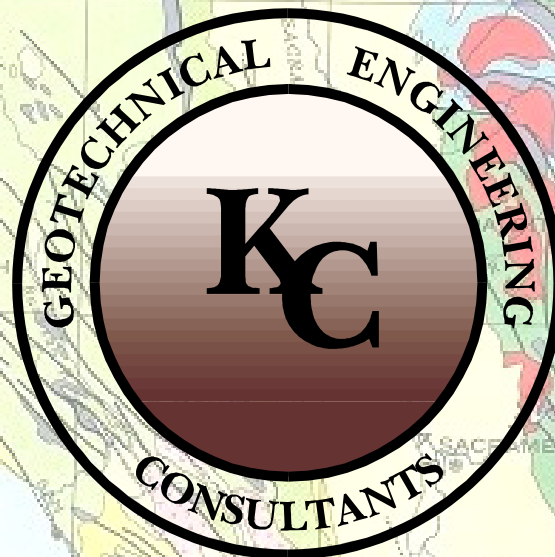


**GEOTECHNICAL FEASIBILITY EVALUATION**

**on  
LANDS OF MORGAN  
TENTATIVE PARCEL MAP**

**at  
SW Corner of Cantelow Road & Gibson Canyon Road  
Vacaville, Solano County, California  
for  
BILL MORGAN**



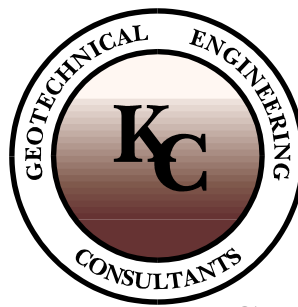
**By**

**KC ENGINEERING COMPANY**

**Project No. VV4433**

**16 February 2018**

865 Cotting Lane, Suite A  
Vacaville, California 95688  
(707) 447-4025



8798 Airport Road  
Redding, California 96002  
(530) 222-0832

**KC ENGINEERING COMPANY**  
A SUBSIDIARY OF MATERIALS TESTING, INC.

Project No. VV4433  
16 February 2018

Mr. Bill Morgan  
7545B Pleasants Valley Road  
Vacaville, CA 95688

Subject: Lands of Morgan Proposed Parcel Split  
SW Corner Cantelow Road & Gibson Canyon Road  
Vacaville, California  
**GEOTECHNICAL FEASIBILITY EVALUATION**

Reference: Tentative Parcel Map, Lands of Morgan, Solano County  
APN's 105-110-070, 100, 440 & 450  
APN 105-160-130  
APN's 105-170-010 & 150  
By Foulk Civil Engineering, Inc., dated 2/12/18

Dear Mr. Morgan:

At your request, **KC ENGINEERING COMPANY** has performed a geotechnical review and site reconnaissance of the subject property to determine whether the proposed parcels are geotechnically feasible to construct new driveways and custom residences and/or other detached secondary dwelling or shops and barn structures. The opinions presented herein are based on our review, observations and experience in the construction and geotechnical engineering fields.

In summary, it is our opinion that each of the proposed parcels shown on the referenced Tentative Parcel Map have areas that are considered geotechnically feasible and can be safely developed with new driveways and residential structures. The actual location of proposed structures will be determined at a later date by future parcel owners and will require site specific geotechnical, waste/septic disposal, and civil grading design plans.

***Site Location & Description***

The subject 310+/- acre property is located in the northern Vacaville area of Solano County, California as shown on Figure 1, Aerial Vicinity Map" included in the Appendix of this report. The property is bounded on the north by Cantelow Road, on the east by Gibson Canyon Road, on the

south by rural hillside residential/agricultural properties, and on the west by Steiger Hill Road as shown on the referenced Tentative Parcel Map by Foulk Civil Engineering, included herein as Figure 2 "Site Plan".

