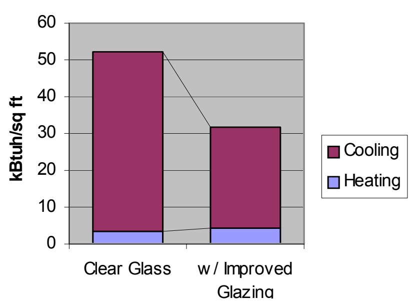
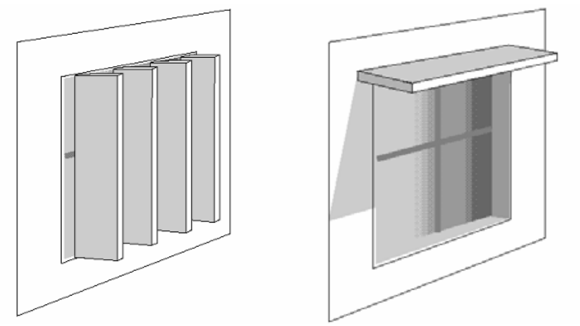


Figure VI-2 Heating and Cooling Energy Use

Shading

A variety of different shading devices can be used to minimize solar heat gain. The sun's path makes vertical louvers or side fins effective on east and west facades, while overhangs are more effective on south façades.



Variations on typical overhangs allow for space constraints or structural limitations that prohibit larger overhangs.

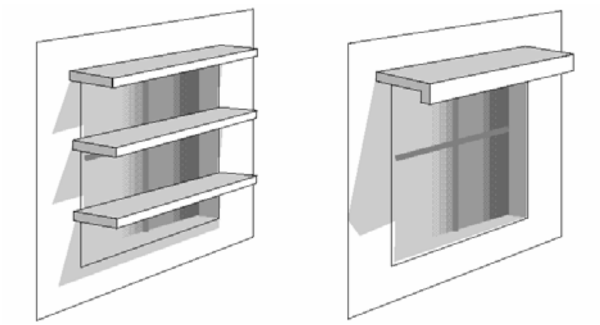


Figure VI-3 Shading Devices

(c) Space Conditioning

Guidelines

Thirty percent of all energy consumed by California households is used to provide space heating and cooling. Occupant comfort is affected by both the quality (e.g. odors, stale air), temperature and velocity of the indoor air. Regulations set minimum ventilation levels to protect occupant health. Natural ventilation is a low energy-consuming alternative that can reduce or eliminate air conditioning needs at Playa Vista during much of the year.

In high density buildings, a whole-building systems approach to the design and selection of equipment can help optimize space conditioning systems and facilitate consideration of shared equipment. Using a central heating and cooling system, or heating and water heating system, can be more cost-effective than installing separate pieces of equipment to provide the same functions. For example, a water loop heat pump system may be effective and can lead to significant construction and energy cost savings. Centralized systems can also facilitate cost effective heat recovery systems or supplemental solar water heating.

A centralized system addresses a number of design issues including:

- Minimizing mechanical equipment space requirements in units.
- Eliminating balcony and roof clutter.
- Reducing the impacts of salt air on condensing coils.

Low density housing lends itself to individual space conditioning units. High efficiency gas furnaces and high efficiency air conditioning systems are therefore recommended.

Mandatory Measures

1. Utilize energy efficient mechanical systems. Possible residential strategies include fans to assist natural ventilation; centralized space and water conditioning systems; high efficiency individual heating and cooling units; and automatic setback thermostats. Possible commercial strategies include variable air volume systems; air economizer cycles that utilize 100% outside air when appropriate; under floor air distribution; and building control systems for lighting, HVAC and other systems. (Source of mandate: mitigation measure #M-3.)
2. Provide medium efficiency (average of 25 to 30 percent per ASHRAE Test Standard 52) air filtration. All air conditioning units must include a charcoal or electronic air filtration system. (Source of mandate: condition of approval #63.)
3. For high density homes, do not locate any equipment on walls, balconies or patios. (Source of mandate: Playa Vista standard.)
4. For any outside equipment, eliminate or minimize noise and provide corrosion protective coatings. (Source of mandate: mitigation measure E-5, Playa Vista standard.)
5. For subterranean garages where ventilation is required, ventilate using high-efficiency fans and incorporate carbon monoxide (CO) sensors to control fan operation. Fans with a motor size over 5 horsepower must be at least 70 percent efficient at the design air flow and pressure, and be certified by ACMA (Air Movement and Control Association, http://www.amca.org). Motors must have efficiencies greater than those listed as “Energy Efficient” in NEMA standard MG 1, Table 12-10. See the Best Practices website at http://www.oit.doe.gov/bestpractices/ for more information. (Source of mandate: mitigation measure #M-3.)

Optional Measures

Minimum number of optional measures required: Not applicable.

1. For high density structures, install water source heat pump system or equivalent to supply heating and cooling at the unit level via a centralized tempered water distribution system.
2. For high density structures, install high efficiency pulse boilers or equivalent to provide heated water for the centralized water source heat pump system.

3. For low density homes, utilize high efficiency forced-air gas furnaces (AFUE greater than 80 percent) and air conditioners (SEER greater than 12), or use high efficiency air-to-air heat pumps for both heating and cooling.
4. Design in cross-ventilation for each dwelling unit to allow the opportunity for natural ventilation with operable openings other than doors.
5. Use fans to assist natural ventilation in all units. Include the use of operable dampers and thermostatic controls.
6. Install operable inlet air dampers for natural ventilation.
7. Install premium efficiency electric motors, as defined in the table below.

PREMIUM EFFICIENCY MOTOR TABLE		
Rated Horsepower	Minimum Efficiency @ 1800 rpm	Options
Less than 1/4	Exempt	
1/4	67%	75% @ 1200 rpm
1/3	71%	
1/2	75%	
3/4	77%	
1.0	85%	
1.5	86%	
2.0	86%	
3.0	89%	
5.0	90%	
7.5	91.5%	
10.0	91.7%	
Greater than 10	92%	

Figure VI-4 Premium Efficiency Motor Table

8. Install variable-speed motors or variable speed drives for pumps and fans wherever feasible.
9. Install a solar water heating system to provide at least 60% of the space heating requirements (see chapter 3.6, Renewable & Alternate Energy Sources).

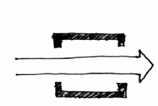
Application

Ventilation

Natural or mechanically-assisted ventilation can reduce air conditioning and heating costs and improve indoor air quality. The proper design of building openings allows the effective use of natural ventilation. The increased air movement extends the upper limit of the temperature at which a person feels comfortable.

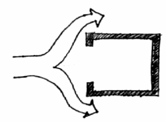
When outdoor air temperatures are below 80°F, windows can be opened or a whole house fan turned on to allow outside air to circulate through a home. When outdoor air temperatures exceed 82°F, minimize infiltration during the day and ventilate at night.

PLAN WITH GOOD CROSS VENTILATION



Air flow through the unit provides excellent ventilation opportunities. Overheated air and odors are flushed from the space.

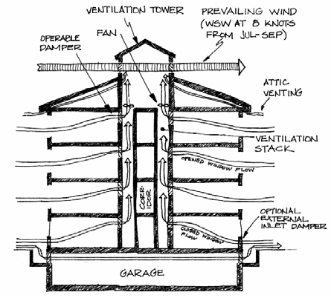
PLAN WITH POOR CROSS VENTILATION



Air fails to adequately flow through the unit. Overheated air and odors tend to stay inside.

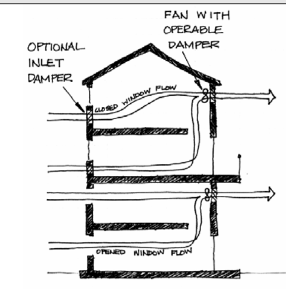
For buildings where design, security or privacy constraints restrict the optimum placement of openings, mechanically assisted ventilation with whole-house fans with operable dampers can be used. These can be as effective as natural ventilation. Stack ventilation can be used where

DOUBLE LOADED CORRIDOR CROSS VENTILATION SCHEME



- *Ventilation shafts & tower allow cross-ventilation.*
- *Operable dampers control ventilation.*
- *Subterranean garages require dedicated ventilation fans.*
- *When windows are closed, inlet dampers allow automatic cross ventilation .*

MULTI-STORY UNIT CROSS VENTILATION SCHEME



- *Operable dampers control ventilation.*
- *When windows are closed, inlet dampers allow automatic cross ventilation.*

Figure VI-5 Ventilation

openings are difficult to provide. Fans can operate when a homeowner is not home, or if the homeowner forgets or prefers not to open windows or doors.

Ventilation fans such as whole house fans should include automatic controls to control their use based on interior and exterior temperatures. If a building requires cooling and outdoor conditions discourage the use of the fan, then the air conditioning system is turned on.

Underground parking garage ventilation fans are another major energy consumer. Mechanical ventilation systems should include high-efficiency fans and carbon monoxide (CO) sensors to control fan operation. Variable speed drives should be provided for parking garage ventilation fans and garage ductwork should be designed to minimize static pressure drop.

<u>Water-Source Heat Pumps</u>

In high density buildings in climates with moderate space heating and cooling needs, water-source heat pumps offer an energy efficient and cost effective alternative to furnaces and air-cooled air conditioners. The diagrams below illustrate how heat pumps work.

There are two water source heat pump installation strategies. Vertical installations in closets or utility rooms have small footprints, typically less than three feet square. Horizontal installations concealed above ceilings typically have a low profile of less than two feet.

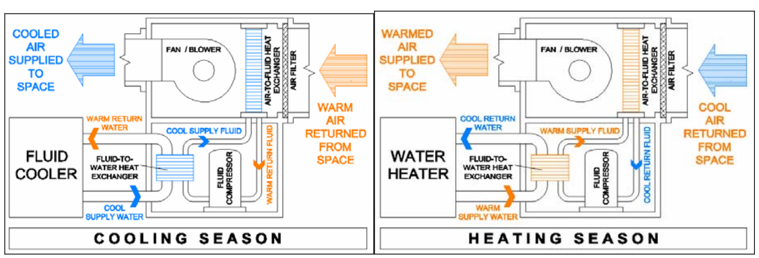


Figure VI-6 Heat Pump

(d) Lighting

Guidelines

Lighting efficiency is important because lighting is one of the largest residential energy consumers. Incandescent lamps, though inexpensive and readily available, are the least efficient light source, last a relatively short time, cost more over time and generate a significant amount of heat, increasing the need for air conditioning. Many fluorescent lamps have similar light qualities to incandescent while being three times as efficient and lasting 10 times as long.

Mandatory Measures

1. Energy efficient lighting that exceeds the Title 24 Energy Efficiency Standards to the extent feasible.(Source of mandate: mitigation measures #B-7c, M-6)
2. T5 high output or super T8 lamps and electronic ballasts in all linear (straight tube) fluorescent fixtures. (Source of mandate: mitigation measures #B-7c, M-6)
3. Fluorescent or high intensity discharge (HID) lighting in all common areas such as interior and exterior corridors, stairways and parking structures, including hard-wired compact fluorescent lamps with electronic ballasts in all common area recessed can fixtures. In recessed cans, both the lamp and ballast must be replaceable, the lamp cannot extend below the bottom of the fixture and parabolic diffusers shall be installed. Care shall be taken to not expose light sources directly to public rights-of-way. (Source of mandate: mitigation measure # B-7c, B-7d, M-6, M-7.)
4. Automatic devices to turn off lights when they are not needed in office common spaces such as conference rooms and bathrooms. (Source of mandate: mitigation measures: #B-7c, M-6.)
5. Photocell controls for all common-area exterior, site and landscape lighting. (Source of mandate: mitigation measures #B-7d, M-7.)
6. No exit signs or other lighting component with radioactive elements for illumination. Radioactive elements are those materials defined

as such by the California Department of Health Services Chemical Detection Limits for Purposes of Reporting (DLRs) and include Tritium. (Source of mandate: mitigation measures #B-7c, M-6.)

