Appendix F

Geological Resources

ESA

F-1 Geotechnical Feasibility Investigation

TRC Lowney

January 15, 2007
1989-30

Ms. Franlinda Khuon
WELLINGTON CORPORATION OF NORTHERN CALIFORNIA
18640 Sutter Boulevard, Suite 100
Morgan Hill, California 95037

RE: GEOTECHNICAL FEASIBILITY INVESTIGATION
MADERA HERMAN PARCELS
MADERA COUNTY, CALIFORNIA

Dear Ms. Khuon:

This letter presents the results of our geotechnical feasibility investigation of the proposed mixed-use development project referenced above. In accordance with our agreement, dated November 13, 2006 (Contract No. HERTRCL029), we have completed limited site reconnaissance and subsurface exploration, and reviewed available project and public agency data in our files. The purpose of our feasibility investigation was to identify possible geotechnical issues associated with mixed-use development. Further evaluation of the geotechnical site conditions should be performed when a conceptual development plan is completed.

PROJECT DESCRIPTION

We understand that the property consists of two adjacent parcels (APN 031-221-001 and 031-222-01) totaling approximately 793.45 acres. The site is located northwest of the intersection of Avenue 17 and Road 28½ in Madera County, California. The parcels are currently being used for agricultural purposes with several structures in the central portion of the site.

We understand that Wellington Corporation of Northern California is considering purchase of the land for mixed-use development. A conceptual plan was not available at the time of our review; however, this type of development typically consists of single- and multi-family housing, open space, and educational and commercial/retail land use. We assume that structures will likely be one to three stories high and be of wood, steel, or masonry construction. Structural loads and grading are yet to be determined; however, we assume that structural loads will be representative for this type of construction and that minor cuts and fills will be required. The development will likely include underground utilities, retaining walls, sound walls, pavements, and landscaping areas.

SITE CONDITIONS

Site Reconnaissance

We performed a brief site reconnaissance of the parcels. The approximately 793.45-acre site is bounded by Road 27 to the west, Road 28½ to the east, the Topeka & Santa Fe Railroad to southwest, residential properties to the south, and undeveloped land to the north. The boundaries of the site are shown on the Site Plan, Figure 2.

At the time of our field exploration, the northern portion of the site was planted with mature fig and almond trees. The southern portion of the site was planted with young fig and almond trees. A structure is located in the central portion of the site. Additional improvements include wells, tanks, and irrigation lines.

Site specific topographic information was not available at the time of our investigation. USGS topographic maps indicate that site grades range from approximately Elevation 310 feet (datum unknown) in the southeast corner of the site to approximately Elevation 280 feet in the northwest corner of the site. The Kismet 7½-minute Quadrangle (USGS, 1987) indicates that a seasonal drainage channel previously ran through the northwest corner of the site. Based on our site reconnaissance, the channel no longer exists in this area, and may have been filled.

Subsurface exploration

We drilled twelve 8-inch diameter hollow-stem auger borings to depths of 15 to 30 feet on December 18 and 19, 2006, using conventional, truck-mounted drilling equipment. The approximate locations of the borings are shown on the Site Plan, Figure 2. Logs of our borings are attached at the end of this letter.

Subsurface Conditions

Our borings encountered alluvial soils to a depth of 30 feet, the maximum depth explored. The alluvium generally consisted of silty sands and poorly graded sands with interbedded silt layers. The sands encountered were generally medium dense to very dense. Our borings encountered very dense cemented sands, known locally as hardpan, at depths ranging from 0 to 12 feet. The cemented layers ranged from 2 to 12 feet in thickness. The upper 2 to 5 feet of soil in EB-1, EB-2, and EB-10 were loose. The interbedded silty layers were generally 2 to 5 feet thick and were stiff to hard.

Our borings did not encounter free ground water to a depth of 30 feet, the maximum depth explored.

GEOLOGIC HAZARDS

A brief qualitative discussion of the potential geologic hazards and their impact on site development follows and is based on our site reconnaissance, subsurface exploration, and research of readily available reports and maps.

Fault Rupture

The site is located approximately 19 miles from the Foothills Fault system and greater than 41 miles from the Great Valley Fault system. The site is not located within a designated Alquist-Priolo Earthquake Fault Zone (known formerly as a Special Studies Zones); therefore, fault rupture through the site is not anticipated.

Ground Shaking

Earthquake intensity is dependent upon the earthquake magnitude, the distance from the earthquake source, and the underlying soil or bedrock deposits. Ground shaking at the site would likely be low to moderate given the historic seismicity of the area and the distance to active faults. The Probabilistic Seismic Hazard Analysis (PSHA) performed by the California Geological Survey estimates a peak horizontal ground acceleration of 0.17g at the site with a 10 percent probability of exceedance in 50 years.

Liquefaction

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands.

Our borings encountered several localized areas of loose sand within 5 feet of the ground surface. Ground water was not encountered in our borings to a depth of 30 feet, the maximum depth explored. Based on the soils encountered in our borings, the depth to ground water, and the expected levels of seismic shaking, the potential for liquefaction at the site may be considered low.