The property generally consists of open undeveloped hillside and valley terrain, with the exception of three residences along Cantelow Road and one mobile home on the southeast along Gibson Canyon Road. The location of the residences are shown on Figure 2. A Rural North Vacaville Water District (NRWD) water tank is located on the western portion of the property which is accessed via a gravel road stemming from Cantelow Road on the north. The topography of the property ranges from relatively flat to gently sloping terrain on the northeast and west side. The majority of the property consists of steep hillside ridges and valley areas with inclinations ranging up to about 1H:1V (horizontal to vertical). The property is covered with native grasses and weeds and areas of scattered to dense oak trees. Two ponds and small earthfill dams are located on the north central portion of the site near the intersection with English Hills Road. We understand that the property has been historically used for cattle grazing. A PG&E high-voltage powerline traverses the property on the southeast.

The near surface soil deposits across the property were observed to consist of primarily of highly expansive sandy and silty clays. Various exposures of competent sandstone bedrock were also observed on the ridge tops and side slopes. Our experience in the area indicates that the surficial expansive clays generally range in thickness from 1 to about 10 feet and are underlain by variably weathered sandstone and claystone bedrock.

Our observation of the property revealed a number of small to medium sized debris-flow and earth-flow type landslides. The location of the obvious landslides observed during our surface reconnaissance are shown on Figure 2 and are generally located on the flanks of the steeper ridges. The majority of the debris flow slides are estimated to range in thickness from 3 to 10 feet thick and range in width from 10 to 50 feet or more. The debris flow slides appear to range in age from relatively recent to tens of years old.

Our observations of the site also revealed isolated areas of undocumented fills and some scattered concrete debris and tires primarily in the central valley areas on future Parcels 4, 5, 9, 14, and 15. The debris and old fill materials appear to be confined to the upper 5 to 10 feet.

### ***Proposed Improvements***

Based on our review of the referenced Tentative Parcel Map, we understand that the proposed improvements are planned to consist of subdividing the property into sixteen parcels with fifteen of the parcels being a minimum of 20 acres and one being 2.5 acres. The 2.5 acre parcel is located on the northern side of Cantelow Road and contains an existing residence. Our review did not include the 2.5 acre parcel. The fifteen 20-acre parcels are planned to be developed individually by future owners and are expected to include a primary custom residence and potential

secondary dwellings and related barn/shop structures. The location of the proposed structures will be determined at a later date by future parcel owners and will require site specific geotechnical, waste/septic disposal, and civil grading design plans.

The Tentative Parcel Map indicates that two 12-foot wide gravel roads will be created. One will intersect with Gibson Canyon Road on the east and provide access to proposed Parcels 1, 2, 13, 14 and 15. The other gravel road will consist of improving the NRWD/SID road to the existing water tank and will provide access to proposed Parcels 6, 7, 8 and 9. The remaining parcels will require driveway access from respective frontage along Cantelow Road or Gibson Canyon Road.

### ***Site Geology***

According to the Geologic Map of the Northeastern San Francisco Bay Region<sup>1</sup>, the geologic materials underlying the western two-thirds of the property consist of the Eocene-aged Markley Sandstone formation (Tmk). The Markley Sandstone is noted to consist of yellow and tan-weathering, light-gray and white, fine to coarse grained quartz-muscovite and quartz-lithic sandstone and siltstone, with light-gray and brown foraminiferal mudstone in places. Pliocene-aged Tehama Formation.

A narrow band of the late Miocene-aged Neroly Sandstone formation (Tn) crosses the central portion of the property in a northwesterly direction. The Neroly Sandstone is noted to consist of blue-gray, fine to coarse grained lithic sandstone. With local tuffaceous sandstone, tuffaceous mudstone and pebble to boulder conglomerate.

The northeastern one-third of the site primarily consists of the Pliocene-aged Tehama formation (Tpth) consists of white quartz arenite, tuffaceous sandstone, siltstone, and pebble to cobble conglomerate. This formation also contains beds of white ash tuff and pink tuff breccia.

The far northeastern corner of the site is mapped as late Pleistocene aged alluvial fan deposits (Qpf). The alluvial fan deposits consists of poorly sorted, moderately to poorly bedded sand, gravel, silt and clay deposited in gently sloping areas.

