Palm Bluffs River Access Schematic Design Report

August 3, 2017

Prepared for:
City of Fresno, California
Department of Public Works

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 CHAPTER 1
INTRODUCTION

1.1 Project Background

The Palm Bluffs River Access Schematic Design (project) presents additional information regarding an access alternative for a proposed public recreation facility that was initially identified as “Site 1 (Route 2)” in the “Palm Bluffs River Access Feasibility Study” prepared for the City of Fresno and dated May 2015. This route was evaluated in the San Joaquin River Conservancy’s River West Fresno, Eaton Trail Extension Draft Environmental Impact Report (DEIR), and is referred to in that evaluation as “Route 5b.” The design presented in this report may be incorporated into the DEIR as a new alternative access, Alternative 5B. The location of the project is shown on the map in Figure 1.1 and is identified as “Project Location.”

The project would provide for a controlled entrance; an access roadway for vehicles, bicyclists, and emergency response; a sidewalk for pedestrians; a staircase for pedestrians with a channel for bicycle portage; a 40-space, paved and landscaped parking area; a vault toilet restroom; connection to the proposed multi-use trail extension; and unpaved, fenced trails to the river. The access roadway would include two 12-foot travel lanes and a 6-foot wide sidewalk from the existing North Palm Avenue cul-de-sac, near the top of the riverside bluff, to a proposed parking lot near the river and below the riverside bluff. The proposed public vehicle entrance would traverse an area currently developed as a City of Fresno Park, Spano Park. Design features are included to reconfigure the park, its landscaping and irrigation system.

The alignment of the access roadway and site of other improvements are shown on the Site Map included with this report as Appendix A. It is expected that the configuration of the Alternative 5B, if it is incorporated in the DEIR, would generally conform to any findings and recommendations provided by this schematic design report.

Much of the surrounding land has now been developed as Palm Bluffs, Park Place, and River Bluff developments and to a considerable extent contains buried landfill materials that remain in place. Special compaction efforts were employed as part of those developments, and some new buildings in the area reportedly contain gas detection facilities to monitor for the presence of landfill gasses. Some of the land within the proposed project area contains similar landfill materials.

A portion of the area that could be affected by the access facilities is privately owned by the Spano Enterprises and various partners. Other lands affected by the project are owned by the City of Fresno, Fresno Metropolitan Flood Control District (FMFCD), and State of California, under the jurisdiction of the San Joaquin River Conservancy.

1.2 Purpose

The purpose of this report is to: document the information gathered and utilized from the topographic survey results, geotechnical investigation, and coordination with the affected property owners; present findings and recommendations related to project feasibility; submit schematic design drawings; and to provide recommendations for future detailed design.
Figure 1.1 Location Map
CHAPTER 2
SCHEMATIC DESIGN PHASE PLANS

2.1 General

Included in Appendix B of this report are reduced scale Schematic Design Phase Plans. The Schematic Design Phase Plans represent a level of design completion of approximately 30% and include the horizontal geometry, limited vertical geometry, and the existing and proposed utilities.

2.2 Topography

The topography shown on the Schematic Design Phase Plans was obtained from field surveys conducted by Blair, Church & Flynn. The surveys were completed on July 3, 2017.

2.3 Easements and Property Lines

The existing property lines are shown on Sheet 2 – Plan and Profile Sheet Index Map of the schematic drawings. The property line locations are approximate and were obtained from City of Fresno GIS data. The land owner name and Assessor’s Parcel Number (APN) for parcels within the proposed project area are shown on the same map.

There is an existing 15-foot FMFCD easement over the existing storm drain system that crosses Spano Park. The easement boundaries are shown on Sheet 4 – Plan and Profile and were obtained from a set of as-built provided by FMFCD.

There is an existing City of Fresno ingress-egress easement over the FMFCD baffled apron structure located on the southeast corner of FMFCD’s Basin DH2 site.

2.4 Existing Utilities

Letters were sent to various utility owners and agencies to determine all existing utilities within the project limits. Several responses have been received, and of the responses received, some do not provide enough detail to accurately map the utilities. Additional contact with the utility owners is being made as required. A summary of the utility responses received from the utility owners and agencies as of the date of this report is shown in Table 2.1. Known utilities are shown on the reduced scale Schematic Design Phase Plans. Comcast, the County of Fresno, Qwest Communications and Time Warner Telecom are the utility companies and agencies that have not provided utility information. A follow-up letter would be sent to these utility companies and agencies in order to refine the design.
Table 2.1 Existing Utility Information

<table>
<thead>
<tr>
<th>Utility Owner</th>
<th>Response Received?</th>
<th>Utilities in Area?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Square (Comcast)</td>
<td>N</td>
<td>—</td>
</tr>
<tr>
<td>AT&amp;T California</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>AT&amp;T Transmission</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>CVIN</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>City of Fresno</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Comcast</td>
<td>N</td>
<td>—</td>
</tr>
<tr>
<td>County of Fresno</td>
<td>N</td>
<td>—</td>
</tr>
<tr>
<td>Fresno Irrigation District</td>
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<td>FMFCD</td>
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<td>Y</td>
</tr>
<tr>
<td>Level 3 Communications</td>
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<td>MCI Network Services</td>
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</tr>
<tr>
<td>PG&amp;E</td>
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<td>Y</td>
</tr>
<tr>
<td>Ponderosa Telephone</td>
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<td>N</td>
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<tr>
<td>Qwest Communications</td>
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<tr>
<td>Sebastian Corporation</td>
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<td>N</td>
</tr>
<tr>
<td>Sprint</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Time Warner Telecom</td>
<td>N</td>
<td>—</td>
</tr>
</tbody>
</table>
CHAPTER 3
EXISTING CONDITIONS & DESIGN REQUIREMENTS

3.1 100 Year Flood Limits

The federal 100-year flood limits were obtained using digital Flood Insurance Rate Maps (FIRMs) for Fresno and Madera Counties, which are available through the Federal Emergency Management Agency (FEMA). Any improvement within the 100-year flood zone is susceptible to inundation by a rain event that has a 1% probability of occurring each year. The base flood elevation changes within the project boundary from an elevation of approximately 265.5 feet to 265.8 feet from west to east respectively using the NGVD 29 datum. Base flood elevations shown in the FIRMs were changed from the NAVD 88 datum to the NGVD 29 datum because it is primarily used by the City of Fresno. All FIRMs associated with the project are available in Appendix C of this report.

3.2 Limits of Waste and Site Description

The project site is known to be within areas used in the past for waste disposal. Wastes from various sources were disposed over many years in the bluff area. In the floodplain, construction and demolition wastes were disposed.

3.2.1 Landfill Wastes

A review was conducted of all of the landfill documents acquired from the Fresno County Department of Public Health (FCDPH). All landfill limit figures that were available were approximate in nature, leaving the precise landfill limits unclear. With the combination of report figures and help from FCDPH personnel, the approximate limits of waste are shown by blue dashed lines on the site map located in Appendix A. As reported in the Geotechnical Memo, landfill materials were encountered in a boring in this area, Boring B-1, at various depths below existing ground surface (EGS).

