"M"

Fault Studies

Containing the Following:

- Ryan Geological Consulting Inc., February 7, 2015, Fault Investigation Report Anthem Winery and Vineyards.
- Ryan Geological Consulting Inc., June 30, 2018, Supplemental Fault Investigation Report Anthem Winery and Vineyards.

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS
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SUPPLEMENTAL FAULT INVESTIGATION REPORT
ANTHEM WINERY AND VINEYARDS, LLC
3454 REDWOOD ROAD
NAPA, CALIFORNIA

June 30, 2018
Job No. 1354.100

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RYAN GEO*LOGICAL* CONSULTING, INC.
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June 30, 2018
Job No. 1354.100

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California 94558

Attention: Mrs. Julie Arbuckle

Subject: Supplemental Fault Investigation Report
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

Dear Mrs. Arbuckle:

1.0 INTRODUCTION

This report presents the results of our supplemental fault investigation at the Anthem Winery and Vineyards, LLC property located at 3454 Redwood Road in Napa, California. The approximate location of the site is shown on the attached Vicinity Map, Figure 1. The site is located within the new State of California designated Alquist-Priolo Earthquake Zones of Required investigation for the West Napa fault as shown on Figure 2.

We were provided plans prepared by Becken, Gillam, Kroger Architects, dated August 30, 2017 that show the proposed improvements. Based on the plans, we understand that, two fermentation buildings, a bottling room, hospitality and office buildings are planned in the northern portion of the site. The proposed site improvements are shown on the Site Plan, Figure 3.

We previously conducted a fault investigation that was focused on evaluating surface fault rupture based on ground cracks that formed at the site during the M6.0 2014 South Napa earthquake and summarized the results in a report dated February 7, 2015. At that time, the State of California had not designated an Alquist-Priolo Earthquake Fault Zone for the area. This supplemental investigation expands coverage of our previous study based on the new State of California designated Alquist-Priolo Earthquake Fault Zone for the West Napa fault that was released by the on January 11, 2018. Pertinent information from our previous study is repeated herein.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation was to expand coverage of our previous study to evaluate the potential for surface fault rupture and how it could impact the proposed site improvements and to satisfy the requirements of the new 2018 Alquist-Priolo (A-P) maps. Our scope of services for this project included the following tasks:

1. Review of existing information in our files regarding the locations of ground cracks at the site that were associated with the 2014 South Napa Earthquake.
2. Geologic research on the West Napa fault and geologic conditions near the site.
3. Review and interpretation of stereo-paired aerial photographs covering the site and vicinity.
4. Excavation and logging of 2 exploratory trenches (T-5 and T-6).
5. Coordinating geophysical studies to supplement our trenching program.
6. Evaluation of the information collected as part of this project.
7. Preparation of this report summarizing the findings of our investigation.

3.0 NEW ALQUIST-PRIOLO EARTHQUAKE FAULT ZONE DESIGNATION

According to the State of California, a fault is defined as "*a shear or zone of closely spaced shears across which earth materials on one side have been displaced with respect to those on the other side because of tectonic forces*." Where a fault ruptures to the ground surface, the line created by their intersection is referred to as surface fault rupture (SFR). The goal of the A-P Act is to mitigate the hazard of SFR by preventing construction of structures intended for human occupancy across the surface trace of an active fault.

To be zoned under the AP Act, a fault must be "*sufficiently active*" during Holocene time (within the past roughly 11,700 years) and "sufficiently *well-defined*" near the ground surface. Prior to the 2014 South Napa Earthquake, the West Napa fault was not sufficiently well-defined and evidence of Holocene activity had not been demonstrated north of the Napa Airport; therefore an AP zone was not delineated (State of California, FER-129). The 2014 South Napa Earthquake provided information regarding the location and activity of the northern portion West Napa fault (FER-256) and as a result, the new 2018 A-P maps were released.

The new 2018 Alquist-Priolo Earthquake Fault Zone designations include splays of the West Napa fault that pass along the west side of Napa Valley. While the southern portions of the fault appear to be well defined and accurately located, however the north end of the fault is inferred and uncertain. The northernmost fault splays are shown bounding the ridgeline between Redwood Road to the west and Dry Creek Road to the east. The Anthem Vineyards and Winery site is located at the north end of the western A-P zone as shown on Figure 2.

At the site, the A-P zone bounds fault splays that are shown as a "*short dash in black and a solid line in orange*" which is labeled on the A-P map as an inferred fault that has not been confirmed and is not well located. The map shows 2 possible splays of the West Napa fault at the site, both of which have branched off the active trace identified to the south. The western inferred splay crosses through the northeastern corner of the site in the vicinity of the proposed winery buildings and stops about ¼ mile north of the site. The western inferred fault splay mapped at the site enters the property near the southeastern corner near the lawn area. This suspected fault splits and stops in the center of the property. Both inferred fault splays cross oblique to the ridgeline.

4.0 WEST NAPA FAULT ZONE

In general, the West Napa fault zone is a roughly 56-kilometer long, right-lateral, strike-slip fault zone that extends from the Carquinez Straits at the south end to just west of Town of St. Helena at the north end. The fault zone includes several short segments of branch faults and subparallel fault splays that bound the western margin of a deep Tertiary to Quaternary aged basin now known as Napa Valley (Wesling and Hanson, 2008). Displacement along the fault zone is right-lateral strike slip with a significant down to the east vertical component. The surface expression of the fault includes offset drainage courses, east-facing scarps, linear drainages and apparent geomorphic lineaments such as saddles and linear breaks in slope.

The southern portion of the West Napa fault, South of the Napa Airport, is well-defined as it cuts through alluvial deposits at the ground surface. To the north, the fault deformation is distributed into several smaller discontinuous branch fault splays where it encounters the relatively hard volcanic and sedimentary bedrock underlying the hills along the west side of Napa Valley. The main trace of the West Napa fault is believed to run along the base of the hills on the west side of the Napa Valley with smaller secondary fault splays are interpreted further to the west in the hills and along the west side of Congress Valley and along Redwood Road and into the Maacamas Mountains. The West Napa fault has a relatively low slip rate on the order of about 1 to 4 millimeters per year.

The fault zone defined in the Quaternary Fault and Fold Database[1] maintained by the U.S. Geological Survey is shown on Figure 3 for reference. The database shows a fault along the flank of the ridgeline on the east side of Redwood Creek, generally passing through the western portion of the site. The fault is designated as Quaternary, less than 1.6 million years; however the database has not been updated to reflect the 2014 earthquake activity. The database also shows a Late Quaternary fault, less than 1.3 million years, at the base of the hills along the west side of Napa Valley near Alston Park, this splay is also an active fault based on recent information. The locations of faults in the database are shown on Figure 4.

5.0 FIELD INVESTIGATION

To investigate the potential for SFR at the site, we excavated and logged a total of 6 trenches during our 2 phases of field investigation. Our field investigations at the site included geologic mapping of surface features following the 2014 South Napa earthquake, excavation and logging of 6 exploratory trenches. Trenches T-1 through T-4 were excavated as part of our 2014 study and T-5 and T-6 were excavated as part of this supplemental investigation. Where trench excavations were limited due to site improvements, our investigation was supplemented the trenches with geophysical surveys.

[1] The Quaternary Fault and Fold Database located at http://earthquake.usgs.gov/hazards/qfaults/ provides information and interactive maps of faults believed to have been active during the Quaternary Period of geologic time, within the past 1.6 million years.

5.1 EXPLORATORY TRENCHING

Exploratory trenching is considered the most conclusive of all investigative techniques commonly used to evaluate the potential for surface fault rupture. We investigated the potential for surface fault rupture at the locations of the proposed buildings, the location of the UAVSAR lineament and the locations of the inferred faults shown on the 2018 A-P map. Our 2014 fault investigation included the excavation and logging of 4 exploratory trenches, designated as T-1 through T-4, totaling about 280 lineal feet between November 4 and 6, 2014. These trenches were positioned to cross surface cracks from the 2014 South Napa earthquake and the UAVSAR lineament mapped by the U.S. Geological Survey. This supplemental investigation included excavation and logging of 2 additional trenches designated, as T-5 and T-6 respectively, totaling 305 lineal feet. Trench T-5 was excavated and logged between April 7 and 8, 2018 and T-6 was excavated and logged on May 7, 2018.

Exploratory trenches were excavated up to about 8 feet deep by Binstock Engineering out of Napa, California using a rubber-tired backhoe. Both trench walls were cleaned by our geologists using hand-held picking tools so that geologic structures and any potential fault-related features could be identified. The south wall of each trench exposure was graphically logged by our engineering geologist in the field at a scale of 1 inch equals 5 feet. Soil and bedrock colors noted on the logs were best fit to the Munsel Soil Color Chart and the Rock Color Chart published by the Geological Society of America (GSA). Trenches were loosely backfilled at the completion of logging. Some settlement and rutting should be expected. The approximate locations of the trenches are shown on the Site Plan, Figure 3, Trench Logs from both investigations are provided in the Appendix.

5.2 GEOPHYSICAL STUDIES

Where exploratory trenching was not practical due to site improvements and physical constraints, we supplemented our subsurface exploration with geophysical surveys. The geophysical surveys were conducted on April 12, 2018 by Advanced Geological Services (AGS) out of Moraga, California. The geophysical survey included 4 seismic refraction lines designated as S-1 through S-4 at the approximate locations shown on the Site Plan, Figure 3. Seismic lines were positioned to cross the inferred faults shown on the 2018 A-P map and to close gaps where trenches could not be excavated. The results of the geophysical survey are summarized in the April 17, 2015 AGS report in Appendix B.

6.0 FINDINGS

6.1 SITE DESCRIPTION

The site is located at 3454 Redwood Road in Napa, California at the approximate location shown on the Vicinity Map. The property is considered a ridgetop hillside property with a peak elevation of about 450 feet Mean Sea Level. The ridge top is less than about 300 feet wide with sides slopes that trend down at relatively steep gradients. The majority of the site is covered with vineyards, except the northern portion which is covered with seasonal grasses and brush and scattered oak trees.

Existing site improvements include a residential dwelling is located in the center of the property and vineyard structures. Underground wine caves are located in the northern portion of the site. A driveway/access road enters the west side of the site from Redwood Road and traverses up to the residence and cave entrance. Two water tanks are located in the northern portion of the property, one at the north end of the vineyard and another in the dense brush to the north in the northern portion of the property.

6.2 REGIONAL GEOLOGY, FAULTING AND SEISMICITY

6.2.1 Geologic Conditions

The site is located in the Coast Ranges geomorphic province[2] of California. The Coast Ranges are characterized by a series of northwest trending folded and faulted mountain chains and intervening valleys. Folding and faulting of the region is generally the result of relative motions between the Pacific and North American tectonic plates. The boundary between these two plates is generally considered to be the San Andreas fault, although in the Bay Area, plate boundary deformation is distributed across a broad network of subparallel faults and fault zones. The majority of deformation is believed to have occurred during the past few million years.

In this portion of the province, the site is located along a northwest trending ridgeline bordering the west side of Napa Valley. Regional geologic maps covering the site by the California Geological Survey[3] (Wagner and Gutierrez, 2010; Clahan *et al*, 2004) and by the USGS (Fox *et al*, 1973; Helley and Herd, 1977) show the site to be underlain by sedimentary bedrock units of the Great Valley Sequence. The Great Valley Sequence is a series of sediments that accumulated in a shallow sea during the Early Cretaceous to Late Jurassic Periods of geologic time, roughly 65 to 150 million years before present. The bedrock in this formation consists of brown to gray beds of sandstone siltstone and claystone with pebble-rich conglomerate beds throughout. The bedrock units are generally moderately to highly weathered, weak to strong and highly fractured. The thickness of individual beds ranges from millimeters in the siltstone and claystone beds to several feet in the sandstone beds.

The above-mentioned geologic maps show a thin band of Domengine Sandstone along the drainage for Redwood Creek, although they each have the contact in slightly different locations. The Domengine Sandstone consists of thick beds of moderately strong to strong sandstone, siltstone and claystone that were deposited During the Eocene epoch of geologic time, roughly 33.9 to 56 million years before present. The contact between the Great Valley Sequence rocks and the Domengine Sandstone is shown as a fault contact on all the above-mentioned geologic maps. The contact is generally shown on the regional maps passing through the center to western portion of the site. Portions of the geologic map prepared by the

[2] The State of California is divided into 12 geomorphic provinces based on landform, geologic processes and geomorphic conditions.
[3] The California Geological Survey (CGS) was formerly known as the California Division of Mines and Geology (CDMG).

State of California (Clahan *et al*, 2004) and by the U.S. Geological Survey (Sims *et al*, 1973) are provided on Figures 5 and 6 respectively.

6.2.2 Faulting

According to the State of California, an active fault is defined as a fault that has demonstrated activity within the Holocene Epoch of geologic time, within the past roughly 11,700 years. Similarly, potentially active faults are those that have demonstrated activity with the Pleistocene Epoch of geologic time, roughly 11,700 to 1.5 million years before present. The A-P Act indicates that faults are to be zoned for special studies where the fault is "sufficiently active" and "sufficiently well-defined". As previously mentioned, the site is located within the State of California designated Earthquake Fault Zone for the West Napa fault.

The closest known active fault is the West Napa fault zone as discussed in this report. Other known active faults in the region that impact the seismicity of the site include, but are not limited to, those listed in the Table 1 below. A map of faults in the San Francisco Bay Area is provided on Figure 7.

TABLE 1. Potential Active Earthquake Fault Sources

Fault Source[4]	Approximate Distance Site To Fault Trace (Mi)[5]	Compass Direction To Fault	Slip Rate (Millimeters Per Year)[6]	Maximum E.Q. Mag. (Mm)[7]
West Napa Fault – Northern	In A-P zone		1 to 4 ± 1	6.5
West Napa fault - Napa Airport	8¼	N	1 ± 1	6.5
Green Valley fault	8½	NE	5 ± 3	6.2
Rodgers Creek	10½	NW	9 ± 2	7.0
Hayward fault - Northern	20½	SW	9 ± 2	7.1
Concord fault	15	SW	4 ± 2	6.2
San Andreas fault – 1906 Rupture	32	SW	24 ± 3	7.9
Greenville fault – Clayton section	34	SE	2 ± 1	6.5
Calaveras fault - Northern	38	SE	6 ± 2	6.8

Given the relatively high seismicity in the region, the site is expected to experience at least one moderate to large magnitude earthquake in the future. The Working Group on Earthquake Probabilities (2008) estimates there is a roughly 65% chance that the San Francisco Bay Area will experience a magnitude 6.7 (or greater) earthquake within in the next 30 years. Interactive probabilistic seismic analysis tools available at the California Geological Survey (CGS) website suggest peak ground accelerations (pga) with a 10% chance of being exceeded in the next 50 years of 0.451g should be expected at the site. Strong

[4] 2008 Fault sources included in the 2014 Fault Parameters provided by the U.S. Geological Survey's Earthquake Hazards Program on-line web tools.
[5] Fault locations and distances to the site were determined from the KML files provided from the Quaternary Fault and fold Database and were measure from the center of the proposed resort site.
[6] Slip rates obtained from Cao *et a*l. (2002).
[7] Maximum earthquake magnitude (Mm) calculated by Peterson *et al*. (1998).

ground shaking from a major earthquake is a hazard that cannot be eliminated but the effects can be reduced by observation of sound construction practices and observance of current seismic design codes.

6.3 HISTORIC SIESMICITY

All sites in the San Francisco Bay Area have been subjected to moderate to large earthquakes over time. Significant earthquakes near the site are discussed below. Of all events, the 2014 South Napa Earthquake provided the most useful information regarding potential SFR at the site. Other nearby events in the site vicinity include the 2017 M3.6 earthquake near Calistoga and the 2000 M5.0 Mt. Veeder earthquake.

6.3.1 August 31, 2017 M3.6 Calistoga Earthquake

On August 31, 2017 a M3.6 earthquake occurred about 7 miles west of the Town of Calistoga, California. The earthquake epicenter is located about 20 miles northwest of the Anthem Winery and Vineyards property. The small earthquake event caused no reported damage or impacts at the site.

6.3.2 August 24, 2014 M6.0 South Napa Earthquake

On August 24, 2014, an earthquake measuring M6.0 occurred along the West Napa Fault Zone. The event, known as the “South Napa Earthquake”, provided basis for the new A-P maps. Several sets of ground cracks were observed along the ridgelines between Dry Creek Road and Redwood Road. Some of the ground cracks were noted at the site as shown on the Site Plan, Figure 3.

The special report by the Earthquake Engineering Research Institute (EERI) provides a map of “observed and inferred” surface fault rupture from the August 24, 2014 South Napa earthquake. The map shows a “Western Strand” that extends from Cuttings Warf in the south to just north of Redwood Road near the intersection with Dry Creek Road. An “Eastern Strand” is shown extending from just south of Old Sonoma Road, through Browns Valley and along the west side of Alston Park. The report also shows shorter strands in Browns Valley and near the Napa Airport.

Earthquake epicenters for the main event and associated aftershocks were located on the “Western Strand” defined in the EERI report. There were no epicenters plotted on the “Eastern Strand”. North of Alston Park, the eastern strand continues with the designation “*probable tectonic rupture from UAVSAR[8] lineament, unverified by field teams”.* The inferred northern end of the eastern strand projects through the hills near the eastern site boundary. The approximate location of the unverified UAVSAR lineament projected through the property is also shown on the Site Plan, Figure 3.

6.3.3 September 3, 2000 M5.0 Mt Veeder Earthquake

On September 3, 2000 a M5.0 earthquake occurred on Mt. Veeder near the community of Lakoya, California. The earthquake occurred on an unnamed fault splay about 3½ miles to the northwest of the

[8] UAVSAR (uninhibited aerial vehicle synthetic aperture radar) detects small changes, up to about ½ inch, in the ground surface based on repeated flight lines over the same location.

site. Shaking in the Napa area was moderate and damage was generally limited to items falling from shelves and failure of unreinforced chimneys. There were no reported damage or impacts at the site.

6.4 AERIAL PHOTOGRAPH INTERPRETATION

We reviewed 10 sets of stereo-paired aerial photographs covering the site vicinity between the years 1958 and 2005. Aerial photographs were obtained from the archive library at Photo Science Geospatial Solutions (formerly Pacific Aerial Surveys) in Novato, California. Aerial photographs were viewed by our engineering geologist using an Old Delft ODSII scanning stereo-scope. Since this was a study of the regional-scale evaluation of the fault conditions impacting the site, photographs were at a scale adequate to review the regional conditions.

From a regional standpoint, there appears to be a strong structural grain causing both Partricks Creek and Redwood Creek to made relatively sharp eastward bends before the join to form Napa Creek. Redwood Creek makes another sharp southeastward bend near the intersection of Redwood Road and Dry Creek Road. We annotated the locations of these creeks on Figure 3. The Quaternary faults which are also [approximately] shown, appear to correlate well with these major changes in flow direction of the drainage systems. The changes in orientation of these creeks suggest that there are multiple faults in the region, at least two of which possibly bind the east and west sides of the ridgeline underlying the site.

In general, we interpreted three photo-lineaments[9] in the aerial photographs that are near the site; however, no one set of photographs were conclusive as the lineaments are vague except for the Alston Park lineament. The photo-lineaments were mapped based on geomorphology and some apparent offset of stream channels as discussed below. It should be noted that mapping lineaments on aerial photographs does not necessarily mean the lineaments are indicative of fault lines, subsurface trenching is needed to confirm the presence of a fault. The approximate locations of the photo-lineaments are shown on Figure 7 for reference. We used a copy of the 1984 photograph as the base for Figure 8 since it was the best reproducible image, not because it depicted conditions better than other photographs.

The western most of the photo-lineaments is along or just upslope of Redwood Creek, near the western site boundary. Redwood Creek is atypically linear along the base of the hills suggesting a structural control for the current creek alignment. Additionally, the hillside along the west flank of the ridge becomes very steep and linear near the tree line above the creek channel. It should also be noted that the geologic map on Figure 5 shows fault contacts bounding the Domengine Sandstone along the west flank of the ridge below the site. This photo-lineament may represent the bedrock fault contact between the two geologic units designated as Quaternary in the Fault and Fold database. Additionally, there are very weak indications of possible photo-lineaments upslope of the tree line which would be well within the site boundaries but not within the area of the proposed buildings.

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[9] A photo-lineament is a line of features interpreted on stereo-paired aerial photographs. Photo-lineaments related to faulting include linear valleys, aligned saddles or spur ridges, and sometimes sharp changes in vegetation. Not all photo-lineaments are reflective of faulting. Photo-lineaments also occur parallel to geologic structures due to differential erosion of individual beds.

There is another photo-lineament interpreted just below the east side of the ridgeline, east of the property boundary. This photo-lineament was based on the steep escarpment below the ridge and alignment of saddles. This photo-lineament does not correlate with any mapped fault shown on the regional maps. However, we understand that this photo-lineament my correlate with the UAVSAR lineament inferred near the site by the U.S. Geological Survey. We understand that preliminary interpretations of the UAVSAR lineament are that is bends westward through the site, however; our interpretation of the eastern photo-lineament would trend past the site to the east and connect with the sharp erosion feature to the northeast of the site. The approximate location of the UAVSAR lineament and our photo-lineaments are shown on Figure 8 for reference.

South of the site, the Alston Park escarpment is bold on the photographs and appears to be a fault feature. However the location does not impact development of the site.

6.5 SUBSURFACE CONDITIONS

The site is underlain by thinly bedded sedimentary units of the Great Valley Sequence at relatively shallow depths below a thin veneer of soil mantle. We encountered claystone and siltstone with thin beds of sandstone during the course of our 2 site investigations. The bedrock is generally tan-brown to gray, highly weathered, friable to weak moderately fractured and thinly bedded. We measured bedrock structure at several locations to strike between about N10W and N55W with dips between 25 and 85 degrees. At all locations bedrock structure was found continuous without indications of shearing offset or other indications of faulting.

Groundwater was not encountered in our trenches due to the shallow depth and location on the ridgeline.

6.6 TRENCH DESCRIPTIONS

In total, we excavated and logged 6 exploratory trenches over the course of our 2 investigations. Trenches T-1 through T-4 were excavated and logged in our initial investigation and are summarized in our 2015 report. Trenches T-5 and T-6 were excavated as part of this supplemental investigation. The approximate locations of the exploratory trenches excavated for this project are shown on the Site Plan, Figure 3. General descriptions of the subsurface conditions encountered in all 6 of our exploratory trenches are provided below. For clarity, we included discussions of our previous trenches (T-1 through T-4) along with descriptions of conditions at that time. Ground cracks discussed under the 2014 trenches are no longer visible at the site. For detailed descriptions of the materials and structures, refer to the individual Trench Logs in Appendix A.

6.6.1 Trench T-1 (2014 study)

Trench T-1 was located in the northern portion of the site. The trench was about 240-feet-long and up to about 8-feet-deep. The trench was positioned to cross the projection of surface cracks that trend towards the proposed fermentation buildings and to shadow the buildings. The UAVSAR lineament projects through the center of the trench as shown on the Figure 3. The eastern inferred fault shown on the 2018 A-P map crosses the west end of the trench.

Minor surface cracks were noted on the north side of the water tank prior to trenching but were not detected in the trench walls during logging. We did encounter trench backfill for a waterline at station 1+90 that connects the two water tanks. The water line trench backfill coincides with the location of the crack between the water tanks that was noted prior to trenching. Below a typical soil cover of about 18- to 24-inches thick, continuously structured sedimentary bedrock units of the Great Valley Sequence were exposed for the entire length of the trench. The bedrock units were found thinly bedded oriented[10] between N20W and N30W dipping to the southwest at inclinations between 23 and 37 degrees. Indications of faulting were not observed in the bedrock. Flexural slip and tight internal folding was observed at Station 0+95.

6.6.2 Trench T-1 (2014 study)

Trench T-2 was located across the major set of ground cracks located along the ridgeline. This set of ground cracks trend from the driveway, through the shed and water tank, and towards the western fermentation building. The trench was positioned on the south side of the shed and was excavated about 15-feet-long and 5-feet-deep. At that location, the trench crossed a set of surface cracks that were dilated up to 2-inches wide. The dilation of the cracks appeared to be somewhat exacerbated by the presence of 18-inches of artificial fill at the ground surface. All surface cracks diminished at the base of the blocky residual soils overlying claystone bedrock. Below the cracks, the claystone was near vertically bedded with a strike of N40W. Indications of faulting were not encountered.

6.6.3 Trench T-3 (2014 study)

Trench T-3 was located in the southern portion of the property where the major set of cracks along the ridgeline enters the property. Surface cracks between ½ and ¾ inch wide were observed extending down to near the base of the residual soils but not into the underlying steeply dipping claystone bedrock, similar to the conditions in Trench T-2. Bedrock structure was oriented striking N20W dipping 65 degrees to the north. Indications of faulting were not observed.

6.6.4 Trench T-4 (2014 study)

Trench T-4 was located along the eastern property boundary across a surface crack that may correlate with the UAVSAR lineament. At that location the surface crack was about ½ inch wide and extended to a depth of about 1½ to 2 feet at most. The underlying claystone bedrock was found oriented striking N30W dipping 70 degrees southwest. Indications of faulting were not encountered.

6.6.5 Trench T-5

Trench T-5 was excavated in the northern portion of the property to extend coverage of T-1 based on the location of the eastern inferred fault shown on the 2018 A-P map. We observed indications of our previous trench T-1 based on a small rut (settled trench backfill) in the field. The trench was about 175-

[10] The orientation of geologic structures such as bedding planes, fractures and faults are commonly measured based on the intersection between feature and the horizontal plane referred to as the "strike line" and the "dip" which refers to the maximum steepest angle down perpendicular from the strike line.

feet-long and up to about 6-feet-deep. The east end of T-5 was positioned to overlap with the west end of T-1. The findings of T-5 were generally an extension of the continuously structured bedrock encountered in T-1. Bedrock structure was oriented between about N20W and N40W with variable dips between about 25 and 61 degrees to the southwest. Ground cracks mapped in 2014 would cross the trench however they were not visible at the time of this investigation. Indications of faulting were not encountered.

