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March 30, 2022
Crawford No. 19-514.1

Mr. Simon Gray, PE
Coleman Engineering
1358 Blue Oaks Blvd., Suite 200
Roseville, CA 95678

Subject: **FINAL GEOTECHNICAL MEMORANDUM**
Evaluation of Slope Creep Along Segment 2 of the Raw Water Pipeline Project
Fort Bragg, California

Dear Mr. Gray,

This Geotechnical Memorandum (Memo) summarizes our findings and presents final conclusions and roadway improvement options with respect to the area of observed slope creep along the Segment 2 portion of the Raw Water Pipeline project in Fort Bragg, California. The options presented in this memorandum are intended for the City's use in assessing/selecting the desired level of roadway improvement to help alleviate adverse effects of slope creep observed within/along the area of concern.

The Segment 2 portion of the project is the subject of our Final Geotechnical Report, dated March 30, 2022. Refer to that report for information not included herein. This memo supersedes our Draft Geotechnical Memorandum, dated December 17, 2020.

1 PROJECT LOCATION AND SITE DESCRIPTION

This project site is located along a narrow access road south of Fort Bragg-Sherwood Road at site coordinates of latitude 39.4395° and longitude -123.7790° (Figure 1, Vicinity Map) between approximate Stations 15+00 and 16+30 of the proposed water main alignment. The road at this location is unpaved and approximately 12 feet (ft) wide with varying shoulder widths and traverses a moderate to steep, easterly-facing slope. The road alignment trends north-south and descends to the northern flood plain of the Noyo River. During our various site visits in April 2019 and June 2020, the road appeared in relatively good condition through this area with no major distress observed.

The slopes that flank this access road are heavily vegetated, with fern undergrowth and dense tree cover. The vegetation was green and lush throughout the area. Water was observed seeping from the slopes at various locations along Segment 2 indicative of saturated conditions during our site visit in April 2019 and our field exploration in June 2020. A drainage ditch runs along the western side of the access road and proceeds to cross under the access road a couple times as it progresses downslope. Ponded water was observed within the drainage ditch at the site. Additionally downslope from the access road, a natural drainage channel flows in from the northeast and travels south towards the Noyo River flood plain.

Surficial soils appear to be primarily residual soils consisting of clayey sand to sandy clay. Some local areas of minor outcrops of decomposed sandstone were observed within the inboard cut-slopes along the access road. A large outcrop of intact rock was observed at the bottom of the access road.

From conversations with the City, we understand that a portion of this access road experienced a significant failure in the past 11± years that damaged the existing water pipeline that runs through the middle of the road. Plans and photographs provided by the City show the repair consisted of excavating out the area and reconstructing the slope. In addition, rock slope protection (RSP) was placed at the toe of the slope.

The current area of concern (subject of this memorandum) is located about 100 ft south of the previously repaired slope section and was first noticed in March 2017, following heavy storms in January and February. Initially, movement downslope from the roadway was observed and more recently movement of the slope above the road was observed in 2020. Movement appears to be primarily associated with relatively shallow soil creep.

The slopes in the area of concern are heavily vegetated and it is/was difficult to identify the limits of the slope creep during our site visits. The survey results also do not show any areas of recent slumping but some breaks in the topography suggest that some downslope movement has occurred.

2 FIELD EXPLORATION

To help evaluate slope conditions within the area of concern, Crawford personnel completed six Dynamic Cone Penetrometer (DCP) tests on June 10 - 12, 2020. The DCP tests were completed using a hand-operated tool called a “Wildcat DCP,” manufactured by Triggs Technology, Inc. Crawford also retained Jerry Beatty Tree Surgery & Tractors to perform a test pit under the supervision of a Crawford field engineer at this location. A summary of the explorations is shown in Table 1.

Table 1: Summary of Subsurface Exploration

Boring I.D.	Completion Date	Surface Elevation (feet)	Boring Depth (feet)	Drill Rig	Hammer Type	Exploration Equipment
D-20-001	06/10/2020	131.7	14.3	Wildcat DCP	Manual Drop (35 lbs)	1.4” driven tip
D-20-002	06/12/2020	137.4	18.0			
D-20-003	06/12/2020	142.5	12.7			
D-20-004	06/12/2020	123.9	11.7			
D-20-005	06/12/2020	122.9	13.3			
D-20-006	06/12/2020	115.6	14.0			
T-20-003	06/10/2020	130.8	6.0	N/A	N/A	Backhoe, 24” Bucket

Crawford’s project engineer logged the test pit consistent with the Unified Soil Classification System (USCS) and the 2010 Caltrans Logging Manual. Selected portions of recovered soil samples were retained in sealed containers for laboratory testing and reference. Groundwater observations were recorded during field operations when/if encountered. The test pit was excavated to a depth of approximately 6.0 ft to evaluate the near surface soils. The test pits were excavated using a Kubota KX91-3 excavator equipped with a 24-inch bucket. At completion, the test pit location was backfilled using native materials.

The DCP tests consists of continuously driving a 1.4-inch O.D. steel cone tip attached to a lead rod until refusal (50 blows per approximately 4-inches) is reached. The rods are advanced using a hand-actuated, 35-lb safety drop hammer falling a distance of 15-inches.

The DCP test provides an approximate quantification of a material's apparent density or stiffness. For this project, DCP testing was completed using manual equipment as described below. The purpose of the test was to aid in understanding the depth between weaker (possibly failed) and more competent ("intact") material across the slope creep area.

Three DCP tests were completed along the access road at the toe of the upslope, and three DCP tests were completed downslope of the access road. Groundwater observations were recorded during field operations when/if encountered.

The location of field tests is shown on Figure 2 in Appendix I.

3 SUBSURFACE CONDITIONS

In general, the subsurface materials encountered in T-20-003 consisted of clayey sand to a depth of 4.0 ft and sandy lean clay to the maximum depth explored of 6.0 ft. Groundwater was not encountered in T-20-003, D-20-001, D-20-002, and D-20-004 through D-20-006. Groundwater was present at the ground surface in D-20-003. Based on the Test Pit and DCP data, we divide the subsurface materials into two general material units.

The DCP tests completed at the toe of the upslope (D-20-001, D-20-002, and D-20-003) along the access roadway generally encountered very soft to medium stiff cohesive material (Unit 1) to a depth of 3.7 ft, 6.0 ft, and 7.0 ft, respectively. T-20-003 encountered Unit 1 materials to a depth of approximately 4.0 ft. The DCP tests conducted downslope (D-20-004, D-20-005, and D-20-006) of the access roadway generally encountered Unit 1 materials to a depth of 9.3 ft, 12.0 ft, and 11.7 ft, respectively. Unit 2 materials were encountered below Unit 1 materials and consisted of stiff to hard cohesive material to the maximum depth explored.

More detailed information is shown on the DCP and Test Pit logs included in Appendix II.

4 GEOLOGIC SETTING

The project is within the Coast Ranges Geomorphic Province of California[1], which is characterized by a series of northwest trending mountain ranges sub-parallel to the San Andres Fault. The Coast Ranges are composed of thick Mesozoic and Cenozoic sedimentary strata. The northern Coast Ranges are dominated by the irregular, knobby, landslide-topography of the Franciscan Complex. The project site is located on the coastal plain between the Coast Ranges and the Pacific, about 30 miles north of the point where the San Andreas Fault intersects the coast at Point Arena.

Published regional geologic mapping[2] shows surface materials as two distinct geologic units in the project vicinity. These consist of Pleistocene-age marine and marine terrace deposits overlying undivided Cretaceous-age marine deposits (Figure 3, Geological Map). The Pleistocene-age marine terrace deposits (Qm) at the project site are described as well sorted

[1] California Geologic Survey (2002), *California Geomorphic Province*, Note 36

[2] Jennings, C.W. and Strand, R.G.,1960, Geologic Map of California: Ukiah Sheet: California Division of Mines and Geology, GAM24, scale 1:250,000.

quartz sand with minor gravel. The Cretaceous-age marine deposits (K) generally consist of graywacke sandstone and shale. Landslide mapping of the Fort Bragg 7.5 quadrangle indicates no landslides or "inner gorge" geomorphic features are mapped within the project area. (Figures 4A and 4B, Landslide Map). No deep-seated failures were observed at this site at the time of our field investigation.

The site is not located near any known active faults (Figure 5, Fault Activity Map).

