Yolo Small Community Flood Risk Reduction Feasibility Study

Appendix C Community of Yolo Structural Alternatives Cost Estimates

Draft April 2019

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Acronyms and Abbreviations

AACEI	Association for the Advancement of Cost Engineering International
BWFS	Basin-Wide Feasibility Study
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVFMP	Central Valley Flood Management Planning
DWR	California Department of Water Resources
CVP	Central Valley Project
DSM	Deep-Soil-Mixing
DWSE	Design Water Surface Elevation
ft	feet
HTOL	hydraulic top of levee
NULE	Non-Urban Levee Evaluation
ROW	Right-of-Way
pcf	pounds per cubic foot
USACE	United States Army Corps of Engineers
WSE	water surface elevation

C.1 Introduction

C.1.1 Purpose

The purpose of this appendix is to describe the development of cost estimates for the final array of structural alternatives identified in the Community of Yolo Small Community Flood Risk Reduction Feasibility Study (Feasibility Study). As discussed in the Feasibility Study, six structural alternatives were initially evaluated and screened down to a final array of three alternatives identified as Restore Left Bank of Cache Creek to USACE Design Flow, Levee Improvements for Left Bank of Cache Creek to Pass 100-year Flow and Restore Left Bank of Cache Creek to USACE Design Profile and Levee Improvements to pass 100-year Flow. These structural improvements include levee improvements to Cache Creek adjacent to the community of Yolo. Potential levee improvements for these alternatives were considered to prepare cost estimates and compare these two alternatives. These structural improvements to the levees include the following:

- Rock slope protection to address erosion
- Improvements to levee geometry to address freeboard deficiencies
- Construction of a cutoff wall to address underseepage and through seepage

These alternatives are included in Figure *1* through Figure *3*. The costs included in this appendix are intended to provide a consistent basis for comparing the relative costs of the different alternatives.

C.1.2 Alternative Descriptions

Alternative 4: Restore Left Bank of Cache Creek to USACE Design Flow

This alternative includes restoring the Cache Creek left bank levee from Levee Mile 1.7 to 2.2 to the intended USACE 1957 design profile. This would include raising the levees to accommodate 3-feet of freeboard over 1957 USACE design profile along with repairing the levees for erosion along the left bank levee of Cache Creek directly adjacent to the community of Yolo between Interstate 5 on the west and to a distance about 600 feet downstream from the easterly extension of Washington Street on the east side of Yolo.

Comparing the existing levee crest elevations from CVFED LiDAR to the DWR 1955/57 design profile, the levees are approximately a foot below the design water surface and short of the required three feet of freeboard by three to four feet. To meet 1955/57 WSE freeboard requirements, these levees would need to be raised approximately 0 to 4 feet. Due to these freeboard deficiencies, the levees also do not meet their levee prism requirements for a 12-foot crest width at 3 feet above the WSE, 3H:1V waterside slopes, and 2H:1V landside slopes. Freeboard and geometry repairs would be required as part of these levee improvements.

To address erosion concerns that are prevalent along the heavily incised reach of Lower Cache Creek containing steep and erosive banks, this alternative includes placing Rock Slope Protection (RSP) on the existing levee prism to minimize the threat of erosion failures directly adjacent to Yolo. RSP will be needed where the channel and parallel left bank levee system

make a sizeable turn downstream in an easterly direction near the easterly extension of Washington Street at the east end of Yolo.

Alternative 5: Levee Improvements for Left Bank of Cache Creek to Pass 100-year Flow

This alternative includes restoring or repairing the Cache Creek left bank levee to the 100-yr level of flood protection. Based on the hydraulic modeling and historical information available, the estimated peak flow of 58,300 cfs overtops levees and high ground at several locations upstream of I-5. As a result, the resulting WSE in the channel downstream of I-5 is approximately 0.8 feet to 1.4 feet lower than the corresponding USACE design profile. To accommodate this resulting WSE with 3 feet of freeboard, the levee crown on the left bank of Cache Creek would have to be raised. The largest levee raises, and enlargement would take place along the left bank levee of Cache Creek on the furthest downstream, easterly end of Yolo, east of Clay and Sacramento Streets.

Based on subsurface information available and the past performance of the levees adjacent and near the community of Yolo, it was concluded that the levees protecting the community of Yolo need repairs for underseepage, through seepage, and erosion in addition to the freeboard and geometry repairs. To address erosion this alternative includes placement of Rock Slope Protection along the existing water side of the levee prism. To address underseepage and through seepage, a cutoff wall is the most practical remedy for this project site as there is not adequate space at the landside levee toe for a berm solution.

Alternative 6: Restore Left Bank of Cache Creek to USACE Design Profile and Levee Improvements to Pass 100-year Flow

This alternative is a combination of the two alternatives described above. This alternative includes restoring the left bank of Cache Creek from LM 1.7 to 2.2 to accommodate 3-feet of freeboard for USACE 1957 design profile along with applicable levee improvements for under seepage, through seepage and erosion.

C.2 Cost Basis

Cost estimates are intended to be Class 4 (feasibility-study level) according to the Association for the Advancement of Cost Engineering International (AACEI). A Class 4 estimate is prepared based on limited information where the preliminary engineering is from 1 to 15 percent complete. Strategic planning, project screening, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget constraints are also considered before proceeding with selection of any preferred alternative.