6.6.6 Trench T-6

Trench T-6 was excavated in the southern portion of the property near the lawn area. The trench was about 130-feet-long and up to about 6-feet-deep. The trench was positioned to cross the western inferred fault shown on the 2018 A-P map. Additionally, ground cracks mapped in 2014 would cross the trench however they were not visible at the time of this investigation. Bedrock structure was oriented between about N10W and N55W with variable dips between about 50 and 70 degrees to the northeast. Subtle folding was observed. Indications of faulting were not encountered.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 GENERAL

Based on the results of our fault investigation, we did not encounter evidence for an active fault crossing through the planned winery improvements. Therefore, the geologic hazard of surface fault rupture (SFR) at the proposed buildings is considered low. The currently proposed winery improvements are considered feasible from a geologic hazard perspective.

Earthquake events start at depth along a fault and slip propagates up and out along the fault plane. Surface fault rupture occurs when a movement along the fault intersects the ground surface creating vertical and lateral offsets. Based on the findings of our 6 exploratory trenches, an active fault does not breach the ground surface within the area of our investigation.

Ground cracks observed following the 2014 South Napa Earthquake are not the result of SFR as they are not the result of a fault propagating up from below and breaching the ground surface. The ground cracks from 2014 are less than 3-feet-deep lateral separations in unconsolidated surface soils on a sharp narrow ridge and do not extend down into the underlying bedrock and therefore are not classified as SFR.

7.2 FAULTS INFERRED AT ANTHEM WINERY SITE

As previously mentioned, the new 2018 A-P map infers 2 fault splays at the site as shown on Figure 3. Additionally, the State map queries these splays, adding additional uncertainty with respect to their presence and location. We could not identify evidence of the presence of these faults during the course of our 2 site investigations or during the geophysical surveys used to supplement our exploratory trenches. We explored every indication of potential faulting at the site including the ground cracks mapped in 2014, the UAVSAR lineaments mapped by the U.S. Geological Survey in 2014, and the inferred faults shown on the 2018 A-P map. In all cases, evidence for an active fault rupturing the ground surface was not present.

The splay of the West Napa fault mapped passing through the site is inferred by the State of California. Based on information from the 2014 South Napa Earthquake the same fault splay was mapped as a well-defined and well-located trace with a consistent trend for over 2 miles extending from roughly Browns Valley Road at the south end to Alston Park at the north end. About ¾ miles south of the site, the fault looses definition and is projected and inferred to the north end of the A-P zone. Where the fault was projected and inferred, it is shown deviating from the consistent trend and turning farther to the west and splitting into separate splays as it crosses the ridgeline through the Anthem Winery site. It is unclear how this alignment was inferred based on the pattern of ground cracks and the alignment of the UAVSAR lineament. The following inconsistencies in the data exist:

- The UAVSAR lineament is not aligned with the pattern of ground cracks in 2014.
- Both of the inferred fault splays on the 2014 A-P map cross the single UAVSAR lineament.
- The inferred faults on the 2018 A-P map are oblique to the pattern of ground cracks in 2014.
- There are no geomorphic indications of faults crossing the ridgeline.
- Recent studies in American Canyon suggest the UAVSAR lineament as plotted by the U.S. Geological Survey may be off by as much as 100 feet from the location of the actual fault trace.

Regardless of how the State mapped the fault, the A-P maps are guidelines to ensure proper investigation within the State of California designated zone of required investigation. We performed the site-specific investigation to evaluate the potential for SFR at the planned development as required. The results of our investigation do not support the presence of the inferred faults as shown on the 2018 A-P map.

Regional geologic maps suggest a fault along the base of the hillside above Redwood Creek near the western photo-lineament discussed above in Section 5.4. This fault may cross through the western portion of the property, beyond the area of our investigation. Additional evidence suggesting a potential fault in the western portion of the property is the geologic structure shown on regional maps. Regional geologic maps show the contact between the Domengine Sandstone and Great Valley Sequence bedrock units as a fault. The Sims *et al* (1973) geologic map shows bedding within the Domengine Sandstone as steeply dipping to the northeast. Our trenches encountered bedding in the Great Valley Sequence dipping relatively steep to the northeast and southwest indicating folding. We did not encounter the faulted contact between the 2 geologic units in our trenches. Therefore, there appears to be a major structural unconformity between the Domengine and Great Valley Sequence west of the area of our investigation.

7.3 RECOMMENDED BUILDING SETBACKS

Buildings intended for human occupancy with an occupancy rate greater than 2,000-man hours per year are required to be set back from active faults to mitigate the potential for SFR impacting the building foundation. Typical building setbacks range from about 25 to 50 feet depending on the character of the individual fault splay identified during site investigations. While we did not encounter evidence of a fault rupturing the ground surface during the course of our 2 investigations, indirect evidence suggests that may be a fault nearby on the flanks of the ridge, but not within the area covered by out investigation. We considered recommending setbacks from the ground cracks noted in 2014; however, our study indicates these are not the result of SFR and in our opinion, they may form again at other location at the site during a moderate earthquake. Therefore, moving the buildings from their currently planned locations might not mitigate the geologic hazard of ground cracks forming in the soil. Our preferred mitigation for this geologic hazard is ground improvement as discussed below in Section 6.4.

At the proposed winery site, we recommend observing a 25-foot setback from the east end of T-1 and the west end of T-5. In our opinion, the 25-foot end-of-trench setbacks are adequate since the some trenches were generally located at the building sites. The current building layout is outside these recommended setbacks.

7.4 GROUND IMPROVEMENT AT BUILDING PADS

There has been a significant amount of ground cracking that developed along the ridgeline upon which the property is located during the 2014 South Napa Earthquake. Trench evidence indicates the ground cracks do not indicate potential SFR, rather they demonstrate the potential for minor separations and dilations of the loose unconsolidated soils mantling the sharp narrow ridgeline during a moderate to large earthquake. Major dilations during a large earthquake could damage foundations that cross the ground cracks. As discussed in our 2015 report, the occurrences of ground cracks appear to correlate with steep bedding in the thinly bedded sedimentary rocks.

Typically, the preferred mitigation to earthquake-induced ground deformation is avoidance, or creating setbacks from the feature in question. Creating setbacks for ground cracks in soil based on steep bedding does not appear appropriate for the site and in our professional opinion, does not reduce the hazard of the cracks forming during future earthquakes. Additionally, based on the sharp narrow geomorphic conditions underlying the site, energy release from a major earthquake could cause formation of similar cracks anywhere if the property and in our opinion, they may not necessarily form where they were previously observed in 2014.

To mitigate the potential for ground cracks in the soil from opening beneath the building foundation during an earthquake, we recommend geotechnical ground improvements to isolate the building foundation from the zone of potential ground cracks. On a preliminary basis, we recommend over-excavating building pads a minimum of 5 feet deep and restoring the excavation with compacted engineered fill reinforced with geogrid. The recommended 5-foot depth penetrates through the unconsolidated soil mantle and into relatively competent bedrock. The over-excavation should extend a minimum of 5-feet beyond the building footprint.

Geogrid should biaxial in tensile strength and cover the entire excavation. Three layers of geogrid are recommended spaced 12-inches vertically with the lowest layer at the base of the excavation. Fill placed in the excavation should be engineered to a minimum of 3 percent over optimum moisture content and a minimum of 90% relative compaction. The upper 12-inches of the excavations should be restored with ½ to 3/4 –inch diameter rounded gravel covered with 2 layers of 15-mil smooth plastic and 2-inches of clean sand. This design is intended to buffer the building foundation from dilations along bedding below. These requirements should be verified by the future geotechnical investigations for site development. Conceptual ground improvements at the building pads are shown on Figure 9.

8.0 OBSERVATIONS DURING CONSTRUCTION

Since existing information suggests a fault nearby the site, we recommend all site excavations be evaluated by an engineering geologist form our firm during site development. Specifically, we recommend our geologist observe all building pad over-excavations to check for indications of unidentified fault slays or any other adverse geologic conditions that may impact safe development of the site. If unidentified faults are encountered during building pad over-excavation, setback may be required at that time.

9.0 LIMITATIONS

The results of this investigation report are based upon the information provided to us regarding site improvements, the findings of our exploratory trenching, geophysical surveys, literature review, experience with similar projects and professional judgment. This project has been conducted in accordance with currently accepted engineering geologic standards only; no other warranty is expressed or implied. The site conditions and locations of features discussed in the text of the report are those that existed at the time of our investigations noted above and during our last field visit in May 2018 and are not necessarily representative of other features, locations or times. If the subsurface conditions encountered during any excavation or construction activities vary from those interpreted in this report, our firm should be contacted to review the conditions for any changes in our recommendations. The review would be acknowledged in writing.

Respectfully submitted,
RYAN GEO*LOGICAL* CONSULTING, INC.

Respectfully submitted,

PROFESSIONAL GEOLOGIST
KEVIN JAMES RYAN
NO. 2404
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Kevin James Ryan, P.G., C.E.G.
Principal Engineering Geologist

Copies: (1 pdf via email, 3 via standard mail)

RGC/Anthem Winery fault supplemental investigation report 6.30.18.doc

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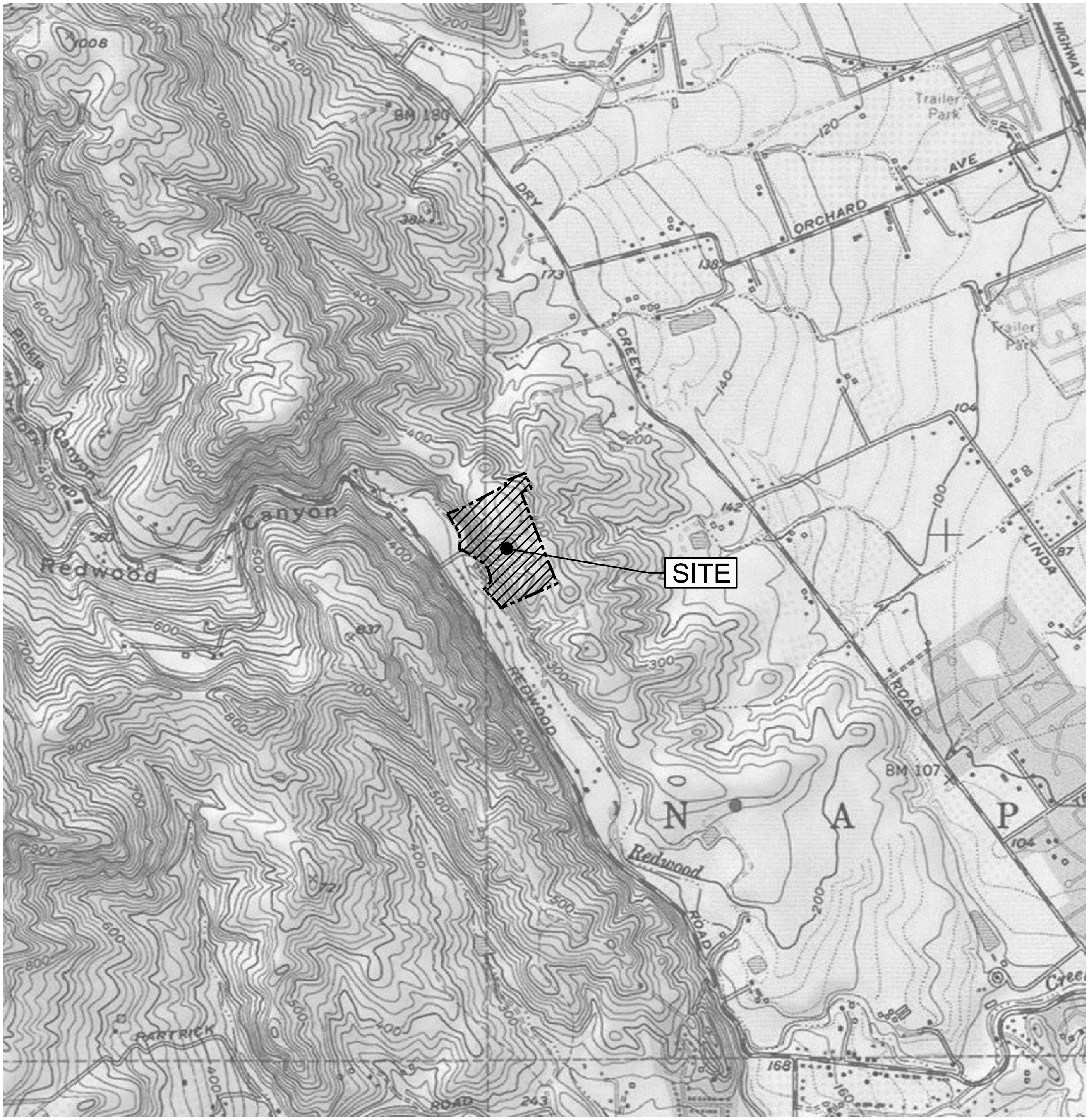
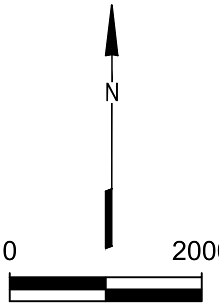
Wagner, D.L. and Guiterrez, C.I., 2010, Preliminary geologic map of the Napa 30' x 60' quadrangle, California: California Geological Survey.

AERIAL PHOTOGRAPHS

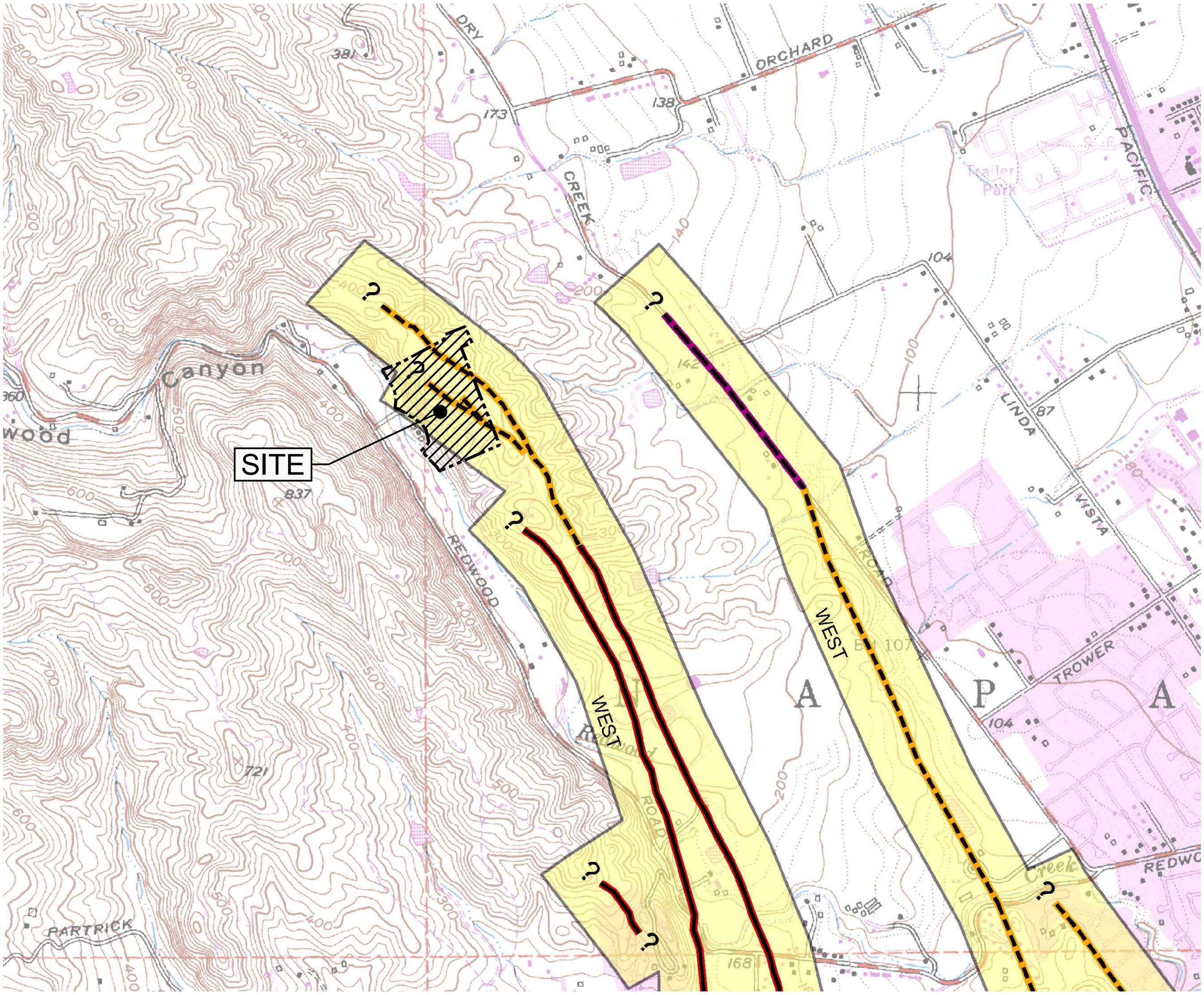
FILM ID	FLIGHT LINE	FRAMES	NOMINAL SCALE	DATE FLOWN
KAV 8930	12	24,24	1:15,000	2-3-05
NAP CIR 6017	206	15,16	1:12,000	9-4-98
CIR5235	5	43,44	1:12,000	9-5-96
CIR4262	5	3,4	1:12,000	5-5-92
AV 3306	30	44,45,46	1:9,600	7-8-88
AV 2475	1	4,5	1:12,000	5-17-84
AV 1215	07	8,9	1:54,000	9-4-75
AV 965	06	10,11	1:48,000	9-8-70
AV 710	07	8,9,10	1:36,000	4-20-66
AV 550	6	3,4	1:36,000	7-9-63



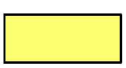


BASE: PORTIONS OF U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, NAPA, CALIFORNIA AT A SCALE OF 1:24,000.

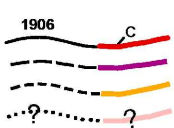
VICINITY MAP		
Anthem Winery and Vineyards, LLC 3454 Redwood Road Napa, California		
DATE: 6-30-18	Project No. 1354.100	Figure 1
RYAN GEO*LOGICAL* CONSULTING, INC. ***PROVIDING LOGICAL GEOLOGICAL SOLUTIONS***		



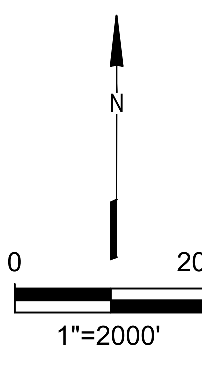
MAP EXPLANATION



Earthquake Fault Zones
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.



Active Fault Traces
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.



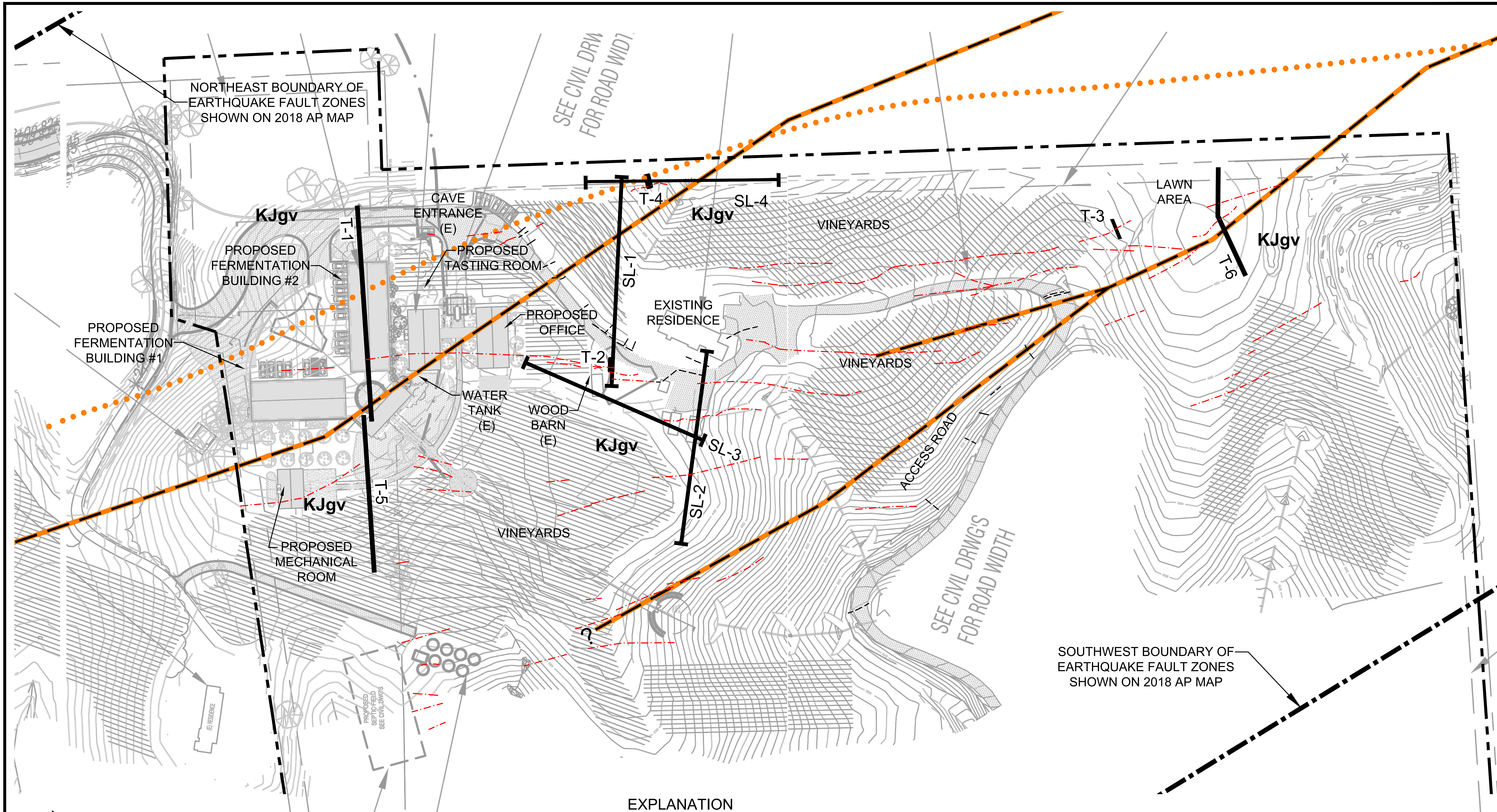
ZONES OF REQUIRED INVESTIGATION
STATE OF CALIFORNIA - 2018

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 2

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS

BASE: PORTION OF STATE OF CALIFORNIA EARTHQUAKE ZONES OF REQUIRED INVESTIGATION , CUTTINGS NAPA QUADRANGLE, CALIFORNIA AT A SCALE OF 1:24,000.