5 DISCUSSION AND CONCLUSIONS

Based on the limited DCP and test pit data, discussions with the City, and field observations in June 2020, the slope creep appears to be mainly a translational feature primarily occurring within Unit 1 materials with potential depth of movement at approximate depths of 4 to 7 ft deep on the inboard of the road and 10 to 12 ft deep on the slope below the roadway. The slope creep is likely caused by oversaturation and the presence of weak near surface native and fill materials. The drainage features in the area were likely overwhelmed and allowed significant storm water to infiltrate/saturate the Unit 1 materials (beneath the road) and on the over-steepened outboard slope.

Refer to Figure 6 that shows a cross-section sketch with the estimated "Intact" material plane. As discussed above, the vegetation made identifying the extent and location of the slope creep difficult during our site visit and field exploration.

Due to the available limited data/information, thick cover of vegetation at the site, and survey results, it is difficult to determine the extent of the slope creep in the field. Therefore, we provide the following options to improve this portion of the alignment identified by the City that has experienced slope creep. The options presented below are considered preventative as no indications of roadway distress were observed as part of this study. The City should review the options presented below and consider their own previous site observations to determine an appropriate level of repair along this portion of the project.

The options include:

1) reconstructing the embankment and establishing a keyway in the underlying medium dense and stiff materials (Unit 2) down slope from the roadway and installing drainage features to help prevent saturation of the road and downslope soils;
2) installing an inboard trench underdrain and moving the planned water line to the inboard portion of the road, and improving drainage along the road; and
3) constructing an inboard cut-slope and installing a rock buttress with improved drainage in combination with options 1 and 2.

The first option will be expensive and may not be necessary at this time since we understand only surficial slope creep has been identified by the City. This option is considered to represent the most effort/cost with lower overall risk of continued movement. The second option is a limited option that does not improve the outboard slope conditions, and attempts to capture and redirect near surface and surface water away from the area. However, it will be relatively inexpensive and should improve drainage below the road and should help support the planned water line. This option is considered to represent lower effort/cost with somewhat higher risk of continued movement. The first two options would require continued monitoring of the inboard and would likely need periodic maintenance if material is deposited on the road.

5.1 OPTION 1: RECONSTRUCTED EMBANKMENT OPTION

The following summarizes the general key elements of the reconstructed embankment. A diagram is provided in Figure 6.

1. Reconstruct embankment section the full length of the distressed area (length to be verified by the City).
2. Establish the base of the reconstructed embankment in the central portion of the failed area, determined by extending a 1.25H:1V line downward from the restored hinge-line to the estimated Unit 2 line. Establish base at higher elevation as needed to transition at each end of repair.
3. A temporary construction backslope, extended from the heel of the toe bench to approximate roadway centerline, at 1H:1V (or flatter) is expected to be appropriately stable during dry season construction. Sub-drainage may be required as a first-order of construction in significant springs are encountered in the excavation; these can be drained independently or incorporated into the permanent sub-drainage system depending on the location and magnitude of flow.
4. Drain the reinforced section with a minimum 24-inch-thick "blanket" of ¾-inch crushed rock placed along the base of the embankment section and extended up the backslope to at least 5 ft below the finished road grade. Wrap the crushed rock with filter fabric (such as Mirafi 140N or equivalent) to prevent mobilization of fines into the drain. Perforated pipe should be placed along the base of the lowest portion of the drain and relieved at regular intervals via solid pipe gravity outlet. Clean-outs should be provided to permit maintenance of the drain.
5. Excavated soils, excluding 2-inch greater dimension materials, may be re-used for embankment fill at this site. Replace the excavated material as compacted embankment, placed to 90% relative compaction (per CTM 216). Spreading and drying of the soils may be necessary for moisture control prior to placement.
6. Construct the exterior finish slope at 2H:1V, or flatter, trimmed to match the adjacent embankment slopes (per Caltrans Standard Specifications). Apply appropriate erosion protection measures to all reconstructed slopes.
7. Re-establish, control, and direct surface drainage from the access road away from the outboard slope and prevent surface water from ponding.
8. Construct a trenched underdrain (e.g., per Caltrans "Standard Plans") along the inner road area to intercept seasonal seepage and shallow groundwater. Construct the underdrain to 5 ft below the ground surface and backfill with permeable material enclosed in filter fabric. Place low permeability soil (compacted structural backfill or cohesive native soil) within the uppermost 2 ft of the trench to prevent surface water from entering the underdrain. Provide gravity outlet below the road and protect the outboard slope where the water outlets.

5.2 OPTION 2: DRAINAGE IMPROVEMENT OPTION

As an alternative to reconstructing the embankment, the City could consider continuing to monitor the slope creep and improving drainage and installing the new pipe as close to the inboard edge of the road as possible. The placement of the pipeline away from the outboard slope would provide some increased level of security with respect to continued creep and/or shallow slumping of the outboard slope. Consideration could also be given to installing the pipeline deeper (say, 7 to 8 ft) within the area of concern. Drainage improvements would include an inboard trench underdrain as described in Option 1 and regrading the road to help prevent water from saturating the outboard slope.

5.3 OPTION 3: INBOARD CUT SLOPE

We understand the City has more recently observed some signs of slope creep in the inboard cut-slope in the area of concern. The inboard cut slope was not initially considered as part of this evaluation/study, however depending on the extent of the creep, the City could consider trimming the inboard slope to 2H:1V or flatter, use of a rock buttress keyed into Unit 2 materials 4 to 7 ft deep along the inboard side of the road, improving drainage above the inboard slope or consider the installation of fingers drains to stiffen/drain the upslope. The City could consider a combination of the above. Some of these suggestions may require a slight realignment of the existing access road. This option would be used in combination with Options 1 or 2, above.

6 LIMITATIONS

Crawford performed these services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. This memo is based on the site conditions and proposed project elements and should be used only for the evaluation and design of repair alternative for the Segment 2 slope creep for the City of Fort Bragg Raw Water Pipeline Replacement project.

It is assumed the soil and groundwater conditions described in this memo are representative of the subsurface conditions at the site. Actual conditions between explorations could be different. The interface shown between soil materials on the boring logs is approximate. The transition between materials may be abrupt or gradual. Recommendations are based on the site observations and logs, which represent our interpretation of the competent materials and general knowledge of the site and geological conditions.

Modern design and construction is complex and it is common to experience changes and delays. The City should set aside a reasonable contingency fund based on complexities and cost estimates to cover changes and delays.

Thank you for including Crawford & Associates, Inc on your design team. Please call if you have questions or require additional information.

Sincerely,
Crawford & Associates, Inc.,

Keiko Lewis
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
KEIKO K. LEWIS
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Reviewed by:

Benjamin D. Crawford, PE, GE
Principal Geotechnical Engineer

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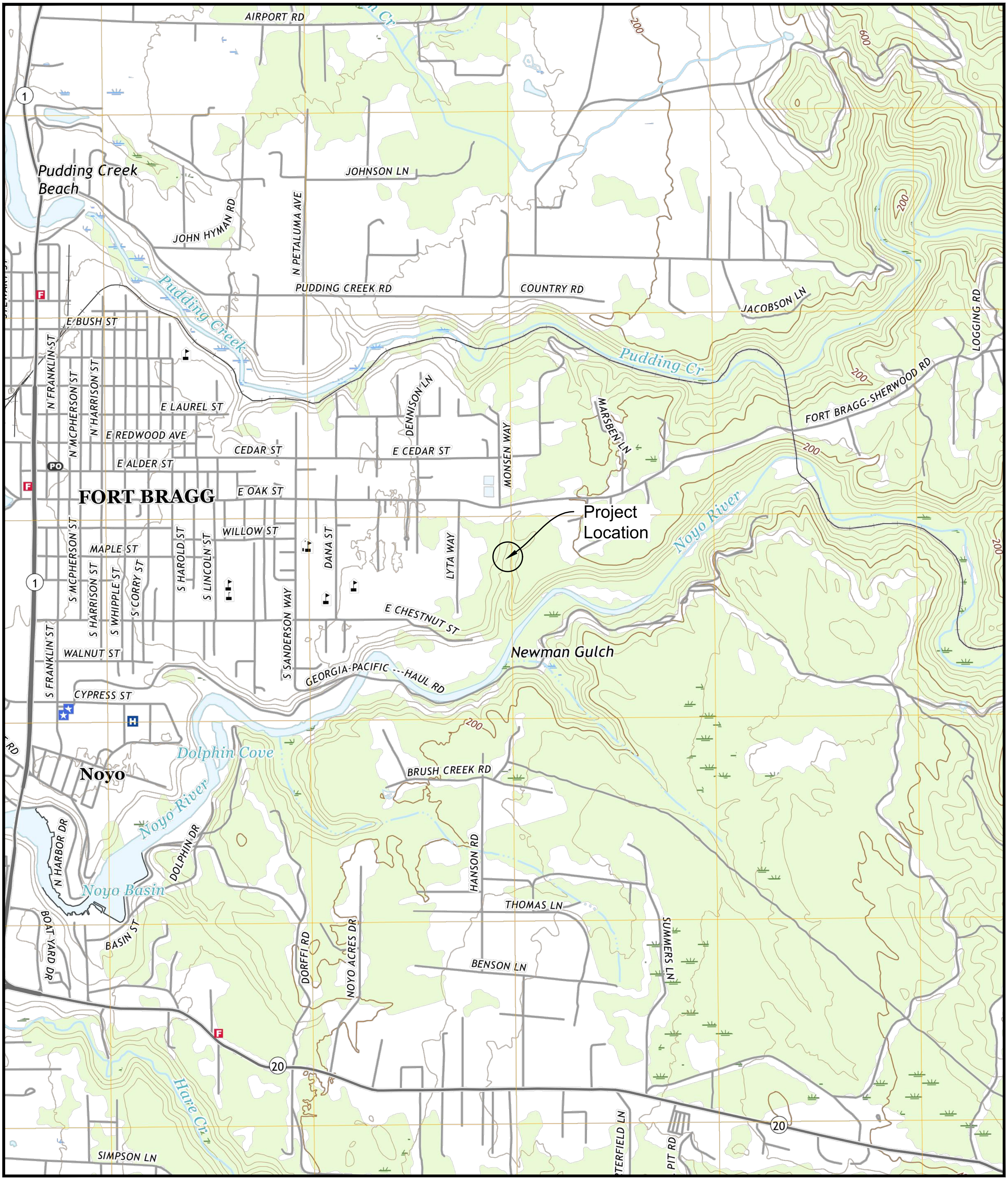
APPENDIX I

