Appendix E

Flood Plain, Hydrology & Hydraulics
and Clean Water Memorandum
Memorandum

Date: March 9, 2017
To: Randy Leptien – LCC Engineering and Surveying, Inc.
    Daniel Carley – Kimley-Horn and Associates Inc.
From: Alvin Yim and Caroline Vurlumis – WRECO
Subject: Pacheco Blvd Improvements Project – Floodplain, Hydrology/Hydraulics, and Water Quality Technical Memorandum

1. INTRODUCTION
Kimley-Horn and Associates, Inc. (KHA) was retained by LCC Engineering and Surveying, Inc. (LCC) for the City of Martinez (City) and Contra Costa County (County) to develop alignment and roadway improvement alternatives on Pacheco Boulevard (Blvd). The proposed project (Project) includes improvements along Pacheco Blvd from Blum Road to Morello Avenue.

Memorandum Purpose
The purpose of this memorandum is to identify potential floodplain, stormwater quality, and drainage impacts and potential mitigation measures due to the proposed Project. This memorandum includes the regulatory requirements, existing conditions, and the potential improvements and impacts associated with floodplain, stormwater quality, and drainage within the Project limits. This memorandum was prepared without any detailed analysis or calculations, and the findings are based on field observations, preliminary Project descriptions, and conceptual layouts of potential short-term and long-term improvements and countermeasures provided by KHA. A location map of the Project is shown in Figure 1, and Preliminary Layouts are shown in Attachment A.

Project Description
Options being considered include:

- Widening of Pacheco Blvd for Segment 1 between Blum Road and Arnold Drive to include additional through lanes, a two-way left turn lane, bicycle lanes, and sidewalks;
- Signalization and lane striping at the intersection of Pacheco Boulevard and Arnold Drive;
- Widening of Pacheco Blvd from Arnold Drive to Arthur Road including addition of two way turn lane, bicycle and pedestrian facilities
- Realignment of Pacheco Boulevard at the Burlington Northern Santa Fe railway tracks;
- Intersection improvements at the intersection of Pacheco Boulevard and Arthur Road, including the addition of an eastbound left turn lane and a northbound right turn lane;
- Widening of Pacheco Boulevard for Segment 3 between Arthur Road and Camino Del Sol; and
• Widening of Pacheco Boulevard for Segment 4 between Camino Del Sol and Morello Avenue.

Pacheco Boulevard is classified as a Route of Regional Significance because of its high importance to the adjacent street network. It is a primary connector to the City of Martinez from other Contra Costa County destinations. Pacheco Boulevard is located parallel to Interstate 680 to the west, and becomes Contra Costa Boulevard south of 2nd Avenue. Within the study area, Pacheco Boulevard is a two-lane, north-south arterial roadway. North of Arthur Road, there is a two-way left-turn lane along the entire length of the study corridor. Pacheco Boulevard serves industrial, retail, and residential land uses. There are intermittent sidewalks and bicycle facilities along Pacheco Boulevard throughout the study corridor. Pacheco Boulevard goes underneath the Burlington Northern Santa Fe railway tracks north of Falling Star Drive. This crossing has been reviewed for relocation due to the narrow road width and horizontal curves approaching and exiting the crossing.
Figure 1. Project Location Map
2. REGULATORY SETTING AND REQUIREMENTS

Floodplain

Federal Emergency Management Agency

The Project spans three Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels: 06013C0088G, 06013C0089G, and 06013C0277F. There are two panels with floodplains along the Project alignment, panels 06013C0088G and 06013C0089G (represented in Figure 2).

![Figure 2. Floodplain at Project Site](Source: Google Earth and FEMA)

According to the FIRMs, the floodplains are located in Zone A (in teal), which is considered to be the 100-year floodplain (Special Flood Hazard Area) without Base Flood Elevations. See Attachment B for the FEMA FIRMettes that are available for the Project area. Zone A represents a base floodplain that has a 1% annual chance flood hazard. It is located between Stations 44+50 and 71+50.
Stormwater Quality
California Clean Water Act (CWA) Section 303(d) List
The CWA Section 303(d) List (State Water Resources Control Boards [SWRCB] 2010) is a compiled list of waters within California that have not attained water quality standards established by the United States Environmental Protection Agency (EPA). The CWA Section 303(d) list outlines the impacted waters as well as identifies the water body type, pollutant, and potential origin of the pollutant.