Lateral Spreading

Lateral spreading typically occurs as a form of horizontal displacement of relatively flat-lying alluvial material toward an open or "free" face, such as an open body of water, channel, or excavation. Movement is generally due to failure along a weak plane and may often be associated with liquefaction. Our borings did not encounter a weak or potentially-liquefiable soil layer through the site. Additionally, there are no free faces within an appropriate distance of the site for lateral spreading to occur. For these reasons, the probability of lateral spreading occurring at the site during a seismic event is low.

Flooding

As shown on the August 4, 1987, Federal Emergency Management Agency *Flood Insurance Rate Map* (FIRM), the majority of the site is within Zone X, described as "Areas determined to be outside the 500-year floodplain."

A small area in the northwestern portion of the site is designated as a Special Flood Hazard Area Zone A: "No base flood elevations determined" for a 100-year flood.

Erosion and Sedimentation

The proposed site is relatively flat without steep slopes on or adjacent to the site. In our opinion, the potential for erosion and siltation occurring at the site during grading would be low. However, during periods of heavy rainfall, runoff can occur. In addition, the near-surface soils consist primarily of sandy soils, which have a moderate to high susceptibility to erosion. A Storm Water Pollution Prevention Plan (SWPPP) should be prepared and implemented during grading operations to reduce the potential for erosion or siltation impacts.

CONCLUSIONS AND DESIGN CONSIDERATIONS

The feasibility-level geotechnical information and opinions provided in the following sections are intended for your project forward planning purposes only. The initial conclusions and opinions presented in this letter were based on our review of available information, and limited site reconnaissance and field exploration. The primary geotechnical concerns potentially affecting the proposed development may include the following:

- Removal of buried debris
- Loose surficial soils
- The presence of shallow cemented soils (hardpan)
- The presence of undocumented fill and/or soil stockpiles

A brief discussion of these concerns is presented below. These concerns should be further evaluated and addressed during a design-level geotechnical investigation once conceptual plans are finalized.

Buried Debris

We observed indications of existing subsurface improvements throughout the site (i.e. foundations, underground pipelines, septic systems, and agricultural/construction debris). These improvements should be removed and the resulting excavations backfilled with engineered fill. Material such as concrete may be crushed and used for fill, providing it conforms to recommendations for engineered fill.

Prior to site development, we recommend that a survey of former and existing structures, such as underground utilities and any localized debris stockpiles, be performed. This survey will facilitate in removal of buried debris prior to construction.

Loose Surficial Soils

Loose surficial soils were encountered in Borings EB-1, EB-2, and EB-10 in the northwestern and southwestern portions of the site. Due to past agricultural activities, such as tilling or disking, localized areas of loose soil may be encountered during construction. Additionally, removal of the existing trees will likely loosen the soils within the trees root zones.

Loose soils could settle under the weight of new fills and/or building foundations. Loose soils could also settle due to saturation or seismic shaking. We recommend that the potential for settlement be mitigated through grading and foundation design.

The upper 1 to 2 feet of loose near-surface soil will likely need to be either scarified and recompacted or over-excavated and replaced as engineered fill prior to the placement of new fills or foundation construction. Shallow foundations, such as rigid mat foundations, can be designed to tolerate any remaining differential settlement.

Shallow Cemented Soils (Hardpan)

As previously discussed, our borings encountered hard, cemented soil layers of varying thickness and depth. Hardpan soils can be fairly impervious and if located directly beneath foundations, could result in locally perched water due to surface water infiltration from rain or landscape irrigation. This can result in saturated soils, ponding of water, and increased moisture around foundations. Due to the variable depth of the hardpan layer, and the potential cuts and fills that may be required to grade the site, it is not known at what depth the hardpan layer will be below finished pad grades. If hardpan soils are determined during grading to be present at a shallow depth below building foundations, it may be necessary to install shallow perimeter subdrains adjacent to foundations. Subdrains would likely be on the order of 18 to 24 inches deep, and would likely consist of a 4-inch diameter perforated pipe surrounded by permeable drain rock. We recommend that the need for foundation subdrains be further evaluated during future phases of investigation and once preliminary grading plans have been developed.

Localized zones of hardpan soils may be encountered during mass grading and installation of underground utilities. This could result in localized difficult excavation areas that require larger ripping or excavation equipment. Contractors should be made aware of the presence of these hardpan soils, and the potential impacts to the construction schedule. Hardpan soils encountered in cut areas may need to be processed to break down the soils to meet the general requirements for engineered fill. Hardpan soils encountered during mass grading and utility excavation will likely increase construction costs and schedules.

Undocumented Fill

Based on our experience with similar agricultural sites, localized areas of undocumented fill may be encountered during construction. We recommend that any undocumented fill be over-excavated to expose undisturbed native soil. The resulting excavations should be backfilled with compacted engineered fill. The extent and thickness of any undocumented fills should be evaluated during a design-level investigation and observed during construction. In addition, the geotechnical and environmental characteristics of the fill materials also should be further evaluated as part of the design-level investigation.