7. Outdoor lighting, other than signs, limited to those required for safety, security, low level exterior architectural illumination and landscaping. Animated building signs prohibited. Illuminated residential building signs not permitted above first level. (Source of mandate: mitigation measures F(2)-1, F(2)-2; condition of approval 5.)

Optional Measures

Minimum number of optional measures required: Not applicable.

1. Porch and patio lighting with hard-wired compact fluorescent fixtures with electronic ballasts.
2. Hard-wired electronic ballasts for all compact fluorescent lamps in residential units.
3. Photocell and motion controls on porch and patio light fixtures with user override.

Application

The photo below depicts the components of a hard-wired compact fluorescent fixture. Note that both the lamps and ballast are

Figure VI-7 Fluorescent Lamp
Hard-wired compact fluorescent lamp in recessed fixture
Image source: Nora lighting

replaceable, the lamp does not extend below the bottom of the fixture and the fixture includes an integral reflector to diffuse the light and improve distribution.

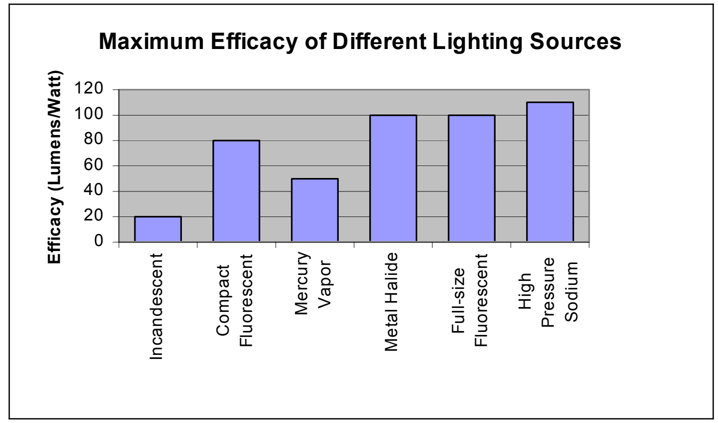


Figure VI-8 Maximum Efficiency of Different Light Sources

Efficacy is a measure of a lamp's efficiency, and is the ratio of light output (in Lumens) to electricity use (Watts). Higher efficacies are better. The following graph shows the maximum efficacy for a variety of light sources. Incandescent lamps are the least efficient and should be avoided.

While compact fluorescent lamps are available that can be screwed into standard incandescent sockets, they should be avoided in new construction. Instead, hard-wired compact fluorescent fixtures should be used because they typically are higher quality and have more efficient and longer-lived electronic ballasts. Furthermore, consumers can not replace the lamps with incandescent lamps, ensuring continued electricity savings.

The use of radioactive elements for illumination should be avoided. Exit signs using Tritium are the most common application for these radioactive materials are often disposed of improperly after their 5 to 20 year life.

(e) *Water Heating*

Guidelines

Thirteen percent of all energy consumed by California's households is used to heat water. Savings can be realized through the use of high efficiency plumbing fixtures and efficient heating equipment.

High quality water efficient plumbing fixtures and water-efficient appliances should be used to reduce hot water demand (see chapter 3.8 Appliances). For builders, lowering water heating demand may permit the installation of smaller capacity water heaters that are both less costly and, depending on the unit, more efficient.

Once demand has been minimized, high efficiency water heating equipment should be installed. The most appropriate equipment selection depends on many factors. The options include:

- Centralized systems in high density buildings: Centralized systems can take advantage of high efficiency condensing boilers or water loop heat pump systems; cogeneration, or combined heat and power systems; heat recovery from chillers; or a centralized solar water heating system. They may also be more space-effective than individual systems. A centralized system may, however, present challenges and extra costs for submetering hot water, which should be installed. Failure to submeter hot water usage and bill residents directly often leads to excessive consumption since there is no perceived "cost" for the extra use.
- Tankless water heaters: These water heaters require very little space and eliminate the standby heat loss that occurs from maintaining a large tank of hot water at high temperature 24 hours per day. These losses can consume up to 40 percent of water heating energy use. Generally, natural gas fired instantaneous heaters should be used, and care taken to ensure the heater is appropriately sized to meet maximum hot water loads. Electric water heaters should be avoided due to large electric demands and the corresponding large conductor sizing required to handle the high currents.
- Condensing water heaters: Normal water heaters only have efficiencies of about 85 percent because they allow significant energy to escape through the flue in the form of water vapor formed during combustion. Condensing heaters capture this energy by allowing lowering flue temperatures and efficiencies are around 95 percent. Some manufacturers provide combined water and space heating systems. Condensing water is acidic and requires special considerations to minimize corrosion.
- Traditional tank-type storage heaters: Efficient models should be specified as there are significant variations. Water heater energy efficiency is measured by the "Energy Factor" (EF), which is the ratio of energy output (heated water) to the energy input (gas or electricity). EF includes recovery efficiency (how efficiently the heat from the energy source is transferred to the water), standby losses (the percentage of heat lost per hour from the stored water compared to the heat content of the water) and cycling losses. The following table summarizes the range of EFs for natural gas tank-type water storage heaters and the Federal Energy Management Program (FEMP)'s recommendation. For more information, see FEMP's "How to Buy an Energy-Efficient Gas Water Heater" at http://www.eere.energy.gov/femp/technologies/eep_gas_waterheaters.cfm#techoptions.

Recommended Natural Gas Tank-Type Storage Water Heater Efficiency Factor (EF)

Water Heater Type	Base EF	FEMP Recommended EF	Best Available EF
Gas, storage	0.59	0.62	0.85

Mandatory Measures

1. Install energy efficient water heating systems. At a minimum, install tank-type water heaters or boiler systems that meet or exceed the Federal Energy Management Program's (FEMP) recommended Efficiency Factors (EFs) (Source of mandate: mitigation measure M-3.)

2. Use high efficiency plumbing fixtures to minimize hot water demand. (see section 4.0, Domestic Water. Source of mandate: mitigation measure #N(1)-2).

Optional Measures

Minimum number of optional measures required: Not applicable.

1. In high density structures, use condensing boilers or other high-efficiency centralized water heating systems.
2. Utilize waste heat recovery. Centralized systems in high density structures lend themselves well to heat recovery from, for example, chillers and microturbines.
3. Utilize high efficiency tankless gas water heaters with an equivalent EF of 0.70.
4. Utilize heat-pump water heaters coupled to a water-loop heat-pump space heating system.
5. Use residential condensing water heaters or combined water/space heating condensing heaters.
6. Install solar water heating. (see section 3.6, Renewable & Alternate Energy Sources).
7. Install Energy Star rated dishwashers and horizontal-axis clothes washers to minimize hot water demand. (see chapter 3.8 Appliances).

(f) Renewable & Alternate Energy Sources

Guidelines

The use of renewable and alternative energy is a key component of sustainable design. The options include:

- Pool and spa heating: Unglazed, low-temperature polymer pool heating collectors are the simplest and lowest cost solar systems and are well established with numerous vendors and manufacturers.
- Domestic hot water and space heating: Traditional "flat plate" collectors with one or two glass covers are the most common. They can heat water to 180°F and higher and be coupled to a storage tank mounted on the roof directly above the collector, thus allowing natural convection to circulate water through the collector without pumps (a thermosiphon system), or to a traditional storage tank located in the building with pumps to circulate the water. There are a number of variations, including an "integral collector-storage system," essentially a water preheater, and high performance evacuated tube collectors. System choice will depend on the application, cost, available roof space, aesthetics and roof strength.
- Photovoltaic (PV) systems: PV systems convert solar radiation to direct current (DC) electricity that, when inverted, provides electricity to meet standard alternating current (AC) needs. Significant government and utility incentives are available. PV panels are typically installed on rooftops. Excess electricity generation is fed back through the meter and into the electricity grid. Net metering laws enable the electricity meter to be effectively spun backwards to reduce consumers' utility bills. Battery storage is therefore not required, although appropriate electrical protective gear must be installed per code.
- Microturbines: These units generate electricity and can achieve high efficiencies if the waste heat is recovered to assist in meeting thermal requirements or produce chilled water from absorption (heat driven) chillers. Recent innovations are making these options more economically attractive. Typically natural gas and around 60 kW in size, microturbines can be centrally located to serve multiple households. Some vendors offer integrated systems that generate electricity, heat and chilled water.

- Fuel cells: Fuel cells, currently being commercialized, convert natural gas to electricity through thermochemical reactions without combustion. The costs are currently high compared to other systems. Fuel cells are typically larger than microturbines. Technologies vying for success in this promising market include phosphoric acid (PAFC), molten carbonate (MCFC), hybrid solid oxide (HSOFC) and proton exchange membrane (PEMFC).

Mandatory Measures

1. Utilize solar heating for swimming pools and spas to provide 50 percent or more of their heating requirements 80 percent of the time. (Source of mandate: mitigation measure #M-4; condition of approval #4.)

2. Make each building photovoltaic-ready (source of mandate: mitigation measures B-7h, M-11.)

- For high density buildings, install and cap a 1½" minimum diameter electric conduit from the roof to the electric panel that serves the common area load. It is assumed that the inverter will be placed on the roof and that any photovoltaic system will serve common area load. Provide the roof framing plan. Design and construct the roof to create as large an unobstructed area as possible and to group any rooftop equipment and vents toward the north end.
- For low density buildings, install and cap a 1¼" minimum diameter electric conduit from the largest south or southwest-facing portion of the roof to the electric meter of each unit. Provide mounting space for an inverter near the meter either on the wall (3' by 3') or on the ground (1' by 3'). Provide the roof framing plan. Design and construct the south-facing roofs to create as large an unobstructed area as possible.

Optional Measures

Minimum number of optional measures required: Not applicable.

1. Provide a solar hot water heating system to supplement mechanical water heating.
2. Install photovoltaic (solar) powered landscape lighting. Energy must be stored centrally and used to power a substantial percentage (50 percent) of the landscape lighting.
3. Install a photovoltaic (solar electric) system to serve building common area lighting loads. Building integrated photovoltaics should be considered.
4. Install microturbines or fuel cells with waste heat recovery. Swimming pools and spas make a suitable heat sink for either low- or high-temperature waste heat from on-site generation.
5. Provide a space dedicated to the future installation of on-site distributed energy systems to supply at least twenty percent (20 percent) of the building's installed electrical capacity. Locate the dedicated space at the building perimeter where it can be easily enclosed and exhaust flues, combustion air, and gas and electric services can be easily supplied. Size the space to allow for installation and servicing of the systems. Future energy systems could be installed by the building owner or a third party energy provider.

Application

Solar water heating, and specifically pool heating, is the most common solar energy application. Thermal systems usually operate at higher efficiencies than photovoltaic systems and require less roof space for equivalent energy capture. Photovoltaic arrays can be integrated directly into roofs (see photo below), walls, windows, parking shades and other architectural features.

Figure VI-9 Photovoltaic System

(g) Controls & Feedback

Guidelines

Sophisticated digital HVAC controls, digital communications, wireless networks and web based applications are quickly penetrating the residential market and provide ever expanding opportunities for increased energy efficiency, improved control and opportunities for better energy management. Energy and water management features are integrated into most "smart-home" systems that include security, building system control, lighting and many other features. Utilities are also using digital and wireless technology for everything from automated meter reading to shedding non-essential loads during power emergencies.

Mandatory Measures (None)

Optional Measures

Minimum number of optional measures required: Not applicable.

1. Install enhanced feature setback HVAC thermostats. Title 24 requires setback thermostats. In addition to the ability to program in setpoints for use during unoccupied periods, include:

- Battery backup (or non-volatile memory) of program schedule.
- Automatic adjustment for daylight savings time.
- Start/stop time optimization that turns on the system as late as possible to achieve setpoint by the specified time and turns off the system as early as possible while maintaining comfort until the shut-off time.