MS4 Permit and C.3 Stormwater Requirements
The Project is within jurisdictional areas of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase I Permit area in Central Contra Costa County in the jurisdiction of San Francisco Bay Regional Water Quality Control Board (RWQCB). The study area within the Region 2 MRP would comply with the San Francisco Bay Region Municipal Regional Stormwater NPDES Permit as described in the Stormwater C.3 Guidebook Contra Costa Clean Water Program (CCCWP) (2012).

Per the CCCWP C.3 stormwater requirements, projects that are an acre or larger must select “one of four flow-control compliance options in Appendix C. Where required, design project features and facilities for hydrograph modification management (flow-control) as well as stormwater treatment. Evaluate feasibility of storage for later use. Prepare and submit a Stormwater Control Plan as described in Chapter 3 and use the Low Impact Development (LID) Guide in Chapter 4, including the sizing factors and criteria for “treatment and flow control” (CCCWP 2012). Projects that create and/or replace 10,000 square feet or more of impervious surface must implement “LID source control, site design, and stormwater treatment onsite or at a joint stormwater treatment facility in accordance with Provisions C.3.c. and C.3.d., unless the Provision C.3.e. alternate compliance options are invoked. For adjacent Regulated Projects that will discharge runoff to a joint stormwater treatment facility, the treatment facility must be completed by the end of construction of the first Regulated Project that will be discharging runoff to the joint stormwater treatment facility.” (NPDES MRP 13).

Construction General Permit Order 2009-009-DWQ
Construction activities that are deemed as “covered” under the SWRCB Construction General Permit (CGP) Order 2009-009-DWQ (amended by 2010-0014-DWQ and 2012-0006-DWQ) must conform to requirements outlined in the CGP, including the implementation of Storm Water Pollution Prevention Plans (SWPPP), among other requirements. Section II.B.1 of the CGP defines covered construction activities as: “Any construction or demolition activity, including, but not limited to, clearing, grading, grubbing, or excavation, or any other activity that results in a land disturbance of equal to or greater than one acre” (CGP Fact Sheet 7).
For all projects subject to the CGP, applicants are required to develop and implement an effective SWPPP.

The CGP separates projects into risk levels 1, 2, or 3. Risk levels are determined during the planning and design phases and are based on sediment and receiving water risks. Requirements apply according to the risk level determined. For example, a Risk Level 3 (highest risk) project would require compulsory stormwater runoff pH and turbidity monitoring, and pre- and post-construction aquatic biological assessments during specified seasonal windows. The CGP’s post-construction requirements for runoff reduction apply to projects that lie outside of jurisdictions covered by a standard Urban Stormwater Management Plan or post construction requirements in either NPDES Phase I or Phase II permits.

**Hydromodification Requirements**

Construction activities that create and/or replace one acre or more of impervious surface must meet hydromodification management (HM) measures as outlined in the MRP. HM standards as outlined in the MRP state that “…increases in runoff flow and volume will be managed so that post-project runoff does not exceed estimated pre-project rates and durations…” (NPDES MRP 35). The countermeasures being considered would have to “match the pre-project discharge rates and durations from 10% of the pre-project 2-year peak flow up to the pre-project 10-year peak flow” (NPDES MRP 35).
3. EXISTING CONDITIONS

**Summary of Existing Hydrology**
The Project area generally consists of flat to rolling, hilly topography dominated by grasslands. During a rain event, water is most likely to flow down the hills from the west side of Pacheco Blvd to the east. There are various pooling areas on the eastern side of Pacheco near the unnamed creek by Las Juntas Elementary School. Water flows through culverts from the west side of Pacheco to the east and along the eastern side.

The Project vicinity in Contra Costa County is zoned primarily as residential, commercial, and light industry.

**Summary of Receiving Waters**
The proposed Project area is within the Mount Diablo Creek and Walnut Creek watersheds, and the Suisun Hydrologic Unit (sub-area 207.33). The USGS topographic map identifies several water bodies in the Project vicinity. The Contra Costa Canal crosses the project site underground between Arnold Drive and Blum Road and remains relatively parallel to the eastern side of the Project site. Water is pumped into the Contra Costa Canal from the Sacramento/San Joaquin Delta near Rock Slough, and the canal ultimately flows to the Martinez Reservoir. Vine Hill Creek, near Las Juntas Elementary School at station 49+25, flows through the Project site. Photo 1 shows the culvert the water channel uses to cross from west to east underneath Pacheco Blvd. This tributary drains into Pacheco Creek, which flows into Grayson Creek, Walnut Creek, and Pine Creek (see Figure 3).