### ***Landslides***

As noted above, our observation of the property revealed a number of small to medium sized debris-flow and earth-flow type landslides. The location of the obvious landslides observed during our surface reconnaissance are scattered across the property and are shown on Figure 2. These landslides are generally located on the flanks of the steeper hillside ridges. The majority of the debris flow slides are estimated to range in thickness from 3 to 10 feet thick and range in

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<sup>1</sup> Graymer, R.W., Jones, D.L., and Brabb, E.E., 2002, *Geologic Map and Map Database of Northeastern San Francisco Bay Region, California*, United States Geological Survey, Miscellaneous Field Studies Map, MF-2403, Version 1.0

width from 10 to 50 feet or more. The debris flow slides appear to range in age from relatively recent to tens of years old.

Although landslide deposits are not shown on the above referenced Geologic Map of the Northeastern San Francisco Bay Region, previous mapping by California Division of Mines and Geology<sup>2</sup> (DMG) indicate a number of small to medium sized earthflows across the property. The DMG map series includes maps of relative landslide susceptibility and relative debris-flow susceptibility. The relative landslide susceptibility map show that majority of the property is in Areas 3 and 4 which indicate the hillside areas are considered generally to most susceptible to landsliding. The relative debris-flow susceptibility map shows the central portion of the property to be in Area C where evidence of debris flows are relatively common on the steeper slopes.

Our reconnaissance and observations confirm the presence of debris-flow and earthflow slides primarily in the central steeper terrain areas of the site as shown on Figure 2. It is noted that the slides observed are considered relatively shallow in nature and likely not deep-seated or massive rotational type landslides. At this time, we recommend structure avoidance in areas downslope of the currently mapped shallow landsliding. Once actual structure locations are designated, we recommend that site specific geotechnical and geologic investigations will be required.

### ***Discussions, Conclusions & Recommendations***

Based on our review, observations and experience in the area, it is the opinion of **KC ENGINEERING COMPANY** that each of the proposed parcels shown on the referenced Tentative Parcel Map have areas that are considered geotechnically feasible and can be safely developed with new driveways and residential structures. The actual location of proposed structures will be determined at a later date by future parcel owners and will require site specific geotechnical/geologic investigation and Civil grading improvement design plans.

The primary geotechnical and geologic hazards identified on the property consist of expansive surface soils, the potential for differential fill thickness under proposed structure locations, and the presence of debris-flow and earthflow landslides. Liquefaction is not considered possible due to the surface cohesive soils and underling bedrock. The near surface soil deposits across the property were observed to consist of primarily of highly expansive sandy and silty clays. Various exposures of competent sandstone bedrock were also observed on the ridge tops and side slopes. Our experience in the area indicates that the surficial expansive clays generally range in thickness from 1 to about 10 feet and are underlain by variably weathered sandstone and claystone bedrock.

It is pointed out that expansive soils are present on the property. The underlying bedrock may also have expansive properties. The potential for downhill soil creep can be anticipated where

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<sup>2</sup> Majmundar, H.H., 1989, *Landslide Hazards in the Vacaville Area, Solano County, California*, Landslide Hazard Identification Map No. 14, DMG Open-File Report 89-17.

structures, yard improvements and swimming pools are located within 10 to 20 feet from the descending slopes. These concerns are typical of the region and can be addressed through proper geotechnical evaluation and civil/structural engineering design.

The site soils are prone to heave and shrink movements with changes in moisture content and, consequently, must be carefully considered in the design of grading, foundations, and drainage. Considering the varying depths of materials and the highly expansive nature of the soils, differential foundation movements can be anticipated if the structure is not adequately supported. Therefore, it is the opinion of **KC ENGINEERING COMPANY** that the proposed structures will need to be supported on either a thickened post-tensioned slab foundation system, or a well-reinforced and deepened pier and grade beam foundation with a raised wood floor foundation system.

It is noted that the landslides observed across the property are considered relatively shallow in nature and likely not deep-seated or massive rotational type landslides. At this time, we recommend structure avoidance in areas downslope of the currently mapped shallow landsliding. Once actual structure locations are designated, we recommend that site specific geotechnical and geologic investigations be required for each Parcel. Depending on actual building locations, landslide mitigation and repair may be required, including complete removal and replacement as a well-drained engineered fill buttress, or construction of debris flow walls and/or collection basins.