FOUNDATIONS

Spread Footings

Provided any undocumented fill and loose surficial soils are removed and replaced as engineered fill, shallow footings may be feasible for support of one- to three-story structures with masonry, wood- or steel-framed construction. Based on our engineering judgment and the anticipated subsurface conditions, allowable bearing pressures on the order of 2,000 to 3,000 pounds per square feet (psf) may be anticipated for combined dead plus live loads. Footings would likely be on the order of 12 to 18 inches wide, and extend 15 to 18 inches below lowest adjacent grade. The feasibility of spread footings should be further evaluated during a design-level geotechnical investigation.

Mat Foundations

As an alternative to spread footings, one- to three-story structures may also be supported on mat slab foundations. Mats generally are designed to resist the differential settlement (dishing effect and tilt) between the center and edges of slabs. A mat foundation generally is designed to alleviate the building distress associated with differential settlement by providing a rigid and relatively thick foundation capable of spanning localized irregular settlements and distributing the building loads appropriately. Average allowable mat pressures on the order of 500 to 1,000 psf and localized maximum pressures of up to 3,000 psf may be feasible. The feasibility of mat foundations should be further evaluated during a design-level geotechnical investigation.

DESIGN-LEVEL GEOTECHNICAL INVESTIGATION

The findings and opinions provided in this letter were based on limited information regarding possible site development including building types, layout and structural loads. In addition, because exploratory borings were widely spaced, the subsurface conditions may vary considerably from those discussed in this report. We recommend that we be retained to perform a design-level geotechnical investigation once site development plans are available. We also recommend that if important business and financial decisions are to be made prior to a design-level geotechnical investigation, that a preliminary geotechnical investigation, which would include additional exploratory test borings to depths of 30 to 50 feet, be performed to further evaluate the site conditions.

CLOSURE

The opinions and information presented in this letter are based on our review of available documents, information contained in our files, a cursory site reconnaissance, and a limited subsurface exploration. This letter has been prepared for the sole use of Wellington Corporation of Northern California, specifically for the two Herman parcels, totaling 793.45 acres, in unincorporated Madera County, California. Our services were performed in accordance with geotechnical engineering principles generally accepted at this time and location; we make no other warranty, expressed or implied.

If you have any questions regarding this letter, please call and we will be glad to discuss them with you.