According to the 2012 State Water Resources Control Board 303(d) list for Water Quality Limited Segments, Grayson Creek, Walnut Creek, and Pine Creek are impaired water bodies. Grayson Creek has a total maximum daily load (TMDL) for trash pollutants. The expected TMDL completion date for allowable discharge of pollutants for Grayson Creek will be completed in 2021. Walnut Creek and Pine Creek currently contain the pesticide pollutant diazinon. Both water bodies are being addressed by the EPA to potentially approve a TMDL determination.
Photo 1. Vine Hill Creek crossing Pacheco from west to east at approximate Station 49+00
Figure 3. Project Topography and Waterway Crossings

Source: USGS and GIS
**Existing Drainage Systems**
Most of the stormwater runoff is allowed to sheet flow to adjacent property or is conveyed in roadside ditches. Overland flow within the Project area is conveyed from east to west according to topography. According to a field visit conducted by WRECO on May 27, 2016, there are approximately 31 existing inlets within the Project limits. However, many of these inlets are impacted by leaf litter and are in need of repair. Many of the inlets and culverts drain water to a pond that runs alongside Pacheco Blvd. Photo 2 displays one culvert channeling water from south to north on the east side of Pacheco Blvd. As-built information will be needed in the future design to verify the drainage system direction and to model proposed system hydraulics.

![Photo 2. Culvert on east side of Pacheco Blvd at approximate Station 79+00](image)

**Drainage Area 57**
A wetland mitigation area and detention basin was installed by the Contra Costa County Flood Control District and Water Conservation District in 2007. This area is known as Drainage Area 57 and is located northeast of Pacheco Blvd, just south of the Burlington Northern Santa Fe (BNSF) Railroad. This area receives storm water flows from the vicinity as well as areas south of Pacheco Blvd via overland flow and existing cross culverts. Flows are treated in the detention basin and larger flows overflow to a 72” culvert that runs under the BNSF Railroad to a junction box that conveys flows to a double 54” culvert system to the north. Figure 4 shows the aerial view of Drainage Area 57.
Any improvements from this Project should not disturb Drainage Area 57. Drainage Area 57 also lies within the Zone A floodplain. Any loss in storage volume in this area should be mitigated by an equal amount of storage volume creation within the area. Because this area is also a wetland mitigation area, vegetation and soil disturbance should be avoided unless there is coordination made with the Contra Costa County Flood Control District and Water Conservation District.

Figure 4. Aerial View of Drainage Area 57

Source: Bing.com

**Soil Characteristics**

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (surveyed on September 18, 2015), the soils in the study area are primarily classified as hydrologic soil group (HSG) D with a small portion of HSG C (see Attachment D for the Web Soil Survey). HSGs C and D soils have low infiltration rates when thoroughly wetted and have high runoff potential.

**Groundwater Hydrology**

Based on Caltrans’ GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA), monitoring wells in the study vicinity indicate the median groundwater elevation ranges from 2.9
to 71.56 feet mean sea level (MSL). They also indicated a median depth to water (DTW) of 6.755 to 17.015 feet below ground surface. Figure 5 shows the well locations with circles denoting well locations as well as the corresponding groundwater elevation and depth to groundwater. WRECO has inquired with the GAMA site regarding vertical datum and their response was that all elevations are relative to the mean sea level elevation and are not necessarily linked to a specific datum universally.
Figure 5. Well Location and Groundwater Elevations in the Project Area
Note: DTW = median depth-to-water (in feet below ground surface)
Groundwater elevation is the median elevation in feet mean sea level
Source: Geotracker GAMA
4. IMPACTS AND MITIGATION MEASURES

Floodplain Assessment
Road widening is a long-term improvement proposed within a flood Zone A. Flood Zone A is defined as the areas with a 1% annual chance of flooding (100-year storm event). As the Pacheco Blvd widening is proposed to be constructed at-grade according to the preliminary layouts, its impact to floodplains should not be significant. The portion of Pacheco Blvd liable to flooding between Stations 44+50 and 71+50 will have minimal to no elevation change during construction. Therefore, long-term impacts to flooding are unlikely. A Location Hydraulic Study should be conducted in the Project Approval/Environmental Document (PA/ED) phase to determine the impacts of the encroachment on the floodplain.