2. Provide on-demand feedback and control of energy and water use via a touchscreen or computer.
3. Install window and sliding door sensors that turn off air conditioning when natural ventilation is in use.
4. Install occupancy sensors that set back temperature setpoints when a residence is unoccupied.
5. Install daylighting sensors that automatically reduce light output when adequate daylight is available.
6. In high density structures, install a digital control system for central systems such as a water source heat pump loop or domestic hot water system.
7. Provide remotely readable utility metering for gas, water and electricity for both individual units and common areas.
8. Provide wireless communication interfaces that the utility can use to turn off air-conditioners and other non-essential loads during power emergencies. Rebates and special tariffs may be available for these and similar systems.

(h) Appliances

Guidelines

Home appliances for refrigeration, cooking, dishwashing and laundry have a substantial impact on energy and water usage. Nationally, appliances are responsible for about 20 percent of total residential energy use. Playa Vista's percentage is higher because the mild climate reduces heating and cooling requirements.

Generally, the higher initial cost of energy and water-efficient appliances will be recovered several times over during the life of the appliance through reduced utility bills.

Playa Vista builders typically offer optional appliance packages that can be included in a home's purchase price. These packages present an excellent opportunity to promote energy and water conserving equipment while allowing homeowners to avoid the out-of-pocket expense of purchasing these new appliances. Including the cost in mortgages allows homeowners to reduce monthly energy and water bills at minimal cost.

The focus at Playa Vista is on Energy Star rated appliances, as designated by this logo. The yellow Energy Guide labels that are placed on all appliances and compare energy consumption and operating costs for "similar models" can be misleading because they typically use a number of rating scales for the same appliance and may not always take into account the varying capacity of different models.

Mandatory Measures

1. Provide low water consumption and energy efficient Energy Star-rated dishwashers. (Source of mandate: mitigation measures #B-7a, M-5, N(1)-2.)
2. Provide energy efficient Energy Star-rated refrigerators if builder installed or part of builder-offered upgrade. (Source of mandate: mitigation measures #B-7a, M-5, N(1)-2.)
3. Provide low water consumption and energy efficient Energy Star compliant clothes washers in common areas and in-home laundry facilities if builder installed or part of builder-offered upgrade. (Source of mandate: mitigation measures #B-7a, M-5, N(1)-2.)
4. Provide energy efficient clothes dryers with automatic shut off using tub moisture sensor (most efficient) or exhaust-mounted temperature sensor in common area and in-home laundry facilities if builder installed or part of builder-offered upgrade. Clothes dryers are not Energy Star rated. (Source of mandate: mitigation measures # B-7a, M-5, N(1)-2.)

Optional Measures

Minimum number of optional measures required: Not applicable.

1. Install a duct from the range exhaust to the outdoors, instead of using a less effective "ductless" system.
2. Provide make-up air for exhaust fans over 100 cfm (range hood and dryer).

VI.2.4 Water

Guidelines

Playa Vista conserves water by both reducing domestic water and landscape consumption and utilizing reclaimed water for landscaping and for non-potable uses in commercial buildings. (See chapter 8. Landscape for details on landscape measures.) The domestic water strategies include low flow faucets, showerheads and toilets, and water efficient dishwashers and clothes washers. These fixtures and appliances not only conserve water, but also lower energy costs by reducing the use of hot water.

Another opportunity is to reduce the amount of water wasted when a user waits for hot water to reach faucets, showerheads and hot water appliances. While waiting, potable water pours down the drain. Insulating hot water supply pipes and reducing the length of supply runs mitigates this problem. An additional strategy is to install return lines from hot water fixtures to reclaim the water in water heaters. This supply/return loop also enables hot water to reach fixtures and appliances quickly, further saving water. These systems have been documented to save over 10,000 gallons per dwelling unit per year. A timer can control the loop pump so that hot water is only circulated when occupants need it, such as mornings and evenings.

Lastly, residents can be made conscious of their water use habits (see chapter 3.7 Controls & Feedback).

Mandatory Measures

1. Use reduced water consumption fixtures. (Source of mandate: mitigation measure #N(1)-2.)

- Toilets: 1.6 gallons per flush.
- Urinals: 1.0 gallons per flush.
- Kitchen faucets: 2.0 gallons per minute.*
- Bathroom faucets: 2.0 gallons per minute.*
- Showerheads: 2.0 gallons per minute.*

* These flow rates apply at 80 PSIG (pounds per square inch gauge). The plumbing system should be designed and balanced to achieve a water pressure of 70 +/- 10 PSIG at all fixtures.

2. Use water conserving Energy Star-rated appliances (see chapter 3.8 Appliances). (Source of mandate: mitigation measures #B-7a, M-5.)
3. In office, retail and other public buildings, install water faucets with activators that automatically shut off water flow when the faucet is not in use. (Source of mandate: mitigation measure #N(1)-3.)

Optional Measures

Minimum number of optional measures required: Three total from the following five categories: Construction Waste; Water; Recycling & Solid Waste; Landscape; and Stormwater Management.

1. Install low flush toilets: 1 gallon per flush pressure-assisted tank-type toilets (e.g., Sloan Flushmate IV equipped fixtures); 0.8 – 1 gallon per flush (liquids)/1.6 gallon per flush (solids) "dual-flush" tank-type toilets (e.g., Caroma fixtures); or 1 gallon per flush (liquids)/1.6 gallon per flush (solids) "dual-flush" flush-valve toilets (e.g., Sloan dual-flush flushometers).
2. Install low flush urinals: waterless (if legalized by City of Los Angeles) or 0.5 gallons per flush.
3. Provide a hot water demand system that recirculates the hot water supply to a remote fixture (usually at the farthest fixture from the main hot water supply to the dwelling) when there is a demand for hot water at that fixture.

Application

<u>Low Flow Appliances</u>

Low flow appliances greatly reduce water consumption. The following graphs show the typical amount of household water use and then the lower amount used with low flow appliances. The third chart shows the percentage savings.

These calculations assumed 1.6 gallon per flush toilets, 2.2 gallon per minute faucets, 2.5 gallon per minute showerheads and a tumbler-style closes washer. Playa Vista will utilize 2.0 gallon per minute or less faucets and showerheads and water conserving appliances, so even greater water conservation will be achieved.

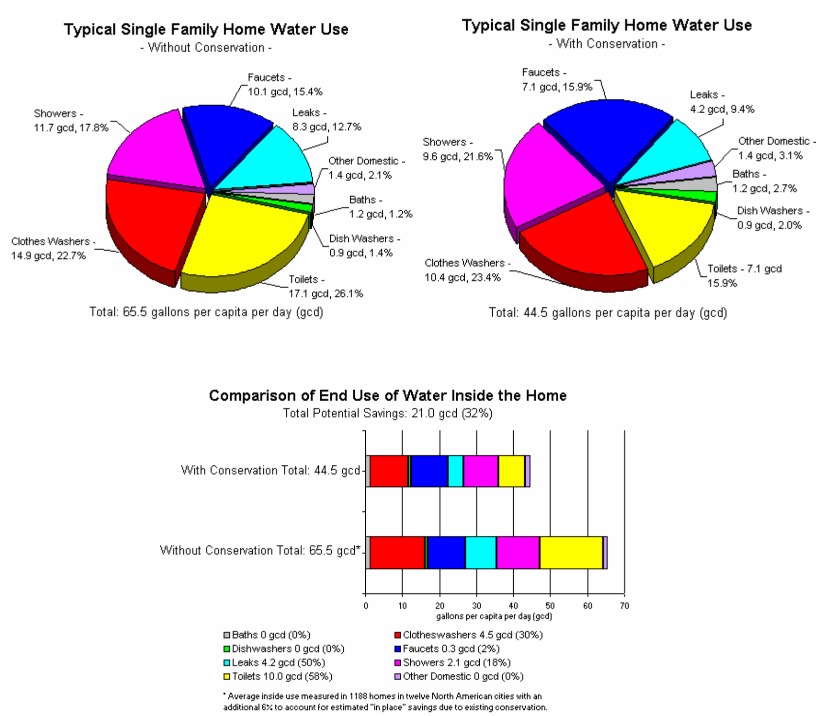


Figure VI-10 Household Water Use

VI.2.5 Recycling & Solid Waste

Guidelines

Playa Vista's goal is to meet and exceed with the state mandate to reduce solid waste by 50 percent. The City of Los Angeles has established additional waste reduction goals of 62 percent by 2010 and 70 percent by 2020. To reach these goals, the City has implemented a commingled recycling collection process that combines the collection of clean paper (if it tears, it can be recycled), glass, plastic bottles and cans. To match this system, Playa Vista requires the installation of dual bins in every unit and dual chutes in all high density buildings.

Under State and local laws, the disposal of household hazardous waste in the solid waste stream, streets or sewage system is prohibited. To assist its residents, Playa Vista is required to provide a site for the City of Los Angeles' mobile household hazardous drop-off program.

Mandatory Measures

1. Install a dual-bin kitchen system for recyclables and trash. One bin should be designated for recyclable materials, the other bin for non-recyclable trash. Install instructional decals (see diagram below). (Source of mandate: mitigation measures #C(2)-3, N(3)-1, N(3)-2.)
2. For high density housing, provide underground recyclable and garbage areas, and install a dual-chute system for recyclables and trash. Install instructional decals on trash and recyclable chutes explaining what materials should be placed in which chute. The decals should also instruct residents as to the proper disposal of household hazardous waste. (Source of mandate: mitigation measures #C(2)-3, N(3)-1, N(3)-2; condition of approval 6.)
3. For low density housing, locate two 60 gallon self-rolling containers with lids (one each for recyclables and trash) in the garage or a dedicated outside enclosed area. Green waste bins will be provided at a central location. (Source of mandate: mitigation measures #C(2)-3, N(3)-1, N(3)-2; condition of approval 6.)
4. Comply with all applicable existing and future regulations for the

collection and disposal of household hazardous waste. (Source of mandate: mitigation measure #N(3)-3.)

Optional Measures

Minimum number of optional measures required: Three total from the following five categories: Construction Waste; Domestic Water; Recycling & Solid Waste; Landscape; and Stormwater Management.

1. For high density housing, use recycled steel for the trash and recycling chutes, and recycled rubber baffles inside the chutes to comply with Playa Vista's goal of using sustainable building materials. The rubber baffles keep recyclables and broken glass from flaring out of the bin.
2. In low density housing, install a trash compactor in each unit's kitchen. This action reduces the required size of the trash bin to 35 gallons.

Application

Kitchen Dual-Bin System

To optimize kitchen space, a pantry, cupboard or other area can be used to enclose the recycling and trash containers.

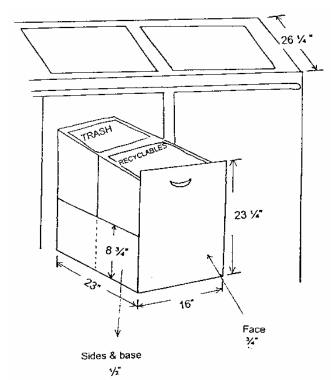


Figure VI-11 Dual-Bin System

Recycling Trash Chutes & Centralized Recycling & Trash Collection

The City permits chute sizes up to 9 square feet. Recycling and trash chutes need to be the same size. In high density housing, use three cubic yard collection bins.

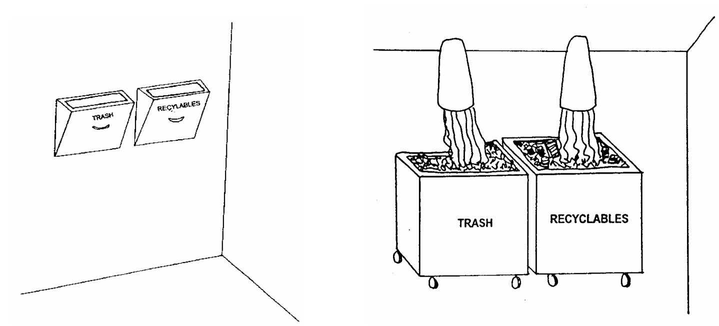


Figure VI-12 Trash chutes

The City requires the following minimum recycling square footage for high density residential buildings:

- For 20 or fewer dwelling units, 30 square feet.
- For 21 to 50 units, 60 square feet.
- For 51 or more units, 100 square feet.
- A minimum vertical clearance of 8 feet.