The Class 4 estimate includes allowances for changes due to the level of detail that typically occurs between the feasibility level and the issuance of final design documents. The expected accuracy ranges for a Class 4 estimate are -15 to -30 percent on the low side and +20 to +50 percent on the high side. The costs presented in this technical memo establish a Baseline Cost for the lower range and adds a 50 percent contingency cost to the Baseline Cost for the higher range. The cost estimates in this document are considered a planning-level tool.

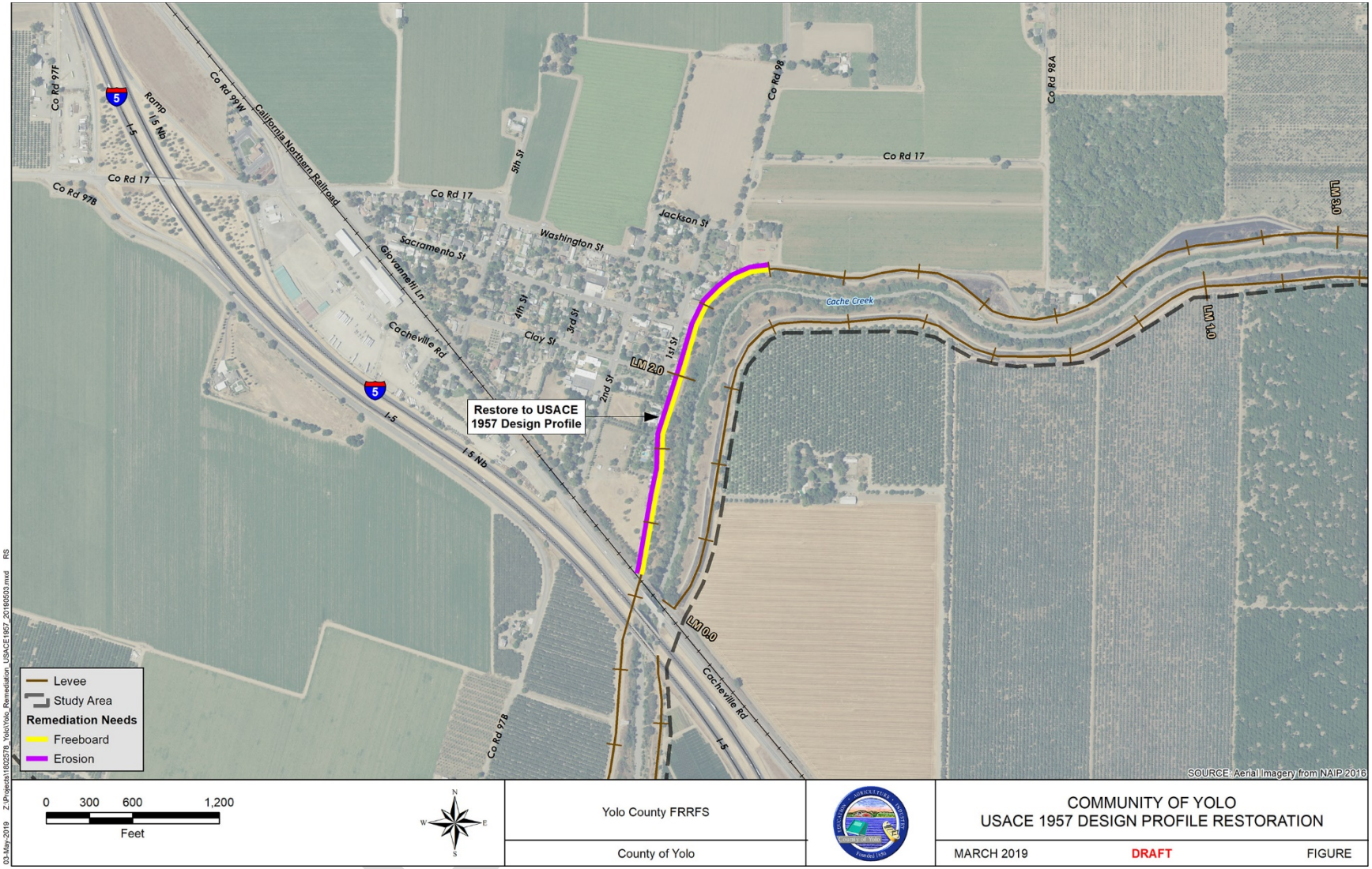

Figure 1: Restore Left Bank of Cache Creek to USACE Design Flow Alternative

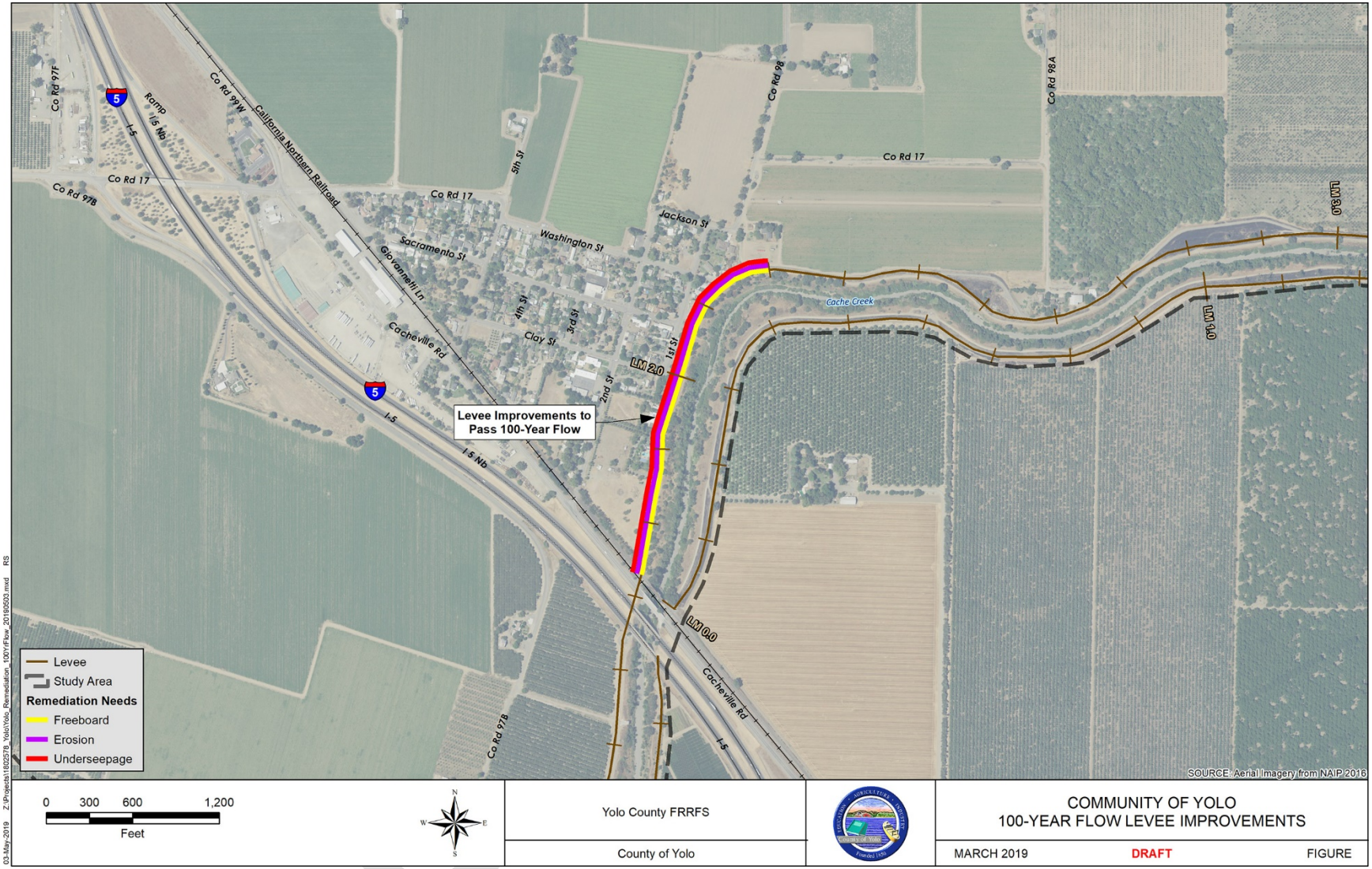

Figure 2: Levee Improvements for Left Bank of Cache Creek to Pass 100-year Flow Alternative