3.2.2 Construction and Demolition Waste

According to the “Site Reconnaissance” report prepared by Twining in 2002, the location of the proposed parking lot is considered a landfill composed of construction and demolition (C&D) waste. The approximate limits of the C&D waste are identified on the Site Map by magenta dashed lines. This site is also referred to as Spano Landfill.

Per the Environmental Protection Agency website, C&D waste materials consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges that often contain bulky, heavy materials, such as concrete, wood, metals, glass, and salvaged building components.

3.3 Emergency Vehicle Access

In order to provide emergency access to the site, the Fresno Fire Department Development Policies must be followed. According to Section 403.2, “Fire Department Access,” the access road must be an approved all weather surface, capable of supporting an 80,000 pound vehicle, have a grade of 10% (10H:1V) or less, and have 24 feet of unobstructed width. Lanes that are one way shall be 15 feet in width.
A vehicle turnaround would be necessary for emergency vehicles within the parking lot. Requirements for a turnaround include a 44 foot centerline turning radius and a 20 feet clear driving width.
CHAPTER 4
PROPOSED IMPROVEMENTS

4.1 General

Included in Appendix B of this report are reduced scale Schematic Design Drawings. The Schematic Design Drawings represent a level of design completion of approximately 30% and include the horizontal geometry, limited vertical geometry, and the existing and proposed utilities. The drawings also include retaining wall and embankment concepts, and a parking lot with security lighting and self-contained vault toilet restroom facilities.

4.2 Street Design

The proposed two-lane access road would begin from the existing North Palm Avenue cul-de-sac and go through the west side of Spano Park before proceeding across the bluff face downgradient toward the river bottom. The access road would be constructed with a 10% maximum gradient across the bluff face. The proposed road would then wrap around the FMFCD stormwater detention basin and end at the proposed parking lot.

4.2.1 Street Cross Section

4.2.1.1 General

The access road is considered a future local roadway and according to Figure MT-1, “Major Street Circulation Diagram,” of the City’s 2014 General Plan, the alignment of future local streets are typically not specified by the General Plan Circulation Diagram. The proposed access road geometry generally conforms to City Standard Drawing P-56, “Local Street Cross-Section” with a few modifications. Those modifications include continuous cross slope and sidewalk, curb and gutter on one side only.

4.2.1.2 Design Speed

According to the State of California Department of Motor Vehicles, the design speed for open space areas and parks is 25 mph. A 5 mph design speed combined with an overall 49.4 foot long fire truck was used for this design to meet the typical fire truck turning radius of 44 feet.

4.2.1.3 Bike Lane and Ramp

The City of Fresno’s Active Transportation Plan identifies Nees Avenue to the San Joaquin River as hosting a planned Class I Bike Path. The access road would be a roadway shared with vehicles and bicyclists along with the option to utilize a proposed pedestrian stairway. A bicycle ramp is planned to accompany the proposed stairway.

4.3 Emergency Vehicle Access

The emergency vehicle tested was 49.42 feet in length from bumper to bumper with a designed speed of 5 miles per hour. This model was successful with the designed access road shown on the schematic design plans.
4.4 Pedestrians and Bicyclists Access

Pedestrians and bicyclists would have two options to access the river from the top of the bluff. Pedestrians can utilize the 6 foot wide sidewalk alongside the access road or make use of the new stairway with a bike rail that would commence from the top of the bluff and at the northwest corner of Spano Park. Bicyclists would use the access roadway or make use of the stairway.

4.5 Parking Lot with Restrooms

A 40-stall parking lot with solar powered security lights and picnic tables would be constructed at the end of the access road and next to the river. There would be no water service for the parking lot area. For the ADA compliant restroom facility, a prefabricated building would be installed with two self-contained vault toilets and a hand sanitizer station.

4.6 Americans with Disabilities Access

The project would provide public vehicle access from the northern terminus of Palm Avenue to the floodplain parking area. From the parking area where ADA-compliant parking spaces would be provided, ADA-compliant grades would allow for access to the trail extension, picnic tables, and proposed restroom.

4.7 Spano Park

Spano Park would be affected by any improvements proposed to go through the park. Currently, the park area is approximately 1.13 acres. With the proposed access road, several existing amenities such as picnic tables, sidewalk and water fountain would need to be removed and relocated. With the implementation of the proposed improvements, the new park area would be approximately 0.89 acres.
5.1 Storm Drain

5.1.1 General

There are existing FMFCD master-planned storm drain facilities within the project limits in the area above the top of bluff. New pipelines and drain inlets to provide drainage for the entrance would be constructed. For the roadway and features below the top of slope, on-site drainage must be provided. Additionally, there is an existing single box culvert and concrete headwall associated with the detention basin that must be extended or otherwise modified.

5.1.2 Existing Inlet at North Palm Avenue Cul-De-Sac

There is an existing double type “D” inlet at the north end of the existing North Palm Avenue cul-de-sac, west of the Spano Park drive approach. There is an existing 24-inch storm drain pipe that connects the inlet to an existing Type “A” manhole north of the inlet.

The inlet conflicts with proposed improvements and it is recommended, and this schematic design assumes, that the inlet, pipeline and manhole be relocated further east, and that the curb and gutter be reconstructed to accommodate the new location of the inlet.

5.1.3 Existing Inlets North of Spano Park Drive Approach and West of the Access Road

There are two existing type “E” inlets in Spano Park, north of the Spano Park drive approach and west of the proposed access road. There is an existing 12-inch PVC pipe that connects both inlets to an existing Type “A” manhole northeast of the inlets.

The inlets and pipe conflict with the proposed improvements and it is recommended, and this schematic design assumes, that the inlets and pipeline be relocated further northeast and connected to the relocated Type “A” manhole.

5.1.4 Existing Inlet North of Spano Park Drive Approach and East of the Access Road

There is an existing type “E” inlet in Spano Park, north of the Spano Park drive approach and east of the proposed access road. There is an existing 12-inch PVC pipe that connects the inlet to an existing Type “A” manhole northwest of the inlet.

The existing inlet conflicts with the proposed improvements and it is recommended, and this schematic design assumes, that the inlet and pipeline be relocated further northeast and connected to the relocated Type “A” manhole.

5.1.5 Proposed Inlet near Existing Box Culvert

A non-master planned inlet and storm drain pipe is proposed at the toe of the bluff and next to the existing apron channel. The acceptance of a non-master planned drainage is subject to the approval of FMFCD. The inlet and storm drain pipe is shown on the schematic plans.
5.1.6 Proposed Extension of Existing Box Culvert

There is an existing chain link fence and 6 foot by 6 foot reinforced concrete box culvert that is located near the southeast corner of FMFCD’s basin.

The existing facilities are in conflict with the proposed access road and it is recommended, and this schematic design assumes, that the box culvert be extended further north to provide sufficient space for the access road and sidewalk.

