SONOMA STATE UNIVERSITY

ANTHROPOLOGICAL STUDIES CENTER

1801 East Cotati Avenue
Rohnert Park, CA 94928-3609

707.664.2381 • fax 707.664.4155
www.sonoma.edu/asc

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John Holson, Senior Archaeologist

Pacific Legacy, Inc.

900 Modoc Street

Berkeley, California 94707

Re: Subsurface Geoarchaeological Investigations for the Proposed Presidio Contemporary Art Museum, Presidio Main Post Project, San Francisco, California

INTRODUCTION

This letter presents the results of subsurface geoarchaeological investigations conducted 3-6 January 2008 by the Anthropological Studies Center (ASC) at the location of the proposed Presidio Contemporary Art Museum (CAM), for Pacific Legacy, Inc. and the Presidio Trust. These investigations focused solely on determining the presence/absence of buried prehistoric archaeological materials, and of paleosols, which represent formerly stable buried land surfaces that are sensitive for the presence of archaeological materials. The two alternative proposed CAM project locations are: within the block where buildings 93, 97, and 98 are currently located; and, alternatively, southwest of Moranga Ave., in and between the current location of buildings 385 and 386 (Figure 1). Project plans include excavation up to 50 feet (ft.) below surface.

The two main goals of this study were (1) to determine whether buried archaeological materials are present within the project area and, if present, (2) to document the depth and extent of paleosols in the project area in order to guide further archaeological work if necessary. The landscape evolution of the project area is discussed below, followed by a description of the methods used in this investigation and the results.

Landscape Evolution

Climatically induced environmental changes over the past 15,000 years have caused significant changes in the landscape of the San Francisco Bay Area that have affected archaeological site visibility. Due to these changes, the known archaeological record likely does not represent the depth and extent of human occupation of the region (Meyer 2003). During the last glacial period, from 28,000 to 11,500 years before present

(B.P.), immense ice sheets formed on the continents of the northern hemisphere covering vast areas in ice more than 2 mi. thick. As a result, global sea level 15,000 years ago was over 300 feet (ft.) lower than today, and the eastern shoreline of the Pacific Ocean was located more than 15 miles (mi.) west of the San Francisco Bay Area, then a large inland valley occupied by the ancestral Sacramento River (Masters and Aiello 2007:37). While the ice sheets melted at different times in different locations, global sea levels began to rise substantially between 15,000 and 11,000 cal B.P. (calibrated years before present) at a rate of 43 ft. every 1,000 years, decreasing to an average rate of approximately 26 ft. every 1,000 years between 11,000 to 8000 cal B.P., at which point the rate slowed dramatically. Between 6000 cal B.P. and the present, sea level rose at an average rate of 4 ft. every 1,000 years. Given this rate, the area now occupied by the San Francisco Bay was first flooded around 10,000 years ago and the estuary rapidly expanded until the rate of submergence decreased around 6,000 years ago. Over the past several thousand years, the bay grew in size as marshlands expanded in response to higher sea levels and the decomposition, compaction, and subsidence of intertidal deposits. These processes resulted in the formation of large tidal mudflats and peat marshes overlying older landforms.

Rising sea levels during the Holocene caused streams flowing into the San Francisco Bay to adjust to higher base levels. As a result, watercourses overflowed their channels and deposited alluvium on surrounding landforms. As a result many Late Pleistocene and Early Holocene landforms along the margins of the bay are covered by alluvium that was deposited during the past 6,000 years (Helley et al. 1979:18). These younger alluvial deposits typically contain several buried surfaces (paleosols) representing periods of landform stability, indicated by soil development, interrupted by brief periods of erosion and/or rapid deposition (Meyer and Rosenthal 2007:8-9). Additionally, Late Holocene alluvial deposits are typically 6 to 10 ft. thick, while in some areas, they are more than 30 ft. thick. The older landforms overlain by this younger sediment are typically marked by well-developed paleosols, indicating that these landforms remained stable at the surface for a considerable amount of time (Meyer 2003:4). For these reasons evidence of early human occupation of the San Francisco Bay Area is likely present under the waters of the bay or associated with older stable landforms buried by alluvial and/or other recent sediments.

