APPENDIX P
Geotechnical Report

US Army Corps of Engineers
Corte Madera Creek Flood Risk Management Project
October 2018

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LIST OF ABBREVIATIONS AND ACRONYMS

ASTM	American Society of Testing and Materials
Caltrans	California Department of Transportation
CGS	California Geological Survey
DSHA	Deterministic Seismic-Hazard Analysis
EM	Engineer Manual
ER	Engineer Regulation
ETL	Engineer Technical Letter
NAVD	North American Vertical Datum
NED	National Economic Development
NGVD	National Geodetic Vertical Datum
PSHA	Probabilistic Seismic Hazard Analysis
SPT	Standard Penetration Test
TSP	Tentatively Selected Plan
USACE	US Army Corps of Engineers
USGS	US Geologic Survey

1.0 INTRODUCTION

1.1 Study Area

This geotechnical appendix provides a screening level summary of site-specific geotechnical and geologic conditions and geotechnical engineering considerations for the Corte Madera Creek Flood Risk Management Project (Project). This Project is being led by the USACE San Francisco District and the Marin County Flood Control District (Sponsor). The Project purpose is conduct a General Reevaluation Report to determine if there is a continued federal interest in providing flood risk management benefits to Corte Madera Creek and it's surrounding communities. The study area encompasses part of Unit 2 and all of Unit 3 and 4. Brief descriptions of Unit 1, 2, 3, and 4 are summarized from the current O&M Manual (USACE, 1988).

- Unit 1 – Extends from the San Francisco Bay and upstream along Corte Madera Creek (Station 166+00 to 281+00). The construction dredged the existing channel to a bottom width of 80 ft wide with 6H:1V side slopes. Construction of Unit 1 was completed in 1967.
- Unit 2 –Construction of Unit 2 was initiated in 1970 and completed in 1971. Improvements were made along Corte Madera Creek (Station 281+00 to 335+00) and Tamalpais Creek (Station 0+00 to 16+94).
  - Channel improvements to Corte Madera Creek between Station 281+00 and 318+50 include a trapezoidal earthen channel and with a 30 ft wide channel invert and 6H:1V side slopes. The channel slopes were lined with riprap between Station 318+00 and 318+50. Transition structures and a stilling basin was constructed between Station 318+50 and 320+30. Channel improvements upstream from the stilling based included a rectangular concrete channel with a bottom width of 33 ft and varying heights from 18 ft on the downstream end to 12 ft at College Avenue.
  - Channel improvements to Tamalpais Creek included a double concrete box culvert between Station 0+00 and 13+66. Each cell was 10 ft wide and 8 ft tall. The culvert connects to the College Avenue culvert system. The channel was buried where it traversed the campus of the College of Marin. From Station 13+66 to 16+94, Tamalpais Creek was improved with a rectangular concrete channel. The channel has a varying bottom width from 15-21 ft wide and a varying wall height of 8-13 ft tall. The upstream end connects to the Goodhill Road culvert system.
- Unit 3 –Construction of Unit 3 was initiated in 1970 and completed in 1971. Improvements to Corte Madera Creek included extending the rectangular concrete channel (Station 335+00 to 369+70). The channel has a bottom width of 33 ft wide and a varying wall height from 9-12 ft tall.
- Unit 4 –Unit 4 was never constructed and is a natural trapezoidal channel with riparian vegetation. Unit 4 continues from the fish ladder to the Sir Francis Drake Bridge Crossing (Station 369+70 to 400+00).

Vertical elevations stated in this document are referenced in North American Vertical Datum (NAVD) 88 unless specifically noted otherwise (e.g. National Geodetic Vertical Datum (NGVD) 29.

1.2 Tentatively Selected Plan

The Tentatively Selected Plan (TSP) and the National Economic Development (NED) plan for the Project is identified as Alternative J. Alternative J includes an underground bypass, fish ladder removal, channel grading, and excavation of the concrete channel for the Allen Park Riparian Corridor, and construction of three segmented floodwalls. The proposed bypass is approximately 2,200 feet long between Station 390+00 and 368+00. The bypass will be composed of precast concrete sections and will have two rectangular (each box culvert opening is 12 feet wide and 7 feet). The existing denil fish ladder will be removed. Channel grading will be performed from the denil fish ladder to Lagunitas Road bridge crossing. In Unit 3, the Allen Park Riparian Corridor plans to remove approximately 900 feet of the concrete channel and create a widened park. This work could involve excavation of the concrete channel, excavating excess soil for the final slopes, potential relocation of a sanitary sewer line, and construction of 2 foot tall floodwalls. Two additional floodwalls will be constructed further downstream on the left bank in Unit 3 and Unit 2. Near Station 354+00, the Unit 3 floodwall is approximately 1,050 feet long and will be 6-6.5 feet tall. The downstream floodwall is approximately 950 feet, spanning between the College Avenue and Stadium Way bridges, and is between 3.5-4.0 feet tall.

2.0 AVAILABLE INFORMATION

Key references used in the preparation of this Geotechnical appendix include:

- ASTM, 2015. Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf-ft3) (2,700 kN-m/m3).
- California Geological Survey (CGS), 2008. Ground Motion Interpolator (2008). http://www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html.
- Caltrans, 2015. Standard Specification, State of California, California State Transportation Agency, Department of Transportation.
- Jennings, C.W., and Bryant, W.A. 2010. Fault activity map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
- Jennings, C.W., Gutierrez, C., Bryant, W., Saucedo, G., and Wills, C. 2010. Geologic map of California: California Geological Survey, Geologic Data Map No. 2, scale 1:750,000.
- OSHA, 2018. 29 CFR 1926, Subpart P, App B – Sloping and Benching. https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926SubpartPAppB.

- USACE, 1980. Design Memorandum No. 2, Supplemental No. 1, Revised Final, Corte Madera Creek Flood Control Project Unit No. 4, Marin County, California. May.
- USACE, 1988. Interim Operation and Maintenance Manual, Unit 1, Unit 2, and Unit 3, Prepared by the US Army Corps of Engineers Sacramento District, Draft. December.
- USACE, 1990. EM 1110-1-1904 Settlement Analysis. September 30.
- USACE, 1995. ER 1110-2-1806 Earthquake Design and Evaluation For Civil Works Projects. July 31.
- USACE, 2000. EM 1110-2-1913 Design and Construction of Levees. April 30.
- USACE, 2003. EM 1110-2-1902 Slope Stability. October 31.
- USACE, 2005. ETL 1110-2-569 Design Guidance For Levee Underseepage. May 1.
- USACE, 2005. EM 1110-2-2100 Stability Analysis of Concrete Structures. December 1.
- USACE, 2014. EM 385-1-1 Safety and Health Requirements. November 30.

Geotechnical evaluation and recommendations presented in this geotechnical appendix are generally limited to the TSP/NED plan (Alternative J). Specific geotechnical concerns and considerations did not influence the selection of the TSP. It is noted that limited subsurface soil and rock information was available in preparation of this report, and the conclusions in the report are based on significant reliance on existing USACE reports, consultant reports, published geologic and geotechnical literature and engineering judgment.

It should also be noted, that geotechnical challenges are often significant for flood control projects and that borehole exploration, laboratory testing and geotechnical engineering analysis will be required during design phases. Findings of such work may reveal conditions that have significant cost or design impacts that cannot be anticipating during all feasibility studies.

3.0 GEOLOGIC CONDITIONS

3.1 Regional and Local Geology

Corte Madera Creek is located within a valley in the Coastal Range geomorphic province of California. The Coast Ranges province is generally characterized by northwest-trending mountain ranges and intervening valleys that are controlled by right-lateral strike-slip faulting along the San Andreas Fault system. The Ross Valley geology is defined as sedimentary alluvium deposits from the Pleistocene-Holocene age. The surrounding hills above the Ross Valley are metamorphic rocks of Cretaceous and Jurassic sandstones with smaller amounts of shale, chert, limestone, and conglomerate from the Franciscan Complex. These rock types include a melange of fragmented and sheared Franciscan Complex rocks. The 2010 CGS (Jennings &

Bryant, 2010) Geologic Map depicts the representative geologic types surrounding the Project as shown in Plate 2.

3.2 Geologic Hazards

3.2.1 Fault Rupture

The Alquist-Priolo Earthquake Fault Zoning Act ensures public safety by prohibiting the siting of most structures for human occupancy across traces of active faults that constitute a potential hazard to structures from surface faulting or fault creep. There are no mapped active surface or subsurface faults crossing the Corte Madera Creek within the limits of the study.

The CGS defines an active fault as one that has had surface displacement within Holocene time (about the last 11,000 years), and a sufficiently active fault as one that has evidence of Holocene surface displacement along one or more of its segments or branches. Faults with movement within the past 1.6 million years (i.e., Quaternary) and no known Holocene displacement are considered moderately capable of rupture and are categorized as “potentially active.” Nearby active or potentially active faults in Northern California are listed in Table 3.1 and referenced in Plate 3.