5.1.7 Proposed Inlet and Settling Swale North of Basin

A drainage inlet and vegetative swale with berms is proposed to collect runoff from the parking lot and northern segment of the access roadway. The swale is proposed to route around the parking lot before daylighting into the river. The purpose of the berm is to allow any collected sediments to settle in the swale before the storm water releases into the river. The inlet and vegetative swale are shown on the schematic plans.
CHAPTER 6
LANDSCAPE AND IRRIGATION IMPROVEMENTS

6.1 Landscape Planting

6.1.1 Spano Park

The existing trees and turf within the project limits would be removed. New trees conforming to the City’s Street Tree Master Plan would be installed and new turf would be established as necessary.

6.1.2 Bluff Area and Parking Lot

Some of the existing trees at the toe of the bluff are within the project limits and would be removed, including several mature western sycamores. For every native tree that is removed, native trees would be replanted at ratios established in the environmental review documentation for the project. New trees and shrubs would be installed along the access road, along the toe of the bluff, and around the parking lot. In addition, for long-term control of erosion, a Caltrans-approved hydroseed mix would be applied to any disturbed areas.

6.2 Irrigation System

6.2.1 Spano Park

The existing irrigation system that is disturbed by the proposed access road would be relocated and re-established as necessary to recreate the remaining park area.

6.2.2 Bluff Area and Parking Lot

There is an existing irrigation system near the proposed parking lot. It is assumed that any new irrigation facilities would be able to connect to the existing irrigation system to provide irrigation for any new trees and shrubs planted within the bluff and parking lot area. If tying into the existing irrigation system is not feasible, then a new well and pump is proposed to provide irrigation for any new vegetation that is planted within the bluff and parking lot area.
CHAPTER 7
GEOTECHNICAL ENGINEERING INVESTIGATION

7.1 General

A geotechnical design memorandum (Geotechnical Memo) was performed for the project by RMA GeoScience, as a subconsultant to the City of Fresno. A copy of the Geotechnical Memo is included in Appendix D for reference. Geotechnical borings were performed at 5 locations. See Figure 2, Boring Location Map in the Geotechnical Memo.

7.2 Pavement Structural Section Design

7.2.1 General

The Geotechnical Memo recommends the pavement structural section should be designed in accordance with the design methodology in the Caltrans Highway Design Manual. Design parameters include the R-value of the soil and the traffic index. The Geotechnical Memo includes various pavement structural sections for various traffic indices.

7.2.2 Traffic Index

North of Nees Avenue, Palm Avenue is considered a local street. The traffic index typically used for design should be 5.0 in conformance with Standard Drawing P-50, “Street Construction Requirements and Traffic Indices.” Recommendations for design traffic indices for 5.5 and 6.0 are also included in this report.

7.2.3 Measured R-Values

A sub-grade resistance value (R-value) was obtained for this report. The R-value and the boring identification number tested are shown in Table 7.1. See Figure 2 Boring Location Map in Appendix D for a location map of the test boring.

<table>
<thead>
<tr>
<th>Test Boring ID</th>
<th>R-value</th>
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<tbody>
<tr>
<td>B-1</td>
<td>53</td>
</tr>
</tbody>
</table>

7.2.4 Design R-values

The recommended R-value for this project is 40.

7.2.5 Pavement Structural Section

There are possible pavement structural sections for each design traffic index shown in Table 7.2. Three different structural sections are shown: one using 2.5 inches of asphalt concrete over 5.0 inches of Class 2 aggregate base, one using 3.0 inches of asphalt concrete over 5.5 inches of Class 2 aggregate base, and one that is using 3.0 inches of asphalt concrete over 6.5 inches of Class 2 aggregate base. For construction cost saving purposes, the actual structural section that would be used on the project is expected to be for a design traffic index of 5.0.
To complete final design, it is recommended that a meeting be held with the Design Engineer and the City to determine the appropriate pavement structural section(s) to be used on the project.

### Table 7.2 Pavement Structural Sections by Design Traffic Index

<table>
<thead>
<tr>
<th>Design TI</th>
<th>AC Thickness (in)</th>
<th>AB Thickness (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>2.5</td>
<td>5.0</td>
</tr>
<tr>
<td>5.5</td>
<td>3.0</td>
<td>5.5</td>
</tr>
<tr>
<td>6.0</td>
<td>3.0</td>
<td>6.5</td>
</tr>
</tbody>
</table>

#### 7.3 Retaining Wall Design

7.3.1 General

The elevation change is approximately 62 vertical feet on the existing bluff slope on the north side of Spano Park; there are a few options for constructing the access road, including one or more retaining walls. The retaining wall should be designed per the recommendations provided in the Geotechnical Memo to resist the following lateral active earth pressures. Design parameters include surface side slope, lateral active earth pressures, and footing widths.

7.3.2 Lateral Active Earth Pressure and Surface Side Slope

The retaining wall should be designed to resist the following lateral active earth pressures with the recommended surface side slope as shown in Table 7.3.

### Table 7.3 Recommended Surface Side

<table>
<thead>
<tr>
<th>Equivalent Fluid Weight (pcf)</th>
<th>Surface Side Slope (H:V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>Level</td>
</tr>
<tr>
<td>41</td>
<td>5:1</td>
</tr>
<tr>
<td>42</td>
<td>4:1</td>
</tr>
<tr>
<td>45</td>
<td>3:1</td>
</tr>
<tr>
<td>58</td>
<td>2:1</td>
</tr>
</tbody>
</table>

7.3.3 Footing Width

The footings for retaining walls are recommended to be embedded at least 24 inches into firm native soils or engineered fill and have a minimum width of 24 inches.
8.1 General

In addition to the possible incorporation in the DEIR to meet California Environmental Quality Act requirements, there are permits and environmental documentation that must be considered to develop this alternative.

8.2 §1600 Lake or Streambed Alteration Agreement (LSAA)

According to the California Department of Fish and Wildlife (DFW), an entity must notify the agency prior to work that may substantially divert or obstruct the natural flow of any river, substantially change or use any material from any river, deposit materials that could pass into any river, or adversely affect existing fish or wildlife resources.

It is recommended that completed plans for this project be submitted to the DFW for review and potential recommendations to reduce impacts to the fish and/or wildlife habitat.

8.3 Army Corps Wetland Delineation Survey

Section 404 of the Clean Water Act gives the Army Corps of Engineers jurisdiction over discharges of fill to Waters of the U.S., including projects that impact wetlands. If a site or access road is found to be within wetlands, building within the wetlands may result in mitigation at a to-be-determined ratio through buying mitigation bank credits, building wetland habitat, or restoring wetland habitat at another location.

A wetland delineation study should be conducted to determine if the proposed alternative is within wetland areas. Typical surveys investigate the site for hydric soils, hydrophytic vegetation, and examine the site hydrology. A wetland delineation study should be prepared in coordination with the final plans.

8.4 Army Corps §404 Nationwide Permit

For construction activities where minimal environmental effects are planned in the waters of the United States, a §404 Nationwide Permit would be required. The Army Corps of Engineers issues Nationwide Permits and the Army Corps of Engineers would review the project prior to the applicant acquiring the permit.