N

0 100

1"=100'

EXPLANATION

APPROXIMATE PROPERTY BOUNDARY

T-6 APPROXIMATE LOCATION OF EXPLORATORY TRENCH

FAULT TRACE SHOWN ON 2018 A-P MAP, SHORT DASH IN BLACK AND SOLID LINE IN ORANGE WHERE INFERRED

APPROXIMATE LOCATION OF SURFACE CRACKS OBSERVED FROM M 6.0 2014 SOUTH NAPA EARTHQUAKE

APPROXIMATE LOCATION OF CRACKS IN ASPHALT PAVEMENT OBSERVED FROM M 6.0 2014 SOUTH NAPA EARTHQUAKE

SL-4 APPROXIMATE LOCATION OF SEISMIC LINE LOCATIONS (ADVANCED GEOLOGICAL SERVICES 2018)

APPROXIMATE LOCATION OF INFERRED UAVSAR LINAMENT (POINTI 2014)

KJgv Great Valley Sequence bedrock

SITE PLAN

Fault Investigation Report
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18 | Project No. 1354.100 | Figure 3

RYAN GEO*LOGICAL* CONSULTING, INC.
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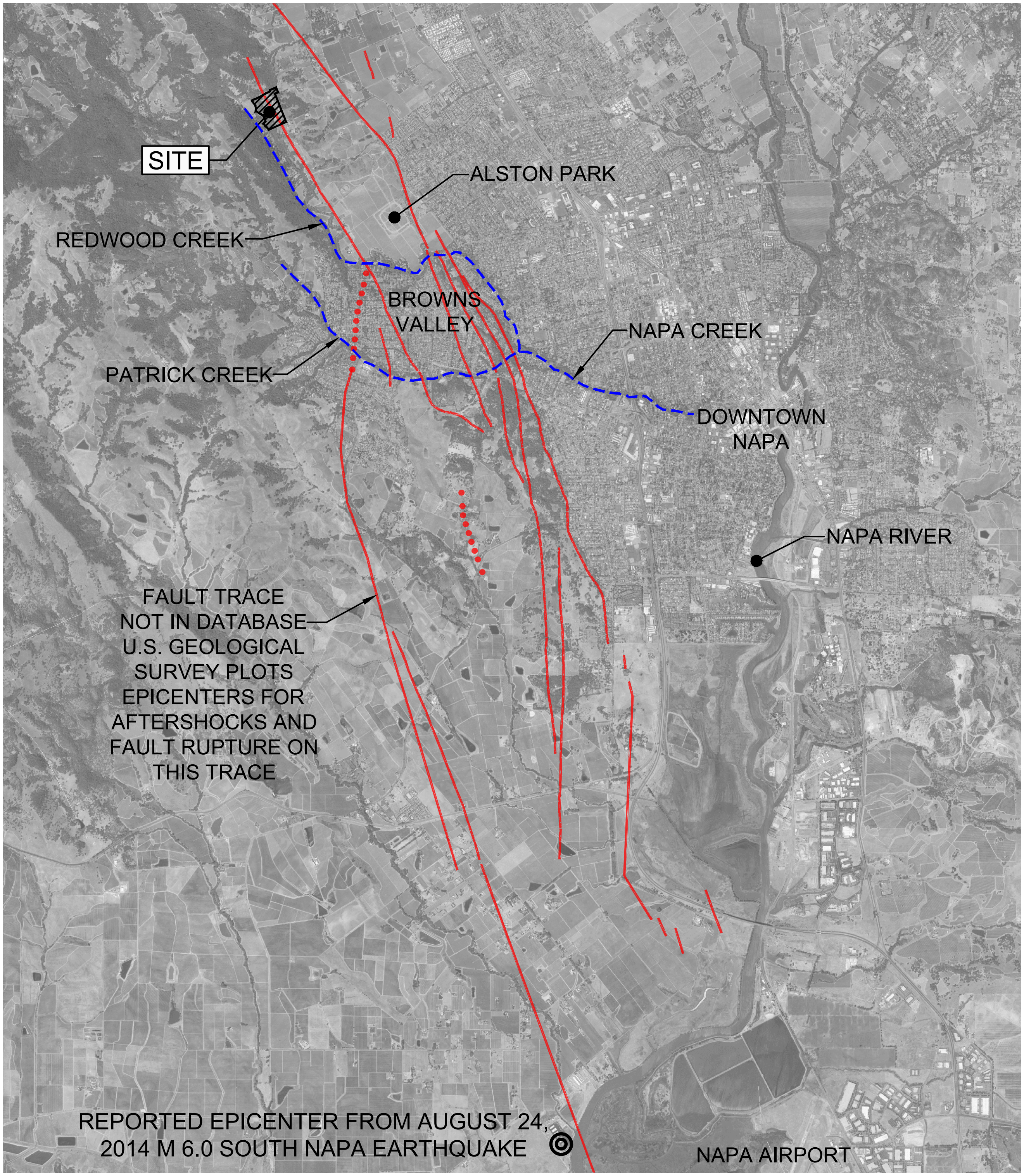

EXPLANATION

QUATERNARY FAULT TRACES IN THE DATABASE FOR FAULT NO. 36A

SELECTED DRAINAGES DISCUSSED IN TEXT

N

0 6000

1"=6000'

BASE: BRYANT, W.A., COMPILER, 2000, FAULT NUMBER 36A, WEST NAPA FAULT, BROWNS VALLEY SECTION, IN QUATERNARY FAULT AND FOLD DATABASE OF THE UNITED STATES: U.S. GEOLOGICAL SURVEY WEBSITE, HTTP://EARTHQUAKES.USGS.GOV/HAZARDS/QFAULTS

QUATERNARY FAULT MAP

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 4

RYAN GEO*LOGICAL* CONSULTING, INC.
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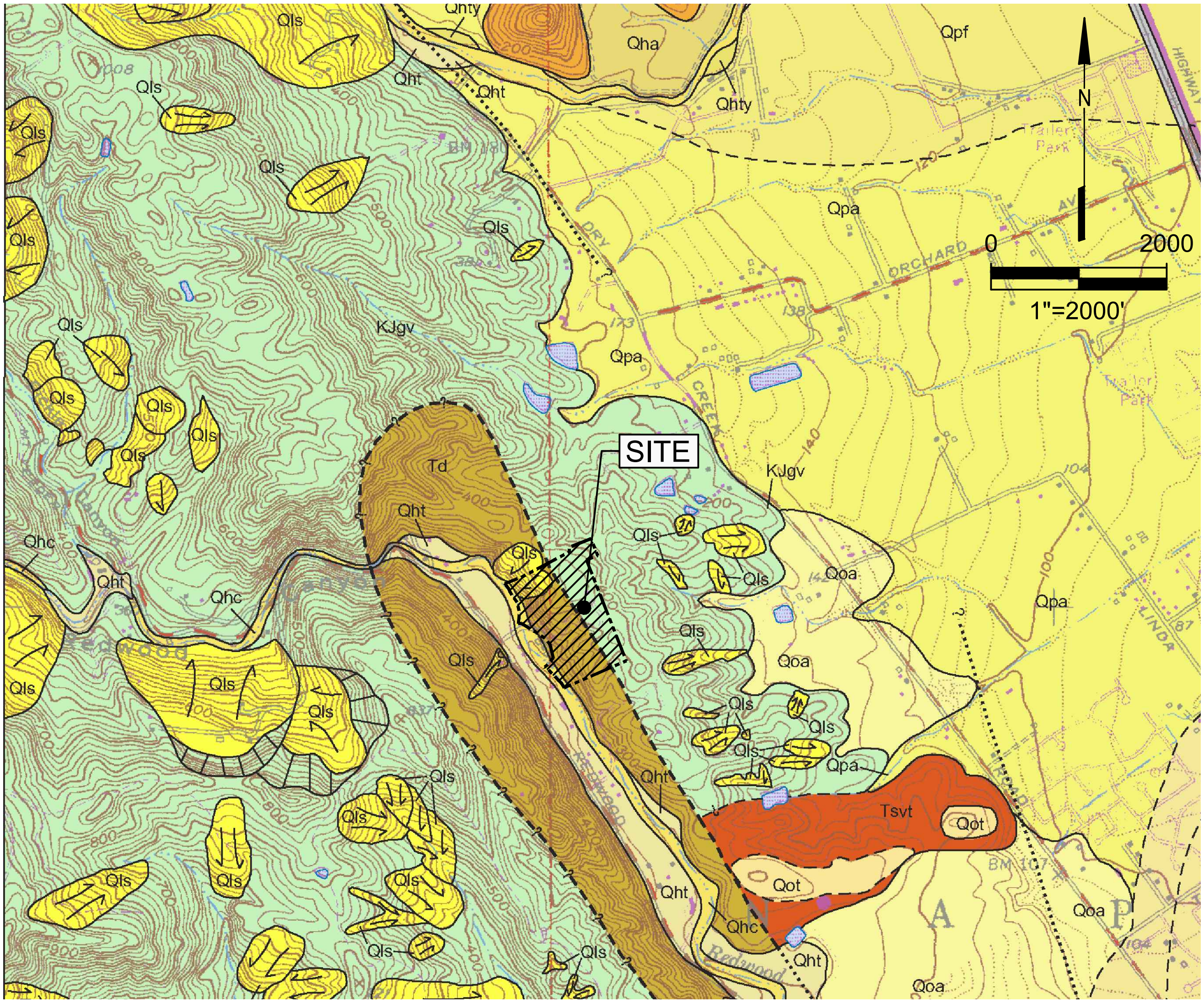


EXPLANATION

CONTACT BETWEEN MAP UNITS - SOLID WHERE ACCURATELY LOCATED, DASHED HERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED, QUERIED WHERE UNCERTAIN

FAULT - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED, QUIVERED WHERE UNCERTAIN

Qhc STREAM CHANNEL DEPOSITS (LATEST HOLOCENE <1,000 YEARS) - DEPOSITS IN ACTIVE, NATURAL STREAM CHANNELS, CONSISTS OF LOOSE ALLUVIAL SAND, GRAVEL, AND SILT

Qht STREAM TERRACE DEPOSITS (HOLOCENE <10,000 YEARS) - STREAM TERRACES DEPOSITED AS POINT BAR AND OVERBANK DEPOSITS, COMPOSED OF MODERATELY TO WELL-SORTED AND BEDDED SAND, GRAVEL, SILT, AND MINOR CLAY

Qpa ALLUVIUM, UNDIVIDED (LATEST PLEISTOCENE) - ALLUVIAL FAN, STREAM TERRACE, BASIN, AND CHANNEL DEPOSITS, COMPOSED OF POORLY TO MODERATELY SORTED SAND, SILT, CLAY, AND GRAVEL

Qoa ALLUVIUM (EARLY TO LATE PLEISTOCENE) - COMPOSED OF CONSOLIDATED SAND, SILT, CLAY, AND GRAVEL. TOPOGRAPHY IS MODERATELY ROLLING WITH LITTLE OR NO ORIGINAL ALLUVIAL SURFACES PRESERVED, DEEPLY DISSECTED

Qls LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE) - INCLUDES DEBRIS FLOWS AND BLOCK SLIDES

Td DOMENGINE SANDSTONE (LATE EOCENE OR EARLY MIOCENE) - BROWN QUARTZO-FELSPATHIC SANDSTONE WITH MINOR THIN CLAYSTONE INTERBEDS

KJgv GREAT VALLEY SEQUENCE (EARLY CRETACEOUS AND LATE JURASSIC) - SANDSTONE, PEBBLE CONGLOMERATE, SILTSTONE, AND SHALE

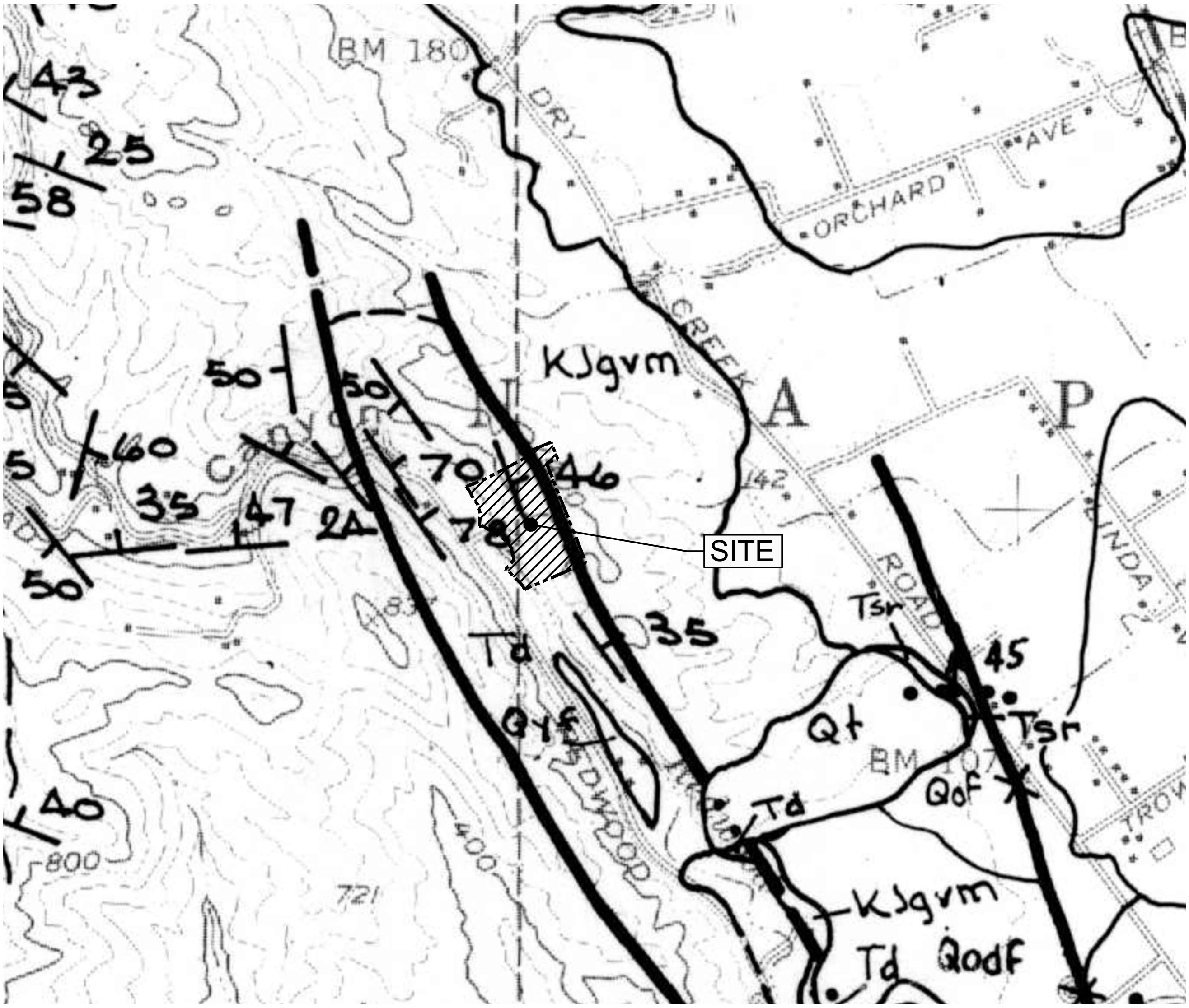
BASE: CLAHAN, K.B., WAGNER, D.L., SAUCEDO, G.J., RANDOLPH-LOAR, C.E. AND SOWERS, J.M., 2004, GEOLOGIC MAP OF THE NAPA 7.5' QUADRANGLE, NAPA COUNTY, CALIFORNIA: CALIFORNIA GEOLOGICAL SURVEY.

REGIONAL GEOLOGIC MAP
CLAHAN et al, 2004

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 5

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS



EXPLANATION

CONTACT - LONG DASHED WHERE UNCERTAIN; SHORT DASHED WHERE GRADATIONAL, DOTTED WHERE CONCEALED

FAULT - LONG DASHED WHERE APPROXIMATELY LOCATED, SHORT DASHED WHERE UNCERTAIN, DOTTED WHERE CONCEALED

STRIKE AND DIP OF BEDDING

Qt TERRACE DEPOSITS; GRAVEL, SAND, SILT, AND CLAY

Qyf ALLUVIAL FAN DEPOSITS GRADING HEADWARD TO TERRACE DEPOSITS, INCISED IN UNIT Qof

Qof ALLUVIAL FAN DEPOSITS BORDERING UPLANDS; HEADS OF FANS INCISED BY CHANNELS PARTLY FILLED BY TERRACED DEPOSITS OF YOUNGER ALLUVIUM, MAINLY DEEPLY WEATHERED POORLY SORTED COARSE SAND AND GRAVEL

Td DOMENGINE SANDSTONE, BROWN FELDSPATHIC QUARTZ SANDSTONE WITH MINOR THIN MUDSTONE INTERBEDS

KJgvm MUDSTONE AND SILTSTONE WITH MINOR THIN-BEDDED SANDSTONE

N

0 2000

1"=2000'

BASE: FOX, K.F., SIMS, J.D., BARTOW, J.A. AND HELLEY, E.J., 1973, PRELIMINARY GEOLOGIC MAP OF EASTERN SONOMA AND WESTERN NAPA COUNTY, CALIFORNIA: U.S. GEOLOGICAL SURVEY MISCELLANEOUS FIELD STUDIES MAP MF-483, BASIC DATA CONTRIBUTION 56.

REGIONAL GEOLOGIC MAP
Fox et al, 1973

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3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 6

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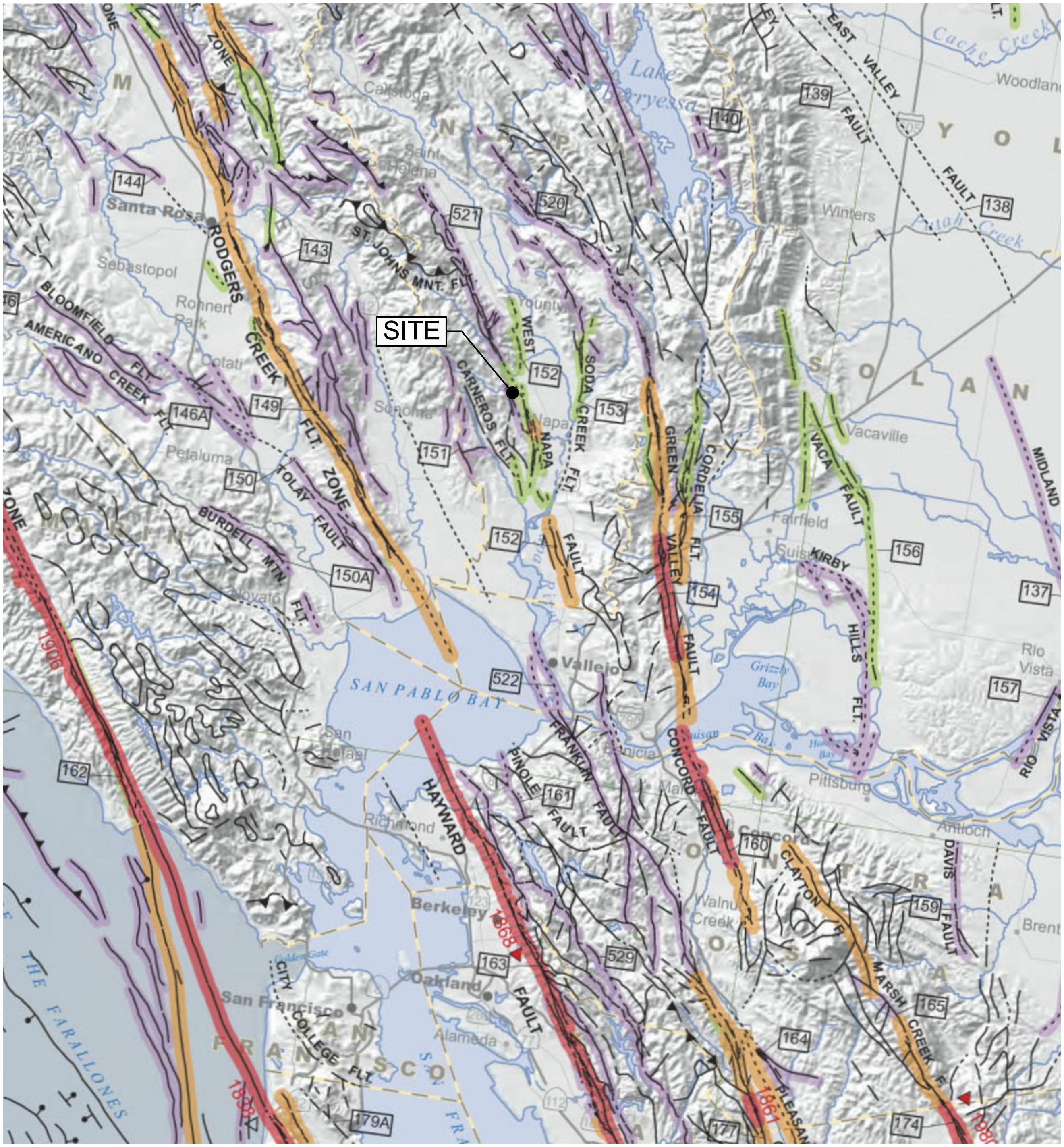
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS



EXPLANATION

FAULT ALONG WHICH HISTORIC (LAST 200 YEARS) WITH HISTORIC RECORD DISPLACEMENT HAS OCCURRED

HOLOCENE FAULT DISPLACEMENT (WITHIN PAST 11,700 YEARS) WITHOUT HISTORIC RECORD

LATE QUATERNARY FAULT DISPLACEMENT (WITHIN PAST 700,000 YEARS)

QUATERNARY FAULT (AGE UNDIFFERENTIATED)

PRE-QUATERNARY FAULT

N

0 50,000

1"=50,000'

BASE: JENNINGS, J.W. AND BRYANT, W.A., 2010 FAULT ACTIVITY MAP OF CALIFORNIA: CALIFORNIA GEOLOGICAL SURVEY, GEOLOGIC DATA MAP NO. 6.

NORTHERN BAY AREA FAULT ACTIVITY MAP

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3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 7

RYAN GEO*LOGICAL* CONSULTING, INC.
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EXPLANATION

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE LOCATION OF PHOTOLINAMENT

APPROXIMATE LOCATION OF INFERRED UAVSAR LINAMENT

N

0 1000

1"=1000'

NOTE:
PHOTOLINAMENTS NOTED ABOVE ARE A CUMULATIVE INTERPRETATION BASED ON REVIEW OF 10 SETS OF STEREO-PAIRED AERIAL PHOTOGRAPHS

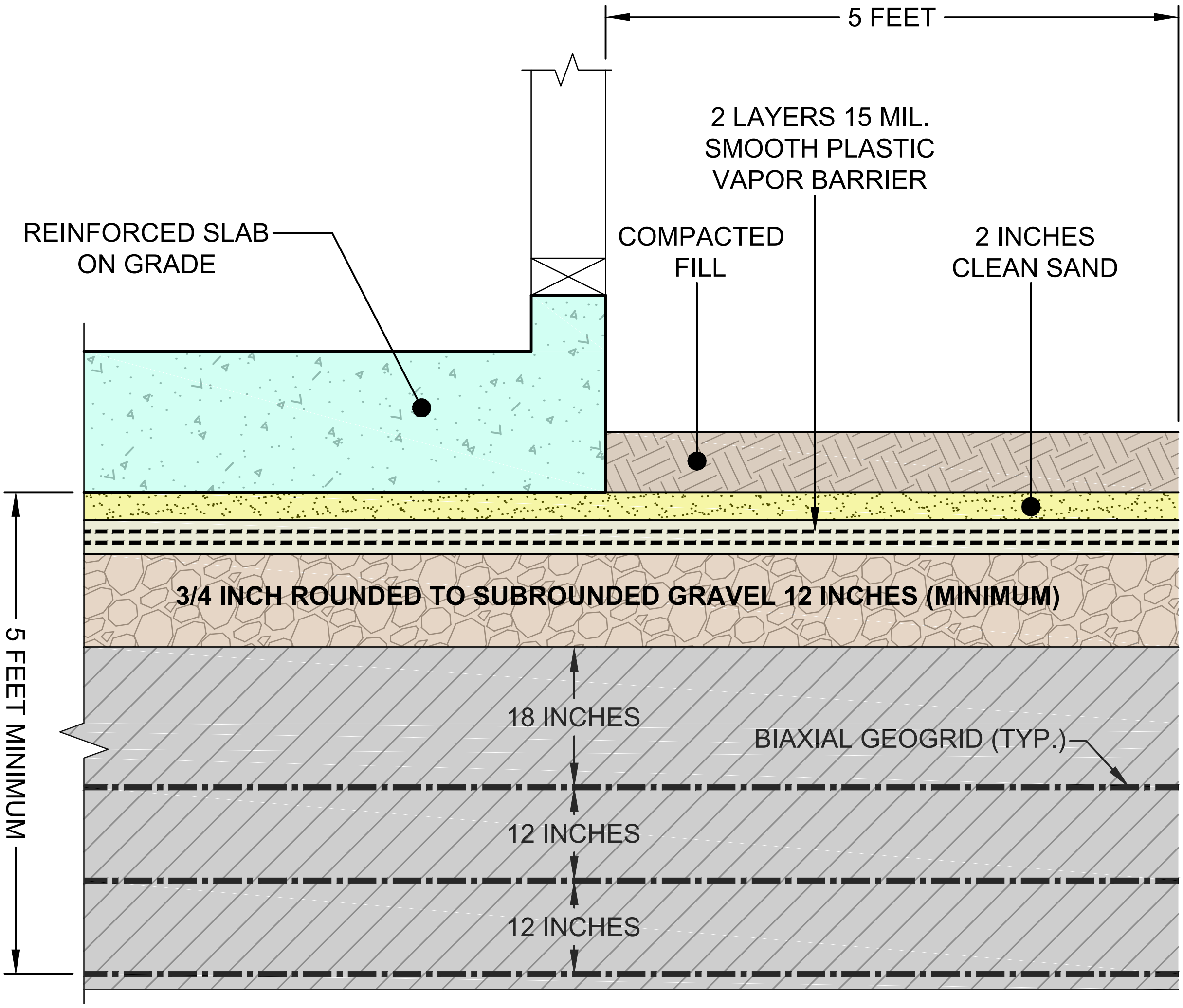
BASE: AERIAL PHOTOGRAPH DATED 5-17-84

AERIAL PHOTOGRAPH INTERPRETATION

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 8

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS



NOTES:

1. Final dimensions shown above and foundation design to be based on future design-level geotechnical report. Modification to the design shown above may be needed to account for building-specific conditions.
2. Excavations shall be a minimum of 5 feet deep (from the original ground surface) and extend a minimum of 5 feet beyond the building footprint.
3. An engineering geologist from our office shall map all excavations. If a near-surface fault is encountered, modification to the land plan may be warranted.