Due to the above geotechnical and geologic hazards and concerns, and as required in the 2016 California Building Code, Chapter 18 "Soils and Foundations", Section 1803, we recommend that site/parcel specific geotechnical investigations be performed once the actual home sites and driveway locations are determined. Parcel specific geotechnical recommendations can then be provided for site grading, foundation type and design, retaining walls, slabs, drainage improvements and driveway sections.

Should you have any questions or require additional information, please call our office at your convenience.



Respectfully Submitted,  
**KC ENGINEERING COMPANY**

*David V. Cymanski*  
David V. Cymanski, G.E.  
Principal Engineer

Copies: 1 Email

## **APPENDIX**

**Aerial Vicinity Map**

**Site Plan**

**Geologic Map**





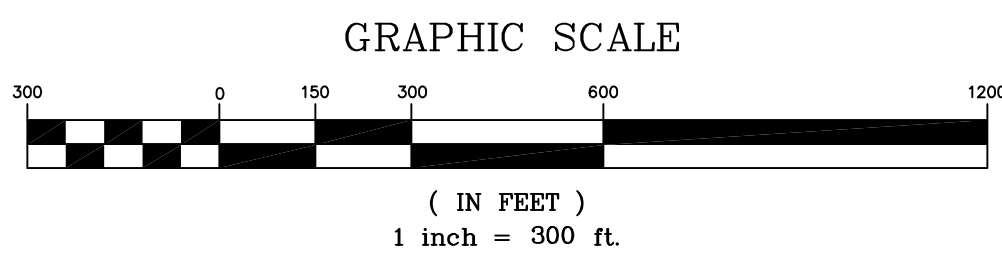
**KC ENGINEERING COMPANY**  
865 Cotting Lane, Suite A  
Vacaville, CA 95688  
707-447-4025

Project No. VV4433  
Lands of Morgan, Proposed Parcel Split  
Cantelow Road, Vacaville CA  
**Figure 1 – AERIAL VICINITY MAP**



C:\Users\pauls\OneDrive\Documents\Projects\07-045\07-045-REV4.dwg, PWD: 12/12/18 11:13 AM