Table 3.1: List of Active Faults near Corte Madera Creek (Jennings and Bryant, 2010)

Fault	Closest Distance to Corte Madera Creek (Miles)
San Andreas Fault	9.8
San Gregorio Fault	10.0
Burdell Mountain Fault	12.0
Bennett Valley Fault Zone	15.0
Pinole Fault	19.0
Hayward Fault	10.0
Morage Fault	14.0
Lakeview Fault	19.0
Rodger’s Creek Fault	19.0
Tolay Fault	20.0

3.2.2 Strong Ground Shaking

Using the CGS Probabilistic Seismic Hazard Analysis (PSHA) Ground Motion Interpolator (CGS, 2008), it is estimated that peak horizontal ground accelerations of about 0.76g and 0.48g have 2 and 10% percent chance of exceedance in 50 years, respectively, as shown in Table 3.2. These ground motions are very strong and capable of causing wide spread seismic damage.

Table 3.2: PSHA near Corte Madera Creek (CGS, 2008)

Probability of exceedance	Peak Ground Acceleration (g)
2% in 50 years	0.76
10% in 50 years	0.48

* Based off of Latitude 37.9547º, Longitude -122.5494º

ER 1110-2-1806 (USACE, 1995) provides current USACE seismic design requirements. For flood control projects, with transient flood loading, it is not normal practice for USACE to design for concurrent flood and seismic loading, due to the low joint probability of occurrence.

3.2.3 Seismically induced liquefaction hazard

The CGS has not yet mapped the project area as part of it's geologic hazard mapping program. Due to the high ground water levels, and alluvial deposits, it is anticipated that portions of the project are likely to be subject to liquefaction during large seismic events. Soils most susceptible to liquefaction are loose, clean sands and silts.

3.2.4 Landslide Hazards

The CGS has not yet mapped the project area as part of it's geologic hazard mapping program. Due to the relatively flat topography around the project, landslide hazards are likely limited to potential slope instability, as discussed in Section 4.1.2.

3.3 Groundwater

Ground water will likely be encountered near the water levels within the existing creek. Excavations should consider the potential for ground water, with potentially very high inflows into excavations. Dewatering and water diversion will most likely be required. Because geotechnical investigation has not been performed as part of the planning effort, ground water inflow rates cannot determined and groundwater inflow rates could be high. Estimates of the potential inflow range could be of by a factor of 100,000 or more and are not possible to be made without more investigation.

4.0 SITE CONDITIONS

4.1 Surface Conditions

4.1.1 Topography

The Ross Valley is confined by Mount Tamalpais to the west (elevation 2,571 feet), a series of hills to the north (typical average near elevation 460 feet), and San Pablo Bay to the east. The upstream channel invert near Unit 4 is approximately 26 feet and the downstream channel invert at the concrete-to-earthen channel is approximately 4 feet. The channel slope over an approximate distance of 8,000 feet is 0.275%.

4.1.2 Bank Instabilities

There are no currently documented unstable areas near Corte Madera Creek. Unit 4 should be reassessed after feasibility. Slope designs of should consider seismic loading, and the potential for repair and necessary utility and development setbacks from the project.

4.2 Subsurface Conditions

Subsurface conditions are summarized in Section 4.2.1 and Section 4.2.2.

4.2.1 Geotechnical Explorations

Geotechnical explorations within the TSP/NED subreaches include 6 boreholes along the Project that were performed for investigation of Unit 4 in the late 1970s. Table 4.1 summarizes the geotechnical investigation data available. Subsequent sections summarize the findings of each exploration.

Table 4.1: Summary of Unit 4 Geotechnical Exploration Locations

Borehole ID	Surface Elevation (ft)	Maximum Depth (ft)	Approximate Station and offset	Location	Source Document
1F-3	23 (NGVD 29)	26	377+40, 50 ft RT	Unit 4	USACE 1980
1F-4	23 (NGVD 29)	27	382+90 125 ft RT	Unit 4	USACE 1980
1F-5	31.5 (NGVD 29)	29	388+50 200 ft RT	Unit 4	USACE 1980
1F-6	25 (NGVD 29)	22	379+80 60 ft LT	Unit 4	USACE 1980
1F-7	29 (NGVD 29)	16.1	387+20 160 ft LT	Unit 4	USACE 1980

7F-9	20 (NGVD 29)	27.5	369+80 50 ft RT	Unit 4	USACE 1980

4.2.2 Soil Conditions

Boreholes are generally logged as a mixture of lean clay, sands and gravels. UCSC Classifications ranged from GC to CL. In boring IF-6 sandstone bedrock was encountered a depth of approximately 20 feet. Bedrock was also encountered in Boring IF-7 at about 15 feet. These two borings are both located Left of the creek, and are the closest boring to the bypass alignment. Shallow bedrock may be encountered within the bypass alignment. The hardness and rippability of the sandstone is unknown. For design of Unit 4, the design values for the soils were were summarized in Design Memorandum No. 2 (USACE, 1980). Groundwater was not encountered in these boreholes.

- Unit Weights (pcf)
  - Dry - 103
  - Moist - 122
  - Saturated - 127
  - Submerged – 65
- Shear Strength
  - “R” Strength - Φ = 18º, c = 0.35 tons/sq. ft
  - “S” Strength - Φ = 32º, c = 0 tons/sq. ft
  - “qu” Strength - Φ = 0º, 2c = 0.70 tons/sq. ft

Design values for the bottom of the boreholes along the bottom of the creek includes:

- Unit Weights (pcf)
  - Dry - 110
  - Moist - 125
  - Saturated - 135
  - Submerged – 70
- Shear Values
  - “S” Strength - Φ = 30º, c = 0 tons/sq. ft

5.0 PRELIMINARY GEOTECHNICAL DESIGN CONSIDERATIONS

Based on the geotechnical and geologic information reviewed to date, and our understanding of the typical project measures and preliminary design recommendations are summarized for the Project.

5.1 Flood wall/Retaining wall

Design criteria for floodwalls and retaining walls is referenced below. For initial design of retaining walls with level backfill, walls should be designed for an active pressure soil load equivalent to an equivalent fluid weigh of 45 pcf, if the wall is drained. For at rest loading, 60 pcf should be used to calculate a uniform soil pressure distribution. For undrained loading an additional 40 pcf should be added to the soil pressure as an equivalent fluid weight.

For sheet-piles or other flexible walls, designs should be carefully evaluated during PED. Drivability of sheetpile walls may be limited in areas of shallow bedrock.

The soil conditions for the project indicate a relatively stiff soil profile. For planning it can be assumed that shallow L or T-type floodwall foundations will be practical. Wall design was not evaluated for this document and should be carefully evaluated during PED.

5.1.1 Seepage

A seepage was not conducted during the feasibility study. A seepage analysis should be performed during PED to ensure designs of floodwalls meet conditions according to EM 1110-2-1913 (USACE, 2000) and ETL 1110-2-569 (USACE, 2005).

5.1.2 Slope Stability

A slope stability analysis was not conducted during the feasibility study. A slope stability analysis should be performed for new channel slopes and flood and retaining wall designs during PED. Analysis should follow relevant portions of EM 1110-2-1913 and EM 1110-2-1902 (USACE, 2003).

5.1.3 Settlement

A settlement analysis was not conducted during the feasibility study. A settlement analysis should be performed during PED according to EM 1110-1-1904 (USACE, 1990) and EM 1110-2-1913.

5.2 Buried Structures

It is recommended that an actual soil unit weight of 140 pcf be used for the design of buried structures (e.g. concrete bypass). Appropriate load and structural capacity factors should be incorporated in structure design per industry standards. Additionally, buried structures in roadways should be designed to accommodate vehicle and traffic loads.

5.2.1 Temporary Excavation Slopes

Temporary sloping and benching of the ground shall be in accordance with the systems outlined in the Occupational Safety and Health Administration (OSHA) 29 CFR 1926, Subpart P, Appendix B (OSHA, 2018). Soil classification must be determined by a competent person according to the criteria referenced in EM 385-1-1 and a excavation/trenching plan and a activity hazard analysis if excavation/trenching is greater than 5 ft (USACE, 2014).

For temporary construction slope excavations, it is anticipated that soils will be Type B, requiring slopes 1:1 or flatter during excavation. This classification shall be re-visited during PED and also will need verification during construction.

5.2.2 Temporary Shoring

It is anticipated that excavations up to 20 feet deep may be required for bypass construction. Braced shoring will likely be required for deeper excavations, with cantilever construction for shallower excavations. Design details will need to be developed in the PED phase. Due to the close proximity of underground utilities and pavements, higher than average shoring costs may be anticipated to prevent excessive utility and pavement deflections and nearby vehicular access.

Due to the shallow bedrock possible along the bypass alignment, careful evaluation of the bedrock profile will be required. Sheet piles are not be planned to be used for shoring at this time due to inability to drive in rock. For deep excavations, soldier pile and lagging or other similar shoring system may be required. Additionally, difficult excavation conditions should be anticipated along the alignment which may slow project construction.