Very truly yours,

TRC LOWNEY

Bernard R. Wair, P.E.
Senior Staff Engineer

John R. Dye, P.E., G.E.
Principal Engineer

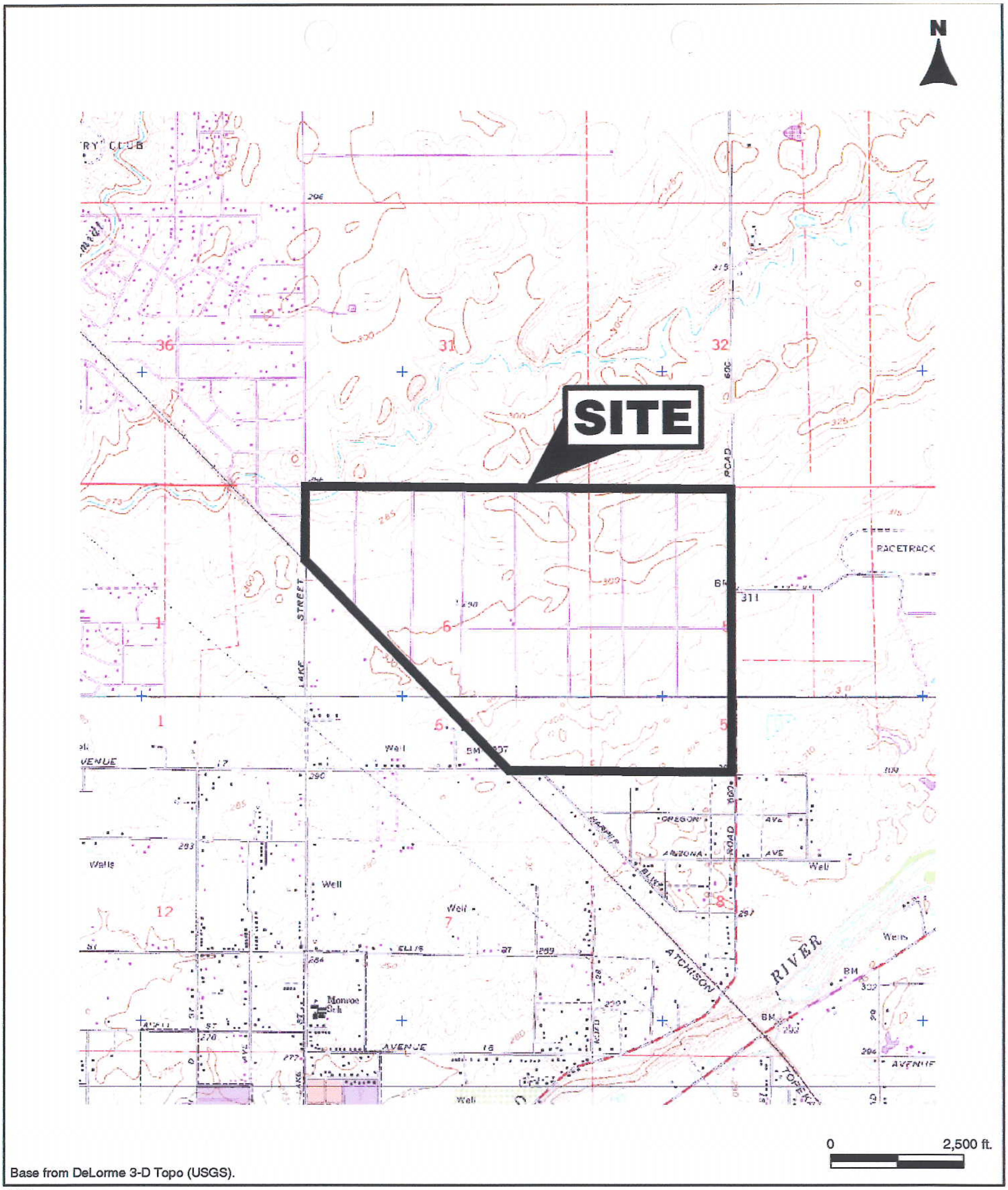
JOHN R. DYE
No. GE2582
EXPIRES 12/31/08

JRD:BRW:jcm

Copies: Addressee (3 wet stamped, 1 via email)
McPharlin Sprinkles & Thomas LLP (1 via email)
Attn: Ms. Katharine L. Hardt-Mason Esq.
Law Offices of Tamara J. Gabel (1 via email)
Attn: Ms. Tamara Gabel, Esq
HMH Engineers (1 via email)
Attn: Mr. David Stanton

Attachments: Figure 1 – Vicinity Map
Figure 2 – Site Plan
Boring Logs (EB-1 through EB-12)

SR/1989-30 Madera_Herman Feas rpt_ltr 011507



Base from DeLorme 3-D Topo (USGS).