8.5 Clean Water Act §401 Permit

Prior to construction or operation of facilities at the project site, which may result in any discharge into the navigable waters, a Clean Water Act §401 permit from the Army Corps of Engineers is required. The permit cannot be submitted until CEQA is completed. After the completion of the CEQA documentation, a 401 Water Quality Certification application would be submitted and reviewed by the State Water Resources Control Board.
8.6 Central Valley Flood Protection Board Encroachment Permit

An encroachment permit application is required to be submitted to the Central Valley Flood Protection Board if a project is located within 300 feet of a designated floodway. The project is located within 300 feet of the floodway and an encroachment permit application would be submitted to the Central Valley Flood Protection Board.

8.7 City of Fresno Permit to Build within a Flood Plain

There are some areas of the project in the federal 100-year flood plain. The City of Fresno Flood Plain Administrator must review the site plans and ensure that it complies with all City ordinances. According to City of Fresno ordinance 11-616(g), the Flood Plain Administrator must determine that the following requirement is met for construction below the base flood elevation:

“The volume of space occupied by the proposed fill or structure below the base flood elevation is compensated for and balanced by a hydraulically equivalent volume of excavation taken from below the base flood elevation. All such excavations shall be constructed to drain freely to the watercourse.”

This ordinance prohibits a net increase of soil in any location below the base flood elevation by means of importing fill. It is possible to alter the base flood elevation limits by transferring soil below the base flood elevation and submitting a Letter of Map Revision to FEMA once the ground is proven to be above flood levels. The City of Fresno also requires the finished floor of structures to be six inches above the base flood elevation. The restroom facility is proposed to be one foot above the base flood elevation.

8.8 FEMA Letter of Map Revision (LOMR)

All work for this project is proposed outside the federal “AE” floodway zone but partially within the floodplain boundary. The project includes transferring soil below the base flood elevation and this work would alter the floodplain boundary. A Letter of Map Revision must be prepared and submitted to the Federal Emergency Management Agency to update the Flood Insurance Rate Map. The floodway channel is identified on the Site Map available in Appendix A.

8.9 Landfill Regulation

The area on the flood plain proposed to be developed into a parking area is known to contain construction and demolition waste, referred to herein as the Spano Landfill. The Fresno County Department of Public Health is the regulatory agency for the area affected by past waste disposal. Any change in use, such as the proposed project, would be subject to the County’s review and approval. Limited borings conducted for the Geotechnical Memo found materials consistent with demolition wastes. This schematic design does not include any specific measures or construction methods to remediate wastes, should any cleanup or remediation be required by the County. Future subsurface investigations and refinements in the design could possibly assist in further avoidance of areas containing wastes.
9.1 General

The access road to the parking lot area is proposed to go through Spano Park, then along the existing bluff slope on the north side of Spano Park and wrap around FMFCD’s Basin DH2 site before reaching the parking lot.

For this to be achieved, discussions with FMFCD took place to determine if they had any concerns.

9.2 Fresno Metropolitan Flood Control District

On July 14, 2017, the City of Fresno, FMFCD and Blair, Church & Flynn staff met to discuss the proposed alignment of the access road and improvements and to see if FMFCD had any concerns with the project. At the time of the meeting, FMFCD did not have any significant concerns. From an operations stand point, FMFCD executive staff shared that they would need to confirm with their field team that the proposed improvements would not interfere with operating and maintaining the basin site. Any concerns brought forward from FMFCD would be addressed as part of subsequent design efforts.
10.1 Findings

This report was designed to further evaluate the access alternative that is identified as “Site 1 (Route 2)” in the “Palm Bluffs River Access Feasibility Study,” also known as “Alternative 5b” in the Draft EIR that was prepared by the San Joaquin River Conservancy. This proposed access roadway includes two 12-foot travel lanes and a 6-foot sidewalk commencing from the existing North Palm Avenue cul-de-sac. The access road to the parking lot is proposed to go through Spano Park, along the existing bluff slope and around FMFCD’s detention basin before reaching the parking lot. For Site 1 (Route 2), also known as “Alternative 5b,” a list of factors to be addressed were determined and a list of options were produced to overcome these, as explained in the following.

10.1.1 Factors

The following list summarizes the challenges to constructing an access road to the San Joaquin River from the Nees and Palm Avenues Intersection:

- Land Use;
- Bluff Slope;
- Emergency Vehicle Access;
- 100-Year Flood Plain;
  - No Net Soil Importation;
- FMFCD Box Culvert; and
- Post Closure Landfill Plan for Spano Landfill.

10.1.2 Access Road Options

In reviewing the list of factors to address, one modification and four options were produced to meet the needs of each factor for constructing the proposed access road. Those options are:

- Reroute Approximately 210 Feet of the Access Road;
- Option 1: Embankments;
- Option 2: Retaining Wall on South Side of Access Road;
- Option 3: Retaining Wall on North Side of Access Road; and
- Option 4: Retaining Wall on North and South Side of Access Road.
10.2 Conclusion

The members of Fresno City Council and City staff recognize the potential of providing an access point to the San Joaquin River for the citizens of Fresno and the surrounding communities, leading to the request for a project feasibility study and a schematic design for access to the river from the Palm Avenue cul-de-sac site. It is important to note that this site does have potential constraints that can be time consuming and costly to address.

On the basis of the findings, it is concluded that there are various access road options that can assist with minimizing the construction cost along with shortening the possible timeline for future completion of the access roadway to the river.

10.3 Recommendations

In order to satisfy the mentioned factors and constraints, along with accommodating access for emergency vehicles, public vehicles, pedestrians and bicyclists, the following recommendations support the design for a future access roadway for the Palm Avenue cul-de-sac site. While several options were produced, the following recommendation assists with meeting the mentioned needs and minimizes the timeline and construction cost for an access road.

The following recommendations are made:

- Re-route Approximately 210 Feet of the Access Road; and
- Option 2: Retaining Wall on South Side of Access Road.

The following elaborates on the recommendations made in this report.

1) Re-route Approximately 210 Feet of the Access Road

The original proposal suggested the initial leg of the access road would be aligned through Assessor's Parcel Number 402-030-70. This parcel is privately owned and according to the 2025 Fresno General Plan this parcel is zoned Commercial Community. Right-of-way would need to be purchased. Also, as reported in the Geotechnical Memo, landfill materials were encountered at Boring B-1 at various depths below existing ground surface (EGS). The soil exploration on Assessor's Parcel Number 402-030-70 encountered debris as early as approximately 5 feet below EGS and to a depth of approximately 32 feet below EGS. Any improvements on this parcel would require development and implementation of a post closure landfill plan. This is an operation that can be very expensive. It is recommended, and the schematic design reflects, re-routing approximately 210 feet of the access road through Spano Park to avoid any improvements on the affected parcel.