CONCEPTUAL GEOGRID REINFORCED PAD DETAIL

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure 9

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS

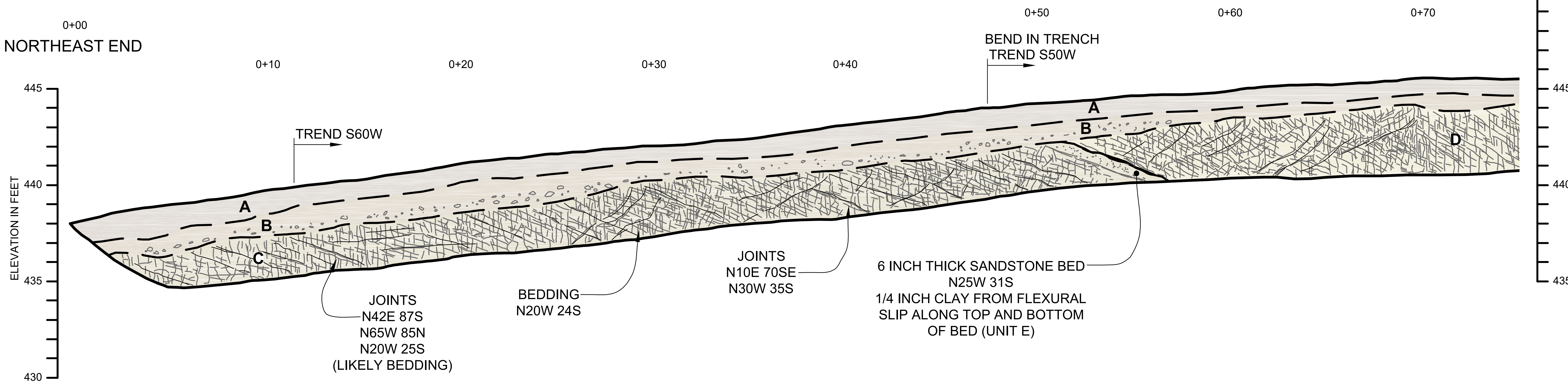
RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS
16 Southwood Drive
Orinda, CA 94563
510-520-5592

APPENDIX 1

TRENCH LOGS T-1 THROUGH T-6

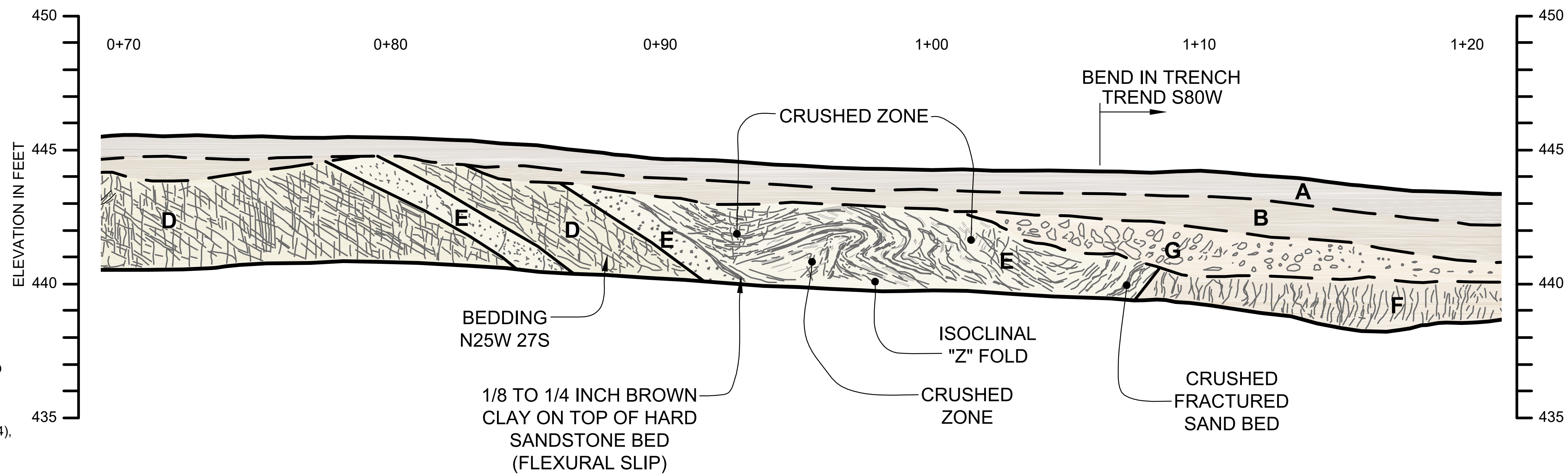
TRENCH T-1 (2014)

LOG OF SOUTH WALL



TRENCH T-1 (2014)

CONTINUED



TRENCH T-1 EXPLANATION

———	GROUND SURFACE AND BOTTOM OF TRENCH
— — —	GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE
A	SANDY SILT WITH CLAY, BROWN (10 YR 4/3), DRY, MEDIUM STIFF TO STIFF, FINE-GRAINED SAND (RESIDUAL SOIL AB)
B	SILTY CLAY, DARK YELLOWISH BROWN (10 YR 4/6), MOIST, STIFF, BLOCKY PED STRUCTURE, TRACE FINE-GRAINED SAND, SOME ROOTS (RESIDUAL SOIL Bt)
C	CLAYSTONE, LIGHT OLIVE-BROWN (5Y 5/6), HIGHLY WEATHERED, WEAK, CRUSHED WITH CLAY LINED JOINTS (GREAT VALLEY SEQUENCE)
D	SILTSTONE, MODERATE YELLOW (5Y 7/6), HIGHLY WEATHERED, WEAK TO MODERATELY STRONG, HIGHLY FRACTURED, THINLY TO THICKLY BEDDED (GREAT VALLEY SEQUENCE)
E	SANDSTONE, FINE-TO MEDIUM-GRAINED, GRAYISH YELLOW (5Y 8/4), MODERATELY WEATHERED, STRONG, THINLY BEDDED (GREAT VALLEY SEQUENCE)
F	CLAYSTONE, MOTTLED DARK YELLOWISH ORANGE (10 YR 6/6), TO MODERATE BROWN (5YR 4/4), HIGHLY WEATHERED, WEAK, CRUSHED
G	SILTY CLAY WITH CLAY AND GRAVEL, YELLOW (10 YR 7/6), DRY, STIFF
H	SILTY CLAY, REDDISH BROWN (5 YR 4/4), MOIST, VERY STIFF, COLUMNAR PED STRUCTURE (COLLUVIAL SOIL)
I	CLAYEY SILT, BROWNISH YELLOW (10 YR 6/8), DRY, STIFF, TRACE ROUNDED SANDSTONE COBBLES
J	SANDSTONE INTERBEDDED WITH SILTSTONE, GRAYISH YELLOW (5Y 8/4), HIGHLY WEATHERED, HIGHLY FRACTURED, THINLY BEDDED

TRENCH T-1

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure A-1

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS

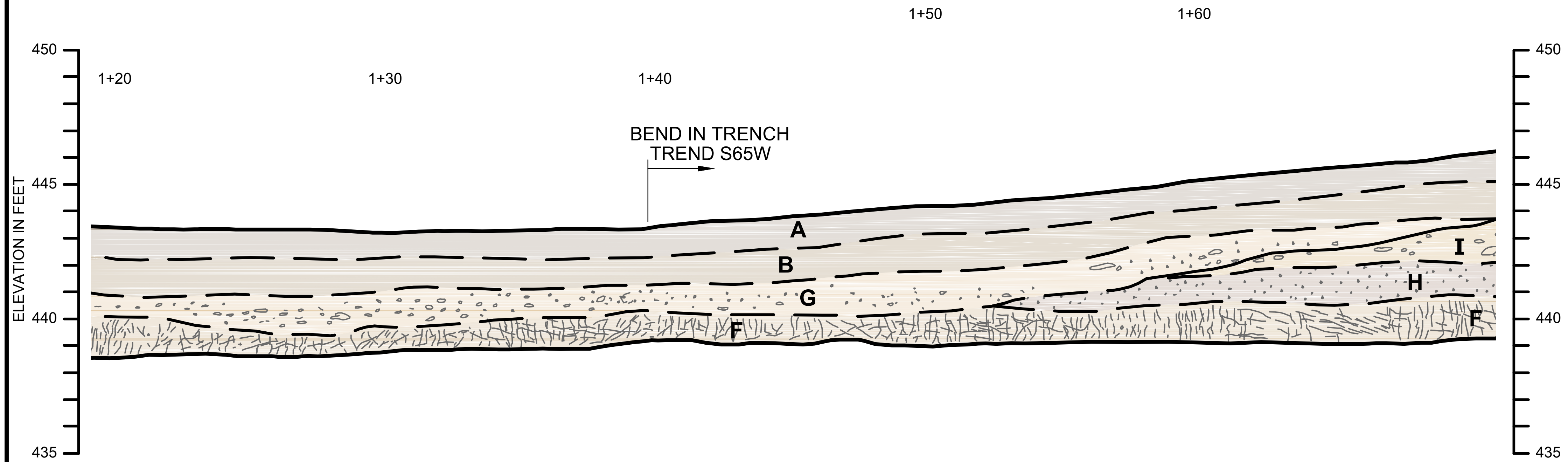
TRENCH T-1 EXPLANATION

GROUND SURFACE AND BOTTOM OF TRENCH

GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE

A	SANDY SILT WITH CLAY, BROWN (10 YR 4/3), DRY, MEDIUM STIFF TO STIFF, FINE-GRAINED SAND (RESIDUAL SOIL AB)
B	SILTY CLAY, DARK YELLOWISH BROWN (10 YR 4/6), MOIST, STIFF, BLOCKY PED STRUCTURE, TRACE FINE-GRAINED SAND, SOME ROOTS (RESIDUAL SOIL Bt)
C	CLAYSTONE, LIGHT OLIVE-BROWN (5Y 5/6), HIGHLY WEATHERED, WEAK, CRUSHED WITH CLAY LINED JOINTS (GREAT VALLEY SEQUENCE)
D	SILTSTONE, MODERATE YELLOW (5Y 7/6), HIGHLY WEATHERED, WEAK TO MODERATELY STRONG, HIGHLY FRACTURED, THINLY TO THICKLY BEDDED (GREAT VALLEY SEQUENCE)
E	SANDSTONE, FINE-TO MEDIUM-GRAINED, GRAYISH YELLOW (5Y 8/4), MODERATELY WEATHERED, STRONG, THINLY BEDDED (GREAT VALLEY SEQUENCE)
F	CLAYSTONE, MOTTLED DARK YELLOWISH ORANGE (10 YR 6/6), TO MODERATE BROWN (5YR 4/4), HIGHLY WEATHERED, WEAK, CRUSHED
G	SILTY CLAY WITH CLAY AND GRAVEL, YELLOW (10 YR 7/6), DRY, STIFF
H	SILTY CLAY, REDDISH BROWN (5 YR 4/4), MOIST, VERY STIFF, COLUMNAR PED STRUCTURE (COLLUVIAL SOIL)
I	CLAYEY SILT, BROWNISH YELLOW (10 YR 6/8), DRY, STIFF, TRACE ROUNDED SANDSTONE COBBLES
J	SANDSTONE INTERBEDDED WITH SILTSTONE, GRAYISH YELLOW (5Y 8/4), HIGHLY WEATHERED, HIGHLY FRACTURED, THINLY BEDDED

TRENCH T-1 (2014)
CONTINUED



TRENCH T-1 (2014)
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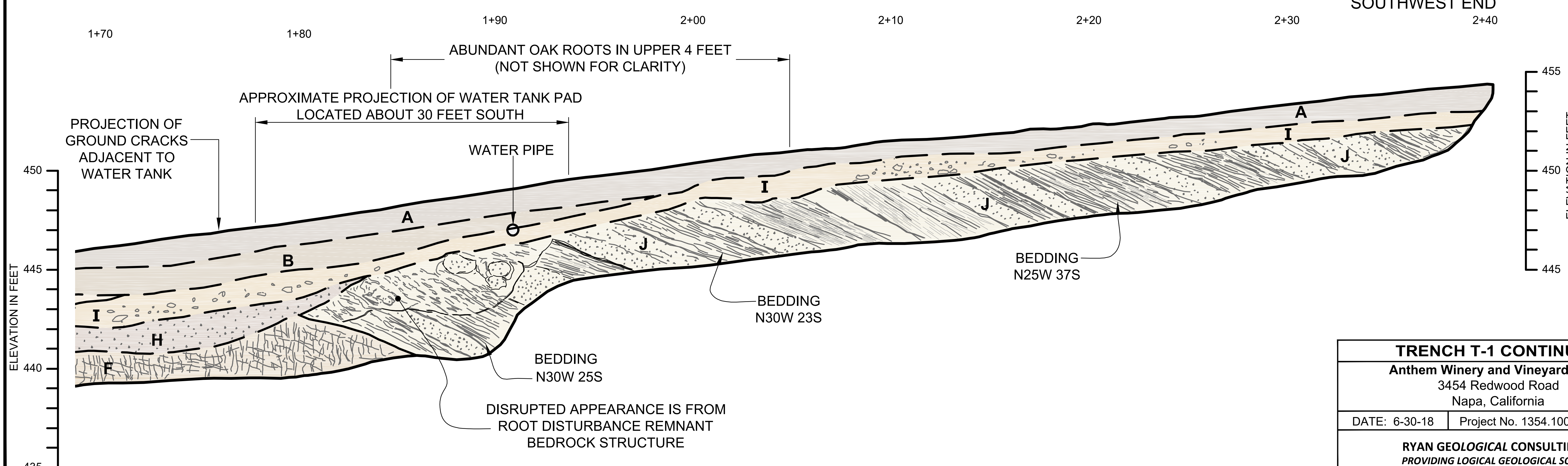
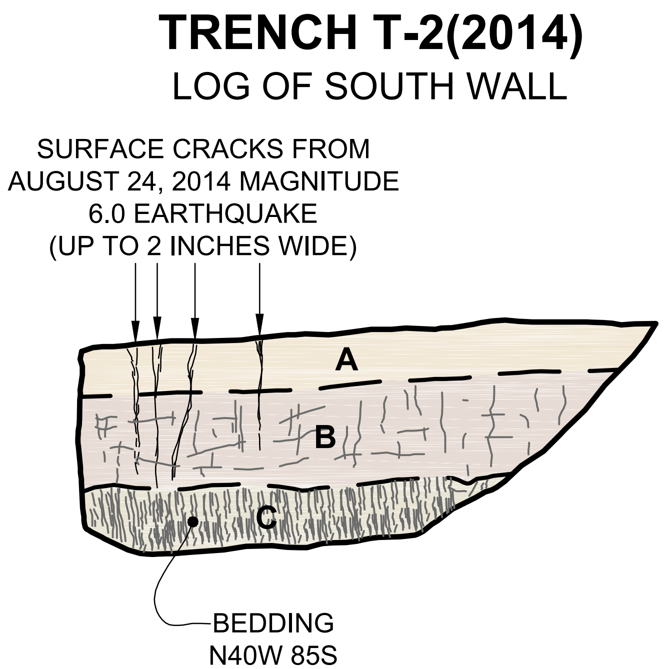


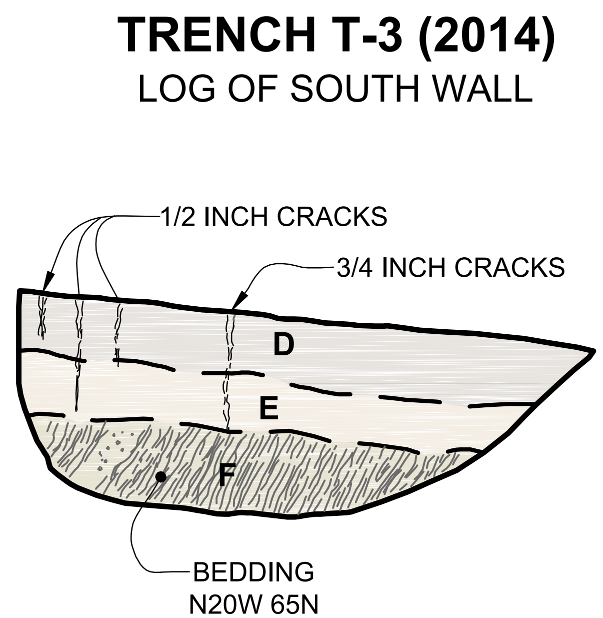
TRENCH T-1 CONTINUED

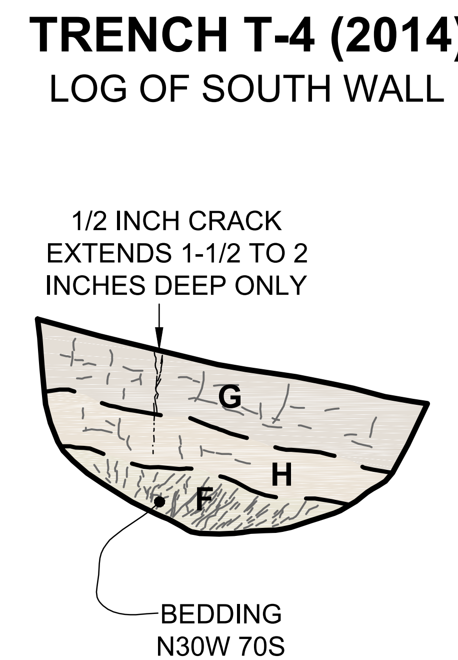
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure A-2

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS







TRENCH T-2 THROUGH T-4 EXPLANATION

Symbol	Description
———	GROUND SURFACE AND BOTTOM OF TRENCH
— — —	GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE
A	SILTY CLAY, BROWNISH YELLOW (10 YR 6/8), DRY, STIFF (FILL)
B	SILTY CLAY, YELLOWISH RED (5 YR 4/6), MOIST, STIFF, COLUMINAR PED STRUCTURE WITH CLAY FILMS ON PED STRUCTURES (PLEISTOCENE SOIL Bt)
C	CLAYSTONE, LIGHT OLIVE-BROWN (5 Y 5/6), TO GRAYISH YELLOW (5 Y 8/4), HIGHLY WEATHERED, WEAK, CRUSHED, THINLY BEDDED
D	SILTY CLAY, GRAY (10 YR 5/1), DRY, STIFF, POROUS (AB)
E	SANDY SILT, VERY PALE BROWN (10 YR 7/4)
F	CLAYSTONE, LIGHT OLIVE-BROWN (5 Y 5/6), HIGHLY WEATHERED, FRIABLE TO WEAK, CRUSHED
G	SILTY CLAY, DARK YELLOWISH BROWN (10 YR 4/4), DRY, STIFF (RESIDUAL SOIL AB)
H	SILTY CLAY, YELLOW-BROWN (10 YR 5/6), DRY TO MOIST, STIFF

TRENCH T-2 THROUGH T-4
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure A-3

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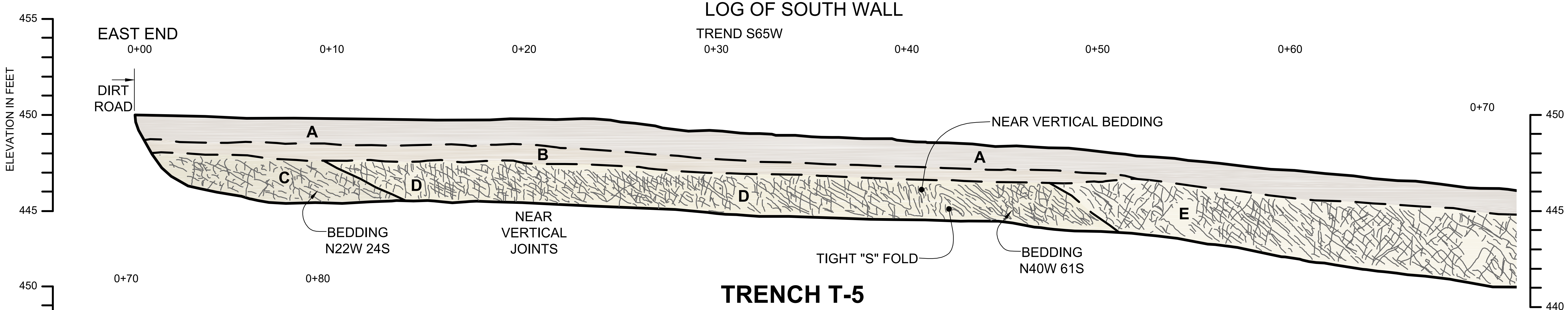
TRENCH T-5

LOG OF SOUTH WALL



TRENCH T-5

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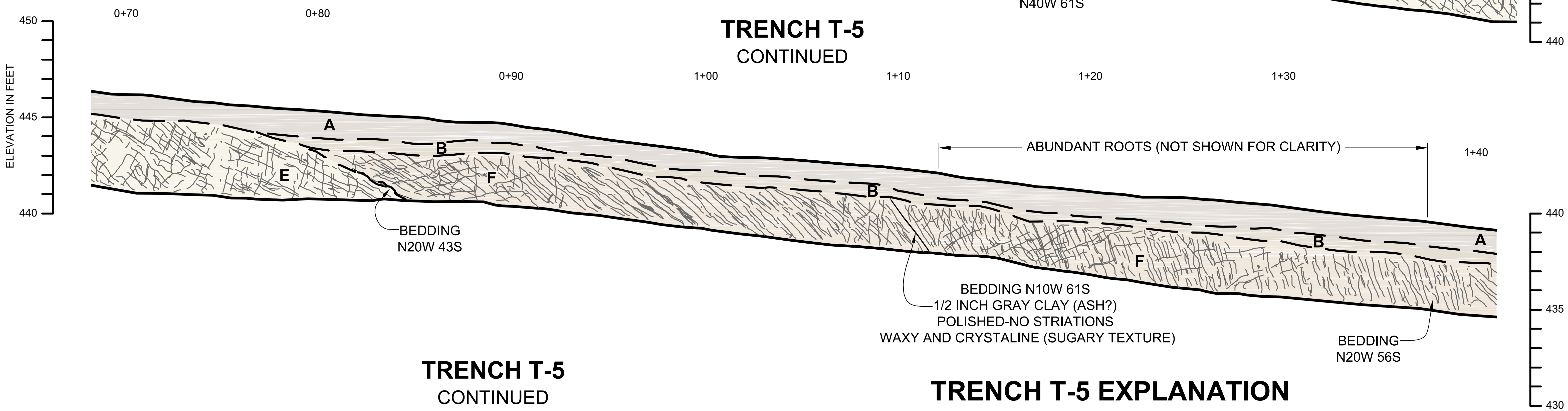

TRENCH T-5

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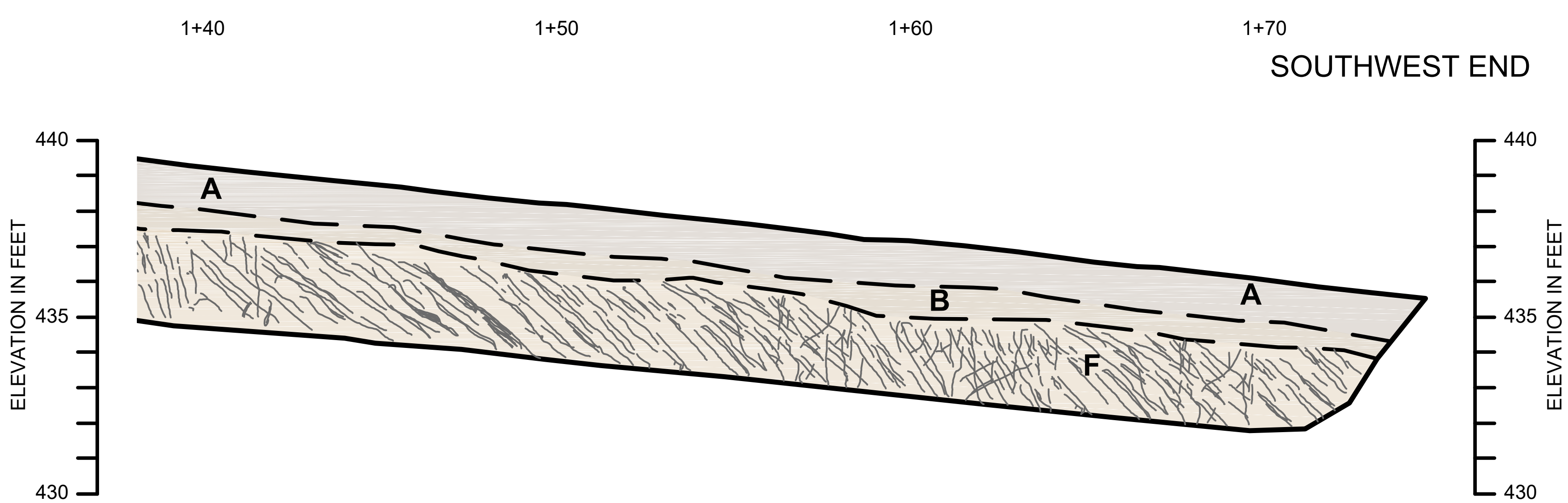

TRENCH T-5 EXPLANATION

(solid line)	GROUND SURFACE AND BOTTOM OF TRENCH
(dashed line)	GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE
A	SANDY SILT WITH CLAY, BROWN (10YR 4/3), MOIST, STIFF, FINE-GRAINED SAND (RESIDUAL SOIL AB)
B	CLAYEY SILT, BROWNISH YELLOW (10YR 6/8), MOIST, STIFF
C	SANDSTONE, INTERBEDDED WITH SILTSTONE, GRAYISH YELLOW (5Y 8/4), HIGHLY WEATHERED, HIGHLY FRACTURED, THINLY BEDDED
D	CLAYSTONE, OLIVE0-BROWN (5Y 5/6) TO GRAY, HIGHLY WEATHERED, WEAK, CRUSHED, OXIDATION BANDING
E	SILTSTONE, HIGHLY WEATHERED, HIGHLY FRACTURED

TRENCH T-5

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure A-4

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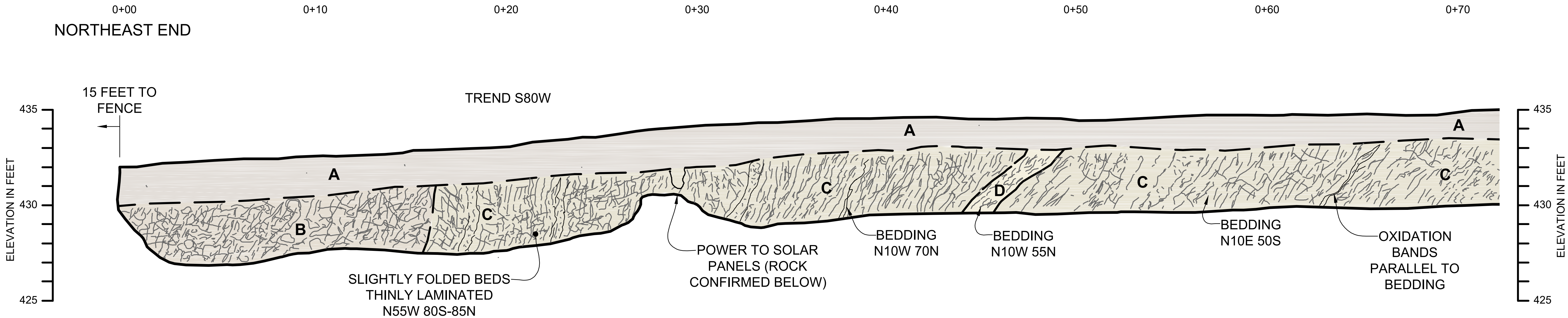
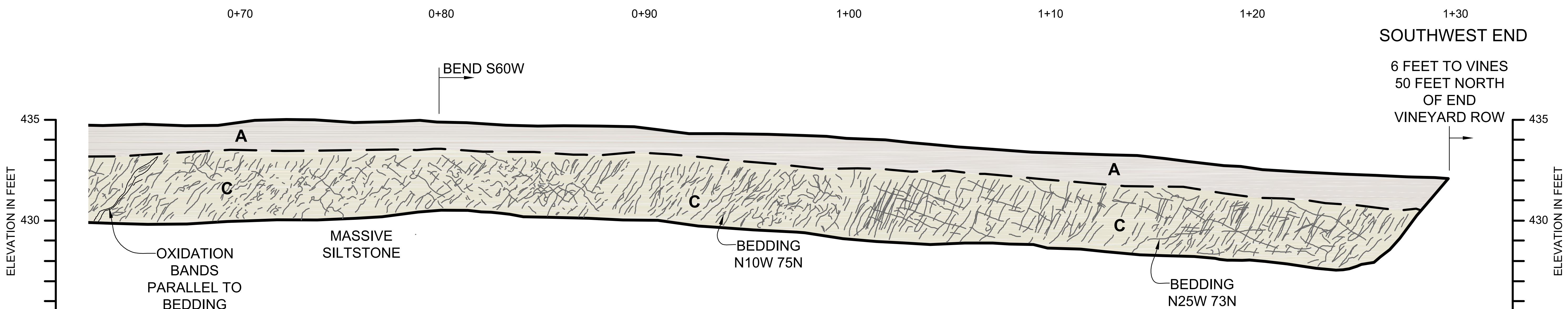
TRENCH T-6
LOG OF SOUTH WALL



TRENCH T-6
CONTINUED



TRENCH T-6 EXPLANATION

(solid line)	GROUND SURFACE AND BOTTOM OF TRENCH
(dashed line)	GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE
A	SILTY CLAY, DARK YELLOW-BROWN (10YR 4/4), MOIST, STIFF, TRACE FINE-GRAINED SAND
B	CLAYSTONE, LIGHT OLIVE-BROWN (5YR 5/6), HIGHLY WEATHERED, FRIABLE, WEAK, CRUSHED
C	SILTSTONE WITH OCCASIONAL SANDSTONE INTERBEDS, PALE YELLOW (5Y 7/6), HIGHLY WEATHERED, WEAK, HIGHLY FRACTURED TO CRUSHED
D	CLAYSTONE, DARK YELLOWISH ORANGE (10 YR 6/6), HIGHLY WEATHERED, FRIABLE, CRUSHED WITH OXIDATION STAINED JOINTS

TRENCH T-6

Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 6-30-18	Project No. 1354.100	Figure A-5

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RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS
16 Southwood Drive
Orinda, CA 94563
510-520-5592

APPENDIX B

AGS GEOPHYICAL SURVEY REPORT dated April 26, 2018

ADVANCED GEOLOGICAL SERVICES

1605 School Street, #4
Moraga CA 94556
925 (808-8965)

April 26, 2018

Kevin James Ryan, PG, CEG
RYAN GEOLOGICAL CONSULTING, INC.
16 Southwood Drive
Orinda, California 94563

Subject: Geophysical Investigation Results
3454 Redwood Road
Napa, California

Dear Mr. Ryan:

1.0 INTRODUCTION

This letter presents the results of Advanced Geological Services, Inc. (AGS) geophysical investigation at 3454 Redwood Road, Napa, California (Figure 1). The purpose of the investigation was to close the gaps between the exploratory trenches due to site constraints. The investigation was performed on April 12, 2018 by AGS senior geophysicist Roark W. Smith. The investigation comprised a seismic refraction survey to look for discontinuities in the subsurface that could indicate the presence of a geologic fault.