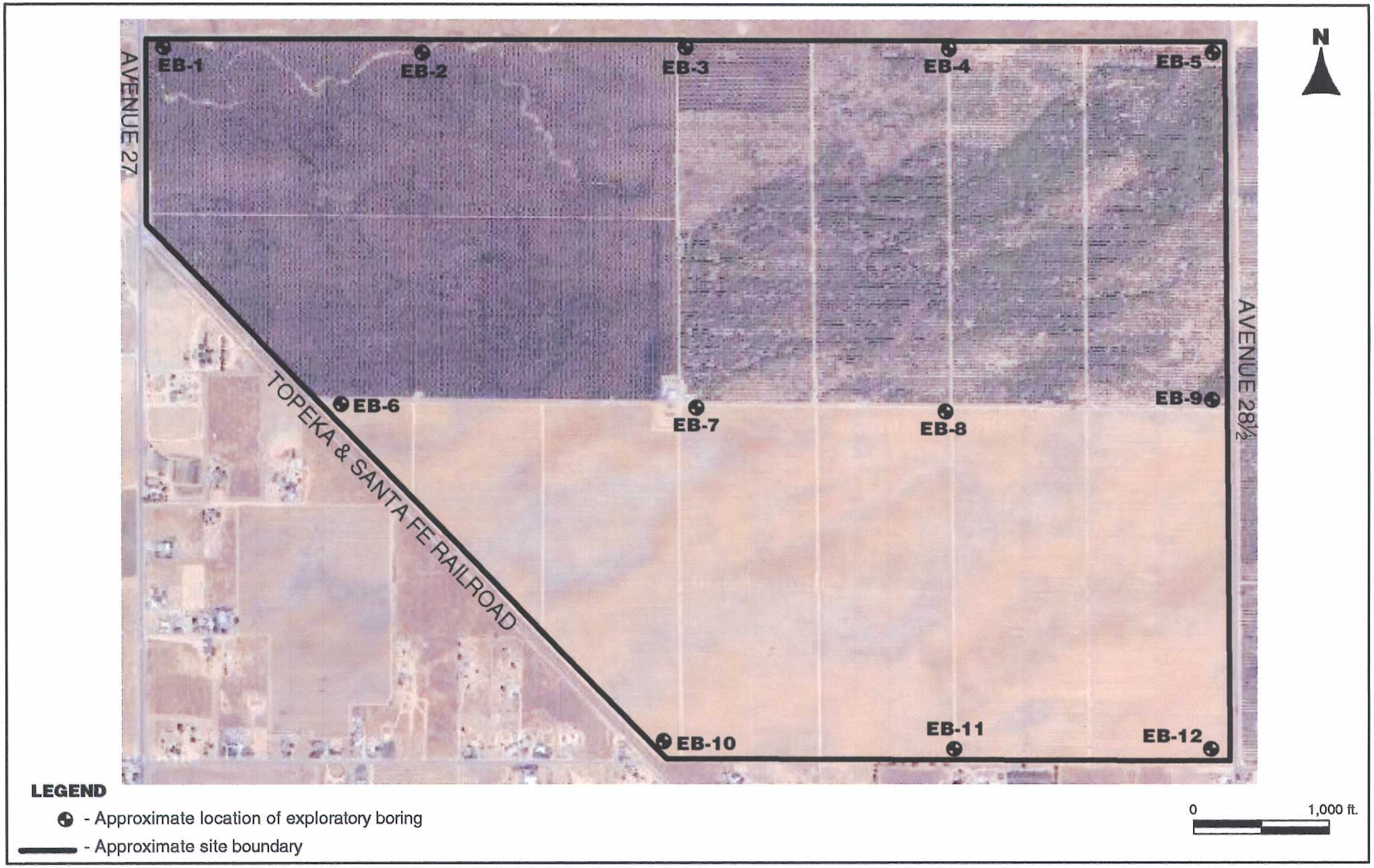
1/07*EB

VICINITY MAP

HERMAN PARCELS
Madera, California

TRC Lowney

FIGURE 1
1989-30



01/10/07*TT

SITE PLAN

HERMAN PARCELS
Madera County, California

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FIGURE 2
1989-30

PRIMARY DIVISIONS			SOIL TYPE		SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (Less than 5% Fines)	GW	●	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	○	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES	GM	○	Silty gravels, gravel-sand-silt mixtures, plastic fines
			GC	▨	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (Less than 5% Fines)	SW	∴	Well graded sands, gravelly sands, little or no fines
			SP	∴	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	SM	▥	Silty sands, sand-silt-mixtures, non-plastic fines
			SC	▨	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50 %		ML	▥	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	☰	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50 %		MH	▥	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	▨	Inorganic clays of high plasticity, fat clays
			OH	≋	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	⩛	Peat and other highly organic soils

DEFINITION OF TERMS

U.S. STANDARD SIEVE SIZE　　CLEAR SQUARE SIEVE OPENINGS

200　40　10　4　3/4"　3"　12"

SILTS AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

GRAIN SIZES

- ☒ TERZAGHI SPLIT SPOON STANDARD PENETRATION
- ⧗ MODIFIED CALIFORNIA
- ▯ D & M UNDERWATER SAMPLER
- ■ SHELBY TUBE
- ○ NO RECOVERY

SAMPLERS

SAND AND GRAVEL	BLOWS/FOOT*
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

RELATIVE DENSITY

SILTS AND CLAYS	STRENGTH+	BLOWS/FOOT*
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-16
VERY STIFF	2-4	16-32
HARD	OVER 4	OVER 32

CONSISTENCY

*Number of blows of 140 pound hammer falling 30 inches to drive a 2-inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).
+Unconfined compressive strength in tons/sq.ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

KEY TO EXPLORATORY BORING LOGS

Unified Soil Classification System (ASTM D-2487)

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FIGURE A-1

EXPLORATORY BORING: EB-1

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 30.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
	0		**SILTY SAND (SM)** loose, moist, reddish brown, fine to medium sand							
					2	☒	4		24	
			decomposing root/branch							
					4	☒	7			
	5		very dense, grades to brown, lightly cemented							
					56	☒				
					63	☒				
	10									
			medium dense, grades to gray, predominately fine sand		17	☒				
	15			SM						
			dense, 3 inch silt seam							
					30	☒				
	20									
					25	☒				
	25									
					22	☒				
	30		Bottom of Boring at 30 feet							

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/15/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-2

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0	▨	**SILTY SAND (SM)** loose, moist, brown, fine to medium sand	SM					
					9	☒	8		18
			very dense, grades light brown		50/1"	☒	10		
	5		grades to reddish brown w/gray		50/5"	☒			
	10				54	☒			
			predominately fine sand		29	☒			
	15		Bottom of Boring at 15 feet						
	20								
	25								
	30								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/10/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-3

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 20.0 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression (scale 1.0, 2.0, 3.0, 4.0)

SURFACE ELEVATION:

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0	**SILTY SAND (SM)** very dense, moist, brown, fine to medium sand	SM	50/5"	☒	8		
				50/3"	☒	9		
	5			50/4"	☒			
	10			50/4"	☒			
		SILT (ML) stiff, moist, gray, some fine sand	ML					
		SILTY SAND (SM) medium dense, moist, gray, fine sand	SM	27	☒			
	15	**POORLY GRADED SAND (SP)** medium dense, moist, gray, fine sand	SP	21	☒	5		4
		SILT (ML) hard, moist, gray, trace fine sand	ML	50/5"	☒			
	20	Bottom of Boring at 20 feet						
	25							
	30							

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA_CORP.GDT 1/10/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-4

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
			SURFACE ELEVATION:						
	0		**SILTY SAND (SM)** medium dense, moist, reddish brown, fine to medium sand		20	☒	6		24
			very dense, cemented		78/11"	☒	10		
	5				50/4"	☒			
				SM					
					50/3"	☒			
	10								
			increased fines		62	☒			
	15		Bottom of Boring at 15 feet						
	20								
	25								
	30								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/15/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-5

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 30.0 FT.