2) Option 2: Retaining Wall on South Side of Access Road

To minimize the area needed to construct the access road and minimize disturbance of Spano Park, it is recommended, and the schematic design reflects, constructing a retaining wall along the south side of the road. Though the option without a retaining wall may be more affordable, it would affect more area of the existing Spano Park facilities and the existing access road south of the basin.
CHAPTER 11
ENGINEER’S OPINION OF PROBABLE CONSTRUCTION COST

11.1 General

The Engineer’s Opinion of Probable Construction Cost (OPCC) for construction of the Palm Bluffs River Access improvements is shown in Table 11.1. The estimate reflects all work shown on the Schematic Design Drawings, as well as related storm drainage and utility improvements. The estimate does not include the cost of any land purchase, or remediation. The cost does not include an entrance kiosk, picnic amenities, or the costs of an irrigation well or pump.

11.2 Pavement Structural Section

The pavement structural section (PSS) is assumed to be 2.5 inches of asphalt concrete over 5 inches of aggregate base. These numbers are used in the calculations of the weights of asphalt concrete and aggregate base in the OPCC. The PSS would be revised should the design traffic index be modified. At that time the quantities may change, which may cause the related costs to change.

11.3 Roadway and Subgrade Preparation

The quantity of roadway excavation used in the estimate assumes the entire depth of the proposed pavement structural section discussed above would be excavated in order to construct the new roadway. After the profile of the proposed road is developed and grading is finalized for the project, and the pavement structural section is selected, this quantity may change.
### Table 11.1  Engineer’s Opinion of Probable Construction Cost

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Extension</th>
</tr>
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<tbody>
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<td>1</td>
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<td>Dust Control Pollution Prevention Implementation</td>
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<td>6</td>
<td>Worker Protection From Hazardous Materials</td>
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<td>Quantity</td>
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<td>Unit Cost</td>
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Subtotal Amount: $3,111,000

Contingencies (approx. 15%): $466,650

Total Construction Cost: $3,577,650

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<tr>
<th>Item No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Extension</th>
</tr>
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<tbody>
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Subtotal Amount: $1,628,000

TOTAL PROJECT COST: $5,205,650
12.1 Recommendations

In completing the final design of the access roadway to the parking lot, there are a few recommendations made to assist with meeting this goal.

The following recommendations are:

- Further Geotechnical Investigation; and
- Boundary Survey.

The following elaborates on the recommendations made in this report.

1) Further Geotechnical Investigation

With re-routing the access road through Spano Park, further geotechnical investigation is recommended for the purpose of acquiring detailed data regarding the subsurface conditions of the park, and of the construction and demolition waste site if required by the regulatory agencies.

2) Boundary Survey

As mentioned in Section 2.3, the existing property lines shown on the schematic drawings were obtained from City of Fresno GIS data. It would be appropriate to conduct a boundary survey to display accurately the property lines of each parcels.
REFERENCES

CA DMV.  See State of California Department of Motor Vehicles.

CalEPA.  See California Environmental Protection Agency.

Caltrans.  See California Department of Transportation.


The Trust for Public Land. 2002 (June 19). *Site Reconnaissance and Soil Assessment Spano River Ranch Property Fresno, California Twining Project No. B32605.01*. San Francisco, CA.
APPENDIX A

Site Map
APPENDIX B

Schematic Design Phase Plans
APPENDIX C

Flood Insurance Rate Maps
APPENDIX D

Geotechnical Design Memorandum
Geotechnical Design Memorandum

To: Andrew Benelli, Assistant Public Works Director (Andrew.Benelli@fresno.gov)
Luis Gonzalez, Project Manager, Blair, Church & Flynn (LGonzalez@bcf-engr.com)

From: George P. Hattrup, G.E.
RMA GeoScience

Date: July 19, 2017

Subject: Geotechnical Design Information
- Palm Bluffs River Access at Spano Park
- North of Palm Avenue & Nees Avenue
- Fresno, California
- RMA Project No. 17H-0177-0

In order to help expedite the design process, the following geotechnical design information is being provided in advance of the Geotechnical Investigation Report that is being prepared for this project. The project site lies within the area of Spano Park, an FMFCD Parcel, and the River West Open Space Area, north of the intersection of Nees and Palm Avenues in Fresno, California, as indicated on Figure 1, Site Vicinity Map. The geographic position of the site is 36.8540° north latitude and 119.8064° west longitude. Based on information provided by Blair, Church & Flynn, the access road will run through the west end of Spano Park, head northeast down and along the river bluff for approximately 750 feet, and then make a 180° turn before heading to the southwest for approximately 900 feet, ending in a parking lot near the river. The access road will have overall length of about 3,050 feet. The new roadway will have a cut-fill section along the face of existing approximately 2H:1V bluff slope, with the fill extending from the new road down to the toe of the existing slope. The proposed retaining wall will have a length of approximately 550 feet, with a maximum height of 12 feet, and be located along the cut or upslope portion of the access road. This project will also include making some drainage improvements where the new access road will cross an existing culvert at the bottom of the bluff slope.

Overview of Subsurface Conditions

Five test borings were drilled along or near the alignment of the planned access road. The locations of the borings was based on the planned alignment of the access road as of June 30, 2017, as shown on Figure 2. The soil encountered in the test borings consisted of both fill and native soils. At Boring B-1, landfill materials were encountered within a fine to medium silty sand matrix to a depth of approximately 32 feet. The landfill materials included miscellaneous trash, wood, tin can, plastic, wire, rope, asphalt, motor oil, and paper. In Borings B-2 and B-3 (within the FMFCD parcel), clean fill consisting of fine to medium silty sand with minor/scattered gravel was encountered to depths of approximately 7 and 12 feet, respectively. In Boring B-5, fill with wood debris and a piece of wire was encountered within a fine to medium silty sand matrix to the maximum depth explored of 11 feet. The native soils encountered below the fill in Borings B-1 through B-3, and at Boring B-4, consisted of fine to medium silty sand with scattered fine gravel and seams of fine sand and sandy silt. The consistency of the soils was generally medium dense to very dense. However, a loose zone of soil was encountered in
Boring B-4 at a depth of approximately 15 feet. More details concerning the fill and native soils encountered in the test borings are provided on the attached boring logs.

Following our field exploration, the proposed alignment of the access road at the top of the bluff was shifted to the east so that it would be within the west end of Spano Park. This realignment was done to avoid constructing the road on landfill material as indicated by Boring B-1. Based on two letters dated May 3, 2002, which were prepared by The Twining Laboratories, and letters dated July 7 and 25, 1994, which were prepared by Fresno County Health Services Agency, landfill material was removed and replaced with engineered fill as part of the construction of Spano Park. The landfill material extended to a depth of approximately 30 feet, which corresponds well with the depth of landfill material that was encountered in our Boring B-1. These letters also indicate that engineered fill material was derived from soil that had been removed and separated from any waste and clean imported soils. One of the Twining letters also indicates that a geotechnical investigation was performed by Twining (report dated March 21, 1991, and report update dated December 2, 1999) for the Spano Park project. In addition, the placement of engineered fill following the removal of the landfill material was documented by Twining in reports dated September 6, 1994, and January 5, 1995. It is understood that the City of Fresno does not have a copy of the geotechnical investigation report, related report update, or reports documenting the engineered fill, which could be made available for review.