Historically, wind-blown sand dunes covered a large part of the San Francisco peninsula. The configuration of the San Francisco dunes indicates that they were formed by the prevailing westerly winds that transported loose sand from Ocean Beach across the poorly vegetated, undulating topography to the east. Although the occurrence and extent of the dune fields in San Francisco are well-documented, the age and evolution of these dunes are only partly understood. Recent geoarchaeological research on the northern San Francisco peninsula has documented at least three periods of dune activity and deposition, interspersed with periods of stability and soil formation during the Late Pleistocene and Holocene. Radiocarbon dates on dune paleosols indicate that sand dunes in this area were deposited prior to 11,000 cal B.P., around 2000 cal B.P., and intermittently from 1000 cal B.P. up to the historic period (Mc Ilroy, Meyer, and Praetzellis 2001:42-44; Praetzellis 2004:28-32).

More recent landscape changes on the northern peninsula include activities associated with historic settlement, such as leveling of sand dunes and other landforms to fill in low-lying areas. Additionally, thick deposits of artificial fill were placed around the margins of the bay to reclaim the marshes and wetlands for human development. While some archaeological resources may have been partially or completely destroyed by historic development, others were likely buried and protected by artificial fill.

Project Area

The project area is situated on a gently sloping north facing hillside approximately 0.65 mi. south of the San Francisco Bay at an elevation of 125 ft. above sea level. Prior to implementation of this investigation, archival research was conducted to assess the sensitivity of the project area for buried archaeological materials and paleosols (Kaijankoski 2008). This research indicated that the project area is situated on a former small drainage that was filled around the beginning of the 20th century. Given the presence of a spring located upslope in this drainage, the project area is highly sensitive for prehistoric archaeological materials. Several previous geotechnical studies within, and adjacent to, the project area document various potential Holocene-age deposits underlying artificial fill. These deposits include dune sand, bay mud, and alluvium overlying the Pleistocene-age Colma Formation (Schlocker 1974). The Colma Formation was deposited well before the earliest known human occupation in the region (~13,000 B.P) and has a very low sensitivity for buried archaeological materials. A recent geotechnical investigation of the project area identified a layer of “creek deposits” overlying the Colma Formation (Ronan and Rodgers 2008; see below). Additionally, recent geologic mapping identified the project area as artificial fill over bay mud (Knudsen et al. 2000). Thus, the sensitivity study concluded that the project area was sensitive for buried archaeological materials, although the nature and age of the subsurface deposits was unclear.

METHODS

A hydraulic coring device known as a “Geoprobe” was used to explore subsurface deposits for buried archaeological materials and paleosols. The Geoprobe was used as an alternative to mechanical excavation because the depth of proposed impacts exceeded the range of mechanical excavation. A total of 17 cores were excavated in the project area to gain a representative sample of the subsurface deposits, taking care to avoid existing buildings and underground utilities (Figure 1).

The samples from subsurface deposits were recovered and stored in clear PVC liners 4 ft. long, and either 2 in. or 1-3/8 in. in diameter. Each liner was placed in a dual-walled push tube that was hydraulically driven to the appropriate depth to capture a continuous core sample from the desired interval. The liners were then extracted from the push tube and labeled to indicate their location, depth, and orientation (i.e., top or bottom), with details recorded on field notes.

All samples were transported to the laboratory at the ASC, where they were stored and allowed to air-dry in a protected place until they could be described and sub-sampled. All of the cores were compared to determine which ones contained the most complete stratigraphic sequences. Although relatively small, the core samples were large enough to (1) allow determination of the nature and extent of the subsurface deposits; and (2) capture any small archaeological materials present.

At the laboratory, stratigraphic units (strata) and soil horizons were identified in the cores on the basis of their physical composition, superposition, textural transitions (fining-upward sequences), and the relative degree of near-surface weathering (soil development). Master soil horizons are designated by uppercase letters (A, B, or C) and preceded by arabic numerals (2, 3, etc.) when the horizon is associated with a different stratum (i.e., 2C); number 1 is understood but not shown. Buried paleosols were identified on the basis of color, structure, horizon development, bioturbation, and the nature of the upper boundary with the overlying deposit (Birkeland et al. 1991; Retallack 1988). Paleosols often exhibit abandoned root and insect holes, or other indications of bioturbation. When a paleosol was identified, the portion suspected of being archaeologically sensitive, typically the upper 2 to 3 ft., was wet-screened with 1/16-in. mesh to identify archaeological materials.