DESIGNED BY: BDF  
DRAFTED BY: SMC  
CHECKED BY: BDF  
ISSUE DATE: 2/12/18



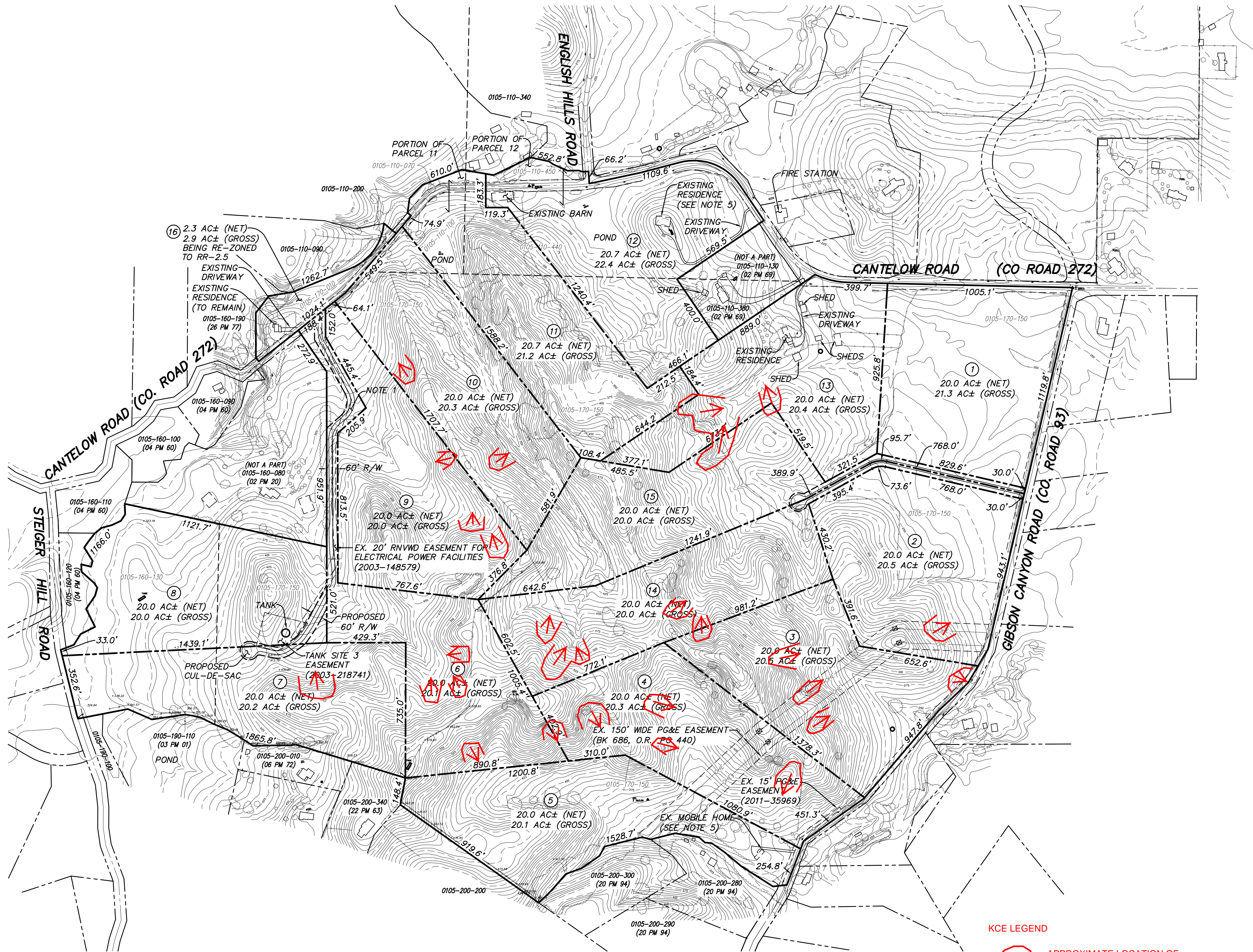
**FCE** FOULK CIVIL ENGINEERING, INC.  
Civil Engineering Land Surveying Planning  
4777 Mangels Boulevard, Fairfield, CA 94534  
(707)864-0784 fax (707)864-0793 e-mail: foulkce@gmail.com



REV.	DATE	DESCRIPTION	BY	APPROVED

PROJECT:	LANDS OF MORGAN SOLANO COUNTY		
SHEET TITLE:	TENTATIVE PARCEL MAP		
SCALE: 1"=300'	DWG: 07-045-REV4	JOB NO: 07-045	XREF:

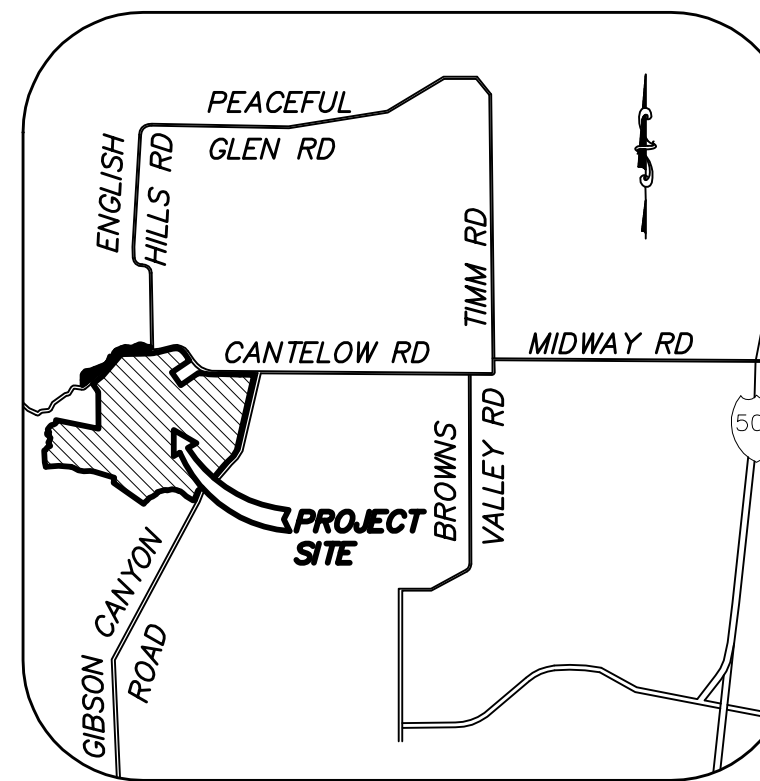
SHEET  
**1**  
OF 1



KCE LEGEND



APPROXIMATE LOCATION OF  
DEBRIS FLOW  
OR EARTHFLOW LANDSLIDE,  
February 2018



VICINITY MAP  
NOT TO SCALE

LEGEND

	EXISTING CONTOURS
	DISTINCTIVE BORDER
	PROPOSED PROPERTY LINE
	ADJACENT PROPERTY LINE
	ASSESSOR'S PARCEL LINE
	EXISTING CENTERLINE
	EXISTING FENCE LINE
	EXISTING BUILDING
	EXISTING ELEC. TOWER
	NOT A SEPARATE PARCEL
	EXISTING TREE
	RURAL NORTH VACAVILLE WATER DISTRICT

