

MFA ELECTRICAL-TELECOMMUNICATIONS  
INFRASTRUCTURE PROJECT  
SECTION 106 TECHNICAL REPORT

NASA AMES RESEARCH CENTER  
MOUNTAIN VIEW, CALIFORNIA  
[13140].5

PREPARED FOR:  
NASA AMES RESEARCH CENTER HISTORIC PRESERVATION OFFICE



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## I. INTRODUCTION

The United States through the National Aeronautics and Space Administration (NASA) possesses the fee simple interest in the Moffett Federal Airfield (MFA) and NASA Ames Research Center (NASA ARC). As the lead federal agency, NASA is responsible for compliance with the National Historic Preservation Act of 1966, as amended through 2006, including Section 106, 36 CFR Section 800, which requires federal agencies to take into account the effects of their activities and programs on historic properties.

NASA has entered into a long term Enhanced Use Lease with Planetary Ventures, LLC (PV) regarding Bay View ("Bay View") and an Adaptive Reuse Lease regarding NASA Ames Research Center Eastside/Airfield ("MFA"). Pursuant to the Adaptive Reuse Lease, PV proposes to install new electrical and telecommunications pathways in order to complete the utilities separations requirement. These upgrades to the existing systems will better serve the MFA and Bay View premises without disrupting the ongoing operations at NASA ARC.

### Nomenclature

For clarity, the proposed Electrical-Telecommunications Infrastructure project will be referred to as "the Undertaking."

Within this report, "NASA ARC" will refer to the full extent of the installation operated by NASA. "NASA Ames campus" will refer to the sub-area of NASA ARC, located within the installation's northwest quadrant that houses the agency's research facilities. MFA will refer to the airfield and its supporting area composing the eastern half of the property. (See Appendix A-1 for relevant Undertaking maps.)

### PURPOSE

The purpose of this document is to provide necessary information for Section 106 consultation and the application of the Criteria of Adverse Effects to the Area of Potential Effects (APE), pursuant to 36 CFR Section 800.5(a).

This document should be reviewed in conjunction with the Undertaking plans and documentation that have been provided as part of this Section 106 consultation submittal. (See Attachments)

### LOCATION OF THE UNDERTAKING

The site of the proposed Undertaking is located at NASA Ames Research Center (NASA ARC) located between the municipalities of Mountain View and Sunnyvale, California, on the southern edge of San Francisco Bay. The site of the Undertaking is approximately 27 miles southeast of San Francisco International Airport, and six miles northwest of San Jose International Airport. The Undertaking involves the installation of electrical and telecommunication utility lines that transverse the larger MFA and NASA ARC site below grade.

## II. DESCRIPTION OF UNDERTAKING

### CONTEXT

#### Moffett Federal Airfield

The installation now known as Moffett Federal Airfield was originally established as Naval Air Station (NAS) Sunnyvale, the West Coast base for the U.S. Navy's burgeoning Lighter-Than-Air (LTA) aviation programs of the 1930s. By the time the air station was commissioned in 1933, the U.S. Naval Bureau of Yards and Docks had constructed Hangar 1, a campus of administrative and residential buildings for military personnel that were related to one another through their Spanish Colonial Revival architectural style, and a small airfield consisting of a landing strip and small diagonal runways in the area east of Hangar 1. The original campus had a formal plan and an axial orientation with Hangar 1; a symmetrical horseshoe-shaped roadway with a large central plaza was flanked by a number of the support buildings. A small community of residences for base staff was constructed around a cul-de-sac southwest of the main campus. The site was transferred to the U.S. Army Air Corps in 1935.

The U.S. Navy regained control of the installation during World War II and reintroduced LTA missions at the installation, by this time known as Moffett Field. Wishing to expand, the Navy acquired over 200 acres of land east of the existing airfield. Hangars 2 and 3 were built in this location between 1942 and 1943. Following the end of the war, the airfield transitioned to support training and testing missions associated with Heavier-Than-Air craft, including supersonic jets. During the late 1940s and 1950s, the Navy expanded the airfield runways and taxiways to meet the take-off and landing requirements of these enhanced aircraft. Additional buildings and airfield features—including explosive storage magazines, fueling pits, and a flight operations building—were introduced in support of these missions.

In 1994, Moffett Field was decommissioned from military use through the Base Realignment and Closure process, after which NASA assumed responsibility for the installation and it was integrated with NASA ARC.

#### NASA Ames Research Center

Established in 1939, the Ames Aeronautical Laboratory was a field center operated by the National Advisory Committee for Aeronautics (NACA) and dedicated to researching and developing technology for military aircraft production leading up to World War II. Initially, the Ames NACA field center was a small collection of buildings and wind tunnels located immediately west of NAS Sunnyvale—later named Moffett Field—and surrounded by agricultural land. These first buildings were sited in a more aesthetic fashion with axial boulevards and the prominent placement of the administration building (N-200) within a large traffic circle. However, as competition for improved aircraft technology mounted during the war, progressively advanced facilities were constructed, and the site landscape became increasingly utilitarian. The expansion of advanced facilities continued into the immediate postwar years, as American scientists and manufacturing companies sought to explore jet propulsion and rocket technologies. At the end of the war, there were two wind tunnels at Ames, but a decade later that number had tripled to include the 6x6 Ft. Wind Tunnel (N-226) and Unitary Plan Wind Tunnel Building Complex (N-227, N-227A, N-227B, N-227C, N-227D).

In 1958, the NACA and all its facilities were integrated into the newly formed National Aeronautics and Space Administration (NASA). Under this new agency, the newly named Ames Research Center was partially rededicated with an expanded mission to include space exploration. Since 1958, with research delving into new and complicated areas, the need for innovative facilities at NASA ARC has been a constant. While the original parts of the ARC campus had evident notes of City Beautiful planning, the expanded areas were typically plotted on a simple grid system, except for the eastern portions, which are angled to correspond with the orientation of the runways at Moffett Federal

Airfield (MFA). Development typically radiated north and west from the original 1940s campus and included new facilities focused on aeronautical and aerospace research. Insular areas of the ARC campus were infilled during the late 1970s and 1980s to accommodate the growth of the installation. The trend of infill development continued through the 1990s and 2000s, with the most recent building, the NASA Ames Sustainability Base (Building N-232), being constructed in 2015 within the original NASA ARC area. The existing campus includes dozens of buildings of all shapes and sizes built from the 1940s to the present.

### Bay View

The Bay View site is located in the northwest corner of the NASA ARC near Mountain View, California. Under the NASA Ames Development Plan, Bay View is a distinct planning area from the other areas at NASA ARC.

Historically, the region was predominantly used for agriculture, but in the 1930s and 1940s, the land nearby the current Bay View site began to shift towards aviation, military, and aerospace uses, corresponding with the founding of Moffett Federal Airfield (MFA) and later NASA ARC.

Based upon historic aerial photographs, the Bay View site was used as farmland from the early twentieth century until the late 1970s. Expansion of nearby NASA ARC appears to be associated with the discontinuation of all agricultural activity at Bay View.

In 2008, PV and NASA entered into a 40-year (with 50-year extensions) Enhanced Use Lease for the Bay View site, which is a portion of the Bay View district, including parcels one, two, and four.

### California Air National Guard

The 129<sup>th</sup> Rescue Wing of the California Air National Guard (CANG) occupies a large site located on the east side of Moffett Field. It is bounded by the Moffett Field runways to the west and south, Hangars 2 and 3 to the north, and Macon Road to the east.

Originally founded in 1955 as the 129<sup>th</sup> Air Resupply Group, the 129<sup>th</sup> was originally located at Hayward Airport, California. In 1975, the regiment was re-designated and repurposed as the 129<sup>th</sup> Aerospace Rescue and Recovery Group. With this new mission and an expanded fleet, the 129<sup>th</sup> required expanded facilities. It began transferring operations to MFA soon thereafter and completed the move in 1984, becoming a permitted tenant of the Navy, which then owned and operated the airfield.

In 1994, NASA assumed control of the airfield following the disestablishment of the Navy. Despite the change in operating agency, the 129<sup>th</sup> Rescue Wing continued to operate at MFA. Prior to 2009, the 129<sup>th</sup> utilized facilities throughout the broader MFA site, including the munitions areas near the golf course, Hangar 3, a medical training facility at the west end of MFA, and a Vehicle Operations facility near the center-south area of the site. In 2009, CANG began to consolidate their operation to the single existing site located at the east side of MFA. This involved a long-term permit process, demolition, construction, and a number of real estate transactions.

## DESCRIPTION OF THE UNDERTAKING

The Undertaking consists of the installation of new electrical and telecommunications pathways to fulfill the utilities separation requirement established in the MFA lease. The purpose of this Undertaking is to construct new, below grade, electrical and telecommunications systems in order to serve the NASA Ames campus and PV's leased premises at MFA and Bay View. As discussed below, the below grade electrical and telecommunication systems are defined by two distinct pathways that are associated with the Undertaking: MFA-Bay View and NASA Ames Switchgear.

### **MFA-Bay View Pathway** Electrical Distribution

The *MFA-Bay View* pathway will involve the construction of a new electrical line through MFA, leading from the east, at the existing Moffett Substation, westward across the parking apron north of Hangars 2 and 3, and underneath the runways of the airfield. On the west side of the airfield, the pathway will diverge north along Zook Road to serve the Bay View premises, and south, parallel to the runways, as part of servicing the MFA leased premises.

The Undertaking includes the construction of a new PV-owned primary 12 kV electrical distribution system to serve MFA and the Bay View premises from the existing East Moffett substation. The electrical distribution system will consist of approximately 15,000 linear feet of new duct bank providing service from the existing Moffett substation to the Bay View premises and throughout the MFA leased premises. It is anticipated that nearly all the electrical duct banks along the MFA-Bay View pathway will be constructed using horizontal directional drilling. This method of construction involves digging an entry pithole for equipment access, then drilling horizontally to an exit pithole. Pitholes will be regularly spaced along the pathway at intervals of approximately 400'. This method will minimize disturbances to existing features at grade by avoiding continuous open trench construction.

Electrical duct banks will vary in size from two to twelve 6-inch High Density Polyethylene (HDPE) conduit. Average duct bank depth will be approximately 3'-15' below grade. To facilitate cable pulling and system maintenance, vaults will be located along the duct bank runs every 400', or when the cumulative number of bends exceeds 270 degrees. Vaults will be below-grade precast concrete structures with scissor or manhole-style access hatches. These vaults will utilize the locations of the pitholes created during the horizontal directional drilling process where feasible.

### Telecommunications

The new MFA-Bay View pathway telecom line will parallel much of the MFA-Bay View electrical line, although an extension will continue southeast beyond the existing Moffett Substation, along Macon Road at the east perimeter, terminating at a point due east of the southern CANG Facilities, adjacent to 11<sup>th</sup> Avenue in Sunnyvale, for a future connection with the outlying system. The southwest end of the pathway will tie-in with the UHF/VHF Transmission Building (Building 454).

The Undertaking involves the construction of a new telecommunications (telecom) system at MFA and Bay View to provide multiple diverse pathways to buildings within the Bay View and MFA premises for fiber optic service.

The system will encompass approximately 20,000 linear feet of new duct bank across the airfield with connections at MFA and the Bay View premises. The new telecom duct banks will be bored in parallel to the proposed electrical infrastructure along the MFA-Bay View pathway, and will be constructed with a minimum of 3' horizontal separation, and 1' vertical separation, from other utilities.

New telecommunications infrastructure will consist of duct banks varying from clusters of two to eight 4" HDPE conduit installed primarily using horizontal directional drilling. As with the electrical distribution, the average duct bank depth will be approximately 3'-15' below grade. To facilitate fiber optic cable pulling and maintenance, vaults will be located along the duct bank runs every 400' or when the cumulative number of bends exceeds 180 degrees. These vaults will be below-grade precast concrete structures with manhole-style access hatches. The fiber-optic connection at Building 454



will reuse existing conduits below grade that extend underneath and into the building; there is no proposed work at the façade of Building 454.

### Staging Sites

There are six proposed staging sites that will be used during the construction of the MFA-Bay View pathway. All staging sites are in the immediate vicinity of the proposed alignments (see Appendix A-2):

- 1) North end of the west aircraft parking apron.
- 2) Southwest corner of the west aircraft parking apron.
- 3) East aircraft parking apron, north of Hangars 2 and 3.
- 4) Along the north alignment at Zook Road.
- 5) Along the south telecom alignment at Macon Road and the eastern boundary.
- 6) Adjacent to the East Moffett Substation at Macon Road.

### **NASA Ames Switchgear**

The *NASA Ames Switchgear* electrical pathway will extend from the existing Switchgear C, located at the southern end of NASA ARC, adjacent to Dailey Road. The pathway will follow Dailey Road north, traversing northwest across the Shenandoah Plaza portion of MFA along McCord Avenue; a small spur line will extend northeast from the primary pathway – between Wescoat Road and South Akron Road—towards Building 10, which will house new switchgear equipment. The northwest trajectory of the primary pathway will continue into the NASA Ames Campus to reach the existing NASA Ames Substation (Building N-225B). In order to maximize the use of existing conduits, three alternate routes are being considered for the route of this pathway through the NASA Ames Campus, between McCord Avenue and Building N-225B (see Appendix A-1):

- 1) Alternative 1 would turn west from McCord Avenue and would follow Durand Road to its termination point at DeFrance Avenue; it would then turn north and follow DeFrance Avenue to its intersection with Parsons Avenue. The pathway would then turn west and follow Parsons Avenue to connect with Building N-225B.
- 2) Alternative 2 would turn southwest from McCord Avenue and would follow King Road to its intersection with DeFrance Avenue. It would then turn north and follow DeFrance Avenue to its intersection with Parsons Avenue. The pathway would then turn west and follow Parsons Avenue to connect with Building N-225B.
- 3) Alternative 3 would turn northeast from McCord Avenue and would follow King Road to its intersection with F Lane. It would then turn northwest and follow F Lane before turning directly west towards the intersection of Servryns/Warner Road and McCord Avenue. The pathway would turn north and follow McCord Avenue to Boyd Road. It would then turn west and follow Boyd Road (which continues to Parsons Avenue) to connect with Building N-225B.

Alternative 2 is considered the preferred route for the NASA Ames Switchgear pathway through the NASA Ames Campus. However, as a final determination has not yet been made regarding the route that will be used, this technical report will discuss all three options for the purposes of determining an Area of Potential Effect and potential adverse effects to historic properties.

The staging site during construction of the NASA Ames Switchgear will be located at an existing parking lot, northeast of Building 10. The site is located immediately south of South Akron Road, and between Severyns and Dugan Avenues to the east and west, respectively (see Appendix A-2).

### Electrical Distribution

In order to achieve separation, existing NASA and CANG loads will be separated from the existing Moffett Substation and connected to the NASA Ames substation on the west side of the NASA Ames campus. Existing underground electrical duct banks will be utilized to the maximum extent feasible to re-route the cabling to the NASA Ames substation; however, it is anticipated that new duct banks will be required in some locations. Where the reuse of existing ductwork is not feasible, open trench construction will be used to lay new conduit on top of the existing ductwork. Open trenches would require the asphalt/concrete to be saw cut and soil excavated using a backhoe. The resulting openings would be approximately 18" wide and excavated to an approximate depth of 3.5'. Locations where open trenching would be necessary are located along the three proposed pathway routes—specifically, select locations following McCord Avenue, King Avenue, Durand Road, F Lane, DeFrance Avenue, and Boyd Road/Parsons Avenue. In these instances, the pathways of the new duct banks and/or conduits will be sited to avoid existing buildings, trees, sidewalks, or other notable landscape features.

A new transformer will be installed at the NASA Ames substation, and a new electrical switchgear will be installed in Building 10. The switchgear equipment proposed for Building 10 is approximately 7'-8" in height by 3'-9" in width by 5' in depth, and will be able to pass through the 12' by 15' doors of the building with ease. It is expected that existing conduits and below-grade openings leading into Building 10 will be utilized. In the event the use of existing openings is not feasible and new conduits are required, however, a new point of access will be constructed below grade from the existing manhole (directly adjacent to the building), under Building 10, and up through the interior floor slab. There is no proposed work at the exterior façades of Building 10.



### III. AREA OF POTENTIAL EFFECTS (APE)

#### DEFINING THE APE

An Area of Potential Effects (APE) is a defined geographic boundary in which historic properties may be affected by an undertaking, including direct effects (such as demolition) and indirect effects (such as blocking a visual corridor) that impact the historic character of a property.<sup>1</sup> An undertaking would have an effect on a historic property if the action would result in changes to the character of any of the historic properties within the APE. An APE may include historic properties that are well beyond the limits of the undertaking.

#### BOUNDARIES

The following analysis for the current Undertaking involves an APE that represents those areas in which the scope of the Undertaking could potentially affect historic properties—if and where they exist—through physical means, or through visual or atmospheric (noise and vibration) changes that could affect a historic property's integrity of setting. For the current Undertaking, the APE is primarily defined by the lands at NASA ARC. Definitive geographical features establish logical boundaries for the identified APE, including Stevens Creek and RT Jones Road to the west, Highway 101 to the south, Enterprise Way and East Patrol Road at the east, and San Francisco Bay to the north.

Vertical boundaries are crucial, as most of the Undertaking is located below grade at a depth ranging between 3'–15'. The APE encompasses the Area of Direct Impact (ADI), meaning the project site and footprint where direct effects to above and below ground historic properties could occur along the linear path of the utility pathways that are proposed to transverse NASA ARC. The ADI also includes the location of any potential staging sites likely to be used during construction. (The location of the ADI is described in greater detail in Section II, Description of the Undertaking). The size and location of the APE also takes into consideration the potential indirect effects that may occur at historic properties, including visual, atmospheric, and audible intrusions.

A map illustrating the location of the APE is included in Appendix A as A-2, and maps illustrating the ADI are included in Appendix A as A-5 through A-10.

#### IDENTIFICATION OF HISTORIC PROPERTIES WITHIN THE APE

Historic properties, as defined in 36 CFR Section 800.16(l)(1), include any district, site, building, structure, or object that is included in or eligible for listing in the National Register.

##### Archaeological Properties

William Self Associates (WSA) has conducted a records search in order to determine if archaeological resources were previously identified along the proposed utilities alignments, where ground disturbance would occur as part of the Undertaking scope. This search determined that there were 11 previously recorded archaeological sites within a quarter-mile of the proposed alignment. These identified recorded sites, however, were recorded ca.1912 and subsurface archaeological surveys conducted since the 1970s have failed to locate these sites or additional artifacts. It has been presumed that agricultural activity and subsequent development of aviation and research facilities at NASA ARC have disturbed and destroyed these archaeological deposits.