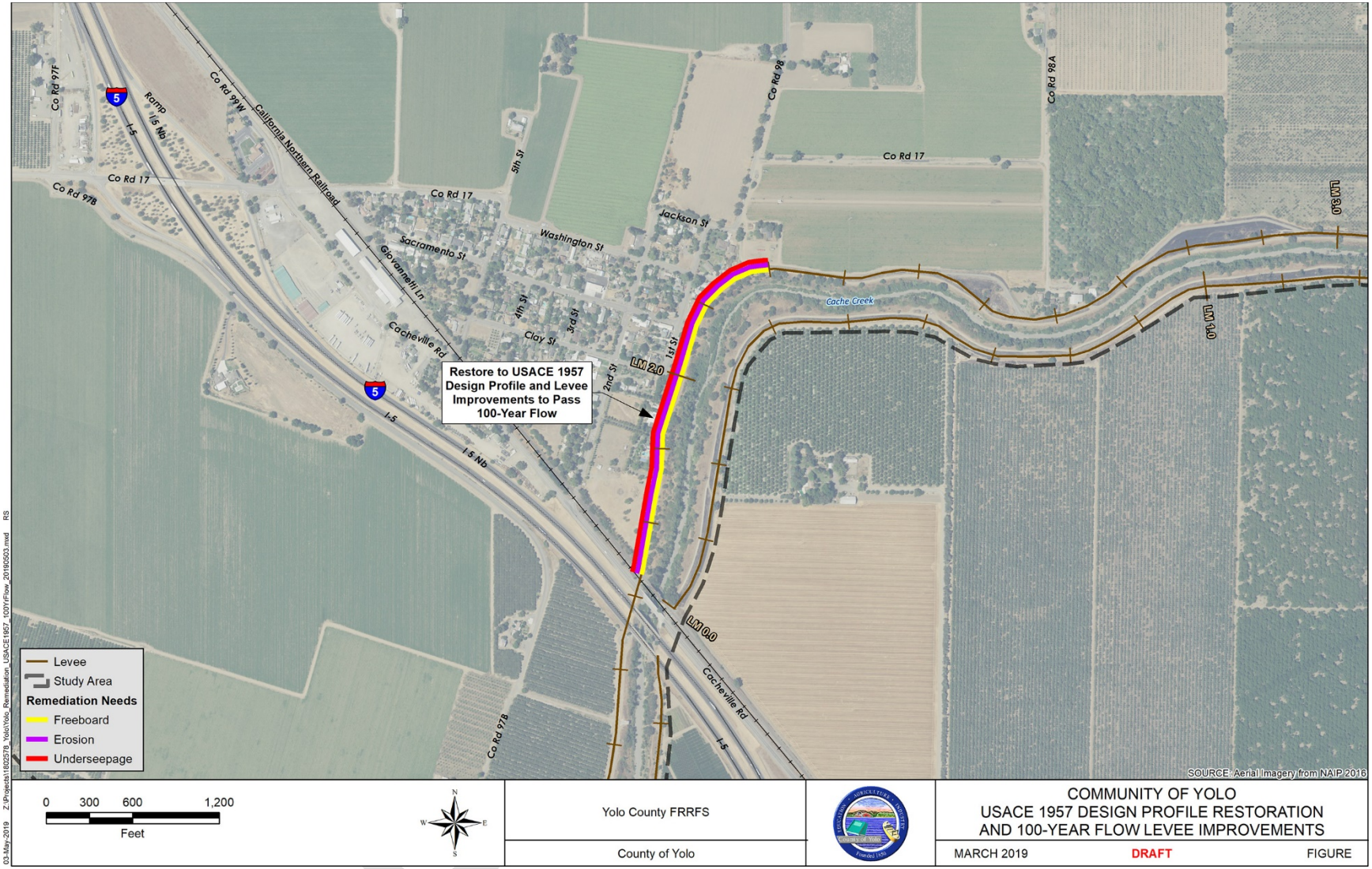

Figure 3: Restore Left Bank of Cache Creek to USACE Design Profile and Levee Improvements to pass 100-year Flow Alternative

C.3 Levee Improvements

As previously described, the alternatives are comprised of a mix of construction of cutoff walls, levee raises to address freeboard deficiencies, and rock slope protection. The following sections describe the design criteria and assumptions used to develop construction quantities for the cost estimates for the community of Yolo.

C.3.1 Cutoff Walls

Geotechnical subsurface exploration data was not available for the levee directly adjacent to the community of Yolo. However, there is Caltrans bridge data for the I-5 bridges slight upstream of the community. In addition, recent DWR data for erosion repair sites both upstream and downstream was also available along with few 1958 explorations from USACE levee improvement work. The recent DWR explorations found gravels at the bottom limit of their explorations, as deep as about 60 feet below the ground surface. The bottom depth of these pervious zones is not known based on the available exploration information. Additional detail on subsurface conditions is included in Appendix B.

Existing subsurface investigations indicate there are areas of shallow sands in the levee foundations as well as deeper units of sand and gravel. The bottom of the aquifer was not found within 65 feet of the ground surface, and due to the presence of a permeable aquifer, it was determined that a fix would be required for underseepage. Due to space limitations of structures directly adjacent to the levee, it was determined that a seepage berm would not be feasible, and a cutoff wall was