OWNER/APPLICANT

BILL MORGAN  
7545 PLEASANT VALLEY ROAD  
VACAVILLE CA, 95688

ASSESSOR'S PARCEL NUMBERS

105-110-070,100,440,450;  
105-160-130;  
105-170-010,150

UTILITIES

WATER: RURAL NORTH VACAVILLE WATER  
DISTRICT OR ON-SITE WELL  
SEWER: ONSITE LEACH FIELD  
ELECTRIC: PG&E  
PHONE: AT&T

NUMBER OF PROPOSED PARCELS

NUMBER OF PROPOSED A20 ZONED PARCELS: 15  
NUMBER OF PROPOSED RR2.5 ZONED PARCELS: 1

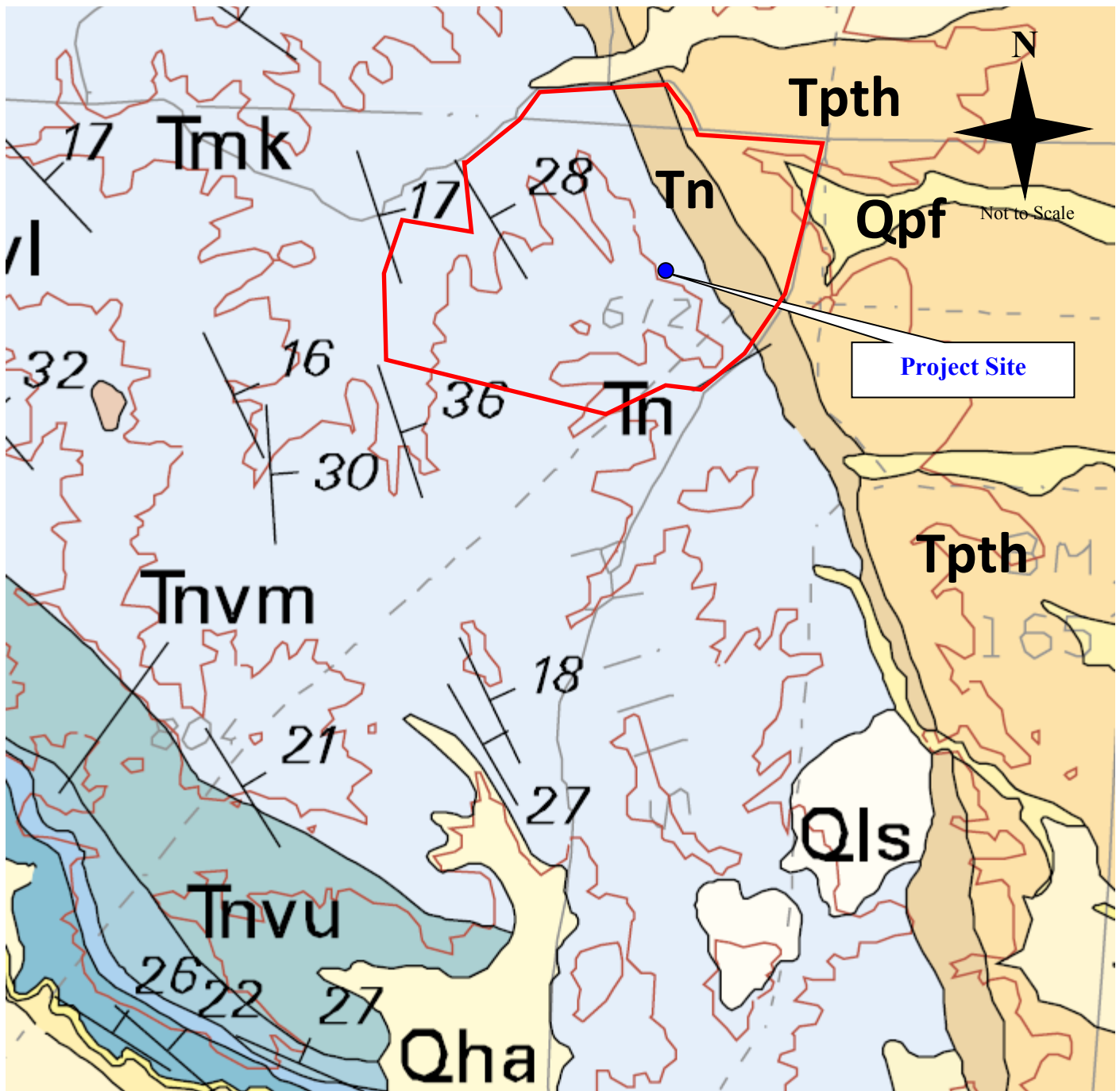
ZONING

EXISTING ZONING = A20  
PROPOSED ZONING = A20, RR2.5

NOTE

- EXISTING 12 FOOT WIDE GRAVEL ROAD PER PLANS ENTITLED "ENGLISH HILLS ROAD WATER DISTRICT ACCESS ROAD TO WELL SITE 3" PREPARED BY THE SOLANO COUNTY TRANSPORTATION DEPARTMENT, DATE APPROVED MARCH 7, 2002. THE MAXIMUM SLOPE OF THIS ROAD IS 11.25' AND IS TO BE WIDENED TO 20 FEET AS A PART OF THIS PARCEL SPLIT.
- GROSS PARCEL AREAS HEREON ARE TO THE CENTER OF EXISTING PUBLIC ROADS, PER RECORD, ON PROJECT FRONTAGE. NET AREAS HEREON ONLY EXCLUDE AREAS WITHIN EXISTING PUBLIC ROADS ON THE PROJECT FRONTAGES.
- AERIAL TOPOGRAPHIC SURVEY SHOWN HEREON WAS PREPARED BY AERO-GEODETIC AS PART OF THE RURAL NORTH VACAVILLE WATER SYSTEM CONSTRUCTION.
- ALL PROPOSED PARCELS WILL HAVE FRONTAGE ON AN EXISTING IMPROVED PUBLIC ROAD.
- EXISTING RESIDENCE TO BE IMPROVED TO CODE OR REMOVED FROM PROPERTY.





Graymer, R.W., Jones, D.L., and Brabb, E.E. 2002, *Geologic Map and Map Database of Northeastern San Francisco Bay Region, California*, USGS Miscellaneous Field Studies Map MF-2403, Version 1

Tmk	Markley Sandstone (Eocene)	Tn	Neroly Sandstone (late Miocene)
Tpth	Tehama Formation (Pliocene)	Qpf	Alluvial fan deposits (late Pleistocene)



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**FIGURE NO. 3 – GEOLOGIC MAP**