The recycling area shall accommodate the collection of all recyclable material without overflowing or forcing significant amounts of recyclables to be discarded as general refuse. It not, the Department of Building and Safety shall require a larger space, even if the dedicated area exceeds the minimum requirements. These requirements are subject to change.

Trash areas must be separated by an occupancy separation with the same fire resistance required for the shaft enclosure, but not less than a one-hour rating. Openings into chute termination rooms shall not be located in exit corridors or stairways.

VI.2.6 Power Signal & Control

Guidelines

Playa Vista's units are designed to encourage access to the ever-expanding electronic media and communications options. To ensure that each unit can readily be modified as needed, it is important to provide easy and serviceable connections in every residence, ensure the reliability of these connections, and provide for power conditioning and interruption protection. It is also recommended that extra service center capacity be provided and that lighting and utility circuits be separated. Design decisions should not limit resident's future options.

Additional issues include:

- Power: There is an increasing need for clean and reliable power for security, emergency lighting, elevators, computers and parking ventilation fans. Photovoltaic systems with battery storage are one possible response for backup power. Gas or diesel powered generators could also be utilized.
- Signal: The keys to accommodating future signal needs are to install high quality wiring and provide chase and access space for future technologies. Playa Vista has established standards to meet these needs.
- Control: Control systems include security, fire alarm, thermostats and control wires from utility meters, doorbells and water heaters. Connecting these systems to the network hub allows for the addition of smart devices.

Mandatory Measures

1. Install fire detection and signal in each unit, automatic call to fire department and an enunciator panel that indicates which unit is generating the alarm signal in the building. (Source of mandate: City ordinance.)
2. Wire each unit to Playa Vista structured wiring standards. (Source of mandate: Playa Vista standard.)
3. Provide seismic gas line shut-off valves. (Source of mandate: City ordinance.)

Optional Measures

Minimum number of optional measures required: Three in high density developments; two in low density buildings.

1. For high density buildings, provide automatic call to building manager (if applicable) and link fire detection to central corridor depressurization ventilation system (if applicable).
2. Provide visual fire alarm in each unit and in common means of egress.
3. Provide feeder and main circuit breaker 25 percent larger than the calculated diversified load for the unit. The diversified load shall be calculated in accordance with NEC section 220-30.
4. Separate lighting circuits from convenience circuits.
5. Provide mounting space inside the electric panel for surge protection, power conditioning and battery backup for each unit. Space must include power and phone line access.

Application

<u>Local Networks</u>

The photograph below shows an example of a network hub. The hub connects units to security systems, fire alarms, building managers, control/feedback systems from utilities and other services. The hubs have the capacity to expand as future technology requires.

Figure VI-13 Network Hub

VI.2.7 Adaptability

Guidelines

All Playa Vista residences should both meet the diverse accessibility needs of the disabled and be easily adapted as families grow, technology advances and lifestyles change.

Homes at Playa Vista must meet all City of Los Angeles disability standards, including door and hallway openings, egress systems, kitchen and bathroom turn around space and appropriate fixture and countertop heights. Additional health and safety considerations include material finishes (see 2. Building Materials), entrances and landscape design (see Playa Vista Landscape Guidelines).

Bathroom showers and water closet walls should be framed so that grab bars can be easily installed at a later date. Likewise, all doors should be either 2'10" wide or framed so that wider doors can be easily installed. By keeping the rough doorway opening between king studs 3'1" wide, 2"10" doors can be installed without major remodeling. Smaller doors should swing outward to be wheelchair accessible; another option is sliding and pocket doors.

Kitchens should include a central work surface so users can reach many appliances from one location. Drawers and cabinets should be designed to help bring storage to users instead of them having to reach for items. Cabinetry and countertops should be adjustable in height and provide leg space for wheelchair accessibility, including under sinks and food preparation areas. There should be good lighting and color rendition.

The photo here shows a prototypical kitchen demonstrating adaptable design using standard builder grade cabinetry.

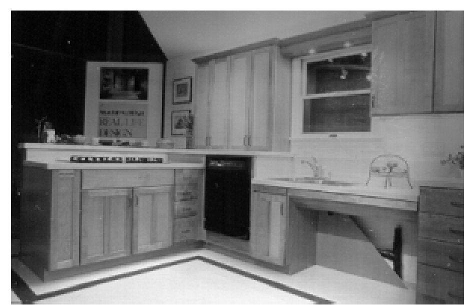


Figure VI-14 Prototypical Kitchen
Image Source: IBACOS

Note the raised dishwasher to alleviate back strain and the lowered kitchen sink with open space below to allow access for wheelchair users.

Chases and conduits should be large enough to accept future technology upgrades and be accessible from the building utility zone. Similarly, residents should have access for all maintenance and repairs, especially in high density buildings. The lowest cost strategy is careful specification of equipment and integration of cleanouts for all otherwise inaccessible traps such as bathtubs and showers.

Complete system and product documentation should be provided to occupants and building managers in both written and electronic form .

Mandatory Measure

1. Conform to all City of Los Angeles disability residential standards. (Source of mandate: City ordinance.)

Optional Measures

Minimum number of optional measures required: Four.

1. Reinforce bath walls for grab bars in all areas around showers and water closets. For low density structures, reinforce the downstairs powder room and one bedroom/full bath.
2. Provide accessible door sizes and swings by installing doors at 2'10" width or framing roughed to allow simple change, and installing out-swinging doors, sliding doors or pocket doors to small rooms. For each low density structure, provide accessible door sizes and swings for the downstairs powder room and one bedroom/full bath.
3. In high density housing, provide adequate access for servicing all trunk lines located within common area corridors and individual units, including water, domestic hot water, sanitary sewer, space conditioning, solar roof access, and telecommunications and major power feed. Adequate access means the ability to, without demolition, access all traps for cleaning, balancing, maintaining filters, upgrading cabling, and servicing bath and shower valves.

   Acceptable access includes doors, access panels, escutcheon plates, cleanouts, removable floor segments and ceiling access. Access within individual units can be satisfied by incorporating shower and bath valves that can be rebuilt by removal of the escutcheon ring, and providing cleanouts to allow for remote clearing of traps and drain lines. In addition, identify the specific paths of supply and waste plumbing lines, building hot water and/or heat pump loops, and electrical and communication services. Acceptable documentation includes electronic and/or paper records in the possession of the resident or landlord.
4. Provide electronic (CD ROM or Web addresses) or written construction, product and system documentation to all residents and building managers.
5. Design kitchens to allow counter height adjustment.

VI.2.8 Landscape

Guidelines

The selection of landscape materials has a significant impact on water consumption and maintenance requirements, helps determine indoor and exterior comfort, and contributes to the attractiveness of a home and community.

Playa Vista is utilizing a series of strategies to minimize the need for landscape water use:

- All landscape must be irrigated with reclaimed water.
- At least 50 percent of plant materials must be native or drought resistant.
- Plants should be selected that produce little organic waste.
- Waste should be composted and returned to the ground as topsoil, or simply left in place through the use of mulching mowers.
- Irrigation controllers should irrigate at appropriate times and in the proper amount.
- Drip irrigation should be utilized to slowly supply water directly to root systems.
- Pervious pavement should be used where appropriate to enable rainwater to soak into the ground rather than drain to the ocean.

Mandatory Measures

1. Comply with The Village at Playa Vista Landscape Guidelines. (Source of mandate: mitigation measure D-2.)
2. Comply with all applicable water conservation standards, including City ordinance 170,978. (Source of mandate: mitigation measure #N(1)-5.)
3. Use at least 50 percent native or drought resistant plants as defined by the City of Los Angeles Landscape Ordinance. All non-native vegetation shall be non-invasive. The ordinance references two documents that identify native plants and native plant communities: 1) for a native plants list (pre-European settlement) see James Hickman's "The Jepson Manual," and 2) for a native plant community list (environmentally similar to native plants) use Robert F. Holland's "Preliminary Descriptions of the Terrestrial Natural Communities of California." (Source of mandate: mitigation measure #C(2)-3.)
4. Plant shade producing trees. (Source of mandate: mitigation measures #B-7f, M-1, M-2, M-9.)
5. Plant at least one tree for every four surface parking spaces such that at least 50 percent of surface parking areas are shaded within ten years. (Source of mandate: City ordinance.)
6. Use reclaimed water for all landscape irrigation, including lawns and raised beds on podiums. Certain restrictions must be followed including: watering at night, i.e. between 10 p.m. and 6 a.m., and no ponding or spraying. All landscape plans (schematics are sufficient) must be submitted to the Los Angeles Department of Water and Power Reclaimed Water Coordinator for approval by LADWP and the Los Angeles County Health Department. (Source of mandate: mitigation measure #N(1)-4.)
7. Use drip or soaker-based irrigation to water all plants (including lawns) slowly and reduce runoff, evaporation and water waste. (Source of mandate: mitigation measure #C(2)-3.)
8. Use automatic controls for irrigation systems, including rain sensors to avoid irrigating after rain and timers to irrigate at night in specific amounts as plants require. (Source of mandate: mitigation measure #N(1)-6.)
9. To establish vegetation, use only slow-release fertilizers that are applied directly to the soil. Do not apply during or with 72 hours of a forecasted rain event. (Source of mandate: mitigation measure #C(2)-3.)

Optional Measures

Minimum number of optional measures required: Three total from the following five categories: Construction Waste; Domestic Water; Recycling & Solid Waste; Landscape; and Stormwater Management.

1. Use at least 75 percent native or drought tolerant plants. See first mandatory measure above for definition of native plants and native plant communities.
2. Use weather-based "evapotranspiration" (ET) irrigation controllers that automatically adjust water supply to meet changing climatic conditions and plant water requirements.

Application

Drought tolerant landscaping

Drought tolerant landscaping utilizes native and other drought resistant plants to conserve water and regional ecosystems. Water thirsty plants are often imported to beautify the landscape. However, with proper planning and skillful design, landscapes can be beautified using native and drought tolerant species.

Microclimates

Landscaping and pavement selections greatly affect the microclimates surrounding a building. Large, flat areas of exposed pavement become extremely hot on the sunny afternoons that abound in Los Angeles. This pavement creates heat islands (pictured below) that are uncomfortable

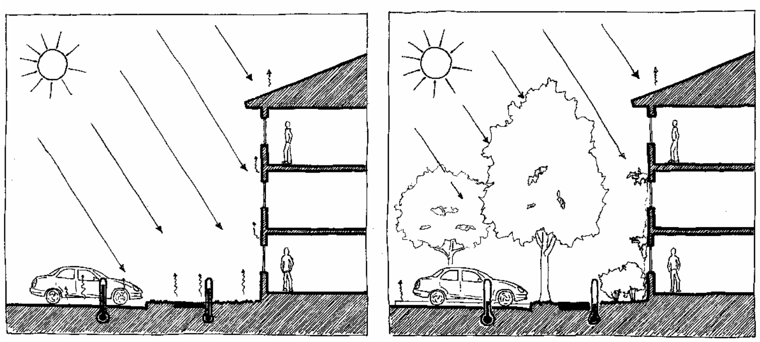


Figure VI-15 Microclimates

even to walk through and which can strain building cooling systems. This problem can be alleviated by planting trees and other vegetation that shades parking areas, pavement and buildings. Moreover, shade and transpiration (the natural evaporative cooling provided by plants) create comfortable outdoor environments. The second drawing illustrates the use of shade trees to cool parking areas and walkways, and the use of vines to shade windows.

Weather-Based Evapotranspiration (ET) Irrigation Controllers

Traditional timer-based irrigation controllers automatically apply water on a preset schedule regardless of climatic conditions and actual plant water requirements. Studies show that consumers are very unlikely to seasonally adjust their timers and that timers are usually set to supply water for worst-case conditions. A study by the Irvine Ranch Water District (IRWD) concluded that, on average, timer-based sprinkler controllers provide 44% more water than plants need.