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Undrained Shear Strength (ksf): ○ Pocket Penetrometer; △ Torvane; ● Unconfined Compression; ▲ U-U Triaxial Compression; 1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0	**SILTY SAND (SM)** very dense, moist, reddish brown, fine to medium sand, cemented	SM	50/5"	☒	4	112	
		dense		33	☒			
	5	increased fines, fine sand		78/11"	☒			
	10	grades to gray brown, decreased fines, less cemented		43	☒			
		POORLY GRADED SAND (SP) medium dense, moist, brown, fine sand	SP					
	15			25	☒			
	20			33	☒			
		SILTY SAND/SANDY SILT (SM/ML) dense, gray, moist, fine sand						
	25		SM	39	☒			
		SILTY SAND (SM) medium dense, moist, grades gray to brown, fine sand	SM	25	☒			
	30	Bottom of Boring at 30 feet						

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

TRC Lowney

EXPLORATORY BORING: EB-6

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

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Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0		**SILTY SAND (SM)** very dense, moist, reddish brown, fine to medium sand, cemented	SM	50/5"	☒	9		
			grades to brown		67	☒	8		
	5		increased fines		77	☒	6		31
	10		medium dense		22	☒			
					26	☒			
	15		Bottom of Boring at 15 feet						
	20								
	25								
	30								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/15/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-7

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-18-06 FINISH DATE: 12-18-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
	0		**SILTY SAND (SM)** very dense, moist, brown, fine to medium sand, cemented		50/2"		8			
			medium dense	SM	28	☒	10			
	5		thin silt seam		14	☒	6		18	
			SANDY SILT (ML) hard, moist, brown, fine sand							
	10			ML	37	☒				
			SILTY SAND (SM) medium dense, moist, brown, fine sand	SM	22	☒	5		30	
	15		Bottom of Boring at 15 feet							
	20									
	25									
	30									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/15/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-8

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-19-06 FINISH DATE: 12-19-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)

○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression

1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0	**SILTY SAND (SM)** very dense, moist, brown, fine to medium sand, cemented						
				71/10"	☒	7		
				50/6"	☒	11		
	5	medium dense predominately fine sand, increased fines		27	☒			
			SM					
	10			90	☒			
				41	☒			
	15	Bottom of Boring at 15 feet						
	20							
	25							
	30							

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

TRC Lowney

EXPLORATORY BORING: EB-9

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-19-06 FINISH DATE: 12-19-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

SURFACE ELEVATION:

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
	0		**SILTY SAND (SM)** very dense, moist, brown, fine sand, cemented		50/1"	▬	6			
					50/4"	☒	6			
	5		fine to medium sand		43	☒				
				SM						
	10									
			fine sand, increased fines		77	☒				
	15		Bottom of Boring at 15 feet							
	20									
	25									
	30									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/10/07 SR*

TRC Lowney

EXPLORATORY BORING: EB-10

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-19-06 FINISH DATE: 12-19-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 25.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE	Undrained Shear Strength (ksf)
	0		**SILTY SAND (SM)** loose, moist, reddish brown, fine sand	SM						
					9	☒	4			
			medium dense							
					16	☒	5			
	5									
					11	☒	5		32	
			fine to medium sand, cemented grades to brown		56	☒				
	10									
					27	☒				
	15									
			increase fines, fine sand		27	☒				
	20									
			grades to light gray-brown		49	☒				
	25		Bottom of Boring at 25 feet							
	30									

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

TRC Lowney

EXPLORATORY BORING: EB-11

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-19-06 FINISH DATE: 12-19-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 15.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0		**SILTY SAND (SM)** very dense, moist, brown, fine sand, cemented	SM	50/4"	☒	7		
			medium dense		25	☒	9		
	5		dense		35	☒			
			medium dense, increased fines		12	☒	5		46
	10				23	☒			
	15		Bottom of Boring at 15 feet						
	20								
	25								
	30								

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

TRC Lowney

EXPLORATORY BORING: EB-12

Sheet 1 of 1

DRILL RIG: MOBILE B-40
BORING TYPE: 8-INCH HOLLOW STEM AUGER
LOGGED BY: BRW
START DATE: 12-19-06 FINISH DATE: 12-19-06

PROJECT NO: 1989-30
PROJECT: MADERA HERMAN FEASIBILITY
LOCATION: MADERA, CA
COMPLETION DEPTH: 30.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

Undrained Shear Strength (ksf)
○ Pocket Penetrometer
△ Torvane
● Unconfined Compression
▲ U-U Triaxial Compression
1.0 2.0 3.0 4.0

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS SURFACE ELEVATION:	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT.)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
	0		**SILTY SAND (SM)** very dense, moist, brown, fine to medium sand, cemented		50/3"	☒	14		
					87/10"	☒	9		
	5				92	☒			
			increased fines	SM	69	☒			
	10								
			dense		42	☒			
	15								
			POORLY GRADED SAND (SP) medium dense, moist, light brown, fine to medium sand, some coarse sand		19	☒	3		5
	20								
				SP	18	☒			
	25								
					20	☒			
					29	☒			
	30		Bottom of Boring at 30 feet						