Figure 1 - Site Location in Napa, CA

2.0 SUMMARY OF FINDINGS

- No fault indications were observed in the seismic survey results.

3.0 SITE DESCRIPTION

The survey was performed within a 280- by 380-foot area on the top a hill where the current residence, along with a dilapidated barn and other buildings, is located. The residence complex is surrounded by vineyards and open, grassy fields. Seismic data were obtained along four lines positioned so as to cross alignments where fault traces, as suggested by topography and previous geotechnical studies of the site, might exist (Figure 2). The seismic lines were positioned along clearings and in open areas so as to avoid crawling through and possibly damaging the winery grapevines.

4.0 SEISMIC REFRACTION (SR) METHOD OVERVIEW

The seismic refraction method uses compressional (P-) wave energy to delineate seismic velocity layers within the subsurface. Interpretation entails correlating the velocity layers to geologic features such as soil and various types of bedrock. To perform a refraction survey, an elastic wave (compressional, or P-wave) is generated at certain locations (shotpoints) along a survey line. The P-wave energy is usually produced with a small explosion or by striking the ground with a sledgehammer. As the P-wave propagates through the ground it is refracted along boundaries between geologic layers with different seismic velocities.

Part of the refracted P-wave energy returns to the ground surface where it is detected by vibration-sensitive devices called geophones, which are placed in a linear array along the seismic survey line. Using linear, “straight-line” geophone arrays is necessary for accurate assessments of the depth, thickness, and velocity of the detected geologic layers. The geophone data are fed to a seismograph, where they are recorded, and then to a computer, where they are analyzed to determine the depth and velocities of subsurface seismic layers. Key data for refraction analysis are the positions of the geophones and shotpoints along a seismic line, and the amount of time it takes for the refracted wave to travel from the shotpoint to each geophone location. Because the P-wave is the fastest traveling of all types of seismic waves, it can be readily identified as the first deflection (“first break”) on a seismic trace.

Additional discussion of the refraction method, its limitations, and the relationship between seismic velocity and geologic materials is presented in Appendix A.

5.0 FIELD PROCEDURES

AGS obtained seismic data along four lines, designated SL-1, SL-2, SL-3, SL-4 (Figure 2). For each line, AGS first laid out a fiberglass tape measure and then placed 24 geophones on the ground at 10-foot intervals to produce a 230-foot long seismic line. The geophones were coupled to the ground by means of 3-inch metal spikes attached to the geophone base. Three shotpoints were used along each line, with shotpoints located 5 feet beyond each end of the geophone array and at the array midpoint. AGS produced P-waves through multiple impacts with a 12-lb sledge hammer against a metal plate placed on the ground surface at each shotpoint location. In general, 10 hammer blows were used (“stacked”) for end shots and 7 blows were used at the center shotpoint. The P-waves produced by the hammer impacts were detected using Mark Products 14-Hz geophones. The detected seismic signals were recorded using a DAQLink II seismic system connected to a laptop computer.

AGS also performed a hand-level survey to measure the relative elevation changes along the line so that the ground surface topography could be incorporated into the data analysis. After the seismic data acquisition was completed along one line, AGS marked the shotpoint locations with pink pin flags and then picked up and moved the seismic spread to the next line and repeated the process. AGS mapped the seismic line locations by referencing them to prominent site features such as the barn, residence building, and vineyard rows.

6.0 DATA PROCESSING AND ANALYSIS

The seismic refraction data quality for this project was very good and “first break” picks were made easily and with high confidence. Data quality was enhanced by “stacking,” which entailed using multiple hammer blows at each shotpoint location to improve the signal-to-noise ratio. The additive affect of stacking of multiple hammer blows at the same location enhances or increases the amplitude of the signal (i.e., the refracted wave arrival) while amplitude of the background noise, which, being random in nature, tends to cancel itself on successive hammer blows and remains largely unchanged.

Seismic data were transferred from the seismograph to a desktop computer where they were processed using the *SeisImager* software package by Geometrics, Inc. Briefly, *SeisImager* is a computer inversion program that generates an initial velocity layer model, produces synthetic data from the model, and then adjusts the model so that the synthetic data better matches the observed field data. The agreement between the synthetic and observed data provides an indication of how well the model represents the true subsurface conditions.

First, AGS used the *SeisImager* module *PickWin* to interpret (“pick”) the P-wave arrivals (“first breaks”) for each of the shotpoint data sets (“shot gathers”) per line. *PickWin* was also used to check (against the geophysicist’s field log) that the proper locations were assigned to the geophones and shotpoints. Next, the first break files were fed to the SeisImager module *PlotRefra*, which was used review time-distance (TD) plots for the seismic lines and assign a seismic layer to each arrival time. For the refraction analysis, each P-wave arrival is considered to have refracted from a distinct seismic layer. The number of layers resolved by the seismic survey, and their thickness and average velocity, is indicated by straight line segments on the TD plot; because these straight-line segments represent a constant velocity condition within the subsurface, they often represent a distinct geologic layer. Topographic elevation files, which were prepared from the hand-level data, were incorporated into the analysis at this point. Next, a time-term inversion was performed to produce layered velocity models. Time-term inversion is a linear least-squares technique that uses the layer assignments and the distances and travel times between the shotpoints and the geophones to develop a velocity layer model that best fits the observed data.

The layered velocity models were then used as starting models for the tomographic inversion process, which was used to assess lateral velocity variations along each seismic line to better show any discontinuities in the subsurface indicative of a fault. Briefly, tomographic inversion is a grid-based modeling process wherein the subsurface is divided into rectangular cells based on the geophone spacing. The tomography software assigns a velocity to each cell, produces a synthetic arrival-time data set based on seismic raypaths projected through the velocity grid, and then compares the synthetic data to the real data recorded in the field. The cell velocities are then adjusted and re-adjusted until the synthetic data achieve a “best fit” with the observed field data. Tomographic modeling is often used to complement layered modeling at sites where gradual velocity transitions, such as those often seen between weathered and unweathered bedrock, are expected. Tomographic modeling can also depict lateral velocity variations within the subsurface more accurately than a layered modeling approach.

7.0 RESULTS

The geophysical investigation results are presented on Figures 2, 3, and 4. Figure 2 shows the seismic line locations. Figures 3 and 4 show the tomographic models generated from the seismic refraction data.

Overall, the data quality was very good and no fault indications were observed in the seismic survey results. “First break” picks were made with ease and the resulting TD plots were smooth and symmetrical, indicating homogeneous subsurface conditions. Accordingly, the associated models show smooth velocity layering and no disruptions indicative of a geologic fault. Areas with disturbed subsurface conditions tend to produce “deranged” TD plots, wherein the first break picks do not plot onto straight line segments.

The seismic results show three velocity layers— an thin, low-velocity (500 to 800 feet per second) surface layer (red-orange colors on the tomographic models) corresponding to surficial soil, and an intermediate velocity layer (2,000 to 3,500 fps, yellow-green) representing weathered bedrock. Line SL-3, which ran across the crown of the hill, exhibited third, higher velocity layer (4,400 fps, blue colors) indicative of “harder”, less-weathered bedrock.

8.0 CLOSING

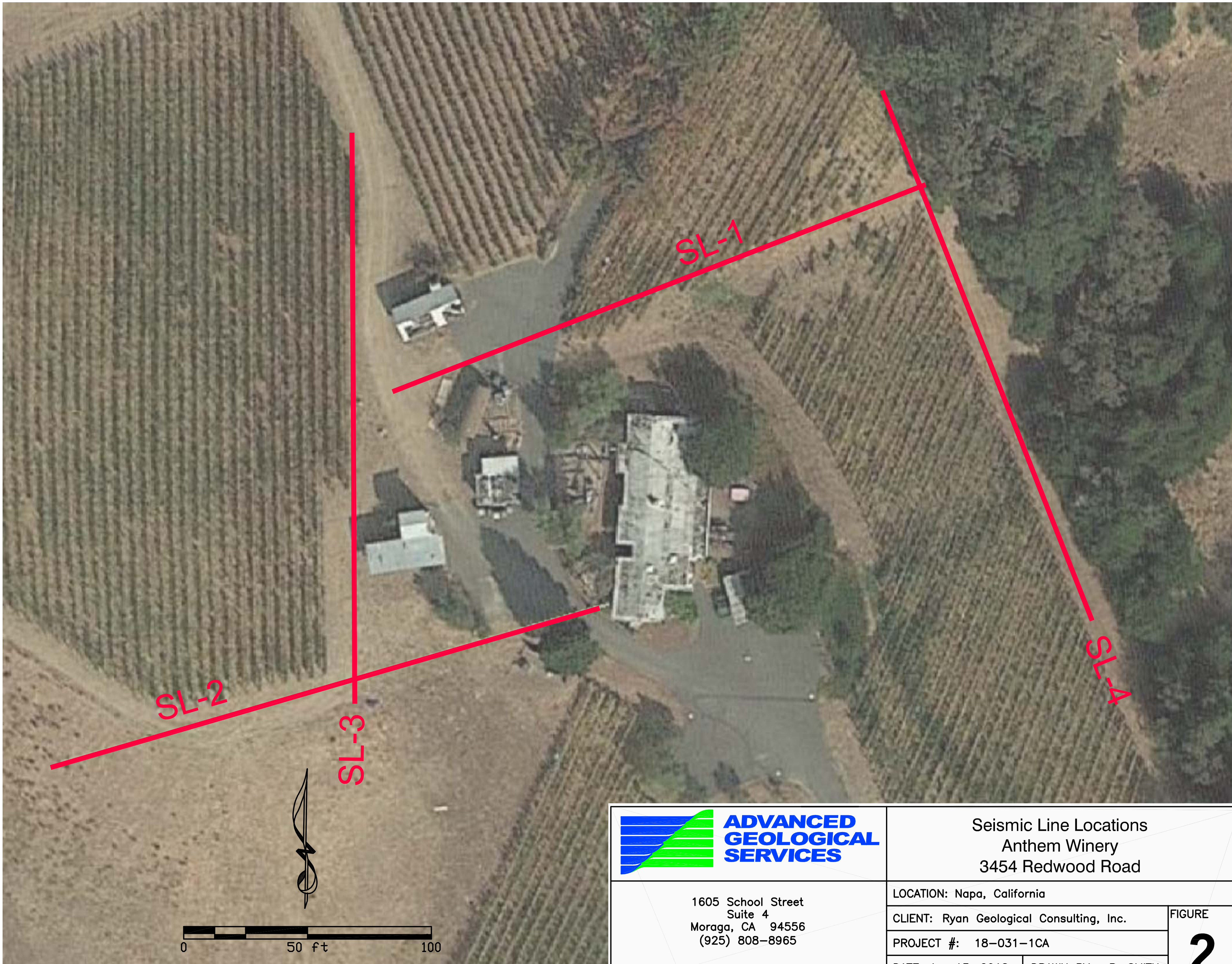
All geophysical data and field notes collected as a part of this investigation will be archived at the AGS office. The data collection and interpretation methods used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site. Due to the nature of geophysical data, no guarantees can be made or implied regarding the targets identified or the presence or absence of additional objects or targets.

AGS appreciates working for you. We enjoyed this project and we look forward to working with you again.

Sincerely,

Roark W. Smith
Senior Geophysicist
Advanced Geological Services, Inc.

Figures:	Figure 1	Site Location Map (imbedded in Report text)
	Figure 2	Seismic Line Locations
	Figure 3	Seismic Refraction Survey Results, SL-1 and SL-2
	Figure 4	Seismic Refraction Survey Results, SL-3 and SL-4
Attachments:	Appendix A:	Seismic Velocity and Limitations of the Refraction Method

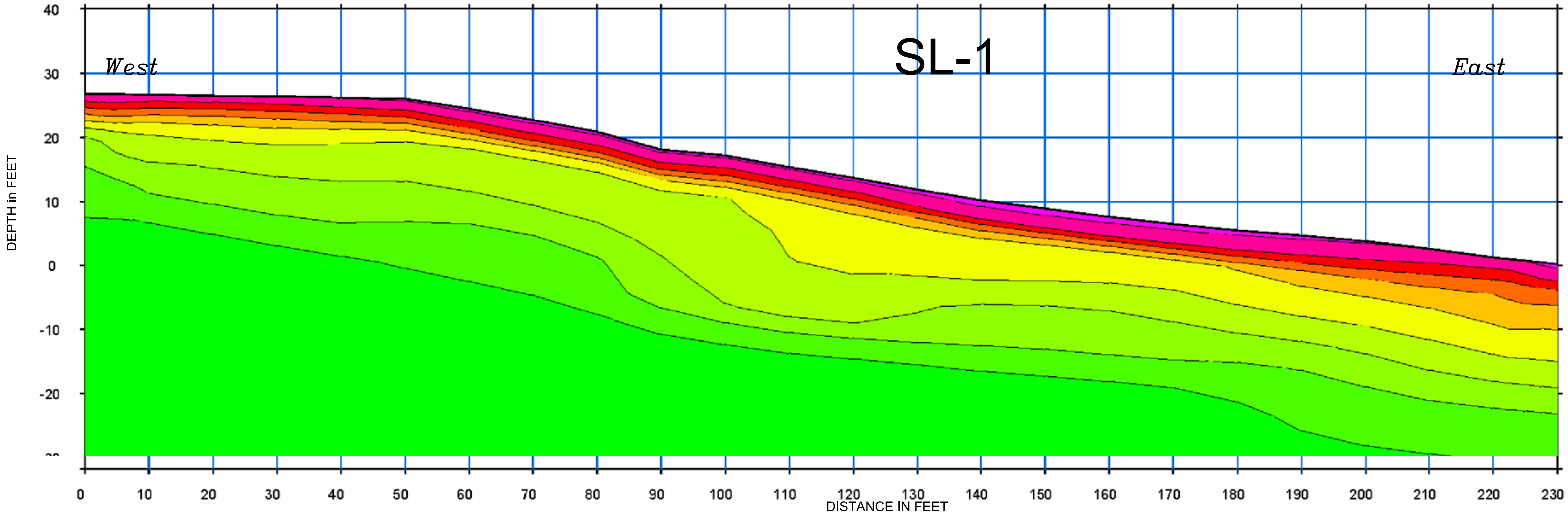


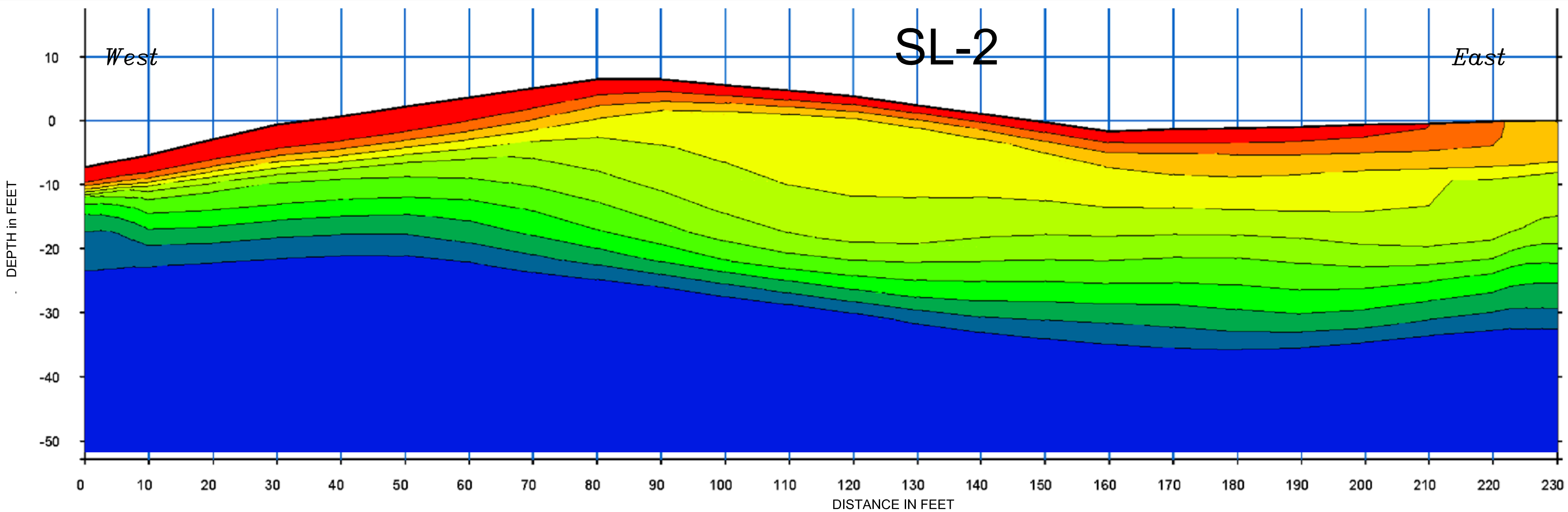
ADVANCED GEOLOGICAL SERVICES

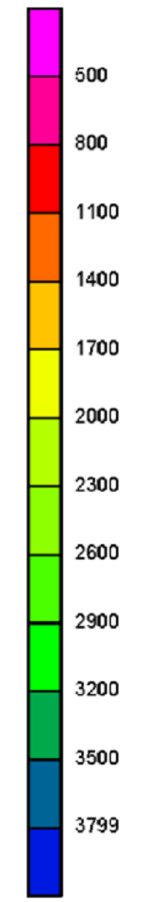
1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

Seismic Line Locations
Anthem Winery
3454 Redwood Road

LOCATION: Napa, California	
CLIENT: Ryan Geological Consulting, Inc.	FIGURE
PROJECT #: 18-031-1CA	2
DATE: Apr 13, 2018	DRAWN BY: R. SMITH







SEISMIC LINE LOCATIONS

EXPLANATION

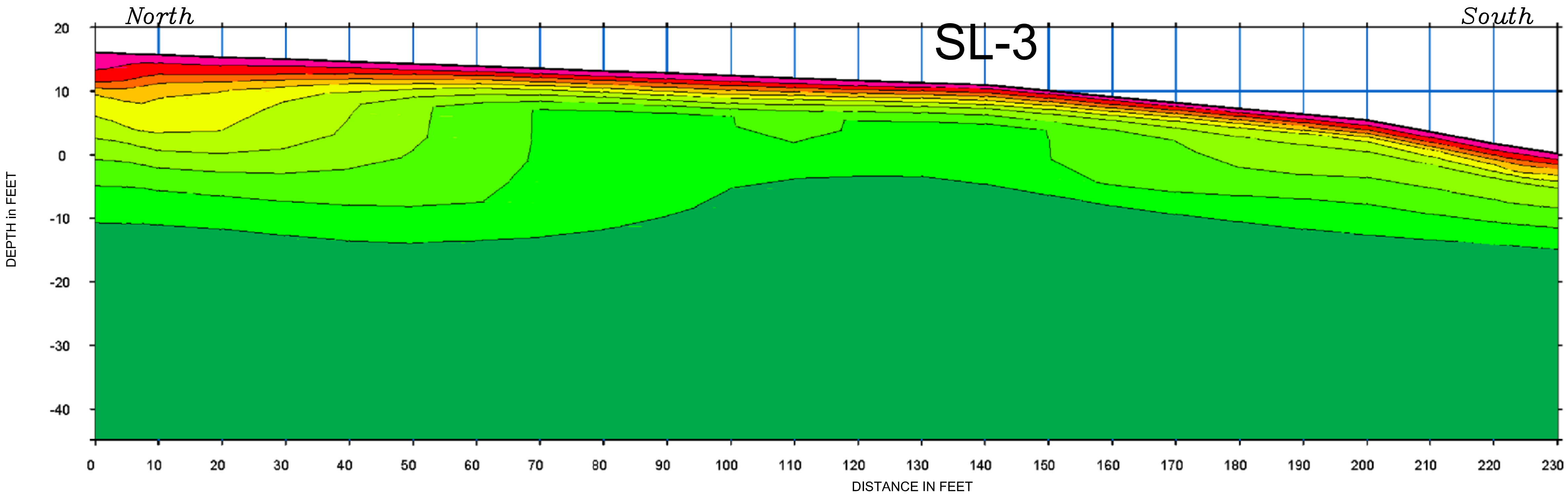
SL-1 SEISMIC LINE DESIGNATION

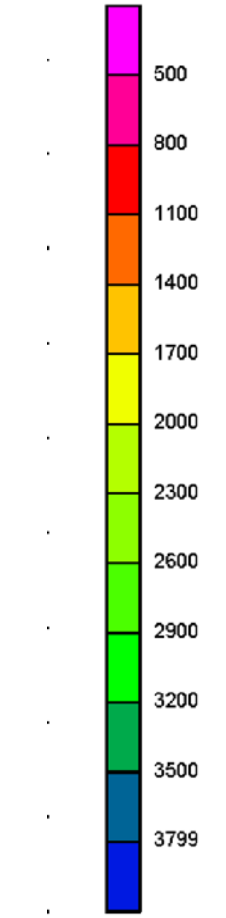
ADVANCED GEOLOGICAL SERVICES

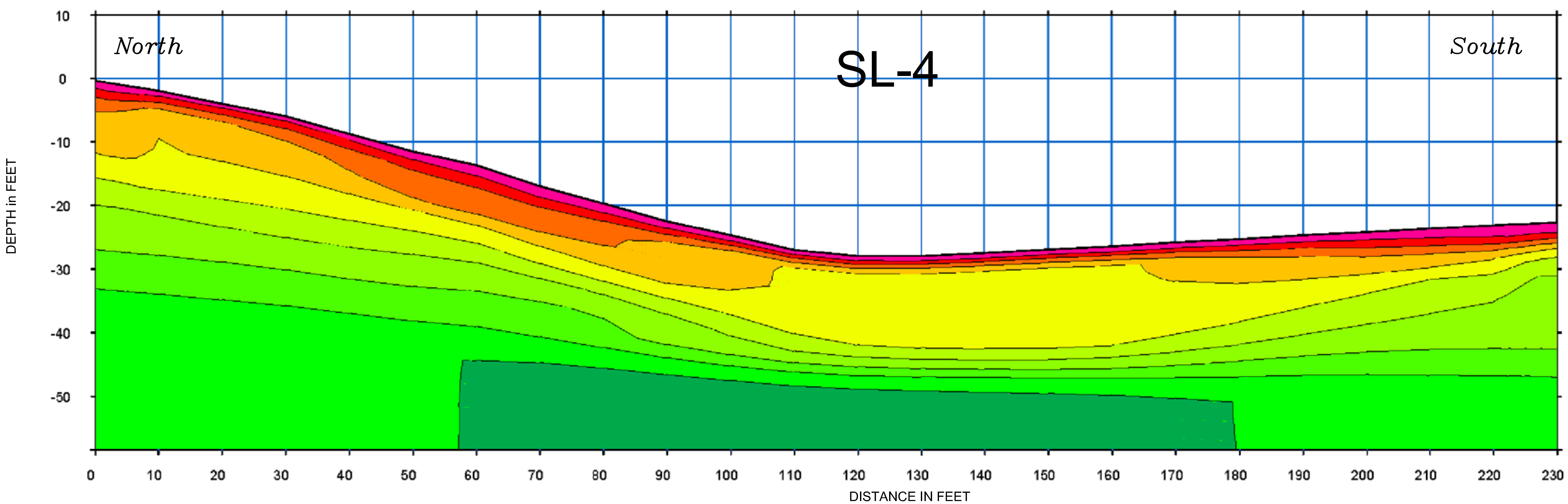
1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

Seismic Refraction Survey Results
SL-1, SL-2
Anthem Winery

LOCATION: Napa, California	
CLIENT: Ryan Geological Consulting, Inc.	FIGURE
PROJECT #: 18-031-1CA	3
DATE: Apr 13, 2018	DRAWN BY: R. SMITH







SEISMIC LINE LOCATIONS

EXPLANATION

SL-3 SEISMIC LINE DESIGNATION

ADVANCED GEOLOGICAL SERVICES

1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

Seismic Refraction Survey Results
SL-3, SL-4
Anthem Winery

LOCATION: Napa, California

CLIENT: Ryan Geological Consulting, Inc.

PROJECT #: 18-031-1CA

DATE: Apr 13, 2018 DRAWN BY: R. SMITH

FIGURE 4

APPENDIX A

SEISMIC VELOCITY AND LIMITATIONS OF THE REFRACTION METHOD

The physical properties of earth materials (fill, sediment, rock) such as compaction, density, hardness, and induration dictate the corresponding seismic velocity of the material. Additionally, other factors such as bedding, fracturing, weathering, and saturation can also affect seismic velocity. In general, low velocities indicate loose soil, poorly compacted fill material, poorly to semi-consolidated sediments, deeply weathered, and highly fractured rock. Conversely, high velocities are indicative of competent rock or dense and highly compacted sediments and fill. The highest velocities are measured in unweathered and little fractured rock.