Master soil horizons include A horizons, or mineral soils enriched by organics near the surface; B horizons, or zones of increased subsurface structure and/or mineral accumulation; and C horizons, or relatively unweathered parent materials. Lowercase letters were used to designate subordinate soil horizons as follows:

"b" is a buried horizon at the location where it was described (not used with C horizons);

"p" is a zone of fill or artificial disturbance;

"t" is a subsurface accumulation of silicate clays;

"ox" is oxidized parent material.

Combinations of these numbers and letters were used to indicate the important characteristics of each major stratum and soil horizon. The colors of the deposits were determined using the Munsell Soil Color Charts (Macbeth 1992). These techniques and designations are consistent with those outlined by Birkeland et al. (1991), Schoeneberger et al. (1998), and the Soil Survey Staff (1998).

RESULTS

Field investigations were conducted at the 17 core locations (Figure 1) from 3 to 6 January 2008. While several historic-period artifacts were identified, no prehistoric archaeological materials were recovered during this investigation. No soil samples were radiocarbon-dated for this study; the only intact paleosol had been buried by artificial fill during the historic period, as indicated by the presence of historic-period artifacts. Examination of the samples resulted in the identification of four major stratigraphic units, which are described below. Core 5 was selected for detailed description as it contained all identified stratigraphic units (Figure 2). Generalized profiles of the project area are depicted in Figures 3, 4, and 5.

Stratigraphic Units

Unit I consists of variable-colored clay that contains 50 to 75 percent small angular gravels, which grades into decomposing bedrock. This unit was encountered in the bottom of Cores 5, 6, 7, and 8 at depths ranging from 12 to 45 ft. below surface. It did not contain an A horizon, suggesting a period of erosion prior to the deposition of Unit II. Thus the contact between Unit I and II represents an erosional unconformity (Figures 3 and 4). The texture, composition, and topographic position of this unit suggest that it is a residual soil formed in bedrock on a hillside. No archaeological materials were found in the unit.

Unit II consists of a thick surface horizon of very dark gray silty clay loam (3Ab), a brownish yellow subsurface horizon of oxidized illuvial clay (3Btox), and oxidized light yellowish brown parent material (3Cox) that grades into unoxidized very pale brown parent material (3C) of homogenous fine to medium sand. The well-developed soil profile of this unit indicates that it remained stable at the surface for a significant time period. This unit was encountered in every core at depths ranging from 5 to 25 ft. below surface. The lower boundary of this unit was only observed in Cores 5, 6, 7, and 8, at depths ranging from 12 to 45 ft. below surface. In Cores 6, 7, and 8 the surface (A horizon) of Unit II had been removed, likely during artificial landscape modifications in the early 20th century. In these cores the interface between Unit II and III represents an erosional unconformity (Figures 3 and 4).

The parent material of this unit indicates that it is the result of wind-blown (eolian) sand-dune deposition. The thick A horizon of this unit is characteristic of a cumulic soil horizon, indicating a low level of sedimentary deposition after the initial period of dune deposition. Given the topographic setting within a short drainage, portions of the surface of this unit likely had a small amount of alluvial material added to it. It is also likely that Late Holocene sand-dune deposition added additional sediment to this unit. Given the well-developed soil profile of this unit, it is likely contemporaneous with the Pleistocene-age Colma Formation. Because the upper portion of this unit was at the surface for most, if not all, of documented human occupation of the San Francisco Bay area, it is very sensitive for the presence of buried archaeological materials. Because the A horizon of this unit (generally the upper 3 ft.) present in all but three cores was identified as sensitive for buried archaeological materials, it was selected for wet-screening. While several historic-period artifacts were found in the screened samples (see Table 1), no prehistoric archaeological materials were found in this unit.