The uncertainty of the subsurface soil and rock conditions along the box culvert bypass alignment may have significant cost impacts to construction of the bypass. Recommend additional borings along the alignment of the bypass.

5.2.3 Permanent Slope design

The project is not planning to re-design any of the channel earth and rock slopes. If slopes are planned to have modified slopes, slope stability analysis will be required.

5.3 Material for Fill

All on-site soils are anticipated to be suitable or general use as fill for general grading, wall backfill and utility trench general backfill, provided it is largely free of oversize material (greater than 2.5 inches) and free of organics and deleterious materials.

The soils on site do not generally appear expansive, and are likely suitable for wall backfill as well. Wall backfill should have a plasticity index less than 25.

Utility bedding and cover should conform to utility manufacture specifications and will likely be required to be imported sand or gravel.

5.4 Earthwork

Fill typically categorized as satisfactory fill could be used as backfill material. Backfill should be placed in lifts not to exceed 8 inches. Compact to at least 90% laboratory maximum density for cohesive materials or 95% percent laboratory maximum density for cohesionless materials per ASTM D1557 (ASTM, 2015).

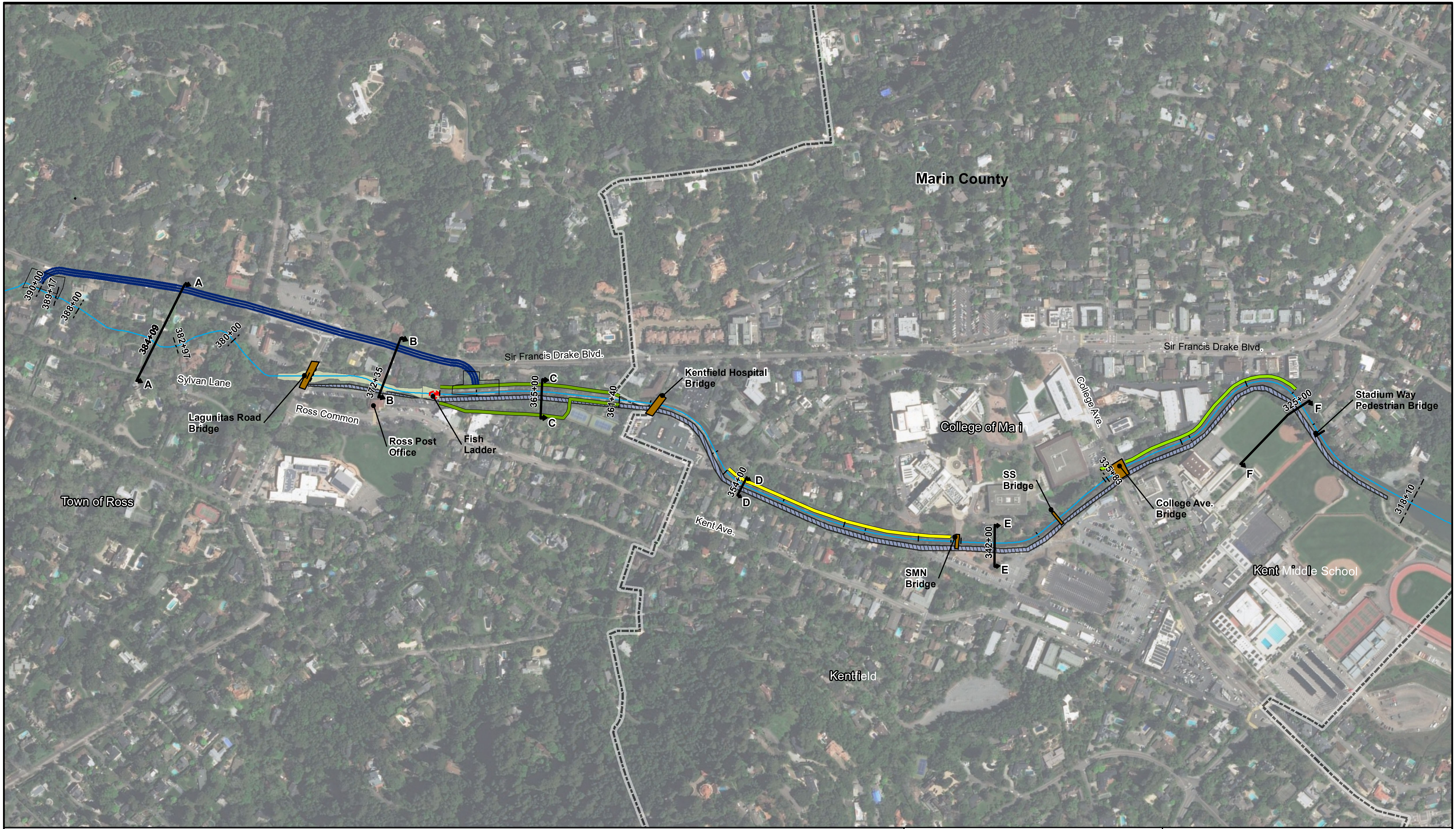
Subgrades for pavements should be compacted to 95% of maximum density to provide a stiff resilient modules for pavements.

5.5 Temporary Cofferdams

Temporary coffer dams may be required to temporarily divert water through areas under construction. Temporary cofferdams could consist of stacked supersack with fill and diversion pipes or shallow sheet piles. The use of small pumps could be used to manage groundwater during construction.

Typically cofferdams are designed by the contractor and submitted for approval at the time of construction.

Plate 1 - Location and Vicinity Map -



Alternative J

- Underground Bypass
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Bridges
- Existing Bike Lane
- Channel Stations
- Cross-Section Location

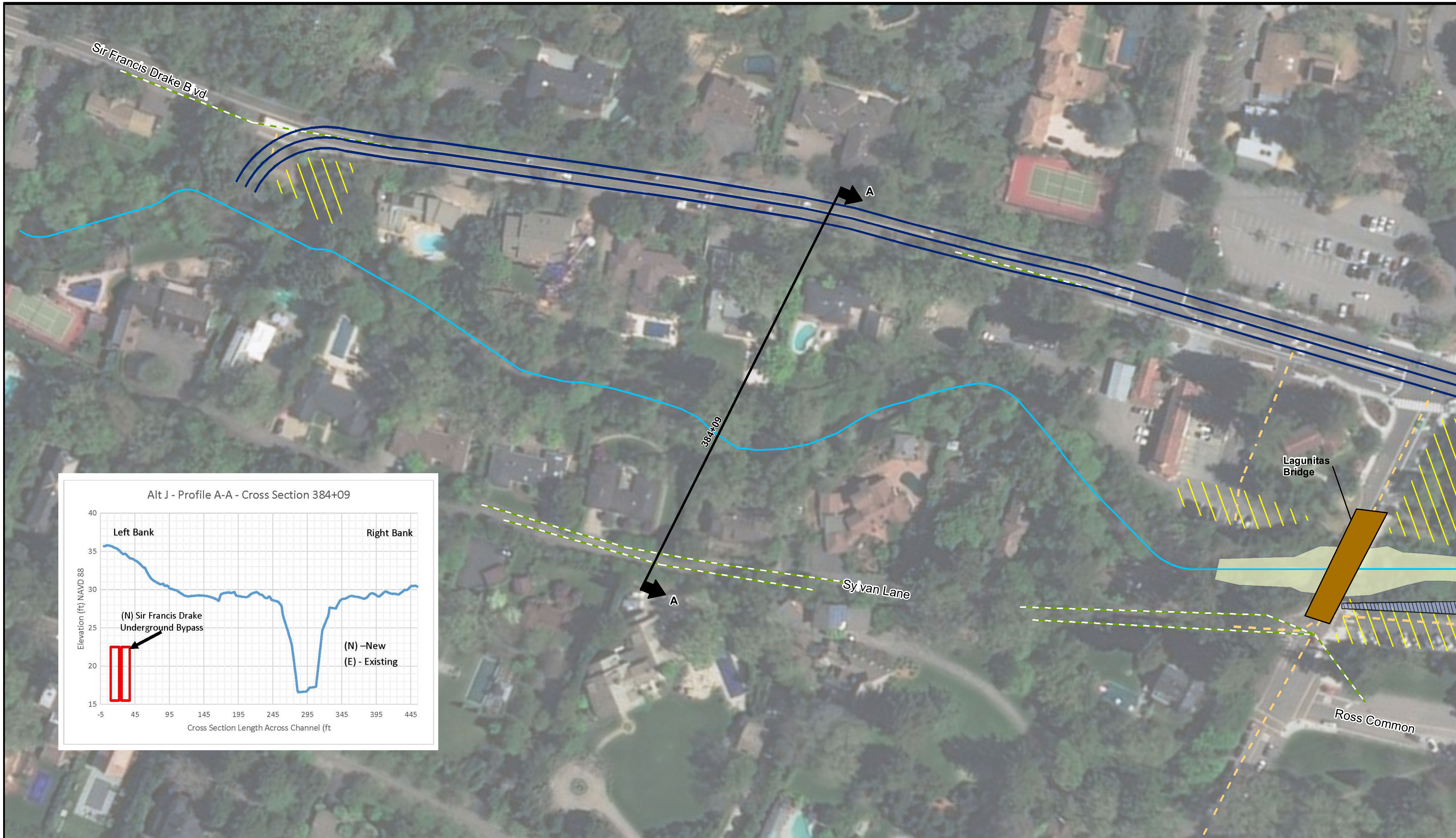
0 200 400 800 Feet

Date: 9/13/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3 - 5a Overview
Corte Madera Creek Flood Risk Management
Corte Madera, Marin County, CA

Burleson Consulting, Inc.