There are certain limitations associated with the seismic refraction method as applied for this investigation. These limitations are primarily based on assumptions that are made by the data analysis routine. The data analysis routine assumes that the velocities along the length of each spread are uniform. If there are localized zones within each layer where the velocities are higher or lower than indicated, the analysis routine will interpret these zones as changes in the surface topography of the underlying layer. A zone of higher velocity material would be interpreted as a low in the surface of the underlying layer. Zones of lower velocity material would be interpreted as a high in the underlying layer. The data analysis routine also assumes that the velocity of subsurface materials increase with depth. Therefore, if a layer exhibits velocities that are slower than those of the material above it, the slower layer will not be resolved. Also, a velocity layer may simply be too thin to be detected.

The quality of the field data is critical to the construction of an accurate depth and velocity profile. Strong, clear “first-break” information from refracted interfaces will make the data processing, analysis, and interpretation much more accurate and meaningful. Vibrational noise or poor subsurface conditions can decrease the ability to accurately locate and pick seismic waves from the interfaces.

Due to these and other limitations inherent to the seismic refraction method, resultant velocity cross-sections should be considered only as approximations of the subsurface conditions. The actual conditions may vary locally.

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RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS
16 Southwood Drive
Orinda, CA 94563
510-520-5592

FAULT INVESTIGATION REPORT
ANTHEM WINERY AND VINEYARDS, LLC
3454 REDWOOD ROAD
NAPA, CALIFORNIA

February 7, 2015
Job No. 1210.100

TABLE OF CONTENTS

LIST OF FIGURES

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS
16 Southwood Drive
Orinda, CA 94563
510-520-5592

February 7, 2015
Job No. 1210.100

Mrs. Julie Arbuckle
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California 94558

Subject: Fault Investigation Report
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

Dear Mrs. Arbuckle:

1.0 INTRODUCTION

This report presents the results of our fault investigation for the proposed winery buildings at your Anthem Winery and Vineyards, LLC property located at 3454 Redwood Road in Napa, California. The approximate location of the site is shown on the attached Vicinity Map, Figure 1. Based on our discussion with you and observations at the site, we understand that several ground cracks were observed following the earthquake that occurred on August 24, 2014.

We were provided plans prepared by Becken, Gillam, Kroger Architects, dated July 29, 2014 that shows proposed improvements. Based on the plans, we understand that two 4,350 square feet fermentation buildings a kitchen and office building are planned in the undeveloped area in the northern portion of the site at the approximate locations shown on the Site Plan, Figure 2. This report addresses the potential for surface fault rupture at the location of the proposed buildings.

The site is not located within a current State of California designated Earthquake Fault Zone for active faults; however, due to the occurrence of ground cracks after the August 24, 2014 earthquake, we conducted this study as if it were within a State designated Alquist-Priolo Earthquake Fault Zone and in accordance with State of California Note 49, Guidelines for evaluating the hazard of surface fault rupture.

2.0 AUGUST 24, 2014 SOUTH NAPA EARTHQUAKE

On August 24, 2014, at about 3:20 am (PDT) an earthquake measuring magnitude 6.0 occurred in the northern San Francisco Bay Area. The U.S. Geological Survey plots the earthquake epicenter about 6 miles southwest of the Town of Napa, California and refers to the event as the “South Napa Earthquake”. Strong ground motions from the earthquake caused damage to several older buildings in the downtown area, deformed roadways and pipelines and damaged homes. Several sets of ground cracks were observed along the ridgelines between Dry Creek Road and Redwood Road. The approximate location of the epicenter from the August 24, 2014 Mw[1] 6.0 South Napa Earthquake is shown on the Quaternary Fault Map on Figure 3.

The special report prepared for the South Napa earthquake by the Earthquake Engineering Research Institute (EERI) provides a map of "observed and inferred" surface fault rupture from the August 24, 2014 South Napa earthquake. The map shows a "Western Strand" that extends from Cuttings Warf in the south to just north of Redwood Road near the intersection with Dry Creek Road. An "Eastern Strand" is shown extending from just south of Old Sonoma Road, through Browns Valley and along the west side of Alston Park. The report also shows shorter strands in Browns Valley and near the Napa Airport. Earthquake epicenters for the main event and associated aftershocks were located on the "Western Strand" defined in the EERI report. There were no epicenters plotted on the "Eastern Strand". North of Alston Park, the eastern strand continues with the designation "*probable tectonic rupture from UAVSAR[2] lineament, unverified by field teams".* The inferred northern end of the eastern strand projects through the hills near the eastern site boundary. We understand that the U.S. Geological Survey has the preliminary interpretation that the UAVSAR lineament may correlate with ground cracks observed near the eastern site boundary along the vineyard and cave entrance. If these ground cracks correlate with the UAVSAR lineament, the lineament would project through the fermentation buildings proposed in the northern portion of the site. The approximate location of the unverified UAVSAR lineament projected through the property is shown on the Site Plan, Figure 2.

3.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this project was to evaluate the potential for surface fault rupture in the vicinity of the proposed new winery buildings based on the location of ground cracks that appeared following the August 24, 2014 Mw 6.0 South Napa Earthquake. Specifically, we initiated an exploratory trenching program to get a decisive view of the near surface soil and bedrock conditions in order to evaluate the potential for surface fault rupture. Exploratory trenches were positioned to shadow the area of the proposed winery buildings and to cross the UAVSAR lineament. Our scope of services included the following tasks:

1. Mapping of ground cracks associated with the August 24, 2014 South Napa Earthquake.
2. Geologic research on the West Napa fault and geologic conditions near the site.
3. Review and interpretation of stereo-paired aerial photographs covering the site and vicinity.
4. Excavation and logging of 4 exploratory trenches.
5. Evaluation of the information collected as part of this project.
6. Preparation of this report summarizing the findings of our investigation.

---

[1] Earthquake magnitude is a measure to characterize earthquake size based on ground motions recorded by seismographs. The moment magnitude "Mw" is the magnitude based on the area of rupture, the average amount of slip and the forces needed to overcome frictional resistances of the rock mass.

[2] UAVSAR (uninhibited aerial vehicle synthetic aperture radar) detects small changes, up to about ½ inch, in the ground surface based on repeated flight lines over the same location.

4.0 FIELD INVESTIGATION

Our field investigation for this project was conducted between November 4 and 6, 2014. The field investigation consisted of site reconnaissance mapping of ground cracks and the excavation and logging of 4 exploratory trenches totaling about 280 lineal feet. During our site investigation, we mapped several sets of ground cracks at the site prior to positioning the trenches. Cracks were approximately located based on site maps and Google Earth GPS locating technology. The approximate locations of the ground cracks near the proposed winery buildings are shown on the Site Plan.

As mentioned in State guidelines provided in Note 49, the most useful and direct method for evaluating fault activity is observing a trench or road cut exposure, since these excavations allow for detailed and continuous observations of geologic materials and structures. Exploratory trenching is considered the most conclusive of all investigative techniques commonly used to evaluate the potential for surface fault rupture. We investigated the potential for surface fault rupture at the locations of the proposed buildings and the location of the UAVSAR lineament with exploratory trenching. Exploratory trenches were excavated up to about 8 feet deep by Binstock Engineering out of Napa, California using a rubber-tired backhoe. Both the north and south trench walls were cleaned by geologists using hand picking tools to identify any potential fault-related features. The south wall of trench exposures were graphically logged by an engineering geologist in the field at a scale of 1 inch equals 5 feet. Soil and bedrock colors noted on the logs were best fit to the Munsel Soil Color Chart and the Rock Color Chart published by the Geological Society of America (GSA). Trenches were loosely backfilled at the completion of logging. Some settlement and rutting should be expected. The approximate locations of the trenches are shown on the Site Plan, Figure 2, Trench logs are provided in the Appendix.

5.0 FINDINGS

5.1 SITE DESCRIPTION

The site is located at 3454 Redwood Road in Napa, California at the approximate location shown on the Vicinity Map. The property is considered a ridgetop hillside property with a peak elevation of about 450 feet Mean Sea Level. The majority of the site is covered with vineyards. A residential structure located in the center of the property. Two water tanks are located in the northern portion of the property, one at the north end of the vineyard and another in the dense brush to the north in the northern portion of the property. The proposed new winery buildings are situated in the northern portion of the property in an area of dense brush and shrubs at the approximate locations shown on the Site Plan.

5.3 SITE OBSERVATIONS

During our field investigation we made a reconnaissance around the property to map surface cracks from the August 24, 2014 South Napa Earthquake. We mapped surface cracks at the site based on visual observations in the field. Surface cracks were mapped in the field based on measuring from existing features such as vineyard rows, fence lines and buildings. The approximate locations of surface cracks noted are shown on the Site Plan. Note that our efforts focused on the major cracks and cracks along the ridgeline that trend towards the proposed fermentation buildings, therefore, not all cracks were mapped or detected, the Site Plan shows selected cracks that were found relatively continuous for distances of more than about 25 feet. Additional cracks in the asphalt pavement were noted although the majority appeared typical shaking related cracking of thin brittle hardscape.

We observed several sets of ground cracks at the site, the most prominent were along the ridgeline, trending between the driveway near the existing residence, northward through the wood shed and to the water tank at the north end of the vineyard and project through the location of proposed Fermentation Building 1. This set of surface cracks included a set of 3 right-stepping fissures, each with up to an inch of dilation[3]. Right-lateral displacement could not be demonstrated. Based on surface observations, portions of the surface cracks appear to align with trench backfill for utility lines between the wood shed and water tank to the north. The crack that trends between the two water tanks is along trench backfill for a water pipe. The second most dominant set of cracks was located in the vineyards on the east side of the ridge, generally downslope of the existing residence. These cracks extended from offsite near the lawn area in the southeastern portion of the site, through the vineyards and died out below the existing residence. They are characterized by short discontinuous cracks with up to an inch of dilation. Right-lateral displacement could not be demonstrated. Although these cracks did not continue north past the center of the site, they would project through the proposed buildings.

Shorter segments of cracks were located along the eastern property boundary below the residence. We understand that this set of cracks may align with the UAVSAR lineament inferred at the northern end of the 2014 rupture zone. The cracks trends towards the entrance to the wine cave in the northeastern portion of the site where the asphalt curb was cracked and offset about ¼ inch. Concrete near the cave entrance was also cracked. This set of cracks would project through the proposed new buildings.

Additional semi-continuous cracks with up to an inch of dilation and no right-lateral offset were noted on the west-facing hillslope below the ridgeline. These cracks were oriented such that they do not impact the proposed buildings and therefore we noted their location but did not investigate the subsurface conditions.

5.3 REGIONAL GEOLOGY, FAULTING AND SEISMICITY

5.3.1 Geologic Conditions

The site is located in the Coast Ranges geomorphic province[4] of California. The Coast Ranges are characterized by a series of northwest trending folded and faulted mountain chains and intervening valleys. Folding and faulting of the region is generally the result of relative motions between the Pacific and North American tectonic plates. The boundary between these two plates is generally considered to be the San Andreas fault, although in the Bay Area, plate boundary deformation is distributed across a

[3] Referring to dilation of a surface crack means the crack opened up in a direction perpendicular to the orientation of the crack, demonstrating opening without lateral offset.
[4] The State of California is divided into 12 geomorphic provinces based on landform, geologic processes and geomorphic conditions.

broad network of subparallel faults and fault zones. The majority of deformation is believed to have occurred during the past few million years.

In this portion of the province, the site is located along a northwest trending ridgeline bordering the west side of Napa Valley. Regional geologic maps covering the site by the California Geological Survey[5] (Wagner and Gutierrez, 2010; Clahan *et al*, 2004) and by the USGS (Fox *et al*, 1973; Helley and Herd, 1977) show the site to be underlain by sedimentary bedrock units of the Great Valley Sequence. The Great Valley Sequence is a series of sediments that accumulated in a shallow sea during the Early Cretaceous to Late Jurassic Periods of geologic time, roughly 65 to 150 million years before present. The bedrock in this formation consists of brown to gray beds of sandstone siltstone and claystone with pebble-rich conglomerate beds throughout. The bedrock units are generally moderately to highly weathered, weak to strong and highly fractured. The thickness of individual beds ranges from millimeters in the siltstone and claystone beds to several feet in the sandstone beds.

The above-mentioned geologic maps show a thin band of Domengine Sandstone along the drainage for Redwood Creek, although they each have the contact in slightly different locations. The Domengine Sandstone consists of thick beds of moderately strong to strong sandstone, siltstone and claystone that were deposited During the Eocene epoch of geologic time, roughly 33.9 to 56 million years before present. The contact between the Great Valley Sequence rocks and the Domengine Sandstone is shown as a fault contact on all the above-mentioned geologic maps. The contact is generally shown on the regional maps passing through the center to western portion of the site. Portions of the geologic map prepared by the State of California (Clahan *et al*, 2004) and by the U.S. Geological Survey (Sims *et al*, 1973) are provided on Figures 4 and 5 respectively.

5.3.2 Faulting

According to the State of California, an active fault is defined as a fault that has demonstrated activity within the Holocene Epoch of geologic time, within the past roughly 11,700 years. Similarly, potentially active faults are those that have demonstrated activity with the Pleistocene Epoch of geologic time, roughly 11,700 to 1.5 million years before present. The Alquist-Priolo Earthquake Fault Zoning Act indicates that faults are to be zoned for special studies where the fault is “sufficiently active” and “sufficiently well-defined”. The closest known fault is the West Napa fault zone as discussed in this report. The State of California seismic hazards zonation program compiles fault information and evaluates fault activity for zonation in accordance with the Alquist-Priolo Act. The West Napa fault was evaluated in 1982 as part of Fault Evaluation Report 129 (FER-129) which recommended the current earthquake fault zone limits. According to FER-129, the West Napa fault is active and sufficiently well-defined in the southern reaches between the Napa Airport and the Carquinez Straits and is zoned accordingly. North of the Napa Airport, the fault is not well-defined and Holocene activity has not been sufficiently demonstrated. Therefore, the northern section of the West Napa fault, along the western boundary of the Napa Valley, has not been zoned for special studies in accordance with the Alquist-Priolo Act.

[5] The California Geological Survey (CGS) was formerly known as the California Division of Mines and Geology (CDMG).

In general, the West Napa fault zone is a roughly 56 kilometer long, right-lateral strike-slip fault zone that extends from the Carquinez straits to just west of Town of St Helena. The fault zone included several short segments of branch faults and subparallel fault splays that bound the western margin of a deep Tertiary to Quaternary aged basin now known as Napa Valley (Wesling and Hanson, 2008). Displacement along the fault zone is right-lateral strike slip with a significant down to the east vertical component. The surface expression of the fault includes offset drainage courses, east-facing scarps, linear drainages and apparent geomorphic lineaments such as saddles and linear breaks in slope. The fault zone defined in the Quaternary Fault and Fold Database[6] maintained by the U.S. Geological Survey is shown on Figure 3 for reference. The database shows a fault along the flank of the ridgeline on the east side of Redwood Creek, generally passing through the site. The fault is designated as Quaternary, less than 1.6 million years. The database also shows a Late Quaternary fault, less than 1.3 million years, at the base of the hills along the west side of Napa Valley near Alston Park. The Quaternary faults in the database are shown on Figure 3.

The southern portion of the West Napa fault, South of the Napa Airport, is well-defined as it cuts through alluvial deposits at the ground surface. To the north, the fault deformation appears to be distributed into several smaller discontinuous branch fault splays where it encounters the relatively hard volcanic and sedimentary bedrock underlying the hills along the west side of Napa Valley. The main trace of the West Napa fault is believed to run along the base of the hills on the west side of the Napa Valley with smaller secondary fault splays are interpreted further to the west in the hills and along the west side of Congress Valley and along Redwood Road and into the Maacamas Mountains. The West Napa fault is considered a second order fault in the greater San Francisco Bay Area fault hazard scenario with a relatively low slip rate on the order of about 1 to 4 millimeters per year. Other known active faults in the region that impact the seismicity of the site include, but are not limited to, those listed in the following table.

Table. Regional Fault Information

Fault Segment	Distance from Site (miles)	Direction from Site	Mean Moment Magnitude (Mw)
Green Valley fault	8½	East	6.80
Cordelia fault	13	Southeast	
West Napa fault Napa Airport Segment	8¼	South	6.70
Rodgers Creek fault South end	10½	Southwest	7.07
Hayward fault Northern Segment	20½	Southwest	6.6

[6] The Quaternary Fault and Fold Database located at http://earthquake.usgs.gov/hazards/qfaults/ provides information and interactive maps of faults believed to have been active during the Quaternary Period of geologic time, within the past 1.6 million years.

Fault Segment	Distance from Site (miles)	Direction from Site	Mean Moment Magnitude (Mw)
Hayward fault Southern Segment	44	Southeast	6.78
Concord fault	15	East	6.25
San Andreas fault North Coast Segment	31	Southwest	7.51
San Andreas fault 1906 Rupture/Peninsula Segment	38½	Southwest	7.23
San Gregorio Fault Zone Northern end	58	Southwest	7.50
Calaveras fault Northern end	41	Southeast	6.8
Greenville Fault Zone Clayton Segment	32	Southeast	6.66
Greenville Fault Zone Marsh Creek-Greenville Segment	45	Southeast	7.00
San Andreas fault Santa Cruz Mountains Segment	78	South	7.12

Given the relatively high seismicity in the region, the site is expected to experience at least one moderate to large magnitude earthquake in the future. The Working Group on Earthquake Probabilities (2008) estimates there is a roughly 65% chance that the San Francisco Bay Area will experience a magnitude 6.7 (or greater) earthquake within in the next 30 years. Interactive probabilistic seismic analysis tools available at the California Geological Survey (CGS) website suggest peak ground accelerations (pga) with a 10% chance of being exceeded in the next 50 years of 0.451g should be expected at the site. Strong ground shaking from a major earthquake is a hazard that cannot be eliminated but the effects can be reduced by observation of sound construction practices and observance of current seismic design codes.

5.4 AERIAL PHOTOGRAPH INTERPRETATION

We reviewed 10 sets of stereo-paired aerial photographs covering the site vicinity between the years 1958 and 2005. Aerial photographs were obtained from the archive library at Photo Science Geospatial Solutions (formerly Pacific Aerial Surveys) in Novato, California. Aerial photographs were viewed by our engineering geologist using an Old Delft ODSII scanning stereo-scope. Since this was a study of the regional-scale evaluation of the fault conditions impacting the site, photographs were at a scale adequate to review the regional conditions.

From a regional standpoint, there appears to be a strong structural grain causing both Partricks Creek and Redwood Creek to made relatively sharp eastward bends before the join to form Napa Creek. Redwood Creek makes another sharp southeastward bend near the intersection of Redwood Road and Dry Creek Road. We annotated the locations of these creeks on Figure 3. The Quaternary faults which are also [approximately] shown, appear to correlate well with these major changes in flow direction of the drainage systems. The changes in orientation of these creeks suggest that there are multiple faults in the region, at least two of which appear to bind the east and west sides of the ridgeline underlying the site.

In general, we interpreted three photo-lineaments[7] in the aerial photographs that are near the site; however no one set of photographs were conclusive as the lineaments are vague except for the Alston Park lineament. The photo-lineaments were mapped based on geomorphology some apparent offset of stream channels as discussed below. It should be noted that mapping lineaments on aerial photographs does not necessarily mean the lineaments are reflecting of fault lines, subsurface trenching is needed to confirm the presence of a fault. The approximate locations of the photo-lineaments are shown on Figure 7 for reference. We used a copy of the 1984 photograph as the base for Figure 7 since it was the best reproducible image, not because it depicted conditions better than other photographs.

The western most of the photo-lineaments is along or just upslope of Redwood Creek, near the western site boundary. Redwood Creek is atypically linear along the base of the hills suggesting a structural control for the current creek alignment. Additionally, the hillside along the west flank of the ridge becomes very steep and linear near the tree line above the creek channel. It should also be noted that the geologic map on Figure 5 shows fault contacts bounding the Domengine Sandstone along the west flank of the ridge below the site. This photo-lineament may represent the bedrock fault contact between the two geologic units designated as Quaternary in the Fault and Fold database. Additionally, there are very weak indications of possible photo-lineaments upslope of the tree line which would be well within the site boundaries but not within the area of the proposed buildings.

There is another photo-lineament interpreted just below the east side of the ridgeline, east of the property boundary. This photo-lineament was based on the steep escarpment below the ridge and alignment of saddles. This photo-lineament does not correlate with any mapped fault shown on the regional maps. However, we understand that this photo-lineament my correlate with the UAVSAR lineament inferred near the site by the U.S. Geological Survey. We understand that preliminary interpretations of the UAVSAR lineament are that is bends westward through the site, however; our interpretation of the eastern photo-lineament would trend past the site to the east and connect with the sharp erosion feature to the northeast of the site. The approximate location of the UAVSAR lineament and our photo-lineaments are shown on Figure 7 for reference.

South of the site, the Alston Park escarpment is bold on the photographs and appears to be a fault feature. However the location does not impact development of the site and there is some debate with respect to the presence of a fault at that location based on recent research.

[7] A photo-lineament is a line of features interpreted on stereo-paired aerial photographs. Photo-lineaments related to faulting include linear valleys, aligned saddles or spur ridges, and sometimes sharp changes in vegetation. Not all photo-lineaments are reflective of faulting. Photo-lineaments also occur parallel to geologic structures due to differential erosion of individual beds.

5.5 TRENCH DESCRIPTIONS

We excavated and logged 4 exploratory trenches at the site. The purpose of the trenching was to evaluate the potential for surface fault rupture at the proposed buildings and to evaluate the subsurface conditions contributing to the observed surface cracking. The approximate locations of the exploratory trenches excavated for this project are shown on the Site Plan, Figure 2. General descriptions of the subsurface conditions encountered in the exploratory trenches are provided below. For detailed descriptions of the materials and structures, refer to the Trench Logs in the Appendix.

Trench T-1 was located in the northern portion of the site ranging up to about 8 feet deep and approximately 240 feet long. The trench was positioned to cross the projection of surface cracks that trend towards the proposed fermentation buildings and to shadow the building footprints plus some buffer. The UAVSAR lineament projects through the center of the trench as shown on the Site Plan. Minor surface cracks were noted on the north side of the water tank prior to trenching but were not detected in the trench walls during logging. We did encounter trench backfill for a waterline at station 1+90 that connects the two water tanks. The water line trench backfill coincides with the location of the crack between the water tanks that was noted prior to trenching. Below a typical soil cover of about 18 to 24 inches thick, continuously bedded sedimentary bedrock units of the Great Valley Sequence were exposed for the entire length of the trench. The bedrock units were found thinly bedded oriented[8] between N20W and N30W dipping to the southwest at inclinations between 23 and 37 degrees. Indications of faulting were not observed in the bedrock. Flexural slip and tight internal folding was observed at Station 0+95.

Trench T-2 was located across the major crack set along the ridgeline that trend from the driveway, through the wood shed and water tank and to the location of Fermentation Building 1. The trench was about 15 feet long and 5 feet deep on the south side of the wood shed. At that location, the trench crossed a set of surface cracks that were dilated up to 2 inches wide. The dilation of the cracks appeared to be somewhat exacerbated by the presence of 18-inches of artificial fill at the ground surface. All surface cracks diminished at the base of the blocky residual soils overlying claystone bedrock. Below the cracks, the claystone was near vertically bedded. Indications of faulting were not encountered.

Trench T-3 was located in the southern portion of the property where the major ridgeline crack set enters the property. Surface cracks between ½ and ¾ inch wide were observed extending down to near the base of the residual soils but not into the underlying steeply dipping claystone bedrock, similar to the conditions in Trench T-2. Indications of faulting were not observed.

Trench T-4 was located along the eastern property boundary across a surface crack that may correlate with the UAVSAR lineament. At that location the surface crack was about ½ inch wide and extended to a

[8] The orientation of geologic structures such as bedding planes, fractures and faults are commonly measured based on the intersection between feature and the horizontal plane referred to as the "strike line" and the "dip" which refers to the maximum steepest angle down perpendicular from the strike line.

depth of about 1½ to 2 feet at most. The underlying claystone bedrock was found dipping steeply to the southwest. Indications of faulting were not encountered.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our investigation of site conditions, we judge that from a geologic hazard standpoint, construction of the proposed buildings is feasible as planned. We did not encounter evidence for an active fault crossing through the northeastern portion of the site in our exploratory trenches that were excavated at the site. Trench T-1 was positioned to shadow the footprint of both fermentation buildings as well as the proposed kitchen and office buildings. Additionally, Trench T-1 crosses the UAVSAR lineament. We did not encounter evidence of faulting in Trench T-1 or in the other 3 trenches excavated at the site. Therefore, setbacks from active faults or end of trench setbacks for those buildings are not needed. The potential for surface fault rupture at the proposed buildings is low.

There has been a significant amount of surface cracking and deformation along the ridgeline upon which the property is located. However, trench evidence indicates the cracks are not related to active fault movement and are more likely the result of ridgetop spreading and shattering[9], a secondary geologic hazard resulting from very strong ground shaking. Similar deformation was observed in the San Gabriel Mountains following the 1994 Northridge earthquake, in the Santa Cruz Mountains following the 1989 Loma Prieta event, and to a lesser degree, following the 1971 San Fernando Valley earthquake. Based on similar observations in the area following the recent South Napa Earthquake, we believe that the deformation observed at the site is the result of ridgetop spreading and shattering.

Based on our observations elsewhere on the ridges bordering the west side of Napa Valley, ridgetop spreading and shattering typically occurs when bedding of the rock layers are very steep to near vertical. At the site, Trenches T-2, T-3 and T-4 all encountered steeply dipping bedrock structure below the fissures. Trench T-1 did not encounter steep bedding and the ground surface only had a fissure along trench backfill for a water pipe. Therefore, where bedrock structure is steep to near vertical, ridgetop spreading and shattering causing fissures at the ground surface should be expected. Where the site is underlain by relatively flat bedding planes, ridgetop spreading and shattering is not expected. This is largely due to flexural slip[10] causing some adjustment of the steep bedding planes. Additionally, the thinly bedded nature of the rock mass would allow for some dilation and contraction of the rock mass along the bedding planes as the concentrated seismic energy exits the ridge.

It should be noted that regional information suggests there is a fault crossing through the property; however, based on the exploratory trenching performed as part of this study, there are no active or potentially faults that cross through the area if the proposed buildings. The U.S. Geological Survey may

[9] Ridgetop spreading and shattering occurs as linear fault-like fissures in the soils when seismic vibrations are amplified and focused on the crest if a steep narrow ridge. Ridgetop spreading and shattering typically occurs on narrow ridges less than about 300 feet wide bordered by moderately steep slopes.