Figure 1: Vicinity Map
Figure 2: Exploration Location Map
Figure 3: Geologic Map
Figures 4A and B: Landslide Map
Figure 5: Fault Activity Map
Figure 6A: Cross Sections A-A’
Figure 6B: Cross Section B-B’



North

Source:
USGS 7.5' Topographic Maps, Fort Bragg, Mendocino County, California, 2018, Scale: 1:24,000.

USGS 7.5' Topographic Maps, Noyo Hill, Mendocino County, California, 2018, Scale: 1:24,000.

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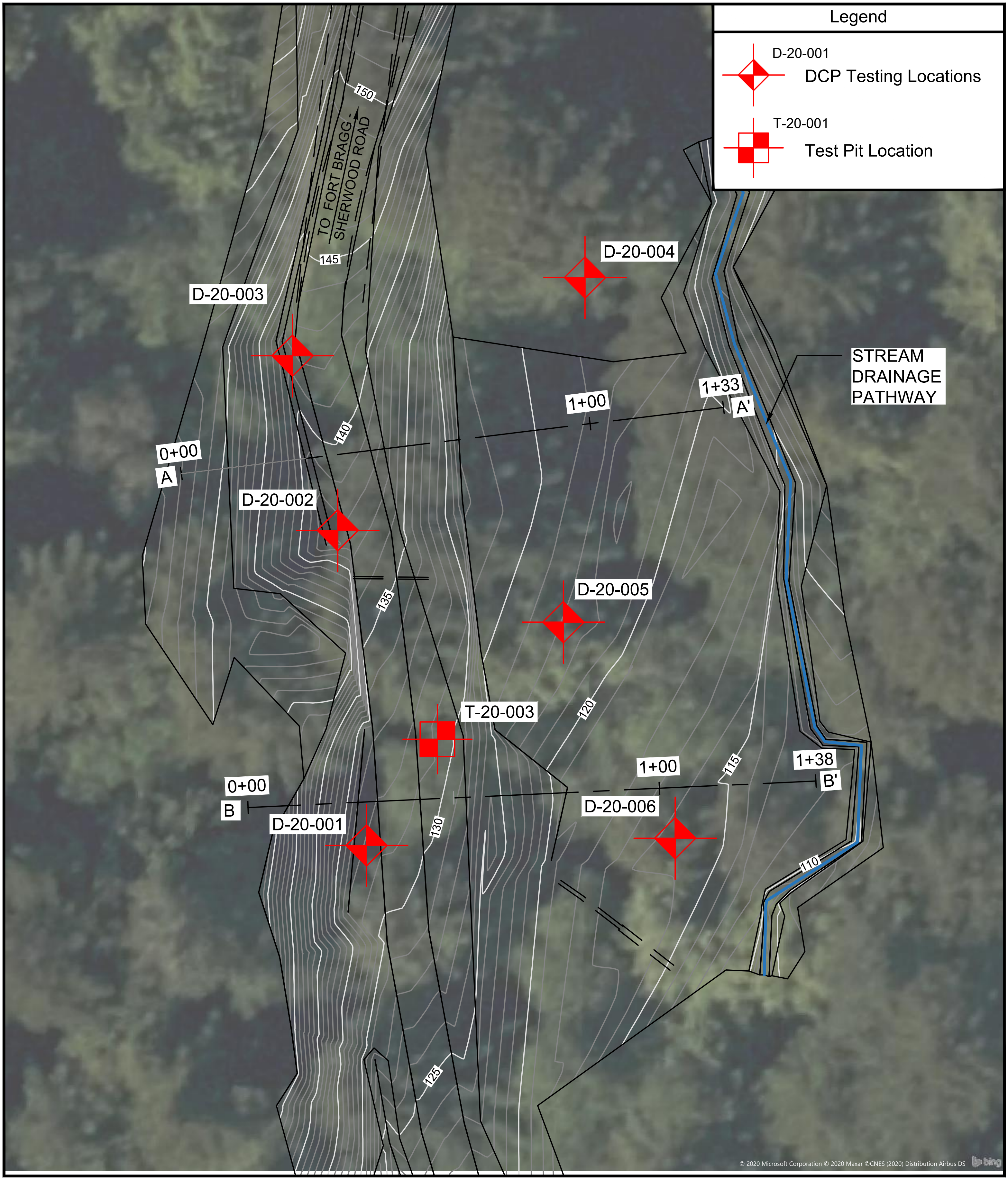
City of Fort Bragg Raw Water Pipeline Replacement Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 1
Vicinity Map

Proj. No:	19-514.1
Scale:	1"=2,000'
Date:	3/25/22



North

Map and Data Source:
Topographic Survey provided by Coleman Engineering via electronic transfer on 11/17/2020.

Basemap: AutoCAD Civil3D Geolocation Tool, using Bing Maps

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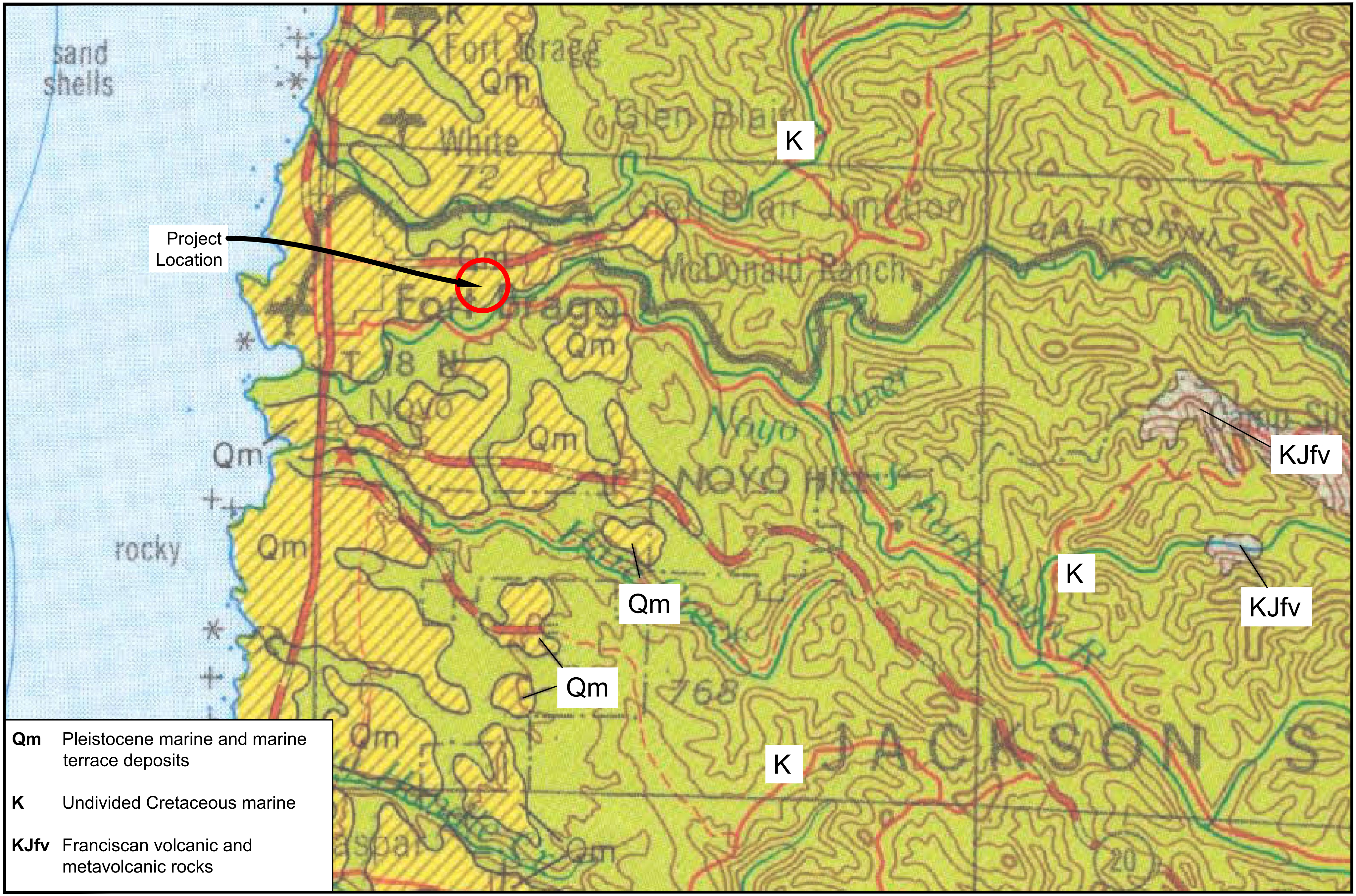
City of Fort Bragg Raw Water Pipeline Replacement
Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 2
Location of Field Tests