As further described in Appendix B, the WSA Archaeological Testing Report, WSA archaeological staff undertook a pedestrian field survey of the area of the Undertaking on November 21-22, 2016,

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<sup>1</sup> Seifert, Donna, *Defining Boundaries for National Register Properties bulletin*, revised 1997: accessed <http://www.nps.gov/NR/publications/bulletins/boundaries/bound1.htm>

involving a visual survey of all observable ground surfaces along the proposed alignment; focus was given to areas that were unpaved and the ground was visible. No cultural materials, nor potential site remnants, were observed at locations along the alignment.

Additionally, WSA staff conducted archaeological coring on December 7-8 and 20-21, 2016, at 24 samples locations along the proposed utility alignment to determine the presence of subsurface archaeological deposits. The locations of these archaeological cores occurred in areas of potential archaeological sensitivity where previous surveys and studies had not been conducted previously. Of these cores, 23 were to a depth of 20', which is well below the Undertaking's anticipated depth ranging between 3'-15'. One core reached an impassible resistance at 11.5' below the surface and an alternative location was not feasible with the number of utility crossings in the immediate area. Upon analysis, no cultural materials were identified in any of the conducted core samples.

The Archaeological Testing Report by WSA, provided as an attachment to this report, contains further details on the results of the records search, field survey, and archaeological core sampling.<sup>2</sup> These investigations did not locate indicators of the previously recorded sites, or any indicators of additional historic or prehistoric sites that could be evaluated for inclusion in the National Register.

#### Above-Ground Historic Properties

Above-ground historic properties located within NASA ARC have previously been studied in efforts to inform an understanding of the historic significance of properties throughout the area. These studies were used to determine whether the construction of the Undertaking may have potential effects on historic properties within the APE. These studies include the following:

- *Man in Space National Historic Landmark Theme Study*, Harry A. Butowsky, National Park Service: 1984.
- *US Naval Air Station Sunnyvale, California Historic District National Register of Historic Places Nomination*, Bonnie Bamberg, Urban Programmers: 1994.
- *NASA Ames Research Center, Moffett Field, California, Survey & Rehabilitation Recommendations*, Page & Turnbull: 2006.
- *Evaluating Historic Resources Associated with the Space Shuttle Program: Criteria of Eligibility for Listing in the National Register of Historic Places (NRHP)*, Page & Turnbull: 2007.
- *Historic Property Survey Report for the Airfield at NASA Ames Research Center, Moffett Field, California*, AECOM: 2013.<sup>3</sup>

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<sup>2</sup> The pedestrian survey did not include portions of the proposed alignments that were added to the Undertaking after the survey took place. These include paved surfaces, as well as areas that have been previously surveyed.

<sup>3</sup> Consultation between NASA and the California Office of Historic Preservation (OHP) expanded the boundaries of the NAS Sunnyvale Historic District to encompass the installation's airfield and adjacent aviation-related buildings and landscape features. The Historic Property Survey Report (HPSR) completed by AECOM dated November 26, 2013 considered resources associated with the airfield for contributing status under an expanded period of significance, 1930-1961, and a list of potential contributors was assembled. The OHP has not formally concurred with this list of properties, but has found it appropriate to consider them as historic properties during subsequent Section 106 consultation. Later this year, Page & Turnbull will evaluate the significance and integrity of the identified potential contributing properties to the Expanded NAS Sunnyvale Historic District, and will submit their findings to OHP for formal concurrence.

- *NASA Section 106 Consultation: Arc Jet Complex Steam Vacuum System Boiler Replacement Project at Ames Research Center, Moffett Field, California*, AECOM: 2015.
- *Historic Property Survey Report for the Defense Fuel Support Point Closure Project at Ames Research Center, Moffett Field, California*, AECOM: 2016.
- *NASA Ames Wind Tunnel Historic District National Register of Historic Places Draft Nomination*, AECOM: 2016.

Based on these previous studies, above-ground historic properties are known to exist within the APE and are listed in the tables below: (i) Table 1 covers the Expanded NAS Sunnyvale National Register Historic District; (ii) Table 2 covers the NASA Ames Wind Tunnel National Register Historic District; and (iii) Table 3 covers Additional Individually Eligible and Listed National Register Historic Properties Located within NASA ARC. The Status/Evaluation column of each table denotes whether the properties: (i) contribute to an identified historic district, (ii) are proposed as contributing properties, (iii) are individually eligible to the National Register, or (iv) ineligible for the National Register. Detailed information on these historic properties (including their historic use and the criteria under which they were evaluated) can be found in the documents identified in the Previous Studies listed above. Those historic properties contained within the Undertaking's ADI, which have the potential to be affected physically by the Undertaking, are described in greater detail following the tables. Maps that show the locations of historic properties are included in Appendix A. (Identified APE and all Historic Properties, see A-2; Expanded NAS Sunnyvale Historic District, see A-3; NASA Ames Wind Tunnel Historic District & NASA ARC, see A-4; and ADI Maps, see A-5 through A-10).

**Table 1: Expanded NAS Sunnyvale National Register Historic District**

<b>Current Name/Historic Use (Building #)</b>	<b>Year Built</b>	<b>Status / Evaluation</b>	<b>Historic Property</b>
Hangar One (1)	1931-1933	Found individually eligible to the National Register through Section 106 review; contributing property to the NAS Sunnyvale Historic District	Yes
Gymnasium/Balloon Hangar (2)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Water Tank and Storage Tank (5)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Boiler Plant Facility/Heat Plant (10)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Security Station/Fire Station and Laundry (15)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Public Works/Locomotive Crane Shed (16)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Administration and Telephone Exchange/ Admirals Building (17)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Memorial Anchor (17A)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Unmanned Aerial Vehicle Research Building/ Aerological Center (18)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Industry Partners Building/Bachelor Enlisted Quarters (19)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Bachelor Officer Quarters (20)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Garages/Bachelor Officers Garage (21)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Garages/Bachelor Officers Garage (22)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Carnegie Mellon University/Dispensary (23)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Carnegie Mellon University Storage/ Ambulance Garage (24)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Admin. Building and Auditorium/Bowling Alley and Rec. Building (25)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Visitor Registration/Gate House (26)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
North Floodlight Tower (32)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
South Floodlight Tower (33)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Scale House (37)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes

Current Name/Historic Use (Building #)	Year Built	Status / Evaluation	Historic Property
Flagpole and Grounds (40)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Housing and Garages (A-I; A1-I1)	1931-1933	Contributing property to the NAS Sunnyvale Historic District	Yes
Hangar 2 (46)	1942-1943	Found individually eligible to the National Register through Section 106 review; contributing property to the NAS Sunnyvale Historic District	Yes
Hangar 3 (47)	1942-1943	Found individually eligible to the National Register through Section 106 review; contributing property to the NAS Sunnyvale Historic District	Yes
Boiler House for Hangars 2 and 3/Heat Plant (55)	1943	Contributing property to the NAS Sunnyvale Historic District	Yes
Inert Ammunition Storage (69)	1943	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Fuse & Detonator Magazine (70)	1943	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
High Explosive Magazines (71-74)	1943	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Airfield Lighting Vault (105)	1947	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Aircraft Compass Calibration Pad (106)	1947	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Tank Truck Filling Rack (141)	1952	Proposed as contributing property to Expanded NAS Sunnyvale Historic District; found ineligible as a component of the Jet Fueling Facility in AECOM, <i>Historic Property Survey Report for the Defense Fuel Point Closure Project</i> , 2016; SHPO concurred with this finding in letter to Keith Venter, NASA Ames Research Center, 6/30/2016	No
High Explosive Magazine (143)	1951	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
High Explosive Magazine (147)	1951	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Flight Operations Building and Tower (158)	1954	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes

Current Name/Historic Use (Building #)	Year Built	Status / Evaluation	Historic Property
UHF/VHF Receiver Building (329)	1958	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Ordnance Handling Pad (442)	1956	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
UHF/VHF Transmission Building (454)	1960	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Runway 32L/14R (MF1000)	1938	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Instrument Runway 32R/14L (MF1001)	1945	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Aircraft Parking Apron (MF1002)	1945	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
High-Speed Aircraft Fueling Pits (MF1003)	1955	Proposed as contributing property to Expanded NAS Sunnyvale Historic District; found ineligible as a component of the Jet Fueling Facility in AECOM, <i>Historic Property Survey Report for the Defense Fuel Point Closure Project</i> , 2016; SHPO concurred with this finding in letter to Keith Venter, NASA Ames Research Center, 6/30/2106	No
West Parallel Aircraft Taxiway (MF1016)	c. 1946	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
East Parallel Aircraft Taxiway (MF1016)	c. 1946	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes
Connecting Taxiways (MF1016)	c. 1946	Proposed as contributing property to Expanded NAS Sunnyvale Historic District	Yes

**Table 2: NASA Ames Wind Tunnel National Register Historic District<sup>4</sup>**

<b>Name (and Building #)</b>	<b>Year Built</b>	<b>Status / Evaluation</b>	<b>Historic Property</b>
Army Aerodynamics 7x10 Ft Wind Tunnel (N-215)	1941	Contributor to the NASA Ames Wind Tunnel Historic District, 2017	Yes
Technical Service Building (N-220)	1940	Contributor to the NASA Ames Wind Tunnel Historic District, 2017	Yes
40x80 Ft Wind Tunnel (N-221)	1944	Contributor to the NASA Ames Wind Tunnel Historic District, 2017	Yes
80x120 Ft Wind Tunnel (N-221B)	1982	Contributor to NASA Ames Wind Tunnel Historic District, 2017	Yes
6x6 Ft Wind Tunnel Ames Aerospace Encounter (N-226)	1946	Contributor to the NASA Ames Wind Tunnel Historic District, 2017	Yes
Unitary Plan Wind Tunnel Building Complex (N-227, N-227A, N-227B, N-227C, N-227D)	1955	National Historic Landmark, 1984, National Park Service; contributor to the NASA Ames Wind Tunnel Historic District, 2017	Yes
Landscape features within historic district boundaries: DeFrance Ave. and Durand Rd.; curbing; mature trees; shrubs; lawns	Various	Contributing features to the NASA Ames Wind Tunnel Historic District, 2017	Yes

<sup>4</sup> Page & Turnbull reviewed the draft National Register of Historic Places nomination for the proposed NASA Ames Wind Tunnel Historic District during completion of this technical report. The final draft of the district's National Register nomination was officially accepted by the Keeper of the National Register on January 11, 2017. As such, the NASA Ames Wind Tunnel Historic District is now listed in the National Register.



**Table 3: Additional Individually Eligible and Listed National Register Historic Properties Located within NASA ARC**

Current Name/Historic Use (Building #)	Year Built	Status / Evaluation	Historic Property
Administration Building (N-200)	1943	Listed in the National Register on January 11, 2017.	Yes
Arc Jet Complex (Buildings N-234, N-238, and the Steam Vacuum System)	1962-1964	Listed in the National Register on January 11, 2017.	Yes
Systems Development Facility/Structural Dynamics Laboratory (N-242)	1964	Determined individually eligible for NRHP listing by AECOM, 2015.	Yes
Flight and Guidance Simulation Lab (N-243)	1967	Listed in the National Register on January 11, 2017.	Yes

Properties Within the Area of Direct Impact

Of the identified above-ground historic properties located within the APE and included in the tables above, a select few are located within the ADI. As such, these properties have the potential to be physically affected by the Undertaking.

*Expanded NAS Sunnyvale Historic District*

Both of the proposed alignments of the Undertaking traverse the Expanded NAS Sunnyvale Historic District. The original NAS Sunnyvale Historic District was listed to the National Register in 1994. This discontinuous district includes the original portions of the NAS Sunnyvale installation campus, also known as Shenandoah Plaza, as well as Hangar 2, Hangar 3, and a portion of the adjacent aircraft apron. The Expanded NAS Sunnyvale Historic District was identified as the result of consultation between NASA and the California Office of Historic Preservation in 2013. Through this consultation, the boundaries of the district were expanded to form a National Register-eligible extension. The expanded district boundaries encompass the airfield, its associated runways, and various support buildings and structures, including the Cold War-era ammunitions facilities at the northeast corner of the property.

The following are contributing properties within the original NAS Sunnyvale Historic District, as well as potentially eligible contributing properties to the National Register-eligible Expanded NAS Sunnyvale Historic District, that are located within the project footprint. As such, these properties are within the ADI and have the potential to be physically affected by the Undertaking:

- Boiler Plant Facility/Heat Plant (Building 10): originally used as a storehouse, Building 10 is a Spanish Colonial Revival-style building and was constructed in 1933 as part of the original configuration of NAS Sunnyvale. The NASA Ames Switchgear will enter the building through existing conduits; it is possible, however, that a new below-grade opening through the floor slab will be necessary to accommodate the Switchgear.
- UHF/VHF Transmission Building (Building 454): constructed ca.1960, Building 454 was historically used as a communications building for air traffic control. The NASA Ames Switchgear alignment will terminate at this building using existing underground conduits.

- Runway 23L/ 14R (MF 1000): originally constructed in 1938, and later extended, this is one of the primary runways at MFA. The runway intersects with the east-west path of the MFA-Bay View alignment.
- Instrument Runway 32R 14L (MF 1001): originally constructed in 1938, and later extended, this is one of the primary runways at MFA. This runway intersects with the east-west path of the MFA-Bay View alignment.
- Aircraft Parking Apron (MF 1002): constructed in 1945, the aircraft parking aprons are large expanses of concrete surface paving located immediately adjacent to Hangars 1, as well as Hangars 2 and 3. The apron paving features a distinct gridded scoring pattern throughout. These parking aprons intersect with the east-west path of the MFA-Bay View alignment

#### *NASA Ames Wind Tunnel Historic District*

The northern portions of the proposed NASA Ames Switchgear Alignment of the Undertaking extend through the NASA Ames Wind Tunnel Historic District. Accepted to the National Register in January 2017, the NASA Ames Wind Tunnel Historic District is comprised of a collection of advanced wind tunnel facilities constructed between 1940 and 1982, and which have been instrumental in the development of aerospace technological advancements during that time.

The following are contributing properties within the Expanded NASA Ames Wind Tunnel Historic District are located within the project footprint. As such, these properties are within the ADI and have the potential to be directly affected by the Undertaking:

- Contributing Landscape Features: identified contributing cultural landscape features include Durand Road, DeFrance Avenue, concrete curbing, mature trees, shrubs, and lawn. These features create a campus setting for the historic district and contextualize the district's contributing research facilities.

#### *Additional Individually Eligible and Listed National Register Properties Located within NASA ARC*

Of the identified individually eligible and listed properties, outlined in Table 3, none are located within the Undertaking's ADI.

## IV. APPLICATION OF THE CRITERIA OF ADVERSE EFFECT

The criteria of adverse effect on historic properties under Section 106 of the NHPA are defined in 36 CFR Section 800.5(a)(1) as follows:

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

According to 36 CFR Section 800.5(a)(2), examples of adverse effects on historic properties include, but are not limited to:

- i. Physical destruction of or damage to all or part of the property;
- ii. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR Section 68) and applicable guidelines;
- iii. Removal of the property from its historic location;
- iv. Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- v. Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
- vi. Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- vii. Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

To comply with Section 106, the criteria of adverse effects are applied to historic properties in the Undertaking's Area of Potential Effects (APE), pursuant to 36 CFR Section 800.5(a)(1). A finding of no adverse effect may be appropriate when the undertaking's effects do not meet the threshold set forth in the criteria of adverse effect, or conditions are imposed to ensure review of rehabilitation plans for conformance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (codified in 36 CFR Section 68). If a finding of adverse effects is made, mitigation is proposed and resolution of adverse effects occurs through consultation in accordance with 36 CFR Section 800.6(a) to avoid, minimize, or mitigate adverse effects on historic properties.

## FINDING OF EFFECT

Per the adverse effects threshold detailed in CFR Section 800.5(a)(2), an analysis of the Undertaking reveals the following:

### Criterion i. Physical destruction of or damage to all or part of the property.

The Undertaking would not damage or lead to the physical destruction of a portion or all of any historic property. Any potential physical impacts to historic properties are considered in the discussion of the Undertaking's adherence to the Secretary of the Interior's Standards under Criterion ii, below. The Undertaking therefore would not cause an adverse effect under Criterion i.

### Criterion ii. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR Section 68) and applicable guidelines.

The following section includes an analysis of the proposed undertaking under the *Secretary of the Interior's Standards for Rehabilitation*. Rehabilitation is considered appropriate to define the Undertaking, as this treatment encompasses projects that "mak[e] possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values."<sup>5</sup>

**Rehabilitation Standard 1:** *A property will be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.*

The proposed Undertaking would not result in changes to the current use of any historic property—including the aviation- and research-related programs of buildings that are individually eligible to the National Register, as well as the Expanded NAS Sunnyvale Historic District and the NASA Ames Wind Tunnel Historic District. Therefore, the Undertaking would adhere to Standard 1.

**Rehabilitation Standard 2:** *The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features and spaces that characterize a property shall be avoided.*

The Undertaking would require the sub-surface installation of electrical and telecommunications infrastructure, primarily involving select alterations to ground surfaces. The MFA-Bay View Pathway would extend across the runways and parking aprons comprising the MFA airfield to reach the east boundary of the property; this pathway would also extend alongside the parking apron east of Hangar 1 and Building 158. The runways and Aircraft Parking Aprons (MF1002) are contributing properties within the Expanded NAS Sunnyvale Historic District. Pit holes introduced to accommodate below-grade directional drilling along the pathway would not be placed on the paved surfaces of the contributing runways, and would not affect the historic circulation patterns of the airfield. Select penetrations in the parking aprons may be required for pit holes and concrete access vaults. The replacement of select areas of pavement will be in-kind to match the materials, color, scoring pattern, and texture of the original and remaining historic fabric, as best feasibly possible. In addition, all in-kind replacement pavements, or the installation of vaults, will be minimal in scale and will have no noticeable impact on the integrity of the overall open character of the parking aprons, or the defining cultural landscape features that convey the significance the historic character of the Expanded NAS Sunnyvale Historic District. As identified in the *Historic Property Survey Report*,

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<sup>5</sup> "Rehabilitation as a Treatment," National Park Service Technical Preservation Services, accessed January 6, 2017, <https://www.nps.gov/tps/standards/four-treatments/treatment-rehabilitation.htm>.

completed by AECOM in 2013, these cultural landscape features include the following: flat topography, open views across aviation areas, views to San Francisco Bay, visual dominance of Hangar 1, and views towards Hangars 2 and 3. By being placed below or at grade, the new electrical and telecommunications infrastructure proposed by the Undertaking would not interfere with any significant visual, spatial, or functional relationships that define the historic character of the Expanded NAS Sunnyvale Historic District or its contributing properties.