Alternative J
- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)
- 2
- 3.5 - 4
- 6 - 6.5

Existing Features
- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

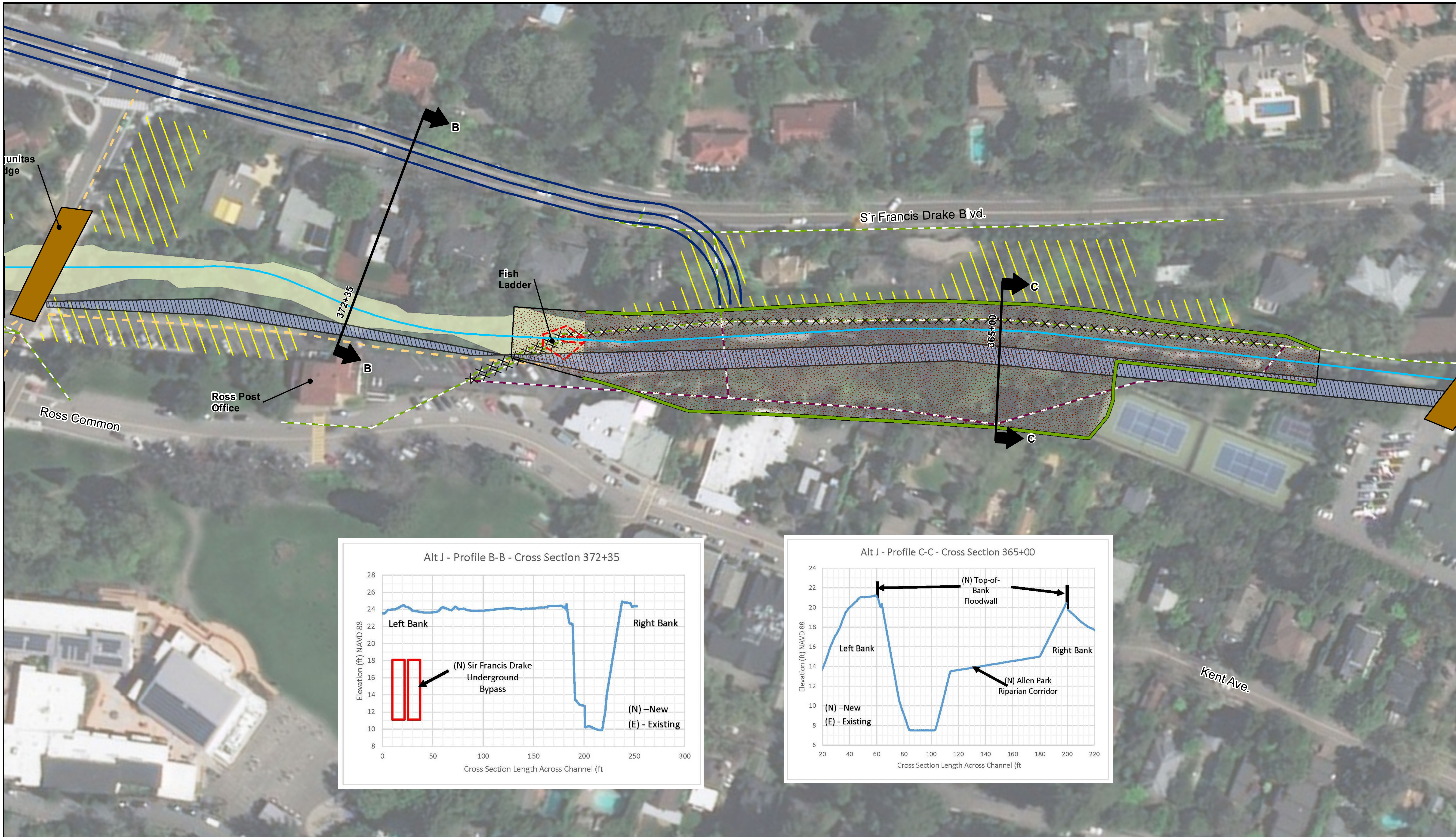
0 50 100 200 Feet

Date: 9/13/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5b Upstream Limit to Lagunitas Road Bridge
Corte Madera Creek Flood Risk Management
Corte Madera, Marin County, CA

Burleson Consulting, Inc.



Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 9/13/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5c Lagunitas Road Bridge to End of Allen Park
Corte Madera Creek Flood Risk Management
Corte Madera, Marin County, CA

Burleson Consulting, Inc.

Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 9/13/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5d End of Allen Park to College of Marin

Corte Madera Creek Flood Risk Management
Corte Madera, Marin County, CA

Burleson Consulting, Inc.

Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

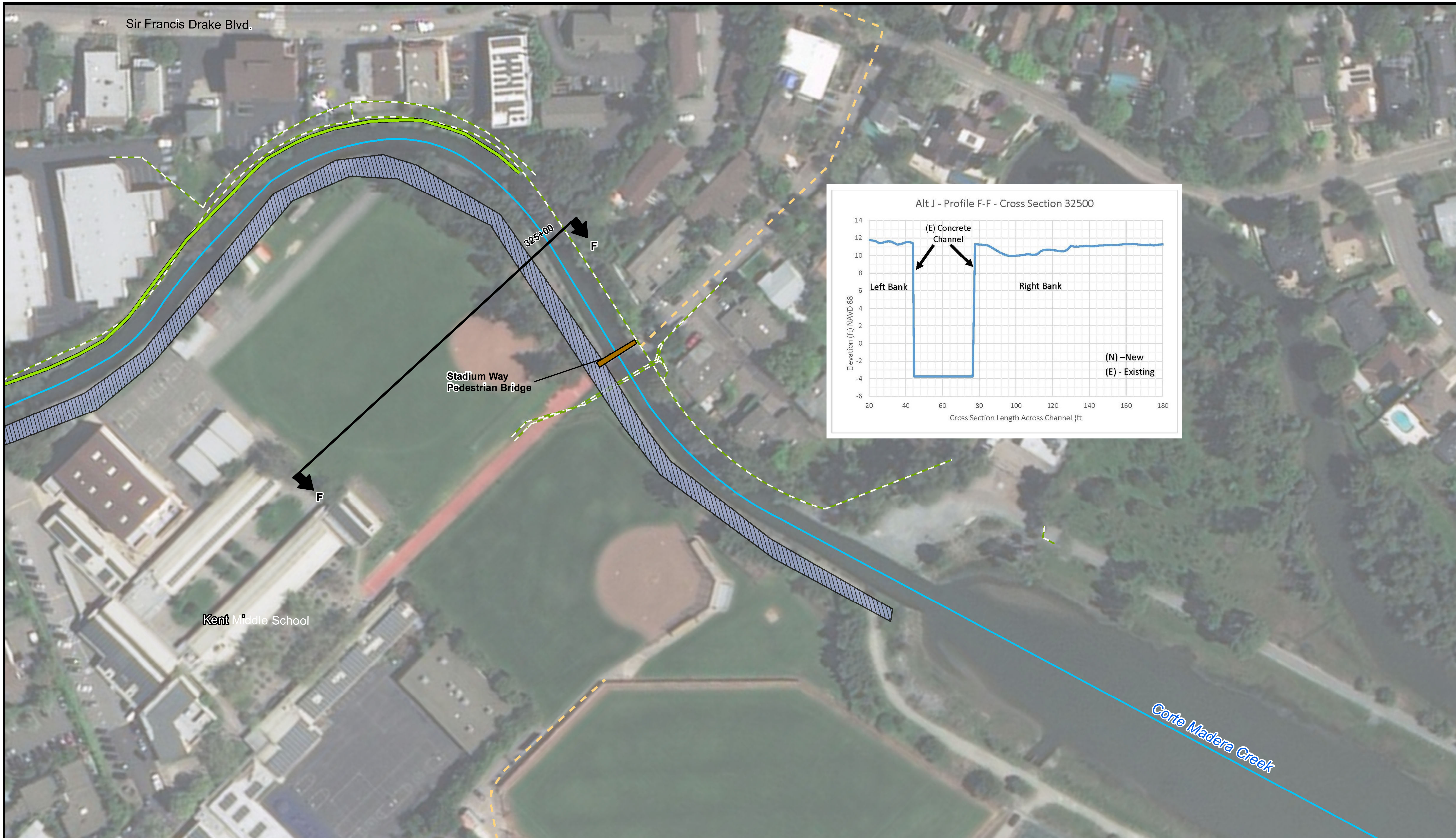
Date: 9/13/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5e SMN Bridge to Kent Middle School

Corte Madera Creek Flood Risk Management
Corte Madera, Marin County, CA

Burleson Consulting, Inc.



Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

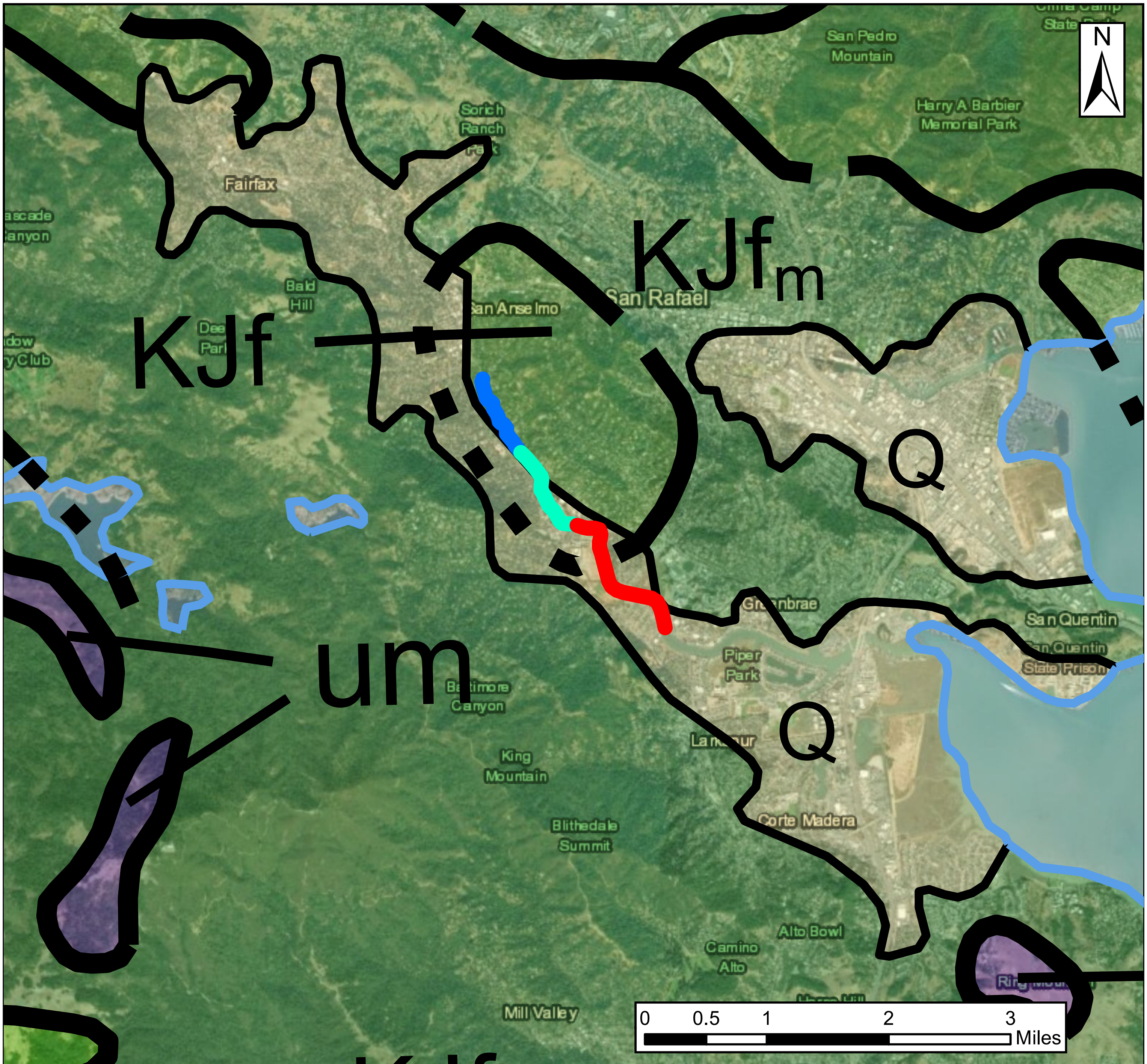
Date: 9/13/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5f Kent Middle School to Downstream Limit

Corte Madera Creek Flood Risk Management
Corte Madera, Marin County, CA

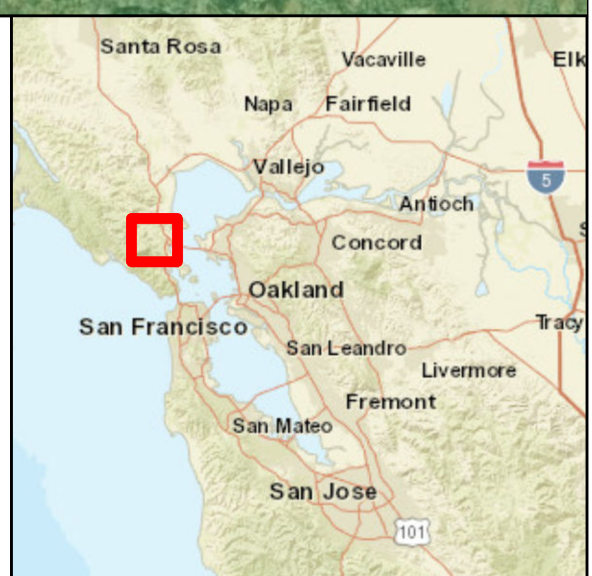
Burleson Consulting, Inc.

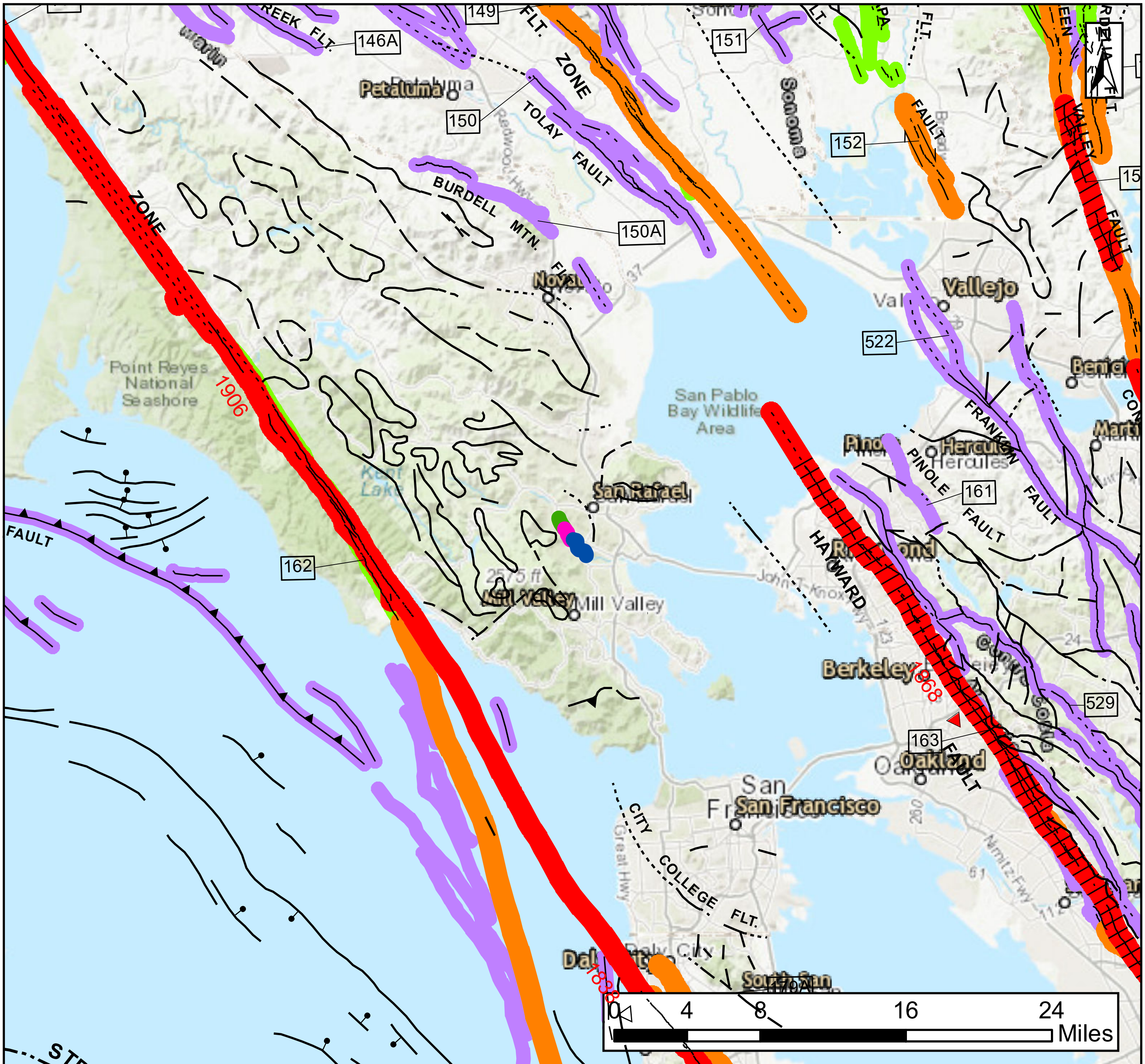


Legend

	Unit 2	
	Unit 3	
	Unit 4	
	Q	Alluvium, lake, playa, and terrace deposits
	KJf	Cretaceous and Jurassic sandstone
	KJfm	Melange of fragmented and sheared Franciscan Complex rocks
	Mzv	Undivided Mesozoic volcanic and metavolcanic rocks
	um	Ultramafic rocks, mostly serpentine
	water	