Proj. No:	19-514.1
Scale:	1" = 30'
Date:	3/25/22



North

Source: Jennings, CW., and Strand, R.G., Geologic Map of California: Ukiah Sheet. Scale 1:250,000, California Division of Mines and Geology, 1960

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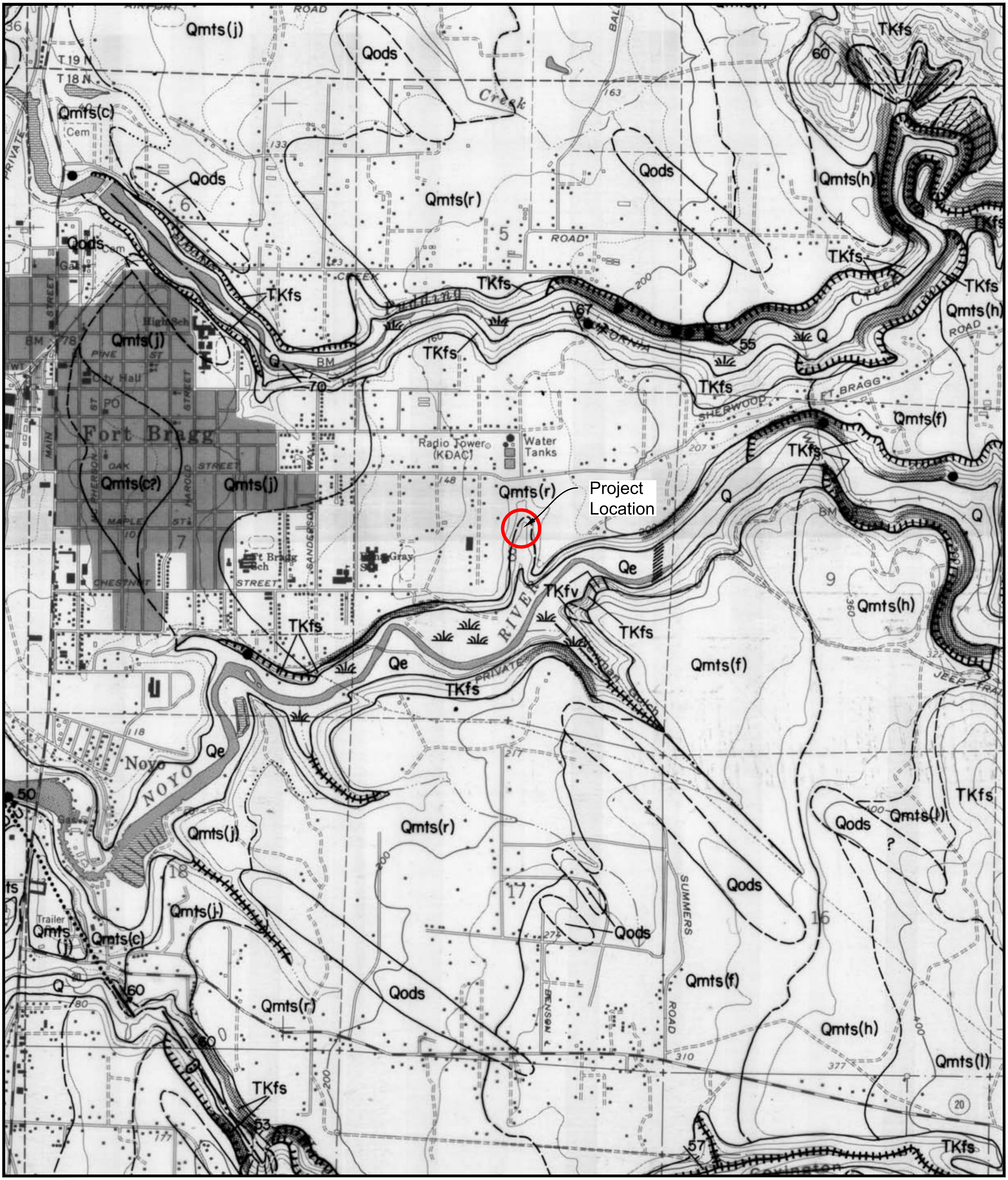
City of Fort Bragg Raw Water Pipeline Replacement
Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 3
Geology Map

Proj. No:	19-514.1
Scale:	1"=6,000'
Date:	3/25/22



North	<u>Source:</u> Kilbourne, Richard, Geologic and Geomorphic Features Related to Landsliding: Fort Bragg 7.5' Quadrangle, Mendocino County, California, Scale 1:24,000, California Division of Mines and Geology, 1982	Crawford & Associates, Inc. Geotechnical Engineering, Design and Construction Services Taber Since 1954 1100 Corporate Way Suite 230 Sacramento, CA 95831 (916) 455-4225	City of Fort Bragg Raw Water Pipeline Replacement Segment 2 Slope Stabilization Fort Bragg, CA	Figure 4a Landslide and Geologic Map Proj. No: 19-514.1 Scale: 1"=2,000' Date: 3/25/22

EXPLANATION

FORT BRAGG 7.5' QUADRANGLE
OFR 83-5 S.F.

DEBRIS SLIDE: includes scarp and slide deposits; solid where active, dashed where dormant.

DEBRIS FLOW/TORRENT TRACK: solid where active, dashed where dormant.

DEBRIS SLIDE AMPHITHEATER/SLOPE

INNER GORGE: where too narrow to delineate at this scale.

ACTIVE SLIDE: too small to delineate at this scale.

Q ALLUVIUM (Holocene): unconsolidated, fine-grained sand and silt along modern river flood plains; minor amounts of gravel in channel areas.

Qbs BEACH SAND (Holocene): unconsolidated medium- to coarse-grained quartz sand with lesser amounts of shell fragments and Coastal Belt Franciscan (TKfs) cobbles.

Qe ESTUARINE DEPOSITS (Holocene): unconsolidated dark grey silt and fine sand along intertidal salt marsh estuaries; generally gradational contact with alluvium (Q).

Qds DUNE SAND (Holocene): medium- to fine-grained principally quartz sand; active and unvegetated.

Qods OLDER DUNES (Pleistocene): well-sorted, semi-consolidated, fine- to medium-grained quartz sand overlying various marine terrace deposits (Qmts); recognized by subdued elongate dune profile, generally trending NW; dune deposits tend to be better drained than underlying units.

Qmts MARINE TERRACE DEPOSITS undifferentiated, progressively older with increased elevation (Pleistocene): deposits generally consist of well-sorted quartz sand with minor gravel and have coarser textures near major drainages; may include some dune sands. Elevations of terrace deposits listed below are approximate and, due to minor regional deformation, apply only to map area.