GROUND WATER OBSERVATIONS:
NO FREE GROUND WATER ENCOUNTERED

LA CORP.GDT 1/15/07 SR*

TRC Lowney

F-2 Updated Geotechnical Feasibility Investigation

TRC
Results you can rely on

1920 Old Middlefield Way
Mountain View, CA 94043

650.967.2365 PHONE
650.967.2785 FAX

www.trcsolutions.com

April 3, 2017
274081

Mr. Glenn Pace
PEMBROOK DEVELOPMENT
175 E. Main Avenue #110
Morgan Hill, California 95037

RE: UPDATED GEOTECHNICAL FEASIBILITY INVESTIGATION
MADERA HERMAN PARCELS
MADERA COUNTY, CALIFORNIA

Dear Mr. Pace:

In this letter we provide an update to the geotechnical feasibility investigation report for the subject improvements. As you know, our predecessor firm, TRC Lowney prepared a report titled "Geotechnical Feasibility Investigation, Madera Herman Properties, Madera, California," dated January 15, 2007. We understand the Madera County is requesting an update to that report. We also understand that the project scope remains consistent with those at the time the report was prepared. Therefore, the geological hazards and conclusions that were provided as part of the 2007 report are considered to remain valid unless specifically superseded herein.

In preparation of this update letter, we were provided a Land Subsidence Assessment report titled "Castellina Master Planned Community – Land Subsidence Assessment" dated September 07, 2016, prepared by Wood Rodgers, Inc. We also reviewed the TRC Lowney 2007 report and a custom soil resource report for the project area generated using United States Department of Agriculture Natural Resources Conservation Service (NRCS) website.

SITE CONDITIONS

Subsurface Conditions:

We reviewed the soil map generated using the NRCS website. The soil map indicates that majority of the surficial soils are mapped to be belonging to Cometa sandy loams and San Joaquin sandy loams which are consistent with subsurface conditions that were encountered during the limited subsurface exploration performed as part of the 2007 report.

Ground Water:

No ground water was encountered in the borings drilled as part of the 2007 study to the maximum explored depth of 30 feet below the ground surface. The ground water was measured at a depth of about 105 feet below ground surface at a monitoring well located about 2.5 miles southwest of the project site (www.geotracker.waterboards.ca.gov). In addition, ground water was measured at a depth of about 60 feet below ground surface in 1990s at a well located about 1,500 feet east of the project site(www.water.ca.gov/waterdatalibrary). Variations in depth to ground water can be expected based on annual precipitation amounts, ground water withdrawal and other factors.

GEOLOGICAL HAZARDS

A brief qualitative evaluation of geologic hazards that were either not made in the 2007 report or updated in the letter is presented below.

Ground Shaking

Based on Equation 11.8-1 of American Society of Civil Engineers(ASCE) 7-10 (ASCE, 2010), a maximum considered earthquake geometric mean peak ground acceleration (PGA_M) of 0.31g can be expected at the site.

Flooding

As shown on the September 26, 2008, Federal Emergency Management Agency, Flood Insurance Rate Map for the Madera County, the majority of the site is within Zone X, described as "Areas determined to be outside the 0.2% annual chance floodplain".

A small area in the northwestern portion of the site is designated as a Special Flood Hazard Area Subject to Inundation by the 1% Annual Chance Flood. The said portion of the site is within Zone A, described as "No base flood elevations determined".

Subsidence

We reviewed the 2016 report prepared by Wood Rodgers for the site. According to the report, the site is expected to undergo subsidence of approximately one inch per year during drought periods based on the data and reports reviewed in preparation of the 2016 report.

CONCLUSIONS

The 2007 feasibility level geotechnical investigation report is considered to remain valid unless specifically superseded in this update letter. The information in this update letter and the 2007 report are intended for planning purposes only. We recommended that we be retained to perform a design-level investigation once site development plans are available.

This letter has been prepared for the sole use of Pembrook Development specifically for planning of the proposed site improvements at the Castellina Master Planned Community development in Madera, California. The opinions and recommendations presented in this letter have been formulated in accordance with accepted geotechnical engineering practices that exist at the time and location this letter was written. No other warranty, expressed or implied, is made or should be inferred.

If you have any questions concerning our recommendations, please call and we will be glad to discuss them with you.

Sincerely,

TRC

Scott Leck, P.E., G.E.
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
SCOTT M. LECK
No GE002067
Exp. 6/30/2018
GEOTECHNICAL
STATE OF CALIFORNIA

SML:MBD

Copies: Addressee (e-mail)

F-3 Land Subsidence Assessment

WOOD RODGERS

September 7, 2016 Job No. 3314.003

Mr. Glenn Pace
Pembrook Development
175 E. Main Avenue, #110
Morgan Hill, California 95037

Dear Mr. Pace:

Subject: Castellina Master Planned Community – Land Subsidence Assessment

In response to your request, Wood Rodgers, Inc. (Wood Rodgers) is pleased to provide this summary of documented land subsidence in the vicinity of the Castellina Master Planned Community (Project). Located in Madera County, California, the Project is in the San Joaquin Valley (Valley) which has experienced land subsidence. Land subsidence within the Valley was discovered in the 1950s as a result of groundwater over-pumping and resulted in significant drops in land surface elevations. The construction of extensometers quantified the rate and magnitude of ground surface displacement; however, primarily on the west side of the valley.