assumed to be required to address underseepage. Because a confining layer was not found in the review of existing borings, it was presumed that cutoff walls would be constructed to 80 feet below ground elevation, the maximum depth allowed using conventional open trench construction techniques. Similar subsurface conditions were found along the entire levee extent and thus it is concluded that the entire length will require a cutoff wall.

The following two alternatives require a cutoff wall: Levee Improvements for Left Bank of Cache Creek to Pass 100-year Flow and Restore Left Bank of Cache Creek to USACE Design Profile and Levee Improvements to Pass 100-year Flow. Due to the physical space requirements for construction of the proposed cutoff walls, it is necessary to degrade the existing levee to provide at least a 35-foot-wide working surface for the equipment. Because of the relatively short height of the existing levees, the majority of the Cache Creek levee would need to be degraded to the existing land side ground elevation to meet the space requirements. Figure *4* shows a conceptual cutoff wall cross section for the levees in these two alternatives.

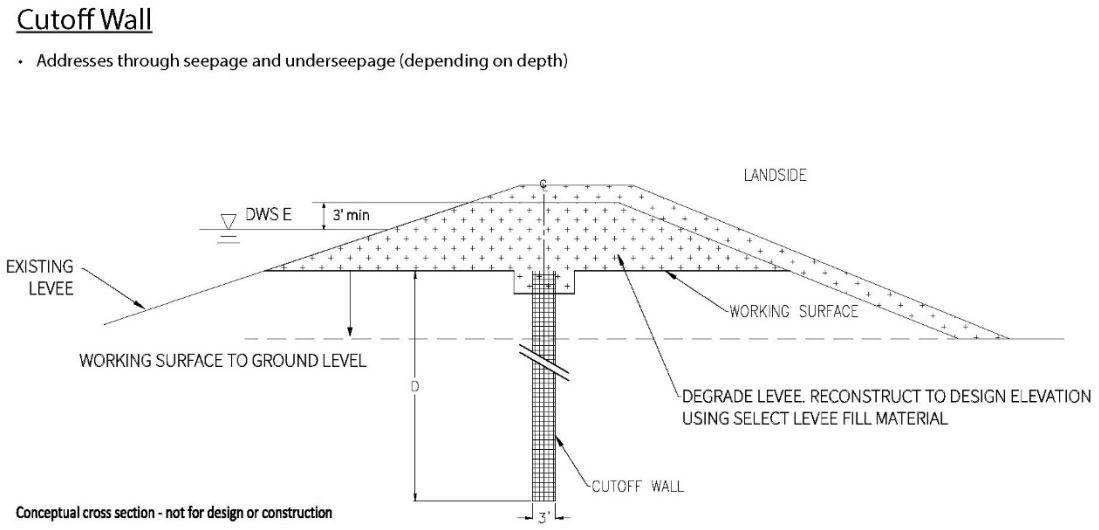

Figure 4: Conceptual Cross Section: Cutoff Wall

C.3.2 Levee Raise

Levee prism geometry was assumed to meet the minimum minor tributary levee standard based on *Barclays Official California Code of Regulations, Title 23. Waters, Division 1 Central Valley Flood Protection Board* (CVFPB, 2014). Levee heights vary between locations and levee crown elevations were established to meet freeboard requirements (three feet) above the 1955/57 and 100-year water surface elevation (WSE) depending on the alternative.