Qmts(c) CASPAR POINT marine terrace sediments: name is from stratigraphically equivalent deposits exposed at Caspar Point (W1/2 of Section 1, T17N, R18W) on the Mendocino 7.5' quadrangle; thickness 0 to 30 feet, mostly unconsolidated fine sand, Indian midden deposits common, native arboreal vegetation absent, found from modern sea cliff to an elevation of generally 100(+15) feet.

Qmts(j) JUG HANDLE FARM marine terrace sediments: name is from stratigraphically equivalent deposits exposed at Jug Handle Farm (SE1/4 of Section 36, T18N, R18W) on the Mendocino 7.5' quadrangle; thickness 0 to 10 feet, with frequent relict stacks of TKfs, sporadically forested, elevation generally 100 to 160(±10) feet.

Qmts(r) RAILROAD marine terrace sediments: name is from stratigraphically equivalent deposits exposed along old Caspar railroad right-of-way (Section 31, T18N, R17W) on the Fort Bragg 7.5' quadrangle; elevation generally 160 to 220(+20) feet.

Qmts(f) FERN CREEK marine terrace sediments: name is from stratigraphically equivalent deposits exposed along Fern Creek Road (Section 6, T17N, R17W) on the Mendocino 7.5' quadrangle; hardpan sporadically developed in map area; elevation generally 220 to 320(±20) feet.

Qmts(h) HANS JENNY PIT marine terrace sediments: name is from stratigraphically equivalent deposits exposed in soil test pits along Gibney Lane (NE1/4 of Section 5, T17N, R17W) on the Mendocino 7.5' quadrangle; hardpan well developed in map area; elevation 320 to 415(±25) feet.

Qmts(l) LOWER CASPAR ORCHARD marine terrace sediments: name is from stratigraphically equivalent deposits exposed at Caspar Orchard (SW1/4 of NW1/4 of Section 10, T17N, R17W) on the Mendocino and Glenblair SW 7.5' quadrangles; hardpan usually broken in map area; elevation 415 to 515(±25) feet.

Qmts(u) UPPER CASPAR ORCHARD marine terrace sediments: name is from stratigraphically equivalent deposits exposed at Caspar Orchard (NE1/4 of NW1/4 of Section 10, T17N, R17W) on the Glenblair SW 7.5' quadrangle; elevation generally 515 to 680 (±30) feet.

TKfs COASTAL BELT FRANCISCAN (Tertiary-Cretaceous): well-consolidated clastic sedimentary rocks; mainly sandstone and shale with minor limestone and conglomerate; NW trending streams tend to lie in more sheared shale.

TKfv COASTAL BELT FRANCISCAN (Tertiary-Cretaceous): volcanic rocks; greenstone and metamorphosed tuffaceous sandstone.

LITHOLOGIC CONTACT: dashed where approximately located, dotted where projected or inferred.

GRADATIONAL CONTACT

FAULT: showing direction of dip and up (U) and downthrown (D) sides; dotted where concealed.

LINEAMENT: linear feature of unknown origin observed on aerial photographs.

STRIKE AND DIP OF BEDDING: when appearing in Quaternary units the symbol represents the underlying bedrock.

BORROW PIT

SPRING

MARSH

SLOPES > 70 PERCENT: compiled from map contours, aerial photo interpretation, and field reconnaissance.

REFERENCES

California Department of Forestry, 1981, Cal Aero Photos: Photos CDF-ALL-UK; Flight 7/9/81; Frames 5-6 to 5-12 and 7-11 to 7-17; black and white, scale 1:24,000.

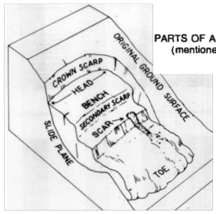
California Division of Mines and Geology, 1976-1982, Geologic Review of Timber Harvesting Plans: Unpublished field studies conducted for the California Department of Forestry.

Henderson, C., and Olmsted,J., 1979, Jug Handle Ecological Staircase: Published by California Institute of Man in Nature, Caspar, California, map scale 1:9,400.

Kramer, J.C., 1976, Geology and tectonic implications of the Coastal Belt Franciscan, Ft. Bragg-Willits area, northern Coast Ranges, California: Unpublished Ph.D. thesis, University of California, Davis, 128 p., map scale 1:48,000.

SOURCES OF GEOLOGIC DATA

Geologic data was compiled from aerial photo interpretation, field reconnaissance, and the modification of published and unpublished geologic maps listed in references above. The author was assisted in the field and office studies by Anibal Mata-Sol and Peter H. Griffith.



PARTS OF A LANDSLIDE
(mentioned in text)

ACTIVITY OF LANDSLIDES

Active or probably active - presently moving or recently moved. Distinct topographic slide features present i.e., sharp barren scarps, cracks, jackstrawed trees. Major revegetation has not occurred.

Dormant - little evidence of recent movement. Slide features modified by weathering and erosion. Vegetation generally well established. Some mass movements may have developed under climatic conditions different from today. Causes of failure may remain and movement could be renewed.

RATES OF LANDSLIDE MOVEMENT*

10 ft/sec or more	= extremely rapid
1 ft/min-10 ft/min	= very rapid
5 ft/day-1 ft/min	= rapid
5 ft/mo-5 ft/day	= moderate
5 ft/yr5 ft/mo	= slow
1 ft/5yr5 ft/yr	= very slow
1 ft/5yr or less	= extremely slow

*Modified from: Varnes, D.J., 1978, Slope movement types and processes *in* Landslides Analysis and Control, Transportation Research Board, National Academy of Sciences, Washington, D.C., Special Report 176 Figure 2.1.

North

Source: Kilbourne, Richard, Geologic and Geomorphic Features Related to Landsliding: Fort Bragg 7.5' Quadrangle, Mendocino County, California, Scale 1:24,000, California Division of Mines and Geology, 1982

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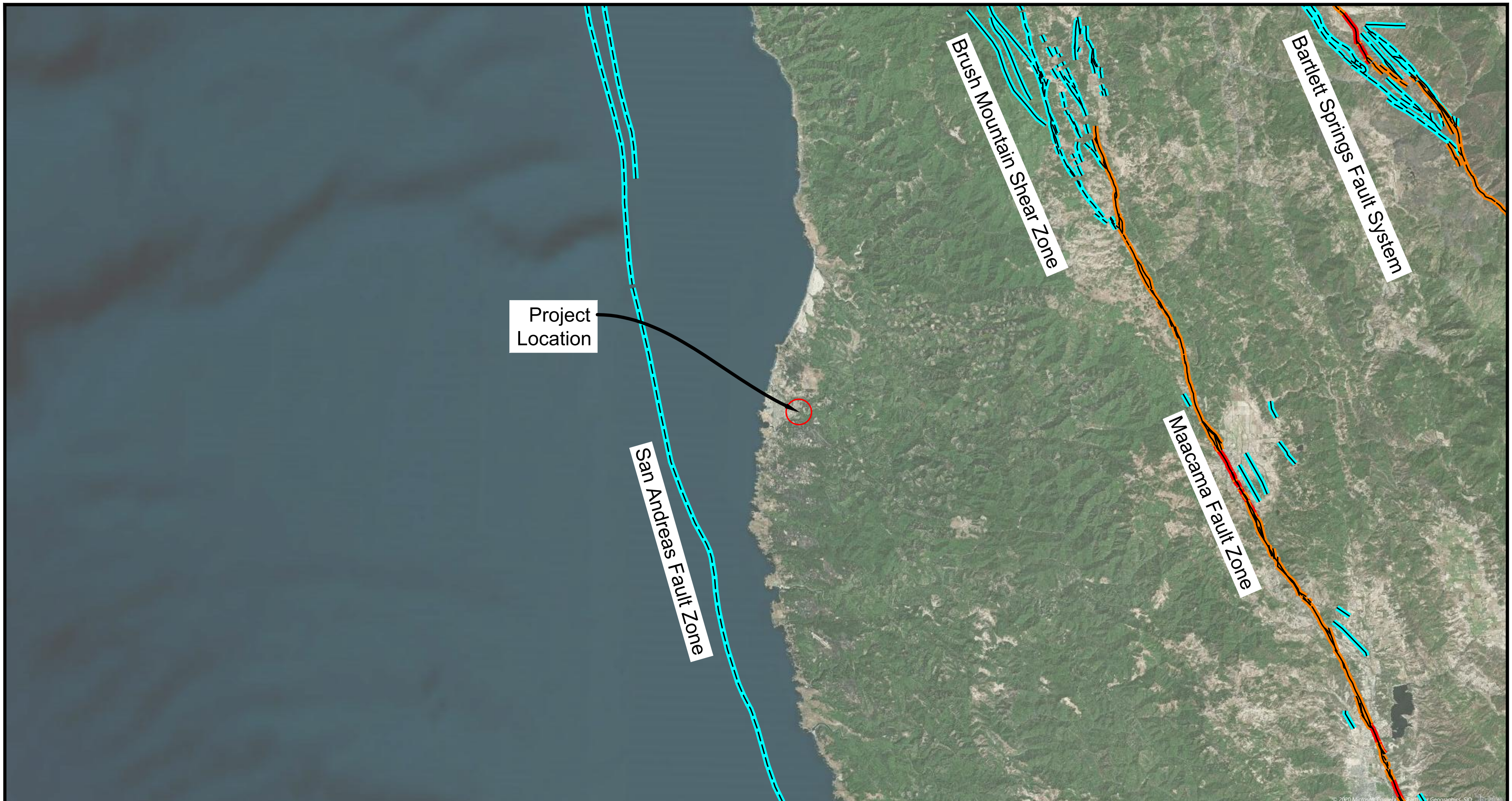
City of Fort Bragg Raw Water Pipeline Replacement
Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 4b
Landslide and Geologic Map Legend