The NASA Ames Switchgear pathway would follow one of three route alternatives within the NASA Ames campus; each option would be located within the boundaries of the NASA Ames Wind Tunnel Historic District. Alternative 1 would follow and would involve areas of open trenching along Durand Road and DeFrance Avenue (both identified as contributing cultural landscape features within the historic district); Alternative 2 would also involve areas of open trenching along DeFrance Avenue; and Alternative 3 would involve an area of open trenching along Boyd Road, which forms the northern boundary of the district and is adjacent to the National Register-listed Building N-234. Open trenching would require that concrete/asphalt be saw cut and removed, and the existing soil excavated. These disturbances to the ground surface would occur only at select locations, be limited in width and depth, and be temporary in order to accommodate the installation of new conduit. All removed pavement would be replaced in-kind. Other elements, such as mature trees alongside the roadways, shrubs, and lawns, have been identified as contributing to the cultural landscape of the district and help convey the bucolic setting of the research campus. Where required in the vicinity of these identified cultural landscape features, such as mature trees, open trenching would be sited to previously paved areas in order to avoid physical impact to the features and subsequent effect on the setting of the district. Trenching would likewise avoid physical impacts to the façades of Building N-234. In the event that open trenching occurs at segments with lawn cover, the excavated section will be patched with soil and replanted with new turf, essentially replacing the original materials in-kind.

Furthermore, the NASA Ames Switchgear pathway would continue south into the Shenandoah Plaza administrative campus, which is within the boundaries of the original and Expanded NAS Sunnyvale Historic District. Open trenching is proposed in the vicinity of contributing buildings 37 (Scale House) and 15 (Security Station/Fire Station and Laundry), but would be sited so that it does not have a physical impact on these buildings. If required, a below-grade penetration to Building 10 (Boiler Plant Facility/Heat Plant) would have no visual effect on the character of its façades.

Where trenching is required, excavated areas would be covered and/or patched in-kind prior to the completion of the Undertaking, and would not have an effect on the broader spatial arrangement of buildings and other contributing features that characterize their respective historic district.

Therefore, the Undertaking would adhere to Standard 2.

**Rehabilitation Standard 3:** *Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other buildings, shall not be undertaken.*

The Undertaking proposes the new below-grade electrical and telecommunications infrastructure that would not be visible at any historic property, or within a historic district, following its installation. The infrastructure would not be mistaken for a historic or conjectural element and would not create a false sense of development at any historic property. Therefore, the Undertaking would adhere to Standard 3.

**Rehabilitation Standard 4:** *Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.*

The Undertaking would not adversely affect any properties or landscape characteristics that have acquired historic significance in their own right. Therefore, the Undertaking would adhere to Standard 4.

**Rehabilitation Standard 5:** *Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.*

The MFA-Bay View pathway will be below grade with minimal interventions at or above the surface. A series of regularly spaced pitholes along the proposed pathway will be required to facilitate the horizontal directional drilling method of construction. Segments of the proposed pathway extend underneath the airfield and its associated runways (MF1000, MF1001), which are identified contributing features to the Expanded NAS Sunnyvale Historic District. However, no pitholes will be constructed within these runways and the Undertaking will not otherwise impact the runways' existing paved surfaces. Construction of any pitholes, rather, will be limited to interstitial spaces adjacent to the runways. The proposed pathway extends underneath both the eastern portion of the concrete Aircraft Parking Apron (MF1002), north of Hangars 2 and 3, as well as the western portion of MF1002, east of Hangar 1. The utilization of the horizontal directional drilling process will preserve much of these contributing features by keeping the majority of the construction work below grade; however, the construction of pitholes may be required at select locations at these aprons. The removal and in-kind replacement of paving at these locations would be minimal in relation to the aprons' paved surfaces, and therefore the gridded paving pattern that defines the historic character of the aprons would be preserved. The southwest terminus of the telecommunications alignment for the MFA-Bayview pathway is at Building 454, which is considered a potentially contributing property to the Expanded NAS Sunnyvale Historic District. A fiber-optic connection will tie in to the building through existing below-grade conduits and openings in the building. Through the reuse of these existing below-grade conduits, the Undertaking would have no effect on the historic features or finishes of the building.

The NASA Ames Switchgear pathway of the Undertaking, which extends through both the Expanded NAS Sunnyvale Historic District and the NASA Ames Wind Tunnel Historic District, will primarily utilize existing conduits along the identified pathway. In the event that new conduits are required, open trenches will be saw cut and excavated at a limited width and depth to facilitate construction; however, pathways will be sited to specifically avoid any distinctive landscape features that contribute to the district's campus-like setting, including: existing trees, lawns, and other vegetation; concrete curbs; and sidewalks. All removed pavement resulting from open trenching will be replaced in-kind. The Undertaking will additionally involve the installation of new switchgear equipment within the envelope of Building 10, which is a contributing property to the NAS Sunnyvale Historic District. The size of the switchgear equipment will allow it to easily fit through the 12' by 15' doors of the building without affecting the property. The electrical connections to the new switchgear equipment will utilize existing conduits and openings leading to Building 10, which are all located below grade. In the event that the conduits are no longer useable, a new small conduit pathway will be constructed below grade. Any required intervention to Building 10's foundation would be minimal in size and would have no effect on the stucco cladding, fenestration pattern, and decorative features that characterize the exterior of the building.

Based on the discussion above, the Undertaking would adhere to Standard 5.

**Rehabilitation Standard 6:** *Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.*

The Undertaking would not involve the treatment of any deteriorated features belonging to a historic property. Therefore, the Undertaking would adhere to Standard 6.

**Rehabilitation Standard 7:** *Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, will be undertaken using the gentlest means possible.*

The Undertaking would not involve harmful chemical or physical treatments of any historic materials belonging to a historic property. Therefore, the Undertaking would adhere to Standard 7.

**Rehabilitation Standard 8:** *Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.*

If archaeological materials are encountered during the Undertaking, construction will be halted, NASA's Procurement Officer and Historic Preservation Officer will be immediately notified, and the standard procedures outlined by WSA in Appendix B shall be followed. All necessary actions would be taken to comply with NASA and the Secretary of the Interior's Standards. Therefore, the Undertaking would adhere to Standard 8.

**Rehabilitation Standard 9:** *New additions, exterior alterations, or related new construction will not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale and architectural features to protect the historic integrity of the property and its environment.*

The Undertaking does not propose additions, exterior alterations, or other forms of new construction to any historic buildings. The majority of elements to be installed will be located below grade and therefore will not be visible. Where new vaults will be required in select locations to support new electrical and telecommunications lines along the MFA-Bay View Pathway, these features will not rise above grade and therefore will not interrupt the existing spatial arrangement and significant view corridors that have been identified within the Expanded NAS Sunnyvale Historic District. Vaults will be visually differentiated as modern infrastructural elements. Therefore, the Undertaking would adhere to Standard 9.

**Rehabilitation Standard 10:** *New additions and adjacent or related new construction shall be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.*

The electrical and telecommunications infrastructure proposed as part of the Undertaking would be placed below grade and is considered removable. The possible removal of conduits, duct banks, and concrete vaults in the future would cause a temporary change in surface conditions within the NASA Ames campus and airfield but would not affect the overall form, character-defining landscape characteristics, or integrity of the NASA Ames Wind Tunnel and Expanded NAS Sunnyvale Historic Districts. Any sub-surface penetration to occur through the foundation of Building 10 could be patched in-kind and covered, and, as a result, would not have an effect on any materials or features that define the historic character of the building's façades. Therefore, the Undertaking would adhere to Standard 10.



### Summary of Analysis under Criterion ii

The Undertaking would adhere to the *Secretary of the Interior's Standards for Rehabilitation*, as described above, and therefore would not cause an adverse effect to historic properties under Criterion ii.

### **Criterion iii. Removal of the property from its historic location.**

The Undertaking would not involve the removal of any historic property from its historic location and therefore would not cause an adverse effect to historic properties under this criterion.

### **Criterion iv. Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance.**

As described under Criterion ii, the Undertaking does not involve changing the existing use of any of the identified historic properties located in the APE. Regarding contributing physical features of setting, the proposed work associated with the Undertaking is predominantly limited to the subsurface installation of utility pathways and will have limited effects on a select few of the cultural landscape features associated with the identified historic properties, specifically paved surfaces.

Along the MFA-Bay View path, there is the potential that select locations at the paved aircraft parking aprons may require small interventions at the pavings to facilitate the construction of pitholes and utility access vaults; however, these areas would be minimal in scale and removed pavings would be replaced in kind, having negligible effect on the integrity of parking apron. The Expanded NAS Sunnyvale Historic District would continue to retain all significant characteristics of setting associated with the parking aprons – flat topography, open views across the airfield, views to San Francisco Bay, and visual dominance of the Hangars.

Along the NASA Ames Switchgear pathway, and the associated proposed alternative routes through the NASA Ames Campus, the utility lines will reuse existing ductwork and conduits where feasible. If the installation of new conduits is required along the NASA Ames Switchgear pathway, open trenches will be required to facilitate the installation of new conduits. All trenches would be temporary and paved over upon completion. Where trenching would occur at contributing roadways – namely along De France Avenue, Durand Road, and Boyd Road – in-kind replacement paving would not impact the significant characteristics as defining circulation routes throughout the NASA Ames Campus. Where the construction of new conduits has the potential to impact identified cultural landscape features (mature trees, shrubs, and lawn), the pathways will be re-routed to paved areas where trenching would be easily reparable using in-kind replacement pavings and not impact the setting of historic properties. As such, the settings of the identified historic districts, as well as their contributing historic properties, will not be affected.

Therefore, the Undertaking would not cause an adverse effect to the character of historic properties under this criterion.

### **Criterion v. Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.**

Under the conditions described for the Undertaking, the majority of visual, atmospheric, and audible elements that are associated with the Undertaking will occur during the construction phase. As part of the construction phase, all atmospheric and audible elements will be temporary in nature and will have no lasting effect on the integrity of any of the identified historic properties. Portions of the aircraft parking aprons will be used as staging sites during construction; however, upon completion of the Undertaking, all construction-related implements that would visually detract from the flat

expansive characteristics of the aprons will be removed; there will be no lasting effect on the integrity of the aircraft parking aprons. As for visual elements that have the potential to diminish the integrity of historic properties, this is limited to the at-grade penetrations associated with the construction of both pathways. As described under previous criteria, pavings removed at the aircraft parking aprons of the Expanded NAS Sunnyvale Historic District, and along the significant roadways throughout the NASA Ames Wind Tunnel Historic District, would be replaced in kind prior to the completion of the undertaking. All new conduit paths along the NASA Ames Switchgear pathway where a potential to physically impact landscape features will be rerouted and sited along adjacent paved areas; no significant trees, shrubs, or lawns will be affected by the Undertaking.

Although the permanent work of the Undertaking will be located below grade and out of sight, some at-grade elements will be constructed and remain visible following the completion of the Undertaking – namely utility access hatches, switchgear equipment, and connections to existing on-site transformers and/or substations. The few permanent above ground elements would be minimal in scale, would have an industrial aesthetic, and would have infrastructural qualities that would not visually detract from the character of the historic properties. As such, the completed Undertaking will not diminish the integrity of any of the identified historic properties. Therefore, the Undertaking would not cause an adverse effect to historic properties under this criterion.

**Criterion vi. Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization.**

The Undertaking would not involve the neglect of a property that causes its deterioration and therefore would not cause an adverse effect to historic properties under this criterion.

**Criterion vii. Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.**

The Undertaking would not involve the transfer, lease, or sale of property out of Federal ownership or control and therefore would not cause an adverse effect to historic properties under this criterion.

#### **Summary of Finding of Effect Analysis**

The analysis provided in this section demonstrates that the proposed Undertaking would have no direct adverse effects. Although historic properties were identified in the direct APE, all proposed work complies with the Secretary of the Interior's Standards for Rehabilitation, the other Section 800.5(a)(2) criterion, and would not alter the character and integrity of said properties, nor their ability to convey historic significance. The APE contains historic properties, but the Undertaking would not result in any change to the character of a property's use or of physical features within a property's setting that contribute to its historic significance, and would not introduce visual, atmospheric, or audible elements that would diminish the integrity of a property's significant historic features. For these reasons, Page & Turnbull concludes that the Undertaking would result in no adverse effects on historic properties, and recommends a finding of No Adverse Effect.

## **V. CONCLUSION**

The Undertaking, involving the construction of the MFA Electrical-Telecommunications Infrastructure, would not have the potential to alter, directly or indirectly, any of the characteristics that qualify a historic property for inclusion in the National Register. After consideration of the criteria of adverse effect, pursuant to 36 CFR Part 800.5(b), this analysis concludes that the Undertaking will result in no adverse effects on historic properties. As such, Page & Turnbull recommends a finding of No Adverse Effect.

## **APPENDIX A: MAPS**

- A-1 Map of the Undertaking.
- A-2 The Undertaking's Area of Potential Effects (APE) and Identified Historic Properties.
- A-3 Historic Properties Located within the Expanded NAS Sunnyvale Historic District at Moffett Federal Airfield (MFA).
- A-4 Historic Properties Located within NASA ARC.
- A-5 Key Map for Area of Direct Impact (ADI) Figures.
- A-6 ADI Map for MFA-Bay View Pathway, North Alignments.
- A-7 ADI Map for MFA-Bay View Pathway, South Alignments.
- A-8 ADI Map for NASA Ames Switchgear Pathway, NASA Ames Campus Alignments.
- A-9 ADI Map for NASA Ames Switchgear Pathway, Shenandoah Plaza Alignment.
- A-10 ADI Map for NASA Ames Switchgear Pathway, South MFA Alignment.

This section includes confidential information  
and has been removed for circulation purposes.

**The following content was redacted from this public posting:**

Figure A-1: Map of the proposed Undertaking  
Figure A-2: The Undertaking's Area of Potential Effects (APE)  
and identified historic properties



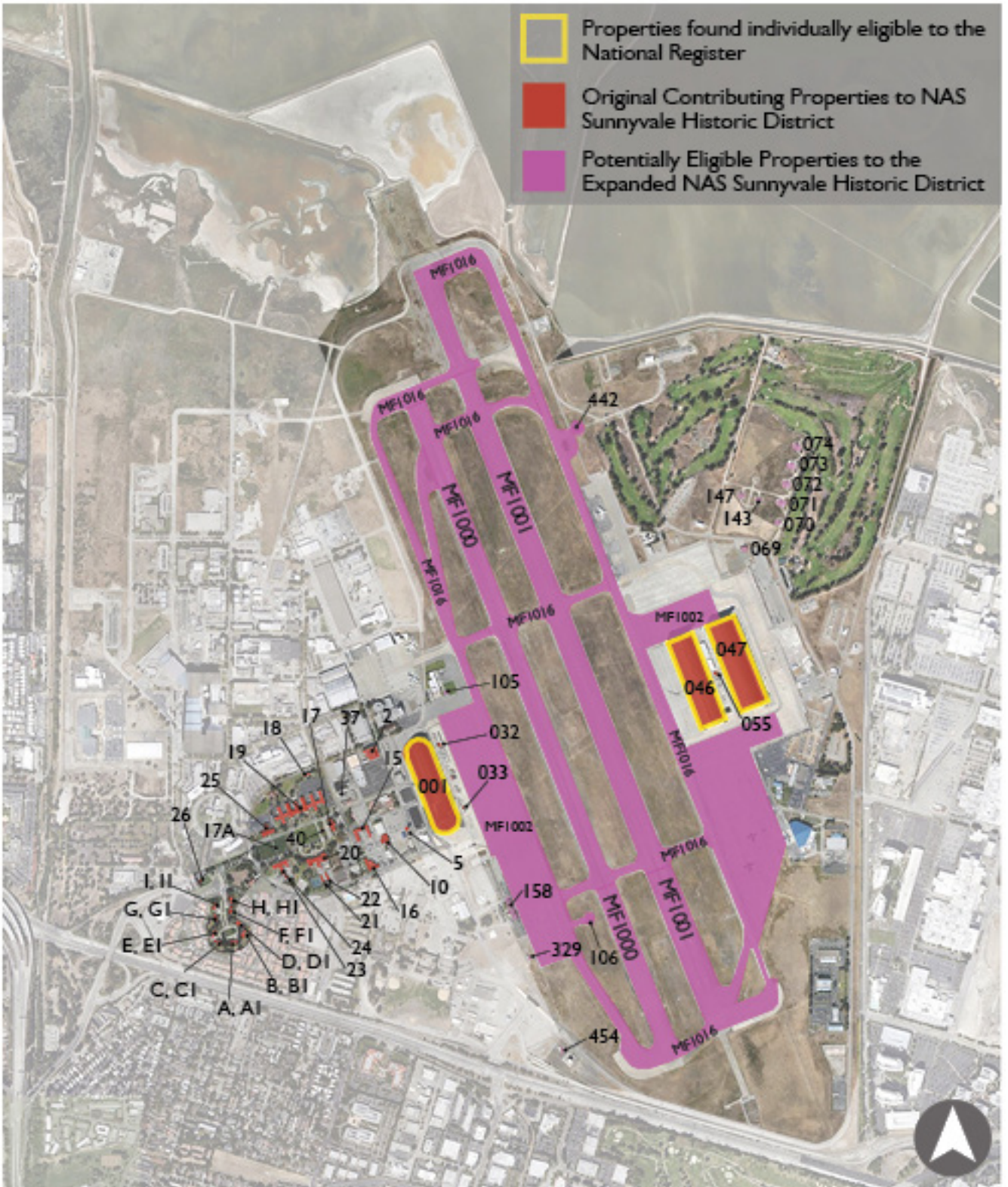


Figure A-3: Historic properties located within the Expanded NAS Sunnyvale Historic District at Moffett Federal Airfield (MFA).  
Source: Page & Turnbull, 2016.