Table 1: Levee Geometry

	Levee Geometry
Crown Width	12’
Landside Slope	2H : 1V
Waterside Slope	3H : 1V
Freeboard	3’
Levee Patrol Road Width	10’

Existing levee profiles were developed every 500 ft along Cache Creek as part of the NULE. A total of 6 profiles were used from Station 1524+50 to Station 1499+00 to determine the existing levee geometry. Based on this assessment, it was determined that existing levee heights were between 0 and 2.8 ft deficient to pass the 100-year flow with 3 feet of freeboard and 0 to 4 feet deficient to pass the 1955/57 design flow.

For the two alternatives that include a cutoff wall, the levee will be reconstructed to the dimensions that are provided above after construction of cutoff wall.

The Restore Left Bank of Cache Creek to USACE Design Flow alternative does not include a cutoff wall and includes a levee raise over the existing levee. The existing levee would require the top 1 ft of material to be removed from the crown and landside slope to properly key into the existing levee material. Raising the levee will include construction of a 12-foot crown width and a landside slope of 2H:1V or flatter down to the landside ground surface with a 3-foot-thick keyway at the base of the fill. It was assumed that raising and improving the levee geometry may impact some of the existing structures which are immediately adjacent to the levee. To account for this, it was assumed that up to some structures and an existing storm drain system may need to be improved or relocated. Figure *5* shows details of a typical freeboard levee raise without a cutoff wall.

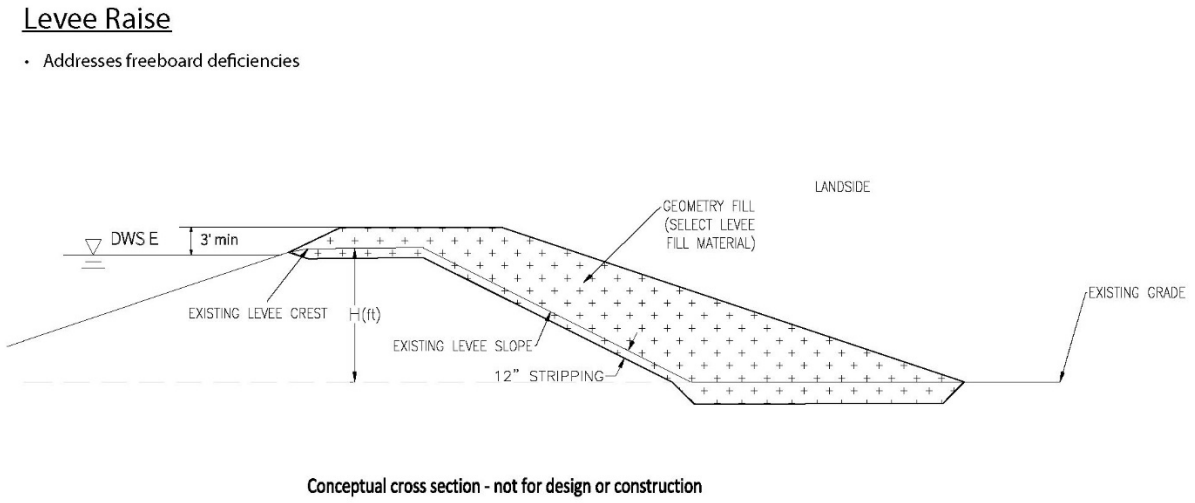

Figure 5*: Conceptual Cross Section: Levee Raise*

C.3.3 Rock Slope Protection (RSP)

Erosion has historically been a consistent problem for the levees protecting Yolo county and the Feasibility Study alternatives include placement of rock slope protection for erosion repair. A cost estimate for waterside rock slope protection along 11.7 miles of the Cache Creek North Bank levee were included in the DWR NULE program's Remedial Alternatives and Cost Estimate Report. This extent includes the approximately 0.5 mile of levee adjacent to the community of Yolo. A conceptual cross-section of the repair is shown in Figure 6. The estimate assumed placement of rock along a 72-foot slope length along the levee slope and a portion of the channel bank slope. The NULE total for the 11.7 miles was approximately eighty-one million dollars, in 2011 dollars. This estimate was scaled to only include the 2,550 ft in the Feasibility Study's structural alternatives and was then escalated from 2011 dollars to December 2018 dollars using a factor of 1.23 based on the 20 cities average from the Engineering News-Record Construction Cost Index.