Proj. No:	19-514.1
Scale:	No Scale
Date:	3/25/22



LEGEND

Quaternary Fault (Age)	Quaternary Fault (Age)	Location
<150 years	<750,000 years	Well Constrained
<15,000 years	<1.6 million years	Moderately Constrained
<130,000 years		Inferred

North

Source:
Basemap: AutoCAD Civil3D Geolocation Tool, using Bing Maps
Fault Data: USGS GIS Data

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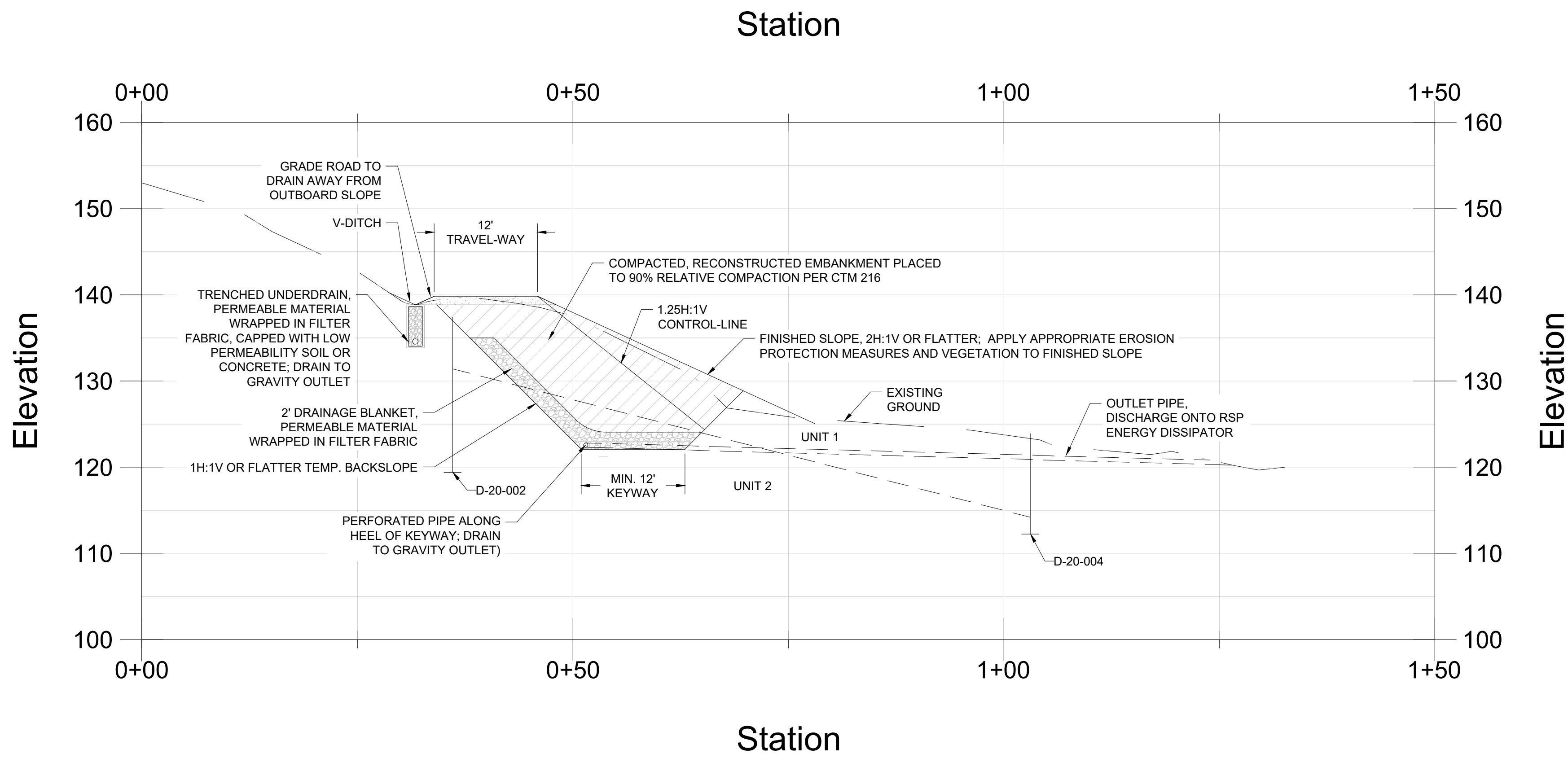
City of Fort Bragg Raw Water Pipeline Replacement
Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 5
Fault Activity Map

Proj. No: 19-514.1
Scale: 1"=40,000'
Date: 3/25/22



Profile View of Cross Section A- A'

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Taber Since 1954

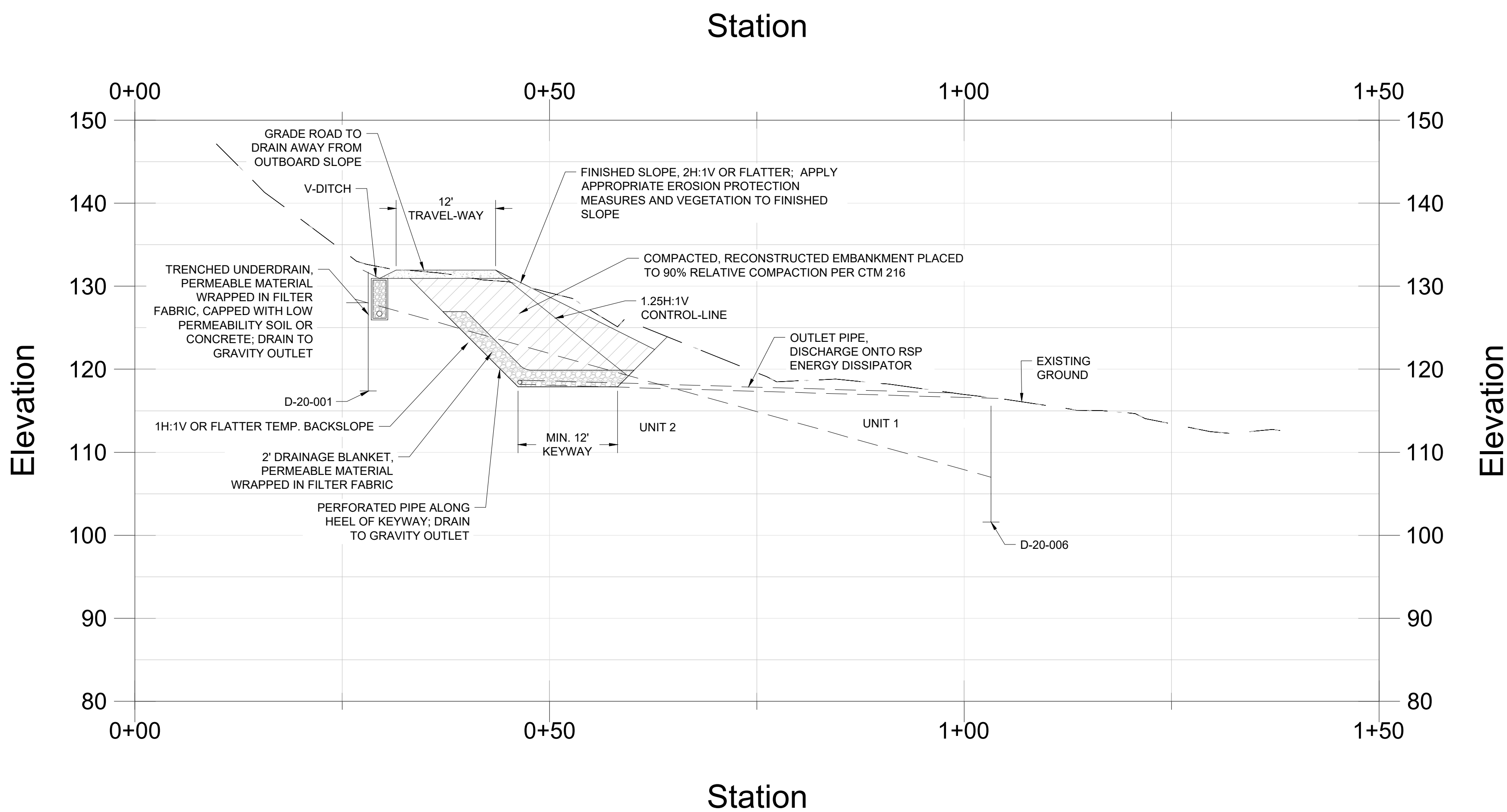
1100 Corporate Way
Suite 230
Sacramento, CA 95831
(916) 455-4225