Weather-based evapotranspiration (ET) controllers are an exciting emerging technology for residential applications. These controllers use a daily or weekly "evapotranspiration" parameter to automatically adjust sprinklers to supply just the amount of water plants require. On hot, windy days more water is supplied, and on milder days less water. Research has shown that ET controllers can reduce irrigation water use by 25% or more. Once limited to agricultural applications, larger commercial landscapes and golf courses, several manufacturers now offer convenient residential systems. The Metropolitan Water District, in conjunction with local water utilities, offers an ET controller rebate program to promote their use.

Another benefit of ET controllers is that they reduce stormwater runoff. The "Residential Runoff Reduction Study," available online at www.irwd.com, reports that ET controllers achieve a 71 percent runoff reduction compared to non-ET systems.

VI.2.9 Stormwater Management

Guidelines

One of the foundations of Playa Vista is the improvement of the water quality of the Ballona Wetlands, Ballona Creek and Santa Monica Bay through the creation of the riparian corridor and freshwater marsh. The corridor and marsh improve the quality of Playa Vista and upstream stormwater runoff and provide significant ecological habitat. The Consolidated Storm Water Pollution Prevention Program, Playa Vista Project (SWPPP), both responds to the increasingly strict stormwater regulations and protects both the site and downstream resources. It details both construction and post-construction requirements. (See 5. Recycling & Solid Waste and 8. Landscape for related measures on these topics.)

Stormwater or "urban runoff" contains pollutants that can lead to the deterioration of downstream "receiving waters." Rainwater scrubs pollutants from the air and picks up additional pollutants as it runs over streets, roofs and landscaped areas. Typical urban pollutants include heavy metals from brake pads and zinc downspouts; petroleum products from cars; fertilizers and pesticides from landscaped areas; and PCBs and mercury washed from the air. These pollutants can cause toxic reactions in aquatic life, including fish. In addition, bacteria and viruses in urban runoff can cause human illnesses from direct contact, inhalation or the drinking of runoff.

The quantity of urban runoff is also a concern because hardened surfaces increase runoff by reducing the area through which rainfall can soak into the ground. Imperviousness (i.e., paved surface) increases the frequency, rate and volume of stormwater runoff. This in turn increases the amount of pollution and the frequency of polluted conditions downstream. Urbanization can also increase the amount of dry weather runoff and therefore pollutants from such sources as pavement washing, car washing and irrigation.

During construction, erosion control measures must be implemented. Examples include gravel bags, straw wattles and silt fences and conducting grading activities during the dry season. Each contractor must submit a Contractor/Builder SWPPP for approval. A copy can be obtained from the project's stormwater program monitors. In addition, to protect post construction resources, permanent "best management practices" (BMPs) must be incorporated into each individual project.

Mandatory Measures

1. Install a roof drain biofiltration system in setback areas that receives and filters runoff. (Source of mandate: mitigation measures #C(2)-1, C(2)-2.)
2. For high density housing, do not allow any runoff to enter underground parking. If there are above ground parking lots, treat runoff before it enters the storm drain system. (Source of mandate: Los Angeles County Standard Urban Stormwater Mitigation Plan (SUSMP).)
3. For low density housing, minimize imperviousness through a reduction in impervious area and/or the use of permeable material by doing one of the following. (Source of mandate: SUSMP; SWPPP section 5.1.6.)

- Minimize impervious parking lot areas (use underground parking and minimum parking lot dimensions for space and lane widths, etc.) and motor court and driveway widths (use the minimum widths allowed by City Code for longer driveways with adjacent landscaping).
- Install sufficient bioretention (swales) without curbs or with curb notches in parking lot islands and other landscape areas adjacent to or near parking lots and motor courts to increase vegetation and allow runoff to enter. Allow for treatment of ¾ inches of runoff or 0.2 inches per hour from the parking lot and tributary areas.
- Use permeable materials for a minimum of 50 percent of driveways, parking areas, walkways and patios when these uses are not over underground parking.

4. Route any driveway runoff to a roadside or driveway adjacent bioswale. (Source of mandate: Playa Vista standard.)

5. Do not use copper or zinc for roofing, downspouts, gutters or other exposed surfaces, and do not use roofing materials with tar papers or other petroleum-based sealers. Use roof materials that are inert, such as tile. (Source of mandate: EIR Section IV.C.(2), Water Quality, Section 3.3.)
6. Install porous pavement, swales, biofilters and parking lot filters, as required by Playa Vista standards. (Source of mandate: SWPPP sections 5.1.4, 5.1.6, 5.1.7.)

Optional Measure

Minimum number of optional measures required: Three total from the following five categories: Construction Waste; Domestic Water; Recycling & Solid Waste; Landscape; and Stormwater Management.

1. For low density buildings, route walkway and/or roof runoff to vegetated areas (bioretention or bioswale).

Application

Best Management Practices

BMPs can be employed to:

- Slow the rate of runoff by extending the detention times of runoff on site to encourage the settling of particles, the sorption (attachment) of pollutants onto particles, or nutrient (phosphorus and nitrogen) uptake by vegetation.
- Increase infiltration (soaking into soils and planters to filter and reduce runoff) and/or evapotranspiration (plant and soil evaporation to reduce runoff).
- Filter runoff using targeted filter media or vegetation that traps or breaks down many contaminants.
- Prevent pollutants from being picked up and transported by stormwater.
- Reduce or eliminate dry weather flows (irrigation overrun, pavement washing, etc.).
- Improve the site's aesthetics and increase water conservation.

Freshwater Marsh

Playa Vista's 26-acre freshwater marsh serves as a regional BMP and represents an innovative approach to stormwater quality and related issues. The freshwater marsh improves water quality by slowing down the flow of stormwater, thereby allowing pollutants to come into contact with vegetation, organic matter and soils that together act like a natural filtration system. "Pretreatment areas" at each marsh stormwater entry capture the majority of pollution by spreading and slowing the flow of water so that sedimentation and filtering occurs. The system is predicted to result in water quality that has approximately 80 percent fewer stormwater pollutants than the typical untreated site.

BMPs Common to all Land Use Types

Bioretention (depressed landscaped areas; see photo below left) can be used in surface parking lots and road medians to capture stormwater and allow it to slowly drain or soak in. Excess runoff drains to the storm drain system via a vertical intake pipe.

Swales (shallow side-sloped grass lined channels with gentle longitudinal slopes; see photo above right) and bioswales (swales with vegetation, usually allowing for temporary ponding and increased infiltration) can channel stormwater from impervious areas into the storm drain system while allowing for some infiltration, filtration and pollutant binding by soils and uptake by plants.

Underground parking can stop pollutants from contacting stormwater.

Figure VI-16 Bioretention & Swales

VI.2.10 Transportation

Guidelines

One of the basic concepts of Playa Vista's mixed-use design is to minimize the need to drive. While both walking and biking are addressed through Playa Vista's urban design; biking must be supported by convenient storage in each building. In addition, the project needs to be ready for a future that may include alternative fueled vehicles.

The engine and fuel of choice for automobiles and other vehicles is competitive for the first time in a hundred years. Hybrid and other clean burning engines and alternative fuels are both more efficient and the key to Los Angeles meeting Federally-mandated clean air goals.

Vehicles utilizing electricity, natural gas, propane, ethanol and methanol are or recently have been on the market. Hybrids, which combine electric drive trains and small engines are, by consensus, the most likely long-term future. It is unclear, however, what type of engine hybrids will use. The choices include fuel cells (which could be powered by hydrogen, methanol or natural gas); gasoline, diesel or natural gas internal combustion engines; or natural gas turbines.

As regulations and demand dictate, electric vehicle charging will be provided in individual buildings whether for neighborhood electric vehicles (NEVs) that require 110 volts, or full size vehicles which require 220 volts. Natural gas fueling may also be provided at a central fueling station, much like a gasoline station.

Mandatory Measures

1. Install 240 volt circuit capacity and conduit for electric vehicle charging in the garage. (Source of mandate: mitigation measure #B-7e, M-8.)
2. Install electric vehicle charging if required by the California Air Resources Board (CARB). (Source of mandate: mitigation measures #B-7e, M-8.)
3. In high density or other shared-garage housing, provide secure bicycle storage sufficient for one bike for every three residential units. Round to the nearest whole number. (Source of mandate: Playa Vista standard.)

Optional Measures (None)

Application

Electric Vehicle Charging

Main house panels and building circuits should have excess capacity to accommodate an added circuit breaker for future electric vehicle load. Electric vehicle chargers typically require one circuit, single phase 208V/240V and an additional panel capacity of 400 Amps. Four vehicles, for example, would require 160A if all are expected to be charged simultaneously, which is a fair assumption as most residential charging takes place at night.

APPENDIX E.iii:
FOURTH AMENDMENT TO CULVER CITY AGREEMENT

FOURTH AMENDMENT TO AGREEMENT

THIS FOURTH AMENDMENT TO AGREEMENT (the "Fourth Amendment") is entered into this 17 day of May, 2004 by and between Playa Capital Company, LLC, a Delaware limited liability Company ("PCC"), and the City of Culver City, a municipal corporation ("Culver City").

WHEREAS, Culver City and PCC's predecessor-in-interest, Maguire Thomas Partners-Playa Vista, a California limited liability partnership, entered into an Agreement dated October 15, 1993, as amended by that certain First Amendment to Agreement (the "First Amendment") dated August 3, 1995, that certain Second Amendment to Agreement (the "Second Amendment") dated January 4, 2004, and that certain Third Amendment to Agreement (the "Third Amendment") dated May 20, 2002 (collectively, the Culver City Agreement").

WHEREAS, Culver City and PCC desire to revise Article II of the Culver City Agreement, to accommodate the development of a new phase of development of the Playa Vista Property, known as the Village at Playa Vista.

NOW, THEREFORE, in consideration of the above premises and of the mutual covenants and agreements contained herein and in the Culver City Agreement, Culver City and PCC do hereby agree to amend the Culver City Agreement as follows:

SECTION 1. Amendment to Article II. Article II of the Culver City Agreement shall be amended in its entirety to read:

A. PCC has proposed to develop a portion of Area D of the Playa Vista Property more particularly described on Exhibit A attached hereto and incorporated herein by reference ("Area D2"). PCC has proposed to develop Area D2 as a mixed use residential project with retail uses as more particularly described on Exhibit B attached hereto and incorporated herein by reference (the "Village"). In connection with the proposed development of the Village, the City of Los Angeles has prepared a Draft Environmental Impact Report for the Village at Playa Vista (State Clearinghouse No. 2002211065, City of Los Angeles EIR No. 2002-6129-EIR) ("DEIR"). As part of the DEIR process, a traffic study was prepared analyzing the traffic related and transportation impacts resulting from the development of the Village (the "Traffic Study").

B. The DEIR includes a number of traffic and transportation mitigation measures within Culver City as set forth on Exhibit C attached hereto and incorporated herein by reference (the "DEIR Culver City Mitigation Measures"). Culver City has reviewed the Traffic Study and has requested the City of Los Angeles make certain modifications to the DEIR Culver City Mitigation Measures (as further refined in negotiations of this Fourth Amendment) as set forth on Exhibit D attached hereto and incorporated herein by reference (the "Revised Culver City Mitigation Measures"). PCC agrees to implement the Revised Culver City Mitigation Measures and Culver City agrees to work with PCC to permit PCC to implement the Revised Culver City Mitigation Measures. Culver City agrees the Revised Culver City Mitigation Measures mitigate all significant impacts of traffic generated by the Village in Culver City as described in Exhibit B.

C. The DEIR contains a subphasing plan and schedule for implementation of the DEIR mitigation measures including the DEIR Culver City Mitigation Measures as set forth on Exhibit E-1 attached hereto and incorporated by reference. PCC agrees to notify Culver City in advance of any modifications or changes to the subphasing plan and schedule, as described in Exhibit E-1, involving mitigation measures not located in Culver City. Consent of Culver City shall not be required to modify or change mitigation measures not located in Culver City; provided, however, that Culver City shall have the right to seek mandamus, specific performance and injunctive relief, including, but not limited to, a temporary restraining order or other equitable relief, with respect to any such change or modification to the subphasing plan and schedule approved by the City of Los Angeles if such change or modification may create a significant, unmitigated impact in Culver City. Culver City shall have no right to damages in any such proceeding, except that if Culver City prevails in it's action PCC shall reimburse Culver City for all City Staff, consultant, and attorney's fees and Court cost associated with such action.