Plate 2 - Geologic Map





Legend

- Unit 2
- Unit 3
- Unit 4
- Historic
- Holocene
- Late Quaternary
- Quaternary

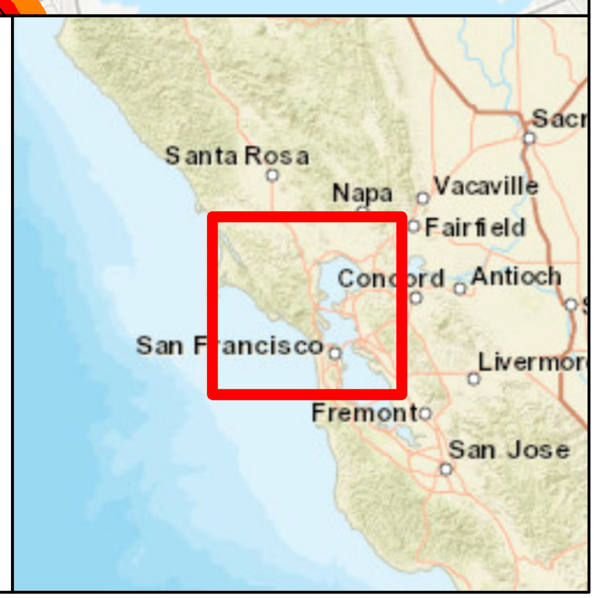
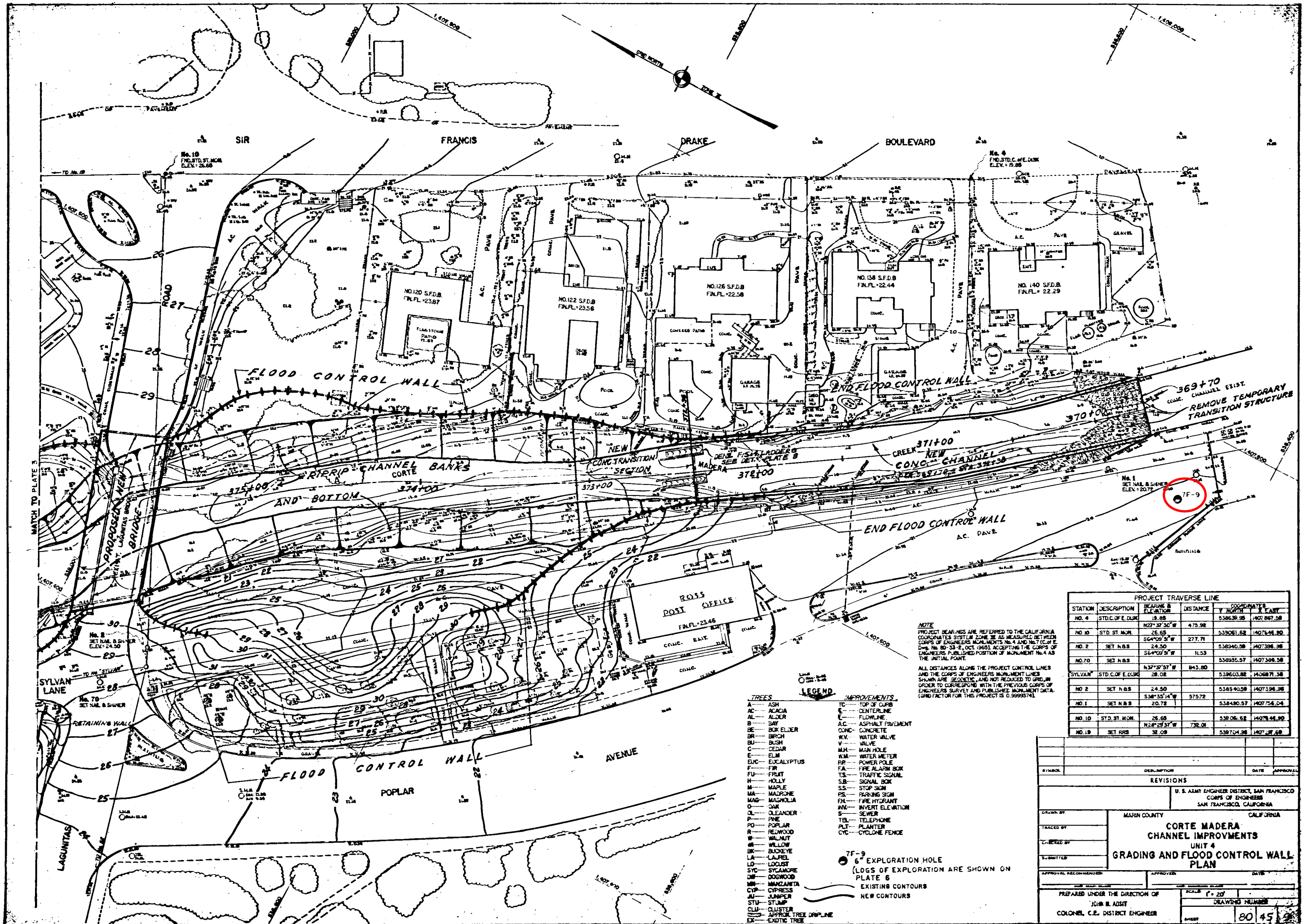


Plate 3 - Fault Map

Plate 4 - Boring Logs (USACE, 1980) -

CMADERA 2583



NOTE

PROJECT BEARINGS ARE REFERRED TO THE CALIFORNIA COORDINATES SYSTEM ZONE III AS MEASURED BETWEEN CORPS OF ENGINEERS MONUMENTS No. 4 AND No. 7 (C. of E. Dwg. No. 80-33-2, OCT. 1965). ACCEPTING THE CORPS OF ENGINEERS PUBLISHED POSITION OF MONUMENT No. 4 AS THE INITIAL POINT.

ALL DISTANCES ALONG THE PROJECT CONTROL LINES AND THE CORPS OF ENGINEERS MONUMENT LINES SHOWN ARE GEODETIC, AND NOT REDUCED TO GRID, IN ORDER TO CORRESPOND WITH THE PREVIOUS CORPS OF ENGINEERS SURVEY AND PUBLISHED MONUMENT DATA. (GRID FACTOR FOR THIS PROJECT IS 0.9999374).

LEGEND

TREES

- A — ASH
- AC — ACACIA
- AL — ALDER
- B — BAY
- BE — BOX ELDER
- BR — BIRCH
- BU — BUSH
- C — CEDAR
- E — ELM
- EUC — EUCALYPTUS
- F — FIR
- FU — FRUIT
- H — HOLLY
- M — MAPLE
- MA — MADRONE
- MAG — MAGNOLIA
- O — OAK
- OL — OLEANDER
- P — PINE
- PO — POPLAR
- R — REDWOOD
- W — WALNUT
- WI — WILLOW
- BK — BUCKEYE
- LA — LAUREL
- LO — LOCUST
- SYC — SYCAMORE
- DW — DOGWOOD
- MN — MANZANITA
- CYP — CYPRESS
- JU — JUNIPER
- STU — STUMP
- CLU — CLUSTER
- APPROX. TREE DRIPLINE
- EX — EXOTIC TREE

IMPROVEMENTS

- TC — TOP OF CURB
- ℄ — CENTERLINE
- FL — FLOWLINE
- A.C. — ASPHALT PAVEMENT
- CONC. — CONCRETE
- W.V. — WATER VALVE
- V — VALVE
- M.H. — MAN HOLE
- W.M. — WATER METER
- P.P. — POWER POLE
- F.A. — FIRE ALARM BOX
- T.S. — TRAFFIC SIGNAL
- S.B. — SIGNAL BOX
- S.S. — STOP SIGN
- P.S. — PARKING SIGN
- F.H. — FIRE HYDRANT
- INV. — INVERT ELEVATION
- S — SEWER
- TEL — TELEPHONE
- PLT — PLANTER
- CYC — CYCLONE FENCE