City of Fort Bragg Raw Water Pipeline Replacement
Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 6A
Cross-Section A-A'

Proj. No: 19-514.1
Scale: 1"=20'
Date: 3/25/22



Profile View of Cross Section B-B'

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
Taber
Since 1954
1100 Corporate Way
Suite 230
Sacramento, CA 95831
(916) 455-4225

City of Fort Bragg Raw Water Pipeline Replacement
Segment 2 Slope Stabilization

Fort Bragg, CA

Figure 6B
Cross-Section B-B'

Proj. No:	19-514.1
Scale:	1"=20'
Date:	3/25/22

Corporate Office: 1100 Corporate Drive, Suite 230 | Sacramento, CA 95831 | (916) 455-4225
Modesto: 1165 Scenic Drive, Suite B | Modesto, CA 95350 | (209) 312-7668
Pleasanton: 6200 Stoneridge Mall Road, Suite 330 | Pleasanton, CA 94588 | (925) 401-3515
Rocklin: 4220 Rocklin Road, Suite 1 | Rocklin, CA 95677 | (916) 455-4225
Ukiah: 100 North Pine Street | Ukiah, CA 95482| (707) 240-4400

APPENDIX II

DCP and Test Pit Logs

WILDCAT DYNAMIC CONE LOG

Crawford & Associates, Inc.
1100 Corporate Way, Suite 230
Sacramento, CA 95831

PROJECT NUMBER: 19-514.1
DATE STARTED: 06-10-2020
DATE COMPLETED: 06-10-2020

HOLE #: D-20-001
CREW: BJU, MCC
PROJECT: Fort Bragg Raw Water Line
ADDRESS: South of Fort Bragg - Sherwood Road
LOCATION: Fort Bragg, CA

SURFACE ELEVATION: 131.7'
WATER ON COMPLETION: Not Encountered
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-						
- 1 ft						
-	11	48.8	•••••••••••••••	13	MEDIUM DENSE	STIFF
-	13	57.7	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 2 ft	15	66.6	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	10	44.4	•••••••••••••	12	MEDIUM DENSE	STIFF
-	10	44.4	•••••••••••••	12	MEDIUM DENSE	STIFF
- 3 ft	10	44.4	•••••••••••••	12	MEDIUM DENSE	STIFF
- 1 m	9	40.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 4 ft	14	54.0	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
-	13	50.2	•••••••••••••••	14	MEDIUM DENSE	STIFF
- 5 ft	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
-	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
-	13	50.2	•••••••••••••••	14	MEDIUM DENSE	STIFF
- 6 ft	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
-	13	50.2	•••••••••••••••	14	MEDIUM DENSE	STIFF
- 2 m	15	57.9	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 7 ft	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	18	61.6	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	15	51.3	•••••••••••••••	14	MEDIUM DENSE	STIFF
- 8 ft	16	54.7	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	17	58.1	•••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
- 9 ft	11	37.6	•••••••••••	10	LOOSE	STIFF
-	13	44.5	•••••••••••••	12	MEDIUM DENSE	STIFF
-	31	106.0	•••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	26	88.9	••••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	30	91.8	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	25	76.5	•••••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 11 ft	28	85.7	•••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
	24	73.4	••••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	23	70.4	•••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
	27	82.6	••••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 12 ft	30	91.8	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	36	110.2	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
	24	73.4	••••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	14	42.8	•••••••••••••	12	MEDIUM DENSE	STIFF

WILDCAT DYNAMIC CONE LOG

PROJECT: Fort Bragg Raw Water Line PROJECT NUMBER: 19-514.1

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	21	58.2	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	35	97.0	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 14 ft	34	94.2	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	38	105.3	••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-						
- 15 ft						
-						
-						
- 16 ft						
- 5 m						
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
- 6 m						
-						
- 20 ft						
-						
-						
- 21 ft						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						
- 30 ft						

WILDCAT DYNAMIC CONE LOG

Crawford & Associates, Inc.
1100 Corporate Way, Suite 230
Sacramento, CA 95831

PROJECT NUMBER:	19-514.1
DATE STARTED:	06-12-2020
DATE COMPLETED:	06-12-2020
HOLE #:	D-20-002
CREW:	BJU, MCC
PROJECT:	Fort Bragg Raw Water Line
ADDRESS:	South of Fort Bragg - Sherwood Road
LOCATION:	Fort Bragg, CA
SURFACE ELEVATION:	137.4'
WATER ON COMPLETION:	Not Encountered
HAMMER WEIGHT:	35 lbs.
CONE AREA:	10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-						
- 1 ft						
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 2 ft	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
- 3 ft	15	66.6	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 1 m	12	53.3	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 4 ft	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
-	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 5 ft	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 6 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	9	34.7	••••••••••	9	LOOSE	STIFF
- 2 m	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
- 7 ft	12	41.0	•••••••••••	11	MEDIUM DENSE	STIFF
-	11	37.6	••••••••••	10	LOOSE	STIFF
-	21	71.8	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 8 ft	22	75.2	•••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	23	78.7	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	23	78.7	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 9 ft	21	71.8	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	17	58.1	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	23	78.7	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	11	37.6	••••••••••	10	LOOSE	STIFF
-	13	39.8	•••••••••••	11	MEDIUM DENSE	STIFF
-	13	39.8	•••••••••••	11	MEDIUM DENSE	STIFF
- 11 ft	13	39.8	•••••••••••	11	MEDIUM DENSE	STIFF
	11	33.7	•••••••••	9	LOOSE	STIFF
-	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
	12	36.7	••••••••••	10	LOOSE	STIFF
- 12 ft	12	36.7	••••••••••	10	LOOSE	STIFF
-	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
	24	73.4	•••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	20	61.2	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF

HOLE #: D-20-002

WILDCAT DYNAMIC CONE LOG

PROJECT: Fort Bragg Raw Water Line

PROJECT NUMBER: 19-514.1

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	35	97.0	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	23	63.7	•••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
- 14 ft	21	58.2	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	22	60.9	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	21	58.2	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 15 ft	22	60.9	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	22	60.9	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	18	49.9	•••••••••••••	14	MEDIUM DENSE	STIFF
- 16 ft	19	52.6	••••••••••••••	15	MEDIUM DENSE	STIFF
- 5 m	25	69.3	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	28	71.1	•••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 17 ft	26	66.0	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	30	76.2	•••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	40	101.6	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 18 ft	50	127.0	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-						
-						
- 19 ft						
- 6 m						
-						
- 20 ft						
-						
-						
- 21 ft						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						
- 30 ft						

WILDCAT DYNAMIC CONE LOG

Crawford & Associates, Inc.
1100 Corporate Way, Suite 230
Sacramento, CA 95831

PROJECT NUMBER: 19-514.1
DATE STARTED: 06-12-2020
DATE COMPLETED: 06-12-2020

HOLE #: D-20-003
CREW: BJU, MCC
PROJECT: Fort Bragg Raw Water Line
ADDRESS: South of Fort Bragg - Sherwood Road
LOCATION: Fort Bragg, CA

SURFACE ELEVATION: 142.5'
WATER ON COMPLETION: 142.5'
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-						
- 1 ft						
-						
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 2 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 3 ft	2	8.9	••	2	VERY LOOSE	SOFT
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 4 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 5 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	9	34.7	••••••••••	9	LOOSE	STIFF
- 6 ft	20	77.2	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 2 m	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 7 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
-	11	37.6	••••••••••	10	LOOSE	STIFF
- 8 ft	11	37.6	••••••••••	10	LOOSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	30	102.6	•••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 9 ft	25	85.5	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	24	82.1	•••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	16	54.7	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 3 m 10 ft	25	85.5	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	22	67.3	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	25	76.5	••••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 11 ft	22	67.3	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
	27	82.6	•••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	35	107.1	•••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
	44	134.6	•••••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 12 ft	38	116.3	•••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	43	131.6	••••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
	50	153.0	••	25+	DENSE	HARD
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Crawford & Associates, Inc.
1100 Corporate Way, Suite 230
Sacramento, CA 95831