D. PCC shall implement the Revised Culver City Mitigation Measures in accordance with the subphasing plan and schedule set forth on Exhibit E-2 attached hereto and incorporated herein by reference. The subphasing plan and schedule for the Revised Culver City Mitigation Measures may not be amended without the prior written consent of the Culver City Chief Administrative Officer or his /her designee.

E. In order to provide assurances to Culver City the projected number of vehicular trips to be generated by the proposed development of the Village is consistent with the DEIR and contained in the Final Environmental Impact Report for the Village at Playa Vista (State Clearinghouse No. 20022111065, City of Los Angeles EIR No. ENV-2002-6129-EIR) ("FEIR"), as certified by the City of Los Angeles, PCC agrees to undertake a Trip Verification Study in accordance with the Protocol for Trip Verification Study set forth on Exhibit F attached hereto and incorporated herein by reference.

In the event the trips determined in accordance with the Protocol for Trip Verification Study as set forth on Exhibit F exceeds the trip generation estimates in Item No. 4 of Exhibit F, PCC shall prepare a traffic analysis that evaluates whether the increased trip generation creates any additional significant impacts in Culver City beyond the impacts previously identified in the FEIR. PCC shall deliver to Culver City such additional analysis within sixty (60) days following the completion of the traffic counts identified in Exhibit F. The traffic analysis shall identify any additional measures that will avoid any such additional impacts in Culver City. PCC and Culver City shall meet and confer with respect to the traffic analysis and additional traffic measures that may be requested by Culver City to avoid such additional impacts identified by the analysis.

In the event Culver City and PCC are unable to reasonably agree on additional traffic measures sufficient to avoid the additional significant impacts in Culver City, PCC may elect to (i) reduce development in subphase 4 of the Village sufficient to avoid the additional significant impacts in Culver City, (ii) reduce development in the First Phase of Playa Vista sufficient to avoid the additional significant impacts on Culver City or (iii) reduce development, in some combination, of the First Phase of Playa Vista and subphase 4 of the Village sufficient to avoid the additional significant impacts on Culver City. If PCC does not make any such reductions and Culver City and PCC are unable to agree on additional mitigation measures to reduce the additional significant impacts on Culver City to a level of insignificance, then Culver City and PCC may agree to have PCC pay to Culver City an amount equal to (a) the number of Peak Hour trips (the higher of A.M. or P.M. Peak Hour trips) required to be reduced in order to avoid the additional significant impacts on Culver City, times (b) the Trip Mitigation Fee, as hereinafter defined. The Trip Mitigation Fee shall be $3,575 per trip in 2004 dollars or equal to the City of Los Angeles Coastal Transportation Corridor Specific Plan trip fee which ever is greater. The basic Trip Mitigation Fee shall be increased annually, commencing on May 1, 2005, by the percentage increase in construction costs in the Los Angeles area based on the Means Construction Cost Index for Transportation Project in Southern California or other similar index agreed to by the parties. Through the compliance with this Paragraph E, Culver City acknowledges and agrees all potential significant impacts of the Village are fully mitigated; provided, that PCC develops the Village in accordance with Exhibit B, unless agreed to by Culver City.

F. Culver City agrees in the event Culver City approves a project in Culver City with estimated traffic and transportation impacts in Culver City similar to the Village without imposing a Trip Verification Study requirement substantially similar to the requirements of Paragraph E above, PCC shall not be obligated to complete the Trip Verification Study as required by Paragraph E above.

G. In the event the City of Los Angeles does not approve the Village, this Fourth Amendment shall be void and of no further force or effect and all the terms of the Culver City Agreement prior to this Fourth Amendment shall be reinstated. In the event the City of Los Angeles reduces the scope of the Village, which avoids some or all impacts in Culver City, Culver City and PCC agree to modify the Revised Culver City Mitigation Measures to the extent impacts from the reduced Village are avoided in Culver City.

H. Culver City covenants and agrees it will not, directly or indirectly, oppose the approval by the City of Los Angeles of the Village. Culver City further agrees it will not challenge, sue or contest, directly or indirectly, in any judicial or administrative proceeding, the approval of the Village or the implementation of the Village in accordance with the approvals for the Village; provided, however, nothing in the Culver City Agreement or this Fourth Amendment, shall limit the ability of Culver City to enforce the provisions of the Culver City Agreement, as amended by this Fourth Amendment.

I. In the event PCC or the City of Los Angeles modifies or changes the Village from that described in Exhibit B, PCC agrees to notify Culver City in advance of any such modifications or changes being approved. Consent of Culver City shall not be required for such modifications or changes; provided, however, that Culver City may seek mandamus, specific performance and injunctive relief, including, but not limited to, a temporary restraining order or other equitable relief, with respect to any such change or modification to the Village from that described in Exhibit B if such change or modification may create a significant, unmitigated impact in Culver City.

SECTION 2. Amendment to Article III, Paragraph E. Paragraph E of Article III shall be amended in its entirety to read:

Any and all notices or other communications required or permitted to be given hereunder are required to be in writing by either party or its attorney, and shall be delivered personally, or sent by telegram or the United States mail, certified, return receipt requested, postage prepaid and addressed as follows:

To PCC:
Playa Capital Company
5510 Lincoln Boulevard
Suite 100
Playa Vista, CA 90094
Attention: General Counsel – Patricia Sinclair, Esq.

and:
Playa Capital Company
5510 Lincoln Boulevard
Suite 100
Playa Vista, CA 90094
Attention: Vice President-Infrastructure

To Culver City:
Chief Administrative Officer
City of Culver City
P.O. Box 507
Culver City, California 90232-0507

and:
City Attorney
City of Culver City
P.O. Box 507
Culver City, California 90232-0507

and:
Public Works Director/City Engineer
City of Culver City
P.O. Box 507
Culver City, California 90232-0507

Either party may from time to time change the address to which and the identity or title of the person to whom such notices, payments or other communications may be sent by giving the other party written notice of such change. Notices and other communications shall be effective on delivery.

SECTION 3. Effective Date. This Fourth Amendment shall become effective upon the date first noted above.

Section 4. Effect on Successors and Recordation. This Fourth Amendment shall be apply to each and every of PCC's successors, transferees and assignees. A memorandum of this agreement shall be recorded against Area D2 as soon as possible after the effective date of this Fourth Amendment and the City of Los Angeles' approval of the Village.

SECTION 5. Effect of this Fourth Amendment. Except as specifically modified by the terms of this Fourth Amendment, the Culver City Agreement shall continue in full force and effect.

SECTION 6. Counterparts. This Fourth Amendment may be executed in multiple counterparts, all of which shall constitute one and the same instrument and each of which shall be, and shall be deemed to be, an original.

SECTION 7. Governing Law. This Fourth Amendment shall be interpreted and construed under the provisions of the laws of the State of California.

IN WITNESS WHEREOF, the parties have hereunto set their hands as of the day and year first above written.

THE CITY OF CULVER CITY,
a municipal corporation

Steven J. Rose, Mayor

ATTEST:

Christopher Armenta
City Clerk

APPROVED AS TO FORM:

Carol A. Schwab
City Attorney

PLAYA CAPITAL COMPANY, LLC
a Delaware limited liability company

By: ____________________
Name: Steve Soboroff
Title: President

And:

By: ____________________
Name: Randy Johnson
Title: Sr. V.P./CFO

EXHIBIT A
Project Boundaries

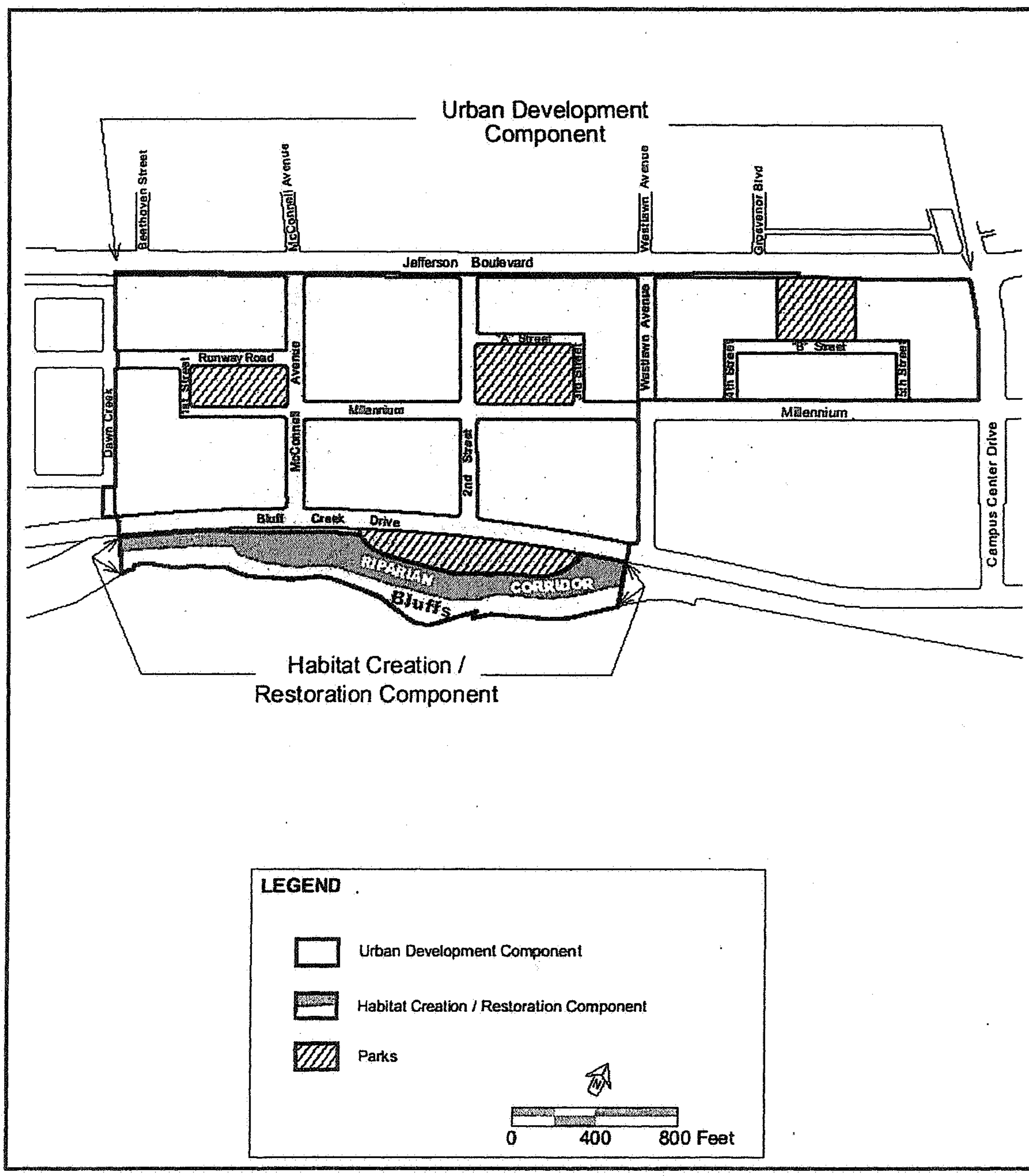


EXHIBIT A cont. Vesting Tentative Tract Map No. 60110

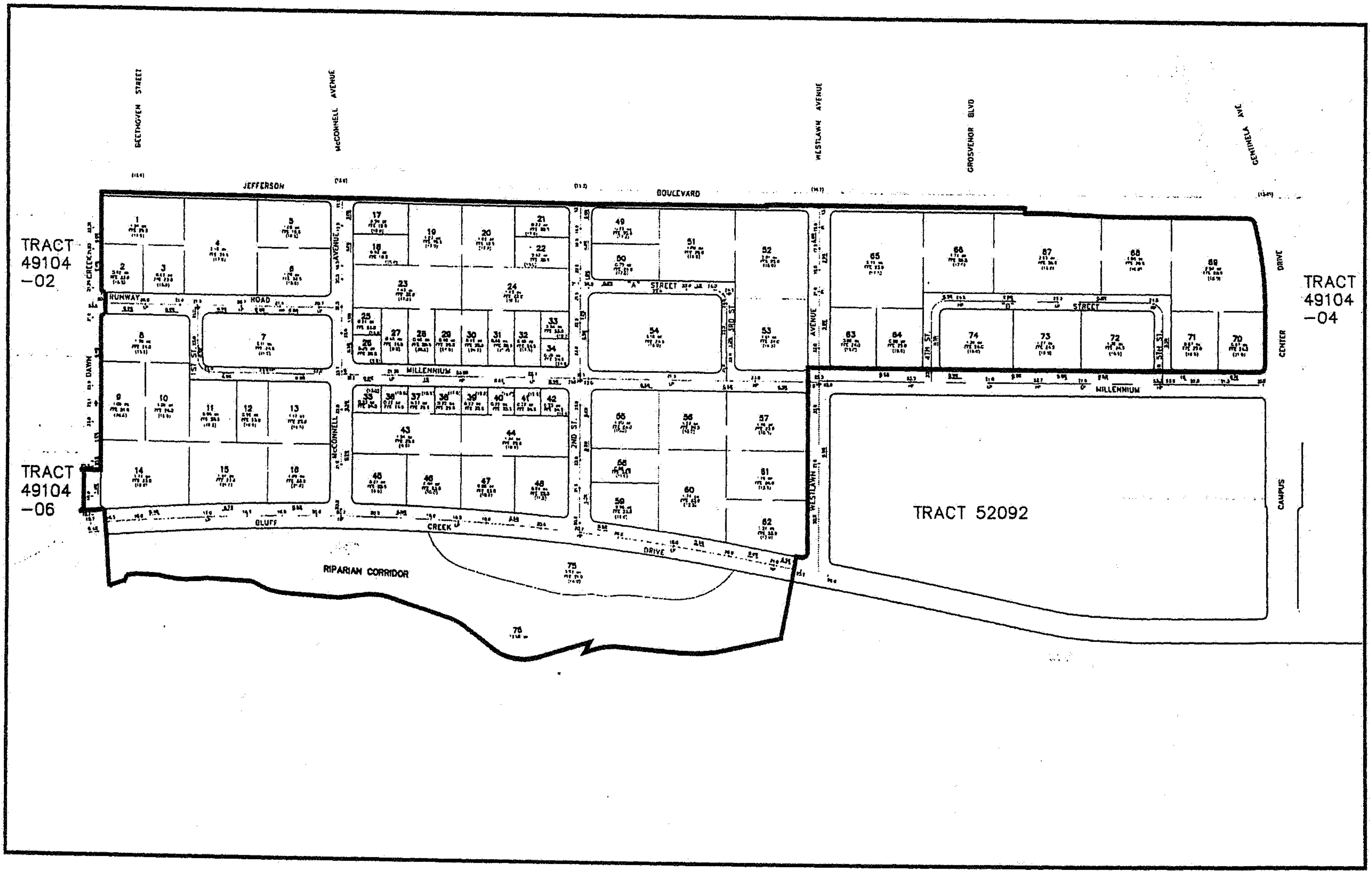


EXHIBIT B

The Village at Playa Vista is located on an approximately 111.0-acre site in the Playa Vista area of West Los Angeles. The Village at Playa Vista consists of the following two components: (1) a mixed-use community ("the Urban Development Component"); and (2) a Riparian Corridor and restoration and maintenance of a portion of the Westchester Bluffs adjacent to the Riparian Corridor (the "Habitat Creation/Restoration Component"), as described in City of Los Angeles EIR No. ENV-2002-6129-EIR.

The Urban Development Component allows the development of a master planned community composed of residential, commercial, recreational, and community-serving uses. This development will occur on an approximately 99.3-acre site consisting of 87.5 acres of residential, commercial, and community serving development, 11.4 acres of parks, and 0.4 acre of other passive open space. The proposed development includes 2,600 dwelling units, 175,000 square feet (sq.ft.) of office space, 150,000 sq.ft. of retail space, 40,000 sq.ft. of community-serving uses, and an equivalency program that allows an exchange of office uses for retail and/or assisted living uses.

The Habitat Creation/Restoration Component includes a total of approximately 11.7 acres, of which the Riparian Corridor involves approximately 6.7 acres, with the restoration of the adjoining portion of the Westchester Bluffs occurring over the remaining 5 acres. The construction of the Riparian Corridor would complete a 25-acre riparian corridor that also includes sections east and west of the Riparian Corridor, ultimately feeding into the Playa Vista First Phase Freshwater Marsh.

The Village would include a number of discretionary actions, including, without limitation:

- Amendment of the Westchester/Playa del Rey Community Plan
- Amendments to the Playa Vista Area D Specific Plan
- Approval of Tract Maps, including without limitation, VTTM No. 60110
- Approval of a Development Agreement
- Other approvals, as necessary, to implement the Village project

EXHIBIT C

Summary of Culver City Mitigation Measures from Draft EIR

1. Physical intersection improvements in Culver City:

- Washington Place/Centinela Avenue—Provide dual east bound & west bound left turn lanes, and install signal phasing & equipment as required.
- Green Valley Circle/Centinela Avenue—Restripe the street in order to provide a west bound right turn lane.
- Sawtelle Boulevard/Culver Boulevard—Provide north bound and south bound right turn lanes consistent with anticipated Caltrans' I-405 improvements.
- Overland Avenue/Culver Boulevard—Add a right-turn lane along the westbound approach on Culver Boulevard, and provide a southbound right-turn–only lane on Overland Avenue.

2. Signal System Improvements:

- Sepulveda Boulevard/Centinela Avenue. Contribute to the design and implementation of ATCS. The intersection of Sepulveda Boulevard and Centinela Avenue is included within the City of Los Angeles' Adaptive Traffic System Control (ATCS) "Airport" system, which is scheduled for implementation by Los Angeles Department of Transportation (NOTE: this system is not a part of the proposed LAX Master Plan currently under review, and is scheduled to be implemented separately and independently from that proposed project).

3. Transit System Improvements:

- PCC shall fund the purchase of six 40-foot buses (at a cost of $400,000 per bus) similar to current Culver CityBus vehicles as follows: one bus each for Lines 2 and 4 and two buses each for Line 6 and New Limited Route along Sepulveda (south).
- PCC shall provide certain Operation and Maintenance (O&M) costs for the new buses purchased using the following parameters:

    a. 100% funding for 3 years and 15% for the next 7 years afterwards.
    b. O&M cost shall be calculated using a rate $85/hour.
    c. For five of the buses the O&M costs shall be calculated based on peak period bus operations (Line 6 and the new Limited Bus) at 7.5 hours/day/bus for 250 days a year.
    d. For one bus the O&M costs shall be calculated based on all-day bus operations (Line 4) at 12.5 hours/day/bus for 250 days a year.
    e. Farebox revenue from each of the PCC funded buses will offset O&M contribution

EXHIBIT D

Revised Culver City Mitigation Measures

1. PCC shall design and construct at its sole cost and to the reasonable satisfaction of Culver City the following physical intersection improvements in Culver City:

- Washington Place/Centinela Avenue—Provide dual east bound & west bound left turn lanes, and install signal phasing & equipment as required.
- Green Valley Circle/Centinela Avenue—Restripe the street in order to provide a west bound right turn lane.
- Sawtelle Boulevard/Culver Boulevard—Provide north bound and south bound right turn lanes consistent with anticipated Caltrans' I-405 improvements.

NOTE—The intersection improvements previously proposed in the DEIR for Culver Boulevard/Overland Avenue would now be addressed by proposed Signal System improvements and the previously proposed physical improvement would be deleted from the program.

2. Signal System Improvements (Traffic and Bus operation enhancements):

- PCC shall provide an adaptive signal synchronization system reasonably acceptable to Culver City at 17 intersections along Jefferson and Culver Boulevards and at the intersection of Playa/Hannum, at a cost to PCC not to exceed $255,000.
- PCC shall provide a control system (at a cost to PCC not to exceed $500,000) and support costs (at a cost to PCC not to exceed $50,000 annually for 10 years) for adaptive signal synchronization system.
- PCC shall retain a traffic consultant, reasonably acceptable to Culver City, to conduct a Signal Optimization Analysis along Sepulveda Boulevard, Washington Boulevard, Jefferson Boulevard, and Overland Avenue corridors within Culver City. The scope of work for the Signal Optimization Analysis shall not exceed a $50,000 cost to PCC.

NOTE—The intersection of Sepulveda Boulevard and Centinela Avenue is included within the City of Los Angeles' Adaptive Traffic System Control (ATCS) "Airport" system, which is scheduled for implementation by Los Angeles Department of Transportation (this system is not a part of the proposed LAX Master Plan currently under review, and is scheduled to be implemented separately and independently from that proposed project). The funding and implementation of ATCS at this location is a component of the Village at Playa Vista Transportation Improvement Program and is separate from the Culver City Signal System Improvements discussed in Section 2 above.

3. Transit System Improvements:

- PCC shall fund the purchase of five 40-foot buses (at a cost of $400,000 per bus) similar to current Culver CityBus vehicles as follows: one bus for Line 4 and two buses each for Line 6 and New Limited Route along Sepulveda (south);

provided, that if in the reasonable discretion of the Culver City Transportation Director, the proposed buses can be provided from alternative sources, then PCC shall remit to Culver City Transportation Department payment in the total amount of $2,000,000 on or before March 31, 2007 for transportation/transit improvements to Culver CityBus operations; provided that the Village is not subject to delay due to litigation or other unforeseen circumstances as reasonably determined by Culver City and PCC, and further, that Culver City shall place such buses in service within six (6) months of delivery, but not later than 24 months after payment of the $2,000,000. In the event said payment is received after March 31, 2007 and the purchase of the buses is not complete prior to December 12, 2008, the expiration of the current purchase agreement with Culver City's bus provider PCC shall provide sufficient funding to cover the full cost equivalent of acquiring the five buses.

- PCC shall provide Transit Priority System (TPS) components (at a cost to PCC not to exceed $200,000) for signalized locations along Washington Boulevard, between the Costco westerly driveway and Berryman Avenue (up to 12 intersections). The TPS shall meet the specification of Culver City.
- PCC shall provide for certain Operation and Maintenance (O&M) costs for the buses purchased using the following parameters:

    a. 100% funding for the first 3 years of operation and 15% for the next 7 years afterwards.
    b. O&M cost shall be calculated using a rate of $85/hour.
    c. For four of the buses the O&M costs shall be calculated based on actual total peak period hours operated (Line 6 and the new Limited Bus) not to exceed 7.5 hours/day/bus for 250 days a year.
    d. For one bus the O&M costs shall be calculated based on actual all-day bus operations (Line 4) not to exceed 12.5 hours/day/bus for 250 days a year.
    e. Farebox revenue from each of the PCC funded buses will offset O&M contribution.
    f. Culver City shall submit invoices for O&M costs on a quarterly basis. PCC shall remit payment within 30 days of receipt.

- PCC will provide for bus fare subsidies of up to 200 bus passes per month for employees or residents at Playa Vista for a period of 10 years at a cost not to exceed $50,000 per year.

NOTE—The new bus proposed in the DEIR for Line 2 is recommended to be deleted, in order to provide funding for the Washington Boulevard Corridor TPS enhancement.

4. Neighborhood Traffic Management Program (NTMP): If needed, after implementation of the PCC Phase 1 funded NTMP implementation, PCC shall provide up to $25,000 to fund a supplemental NTMP for the Sunkist Park neighborhood in Culver City and for subsequent implementation of traffic calming measures identified in the plan.

5. Construction vehicle travel through Culver City shall be subject to the review and reasonable approval of Culver City, and shall be conducted in accordance with the standard rules and regulations established by Culver City. These include allowable operating times for construction activities, truck haul routes, clearance requirements, etc.