Unit III consists of mixed fill of highly variable color, ranging from very hard yellowish brown clay loam to loose pale brown dune sand. This unit was encountered in every core except for Cores 7 and 8 at depths ranging from 0 to 2.5 ft. below surface. The lower boundary of this unit ranged from 5 to 25 ft. below surface. The mixed nature of this unit, the presence of historic-period artifacts underlying it, and brick and coal (Core 1 at 4 ft. and 14 ft. below surface respectively) within this unit indicate that it is historic-period artificial fill. No prehistoric archaeological materials were found in this unit. Geotechnical investigations in the project area identified the deposits at this depth as "creek deposits" (Ronan and Rodgers 2008). While the yellowish brown clay loam present intermittently in this unit is likely alluvial material, it has been disturbed or was brought in from elsewhere. It is possible that intact alluvial materials are present in this drainage in areas not tested by this investigation.

Unit IV consists of asphalt overlying 1 ft. of concrete that overlies angular road base rock. This unit was encountered in Cores 1 to 13 at depths ranging from 0 to 2.5 feet below surface. This unit represents road construction during the historic period. No archaeological materials were found in this unit.

Wet-screening Results

At the laboratory the portion of a core that was suspected of being archaeologically sensitive was wet-screened with a 1/16-inch mesh. This was typically the upper 2 to 3 ft. (A horizon) of Unit II. Several historic-period artifacts were found during screening, including bottle glass and white improved earthenware (WIE) ceramic fragments. See table below for results of the screening.

Table 1. Wet-screening results.

Core	Depth (ft.)	Cultural Materials
1	17-20	none
2	18-21	none
3	18-20	none
4	16-19	none
5	11-14	none
9	14-17	none
10	20-23	none
11	20-23	1 blue transfer-printed WIE fragment (possible plate)

Table 1 cont.

12	13-16	6 olive-green glass fragments and charcoal
13	21-24	1 WIE fragment
14	24-27	none
15	25-28	none
16	25-28	none
17	15-18	none

ANALYSIS AND ARCHAEOLOGICAL SENSITIVITY

Various natural and artificial deposits are present in the project area. For this reason the vertical subsurface archaeological sensitivity varies considerably. Unit I is an eroded hillslope soil that formed in bedrock. It has a very low sensitivity for archaeological materials. Unit II is a well-developed soil formed in a thick sand-dune deposit. This unit it is likely contemporaneous with the Pleistocene-age Colma Formation (Schlocker 1974). Because the upper portion (approximately 3 ft.) of this unit was at the surface for most, if not all, of documented prehistoric human occupation of the San Francisco Bay area, it is very sensitive for the presence of buried prehistoric archaeological materials. The surface of Unit II also has a high sensitivity for intact buried historic-period archaeological materials. Given the recovery of several historic-period artifacts in three separate soil cores, it is likely that other historic-period artifacts are present at the surface of Unit II, and may constitute a potentially intact historic-period archaeological site. Unit III is historic-period artificial fill. This unit has no sensitivity for intact prehistoric archaeological materials but may contain intact historic-period archaeological materials, depending on the rate of filling of the drainage during the historic period. Unit IV is historic-period road construction material. This unit has no sensitivity for intact prehistoric archaeological materials.

CONCLUSIONS

Subsurface explorations were undertaken to determine the presence or absence of archaeological materials and paleosols in the project area. While numerous historic-period archaeological materials were encountered, no prehistoric archaeological materials were found during this investigation.

The absence of prehistoric archaeological material cannot be interpreted as a lack of prehistoric human use and/or occupation of the project area. Given the limited scope of this investigation (17 soil cores 2 in. or 1 3/8 in. in diameter), buried prehistoric archaeological materials may have been missed. For these reasons, certain depths below surface within the project area (specifically, the surface of Unit II) are considered highly sensitive for buried prehistoric materials. Additionally the surface of Unit II is considered highly sensitive for intact historic-period archaeological materials. Future archaeological studies in the vicinity should consider these factors in assessing the potential for encountering prehistoric archaeological materials in the project area.