**Seismic Considerations**

The subject site is not located within the boundaries of an Earthquake Fault Zone for fault rupture hazard as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no faults are known to pass through the property. The nearest active earthquake fault zones (evidence of displacement within the past 11,700 years) are the Nunez Fault, the Ortigalita Fault Zone, and the San Andreas Fault Zone, located approximately, 56 miles southwest, 57 miles west, and 70 miles west, respectively, of the project site.

Seismic design parameters have been developed in accordance with Section 1613 of the 2016 California Building Code (CBC) using the online U.S. Geological Survey Seismic Design Maps Calculator (ASCE 7-10 Standard) and a site location based on latitude and longitude. The calculator generates probabilistic and deterministic maximum considered earthquake spectral parameters represented by a 5-percent damped acceleration response spectrum having a 2-percent probability of exceedance in 50 years. The deterministic response accelerations are calculated as 150 percent of the largest median 5-percent damped spectral response acceleration computed on active faults within a region, where the deterministic values govern. The calculator does not, however, produce separate probabilistic and deterministic results. The parameters generated for the subject site are presented below:
According to CBC Section 1613.3 and based on the spectral response acceleration parameters $S_{D_6}$ and $S_{D_1}$ indicated above, the Seismic Design Category is D (CBC Table 1604.5 and Section 1613.5.6) for all Risk Categories. Based on our subsurface exploration and our knowledge of the geologic setting, there is no significant risk of ground rupture, liquefaction, lateral spreading, or seismic settlement to occur at the subject site during a design-level seismic event.

### Site Preparation and Grading

The following procedures should be implemented during site preparation and earthwork grading for the proposed buildings. It should be noted that all references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D 1557 laboratory test procedures.

Within the area of the planned roadway, parking lot, and fill slope improvements, trash, debris, and the near-surface soils containing vegetation, roots, or other objectionable organic matter should be stripped to expose a clean soil surface. Based on our field exploration, the site should be stripped to a depth of at least 4 inches. In addition, tree roots will need to be removed or grubbed out and properly disposed of so they are not mixed into over-excavated soils that will be used as engineered fill. It is anticipated that the grubbing of tree roots will need to extend to a depth of approximately 2 to 3 feet below the stripped surface within the canopy area of the trees. All concentrations of tree roots and isolated roots greater than 1/2-inch in diameter must be removed. Materials resulting from stripping and grubbing operations should be removed from the site and properly disposed. The stripped and grubbed surfaces should be reviewed and approved by the Project Geotechnical Engineer prior to placing compacted fill.

In areas where the full width of the roadway is in cut, the subgrade below the AC pavement section and sidewalk area should be scarified at least 8 inches, moisture-conditioned to at least optimum moisture content, and compacted to at least 95 percent relative compaction. In areas where one side of the roadway is in cut and the other side is in fill, the subgrade in the cut area should be over-excavated 12 inches and the exposed ground surface should be scarified at least 6 inches, moisture-conditioned to at
least optimum moisture content, and compacted to at least 95 percent relative compaction. In areas where fill will be placed, the stripped ground surface should be scarified at least 8 inches, moisture-conditioned to at least optimum moisture content, and compacted to at least 92 percent relative compaction, except the upper two feet of subgrade below pavement sections should be compacted to at least 95 percent relative compaction.

Excavated soils that are free of organics or other deleterious materials may be used as engineered fill, subject to the review and approval of the Project Geotechnical Engineer. Fill material should be placed in nearly horizontal layers, uniformly moisture conditioned to at least optimum moisture content, and then compacted in layers that do not exceed 8 inches in thickness. Engineered fill must be compacted to achieve a relative compaction of at least 92% except for the upper 24 inches of subgrade pavement sections subject to vehicular traffic, which must be compacted to at least 95 percent.

Permanent cut and fill slopes should be no steeper than 2H:1V. Appropriate measures should be taken to protect the faces of fill and cut slopes from erosion, including the construction of a berm, swale, or curb at the top of the slopes to prevent runoff from flowing over the top of the slope. Temporary cuts must be no steeper than 1:1 and Cal/OSHA construction safety orders should be observed during all underground work.

Fill slopes must be properly keyed and benched into the existing slope where the planned roadway will be constructed along the face of the river bluff. The keyway should be at least 12 feet wide and extend into firm and stable soils at least two feet below the bottom of the ditch that exists at the toe of the existing slope. As fill is placed it should be benched into the existing FMFCD embankment using 2-foot vertical benches and benched into the river bluff slope using 4-foot vertical benches. A representative from RMA GeoScience must review and approve the keyway and benches as they are being constructed to evaluate the stability surrounding soils and determine if changes to these recommendations are warranted.

**Slope Stability Analysis**

A slope stability analysis is being performed to evaluate the overall stability of the existing river bluff slope and the proposed slope condition at roadway Station 14+00. Details of this analysis will be provided in our forthcoming geotechnical report; however, based on the analysis that has been completed to date, the factors of safety against a slope failure are provided below.

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<th>Slope Condition</th>
<th>Factor of Safety</th>
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</thead>
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<td>Existing Slope - Static Conditions</td>
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<tr>
<td>Existing Slope - Seismic Conditions</td>
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<td>Proposed Slope with Roadway - Static Conditions</td>
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<tr>
<td>Proposed Slope with Roadway - Seismic Conditions</td>
<td>1.66</td>
</tr>
</tbody>
</table>
Our slope stability analysis indicates that the proposed roadway project will enhance the stability of the river bluff slope in the project area. This was anticipated, since the new fill embankment will act as a buttress on the lower part of the existing slope.

**Imported Fill Material**

Imported fill materials must be free of organics, non-hazardous and be obtained from a single, uniform source that meets the following criteria:

- **Maximum Particle Size:** 3 inches
- **Percent Passing 3/4 inch Sieve:** 90% - 100%
- **Percent Passing #4 Sieve:** 65% - 100%
- **Percent Passing #200 Sieve:** 20% - 50%
- **Remolded Angle of Internal Friction:** ≥ 32°
- **Minimum R-Value:** 40 (for upper 12" of subgrade below pavement sections)
- **Soluble Sulfates:** < 1,000 mg/kg
- **Soluble Chlorides:** < 200 mg/kg
- **pH:** in the range of 6.0 to 8.5

**Retaining Walls**

Provided a non-expansive, drained backfill is placed, retaining structures should be designed to resist the following lateral active earth pressures:

<table>
<thead>
<tr>
<th>Surface Slope of Retained Materials (Horizontal:Vertical)</th>
<th>Equivalent Fluid Weight (pcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>38</td>
</tr>
<tr>
<td>5:1</td>
<td>41</td>
</tr>
<tr>
<td>4:1</td>
<td>42</td>
</tr>
<tr>
<td>3:1</td>
<td>45</td>
</tr>
<tr>
<td>2:1</td>
<td>58</td>
</tr>
</tbody>
</table>

Footings for retaining walls should be embedded at least 24 inches into firm native soils or engineered fill and have a minimum width of 24 inches. Footings may be designed using an allowable average bearing pressure of 3,000 psf with a maximum toe pressure of 3,500 psf. and lateral resistance values recommended for continuous wall footings. This allowable bearing pressure represents an allowable net increase in soil pressure over existing soil pressure and may be increased by one-third for short-term seismic loads. The type and dimensions of concrete, and the size and location of reinforcing steel, used in foundations should be specified by the Project Design Engineer.