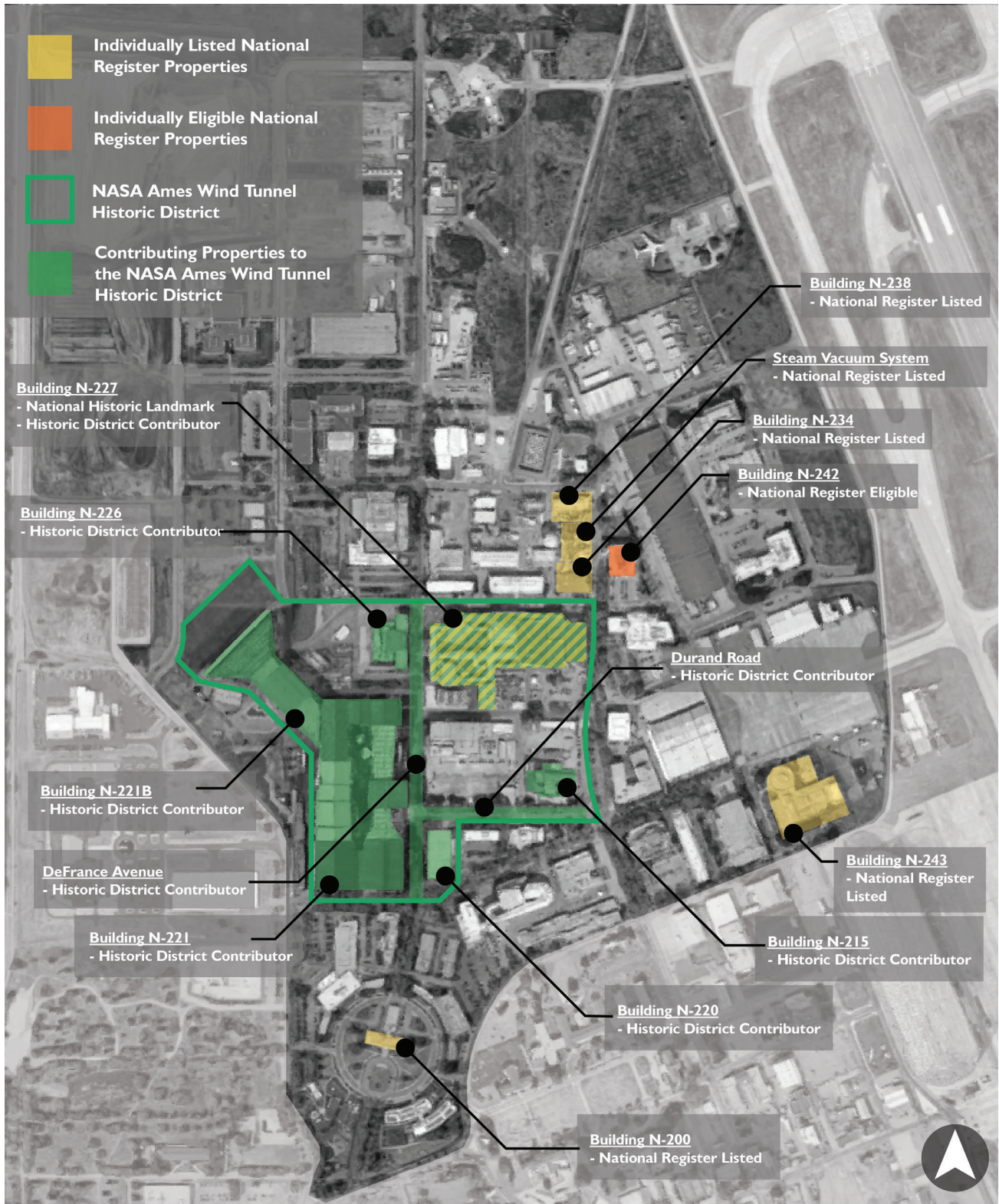


Figure A-4: Historic properties located within the NASA Ames Campus. Source: Page & Turnbull, 2016.

**The following content was redacted from this public posting:**

Figure A-5: Key Map for Area of Direct Impact (ADI) Figures

Figure A-6: ADI Map for MFA-Bay View Pathway, North Alignments

Figure A-7: ADI Map for MFA-Bay View Pathway, South Alignments

Figure A-8: ADI Map for NASA Ames Switchgear Pathway,  
NASA Ames Campus Alignment

Figure A-9: ADI Map for NASA Ames Switchgear Pathway,  
Shenandoah Plaza Alignment

Figure A-10: ADI Map for NASA Ames Switchgear Pathway, South MFA Alignment

**APPENDIX B: ARCHAEOLOGY TESTING REPORT**

William Self Associates, Inc. "Archaeological Testing Report: MFA Electrical-Telecommunications Infrastructure Project, Santa Clara County, California." (January 2017).

This section includes confidential information  
and has been removed for circulation purposes.

**Archaeological Testing Report**  
**MFA Electrical-Telecommunications Infrastructure Project**  
**Santa Clara County, California**



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January 2017

**Archaeological Testing Report**  
**MFA Electrical-Telecommunications Infrastructure Project**  
**Santa Clara County, California**

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January 2017



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## Executive Summary

Page & Turnbull contracted with WSA, Inc. to conduct archaeological survey and testing for the PV Moffett Federal Airfield (MFA) Electrical-Telecommunications Infrastructure Project (Undertaking) at NASA Ames Research Center, Moffett Field, Santa Clara County, California (ARC). This work was undertaken pursuant to Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended), and was overseen by the National Aeronautics and Space Administration (NASA). The Undertaking is located within the Planetary Ventures (PV) leasehold and NASA property at MFA, and includes installation of new electrical and telecommunications pathways in order to fulfill the utilities separation requirement established in the PV lease. Approximately 15,000 linear feet of new electrical duct bank and 20,000 linear feet of new telecommunications duct bank will be installed between 3 and 15 feet below ground surface.

This report describes and interprets the findings of the archaeological survey and testing program conducted between November 21 and December 21, 2016. The testing program was developed in response to proposed Undertaking impacts, which include trenching, directional drilling, and excavation for drilling pits, receiving pits, and maintenance vaults along the utility alignment to be shared by the electrical and telecommunications conduits.

Archaeological testing for the Undertaking was conducted according to an approved Archaeological Work Plan (AWP) prepared by WSA. Based on research presented in the AWP, WSA proposed a preconstruction archaeological testing strategy consisting of 20-foot deep cores placed within archaeologically sensitive areas and in areas that had not previously been subject to archaeological survey or testing. The purpose of the archaeological testing program was to determine to the extent possible the presence or absence of archaeological resources within the Undertaking alignment, and to identify and evaluate whether any archaeological resources in the Undertaking alignment constitute a historic property under Section 106 of the NHPA.

WSA archaeologists conducted a pedestrian survey of the Undertaking area on November 21-22, 2016, and conducted the coring on December 7-8 and 20-21, 2016. No prehistoric or historic period archaeological deposits were encountered during survey or subsurface testing.

## 1.0 Description of the Undertaking

PV proposes to install new electrical and telecommunications pathways in the MFA Lease and NASA properties in order to fulfill the utilities separation requirement established in the MFA lease. The MFA–Bay View pathway will involve an electrical line leading from the east side of campus, at the existing Moffett Substation, westward across the parking apron north of Hangars 2 and 3, and underneath the runways of the airfield. On the west side of the airfield, the pathway will diverge north along Zook Road to serve the Bay View campus, and south, parallel to the runways, to serve PV buildings at MFA. The telecom line will parallel much of the MFA-Bay View electrical line, although an extension will continue southeast beyond the existing Moffett Substation, along the majority of Macon Road at the east perimeter, exiting NASA property at ARC due east of the southern California Air National Guard (CAANG) Facilities, adjacent to 11th Avenue in Sunnyvale, to connect with the outlying system.

The NASA Ames Switchgear pathway will extend from the existing Switchgear C, located at the southern end of NASA ARC, adjacent to Dailey Road. The switchgear will follow Dailey Road north, traversing northwest across the Shenandoah Plaza portion of MFA along McCord Avenue; a small spur line will extend northeast from the primary pathway – between Wescoat Road and South Akron Road – towards Building 10, which will house new switchgear equipment. The northwest trajectory of the primary pathway will continue into the NASA Ames Campus to reach the existing NASA Ames Substation (Building N-225B). Three alternate routes are being considered for the route of this pathway through the NASA Ames Campus, between McCord Avenue and Building N-225B:

- 1) Alternative 1 would turn west from McCord Avenue and would follow Durand Road to its termination point at DeFrance Avenue; it would then turn north and follow DeFrance Avenue to its intersection with Parsons Avenue. The pathway would then turn west and follow Parsons Avenue to connect with Building N-225B.
- 2) Alternative 2 would turn southwest from McCord Avenue and would follow King Road to its intersection with DeFrance Avenue. It would then turn north and follow DeFrance Avenue to its intersection with Parsons Avenue. The pathway would then turn west and follow Parsons Avenue to connect with Building N-225B.
- 3) Alternative 3 would turn northeast from McCord Avenue and would follow King Road to its intersection with F Lane. It would then turn northwest and follow F Lane before turning directly west towards the intersection of Servryns/Warner Road and McCord Avenue. The pathway would turn north and follow McCord Avenue to Boyd Road. It would then turn west and follow Boyd Road (which continues to Parsons Avenue) to connect with Building N-225B.

Alternative 2 is considered the preferred route for the NASA Ames Switchgear pathway through the NASA Ames Campus. However, as a final determination has not yet been made regarding the route that will be used, this report includes consideration of alignments for all three options.

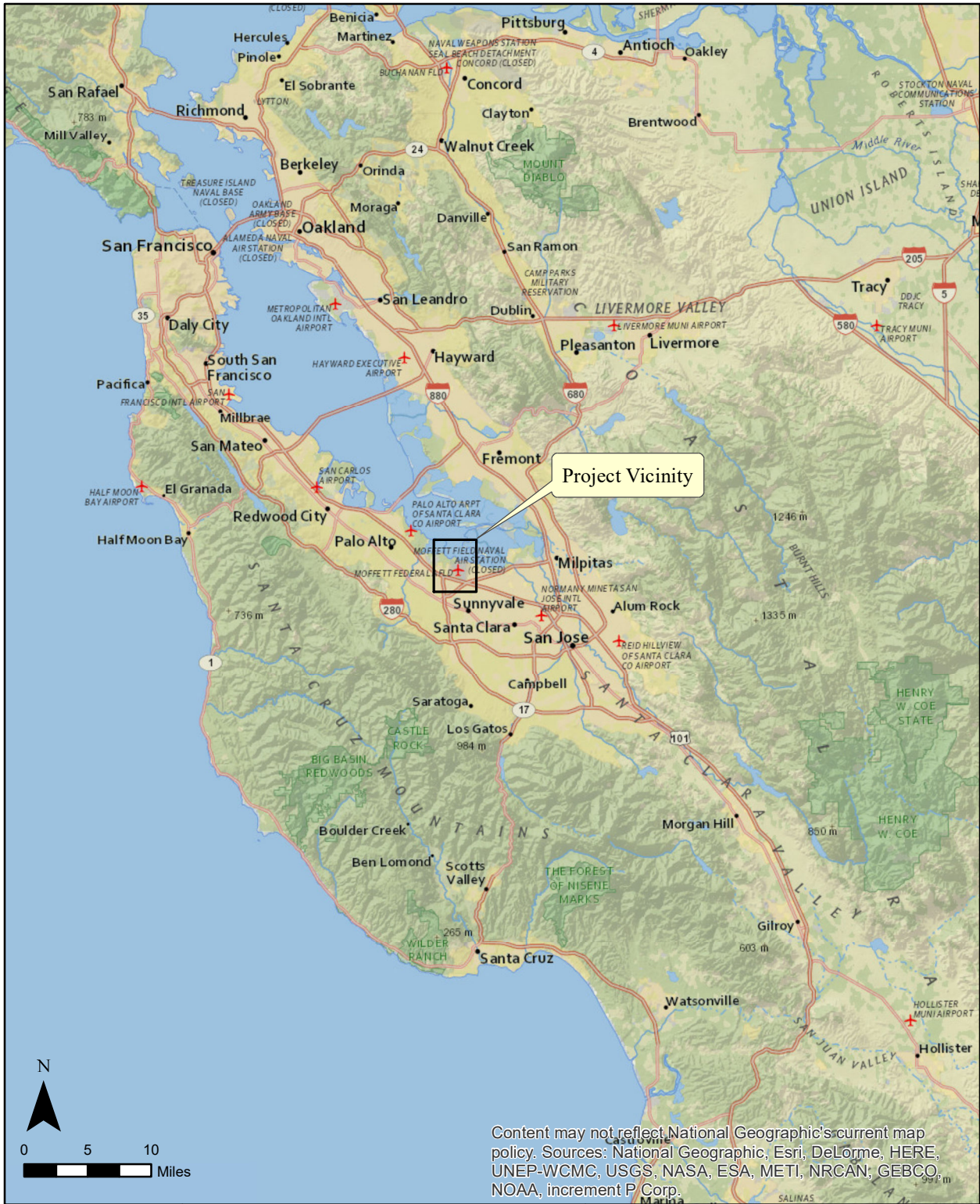
Electrical system installation will consist of approximately 15,000 linear feet of new duct bank with depths varying from 3 feet to 15 feet below ground surface, to provide service from the existing Moffett substation to the Bay View lease area and MFA loads. Pre-cast concrete vaults will be placed every 400 feet, or where the cumulative number of bends in a segment exceeds 270 degrees, to facilitate cable pulling and system maintenance. Existing underground electrical duct banks will be used where possible; however, new duct banks will be required in some areas.

Telecommunication system installation will consist of approximately 20,000 linear feet of conduit duct bank with depths varying from 3 feet to 15 feet below surface, bored parallel to the proposed electrical installation with a minimum of 3 feet horizontal and 1 foot vertical separation from other utilities. Pre-cast concrete vaults will be placed every 400 feet, or where the cumulative number of bends in a segment exceeds 180 degrees, to facilitate cable pulling and system maintenance.

The purpose of the archaeological coring program was to identify the presence or absence of subsurface prehistoric and historic-period materials in portions of the proposed utility alignment that are archaeologically sensitive due to proximity to previously recorded sites or mapped locations of historic-period structures or that have not previously been subject to archaeological survey or testing.

## **2.0 Location and Environment**

The Undertaking area is located on the southern portion of the San Francisco Peninsula, which lies along the southwest boundary of the San Francisco Bay (Figures 1-3). The Undertaking area ecology, though heavily impacted by dense urban development, is coastal littoral, which consists of land strips along the coast that are characterized by a series of microenvironments including estuaries, bays, marshes, and grassy terraces (Chartkoff and Chartkoff 1984). Common vegetation throughout the area includes valley oak (*Quercus lobata*), live oak (*Quercus agrifolia*), California buckeye (*Aesculus californica*), California bay laurel (*Umbellularia californica*), star thistle (*Centaurea solstitialis*), wild oats (*Avena fatua*), morning glories (*Convolvulus*), lupine (*Lupinus*), poppies (*Papaver*), wild artichokes (*Cynara scolymus*), and various other native and imported grasses. Animal life within the region is diverse. While animals such as pronghorn sheep, antelope, tule elk, mule deer, black-tail deer, and grizzly bear occupied the area throughout prehistory, the region today favors small, herbivorous mammals, especially voles, pocket gophers, ground squirrels, and



**Project Vicinity Map**

**Figure 1**  
**MFA Electrical-Telecommunications**  
**Infrastructure Project**  
**Page & Turnbull**  
**Santa Clara County, CA**





Project Area Map

Figure 2  
MFA Electrical-Telecommunications  
Infrastructure Project  
Page & Turnbull  
Santa Clara County, CA

**The following content was redacted from this public posting:**

Project Location map

pocket mice (*Brown* 1985). The few larger, open areas in the region attract some larger animals including deer, rabbit, skunk, opossum, raccoon, and a number of birds including red-tailed hawks and turkey vultures.

### **3.0 Cultural Setting**

#### **3.1 Prehistoric Archaeological Context**

Research into local prehistoric cultures in the San Francisco Bay Area began formally when Nels C. Nelson of the University of California conducted his first intensive archaeological surveys of the region from 1906 to 1908. Nelson documented 425 shellmounds along the Bay shoreline and adjacent coast when the Bay was still ringed by salt marshes up to five miles wide (Nelson 1909). He maintained that the intensive use of shellfish, a subsistence strategy reflected in both coastal and bay shoreline middens, indicated a general economic unity in the region during prehistoric times, and he introduced the idea of a distinct San Francisco Bay archaeological region (Moratto 1984:227).

In 1911, Nelson supervised excavations at CA-SFR-7 (the Crocker Mound) near Hunter's Point in San Francisco County, a site that was later dated from 1050 B.C. to A.D. 450. Llewellyn L. Loud identified archaeological components from the same period in Santa Clara County in 1911 while excavating at CA-SCL-1 (the Ponce, Mayfield, or Castro Mound site) (Loud 1912). R. J. Drake recognized comparably dated archaeological components in San Mateo County in 1941–1942 at CA-SMA-23 (Mills Estate) in San Bruno (Moratto 1984:233).

Conducted more or less independently from the work of Nelson and Loud, investigations into the prehistory of the Central Valley of California, presaged by early amateur excavations in the 1890s, began in earnest in the 1920s. In the early 20th century, Stockton-area amateur archaeologists J. A. Barr and E. J. Dawson separately excavated a number of sites in the Central Valley and made substantial collections. On the basis of artifact comparisons, Barr identified what he believed were two distinct cultural traditions, an early and a late. Dawson later refined his work and classified the Central Valley sites into three “age-groups” (Schenck and Dawson 1929:402).

Professional or academic-sponsored archaeological investigations in central California began in the 1930s, when J. Lillard and W. Purves of Sacramento Junior College formed a field school and conducted excavations throughout the Sacramento Delta area. By seriating artifacts and mortuary traditions, they identified a three-phase sequence similar to Dawson's, including Early, Intermediate, and Recent cultures (Lillard and Purves 1936). This scheme went through several permutations, including Early, Transitional, and Late Periods (Lillard et al. 1939) and Early, Middle, and Late Horizons (Heizer and Fenenga 1939). In 1948 and



again in 1954, Richard Beardsley refined this system and extended it to include the region of San Francisco Bay (Beardsley 1948, 1954). The resulting scheme came to be known as the Central California Taxonomic System (CCTS) (Fredrickson 1973; Hughes 1994:1). Subsequently, the CCTS system of Early, Middle, and Late Horizons was applied widely to site dating and taxonomy throughout central California. This system focused on the archaeology of the Delta region, with its more established tradition of archaeological investigations of rich archaeological sites, to set the standard by which other regions were assessed. Resulting explanations of regional prehistory and culture change tended to place the Delta as the earlier center for interaction, change, and development, with the Bay Area following on a separate, somewhat different path.