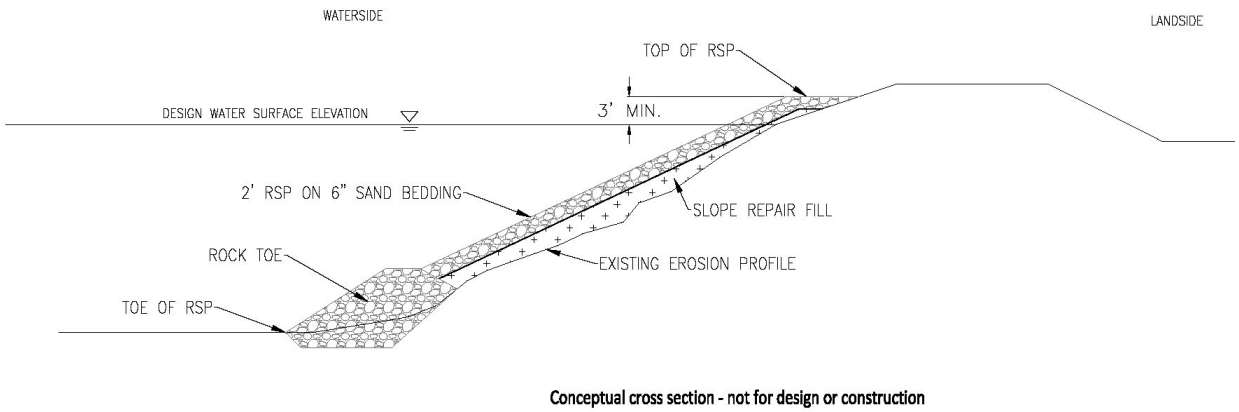

Figure 6: Conceptual Cross Section: Rock Slope Protection

C.3.4 Construction Sequence

For the purposes of this cost estimate, it is assumed that all activities occur during a single construction season. For the alternatives which include a cutoff wall, it is assumed that the existing levee is removed, and the cutoff wall is constructed first. After the cutoff wall is constructed, suitable levee fill material would be brought on site to construct the levee to the required levee geometry. For the alternative without a cutoff wall, the levee geometry would be improved without removal of the existing levee. Rock slope protection would then be added as the final step to the waterside slope in all alternatives.

C.4 Cost Development

A cost estimate was developed for each of the cross-levee alignments by applying unit costs to quantities based upon conceptual designs. Unit costs were established for construction items included within the conceptual designs.

Capital costs consist of:

- Major Construction Item costs (unit costs)
- Other Construction Costs including:

    - Unallocated items in construction costs as a percentage of the Major Construction Item costs (percentage)
    - Mobilization and demobilization of construction equipment as a percentage of the Major Construction Item costs (percentage)
- Other Owner Costs including:
    - Environmental documentation, permitting, and mitigation as a percentage of all construction costs (percentage)
    - Design and engineering costs as a percentage of all construction costs (percentage)
    - Legal costs to implement project as a percentage of all construction costs (percentage)
    - Construction management as a percentage of all construction costs (percentage)
    - Real estate capital outlay and acquisition costs (unit costs)

The sum of the costs presented above is considered the Baseline Cost. The Baseline Cost does not include a contingency and is considered the expected low range of costs. To accommodate the uncertainty of the estimates, and in line with industry standards, an additional estimating contingency of 50 percent has been included to provide a cost estimate range.

The following construction activities are included in the cost estimates for the proposed cross-levees:

- Clearing and grubbing: Clearing all vegetation and debris above the ground surface from 25 feet beyond the waterside and landside toe.

- Stripping: Stripping the original ground surface a minimum of 12 inches

- Soil-bentonite cutoff wall: Cost includes excavation, preparation of slurry, placement, and curing efforts for cutoff wall.

- Select levee fill: Select levee fill used for all levee embankment construction including geometry improvements will conform to requirements (CVFPB, 2014). Local sources of select levee fill have not been identified. Therefore, it is assumed that a source within a 30-mile round trip will be utilized for select levee fill. It is assumed that no levee degrade material will be used for select levee fill.

- Excavation - Levee Degrade: Cost includes excavation of the existing levee and local disposal of material.

- Aggregate Base: A 6-inch-thick, all-weather aggregate base road shall be provided for the levee crown (12 feet wide).

- Hydroseed: Hydroseeding for erosion protection will occur along both the landside and waterside slopes of the levee as well as the landside and waterside toe access corridors and all disturbed areas impacted by levee construction activities.

- Relocations: There are many residential structures along the project area which are in close proximity to the levee toe. These structures will need to be relocated or will need additional engineering construction to address their impact. These specific structures are not identified in this Appendix or Feasibility Study. Additionally, there is an existing storm drain structure that will need to be relocated or modified to allow for levee improvements.

- Unallocated items in construction costs: Items include utility relocations, pipe relocations, and all other unknown site conditions at the time these cost estimates were prepared.

- Mobilization and demobilization: Includes activation of contractor's physical equipment, labor to the construction site, and the cleanup and removal of resources from the construction site.

- Environmental documentation, permitting, and mitigation: Includes all studies and report preparation necessary to complete an EIR/EIS. Also includes any mitigation activities that may be required for completion of the project.

- Design and engineering costs: Costs include investigations; design and engineering of project including surveying, geotechnical investigation, utility investigation and coordination, preparation of plans, specifications and cost estimates, along with all other items necessary to complete the design of the project for bidding.

- Legal costs: Broken out of permitting and cost items. Includes all Owner legal costs to implement the project.

- Engineering during construction: Cost includes engineering during construction activities including review of submittals, RFIs, bidder questions, changes, etc.

- Construction management: Cost includes management and oversight, including inspection and testing of the construction efforts.

- Right-of-way (ROW) acquisition: ROW quantities are based on estimates of the amount of additional space that the levee footprint would occupy based on raised levees. All the additional ROW is assumed to be residential.