EXHIBIT E-1

VILLAGE AT PLAYA VISTA
DRAFT EIR MITIGATION SUBPHASING PLAN [a]

Subphase [b]	P.M. Peak-Hour Trips per Subphase [b]	Transportation System Improvements [c, d, e, f]	Jurisdiction
Village Subphase 1	575	1. Provide funding for 1 bus for Culver City Bus Line 6 (CC6)	Culver City
		2. Provide funding for 1 bus for Culver City Bus Line 2 (CC2)	Culver City
		3. Provide funding for Airport System ATCS	City of Los Angeles
		4. Provide funding for Transit Priority System (TPS) on Lincoln Corridor	City of LA/Caltrans
		5. Signal improvement (phasing) at Lincoln Bl/83rd St	City of LA/Caltrans
		6. Provide funding for neighborhood traffic management	City of Los Angeles
Village Subphase 2	575 (1,150 cumulative)	1. Provide funding for 2 buses for CC4 (includes extension to Playa Del Rey)	Culver City
		2. Physical and/or operational improvements at:	
		2a. Centinela Av/Venice Bl	City of LA/Caltrans
		2b. Green Valley Circle/Centinela Avenue	Culver City
		2c. La Tijera Bl/Centinela Av	City of Los Angeles
		2d. Overland Av/Culver Bl	Culver City
		2e. Sawtelle Bl/Culver Bl	Culver City
		3. Provide funding for signal improvement at Aviation Bl/Florence Av/Manchester Av	City of Inglewood
		4. Project component – Jefferson Boulevard corridor improvement (between Beethoven Av to Centinela Av) [g]	City of Los Angeles
		5. Project component – complete Bluff Creek Dr corridor improvement (Dawn Creek to Westlawn) [g]	City of Los Angeles
		6. Campus Center Drive between Millennium and Bluff Creek Drive – Public Access	City of Los Angeles
Village Subphase 3	575 (1,725 cumulative)	1. Provide funding for Smart Corridor System ATCS	City of Los Angeles
		2. Extension of internal shuttle to off-site locations	LA/Culver City/LA County
		3. Physical and/or operational improvements at:	
		3a. Centinela Av/Culver Bl	City of Los Angeles
		3b. Centinela Av/Washington Pl	Culver City
		3c. La Brea Av/Centinela Av	City of Inglewood
		3d. Palawan Way/Admiralty Way	Los Angeles County

EXHIBIT E-1

VILLAGE AT PLAYA VISTA
DRAFT EIR MITIGATION SUBPHASING PLAN
(Continued)

Subphase [b]	P.M. Peak-Hour Trips per Subphase [b]	Transportation System Improvements [c, d, e, f]	Jurisdiction
Village Subphase 4	575 (2,300 cumulative)	1. Provide funding for 2 buses for CC6 Limited	Culver City
		2. Operational improvement at I-405 NB Ramps/Jefferson Bl	Culver City/Caltrans
		3. Centinela Avenue corridor improvement (Culver to SR-90)	City of Los Angeles

[a] *The subphasing plan may be revised, where appropriate and as determined by LADOT: (1) upon demonstration that measures for each subphase in the revised subphasing plan are equivalent or superior to the original mitigation measures; and/or (2) upon demonstration that approval or implementation of measures has been delayed, provided that the Applicant has demonstrated reasonable efforts and due diligence to the satisfaction of LADOT.*

[b] *P.M. peak-hour trip generation for each subphase would determine the specific traffic improvements shown. P.M. peak-hour trip generation to be estimated as subphases develop using the following factors:*

Dwelling Units – 0.54 trip per unit
Office – 1.74 trips per 1,000 sf
Retail – 3.83 trips per 1,000 sf (includes pass-by reduction)
Community Serving Uses – 0.45 trip per 1,000 sf (includes internal capture reduction)

[c] *Prior to the issuance of any building permit for each subphase, all on- and off-site mitigation measures for the subphase shall be complete or suitably guaranteed satisfactory to LADOT.*

[d] *Temporary Certificates of Occupancy may be granted in the event of any delay through no fault of the Applicant, provided that, in each case, the applicant has demonstrated reasonable efforts and due diligence to the satisfaction of LADOT.*

[e] *Substitute mitigation measures may be provided subject to approval by the agency with jurisdiction over the location of the measure, upon demonstration that the substitute measure is equivalent or superior to the original mitigation measure.*

[f] *Prior to the issuance of the final Certificate of Occupancy in the final subphase, all required improvements in the entire mitigation phasing plan shall be funded, completed, or resolved to the satisfaction of LADOT.*

[g] *The Jefferson Boulevard and Bluff Creek Drive corridors are components of the Proposed Project. Neither improvement serves to mitigate any Project impact; they are included in this table to establish timing for completion.*

NOTE: These mitigation measures are described in more detail in Section IV.K.(1), Traffic and Circulation of the Draft EIR for the Village at Playa Vista, and Section II.15, Corrections and Additions, of the Final EIR for the Village at Playa Vista

EXHIBIT E-2

VILLAGE AT PLAYA VISTA
REVISED CULVER CITY MITIGATION SUBPHASING PLAN

Subphase [b]	P.M. Peak-Hour Trips per Subphase [b]	Transportation System Improvements [c, d, e, f]	Jurisdiction
Village Subphase 1	575	1. Provide funding for 5 buses for Culver City Bus	Culver City
		2. Provide funding for Airport System ATCS	City of Los Angeles
		3. Provide funding for Transit Priority System (TPS) on Lincoln Corridor	City of LA/Caltrans
		4. Signal improvement (phasing) at Lincoln Bl/83rd St	City of LA/Caltrans
Village Subphase 2	575 (1,150 cumulative)	1. Physical and/or operational improvements at:	
		1a. Centinela Av/Venice Bl	City of LA/Caltrans
		1b. Green Valley Circle/Centinela Avenue	Culver City
		1c. La Tijera Bl/Centinela Av	City of Los Angeles
		2. Provide funding for signal improvement at Aviation Bl/Florence Av/Manchester Av	City of Inglewood
		3. Project component – Jefferson Boulevard corridor improvement (between Beethoven Av to Centinela Av) [g]	City of Los Angeles
		4. Project component – complete Bluff Creek Dr corridor improvement (Dawn Creek to Westlawn) [g]	City of Los Angeles
		5. Campus Center Drive between Millennium and Bluff Creek Drive – Public Access	City of Los Angeles
Village Subphase 3	575 (1,725 cumulative)	1. Provide funding for Smart Corridor System ATCS	City of Los Angeles
		2. Extension of internal shuttle to off-site locations	LA/Culver City/LA County
		3. Physical and/or operational improvements at:	
		3a. Centinela Av/Culver Bl	City of Los Angeles
		3b. La Brea Av/Centinela Av	City of Inglewood
		3c. Palawan Way/Admiralty Way	Los Angeles County
		4. Provide Culver City Adaptive Signal Synchronization System	Culver City
		5. Provide Culver City Transit Priority System (TPS) along Washington Bl	Culver City
Village Subphase 4	575 (2,300 cumulative)	1. Operational improvement at I-405 NB Ramps/Jefferson Bl	Culver City/Caltrans
		2. Centinela Avenue corridor improvement (Culver to SR-90)	City of Los Angeles
		3. Physical and/or operational improvements at:	
		3a. Sawtelle Bl/Culver Bl	Culver City
		3b. Centinela Av/Washington Pl	Culver City

VILLAGE AT PLAYA VISTA
REVISED CULVER CITY MITIGATION SUBPHASING PLAN
(Continued)

Subphase [b]	P.M. Peak-Hour Trips per Subphase [b]	Transportation System Improvements [c, d, e, f]	Jurisdiction
		4. Provide funding for neighborhood traffic management	City of Los Angeles

[a] *The subphasing plan may be revised, where appropriate and as determined by LADOT: (1) upon demonstration that measures for each subphase in the revised subphasing plan are equivalent or superior to the original mitigation measures; and/or (2) upon demonstration that approval or implementation of measures has been delayed, provided that the Applicant has demonstrated reasonable efforts and due diligence to the satisfaction of LADOT.*

[b] *P.M. peak-hour trip generation for each subphase would determine the specific traffic improvements shown. P.M. peak-hour trip generation to be estimated as subphases develop using the following factors:*
- *Dwelling Units – 0.54 trip per unit*
- *Office – 1.74 trips per 1,000 sf*
- *Retail – 3.83 trips per 1,000 sf (includes pass-by reduction)*
- *Community Serving Uses – 0.45 trip per 1,000 sf (includes internal capture reduction)*

[c] *Prior to the issuance of any building permit for each subphase, all on- and off-site mitigation measures for the subphase shall be complete or suitably guaranteed satisfactory to LADOT.*

[d] *Temporary Certificates of Occupancy may be granted in the event of any delay through no fault of the Applicant, provided that, in each case, the applicant has demonstrated reasonable efforts and due diligence to the satisfaction of LADOT.*

[e] *Substitute mitigation measures may be provided subject to approval by the agency with jurisdiction over the location of the measure, upon demonstration that the substitute measure is equivalent or superior to the original mitigation measure.*

[f] *Prior to the issuance of the final Certificate of Occupancy in the final subphase, all required improvements in the entire mitigation phasing plan shall be funded, completed, or resolved to the satisfaction of LADOT.*

[g] *The Jefferson Boulevard and Bluff Creek Drive corridors are components of the Proposed Project. Neither improvement serves to mitigate any Project impact; they are included in this table to establish timing for completion.*

NOTE: These mitigation measures are described in more detail in Section IV.K.(1), Traffic and Circulation of the Draft EIR for the Village at Playa Vista, and Section II.15, Corrections and Additions, of the Final EIR for the Village at Playa Vista

EXHIBIT F

Village at Playa Vista
Protocol for Trip Verification Study

1. Ninety (90) days after occupancy of 75% of the total entitled development for the Village, but prior to any occupancy of Subphase 4 of the Village as defined in the FEIR, PCC shall provide to Culver City a detailed site plan of the constructed portion of the Village. The site plan will detail i.) the location of all internal and external public and private streets adjacent to and within the Village site; ii.) the Village development lots; iii.) completed buildings; and iv.) driveways connecting the developed lots to the streets. The site plan shall be keyed to identify each completed structure and the corresponding square footage and use for non-residential space and the number and type (bedrooms) of residential units. The site plan shall also identify the current occupancy rate for the non-residential space and the residential units, by type for each building.

2. Culver City shall use the site plan to identify the driveway locations to be counted in the Trip Verification Study. The Trip Verification Study shall collect driveway counts at the driveways serving individual residential-only buildings that are substantially occupied and that cumulatively provide between a 25% and a 35% sample of the then constructed residential units of the Village.

3. The automatic-machine counts shall be conducted over three weekday periods at each location, as identified in "2" above, in order to collect traffic data during morning (6-9 AM) and afternoon (4-7 PM) peak time periods. The counts will be taken on Tuesdays, Wednesdays and Thursdays only, provided that each sample driveway location is to be counted 3 times, once for each day and only one day per week. The 3 counts will be taken during weeks when normal traffic patterns would be expected to occur, and specifically not when there are holidays or school vacations scheduled at Los Angeles Unified School District, Culver City Unified School District, University of California at Los Angeles, University of Southern California, Loyola Marymount University, Santa Monica College and West Los Angeles College, unless otherwise reasonably approved by the parties. In order to ensure that the 3 counts are taken during periods that most likely will yield a true sampling of normal traffic patterns, the counts will not be required to be taken on consecutive weeks.

4. The data from the counts shall be averaged to determine the actual trip rates for AM and PM Peak Hours and shall be compared to the Peak Hour rates published in the DEIR. The peak hour rates published in the DEIR are based on Institute of Transportation Engineers "Trip Generation," 6th Edition, 1997, are as follows for residential uses, pursuant to DEIR Table 120, Trip Generation Estimates, Page 860:

AM Peak Hour Trips/Units 0.44

1,144 total AM Peak Hour Trips (2,600 Units)

PM Peak Hour Trips/Units 0.54

1,404 total PM Peak Hour Trips (2,600 Units)