As more data were acquired through continued fieldwork, local exceptions to the CCTS were discovered. The accumulation of these exceptions, coupled with the development of radiocarbon dating in the 1950s and obsidian hydration analysis in the 1970s, opened up the possibility of dating deposits more accurately. Much of the subsequent archaeological investigation in central California focused on the creation and refinement of local versions of the CCTS.

Citing limitations with the existing classificatory schemes, Ragir (1972) adopted a new set of terms for describing archaeological cultures based on their localities. Around this same time, a series of workshops was convened to discuss concerns in California archaeology, including revisions to the CCTS (Fredrickson 1973:88-91). In his doctoral dissertation, Fredrickson (1973) reviewed the state of archaeology in California. Adopting some of the revisions agreed upon at the workshops as well as incorporating modifications employed by Ragir and Bennyhoff, Fredrickson (1973) suggested an alternative way of classifying the prehistory of California. Fredrickson (1973:113-114) proposed four “major chronological periods” in prehistoric California: the Early Lithic Period (described as hypothetical), a Paleoindian Period, an Archaic Period, and an Emergent Period. The Archaic and Emergent Periods were further divided into Upper and Lower periods. Subsequently, Fredrickson (1974, 1994) revised the findings and concepts discussed in his doctoral dissertation, further subdividing the Archaic into Lower, Middle, and Upper.

Various modifications of the CCTS (e.g., Bennyhoff and Hughes 1987; Fredrickson 1973, 1974; Milliken and Bennyhoff 1993) sustain and extend the system’s usefulness for organizing our understanding of local and regional prehistory in terms of time and space. The cultural patterns identified in the Bay Area that, in a general way, correspond to the CCTS scheme are the Berkeley and Augustine patterns. Dating techniques such as obsidian hydration analysis or radiometric measurements can further increase the accuracy of these assignments.

The Early Berkeley Pattern has been dated from at least 3000 B.C. in the east San Francisco Bay (e.g., Alameda County, where the earliest Early Berkeley sites appear) (Hughes 1994), with the number of sites increasing through A.D. 1 (Moratto 1984:282). Late Berkeley Pattern (500 B.C. - A.D. 1000) sites are much more common and well documented, and, therefore, better understood than the Early Berkeley Pattern sites. Berkeley Pattern sites are scattered in more diverse environmental settings, but riverine settings are prevalent.

It is during this period that the Bay Area shellmounds were inhabited (Lightfoot and Luby 2002), and deeply stratified shellmound deposits that developed over generations of occupation are common to Berkeley Pattern sites.

The Augustine Pattern coincides with the Late Period, ranging from as early as A.D. 700 to about A.D. 1800. Intensive fishing, hunting, and gathering (especially of acorns) typify this period, as well as a large population increase, expanded trade and exchange networks, increased ceremonialism, and the practice of cremation, in addition to flexed burials. Beginning in the last quarter of the 18th century, the Augustine Pattern was disrupted by the Spanish explorers and the mission system (Moratto 1984:283).

Most recently, Milliken et al. (2007:99-123) developed what they term a “hybrid system” for the San Francisco Bay Area, combining the Early-Middle-Late Period temporal sequence with the pattern-aspect-phase cultural sequence. Following Fredrickson, Milliken et al. (2007:103) define patterns as “units of culture marked by distinct underlying economic modes, technological adaptations, and ceremonial practices.” The aspect is defined as a local variation in a major economic pattern, with a sequence of phases within a particular district representing an aspect. Following Willey and Phillips (1958), phases represent the smallest units of related site components “spatially limited to the order of magnitude of a locality or region and chronologically limited to a relatively brief interval of time” (Milliken et al. 2007:103).

Milliken et al.’s (2007) San Francisco Bay Area Cultural Sequence includes:

Early Holocene (Lower Archaic ) from 8000 to 3500 B.C.

Early Period (Middle Archaic) from 3500 to 500 B.C

Lower Middle Period (Initial Upper Archaic) from 500 B.C. to A.D. 430

Upper Middle Period (Late Upper Archaic) from A.D. 430 to 1050

Initial Late Period (Lower Emergent) from A.D. 1050 to 1550

Terminal Late Period, post-A.D. 1550

There is no discussion in this report of pre-8000 B.C., as no archaeological evidence dating to this early time period has been located in the Bay Area. Milliken et al. (2007) posit that this dearth of archaeological material may be related to subsequent environmental changes that submerged sites, buried sites beneath alluvial deposits, or destroyed sites through stream erosion. A summary of the approach presented by Milliken et al. (2007) follows.

Beginning around 3500 B.C., evidence of sedentism, interpreted to signify a regional symbolic integration of peoples, and increased regional trade, emerges in the form of new ground stone technology and the introduction of cut-shell beads into burial contexts (Milliken et al. 2007:114). This Early Period lasted until ca. 500 B.C. The earliest mortar and pestles found so far date to post-4000 B.C., with wood mortars dating to 3800 B.C. found in the vicinity of the Los Vaqueros reservoir. By 1500 B.C., mortars and pestles replaced milling slabs and handstones at some East Bay sites. Sedentism or semi-sedentism is in evidence in the East Bay during this period in the form of burial complexes with associated ornamental grave goods, such as were found at West Berkeley, Ellis Landing, and Pacheco shellmounds, and house floors with postholes, as have been found at the Rossmoor site near Walnut Creek (Milliken et al. 2007:115; Price et al. 2006).

Milliken et al. (2007:115) identify “a major disruption in symbolic integration systems” circa 500 B.C., marking the beginning of the Lower Middle Period (500 B.C. to A.D. 430). Changes included the disappearance of rectangular shell beads and introduction of split-beveled and small saucer Olivella beads (inferred to represent some of the earliest religious artifacts), which appear around the Early/Middle Transition bead horizon. The Upper Middle Period (A.D. 430 to 1050) is marked by the collapse of the Olivella saucer bead trade in central California, an increase in the occurrence of sea otter bones in those sites that were not abandoned, and the spread of the extended burial mortuary pattern characteristic of the Meganos complex into the interior East Bay.

The Initial Late Period, dating from A.D. 1050 to 1550, is characterized by increased manufacture of status objects. In lowland, central California during this period, Fredrickson (1973 and 1994, quoted in Milliken et al. 2007:116) noted evidence for increased sedentism, the development of ceremonial integration, and status ascription. The beginning of the Late Period (ca. A.D. 1000) is marked by the Middle/Late Transition bead horizon. Well-fashioned “show” mortars, new Olivella bead forms, and a variety of Haliotis ornaments with multiperforated and bar-scored forms appear during this period. These new artifact forms are reflective of the beginning of the Augustine Pattern, while those features of the classic Augustine Pattern, such as the arrow, banjo effigy ornaments, the flanged pipe, and Olivella callus cup beads (post-A.D. 1250). Coincident with the introduction of the bow and arrow, Napa Valley obsidian manufacturing debitage increased markedly in the interior East Bay, while there was a striking decrease in biface manufacture and debitage at Napa Valley Glass

Mountain quarries. In the South Bay, however, local Franciscan chert continued to be used and completed obsidian projectile points were traded in from the north. Social stratification is evident in the introduction or, in some areas, reintroduction of partial cremations with high-status grave goods. In addition, the variety of status goods included in interments and in association with cremations of high-status individuals increased (Milliken et al. 2007:117).

Olivella sequin and cup beads disappear circa A.D. 1500 to 1550, marking the beginning of the Terminal Late Period. Clamshell disk beads were traded across the North Bay during this period, although there is no evidence that they spread south of the Carquinez Strait at this time. The earliest clamshell disks south of the Carquinez Strait date to A.D. 1670 in Contra Costa County. Sometime between A.D. 1500 and 1650, fewer beads appear as grave goods, and only Olivella lipped and spire-lopped beads appear in South Bay and Central Bay interments. Other changes occurred around the San Francisco Bay Area during this period. Clamshell disk beads, magnetite tube beads, the toggle harpoon, hopper mortars, plain, corner-notched, arrow-sized, projectile points, and secondary cremation initially appear in the North Bay during the Terminal Late Period. The hopper mortar did not extend into the Central or South Bay, although plain, corner-notched, projectile points did begin appearing in the Central Bay. Desert side-notched points spread from the Central Coast into the South Bay (Milliken et al. 2007:117).

### **3.2 *Ethnographic Context***

There is a considerable body of ethnographic literature regarding the Native American inhabitants of the Project area. This section provides a brief summary of that ethnography and is intended to provide a general background only. For a more extensive review of Ohlone ethnography, see Bocek (1986); Cambra et al. (1996); Kroeber (1925); Levy (1978); Milliken (1983); and Shoup et al. (1995).

The Project area lies within the region occupied by the Ohlone or Costanoan group of Native Americans at the time of historic contact with Europeans (Kroeber 1925:462-473). Although the term Costanoan is derived from the Spanish word *Costaños*, or “coast people,” its application as a means of identifying this population is based in linguistics. The Costanoans spoke a language now considered one of the major subdivisions of the Miwok-Costanoan, which belonged to the Utian family within the Penutian language stock (Shiple 1978:82-84). Costanoan actually designates a family of eight languages, which were spoken by tribal groups occupying the area from the Pacific Coast to the Diablo Range, and from San Francisco to Point Sur. Modern descendants of the Costanoan prefer to be known as Ohlone. The name Ohlone is derived from the Oljon group, which occupied the San Gregorio watershed in San Mateo County (Bocek 1986:8). The two terms (Costanoan and Ohlone) are used interchangeably in much of the ethnographic literature.

On the basis of linguistic evidence, it has been suggested that the ancestors of the Ohlone arrived in the San Francisco Bay area about 1,500 years ago, having moved south and west from the Sacramento-San Joaquin Delta region. The ancestral Ohlone displaced speakers of a Hokan language and were probably the producers of the artifact assemblages that constitute the Augustine pattern described above (Levy 1978:486).

Although linguistically related as a family, the eight Costanoan languages actually comprised a continuum in which neighboring groups could probably understand each other. Beyond neighborhood boundaries, however, each group's language was likely unrecognizable to the other. Each of the eight language groups was subdivided into smaller village complexes or tribal groups that operated as independent political entities, each occupying specific territories. Each group controlled access to the natural resources of the territories. Although each group had one or more permanent villages, their territory contained numerous smaller campsites used as needed during a seasonal round of resource exploitation.

Extended families lived in domed structures thatched with tule, grass, wild alfalfa, or ferns (Levy 1978:492). Semisubterranean sweathouses were built into pits excavated next to stream banks and covered with a structure. The tule raft, propelled by double-bladed paddles similar to those that were used in the Santa Barbara Channel Island region, was used to navigate across San Francisco Bay (Kroeber 1925:468).

The Ohlone utilized the marine and riverine resources of the San Francisco Bay and nearby creeks. These areas were important sources for seasonal foods such as migratory waterfowl and shorebirds, which provided protein-rich supplements to the typical aboriginal diet of greens, roots and bulbs, seeds, and acorns, as well as fish (Levy 1978). Mussels were an important staple in the Ohlone diet as were acorns of the coast live oak, valley oak, tanbark oak, and California black oak. Seeds and berries, roots and grasses, as well as the meat of deer, elk, grizzly, rabbit, and squirrel formed the Ohlone diet. Careful management of the land through controlled burning served to insure a plentiful and reliable source of all these foods (Levy 1978:491).

The Ohlone usually cremated a corpse immediately upon death, but the body was interred if there were no relatives to gather wood for the funeral pyre. Mortuary goods comprised most of the personal belongings of the deceased (Levy 1978:490).

The arrival of the Spanish in the San Francisco Bay Area led to a rapid and major reduction in native California populations. Diseases, declining birth rates, and the effects of the mission system served to largely eradicate their traditional lifeways (which are currently experiencing resurgence among Ohlone descendants). Brought into the missions, the surviving Ohlone, along with former neighboring groups of Esselen, Yokuts, and Miwok, were transformed from hunters and gatherers into agricultural laborers (Levy 1978; Shoup et al. 1995). With

the secularization of the mission system by an independent Mexico in the 1830s, numerous ranchos were established. Generally, the few Indians who remained were then forced, by necessity, to work on the ranchos.

Today, descendants of the Ohlone live throughout the Bay Area. Several Ohlone groups (e.g., Muwekma, Amah Mutsun) have banded together to seek federal recognition. Many Ohlone, both as individuals and as groups, are active in preserving and reviving elements of their traditional culture, such as dance, basketry, and song, and are active participants in the monitoring and excavation of archaeological sites.

### **3.3 *Historic Period Context***

The historical background of the region and study area was compiled from primary and secondary sources including Shoup et al.'s *Inigo of Rancho Posolmi* (1995), Hyding's *From Frontier to Suburb* (1984), the County of Santa Clara Historic Context Statement prepared by Archives and Architecture, LLC in 2004 and updated in 2012.

#### Regional History

The 1769 expedition led by Captain Gaspar de Portola initiated the period of contact between Spanish colonists and the native people of the Santa Clara Valley. The Portola party reached the Santa Clara Valley in the fall of that year, camping on San Francisquito Creek, northwest of the Undertaking area. Father Juan Crespí, who recorded the details of the expedition, wrote:

At once upon our reaching here, several very well-behaved heathens, most of them well-bearded, came to the camp, giving us to understand that they were from three different villages, and I do not doubt there must be many of these, from the many smokes seen in different directions (Crespí in Stanger and Brown 1969:105 in Shoup et al. 1995:22).

A year later, Pedro Fages led an expedition that explored the eastern shore of San Francisco Bay, eventually reaching the location of modern-day Fremont, where they traded with the local native people. In 1772, a second Fages expedition traveled from Monterey passing through the Santa Clara Valley (Levy 1978:398). After passing northward through the region in March, they explored the Diablo Valley and returned south through the Santa Clara Valley in early April:

We encountered heathen who as soon as they saw us got scared and ran inside their two little houses. (I wanted to give them) some little strings of beads, but there was no way we could make them receive the gift (Fages 1972 [1772]:354 in Shoup et al. 1995:23).

In 1774, Captain Fernando Rivera y Moncada, while scouting locations for a mission and military installment, encountered local Indian people in the Santa Clara Valley. In 1776, a mission scouting expedition under the leadership of Juan Bautista de Anza and Friar Pedro Font traveled through the same area and also traded with residents of native villages encountered along the way (Bolton 1930). Font recorded that the party had observed 100 native people while traveling through the Santa Clara Valley (Font 1930[1776]:324 in Shoup et al. 1995:25).

The first mission in the San Francisco Bay Area was established in San Francisco with the completion of Mission San Francisco de Asis (Mission Dolores) in 1776. Mission Santa Clara de Asis followed in 1777, and Mission San Jose in 1797. The missions relied on the Native American population both as their source of Christian converts and their primary source of labor. Diseases introduced by the early expeditions and missionaries, and the contagions associated with the forced communal life at the missions, resulted in the death of a large number of local peoples. Cook (1943) estimates that by 1832, the Ohlone population had been reduced from a high of over 10,000 in 1770 to less than 2,000.

Mission Santa Clara, founded in 1777, controlled much of the land of the Santa Clara Valley (approximately 80,000 acres) until the 1830s. Mission lands were used primarily for the cultivation of wheat, corn, peas, beans, hemp, flax, and linseed, and for grazing cattle, horses, sheep, pigs, goats, and mules. In addition, mission lands were used for growing garden vegetables and orchard trees such as peaches, apricots, apples, pears, and figs.

Within a period of 25 years after the founding of Mission Santa Clara, most local native peoples had been affected by the presence of the missionaries. Though some Indians gave up their traditional way of life by choice, many were coerced, manipulated, and forced to the mission. By the mid-1790s, the traditional Ohlone economy had been significantly disrupted. Native populations outside the Mission had suffered losses to Spanish disease, a decline in food resources, a disrupted trade system, and a significant drought in 1794. “Perhaps knowing or sensing the Indians’ new vulnerability, it was precisely at this point in time that both aggressive preaching and violence were used to encourage conversion” (Shoup et al. 1995:45). Mission records of 1794 and 1795 show that 586 Native Indians were baptized. While earlier baptisms were composed primarily of children, 80 percent of the converts during this period were adults. The independent tribal elders had finally been brought into the mission system.

The next several decades represent a time of relative stability throughout the Santa Clara Valley. During this period, the Spanish and Mexican population outside of the Mission grew in numbers, power, and prosperity, and Mexico, having gained its independence from Spain, began administering the 21 California missions. By the 1820s, when American trappers began exploring the region, Indians of the San Jose and Santa Clara missions began to rebel



(Shoup et al 1995:83). The rebellion was led by Indian chieftain Estanislao and his companion Cipriano, and the confrontations that took place in the summer of 1829 resulted in casualties for both the Indian rebels and the soldiers serving the mission (Shoup et al. 1995:86). The fact that Indian people who had maintained long-term relationships with local missions were motivated to rebel against them reflected poorly on the institution's success, and signaled the beginning of the final chapter in Mission Santa Clara's long existence (Shoup et al. 1995:87-89).

The Mexican government began the process of secularizing mission lands in the 1830s. The secularization of the mission lands was decreed in 1834, but the process did not get underway at Mission Santa Clara until 1837. Within a few years, the lands of all 21 missions were expropriated in the form of land grants. Despite regulations that stipulated that the land grants were to be distributed fairly, recipients of the land grants were primarily Californios who had allied themselves with Jose Ramon Estrada, Governor Juan Bautista Alvarado's brother-in-law, who oversaw the process (Shoup et al. 1995:98-99). By 1845, eight land grants of the former Mission Santa Clara lands were formally awarded to Californios and their Anglo allies (54,284 acres); four were awarded to Mission Indians (11,917 acres) (Shoup et al. 1995:104). The study area was located on land in between two rancho land grants: Rancho Pastoria de las Borregas to the west and Rancho Ulistac to the east.

With their victory in the Mexican-American War (1846-1848), the United States took possession of California and Anglo-European settlers began to arrive in the Santa Clara Valley. The 1849 Gold Rush brought an unprecedented wave of settlers, many of whom acquired land and turned their attention to agriculture. In November of 1849, San Jose became the first capital of the State of California. The following decades were marked by a transition from the ranching economy favored by Spanish and Mexican landholders to an economy based at first on grain agriculture, such as wheat, then increasingly on orchard and specialty vegetable agriculture.

While there had been a flood of immigrants into California during the Great Depression, the influx during World War II was substantially greater. The defense industry expanded and cities surrounding the San Francisco Bay developed rapidly (Kyle 1990: xvi). New shipyards came into existence, the number of factories in use increased by a third, and the population of industrial workers more than doubled (Cole 1988:129). The output of Bay Area shipbuilding facilities - 1,400 vessels during a war that lasted 1,365 days - remains staggering.