Stormwater Quality Assessment

Stormwater Quality Measures for C.3 requirements
As the Project anticipates adding more than 1 acre of new contiguous impervious area for pavement and sidewalk areas, the project must comply with the following updated Contra Costa Clean Water Program Stormwater C.3 requirements: “Select one of four flow-control compliance options in Guidebook Appendix C. Where required, design project features and facilities for hydrograph modification management (flow-control) as well as stormwater treatment. Prepare and submit a Stormwater Control Plan as described in Chapter 3 and use the LID Design Guide in Chapter 4, including the sizing factors and criteria for treatment and flow control.” The new Municipal Regional Stormwater Permit (MRP 2.0) requires that “any Regulated Project that starts construction after January 1, 2016 must implement the LID requirements.” To comply, the project must follow the design and submittal requirements in the Stormwater C.3 Guidebook, 6th edition.

The project anticipates widening Pacheco Blvd in multiple sections to add additional lanes, bicycle lanes, and sidewalks. The project is subject to the “50 percent rule” for stormwater treatment. The “50 percent rule” of the C.3 provisions indicates that “If the new project results in an alteration of more than 50% of the impervious surface of a previously existing development, and the existing development was not subject to stormwater treatment measures, then the entire project must be included in the treatment measure design” (C.3 Guidebook 3). Stormwater treatment and hydromodification measures such as bioretention areas would be required to account for the C.3/hydromodification mitigation requirements of treating an area equivalent to the total disturbed, reworked, or added impervious surfaces.

For permanent stormwater quality treatment measures, preliminary calculations using Contra Costa County’s Clean Water Program’s Integrated Management Practices Calculator were used to size potential storm water treatment BMPs for the added and reworked impervious areas. The Project team believes that some of the designated landscaping areas along the Project site could be used as biortention swales that can treat the impervious runoff.
It is anticipated that the minimization measures during construction would need to provide erosion control plans demonstrating effective BMPs. Section C.6.c of the MRP notes that effective BMPs shall be provided in six categories: erosion control, run-on and run-off control, sediment control, active treatment systems (as necessary), good site management, and non-stormwater management.

**Construction General Permit Order 2009-009-DWQ**

It is currently anticipated that permanent improvements would disturb more than two acres of soil. As a result, there would be requirements to conform to the CGP including BMPs such as source control measures (designated vehicle wash areas and fueling areas, etc.), sediment control (silt fence, gravel bag berms, etc.), and soil stabilization (hydoseeding, preserving existing vegetation, straw mulch, etc.).

Meeting requirements of the CGP include electronically filing the Permit Registration Documents (PRDs) prior to commencement of construction activity. As part of the PRDs, a Notice of Intent, SWPPP, and additional applicable documents must be submitted. Quarterly non-stormwater visual inspections will be required, during which “the discharger must visually observe each drainage area for the presence of (or indications of prior) unauthorized and authorized non-stormwater discharges and their sources” (CGP Fact Sheet 21). During construction of the midterm countermeasures, there will also be a need to perform and maintain post-storm event inspections as outlined in Section II.I.1.a. of the CGP.

In accordance with the CGP, midterm countermeasures would be required to perform a risk assessment to determine the Project risk level (see Table 1). A project’s risk level is determined by the sediment risk factors and receiving water risk.

The sediment risk factor is estimated using the following equation:

\[
\text{Sediment Risk Factor} = \text{LS Factor} \times \text{R Factor} \times \text{K Factor}
\]