C.4.1 Unit Costs Development

Unit costs are based primarily on the Central Valley Flood Protection Plan, Sacramento Basin-Wide Feasibility Study (BWFS), Appendix 1-D: Yolo Bypass Cost Estimates. All unit costs were escalated from June 2014 to December 2018 using the 20 cities average from the *Engineering News-Record* Construction Cost Index, which resulted in an escalation factor of 1.14. Major construction items, their units of measurement, cost, and a description of the selected unit costs are identified in Table 2. All values include materials, labor, placement, and delivery to site. Any values different from what was used in the BWFS are indicated in the description.

Other Construction Costs are applied as a percentage of the Major Construction Item costs. Summing the Major Construction Item and Other Construction Costs together presents the Total Construction Cost representing the physical construction components of the work. Other Owner costs are applied as a percentage to the Total Construction Cost and are meant to represent the additional costs to the Owner expected through the construction of a project.

Table 2: Cross-Levee Unit Costs

Construction Activity Description	Unit	Unit Cost	Notes
Remove Existing Asphalt Base	CY	3.42	
Clearing and Grubbing	AC	$6,458.09	
Stripping	CY	$9.97	
Excavate and dispose of existing material	CY	$10.98	
Select Levee Fill (New Levee Construction)	CY	$25.00	Cost is based on estimates from recent projects in the area.
Aggregate Base	CY	$90.41	
Electrical Overhead Line Relocation (12 kV)	LF	$59.26	
Hydroseeding	AC	$3,871	
Structure Relocation	EA	$200,000	Estimated cost to relocate impacted structures
Local Drainage Structure	EA	$100,000	Estimated cost to account for existing drainage features during construction
Erosion Protection Riprap	LF	$1,616	Unit cost estimated based on NULE segments. This unit cost already has other costs and contingency included
Other Construction Costs*			
Unallocated Items in Construction costs		15.0%	
Mobilization and Demobilization		5.0%	
Other Owner Costs**			
Environmental Documentation, Permitting, and mitigation		35.0%	Costs consistent with NULE assumptions for levees with significant existing vegetation.
Design and Engineering Costs		15.00%	
Legal Costs		2.00%	
Engineering during Construction		2.00%	
Construction Management		15.00%	
Real Estate Capital Outlay and Acquisition Costs			
Permanent Right-of-Way (Fee Title)-Agricultural	AC	$205,000	Estimate for the agricultural area around Knights Landing. Cost is only for ROW acquisition and doesn't include purchase of full parcels.

*Other Construction Costs are a percentage of the Major Construction Items Subtotal.
** Other Owner Costs are a percentage of the Construction Total.

C.5 Cost Summary

Using the standard levee design, construction quantities were calculated based on the existing ground elevations for each of the segments and were summed up to calculate the quantities for each activity. The unit costs identified in Table 2 were then applied to the construction quantities to determine the estimated cost for each alternative. Cost summaries for each of the cross-levee alternatives are included in Table 3 through Table 5.

Cost estimates for the elements for each of the Alternatives are summarized in Table 6.

Table 3: Alternative 4: Restore Left Bank of Cache Creek to USACE Design Flow

Construction Item	Unit	Unit Cost	Cost	
Prepare Existing Levee			**Quantity**	**Cost**
Remove existing AB	CY	$3.42	557	$1,909
Clearing and Grubbing (SF/lf)	AC	$6,458.09	3.6	$23,016
Stripping (CY/lf)	CY	$9.97	5,750	$57,344
Levee Raise				
Improve Levee Geometry with 3' FB	CY	$32.29	13,558	$437,817
Aggregate Base Crown	CY	$90.41	472.2	$42,695
Hydroseeding (LS Slope)	AC	$3,871.35	1.0	$3,820
Major Relocations				
Structures	Num.	$200,000	4	$800,000
Local Drainage Structures	Num.	$100,000	1	$100,000
Major Construction Items Subtotal =				**$1,466,601**
Other Construction Costs**				
Unallocated Items in Construction Costs		15%		$219,990
Mobilization and Demobilization		5%		$73,330
Construction Total =				$293,320
Other Owner Costs***				**$1,759,921**
Environmental Documentation and Permitting		35%		$615,972
Design and Engineering Costs		15%		$263,988
Legal Costs		2%		$35,198
Engineering during Construction		2%		$35,198
Construction Management		15%		$263,988
Other Owner Costs Subtotal =				**$1,214,346**
Other Items				
Permanent Right-of-Way (fee Title)-Residential	AC	$205,000.00	0.5	$103,335
Erosion Protection Riprap	LF	$1,616.00	2,550	$4,120,794

Total Site Baseline Cost = **$7,200,000**

Contingency of 50%

Expected Project Cost = **$8,700,000**

NOTES:

**Other Construction Costs are a percentage of the Major Construction Items Subtotal.

*** Other Owner Costs are a percentage of the construction Total.

*** Riprap has already had contingency applied to it so it is not escalated

Table 4: Alternative 5: Levee Improvements for Left Bank of Cache Creek to Pass 100-year Flow