California also became an important location for installations of all branches of the United States military during the war. Largely because a portion of the war was fought in the Pacific Theater, and the attack on Pearl Harbor made California a strategic location, the Army, Air Force, Navy, and Marines utilized the human and natural resources of the Bay Area for national defense (Beck and Haase 1988:86-88). As well as the industrial facilities along the

Bay shore, the Alameda Naval Air Station, the Oakland Army Base, Moffett Field, and local Army training camps drew civilian and military families to the communities surrounding the study area.

In addition to heavy industries, such as shipbuilding, high-tech industries such as electronics also expanded rapidly during the war. Later, these firms contributed to the emerging field of communications (Hynding 1984:270). In addition to drawing manpower, the facilities established for the war effort spurred industrial and high-tech research that laid the foundation for today's economy that is increasingly reliant on the innovation of highly skilled workers.

The Undertaking area is located on the northern edge of the modern-day city of Sunnyvale, which was incorporated in 1912. Sunnyvale grew up on former orchard land that was once owned by real estate developer W. E. Crossman. During the last half of the 19th century, the residents of Santa Clara County, then linked to commercial markets via railroads, produced all manner of agricultural goods, including carrots, almonds, tomatoes, prunes, apricots, plums, walnuts, cherries, and pears (NPS 2006). Like much of the San Francisco Bay area, the region remained largely rural until the onset of World War II, which served as a catalyst for both industrialization and then a post-war population and housing boom. The area began taking its current form as technology firms settled in the region first to serve the Navy at the Moffett Federal Airfield and then the growing number of high-tech and aerospace firms that settled in the region.

### History of the Undertaking Area

The Undertaking area lies within the area that once formed part of the Rancho Posolmi, a tract of land that was awarded to Lope Inigo, an Ohlone Indian who had served as alcalde at Mission Santa Clara, in February 1844. With the mass migrations of settlers into the area after the gold rush, Inigo had to contend with squatters who found his land appealing. First among them were John Whisman and his family, who built a home in the southwest corner of his rancho (Shoup et al. 1995:116). By the late 1850s, Robert Walkinshaw, a native of Scotland, had purchased 847.98 acres of Rancho Posolmi. Thomas Campbell had purchased 400 acres, and Inigo held just 448.2 acres (Shoup et al. 1995:117). Though Walkinshaw had purchased a large tract of Inigo's land, historical accounts make it clear that he also befriended him, and likely helped to protect him in the midst of rapid change. Inigo died in February 1864 at the age of 83. According to L.L. Loud, in 1912, he was buried on the smaller Inigo Mound: This was about one-half mile north of the southwestern corner of the Posolmi grant, which was near the Mountain View-Alviso Road. His gravesite was close to where the Walkinshaw family had their ranch complex. The place had been a village site, perhaps the same village where Inigo was born in 1781. He was thus put to rest with many of his own people (Shoup et al. 1995:125).

A series of owners, primarily using the land for agriculture, held Posolmi from the time of Inigo's death to the 1930s. The 1876 Thompson and West atlas map for the Undertaking area notes landowners D. Frink, J. Bailey, E. Jenkins, W. Gallimore, and R. Walkinshaw in the area traversed by the proposed utility installation alignment. According to this map, one building within the E. Jenkins property is immediately adjacent to the proposed utility alignment on Dailey Road, and one building and yard within the J. Bailey property are to the south of a spur in the alignment that connects to Hangar 1. An 1899 USGS Palo Alto 1:62500 topographic quadrangle shows one building to the immediate east of the proposed alignment on Dailey Road between Girard and Edquiba roads, likely the same as that within the Jenkins property on the 1876 map. The 1899 quadrangle also shows two buildings to the west of the proposed alignment along Macon Road, east of Hangars 2 and 3 (building locations are depicted over modern aerial in Figure 4). Several other buildings mapped in the vicinity appear to have been more than 100 feet away from the proposed alignments

The last agricultural owners to reside on Posolmi were the Holthouse family, who bought the land from the Hirsch Land Company in 1919. In 1931, the San Jose Chamber of Commerce raised \$500,000 and purchased 1,000 acres of land, consisting mostly of the Posolmi land grant. The city donated the land to the U.S. Navy who then began construction of the Naval Air Station and Moffett Field. The Holthouse Family retained a small section of land on the eastern edge of Posolmi. They sold it to Lockheed Corporation in the early 1960s, who then constructed the Lockheed Space Center. Today, no structures of the original Posolmi land grant remain.

While there had been a flood of immigrants into California during the Great Depression, the influx during World War II was substantially greater. The defense industry expanded and cities surrounding the San Francisco Bay developed rapidly (Kyle 1990: xvi). New shipyards came into existence, the number of factories in use increased by a third, and the population of industrial workers more than doubled (Cole 1988:129). The output of Bay Area shipbuilding facilities - 1,400 vessels during a war that lasted 1,365 days - remains staggering.

California also became an important location for installations of all branches of the United States military during the war. Largely because a portion of the war was fought in the Pacific theater, and the attack on Pearl Harbor made California a strategic location, the Army, Air Force, Navy, and Marines utilized the human and natural resources of the Bay Area for national defense (Beck and Haase 1988:86-88). As well as the industrial facilities along the Bay shore, the Alameda Naval Air Station, the Oakland Army Base, Moffett Field, and local Army training camps drew civilian and military families to the communities surrounding the Undertaking area. In addition to drawing manpower, the facilities established for the war effort spurred industrial and high-tech research that laid the foundation for today's economy, which is increasingly reliant on the innovation of highly skilled workers.

### 3.4 Previously Recorded Archaeological Sites

WSA implemented a records search encompassing the NASA Ames Research Center (ARC) property in September, 2015 (NWIC File No. 15-0242). The following discussion of previously recorded resources and reports within and adjacent to the proposed Undertaking area is excerpted from those results. Review of the records search results for the NASA ARC property determined that no previously recorded archaeological sites are located directly within the Undertaking area. Eleven previously recorded archaeological sites [REDACTED]

[REDACTED] (Table 1, Figure 4).

[REDACTED], was first recorded as a midden deposit by Llewellyn L. Loud in 1912, although it may have been recorded earlier on Nelson's map of shellmounds from 1909. Loud recorded that he observed skeletal fragments and abalone shell on the surface of the mound and the site was known as the Smaller Inigo Mound. Archaeological work at [REDACTED] has been fairly extensive, although the most concentrated effort took place between May 2006 and February 2008, when WSA carried out archaeological testing, data recovery, and archaeological monitoring in association with the Moffett Towers project [REDACTED] (Arrigoni et al. 2008). Intact basal deposits associated with [REDACTED] representing the northern extent of the archaeological site, were encountered in the southern portion of the Moffett Towers project area. Native American burials (n=37) and prehistoric pit features, unique to the San Francisco Bay area, were recovered. These represented occupation and burial at the site from 800 B.C. to 980 A.D.

Nonhuman prehistoric cultural material recovered at the Moffett Towers site included flaked stone, ground stone artifacts, modified fauna, shell beads, shell ornaments, mineral artifacts, unmodified faunal bone, and unmodified shell. Four of the 32 prehistoric pit features associated with [REDACTED] contained human remains. Closer to the current Undertaking area, [REDACTED], Woodward-Clyde archaeologists Sally Morgan and Barb Voss found two lithic artifacts on the ground surface and buried human remains during monitoring for installation of a water line that they interpreted as site materials "displaced through agricultural activity and highway and airfield construction in the area" (Morgan et al.,1995:6).

[REDACTED] were all recorded as small occupation sites containing habitation debris by L.L. Loud in 1912 based on locations noted on Nels Nelson's map. Their dimensions and exact locations have not been confirmed through subsequent field studies. Loud also recorded [REDACTED] in 1912, although with some additional detail, including the interpretation of the site as a "small campsite" that was "nearly totally destroyed already."

**Table 1: Previously Recorded Archaeological Sites Within ¼-Mile of the Undertaking Area**

Primary-#	Trinomial	Identifier/Site Components	Site Type	Dimensions	Recorded By
█ █	█ █	█ █ █	█ █	█ █	█ █ █ █ █
█ █	█ █	█	█	█	█
█ █	█ █	█ █	█	█	█
█ █	█ █	█ █	█	█	█
█ █	█ █	█ █	█	█	█
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█ █	█ █	█ █ █	█	█ █ █	█ █
█ █	█ █	█ █	█	█ █	█ █
█ █	█ █	█	█	█	█

When Loud recorded █, also in 1912, the shellmound site was 0.6 miles long and two to four feet high. It contained human skeletal remains and prehistoric artifacts. Caltrans' 1987 attempt to relocate the site using surface survey and auger bores in the █ was not successful and Caltrans concluded that the site had likely been destroyed by agricultural use and subsequent development.

Figure 4. Figure removed to protect confidentiality of archaeological site locations.

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With specific reference to the area of their 1991 survey in the vicinity of [REDACTED] within the Undertaking area, Basin Research Associates, Inc. concluded that

Development, including the current facilities and especially past subsurface infrastructure improvements appear to have destroyed the integrity of any archaeological resources... These [developments] include electrical distribution systems; fresh water lines; sanitary sewer systems; storm drains; gas, fuel and steam lines; and, underground telephone distribution lines... The likelihood of the existence of pristine archaeological sites is remote as a result of the construction associated with the placement of these lines. In addition, historic agricultural practices and commercial use of mound sites for top soil and fill underscore the probable lack of stratigraphic integrity. (1991:17).

[REDACTED], was originally identified in Nelson's 1909 survey and was recorded as being four feet high and at least four feet deep. Multiple subsequent pedestrian surveys have failed to locate the site, although the effectiveness of these surveys has been limited due to agricultural and other disturbances. However, a subsurface backhoe testing program conducted by Basin Research in April and November 1993 (58 backhoe units excavated on a 200 foot grid) failed to locate the midden. Two historic-period sources have identified prehistoric sites [REDACTED] (Whelan 1876 and Crittenden 1876). The sites identified in these historic-period sources have not been formally recorded as archaeological sites and they were not included in the results of the records search. The reliability of their reported locations likely varies by source. While it seems clear that a prehistoric site was [REDACTED] in the late 19th and early 20th century, more recent archaeological investigations by Chavez (1981), Basin Research Associates (1993), and WSA (2016) have found no evidence that intact site deposits remain.

Albion Environmental's 2006 work at [REDACTED]  
[REDACTED], recorded both historic debris and prehistoric material, including a Native American burial (Garlinghouse and Hylkema 2006). In addition to the burial, which was discovered 35 to 38 inches below the modern ground surface, the prehistoric component consisted of shellfish, faunal bone, charcoal, fire affected rock, chert flakes, obsidian, and awl fragments. The Berry Court site is considered potentially eligible to the NRHP, and though [REDACTED], it is a reminder that subsurface portions of prehistoric sites continue to exist within several feet of the modern ground surface.

### **3.5 Previous Archaeological Studies**

Six previous archaeological studies identified during WSA's records search have included pedestrian survey and/or subsurface testing of areas overlapping with the proposed utility

alignments. Three surveys, David Chavez 1981, William Self Associates 1990, and Basin Research Associates 1991, consisted of pedestrian surface survey. Subsurface survey, including backhoe trench testing by Basin Research Associates in 1993, auger testing and trench monitoring by Woodward-Clyde (Morgan and Voss) in 1995, and controlled excavation by Hylkema in 1995 were employed to identify and evaluate deposits related to previously recorded sites within ¼ mile of the Undertaking area. These studies are summarized in Table 2.

While large portions of the Undertaking area have been surveyed for previous ground-disturbing projects, there has not been full previous survey coverage of the proposed utility alignment. Approximately 9,400 feet of the proposed electrical and telecommunications utility alignment has not previously been studied archaeologically.

**Table 2. Previous Archaeological Studies Within the Undertaking Area**

NWIC Study-#	Date	Author	Title	Study Type	Summary
S-8447	1981	David Chavez	Cultural Resources Review for the Ames Research Center Environmental Resources Document, Santa Clara County, California.	Pedestrian survey.	[REDACTED]
S-11950	1990	William Self Associates	Cultural Resources Survey Report for Proposed Commissary Building, Naval Air Station, Moffett Field, Santa Clara County, CA.	Pedestrian survey.	[REDACTED]
S-13461	1991	Basin Research Associates, Inc.	Archaeological Overview and Survey, Naval Air Station Moffett Field, Santa Clara County, California	Pedestrian survey.	[REDACTED]
S-16393	1993	Basin Research Associates, Inc.	Final Report, Archaeological Testing Program: CA-SCL-23 and Vicinity, for the National Wind Tunnel Complex (NWTC) NASA Ames Research Center, Moffett Field, Santa Clara County, California	Pedestrian survey and subsurface testing	[REDACTED]

NWIC Study-#	Date	Author	Title	Study Type	Summary
S-16658	1995	Sally Morgan and Barb Voss,	Final Archaeological Monitoring Report, City of Sunnyvale Reclaimed Water Pipeline Through Sunnyvale Municipal Golf Course and Moffett Field Naval Air Station, Santa Clara County, California.	Subsurface testing and monitoring.	[REDACTED]
S-18367	1995	Mark Hylkema	Historic Property Survey Report and Finding of No Effect for the Proposed Ramp Metering and HOV Ramp Project (Caltrans)	Subsurface testing.	[REDACTED]

## 4.0 Field Methods

### 4.1 Pedestrian Survey

On November 21 and 22, 2016, WSA Staff archaeologists Thomas Young and Ashley Schmutzler conducted a pedestrian survey of 4.9 miles of the proposed utility alignments within the MFA leasehold and NASA ARC owned areas (Figure 5; Appendix A, Photos 1-6). A large portion of the survey area is fully developed, consisting of office buildings, paved roads and sidewalks, and landscaped grounds. Unpaved ground was examined for evidence of prehistoric and historic cultural material such as, but not limited to, darker soil, shell, animal bone, worked stone objects, stone tools, glass, ceramic, brick and other structural material, and standing structures. The survey encompassed 20 feet on either side of the alignment’s center line. The surveyed alignment differs from the alignment at the time of coring due to subsequent changes made during the ongoing planning process. Areas not subject to pedestrian survey, which include alignments added or amended to the project area after November 21, are either paved and/or have been previously surveyed for other projects as mapped on Figure 4.

WSA archaeologists surveyed the entire proposed utility alignment within NASA ARC property, with the exception of the southern portion along Dailey Rd. from Edquiba to the alignment’s southern terminus . This portion was entirely paved for use as sidewalks or parking lots. There were short stretches of exposed ground surface between the sidewalk and buildings, or between paved areas, but these were landscaped/manicured lawn or ornamental plantings or street trees. The southern portion that was unpaved was also landscaped lawn

with leaf and pine needle litter under the trees, with approximately 15-20% visible soil. A gas meter and valve station, surrounded by a fence, was located at the southern terminus of the survey alignment. Along the northern-most alignment segment within NASA ARC property, which began at the airfield fence line and travelled west across open ground to DeFrance Ave., the ground surface was relatively flat, with some dips and rises on the surface. High grasses and clusters of small trees and shrubs in the area were noted, although the survey alignment was clear of anything except for grasses. An old raised roadbed cuts across the survey alignment, travelling north-south. Lindbergh Ave crosses the alignment in a northeast/southwest direction, and there is a gravel road that travels alongside the airfield fenceline at Zook Rd.

Within the MFA leasehold property, two-thirds of the survey alignment was in open, undeveloped land with grasses and low-lying vegetation. The remaining third of the survey alignment traversed paved and developed areas. The ground along the Macon Road segment was unpaved, and was flat with some small bumps and dips. Many rodent burrows allowed for periodic glimpses into the subsurface soils. The soil was a dry, silty clay, medium brown in color, with some gravels and many snail shells on the surface. Vegetation included wild grasses, weeds, and shrubs. Within the airfield area, the West Transient Ramp area has been paved over. Once the survey team got into open ground, visibility was fairly good (approximately 20-25% visible ground surface), and the terrain was flat, with some small dips and bumps on the surface. Rodent burrows pock-marked the surface, and these were investigated for subsurface soils and cultural materials. The soil was medium brown dry silty clay with some gravels. Many snail shells dotted the surface, but were not observed in the soil churned-up by rodents. From the fire department building to Gate G, the survey area was unpaved, and the ground was flat with some small bumps and dips on the surface, similar to what was observed in the southern portion; ground visibility was the same as well, with the same dry, silty clay. The ground in the sod areas between runways was flat, with fewer rodent burrows than in other areas, and the soil was a dry, silty clay, medium brown color, with some gravels and snail shells on the surface.

#### ***4.2 Archaeological Coring***

On December 7-8 and 20-21, 2016, following procedures outlined in the November 2016 Archaeological Work Plan (WSA 2016), WSA archaeologists conducted archaeological coring at 24 locations in archaeologically sensitive and previously unsurveyed areas along the proposed utility alignment in order to determine the presence or absence of subsurface archaeological deposits in the Undertaking area. Locations were selected based on proximity to previously recorded archaeological sites and on the absence of previous archaeological surveys or testing (Figure 5).

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Archaeological Pedestrian Survey Areas and Testing Locations

Test Bore Locations 1-3 were placed on the southern portion of the proposed alignment along Macon Road to identify any previously unrecorded intact deposits or dense concentrations of redeposited debris related to [REDACTED] area (Appendix A, Photos 7, 8). Previous trench-monitoring programs near the Undertaking area identified surface and buried remains associated with redeposition from [REDACTED] (Morgan and Voss 1995), and intact deposits have been studied to [REDACTED] Undertaking area adjacent to the MFA Lease area (Arrigoni et al. 2008).

Test Bore Locations 4-7 were placed in the vicinity of the mapped locations of two late nineteenth-century buildings adjacent to the portion of the proposed alignment east of Hangars 2 and 3 (Appendix A, Photos 9, 10). Macon Road between East Patrol Road and the electrical substation east of the Fuel Farm and Wash Rack has not been subject to previous archaeological survey.

Test Bore Locations 8-10 were placed in a grassy area east of Zook Road near its intersection with Hall Lane. The portion of Zook Road north of Hangar 1 has been partially subject to pedestrian survey, however the grassy area north of Taxiway C, east of Zook Road has not previously been subject to archaeological study.

Test Bore Locations 11-18 were placed along the western edge of the West Center Sod and Southwest Sod adjacent to the West Parallel Taxiway (Appendix A, Photos 11, 12). [REDACTED] [REDACTED] Though the area has been previously subject to pedestrian survey, the proximity of a previously recorded site warranted subsurface testing within the proposed alignment.