[10] Flexural slip refers to internal adjustments or slip between individual bedding planes resulting from tectonic stresses. Flexural slip is most common along major geologic contacts and in clay-rich bedrock formations.

infer a fault near the eastern property boundary based on the UAVSAR lineament. While the lineament inferred at the northern end of the 2014 rupture may connect with tectonic rupture to the south, exploratory trenches excavated at the site indicate that an active fault does not breach the ground surface where the new buildings are planned at the site. Additionally, we did not encounter evidence for a fault at the location where the U.S. Geological Survey preliminarily interprets the UAVSAR lineament to cross the property.

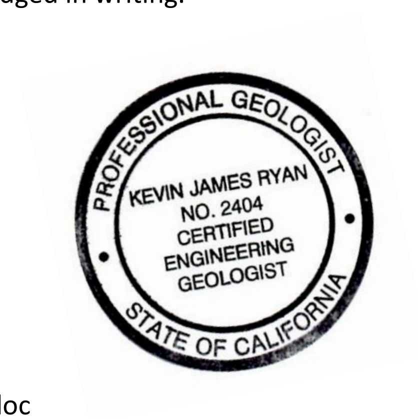
Regional geologic maps suggest a fault along the base of the hillside above Redwood Creek near the western photo-lineament discussed above. This fault may cross through the western portion of the property, beyond the area of proposed buildings. Additional evidence suggesting a fault in the western portion of the property is the structure shown on regional geologic maps. Regional geologic maps show a fault at the contact between the Domengine Sandstone and Great Valley Sequence bedrock units. The Sims *et al* (1973) geologic map shows bedding within the Domengine Sandstone as steeply dipping to the northeast. Our trenches encountered bedding in the Great Valley Sequence dipping to the southwest. Therefore, there appears to be a major structural unconformity between the Domengine and Great Valley which is mapped as a bedrock fault. Activity along this bedrock fault has not been established and was not evaluated as part of this project since is does not cross close to the proposed winery buildings. This fault would be the Quaternary (less than 1.6 million years) fault listed in the Fault and Fold Database.

7.0 LIMITATIONS

The results of this investigation report are based upon the information provided to us regarding site improvements, the findings of our field investigation and literature review, experience with similar projects and professional judgment. This project has been conducted in accordance with currently accepted engineering geologic standards only; no other warranty is expressed or implied. The site conditions and locations of features discussed in the text of the report are those that existed at the time of our field visits in November 2014 and are not necessarily representative of other features, locations or times. If the subsurface conditions encountered during any excavation or construction activities vary from those interpreted in this report, our firm should be contacted to review the conditions for any changes in our recommendations. The review would be acknowledged in writing.

Respectfully submitted,
RYAN GEOLOGICAL CONSULTING,

Kevin James Ryan, P.G., C.E.G.
Principal Engineering Geologist



Copies: (1 pdf via email, 3 via standard mail)

RGC/Anthem Winery fault investigation report 2.7.15.doc

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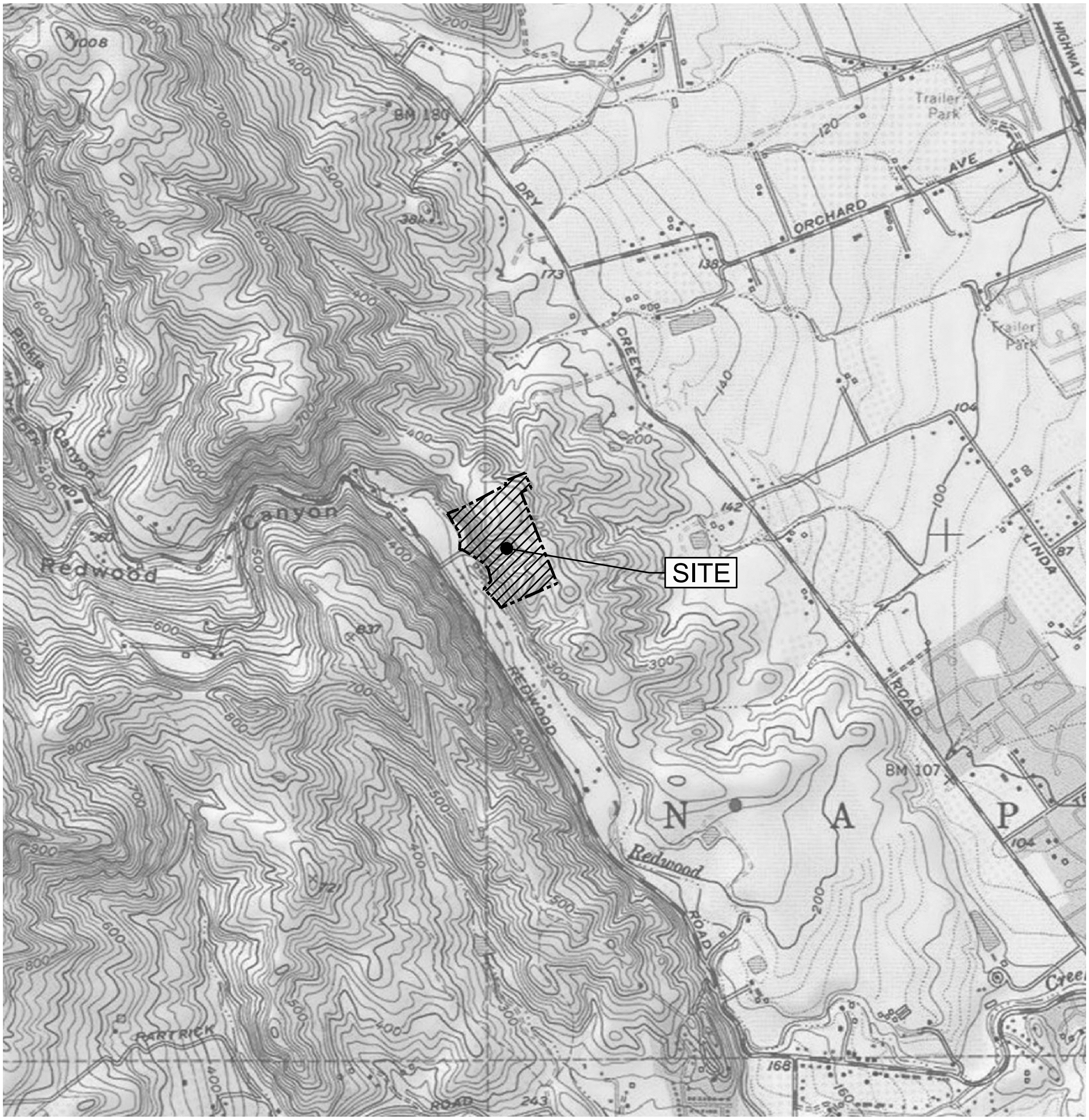
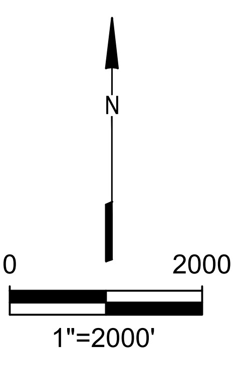
AERIAL PHOTOGRAPHS

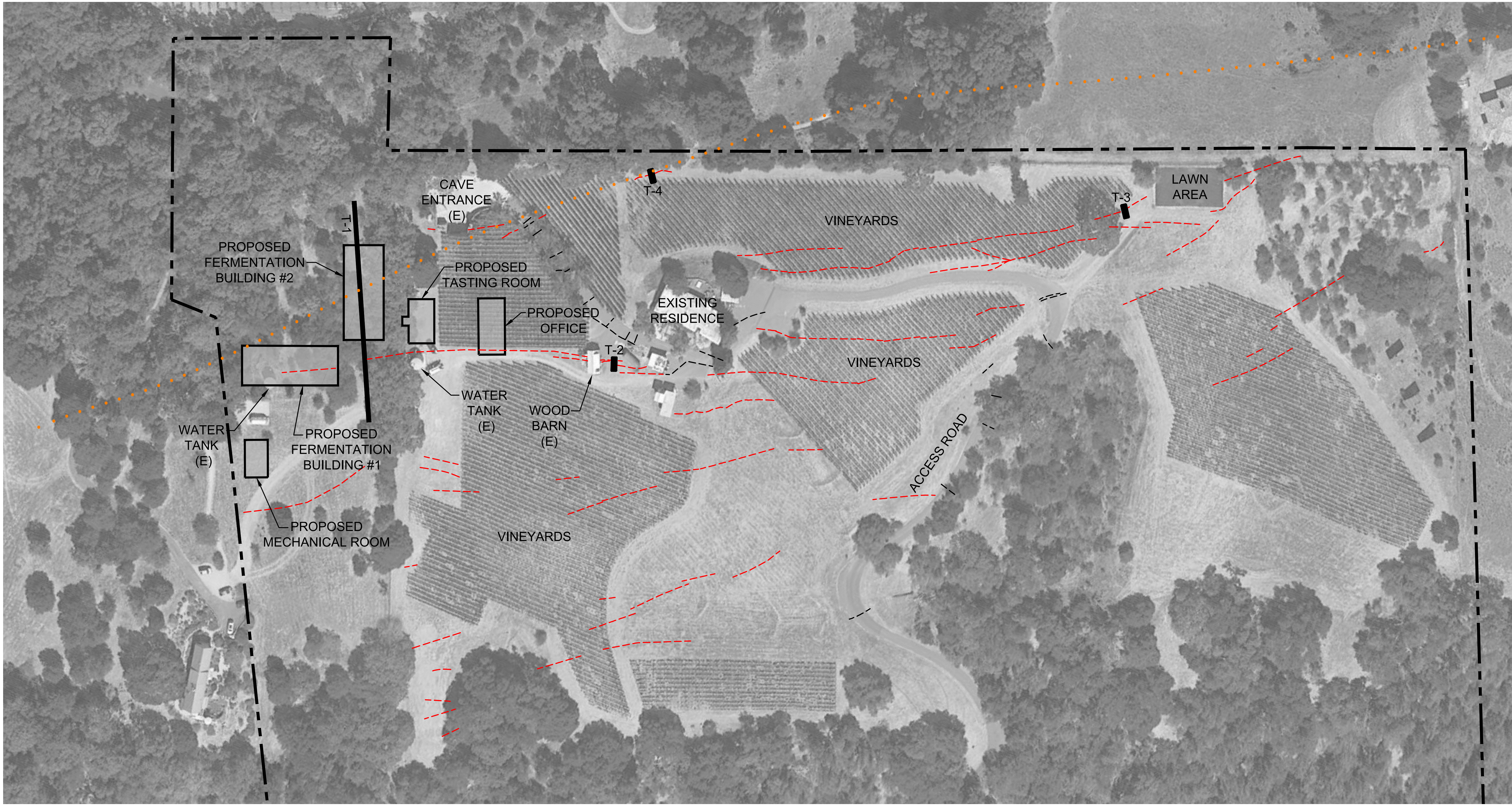
FILM ID	FLIGHT LINE	FRAMES	NOMINAL SCALE	DATE FLOWN
KAV 8930	12	24,24	1:15,000	2-3-05
NAP CIR 6017	206	15,16	1:12,000	9-4-98
CIR5235	5	43,44	1:12,000	9-5-96
CIR4262	5	3,4	1:12,000	5-5-92
AV 3306	30	44,45,46	1:9,600	7-8-88
AV 2475	1	4,5	1:12,000	5-17-84
AV 1215	07	8,9	1:54,000	9-4-75
AV 965	06	10,11	1:48,000	9-8-70
AV 710	07	8,9,10	1:36,000	4-20-66
AV 550	6	3,4	1:36,000	7-9-63





BASE: PORTIONS OF U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE, NAPA, CALIFORNIA AT A SCALE OF 1:24,000.

VICINITY MAP		
Fault Investigation Report **Anthem Winery and Vineyards, LLC** 3454 Redwood Road Napa, California		
DATE: 2-7-15	Project No. 1210.100	Figure 1
RYAN GEO*LOGICAL* CONSULTING, INC. ***PROVIDING LOGICAL GEOLOGICAL SOLUTIONS***		



EXPLANATION

APPROXIMATE PROPERTY BOUNDARY

T-4 APPROXIMATE TRENCH LOCATION

APPROXIMATE SURFACE CRACKS

APPROXIMATE CRACKS IN ASPHALT PAVEMENT

APPROXIMATE LOCATION OF INFERRED UAVSAR LINAMENT

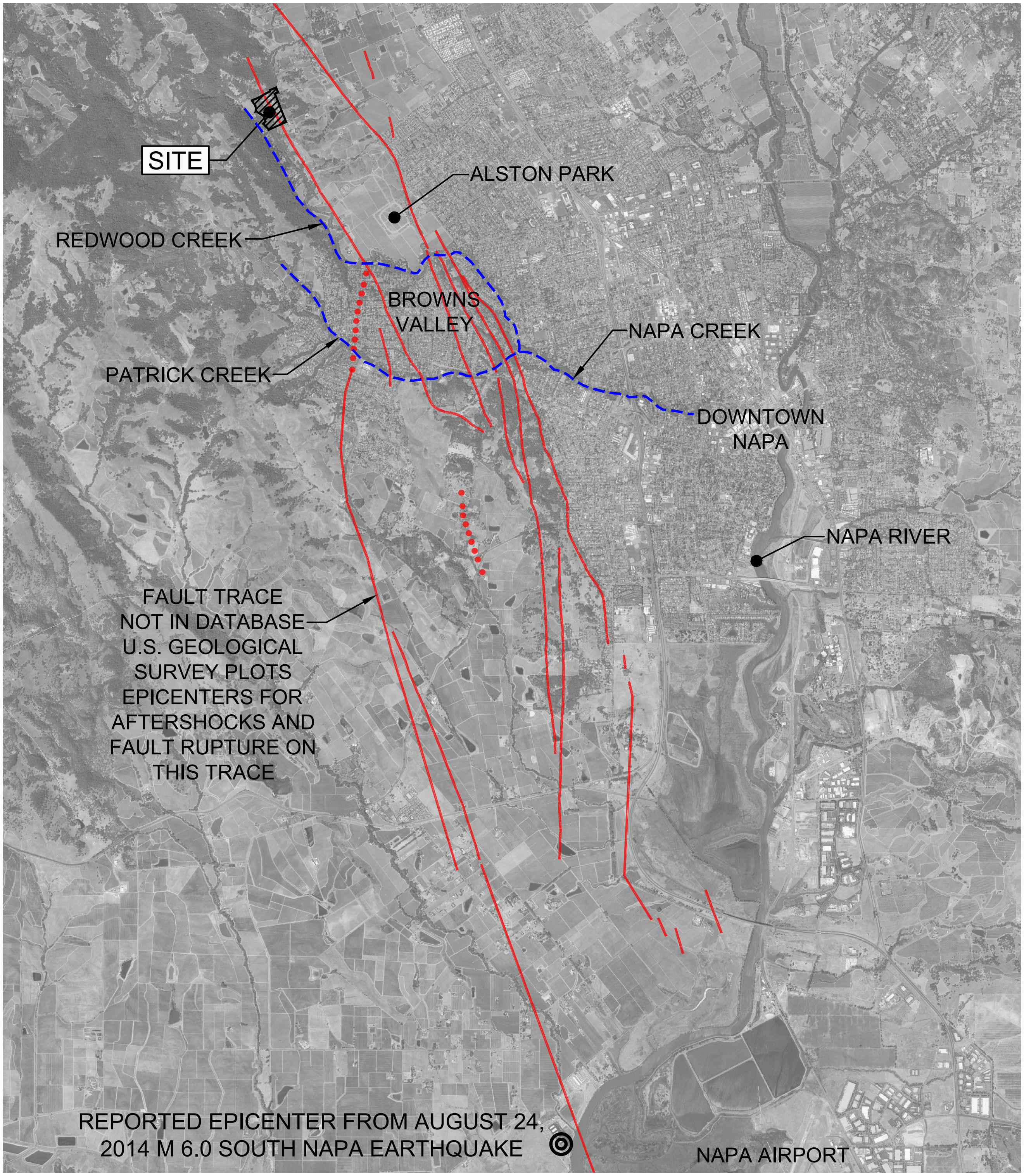
APPROXIMATE PROPOSED BUILDING LOCATION

SITE PLAN

Fault Investigation Report
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 2-7-15	Project No. 1210.100	Figure 2

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS



EXPLANATION

QUATERNARY FAULT TRACES IN THE DATABASE FOR FAULT NO. 36A

SELECTED DRAINAGES DISCUSSED IN TEXT

N

0 6000

1"=6000'

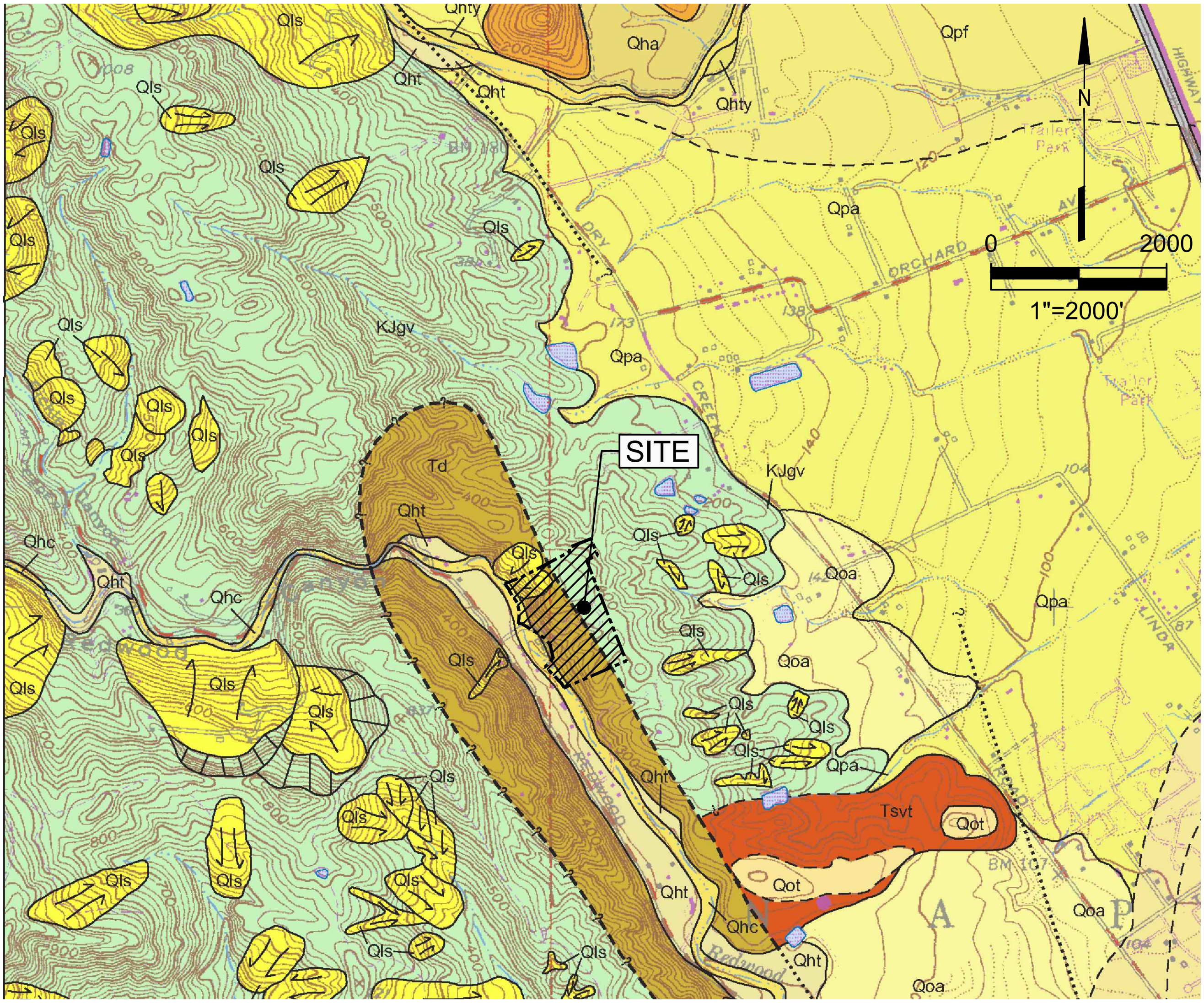
BASE: BRYANT, W.A., COMPILER, 2000, FAULT NUMBER 36A, WEST NAPA FAULT, BROWNS VALLEY SECTION, IN QUATERNARY FAULT AND FOLD DATABASE OF THE UNITED STATES: U.S. GEOLOGICAL SURVEY WEBSITE, HTTP://EARTHQUAKES.USGS.GOV/HAZARDS/QFAULTS

QUATERNARY FAULT MAP

Fault Investigation Report
Anthem Winery and Vineyards, LLC
3454 Redwood Road
Napa, California

DATE: 2-7-15	Project No. 1210.100	Figure 3

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS



EXPLANATION

CONTACT BETWEEN MAP UNITS - SOLID WHERE ACCURATELY LOCATED, DASHED HERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED, QUERIED WHERE UNCERTAIN

FAULT - SOLID WHERE ACCURATELY LOCATED, DASHED WHERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED, QUIVERED WHERE UNCERTAIN

Q□c — STREAM CHANNEL DEPOSITS (LATEST HOLOCENE □1,000 YEARS) - DEPOSITS IN ACTIVE, NATURAL STREAM CHANNELS, CONSISTS OF LOOSE ALLUVIAL SAND, GRAVEL, AND SILT

Q□t — STREAM TERRACE DEPOSITS (HOLOCENE □10,000 YEARS) - STREAM TERRACES DEPOSITED AS POINT BAR AND OVERBANK DEPOSITS, COMPOSED OF MODERATELY TO WELL-SORTED AND BEDDED SAND, GRAVEL, SILT, AND MINOR CLAY

Qpa — ALLUVIUM, UNDIVIDED (LATEST PLEISTOCENE) - ALLUVIAL FAN, STREAM TERRACE, BASIN, AND CHANNEL DEPOSITS, COMPOSED OF POORLY TO MODERATELY SORTED SAND, SILT, CLAY, AND GRAVEL

Qoa — ALLUVIUM (EARLY TO LATE PLEISTOCENE) - COMPOSED OF CONSOLIDATED SAND, SILT, CLAY, AND GRAVEL. TOPOGRAPHY IS MODERATELY ROLLING WITH LITTLE OR NO ORIGINAL ALLUVIAL SURFACES PRESERVED, DEEPLY DISSECTED

Ql□ — LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE) - INCLUDES DEBRIS FLOWS AND BLOCK SLIDES

Td — DOMENGINE SANDSTONE (LATE EOCENE OR EARLY MIOCENE) - BROWN QUARTZO-FELSPATHIC SANDSTONE WITH MINOR THIN CLAYSTONE INTERBEDS

KJg□ — GREAT VALLEY SEQUENCE (EARLY CRETACEOUS AND LATE JURASSIC) - SANDSTONE, PEBBLE CONGLOMERATE, SILTSTONE, AND SHALE

BASE: CLAHAN, K.B., WAGNER, D.L., SAUCEDO, G.J., RANDOLPH-LOAR, C.E. AND SOWERS, J.M., 2004, GEOLOGIC MAP OF THE NAPA 7.5' QUADRANGLE, NAPA COUNTY, CALIFORNIA: CALIFORNIA GEOLOGICAL SURVEY.