7F-9 6" EXPLORATION HOLE (LOGS OF EXPLORATION ARE SHOWN ON PLATE 6

EXISTING CONTOURS

NEW CONTOURS

PROJECT TRAVERSE LINE

STATION	DESCRIPTION	BEARING & ELEVATION	DISTANCE	COORDINATES Y NORTH	COORDINATES X EAST
NO. 4	STD. C. OF E. DISK	19.88		538639.95	1407867.58
		N27°37'30"W	475.92		
NO. 10	STD. ST. MON.	26.65		539061.62	1407646.90
		S64°09'51"W	277.71		
NO. 2	SET N&S	24.50		538940.59	1407396.96
		S64°09'51"W	11.53		
NO. 70	SET N&S			538935.57	1407386.58
		N37°37'57"W	843.80		
"SYLVAN"	STD. C. OF E. DISK	28.02		539603.82	1406871.36
NO 2	SET N&S	24.50		538940.59	1407396.96
		S38°35'14"W	575.72		
NO. 1	SET N&S	20.72		538490.57	1407756.04
NO. 10	STD. ST. MON.	26.65		539061.62	1407646.90
		N28°29'37"W	732.01		
NO. 19	SET RRS	32.09		539704.96	1407[illegible].60

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:

MARIN COUNTY — CALIFORNIA

CORTE MADERA CHANNEL IMPROVMENTS
UNIT 4
GRADING AND FLOOD CONTROL WALL PLAN

APPROVAL RECOMMENDED: — APPROVED: — DATE:

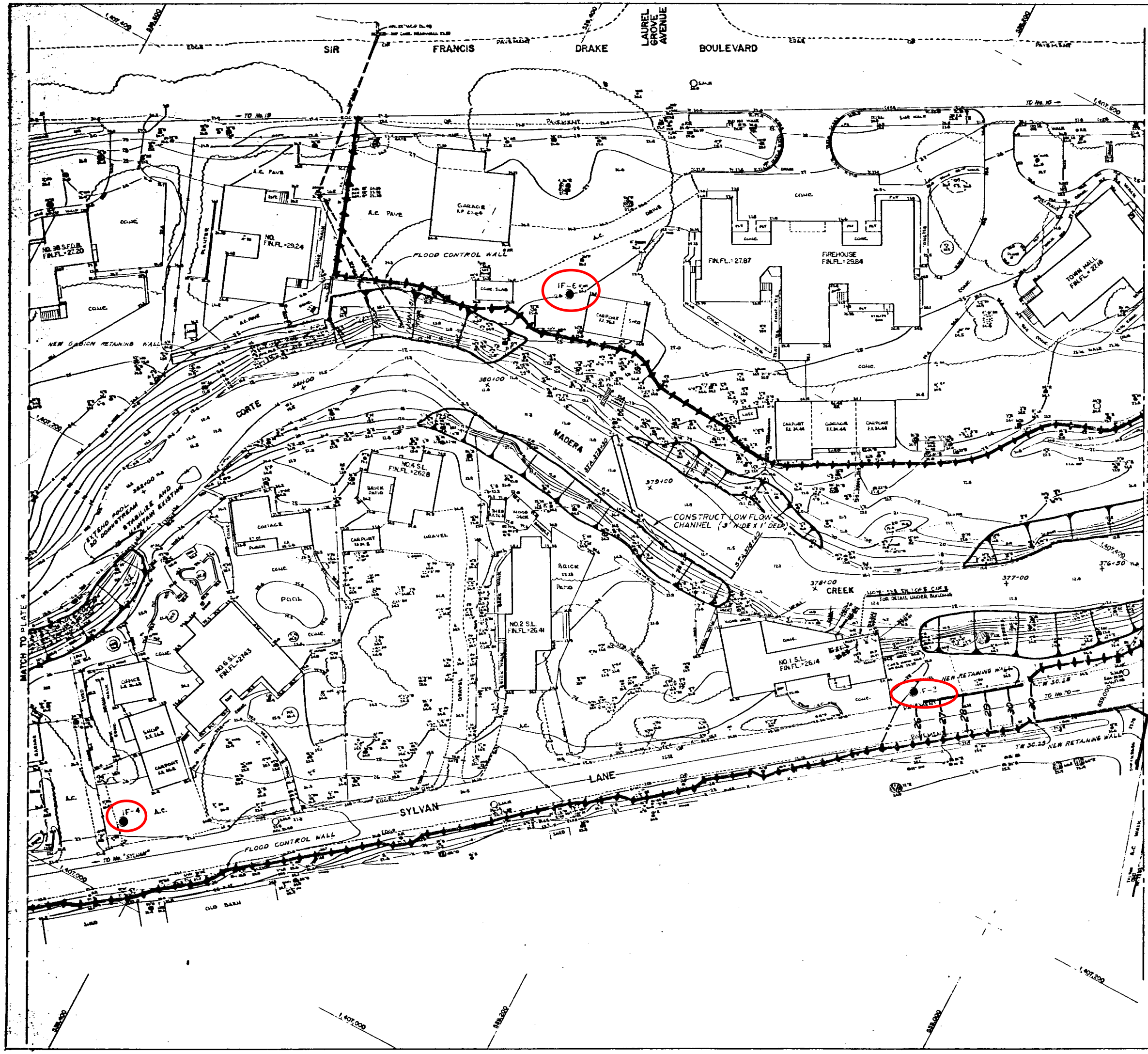
PREPARED UNDER THE DIRECTION OF
JOHN H. ADSIT
COLONEL, C.E., DISTRICT ENGINEER

SCALE: 1" = 20'

DRAWING NUMBER

SHEET 80 45 [illegible]

PLATE 2



PROJECT TRAVERSE LINE					
STATION	DESCRIPTION	BEARING & ELEVATION	DISTANCE	COORDINATES Y NORTH	COORDINATES X EAST
NO.10	STD. ST. MON.	26.65		538061.62	1407646.90
		N28°29'37"W	732.01		
NO.19	SET RRS	32.09		539704.96	1407297.69
NO.70	SET N&S			538936.57	1407386.58
		N37°37'57"W	843.80		
SYLVAN	STD.C.OF E.DISK	28.02		539608.82	1406871.36

LEGEND

TREES

- A — ASH
- AC — ACACIA
- AL — ALDER
- B — BAY
- BE — BOX ELDER
- BR — BIRCH
- BU — BUSH
- C — CEDAR
- E — ELM
- EUC — EUCALYPTUS
- F — FIR
- FU — FRUIT
- H — HOLLY
- M — MAPLE
- MA — MADRONE
- MAG — MAGNOLIA
- O — OAK
- OL — OLEANDER
- P — PINE
- PO — POPLAR
- R — REDWOOD
- W — WALNUT
- WI — WILLOW
- BK — BUCKEYE
- LA — LAUREL
- LO — LOCUST
- SYC — SYCAMORE
- DW — DOGWOOD
- MN — MANZANITA
- CYP — CYPRESS
- JU — JUNIPER
- STU — STUMP
- CLU — CLUSTER
- APPROX. TREE DRIPLINE
- EX — EXOTIC TREE

IMPROVEMENTS

- TC — TOP OF CURB
- ℄ — CENTERLINE
- FL — FLOWLINE
- A.C. — ASPHALT PAVEMENT
- CONC — CONCRETE
- W.V. — WATER VALVE
- V — VALVE
- M.H. — MAN HOLE
- W.M. — WATER METER
- P.P. — POWER POLE
- F.A. — FIRE ALARM BOX
- T.S. — TRAFFIC SIGNAL
- S.B. — SIGNAL BOX
- S.S. — STOP SIGN
- P.S. — PARKING SIGN
- F.H. — FIRE HYDRANT
- INV. — INVERT ELEVATION
- S — SEWER
- TEL — TELEPHONE
- PLT — PLANTER
- CYC — CYCLONE FENCE
- TW — TOP OF WALL

IF-3 ● 4" EXPLORATION HOLE (LOGS OF EXPLORATION ARE SHOWN ON PLATE 6)

EXISTING CONTOURS

NEW CONTOURS

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY
TRACED BY
CHECKED BY
SUBMITTED