Test Bore Locations 19-21 were placed in the grassy area to the south of the West Transient Ramp and east of Macon Road (Appendix A, Photos 13, 14). [REDACTED] [REDACTED].

Test Bore Locations 22-24 were placed in unpaved areas where new conduit is planned to be installed on the east side of Dailey Road / McCord Avenue between Westcoat Road and Bushnell Road (Appendix A, Photo 15). This portion of the alignment has not been subject to previous archaeological survey or testing.

Prior to commencement of coring, all 24 proposed core locations were marked for utility locations by BKF Engineering. During this process, five of the originally proposed test bore locations (TBL), TBLs 7, 18, 22, 23, and 24, were shifted along the alignment to avoid buried utilities. Cascade Drilling conducted the drilling and core recovery in 2 inch diameter plastic sheaths using a truck-mounted GeoProbe 6600 at TBLs 1-7 and 19-21 on December 7, 2016 and a tread-mounted GeoProbe 6620-DT at TBLs 8-18 and 22-24 on December 20-

21, 2016. Hand augering was employed at some core locations where proximity to buried utilities made the direct-push rig an unsafe option. Twenty-three cores were excavated to the full 20 foot planned depth. One core, TBL 23, was excavated by hand auger to only 11.5 feet below surface, as impassable resistance was encountered at this depth, and an alternate location could not be used due to the presence of multiple utility crossings in the vicinity. WSA archaeologists inspected all soils in the field, and recorded each bore with photographs, field notes including detailed soil descriptions, and Trimble GeoXT GPS. Appropriate health and safety procedures for working in areas of potential soil contamination were followed by WSA staff and contractors as outlined in the Site-Specific Environmental Health and Safety Plan (EHASP) prepared for WSA by BioMax Environmental, Inc. Ramona Garibay and Lola Garibay were Native American monitors for the Undertaking.

## **5.0 Survey and Testing Results and Recommendations**

No cultural materials were observed on the surface or in the disturbed soil visible in rodent burrows, nor were there any visible structures or remnants of structures observed during survey of the proposed Undertaking alignments. Ground visibility in unpaved areas overall was fair (15-25%), with grasses and other vegetation obscuring the surface. Large portions of the survey area have been developed, either by hardscaping or landscaping, therefore limiting potential for encountering cultural material during the pedestrian survey.

No cultural materials were observed in any of the 24 cores excavated along the Undertaking alignment. At one location, TBL 21, very small shell fragments were observed in dark brown and grey silty clay at approximately 6 feet below surface. Small charcoal flecks were recorded in compact grey-green clay between 16 and 20 feet below surface in TBLs 1 and 2. Soil recovery percentages in the cores was very high, with most cores recovering 90% - 100% of soils. Detailed soil descriptions for each core are presented in Appendix B.

While surface survey and subsurface testing aim to identify archaeological deposits prior to construction, there still remains the possibility that buried, intact deposits exist within archaeologically sensitive portions of the Undertaking area. WSA recommends that cultural resources monitoring be conducted by a qualified archaeologist where open trenching used for utility installation, vault installation, and direct-bore entry and exit pits intersects with areas of prehistoric and historic-period archaeological sensitivity, as defined in consultation with NASA.

In the event of accidental discovery of archaeological deposits or human remains during ground-disturbing Undertaking activities, the procedures described in the NASA Ames Research Center Integrated Cultural Resources Management Plan (AECOM 2014:5-20 to 5-22; 6-24 to 6-27), shall be followed.

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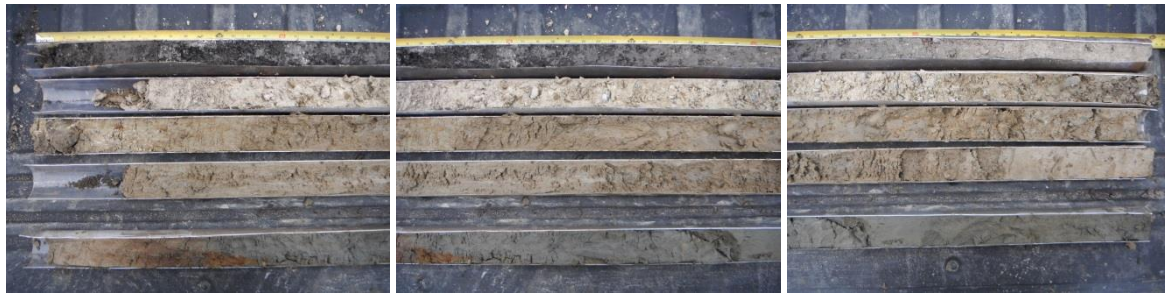
Appendix A: Photographs

## **Appendix B**

### **Test Bore Descriptions**

### TBL-1

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 1 (0-4 feet)	very compact, damp, dark grey black clay, small gravel	100%	
	light grey white silty clay, little gravel		
TBL 1 (4-8 feet)	light grey-white sandy clay with larger rounded gravels	90%	
	light brown moist, less compact clayey silt with small- large rounded gravels		
TBL 1 (8-12 feet)	loose clayey brown/orange sand with oxidized inclusions	100%	
	extremely compact light brown clay, no gravels		
TBL 1 (12-16 feet)	moderately compact plastic silty clay with oxidized inclusions	90%	
	hard, compact grey-green clay with some silt, tiny charcoal flecks.		
TBL 1 (16-20 feet)	moderately compact plastic silty clay with oxidized inclusions	100%	
	hard, compact grey-green clay with some silt, tiny charcoal flecks.		

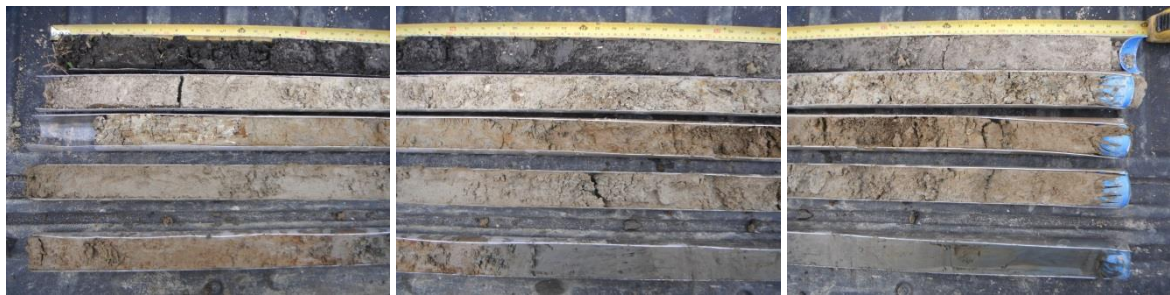


TBL-1 Core Segments



**TBL-2**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 2 (0-4 feet)	dark brown/black loamy clay top soil, dry and clumpy with roots	100%	
	transition to very compact light grey-yellow silty clay, damp, little gravel		
TBL 2 (4-8 feet)	very compact light yellow/white clay with trace silts, damp, rounded gravels	100%	
	less compact sandy with more gravels, oxidized inclusions, orange and green pockets increasing with depth		
TBL 2 (8-12 feet)	plastic clay with fine granules, oxidized inclusions, about 1% gravel, lens of sandy gravelly wet soil about 10-11 feet below surface	90%	
TBL 2 (12-16 feet)	very soft wet plastic light brown clay with some gravels	100%	
TBL 2 (16-20 feet)	very compact plastic light brown clay with small rounded gravels, some charcoal flecking, oxidized inclusions, damp	100%	
	yellowish-brown-grey plastic clay, hard compacted with some charcoal flecking		
	less compact, more plastic grey clay with wood inclusion		



TBL-2 Core Segments

**TBL-3**

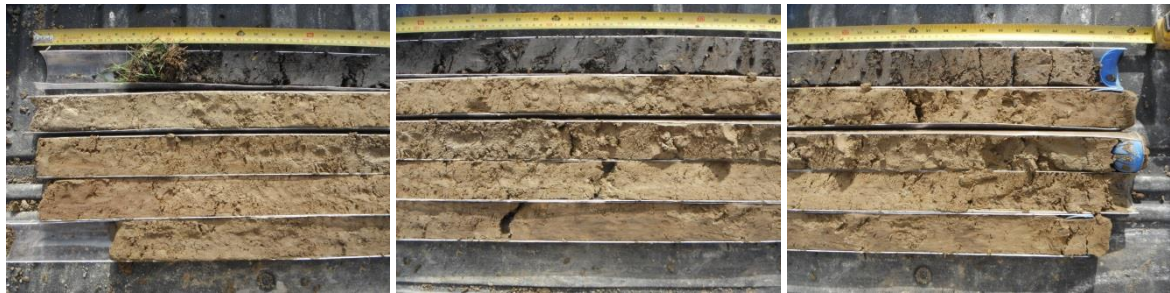
Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 3 (0-4 feet)	dark brown/black loamy clay top soil with roots and round gravels, crumbly, damp	100%	
	transition to light yellow/white crumbly silt with some clay, small rounded gravel		
TBL 3 (4-8 feet)	light yellow/white crumbly silt with more clay, small rounded gravel, orange-brown pockets	100%	
	damp sandy brown-orange clay with dark brown pockets, 25% small rounded gravels		
TBL 3 (8-12 feet)	upper 1 foot moderately compact light brown clay mottled with orange/chalky white inclusions, 15% small rounded gravel	100%	
	9 - 11 feet more plastic light brown clay with orange inclusions, damp, more compact at 11 feet		
TBL 3 (12-16 feet)	loose plastic light brown clay with 1% gravel, fine granules	90%	
	compact light brown clay with 1 % gravel, damp		
TBL 3 (16-20 feet)	orange-brown mottled gray clay with fine granules, 1% gravel, damp	90%	
	compact grey clay mottled with orange, wood and root inclusions, damp		



TBL-3 Core Segments

**TBL-4**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 4 (0-4 feet)	compact dark brown/black loamy clay topsoil with 1% small rounded gravel, damp	90%	
	transitions to light brown clay with some silt, 5% small rounded gravels, damp		
TBL 4 (4-8 feet)	very compact yellow gray silt with 5% small rounded gravels, transitions to less compact light brown / yellow silty clay with more gravel, more compact at 8 feet	100%	
	moderately compact plastic light brown clay with small granules		
TBL 4 (8-12 feet)	greyish brown gritty wet clay with 20% small rounded black gravel	100%	
	moderately compact orange-brown gritty clay with 5% small rounded gravels and small rocks, wet		
TBL 4 (12-16 feet)	moderately compact yellowish brown clay with orange mottling, 1% gravel	100%	
	moderately compact yellowish brown clay with orange mottling, some sand, wet		
TBL 4 (16-20 feet)	loosely compacted yellow-brown clay with sand, gravels	90%	
	compacted yellow-brown clay with oxidized inclusions, fewer gravels than above		



TBL-4 Core Segments

**TBL-5**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 5 (0-4 feet)	dark brown / black / grey-brown loamy clay top soil	100%	
	very compacted dark greyish brown silty clay, 1% gravels		
TBL 5 (4-8 feet)	hard compacted light yellow-brown clayey silt, 5% small rounded gravel	100%	
	looser compacted dark yellow-brown gritty clay, 1% gravel, transitioning to hard compacted yellowish brown clay mottled with orange, some small rounded gravels		
TBL 5 (8-12 feet)	hard compacted yellowish brown clay mottled with orange, some small rounded gravels, concrete fragments 3-4cm in size between 9.5 and 10.5 feet below surface.	100%	
	hard compacted yellowish brown clay mottled with orange, some small rounded gravels, concrete fragments 3-4cm in size between 9.5 and 10.5 feet below surface.		
TBL 5 (12-16 feet)	moderately compact yellowish brown gritty clay mottled with orange, sandier with loose compaction around 14 feet below surface	100%	
	moderately compact yellowish brown gritty clay mottled with orange, sandier with loose compaction around 14 feet below surface, more compacted, higher clay content at 16 feet below surface		
TBL 5 (16-20 feet)	sandy yellowish-brown with small to mid-sized rounded black gravel, wet	90%	
	transition to hard compacted yellowish brown clay, slightly gritty		



TBL-5 Core Segments



**TBL-6**

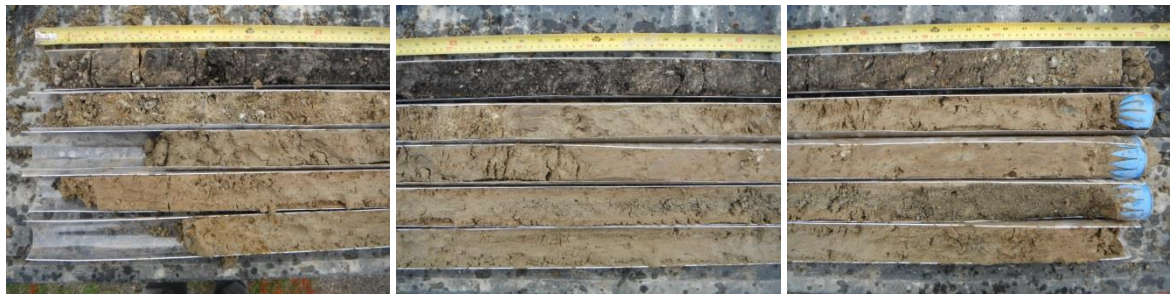
Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 6 (0-4 feet)	dark yellowish-brown to black loamy clay top soil	100%	
	Compact light grey with over 50% small to large gravel, dry		
TBL 6 (4-8 feet)	loosely compacted light brown clayey sand with yellow and purplish brown mottling, over 75% small to large, rounded and angular gravel	90%	
	loosely compacted light brown clayey sand with yellow and purplish brown mottling, over 75% small to large, rounded and angular gravel		
TBL 6 (8-12 feet)	loosely compacted light brown clayey sand with yellow and purplish brown mottling, over 75% small to large, rounded and angular gravel	90%	
	Abrupt change to very compact yellowish brown clay with oxidized inclusions, 5% small rounded gravels, moist		
TBL 6 (12-16 feet)	very compact yellowish brown clay with oxidized inclusions, 5% small rounded gravels, moist	100%	
	transition to loosely compacted sandy orange-brown clay, less than 5% medium sized rounded gravel, lowest 6 inches more compacted with oxidized inclusions		
TBL 6 (16-20 feet)	loosely compacted plastic orange-brown clay with some silt	80%	
	hard compacted orange-brown clay with dark brown inclusions, no gravel		



TBL-6 Core Segments

**TBL-7**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 7 (0-4 feet)	orange-brown top soil with gravel fill	100%	
	moderately compact olive brown clayey sand with 25-30% gravel		
TBL 7 (4-8 feet)	moderately compact olive brown clayey sand with 25-30% gravel	100%	
	loosely compacted orange-brown clayey sand with less than 5% gravel, moist		
TBL 7 (8-12 feet)	loosely compacted sandy orange-brown clay with small to medium rocks	80%	
	compacted orange-brown clay with less than 5% gravel, oxidized inclusions		
TBL 7 (12-16 feet)	compacted orange-brown clay with less than 5% gravel, oxidized inclusions	100%	
	loosely compacted sandy clay with small rounded black gravels, more sand and gravel, more compaction at 15 feet and below		
TBL 7 (16-20 feet)	moderate-hard compacted orangish brown clay mottled with grey	80%	
	Brown gritty clay mottled with dark brown and orange, small gravels		
	Hard compacted orange-brown clay		



TBL-7 Core Segments

**TBL-8**

<b>Bore (depth in feet)</b>	<b>Soil / Sediment Description</b>	<b>Recovery %</b>	<b>Comments</b>
TBL 8 (0-4 feet)	very dark greyish brown sandy clay top soil	100%	
	dark olive brown compact clay		
TBL 8 (4-8 feet)	very dark brown compact clay with multi-colored marbling	100%	
	very dark brown compact clay with multi-colored marbling		
TBL 8 (8-12 feet)	dark greenish-grey compact clay	100%	
	olive brown compact clay		
TBL 8 (12-16 feet)	medium compact olive sandy clay with marbling, less than 10% gravel	100%	
	medium compact olive sandy clay with marbling, less than 10% gravel		
TBL 8 (16-20 feet)	medium compact dark yellowish brown sandy clay, less than 10% gravel	100%	
	Black sandy clay with approximately 25% gravel, very wet		
Core segment photo not available.			

**TBL-9**

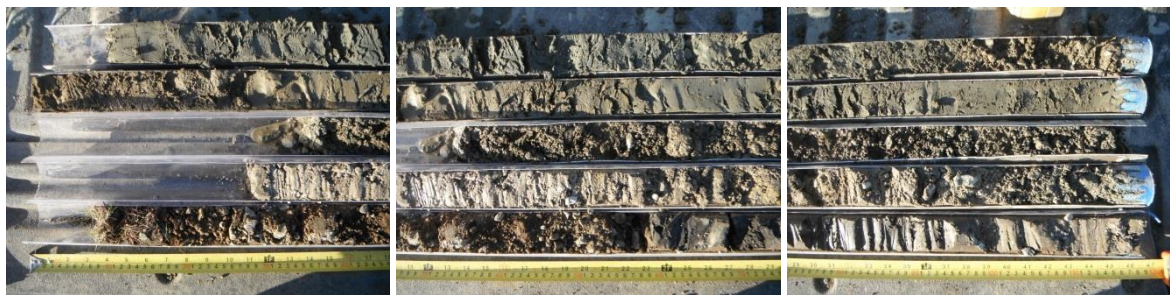
<b>Bore (depth in feet)</b>	<b>Soil / Sediment Description</b>	<b>Recovery %</b>	<b>Comments</b>
TBL 9 (0-4 feet)	very dark brown sandy clay topsoil over brown sandy, 50% gravel	70%	
	very compact black clay		
TBL 9 (4-8 feet)	compact greyish-brown clayey sand	90%	
	light olive brown sandy clay, wet		
TBL 9 (8-12 feet)	light olive brown and dark greenish grey clay	100%	
	olive brown sandy clay		
TBL 9 (12-16 feet)	compact olive brown clay, black and orange marbling	100%	
	compact olive brown clay, black and orange marbling		
TBL 9 (16-20 feet)	loose olive brown clay, wet, transition to compact dark yellowish brown clay	100%	
	yellowish brown sandy clay with 30% gravel at base		
Core segment photo not available.			