The LS factor is the length-slope factor, R factor is the rainfall-runoff erosivity factor, and K factor is the soil erodibility factor. The LS factor and the R factor were determined using Caltrans’ Water Quality Planning Tool. To be conservative, a LS factor of 1.83 and an R factor of 86.35 were used to determine the sediment risk. The soil erosion (K) factor was determined based on existing soil data (rock free) within the study vicinity per the NRCS Web Soil Survey. The soils near the Project area have K factors ranging from 0.24 to 0.37. To be conservative, the K factor was assumed to be 0.37 for this Project. The factors used to determine the hydrologic unit sediment risk are summarized in Table 1. The sediment risk is classified as low when the product of the LS, R, and K factors is less than 15, medium when the product is between 15 and 75, and high when the value is greater than 75. The product in this case is 58.47, which is a medium sediment risk.
The receiving water risk can be classified as low or high depending on whether a project drains to a sediment-sensitive water body. A sediment-sensitive water body is either on the most recent 303(d) list for water bodies impaired for sediment; has an EPA approved TDML plan for sediment; or has the beneficial uses of cold freshwater habitat (COLD), fish spawning (SPWN), and fish migration (MIGR). Because two of the receiving water bodies are impaired, the receiving water risk would be high for the entire Project area.

The risk level is classified as 1) Risk Level 1 if both the sediment and receiving water risk are low, 2) Risk Level 3 if both the sediment and receiving water risk are high, and 3) all other combinations are classified as Risk Level 2. Based on the preliminary information, the Project would be most likely classified as Risk Level 2. The actual Project risk level will be refined during the Project design phase when more information is available.

Table 1. Risk Level Assessment

<table>
<thead>
<tr>
<th>LS factor</th>
<th>R factor</th>
<th>K factor</th>
<th>Product</th>
<th>Sediment Risk</th>
<th>Receiving Water Risk</th>
<th>RISK LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.83</td>
<td>86.35</td>
<td>0.37</td>
<td>58.47</td>
<td>Medium</td>
<td>High</td>
<td>2</td>
</tr>
</tbody>
</table>

Risk Level 2 projects would require the use of standard best management practices (BMPs) and effluent sampling at all discharge points. These samples would need to meet the numeric action levels for pH and turbidity. If discharge samples exceed the levels set forth in the CGP, exceedance reporting and BMP modifications would potentially be required. Risk Level 1 and 2 projects require a SWPPP to be developed by the contractor. Risk Level 2 projects would also be required to prepare a Rain Event Action Plan prior to any likely rain event. Risk level calculations are shown in Attachment C.

**Drainage Impact Assessment**

**Drainage Criteria**

The proposed drainage system for the Project is designed according to standards specified in the following documents, listed in the order of precedence:

- Contra Costa County Flood Control Documents and Standards
- California Department of Transportation’s (Caltrans) *Highway Design Manual* (HDM)
- FHWA’s *Hydraulic Design Series No. 5, Hydraulic Design of Highway Culverts*, (HDS-5) (April 2012)
Drainage Impacts and Mitigation

In general, the Project would maintain the existing drainage patterns to the maximum extent practicable, although there will be necessary changes to accommodate the proposed widening of the road. The drainage system modifications proposed to accommodate the proposed roadway work may include, but are not limited to: cross culverts, longitudinal drainage pipes, headwalls, flared end sections, rock slope protection, manholes, inlets, and roadside lined and unlined ditches.

The existing on-site drainage inlets would need to be relocated to the new edge of curbs for the new sidewalk and widening areas. The new inlets would need to be designed and spaced according to the methodologies outlined in the FHWA’s HEC-22 to prevent excessive roadway runoff from inundating the travelway.

Widening of the roadway at the creek crossing may require a hydraulic model during the PA/ED or PS&E phases to assess the impacts to the water surface elevation along the creek in the vicinity. Temporary creek diversions may also be required during construction.
5. REFERENCES

Bing Maps. Bird’s Eye View

California Department of Transportation. Water Quality Planning Tool.


Contra Costa Clean Water Program. (March 2016) Stormwater C.3 Update.

Federal Emergency Management Agency (FEMA). (July 1, 2016). Flood Insurance Rate Map (FIRM) for Alameda County and Incorporated Areas, Map Number 06013C0088G, 06013C0089G, 06013C0277F.

San Francisco Bay Regional Water Quality Control Board. (October 14, 2009) Municipal Regional Stormwater NPDES Permit CAS612008


State Water Resources Control Board. GeoTracker
<http://geotracker.waterboards.ca.gov/map/?global_id=SL0607724806> (Last Accessed: June, 2016)

State Water Resources Control Board. 303(d) List
ATTACHMENTS
Attachment A: Preliminary Layouts
Attachment B: FEMA FIRMette Panels
Attachment C: Risk Level Calculations
Attachment D: Web Soil Survey