Sincerely,

Philip Kaijankoski

Staff Geoarchaeologist

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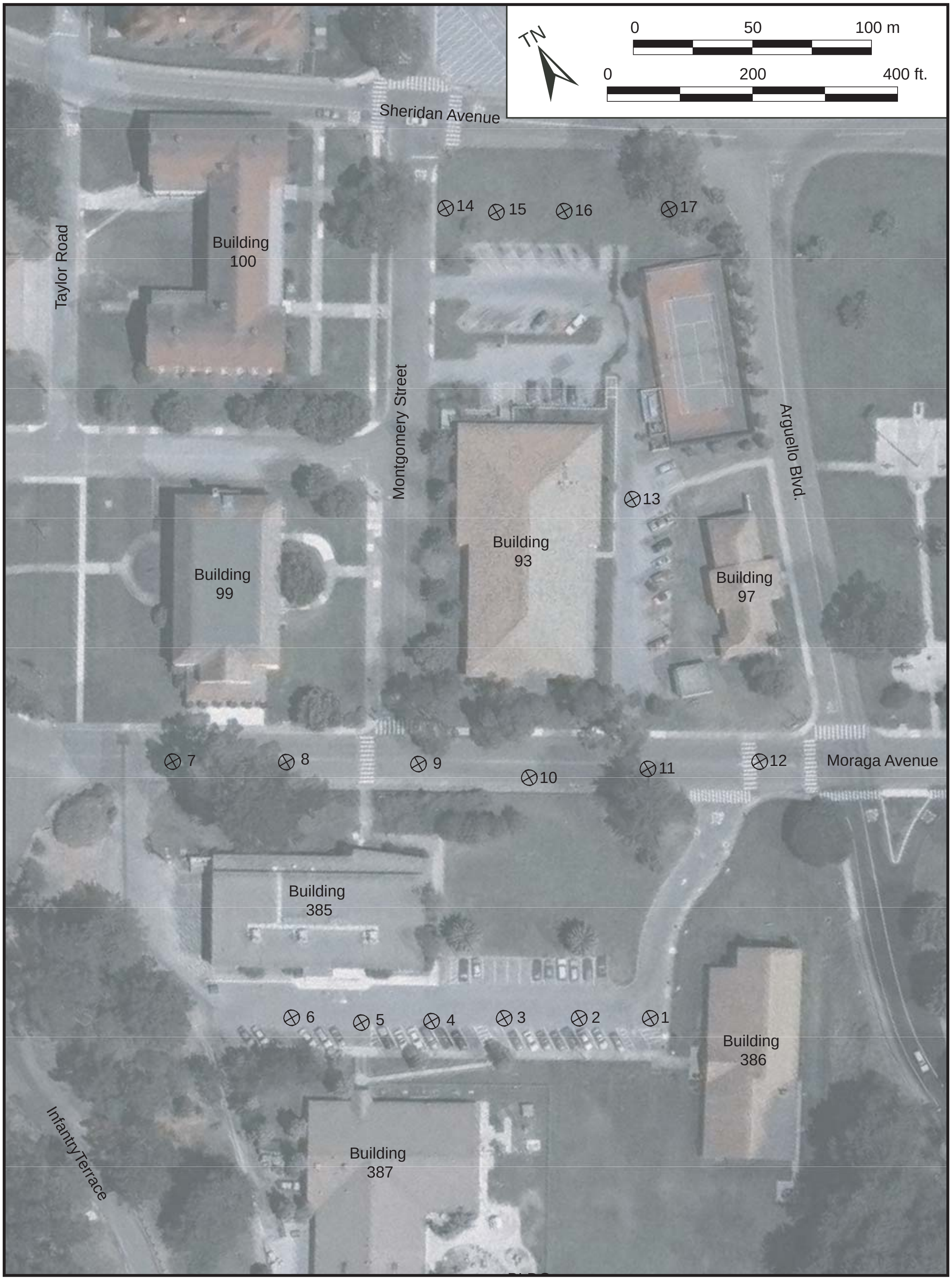

Figure 1. Geoarchaeological core locations, proposed Presidio Contemporary Art Museum, Presidio Main Post Project, San Francisco, California.