**TBL-10**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 10 (0-4 feet)	very dark greyish brown sandy gravel over compact very dark grey clay with 10% gravel	100%	hand augered
	olive brown clayey sand with 10% gravel over light brown and brown sandy clay		
TBL 10 (4-8 feet)	light brown and brown sandy clay	100%	hand augered to 7.5 feet
	brown, coarse sandy gravel, wet		
TBL 10 (8-12 feet)	dark greenish-grey coarse sandy gravel, wet	60%	
	dark greenish-grey coarse sandy gravel, wet		
TBL 10 (12-16 feet)	olive brown mottled clay, moist	90%	
	olive brown mottled clay, moist		
TBL 10 (16-20 feet)	olive brown clay, less mottling than above, moist	90%	
	olive brown mottled clay, moist		
Core segment photo not available.			

**TBL-11**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 11 (0-4 feet)	very dark brown and dark brown sandy gravel, some clay	100%	
	dark grey and greyish brown compact clay, 25% gravel		
TBL 11 (4-8 feet)	dark grey and greyish brown compact clay, 25% gravel	100%	
	dark grey compact clay, 25% gravel, transition to dark olive brown coarse gravely sand with 50% gravel		
TBL 11 (8-12 feet)	dark olive brown coarse gravely sand with 50% gravel, some wet pockets and larger rocks	60%	
	dark olive brown coarse gravely sand with 50% gravel, transition to olive sandy clay		
TBL 11 (12-16 feet)	olive sandy clay, transition to dark greenish grey clay with some clayey sand at lower depths	90%	
	dark greenish grey clay with some clayey sand at lower depths		
TBL 11 (16-20 feet)	dark greenish grey clay with some clayey sand at lower depths, transition to greenish grey sandy clay	90%	
	greenish grey sandy clay, transition to olive grey gravely sand with 50% gravel		

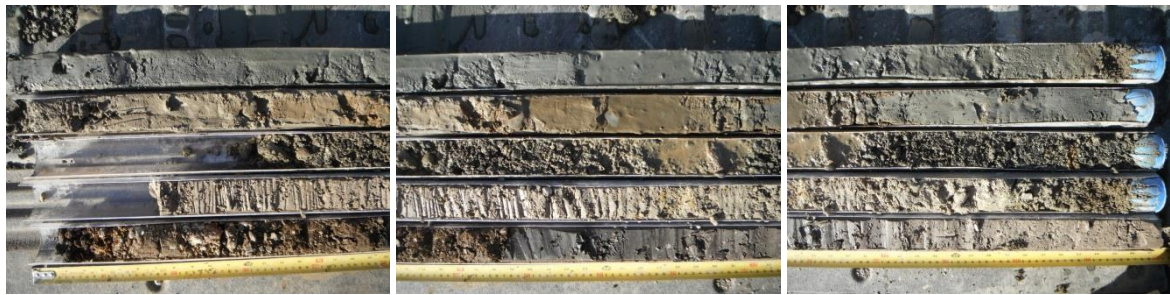


TBL-11 Core Segments



**TBL-12**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 12 (0-4 feet)	very dark greyish brown sandy clay with 50% gravel	100%	
	compact very dark grey and greyish brown clay		
TBL 12 (4-8 feet)	compact very dark grey and greyish brown clay	90%	
	compact very dark grey and greyish brown clay, transition to light gray sandy clay, 25% gravel, wet		
TBL 12 (8-12 feet)	dark olive grey coarse sandy gravel, 50-75% gravel, some pockets of water	70%	
	olive grey coarse sandy gravel, 50-75% gravel, some pockets of water		
TBL 12 (12-16 feet)	olive sandy clay, wet, transition to olive brown wet sandy clay with less sand	100%	
	moderately compact greenish grey sandy clay, damp		
TBL 12 (16-20 feet)	greenish grey sandy clay, wet	100%	
	greenish grey sandy clay, wet, transition to olive grey sand, wet		



TBL-12 Core Segments

**TBL-13**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 13 (0-4 feet)	very dark brown to dark yellowish brown sandy clay fill, 40% gravel	90%	
	black compact clay, transition to grey compact clay with 20% gravel		
TBL 13 (4-8 feet)	greyish brown compact clay, less than 5% gravel	100%	
	grayish brown to dark grayish brown sandy clay with increasing gravel, up to 50% gravel at 8 feet		
TBL 13 (8-12 feet)	greyish brown to dark grey coarse sand with 50% gravel	80%	
	greyish brown to dark grey coarse sand with 50% gravel		
TBL 13 (12-16 feet)	dark grey sandy clay, wet with some wetter pockets	100%	
	greenish grey sandy clay, wet		
TBL 13 (16-20 feet)	greenish grey clayey sand, damp	100%	
	greenish grey clayey sand, damp		



TBL-13 Core Segments

### TBL-14

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 14 (0-4 feet)	no recovery above 2 feet below surface, very dark brown and dark yellowish brown sandy clay fill with 50% gravel	70%	
	compact black clay with less than 5% gravel		
TBL 14 (4-8 feet)	compact black clay with less than 5% gravel	100%	
	compact black clay with less than 5% gravel, transition to compact light olive brown sandy clay		
TBL 14 (8-12 feet)	olive sandy gravel with 50-75% gravel	80%	
	olive sandy gravel with 50-75% gravel, transition to olive brown sandy clay, wet		
TBL 14 (12-16 feet)	olive clayey sand, wet	100%	
	light olive brown sandy clay, wet		
TBL 14 (16-20 feet)	greenish grey fine sandy clay	100%	
	loose greenish grey coarse sandy clay		



TBL-14 Core Segments

## TBL-15

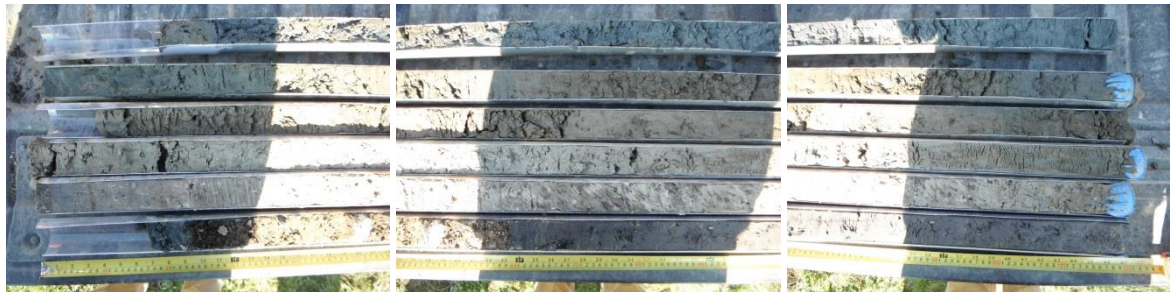
Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 15 (0-4 feet)	medium coarse olive sandy clay, 30% gravel	75%	
	very dark grey compact dry clay		
TBL 15 (4-8 feet)	compact very dark grey clay, dry, transition to compact light grey clay, 30% gravel, dry	90%	
	compact light grey clay, 30% gravel, dry		
TBL 15 (8-12 feet)	compact light grey clay, 30% gravel, dry	100%	
	olive brown sandy clay		
TBL 15 (12-16 feet)	olive clayey sand, very wet	100%	
	olive sandy clay		
TBL 15 (16-20 feet)	olive grey sandy clay, transition to greenish grey sandy clay	100%	
	loose greenish grey sandy clay		



TBL-15 Core Segments

### TBL-16

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 16 (0-4 feet)	olive brown sandy clay, 30% gravel	90%	
	black compact clay		
TBL 16 (4-8 feet)	pale yellow compact clay	100%	
	pale yellow compact clay, transition to light yellowish brown sandy clay		
TBL 16 (8-12 feet)	compact pale olive sandy clay, transition to looser olive grey sandy clay	100%	
	loose olive grey sandy clay, transition to light olive brown clayey sand		
TBL 16 (12-16 feet)	moderately compact light olive brown sandy clay, becoming more compact with depth	100%	
	compact light olive brown sandy clay, transition to olive clayey sand, wet		
TBL 16 (16-20 feet)	compact olive grey sandy clay	100%	
	greenish grey clayey sand, very wet, transition to dark grey compact sandy clay, some greenish grey mottling		

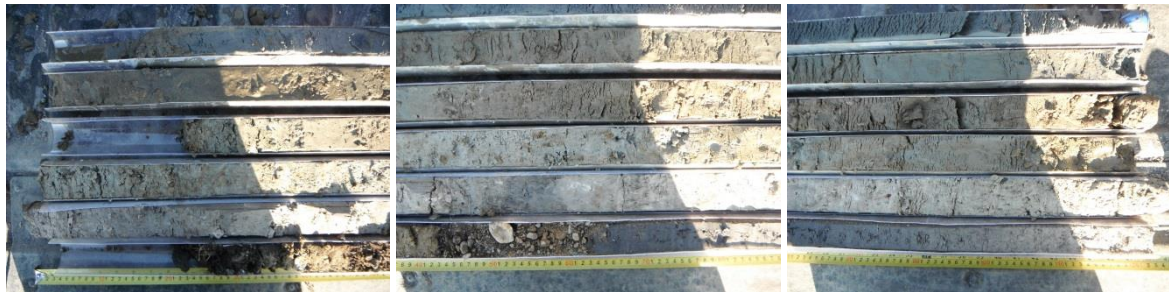


TBL-16 Core Segments



**TBL-17**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 17 (0-4 feet)	black and olive brown sandy clay, 10% gravel	80%	
	compact dark grey to light brownish grey clay, dry, 50% gravel		
TBL 17 (4-8 feet)	compact light brownish grey clay, dry	100%	
	compact light grey clay, 20% gravel, dry		
TBL 17 (8-12 feet)	compact light brownish grey fine sandy clay, 5% gravel, moist, some olive brown speckling	100%	
	compact olive brown fine sandy clay, moist		
TBL 17 (12-16 feet)	compact olive brown to light olive brown fine sandy clay	100%	
	dark grey fine sandy clay, transition to light olive brown clayey sand, very wet		
TBL 17 (16-20 feet)	compact olive brown clay, moist, transition to greenish grey fine clay, moist	100%	
	light olive brown sand, very wet, transition to compact greenish grey moist clay		



TBL-17 Core Segments

### TBL-18

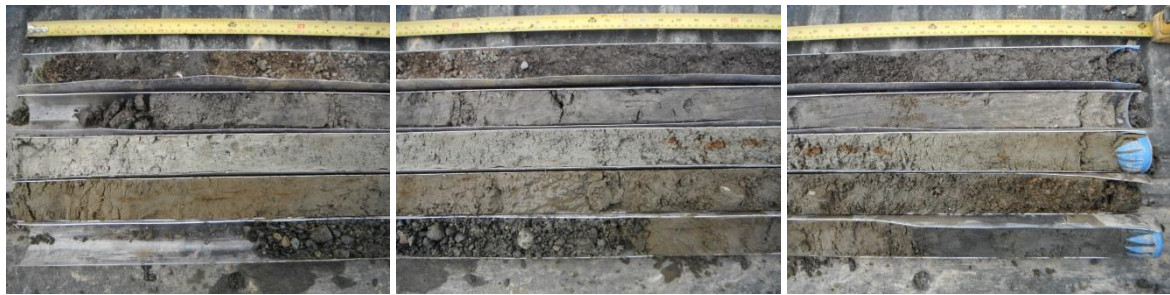
TBL 18 (0-4 feet)	very dark greyish brown to olive brown sandy gravel, 50% gravel compact olive brown to light olive brown clay, moist	90%	
TBL 18 (4-8 feet)	compact gray to grayish brown clay, moist compact gray to grayish brown clay, moist, transition to light yellowish brown clay	100%	
TBL 18 (8-12 feet)	light yellowish brown clay, transition to light olive brown sandy clay, moist, 5% gravel light olive brown sandy clay, moist, 5% gravel	100%	
TBL 18 (12-16 feet)	light olive brown sandy clay, moist, 5% gravel, transition to olive sandy clay, moist light olive brown to greyish brown sandy clay, moist	100%	
TBL 18 (16-20 feet)	grayish brown sand, very moist to compact olive brown sandy clay compact olive grey sandy clay, moist	100%	



TBL-18 Core Segments

**TBL-19**

<b>Bore (depth in feet)</b>	<b>Soil / Sediment Description</b>	<b>Recovery %</b>	<b>Comments</b>
TBL 19 (0-4 feet)	compact dark brown/black loamy clay, angular gravels to sandy orange brown with 50% angular gravel	100%	
	moderately compact greyish brown loamy clay		
TBL 19 (4-8 feet)	moderately compact greyish brown loamy clay	90%	
	moderately compact light grey brown clay		
TBL 19 (8-12 feet)	moderately compact light grey brown clay, transition to light grey silty clay with orange inclusions and 5% rounded gravels	100%	
	light grey silty clay with orange inclusions and 5% rounded gravels, transition to moderately compact light brown gritty clay		
TBL 19 (12-16 feet)	moderately compact light brown gritty clay, transition to loosely compacted light grey brown sandy clay, wet	100%	
	loosely compacted sandy gravel, moist		
TBL 19 (16-20 feet)	greyish angular gravel, more than 75%, angular and sub-angular, to moderately compacted light grey brown gritty clay with some wood inclusions	100%	
	moderately compact dark grey slightly gritty clay		



TBL-19 Core Segments



**TBL-20**

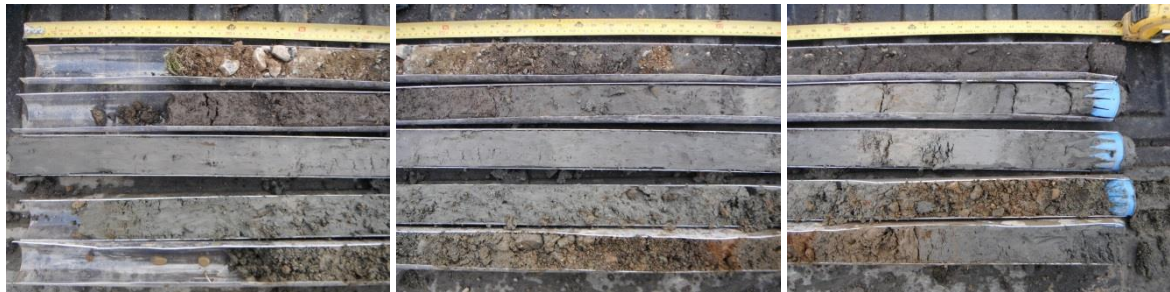
<b>Bore (depth in feet)</b>	<b>Soil / Sediment Description</b>	<b>Recovery %</b>	<b>Comments</b>
TBL 20 (0-4 feet)	moderately compact gravel fill over silty loam top soil, angular gravel	90%	
	compact dark brown to black, some gravel		
TBL 20 (4-8 feet)	compact dark brown to black, some gravel, transition to compact tan/yellow clay with fine orange and black granular inclusions	90%	
	hard compact dark grey brown with orange flecking		
TBL 20 (8-12 feet)	hard compact dark grey brown with orange flecking	90%	
	moderately compact dark grey silty clay mottled with greenish grey, some bands of orange sandstone, oxidized inclusions below 10 feet		
TBL 20 (12-16 feet)	moderately compact sandy clay with oxidized inclusions and 1% small rounded gravel, wetter and sandier around 14 feet with wood fragments and 5% small rounded gravel	95%	
	loosely compacted dark grey brown with sand and 5% small round gravels, to light brown and dark brown clayey sand with 5% small to medium gravels		
TBL 20 (16-20 feet)	loosely compacted light brown and dark brown clayey sand, wet	90%	
	moderately compacted gritty clay with 5% small rounded gravels, moist, to loosely compacted light brown with 75% small rounded gravels		



TBL-20 Core Segments

**TBL-21**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 21 (0-4 feet)	moderately compact light brown sandy clay with 50% gravel	85%	
	very compact dark brown to black silty clay with little gravel		
TBL 21 (4-8 feet)	very compact dark brown to black silty clay with little gravel	85%	
	very compact dark brown and grey with small shell fragments, transition to greyish yellow lens within level		
TBL 21 (8-12 feet)	very compact dark brown to black clay with some greenish grey	100%	
	very compact dark brown to black clay with some greenish grey, discrete yellowish layer within		
TBL 21 (12-16 feet)	loosely compacted greenish grey gritty clay with orange streaks and 10-15% small gravels	90%	
	loosely compacted sandy clay with reddish gravels, 75% small to large, rounded to angular gravels		
TBL 21 (16-20 feet)	loosely compacted greenish grey to orangish brown sandy gavel with small to large gravels, angular to rounded	75%	
	moderately compact grey clay, no gravel, damp		



TBL-21 Core Segments

**TBL-22**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 22 (0-4 feet)	black, to pinkish grey, to grey sandy clay, moist	100%	hand augered
	grey sandy clay		
TBL 22 (4-8 feet)	grey sandy clay	100%	hand augered
	grey sandy clay, very wet, 50% gravel		
TBL 22 (8-12 feet)	grey sandy clay, to grayish brown and light olive brown clay, wet	100%	hand augered to 9 feet
	grayish brown and light olive brown clay, wet		
TBL 22 (12-16 feet)	light olive brown clay, wet	100%	
	light olive brown clay, wet		
TBL 22 (16-20 feet)	greenish grey sandy clay	100%	
	light olive brown sandy clay, 25% gravel		



TBL-22 Core Segments Below 9 feet

**TBL-23**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 23 (0-4 feet)	black sandy clay top soil	100%	hand augered
	gray sandy clay		
TBL 23 (4-8 feet)	light brownish grey sandy clay	100%	hand augered
	light brownish grey sandy clay		
TBL 23 (8-12 feet)	light brownish grey sandy clay	100%	hand augered
	greenish grey sandy clay, very wet, excavation only to 11.5 feet		
No core photographs.			

**TBL-24**

Bore (depth in feet)	Soil / Sediment Description	Recovery %	Comments
TBL 24 (0-4 feet)	black sandy clay	100%	hand augered
	black sandy clay		
TBL 24 (4-8 feet)	grey sandy clay	100%	hand augered
	grey sandy clay, to light yellowish brown and light olive brown clay with little sand, moist		
TBL 24 (8-12 feet)	light yellowish brown and light olive brown clay with little sand, moist, some mottling	100%	hand augered to 10 feet
	olive clay, moist		
TBL 24 (12-16 feet)	olive clay, moist	90%	
	olive clay, moist, to very dark grey sandy clay		
TBL 24 (16-20 feet)	very dark grey sandy clay	100%	



TBL-24 Core Segments

This section includes confidential information  
and has been removed for circulation purposes.

## **APPENDIX C: EXISTING CONDITIONS | SITE PHOTOGRAPHS**

This section includes confidential information  
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**The following content was redacted from this public posting:**

Site Photographs



This section includes confidential information  
and has been removed for circulation purposes.

## **APPENDIX D: SELECTED DRAWINGS**

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and has been removed for circulation purposes.