REGIONAL GEOLOGIC MAP
CLAHAN et al, 2004

Fault Investigation Report
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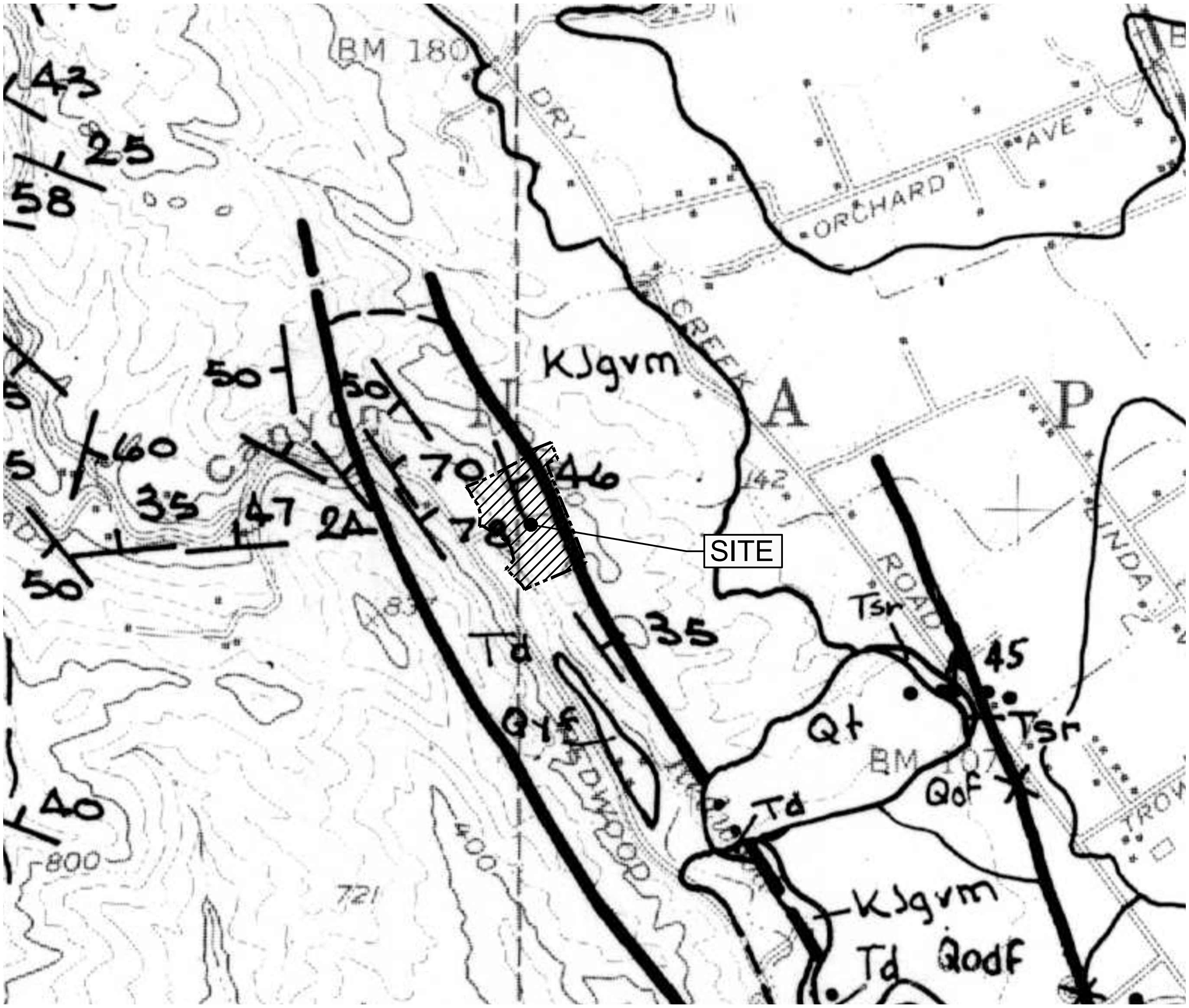
Napa, California

DATE: 2-7-15	Project No. 1210.100	Figure 4

RYAN GEO*LOGICAL* CONSULTING, INC.
PROVIDING LOGICAL GEOLOGICAL SOLUTIONS



EXPLANATION

CONTACT - LONG DASHED WHERE UNCERTAIN□SHORT DASHED WHERE GRADATIONAL, DOTTED WHERE CONCEALED

FAULT - LONG DASHED WHERE APPROXIMATELY LOCATED, SHORT DASHED WHERE UNCERTAIN, DOTTED WHERE CONCEALED

STRIKE AND DIP OF BEDDING

Qt — TERRACE DEPOSITS□GRAVEL, SAND, SILT, AND CLAY

Q□f — ALLUVIAL FAN DEPOSITS GRADING HEADWARD TO TERRACE DEPOSITS, INCISED IN UNIT Qof

Qof — ALLUVIAL FAN DEPOSITS BORDERING UPLANDS□HEADS OF FANS INCISED BY CHANNELS PARTLY FILLED BY TERRACED DEPOSITS OF YOUNGER ALLUVIUM, MAINLY DEEPLY WEATHERED POORLY SORTED COARSE SAND AND GRAVEL

Td — DOMENGINE SANDSTONE, BROWN FELDSPATHIC QUARTZ SANDSTONE WITH MINOR THIN MUDSTONE INTERBEDS

KJg□□ — MUDSTONE AND SILTSTONE WITH MINOR THIN-BEDDED SANDSTONE

N

0 2000

1"=2000'

REGIONAL GEOLOGIC MAP
Fox et al, 1973

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RYAN GEO*LOGICAL* CONSULTING, INC.
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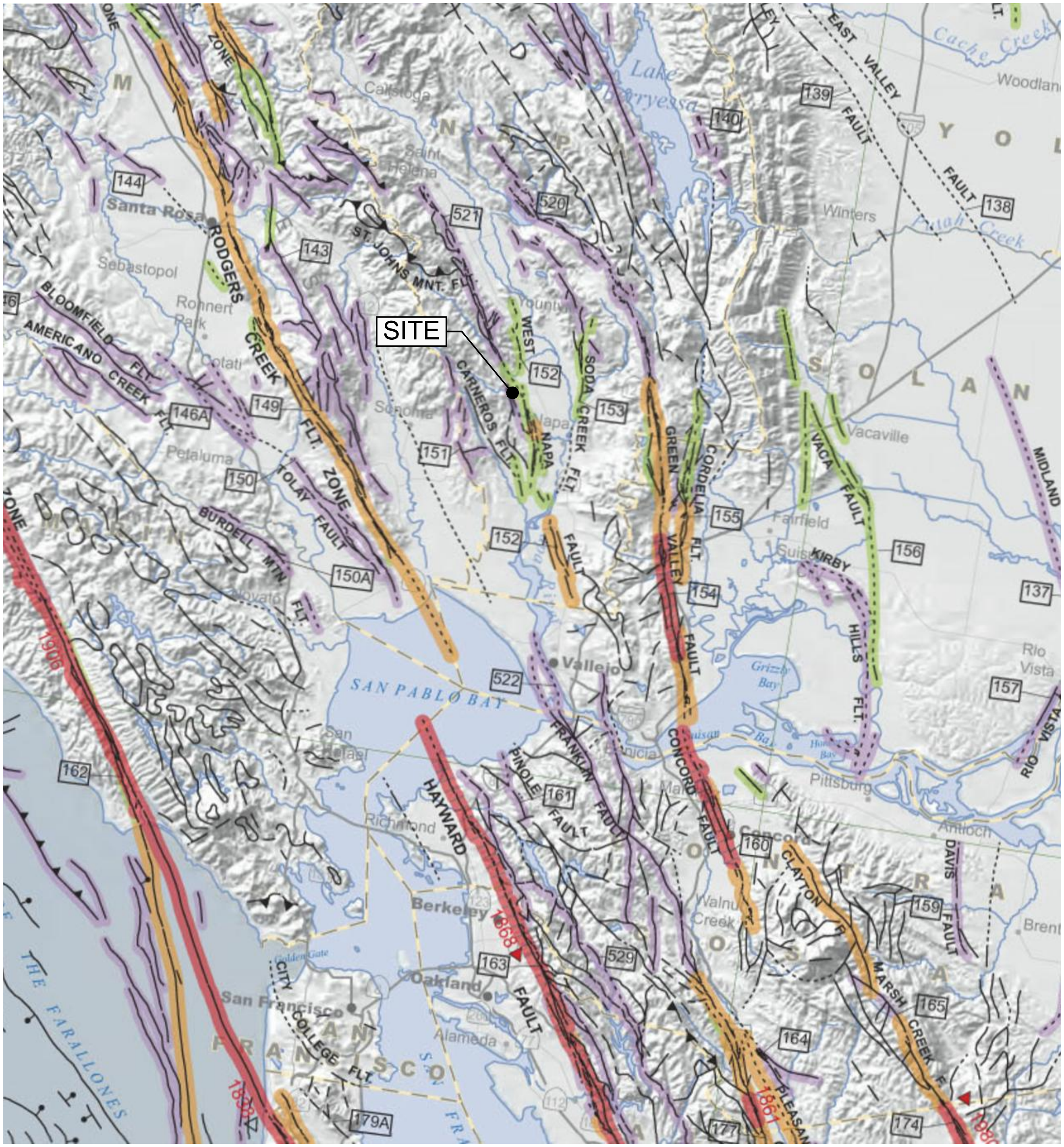
BASE: FOX, K.F., SIMS, J.D., BARTOW, J.A. AND HELLEY, E.J., 1□73, PRELIMINARY GEOLOGIC MAP OF EASTERN SONOMA AND WESTERN NAPA COUNTY, CALIFORNIA: U.S. GEOLOGICAL SURVEY MISCELLANEOUS FIELD STUDIES MAP MF-483, BASIC DATA CONTRIBUTION 56.



EXPLANATION

FAULT ALONG WHICH HISTORIC (LAST 200 YEARS) WITH HISTORIC RECORD DISPLACEMENT HAS OCCURRED

HOLOCENE FAULT DISPLACEMENT (WITHIN PAST 11,700 YEARS) WITHOUT HISTORIC RECORD

LATE QUATERNARY FAULT DISPLACEMENT (WITHIN PAST 700,000 YEARS)

QUATERNARY FAULT (AGE UNDIFFERENTIATED)

PRE-QUATERNARY FAULT

N

0 50,000

1"=50,000'

NORTHERN BAY AREA FAULT ACTIVITY MAP

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BASE: JENNINGS, J.W. AND BRYANT, W.A., 2010 FAULT ACTIVITY MAP OF CALIFORNIA: CALIFORNIA GEOLOGICAL SURVEY, GEOLOGIC DATA MAP NO. 6.

EXPLANATION

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE LOCATION OF PHOTOLINAMENT

APPROXIMATE LOCATION OF INFERRED UAVSAR LINAMENT

N

0 1000

1"=1000'

NOTE:
PHOTOLINAMENTS NOTED ABOVE ARE A CUMULATIVE INTERPRETATION BASED ON REVIEW OF 10 SETS OF STEREO-PAIRED AERIAL PHOTOGRAPHS

BASE: AERIAL PHOTOGRAPH DATED 5-17-84

AERIAL PHOTOGRAPH INTERPRETATION

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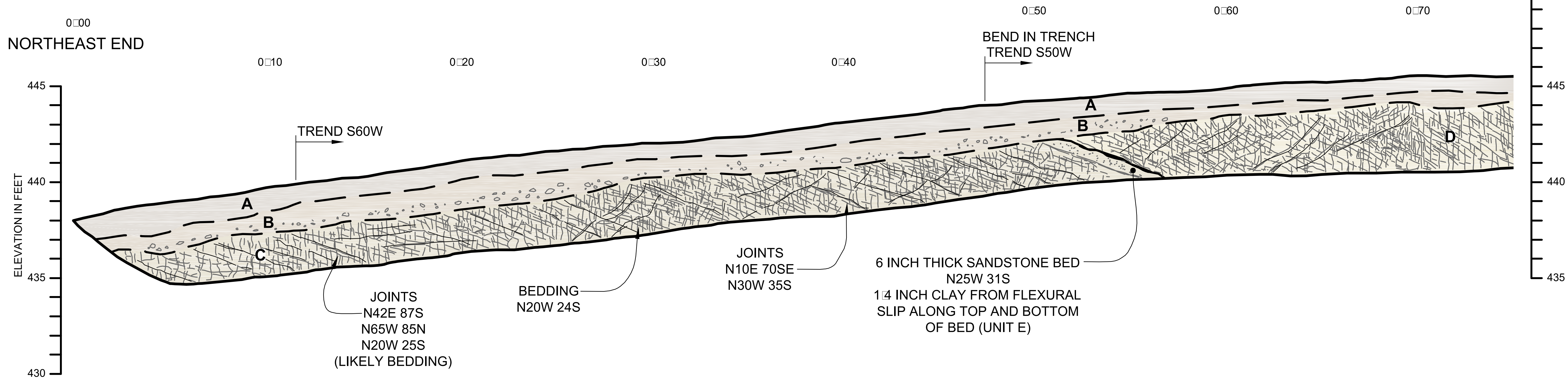
APPENDIX

TRENCH LOGS T-1 THROUGH T-4

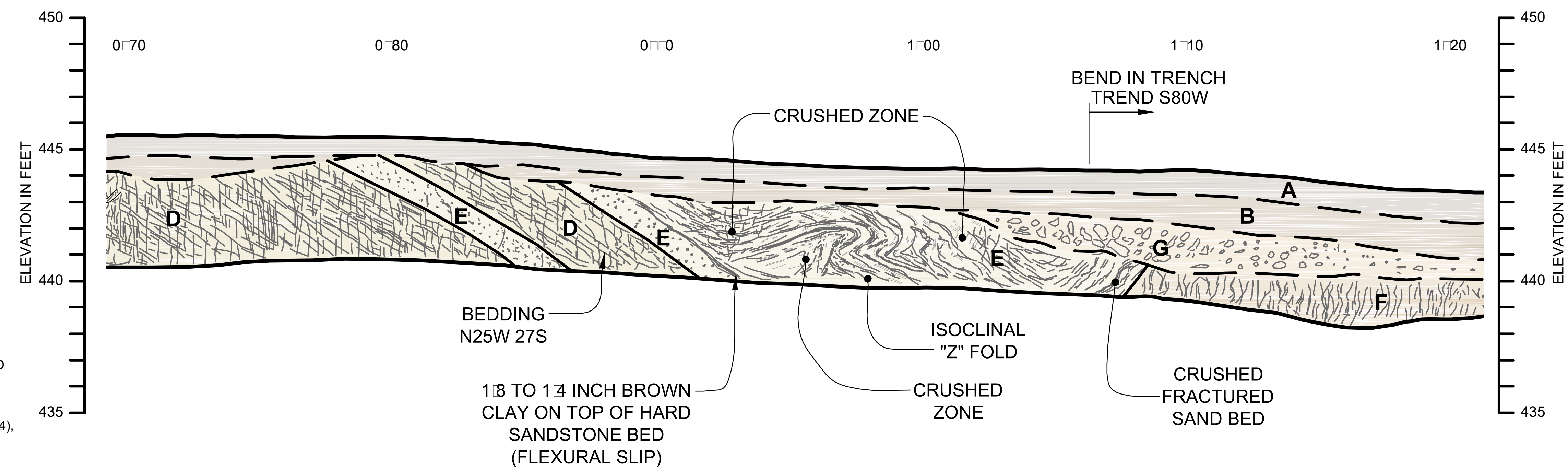
TRENCH T-1

LOG OF SOUTH WALL



TRENCH T-1

LOG OF SOUTH WALL CONTINUED



TRENCH T-1 EXPLANATION

———	GROUND SURFACE AND BOTTOM OF TRENCH
— — —	GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE
A	SANDY SILT WITH CLAY, BROWN (10 YR 4/3), DRY, MEDIUM STIFF TO STIFF, FINE-GRAINED SAND (RESIDUAL SOIL AB)
B	SILTY CLAY, DARK YELLOWISH BROWN (10 YR 4/6), MOIST, STIFF, BLOCKY PED STRUCTURE, TRACE FINE-GRAINED SAND, SOME ROOTS (RESIDUAL SOIL Bt)
C	CLAYSTONE, LIGHT OLIVE-BROWN (5Y 5/6), HIGHLY WEATHERED, WEAK, CRUSHED WITH CLAY LINED JOINTS (GREAT VALLEY SEQUENCE)
D	SILTSTONE, MODERATE YELLOW (5Y 7/6), HIGHLY WEATHERED, WEAK TO MODERATELY STRONG, HIGHLY FRACTURED, THINLY TO THICKLY BEDDED (GREAT VALLEY SEQUENCE)
E	SANDSTONE, FINE-TO MEDIUM-GRAINED, GRAYISH YELLOW (5Y 8/4), MODERATELY WEATHERED, STRONG, THINLY BEDDED (GREAT VALLEY SEQUENCE)
F	CLAYSTONE, MOTTLED DARK YELLOWISH ORANGE (10 YR 6/6), TO MODERATE BROWN (5YR 4/4), HIGHLY WEATHERED, WEAK, CRUSHED
G	SILTY CLAY WITH CLAY AND GRAVEL, YELLOW (10 YR 7/6), DRY, STIFF
H	SILTY CLAY, REDDISH BROWN (5 YR 4/4), MOIST, VERY STIFF, COLUMNAR PED STRUCTURE (COLLUVIAL SOIL)
I	CLAYEY SILT, BROWNISH YELLOW (10 YR 6/8), DRY, STIFF, TRACE ROUNDED SANDSTONE COBBLES
J	SANDSTONE INTERBEDDED WITH SILTSTONE, GRAYISH YELLOW (5Y 8/4), HIGHLY WEATHERED, HIGHLY FRACTURED, THINLY BEDDED

TRENCH T-1

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TRENCH T-1 EXPLANATION

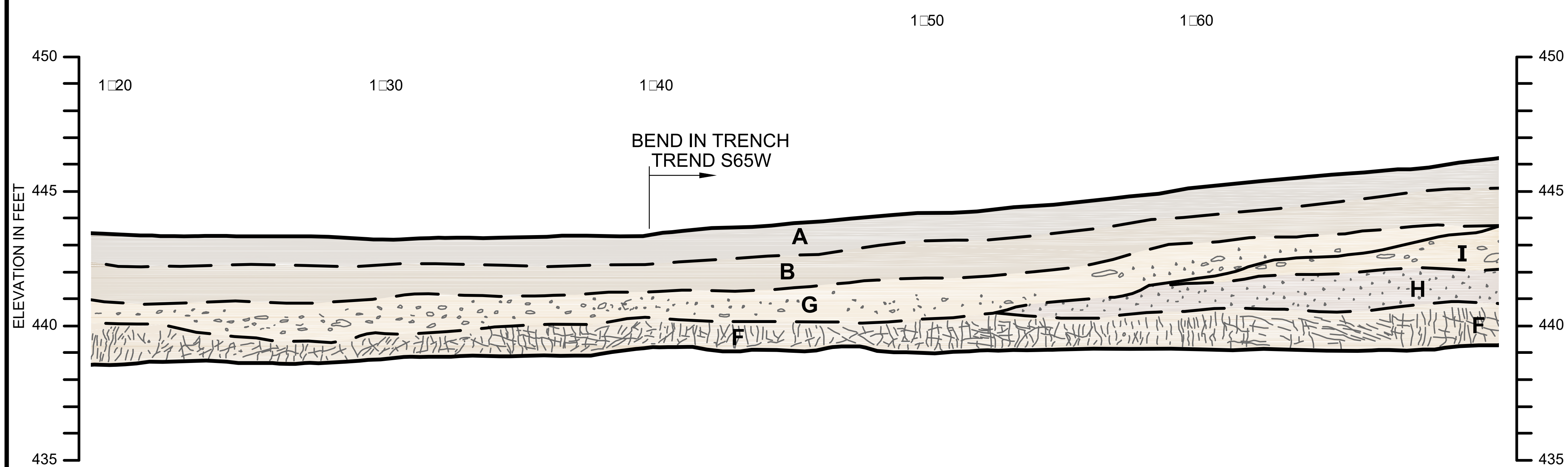
GROUND SURFACE AND BOTTOM OF TRENCH

GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE

A	SANDY SILT WITH CLAY, BROWN (10 YR 4□3), DRY, MEDIUM STIFF TO STIFF, FINE-GRAINED SAND (RESIDUAL SOIL AB)
B	SILTY CLAY, DARK YELLOWISH BROWN (10 YR 4□6), MOIST, STIFF, BLOCKY PED STRUCTURE, TRACE FINE-GRAINED SAND, SOME ROOTS (RESIDUAL SOIL Bt)
C	CLAYSTONE, LIGHT OLIVE-BROWN (5Y 5□6), HIGHLY WEATHERED, WEAK, CRUSHED WITH CLAY LINED JOINTS (GREAT VALLEY SEQUENCE)
D	SILTSTONE, MODERATE YELLOW (5Y 7□6), HIGHLY WEATHERED, WEAK TO MODERATELY STRONG, HIGHLY FRACTURED, THINLY TO THICKLY BEDDED (GREAT VALLEY SEQUENCE)
E	SANDSTONE, FINE-TO MEDIUM-GRAINED, GRAYISH YELLOW (5Y 8□4), MODERATELY WEATHERED, STRONG, THINLY BEDDED (GREAT VALLEY SEQUENCE)
F	CLAYSTONE, MOTTLED DARK YELLOWISH ORANGE (10 YR 6□6), TO MODERATE BROWN (5YR 4□4), HIGHLY WEATHERED, WEAK, CRUSHED
G	SILTY CLAY WITH CLAY AND GRAVEL, YELLOW (10 YR 7□6), DRY, STIFF
H	SILTY CLAY, REDDISH BROWN (5 YR 4□4), MOIST, VERY STIFF, COLUMNAR PED STRUCTURE (COLLUVIAL SOIL)
I	CLAYEY SILT, BROWNISH YELLOW (10 YR 6□8), DRY, STIFF, TRACE ROUNDED SANDSTONE COBBLES
J	SANDSTONE INTERBEDDED WITH SILTSTONE, GRAYISH YELLOW (5Y 8□4), HIGHLY WEATHERED, HIGHLY FRACTURED, THINLY BEDDED

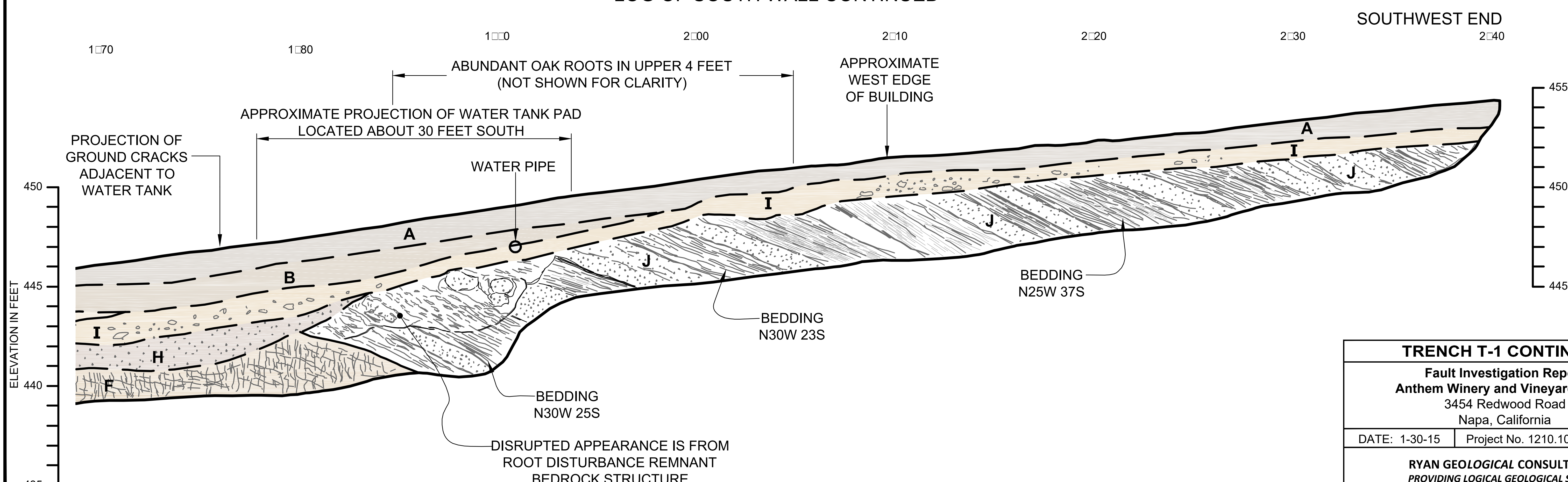
TRENCH T-1

LOG OF SOUTH WALL CONTINUED



TRENCH T-1

LOG OF SOUTH WALL CONTINUED



TRENCH T-1 CONTINUED

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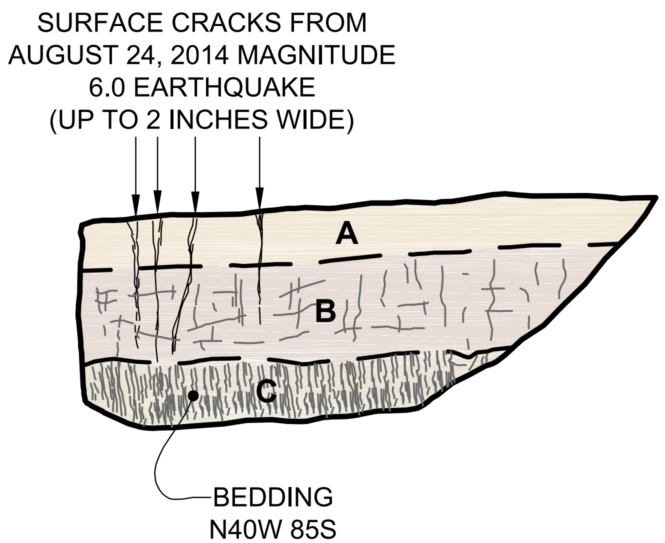
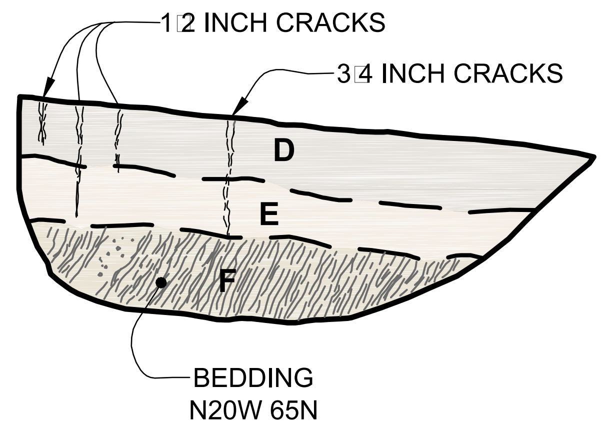
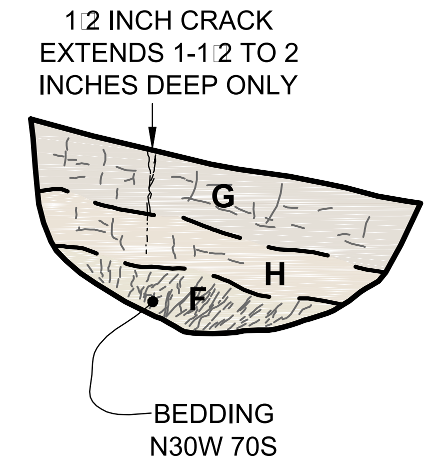
TRENCH T-2
LOG OF SOUTH WALL



TRENCH T-3
LOG OF SOUTH WALL



TRENCH T-4
LOG OF SOUTH WALL



TRENCH T-2 THROUGH T-4 EXPLANATION

———	GROUND SURFACE AND BOTTOM OF TRENCH
— — —	GEOLOGIC CONTACT, SOLID WHERE SHARP, DASHED WHERE APPROXIMATE
A	SILTY CLAY, BROWNISH YELLOW (10 YR 6/8), DRY, STIFF (FILL)
B	SILTY CLAY, YELLOWISH RED (5 YR 4/6), MOIST, STIFF, COLUMINAR PED STRUCTURE WITH CLAY FILMS ON PED STRUCTURES (PLEISTOCENE SOIL Bt)
C	CLAYSTONE, LIGHT OLIVE-BROWN (5 Y 5/6), TO GRAYISH YELLOW (5 Y 8/4), HIGHLY WEATHERED, WEAK, CRUSHED, THINLY BEDDED
D	SILTY CLAY, GRAY (10 YR 5/1), DRY, STIFF, POROUS (AB)
E	SANDY SILT, VERY PALE BROWN (10 YR 7/4)
F	CLAYSTONE, LIGHT OLIVE-BROWN (5 Y 5/6), HIGHLY WEATHERED, FRAIBLE TO WEAK, CRUSHED
G	SILTY CLAY, DARK YELLOWISH BROWN (10 YR 4/4), DRY, STIFF (RESIDUAL SOIL AB)
H	SILTY CLAY, YELLOW-BROWN (10 YR 5/6), DRY TO MOIST, STIFF

TRENCH T-2 THROUGH T-4

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DATE: 1-30-15	Project No. 1210.100	Figure A-3

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