MARIN COUNTY CALIFORNIA

CORTE MADERA CREEK
CHANNEL IMPROVEMENTS UNIT NO. 4
GRADING & FLOOD CONTROL WALL PLAN

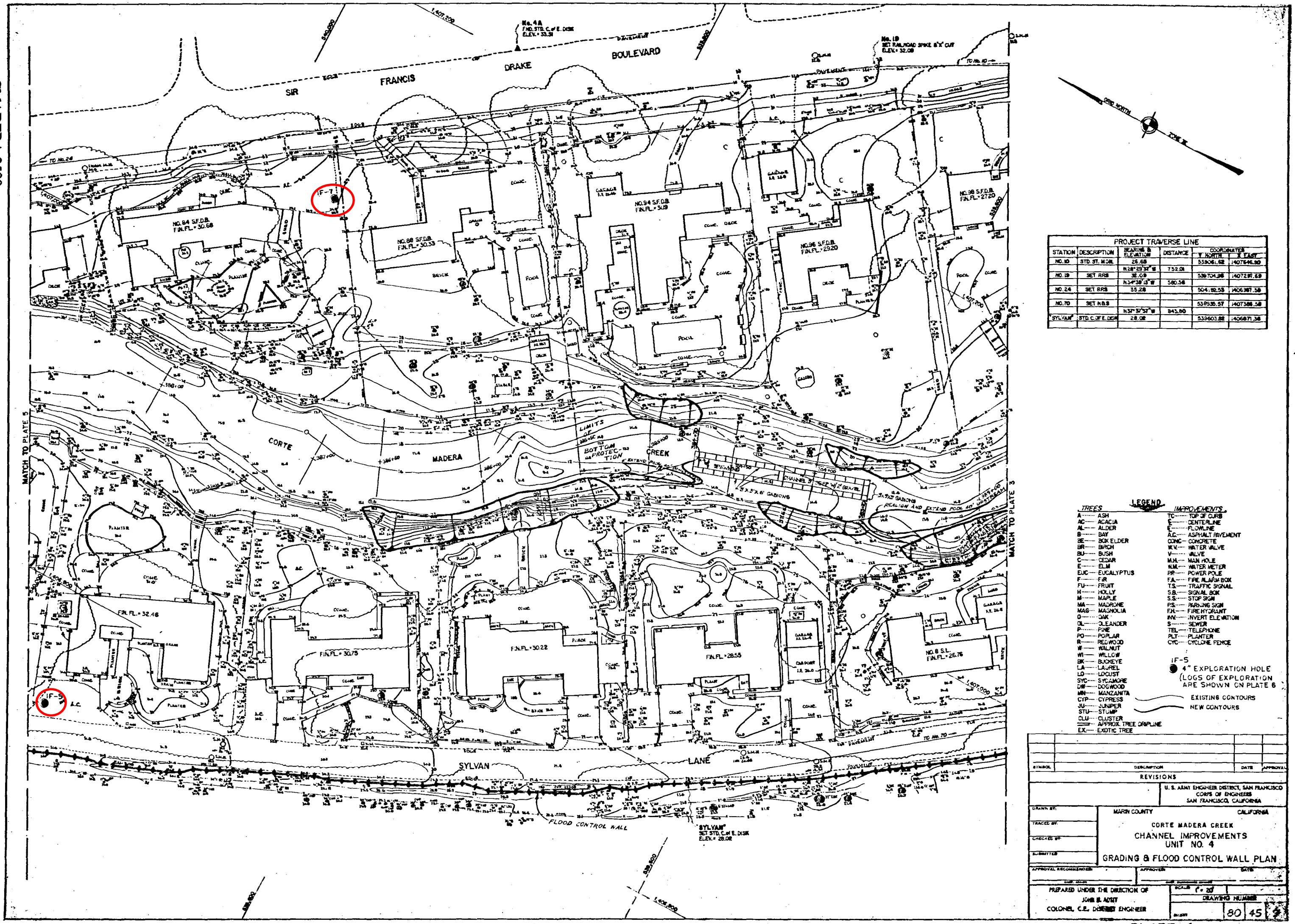
APPROVAL RECOMMENDED: APPROVED: DATE:

PREPARED UNDER THE DIRECTION OF
JOHN M. ADSIT
COLONEL, C.E., DISTRICT ENGINEER

SCALE: 1" = 20'

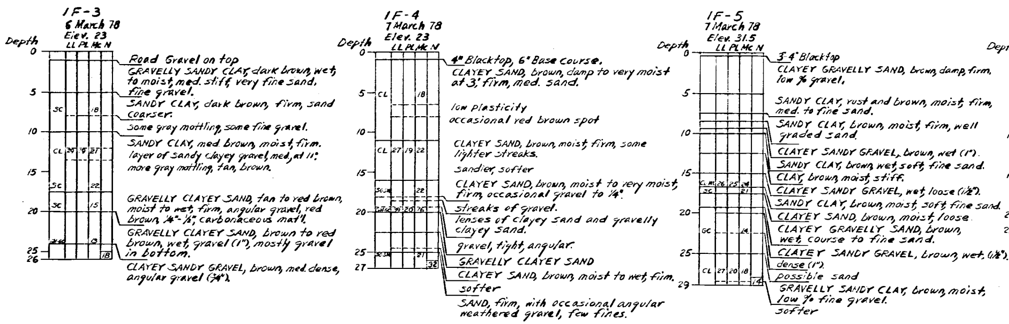
DRAWING NUMBER
SHEET 80 45 9

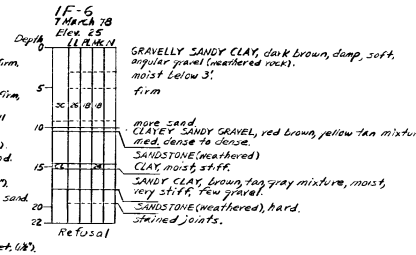
PLATE 3

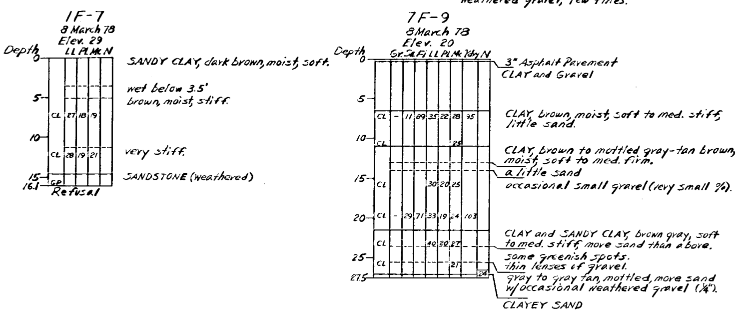


PROJECT TRAVERSE LINE					
STATION	DESCRIPTION	BEARING & ELEVATION	DISTANCE	COORDINATES Y NORTH	X EAST
NO. 10	STD. ST. MON.	26.65		539061.62	1407646.90
		N28°29'37"W	732.01		
NO. 19	SET RRS	32.09		539704.96	1407297.69
		N34°39'13"W	580.56		
NO. 24	SET RRS	35.28		504182.53	1406387.58
NO. 70	SET N&S			538935.57	1407386.58
		N37°37'57"W	843.80		
"SYLVAN"	STD. C. OF E. DISK	28.02		539603.82	1406871.38

PLATE 4







TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve). Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to field identification.

Descriptive Term	Field Identification
Very loose	
Loose	Can be excavated with a shovel.
Medium dense	
Dense	Required Pick for excavation.
Very dense	

FINE GRAINED SOILS (major portion passing No. 200 sieve). Includes (1) inorganic and organic silts and clays. (2) gravelly, sandy or silty clays and (3) clayey silts. Consistency is rated according to field identification.

Descriptive Term	Field Identification
Very soft	Easily penetrated several inches by fist.
Soft	Easily penetrated several inches by thumb.
Firm	Can be penetrated several inches by thumb with moderate effort.
Stiff	Readily indented by thumb but penetrated only with great effort.
Very stiff	Readily indented by thumbnail.
Hard	Indented with difficuity by thumbnail.

GENERAL NOTES:

1. ELEVATION INDICATES APPROX. GROUND SURFACE AND TOP OF HOLE. ELEVATIONS ARE BASED ON THE DATUM OF MEAN SEA LEVEL.
2. FIELD VISUAL CLASSIFICATIONS AND DESCRIPTIONS OF THE VARIOUS SOILS ENCOUNTERED IN THE BORING ARE SHOWN TO THE RIGHT OF THE LOG.
3. ALL HOLES TO REQUIRED DEPTH EXCEPT AS SHOWN.
4. ABSENCE OF GROUND WATER DATA ON A BORING LOG DOES NOT NECESSARILY MEAN THAT GROUND WATER WILL NOT BE ENCOUNTERED OF THAT LOCATION WITHIN THE VERTICAL REACH OF THE BORING.
5. SOIL CLASSIFICATIONS ARE IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM OF THE DEPARTMENT OF DEFENSE (MIL-STD-619B, REVISED 12 JUNE 1968).
6. LOCATIONS OF EXPLORATION HOLES ARE SHOWN ON PLATES 1, 2 AND 3.

LEGEND

Gr. — GRAVEL, %.
Sa. — SAND, %.
Fi. — % OF FINES PASSING NO. 200 SIEVE.
LL — LIQUID LIMITS.
PL — PLASTIC LIMITS.
Mc — MOISTURE CONTENT, %.
γdry — DRY UNIT WEIGHT, LBS./CU. FT.
1F — 4" EXPLORATION HOLE.
7F — 6" EXPLORATION HOLE.
N — STANDARD PENETRATION TEST: NUMBER OF BLOWS PER FOOT INDICATES BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SAMPLER, USING A 140-POUND HAMMER WITH A 30-INCH DROP.
(3/4") — THE NUMBER IN PARENTHESES INDICATES MAXIMUM GRAIN SIZE.

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY: G. H. M.
TRACED BY: /
CHECKED BY: RB
SUBMITTED:

MARIN COUNTY CALIFORNIA

CORTE MADERA CREEK

LOGS OF EXPLORATION

APPROVAL RECOMMENDED: APPROVED: DATE:

PREPARED UNDER THE DIRECTION OF JOHN M. ADSIT COLONEL, C.E. DISTRICT ENGINEER

SCALE: DRAWING NUMBER
SHEET 80 45 9

PLATE 6