Lateral loads may be resisted by soil friction and the passive resistance of the soil. The following parameters are recommended.
- Allowable Passive Earth Pressure = 200 pcf (equivalent fluid weight, includes a factor of safety = 2.0)
- Allowable Coefficient of Friction (soil to footing) = 0.4 (includes a factor of safety = 1.5)

**Cement Type and Soil Corrosion Potential**

The results of a test performed on a shallow sample of soil obtained from the project site indicate the soluble sulfate content is 13.3 mg/kg (0.000133 percent by weight). Thus, below-grade concrete at the subject site should have a negligible exposure to water-soluble sulfate in the soil. Our recommendations for concrete exposed to soils containing various concentrations of soluble sulfate are presented in the table below.

**Recommendations for Concrete Exposed to Soils Containing Soluble Sulfate**

<table>
<thead>
<tr>
<th>Sulfate Exposure</th>
<th>Water Soluble Sulfate (SO₄) in Soil (% by Weight)</th>
<th>Sulfate (SO₄) in Water (ppm)</th>
<th>Cement Type (ASTM C150)</th>
<th>Maximum Water-Cement Ratio (by Weight)</th>
<th>Minimum Compressive Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negligible</td>
<td>0.00 - 0.10</td>
<td>0-150</td>
<td>--</td>
<td>--</td>
<td>2,500</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.10 - 0.20</td>
<td>150-1,500</td>
<td>II</td>
<td>0.50</td>
<td>4,000</td>
</tr>
<tr>
<td>Severe</td>
<td>0.20 - 2.00</td>
<td>1,500-10,000</td>
<td>V</td>
<td>0.45</td>
<td>4,500</td>
</tr>
<tr>
<td>Very Severe</td>
<td>Over 2.00</td>
<td>Over 10,000</td>
<td>V plus pozzolan or slag</td>
<td>0.45</td>
<td>4,500</td>
</tr>
</tbody>
</table>

Use of alternate combinations of cementitious materials may be permitted if the combinations meet design recommendations contained in American Concrete Institute guideline ACI 318-11.

Our testing also indicates that there is a very low soluble chloride content (15.0mg/kg) in the onsite soils; therefore, no special protection of reinforcing steel should be required due to soil conditions.

The soils were also tested for soil reactivity (pH) and minimum electrical resistivity (ohm-cm). The test results indicate that the on-site soils have a soil reactivity of 8.6 and a minimum electrical resistivity of 11,450 ohm-cm. A neutral or non-corrosive soil has a pH value ranging from approximately 6 to 8.4. Generally, soils that could be considered moderately corrosive to ferrous metals have minimum resistivity values of about 3,000 ohm-cm to 10,000 ohm-cm. Soils with minimum resistivity values less than 3,000 ohm-cm can be considered corrosive and soils with minimum resistivity values less than 1,000 ohm-cm can be considered extremely corrosive. In any case, buried metal conduits should have a protective coating in accordance with the manufacturer’s specifications. A corrosion specialist should be consulted if more detailed recommendations are required.
Pavement Sections

The sub-grade Resistance value (R-value) of a near-surface soil sample obtained from Boring B-1 was
determined in accordance with CT 301. The results of this test indicated an R-value of 53. However, due
to the variability of the soil conditions along the project alignment and that imported fill will probably be
used to construct much of the roadway embankment, a subgrade R-value of 40 is recommended for
design purposes. The asphalt concrete (AC) structural section recommendations given herein were
developed using the procedures outlined in Chapter 630 of the California Highway Design Manual. The
design procedure is based on the principle that the pavement structural section must be of adequate
thickness to distribute the load from the design Traffic Index (TI) to the subgrade soils in such a manner that
the stresses from the applied loads do not exceed the strength of the soil (R-value). Recommended
structural sections are given below:

<table>
<thead>
<tr>
<th>Design TI</th>
<th>Recommended Pavement Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 or less</td>
<td>2.5” AC over 5.0” Class 2 AB</td>
</tr>
<tr>
<td>5.5</td>
<td>3.0” AC over 5.5” Class 2 AB</td>
</tr>
<tr>
<td>6.0</td>
<td>3.0” AC over 6.5” Class 2 AB</td>
</tr>
</tbody>
</table>

Prior to paving, the subgrade should be prepared in accordance with the "Site Preparation and Grading"
section of this document. All aggregate base courses should be moisture conditioned to within 2% of
optimum moisture content and compacted to a minimum of 95% relative compaction. The AC mix design(s)
and installation requirements should be specified by the Project Civil Engineer.

Attachments:  Figure 1, Site Vicinity Map
               Figure 2, Boring Location Map
               Logs for Borings B-1 through B-5
FIGURE 1
SITE VICINITY MAP
Palm Bluffs River Access
North of Palm and Nees Avenues
Fresno, California 93711
Project #17H-0177-0

Scale: 1" ≈ 2,170’
FIGURE 2
BORING LOCATION MAP
Palm Bluffs River Access
North of the Intersection of
Nees Avenue and Palm Avenue
Fresno, California
Project #17H-0177-0

Reference: Site Plan prepared by Blair, Church & Flynn Consulting Engineers, 05/17/2015

Scale: 1" ≈ 310'
**Exploratory Boring Log**

**Boring No. B-1**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Samples Type</th>
<th>Blows (blows/ft)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>USCS</th>
<th>Graphic Symbol</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>FILL:</strong> Brown, fine to medium SILTY SAND with minor clay, moist, dense, with interlayers of fine to medium SAND and scattered fine gravel</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>34</td>
<td>7.0</td>
<td>118.5</td>
<td></td>
<td></td>
<td>. . .increasing sand content, with scattered debris: wood fragments, tin can, asphalt fragments, plastic</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>40</td>
<td>5.4</td>
<td>112.6</td>
<td></td>
<td></td>
<td>. . .gray staining, fine to coarse, with scattered fine gravel, very dense, odor of petroleum, with scattered debris: trash, asphalt fragments</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>58</td>
<td>3.1</td>
<td>121.9</td>
<td></td>
<td></td>
<td>. . .rope . . .with scattered wire</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>34</td>
<td>6.9</td>
<td>107.8</td>
<td>SM</td>
<td></td>
<td>. . .medium dense, more plastic and wood debris</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>20</td>
<td>10.9</td>
<td>102.2</td>
<td></td>
<td></td>
<td>. . .paper and wood debris</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>. . .increasing silt content</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>27</td>
<td>11.4</td>
<td>107.8</td>
<td></td>
<td></td>
<td>. . .increasing silt content</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>35</td>
<td>8.1</td>
<td>83.7</td>
<td>SM</td>
<td></td>
<td>. . .increasing silt content</td>
</tr>
</tbody>
</table>

**Note**

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:

ID = 2.5"  OD = 3"

**Symbols:**

- **S** - SPT Sample
- **D** - Bulk Sample
- **T** - Modified California Tube Sample
- **R** - Ring Sample
- **Groundwater**
- **End of Boring**

**Geographic Position:**

36.85309°, -119.80651°
### Exploratory Boring Log

**Boring No.: B-1**  
**Sheet 2 of 2**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Blows (blows/ft)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>USCS</th>
<th>Graphic Symbol</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>T</td>
<td>60</td>
<td>34.3</td>
<td>82.3</td>
<td>SM</td>
<td>![Symbol]</td>
<td>. . . very dense</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note*

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows: ID = 2.5"  OD = 3"

**Sample Types:**
- SPT Sample
- Bulk Sample
- Modified California Tube Sample
- Ring Sample

**Symbols:**
- Groundwater
- End of Boring

---

**Date Drilled:** July 5, 2017  
**Logged By:** MJS  
**Location:** See Boring Location Map  
**Geographic Position:** 36.85309°, -119.80651°

**Notes:**
1. Boring terminated at 41’
2. No Groundwater Encountered
3. Boring backfilled with soil cuttings

---

**Drilling Equipment:** CME 75, Hollow Stem Auger  
**Borehole Diameter:** 7"  
**Drive Weights:** 140 lbs. (Autohammer)  
**Drop Height:** 30"
### Exploratory Boring Log

#### Boring No.  B-2

**Date Drilled:** July 5, 2017  
**Logged By:** MJS  
**Location:** See Boring Location Map  
**Geographic Position:** 36.85392°, -119.80609°

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Blows (blows/ft)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>USCS</th>
<th>Graphic Symbol</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>T</td>
<td>39</td>
<td>9.8</td>
<td>107.7</td>
<td>SM</td>
<td></td>
<td><strong>FILL:</strong> Brown, fine to medium SILTY SAND with scattered fine gravel, moist, dense</td>
</tr>
<tr>
<td>10</td>
<td>R</td>
<td>40</td>
<td>9.4</td>
<td>100.2</td>
<td>SM</td>
<td></td>
<td><strong>NATIVE:</strong> Brown, fine to medium SILTY SAND with scattered fine gravel, moist, dense</td>
</tr>
<tr>
<td>15</td>
<td>T</td>
<td>21</td>
<td>6.0</td>
<td>94.0</td>
<td></td>
<td></td>
<td>. . . fine grained, increasing sand content, no fine gravel</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Symbols:**
- SPT Sample  
- Bulk Sample  
- Modified California Tube Sample  
- Ring Sample  
- Groundwater  
- End of Boring

**Sample Types:**
- S - SPT Sample  
- B - Bulk Sample  
- T - Modified California Tube Sample  
- R - Ring Sample

*Note*
All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:
- ID = 2.5"  
- OD = 3"

**Drive Weights:** 140 lbs. (Autohammer)  
**Drop Height:** 30"  
**Drilling Equipment:** CME 75, Hollow Stem Auger  
**Borehole Diameter:** 7"
### Exploratory Boring Log

**Boring No.** B-3

#### Date Drilled:
July 5, 2017

#### Logged By:
MJS

#### Location:
See Boring Location Map

#### Geographic Position:
36.85445°, -119.80487°

#### Drilling Equipment:
CME 75, Hollow Stem Auger

#### Borehole Diameter:
7" 

#### Drive Weights:
140 lbs. (Autohammer)

#### Drop Height:
30"

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Blows (blows/ft)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>USCS</th>
<th>Graphic Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>T</td>
<td>29</td>
<td>8.2</td>
<td>109.1</td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>R</td>
<td>33</td>
<td>14.0</td>
<td>104.4</td>
<td>SM</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>S</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Material Description

This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

**FILL:**
Brown, fine to medium SILTY SAND with scattered coarse grains and fine gravel, moist, medium dense

- . . . no gravel
- . . . dense

**NATIVE:**
Brown, fine to medium SILTY SAND, moist, dense

- . . . light brown, very loose

#### Notes:
1. Boring terminated at 16'
2. No Groundwater Encountered
3. Boring backfilled with soil cuttings

#### Sample Types:
- **S** - SPT Sample
- **B** - Bulk Sample
- **T** - Modified California Tube Sample
- **R** - Ring Sample

#### Symbols:
- ** groundwater**
- ** end of boring**

---

*Note*
All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:

- **ID** = 2.5" 
- **OD** = 3"
### Exploratory Boring Log

#### Boring No.  B-4

**Date Drilled:** July 5, 2017  
**Logged By:** MJS  
**Location:** See Boring Location Map  
**Geographic Position:** 36.85479°, -119.80595°  
**Drilling Equipment:** CME 75, Hollow Stem Auger  
**Borehole Diameter:** 7"  
**Drive Weights:** 140 lbs. (Autohammer)  
**Drop Height:** 30"  

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Blows (blows/ft)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>USCS</th>
<th>Graphic Symbol</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>T</td>
<td>17</td>
<td>11.3</td>
<td>107.0</td>
<td></td>
<td>SM</td>
<td>NATIVE: Brown, fine to medium SILTY SAND, moist, medium dense . . . dense, with seams of fine to medium SAND</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
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</tr>
<tr>
<td>30</td>
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<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sample Types:**
- [ ] - SPT Sample  
- [ ] - Bulk Sample  
- [ ] - Modified California Tube Sample  
- [ ] - Ring Sample  

**Symbols:**
- [ ] - Groundwater  
- [ ] - End of Boring

---

*Note*

All blow counts associated with Modified California Sample are uncorrected. The sampler dimensions are as follows:

- ID = 2.5"
- OD = 3"
**Exploratory Boring Log**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Blows (blows/ft)</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>USCS</th>
<th>Graphic Symbol</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>S</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>SM</td>
<td>LIGHT BROWN FINE TO MEDIUM SILTY SAND WITH SCATTERED FINE GRAVEL, MOIST, MEDIUM DENSE</td>
</tr>
<tr>
<td>10</td>
<td>S</td>
<td>21</td>
<td>4.9</td>
<td>97.9</td>
<td></td>
<td></td>
<td>... very loose, with wood debris</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>... medium dense, increasing sand content</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>... with scattered wire</td>
</tr>
</tbody>
</table>

**Notes:**
1. Boring terminated at 11’
2. No Groundwater Encountered
3. Boring backfilled with soil cuttings

**Material Description**

This log contains factual information and interpretation of the subsurface conditions between the samples. The strata indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log shows subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.

**Symbols:**
- S - SPT Sample
- T - Bulk Sample
- F - Modified California Tube Sample
- R - Ring Sample
- Water Table
- Groundwater
- End of Boring

**Date Drilled:** July 5, 2017

**Logged By:** MJS

**Location:** See Boring Location Map

**Geographic Position:** 36.85382°, -119.80783°

**Drilling Equipment:** CME 75, Hollow Stem Auger

**Borehole Diameter:** 7”

**Drive Weights:** 140 lbs. (Autohammer)

**Drop Height:** 30"