Construction Item	Unit	Unit Cost	Cost	
Removal of Existing Levee			**Quantity**	**Cost**
Remove existing AB	CY	$3.42	557	$1,909
Excavate Levee and Disposal	CY	$10.98	12,645	$138,823
Cutoff Wall Construction				
Trench Excavation	CY	$10.98	3,400	$37,328
Backfill Trench	CY	$25.00	3,400	$85,000
SB Cutoff Wall 80 ft depth	SF	$11.06	204,000	$2,256,442
Rebuild Levee to 100-yr Flow				
Rebuild Levee Geometry with 3' FB	CY	$25.00	18,841	$471,028
Aggregate Base Crown	CY	$90.41	472	$42,695
Hydroseeding (LS Slope)	AC	$3,871.35	0.84	$3,265
Major Relocations				
Structures	Num.	$200,000	3	$600,000
Local Drainage Structures	Num.	$100,000	1	$100,000
Major Construction Items Subtotal =				**$3,736,490**
Other Construction Costs*				
Unallocated Items in Construction Costs		15%		$560,473
Mobilization and Demobilization		5%		$186,824
Construction Total =				**$4,483,788**
Other Owner Costs**				
Environmental Documentation and Permitting		35%		$1,569,326
Design and Engineering Costs		15%		$672,568.19
Legal Costs		2%		$89,675.76
Engineering during Construction		2%		$89,675.76
Construction Management		15%		$672,568.19
Other Owner Costs Subtotal =				**$3,093,814**
Other Items				
Permanent Right-of-Way (fee Title)-Residential	AC	$205,000.00	0.3	$56,221
Erosion Protection Riprap	LF	$1,616.00	2,550	$4,120,794

Total Site Baseline Cost = $11,800,000
Contingency of 50%
Expected Project Cost = $15,600,000

NOTES:
*Other Construction Costs are a percentage of the Major Construction Items Subtotal.
** Other Owner Costs are a percentage of the construction Total.
*** Riprap has already had contingency applied to it, so it is not escalated

Table 5: Alternative 6. Levee Improvements for Left Bank of Cache Creek to USACE 1957 Design Profile

Construction Item	Unit	Unit Cost	Cost	
Removal of Existing Levee			**Quantity**	**Cost**
Remove existing AB	CY	$3.42	557	$1,909
Excavate Levee and Disposal	CY	$10.98	12,645	$138,823
Cutoff Wall Construction				
Trench Excavation	CY	$10.98	3,400	$37,328
Backfill Trench	CY	$25.00	3,400	$85,000
SB Cutoff Wall 80 ft depth	SF	$11.06	204,000	$2,256,442
Rebuild Levee to 57 Profile				
Rebuild Levee Geometry with 3' FB	CY	$25.00	24,147	$603,667
Aggregate Base Crown	CY	$90.41	472	$42,695
Hydroseeding (LS Slope)	AC	$3,871.35	0.99	$3,820
Major Relocations				
Structures	Num.	$200,000	4	$800,000
Local Drainage Structures	Num.	$100,000	1	$100,000
Major Construction Items Subtotal =				**$4,069,684**
Other Construction Costs*				
Unallocated Items in Construction Costs		15%		$610,453
Mobilization and Demobilization		5%		$203,484
Construction Total =				**$4,883,621**
Other Owner Costs**				
Environmental Documentation and Permitting		35%		$1,709,267
Design and Engineering Costs		15%		$732,543.13
Legal Costs		2%		$97,672.42
Engineering during Construction		2%		$97,672.42
Construction Management		15%		$732,543.13
Other Owner Costs Subtotal =				**$3,369,698**
Other Items				
Permanent Right-of-Way (fee Title)-Residential	AC	$205,000.00	0.5	$103,335
Erosion Protection Riprap	LF	$1,616.00	2,550	$4,120,794
Total Site Baseline Cost =				**$12,500,000**
Contingency of 50%				
Expected Project Cost =				**$16,700,000**

NOTES:
*Other Construction Costs are a percentage of the Major Construction Items Subtotal.
** Other Owner Costs are a percentage of the construction Total.
*** Riprap has already had contingency applied to it so it is not escalated

Table 6: Cost Estimate Summary by Alternative

		Alternative 4	Alternative 5	Alternative 6
Remove Existing levee			$140,732	$140,732
Prepare Existing Levee		$82,269		
Cutoff Wall Construction			$2,378,770	$2,378,770
Rebuild Levee to Design		$484,332	$516,988	$650,183
Relocations		$900,000	$700,000	$900,000
Major Construction Items Subtotal =		**$1,466,601**	**$3,736,490**	**$4,069,684**
Other Construction Costs**				
Unallocated Items in Construction Costs	15 %	$219,990	$560,473	$610,453
Mobilization and Demobilization	5%	$73,330	$186,824	$203,484
Construction Total =		**$1,759,921**	**$4,483,788**	**$4,883,621**
Other Owner Costs***				
Environmental Documentation and Permitting	35 %	$615,972	$1,569,326	$1,709,267
Design and Engineering Costs	15 %	$263,988	$672,568	$732,543
Legal Costs	2%	$35,198	$89,676	$97,672
Engineering during Construction	2%	$35,198	$89,676	$97,672
Construction Management	15 %	$263,988	$672,568	$732,543
Other Owner Costs Subtotal =		**$1,214,346**	**$3,093,814**	**$3,369,698**
Other Items				
Permanent Right-of-Way (fee Title)- Residential	0	$103,335	$56,221	$103,335
Erosion Protection Riprap	LF	$4,120,794	$4,120,794	$4,120,794
Total Site Baseline Cost =		**$7,200,000**	**$11,800,000**	**$12,500,000**
Contingency of 50%				
Expected Project Cost =		**$8,700,000**	**$15,600,000**	**$16,700,000**

C.6 References

California Department of Water Resources: BWFS Sacramento Basin Appendix D, Yolo Bypass Cost Estimates. January 2016.

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