PROJECT NUMBER: 19-514.1
DATE STARTED: 06-12-2020
DATE COMPLETED: 06-12-2020

HOLE #: D-20-004
CREW: BJU, MCC
PROJECT: Fort Bragg Raw Water Line
ADDRESS: South of Fort Bragg - Sherwood Road
LOCATION: Fort Bragg, CA

SURFACE ELEVATION: 123.9'
WATER ON COMPLETION: Not Encountered
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

	BLOWS	RESISTANCE	GRAPH OF CONE RESISTANCE		TESTED CONSISTENCY	
DEPTH	PER 10 cm	Kg/cm²	0 50 100 150	N'	NON-COHESIVE	COHESIVE
-						
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 ft	9	40.0	•••••••••••	11	MEDIUM DENSE	STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
-	11	48.8	••••••••••••••	13	MEDIUM DENSE	STIFF
- 2 ft	15	66.6	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	14	62.2	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	15	66.6	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 3 ft	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 1 m	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 4 ft	16	61.8	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	9	34.7	••••••••••	9	LOOSE	STIFF
- 5 ft	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
-	14	54.0	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	9	34.7	••••••••••	9	LOOSE	STIFF
- 6 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 2 m	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 7 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
-	4	13.7	•••	3	VERY LOOSE	SOFT
- 8 ft	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
-	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 9 ft	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 3 m 10 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	13	39.8	•••••••••••	11	MEDIUM DENSE	STIFF
-	14	42.8	••••••••••••	12	MEDIUM DENSE	STIFF
- 11 ft	15	45.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	26	79.6	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 12 ft						

WILDCAT DYNAMIC CONE LOG

Crawford & Associates, Inc.
1100 Corporate Way, Suite 230
Sacramento, CA 95831

PROJECT NUMBER: 19-514.1
DATE STARTED: 06-12-2020
DATE COMPLETED: 06-12-2020

HOLE #: D-20-005
CREW: BJU, MCC
PROJECT: Fort Bragg Raw Water Line
ADDRESS: South of Fort Bragg - Sherwood Road
LOCATION: Fort Bragg, CA

SURFACE ELEVATION: 122.9'
WATER ON COMPLETION: Not Encountered
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-						
- 1 ft						
-	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
-	8	35.5	••••••••••	10	LOOSE	STIFF
- 2 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 3 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	1	3.9	•	1	VERY LOOSE	VERY SOFT
- 4 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 5 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 6 ft	4	15.4	••••	4	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 2 m	3	11.6	•••	3	VERY LOOSE	SOFT
- 7 ft	3	10.3	••	2	VERY LOOSE	SOFT
-	4	13.7	•••	3	VERY LOOSE	SOFT
-	3	10.3	••	2	VERY LOOSE	SOFT
- 8 ft	3	10.3	••	2	VERY LOOSE	SOFT
-	3	10.3	••	2	VERY LOOSE	SOFT
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
- 9 ft	5	17.1	••••	4	VERY LOOSE	SOFT
-	4	13.7	•••	3	VERY LOOSE	SOFT
-	6	20.5	•••••	5	LOOSE	MEDIUM STIFF
- 3 m 10 ft	4	13.7	•••	3	VERY LOOSE	SOFT
-	5	15.3	••••	4	VERY LOOSE	SOFT
-	5	15.3	••••	4	VERY LOOSE	SOFT
- 11 ft	6	18.4	•••••	5	LOOSE	MEDIUM STIFF
	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	9	27.5	•••••••	7	LOOSE	MEDIUM STIFF
	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
- 12 ft	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	11	33.7	•••••••••	9	LOOSE	STIFF
	18	55.1	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 4 m 13 ft	28	85.7	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF

HOLE #: D-20-005

WILDCAT DYNAMIC CONE LOG

PROJECT: Fort Bragg Raw Water Line

PROJECT NUMBER: 19-514.1

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	27	74.8	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-						
- 14 ft						
-						
-						
- 15 ft						
-						
-						
- 16 ft						
- 5 m						
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
- 6 m						
-						
- 20 ft						
-						
-						
- 21 ft						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						
- 30 ft						

WILDCAT DYNAMIC CONE LOG

Crawford & Associates, Inc.
1100 Corporate Way, Suite 230
Sacramento, CA 95831

PROJECT NUMBER: 19-514.1
DATE STARTED: 06-12-2020
DATE COMPLETED: 06-12-2020

HOLE #: D-20-006
CREW: BJU, MCC
PROJECT: Fort Bragg Raw Water Line
ADDRESS: South of Fort Bragg - Sherwood Road
LOCATION: Fort Bragg, CA

SURFACE ELEVATION: 115.6'
WATER ON COMPLETION: Not Encountered
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-						
-						
- 1 ft						
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 2 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	8	35.5	••••••••••	10	LOOSE	STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 3 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
- 4 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	2	7.7	••	2	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 5 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 6 ft	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 2 m	4	15.4	••••	4	VERY LOOSE	SOFT
- 7 ft	4	13.7	•••	3	VERY LOOSE	SOFT
-	3	10.3	••	2	VERY LOOSE	SOFT
-	3	10.3	••	2	VERY LOOSE	SOFT
- 8 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
- 9 ft	13	44.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 3 m 10 ft	7	23.9	••••••	6	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
- 11 ft	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
	14	42.8	••••••••••••	12	MEDIUM DENSE	STIFF
- 12 ft	14	42.8	••••••••••••	12	MEDIUM DENSE	STIFF
-	15	45.9	•••••••••••••	13	MEDIUM DENSE	STIFF
	17	52.0	•••••••••••••••	14	MEDIUM DENSE	STIFF
- 4 m 13 ft	18	55.1	•••••••••••••••	15	MEDIUM DENSE	STIFF

HOLE #: D-20-006

WILDCAT DYNAMIC CONE LOG

PROJECT: Fort Bragg Raw Water Line

PROJECT NUMBER: 19-514.1

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	19	52.6	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	24	66.5	•••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
- 14 ft	36	99.7	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-						
-						
- 15 ft						
-						
-						
- 16 ft						
- 5 m						
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
- 6 m						
-						
- 20 ft						
-						
-						
- 21 ft						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						
- 30 ft						

LOG OF BORING T-20-003

PROJECT NO: 19-514.1	BEGIN DATE: 6/10/20	DRILLING CONTRACTOR: Jerry Beaty
PROJECT: Fort Bragg Raw Water Line	COMPLETION DATE: 6/10/20	DRILLING METHOD: Test Pit
LOCATION: Fort Bragg, CA	SURFACE ELEVATION: (ft)	DRILL RIG: Backhoe
COUNTY: Mendocino	SURFACE CONDITION: Soil	HAMMER TYPE: N/A
CLIENT: Coleman Engineering	WATER DEPTH: Not Encountered(ft.)	SAMPLER TYPE & SIZE: BULK
LOGGED BY: MCC/BJU	READING TAKEN: 6/10/20	BOREHOLE DIAMETER: N/A
DEPTH OF BORING: 6(ft)	HAMMER EFFICIENCY: N/A(%)	BACKFILL METHOD: Native soil

FIELD											LABORATORY							
ELEVATION (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 IN.	BLOWS PER FOOT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	RECOVERY(%)	RQD (%)	PLASTIC LIMIT	LIQUID LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	DRILL METHOD	CASING DEPTH	REMARKS
	0	Bulk	1				SC	CLAYEY SAND (SC); brown; dark brown; moist; mostly coarse to fine SAND; some low plasticity, low toughness fines; trace rootlets.	100									
	2	Bulk	3				SC		100									
	3	Bulk	4				SC		100						43			
	4	Bulk	5				CL	SANDY lean CLAY (CL); brown; dark brown; moist; some coarse to fine SAND; mostly low to medium plasticity, low to medium toughness fines.	100									
	5	Bulk	6				CL	Little coarse to fine SAND.	100									
	6							Bottom of borehole at 6.0 ft bgs										

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

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PROJECT NUMBER: 19-514.1
PROJECT: Fort Bragg Raw Water Line
TEST PIT: T-20-003
ENTRY BY: MCC
CHECKED BY: KKL SHEET 1 of 1