Recently published data suggests that land subsidence continues in the vicinity of El Nido, California. The land subsidence depression in the El Nido area appears to extend to the Project site.

Land Subsidence and Monitoring

Land subsidence has been correlated to occur during drought periods as a result of increased groundwater pumping for agriculture (Faunt, 2016) and with geologic formations consisting of fine-grained sediments. Two types of land subsidence occur, elastic and inelastic subsidence. Elastic subsidence is temporary, typically a result of seasonal fluctuations in groundwater levels where ground surface elevations return to previous years conditions. Inelastic land subsidence is the permanent displacement of the ground surface and occurs when groundwater levels are drawn down past the respective historical low, such as during prolonged droughts when groundwater basins are stressed and sometimes overdrafted.

Permanent land subsidence can occur when fine-grained sediments (such as compressible clays) compact. The clay compaction results in the permanent loss of groundwater storage capacity and lowers the elevation of the ground surface.

Direct and indirect (remote) methods are utilized to measure ground surface displacement and land subsidence. Direct methods include extensometers constructed in deep borings and ground-based GPS (Global Positioning Systems) stations. Extensometers measure the change in thickness of a particular depth interval or the compaction and expansion of an aquifer system. A network of extensometers monitored by the USGS is located along the western side of the valley, with the nearest station approximately 30 miles southwest of the Project. GPS stations, which provide three-dimensional monitoring of a single point on the ground surface, were constructed to monitor for geologic plate motion caused by plate tectonics. GPS stations have increasingly been used to monitor for land subsidence. The U.S. Bureau of Reclamation surveys a geodetic network of 70 GPS stations for the San Joaquin River Restoration Program (SJRRP) in July and December of each year to monitor ongoing subsidence. In addition, continuously monitored GPS stations (CGPS) record daily measurements which allow for comparison between selected time frames. One such monitored CGPS station, Station P307, is located in the City of Madera approximately 3.5 miles south of the Project as shown in Figure 1. The CGPS station is managed by the Plate Boundary Observatory/UNAVCO (a non-profit university-governed consortium), which publishes the data on their website[1].

In addition to direct measurements, remote measurements of land surface elevation include the use of radar acquired from satellites orbiting the earth and from airplanes. Interferometric Synthetic Aperture Radar (InSAR) is used to measure the elevation of the ground surface over large areas. The technique uses two Synthetic Aperture Radar (SAR) images of the same area acquired at different times and identified changes in land surface elevation. The differences are illustrated on maps called interferograms and show changes to ground surface elevations for that time frame, with resolution typically of less than one-inch, and usually less than 0.5-inch.

Regional Land Subsidence

Several groups have released study's evaluating the location, amount, and rate of land subsidence in the Valley. Regionally, land subsidence has occurred northwest of the Project near El Nido.

As reported by NASA's Jet Propulsion Laboratory (JPL) in a report titled "Progress Report: Subsidence in the Central Valley, California," interferograms prepared from InSAR data between 2007 and 2010 indicate an area of land subsidence approximately 25 miles northwest of the Project site. The subsidence is centered south of the town of El Nido, where at its center, subsidence was approximately 24 inches for the period. The magnitude of subsidence in this depression decreases with distance towards the Project site. From May 2014 to January 2015, an additional 10-inches of land subsidence occurred within this depression. The Project site is located on the outer edge of the mapped area of land subsidence.

A report by the USGS on land subsidence, prepared by Faunt, analyzed interferograms generated between 2008 and 2010 from the European Space Agency's ENVISAT satellite. This report, similar in conclusion to JPL's, identified over 21 inches of land subsidence has occurred near the town of El Nido, with the Project site located on the perimeter of this area of subsidence.

Biannual reports of land subsidence prepared by the SJRRP from December 2011 to December 2015 suggest land subsidence rates of up to one foot per year have occurred in the area of El

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[1] https://www.unavco.org/instrumentation/networks/status/pbo/overview/P307

Nido; however, the rate of subsidence decreases with distance. As shown in Figure 1, the SJRRP data illustrates the magnitude of land subsidence for the period between December 2014 and December 2015.

Local Subsidence

The interferograms analyzed by JPL for the Valley indicate between June 2007 and December 2010, land subsidence between two and five inches has occurred in the area of the Project. According to Faunt (of the USGS), there is less than one inch of subsidence during this period.

Similarly, daily ground surface elevations starting in October of 2005, as monitored by the UNAVCO CGPS station in Madera County (P307), indicate annual subsidence of just over one inch from 2010 through 2015, with a total displacement of approximately seven inches. Since readings have begun (October 2005), total ground surface displacement recorded at Station P307 is just over 11 inches, which indicates the Madera area is susceptible to minor land subsidence. As shown in Figure 1, the SJRRP program interpolates an annual rate of subsidence of fewer than 0.3 feet (3.6 inches) at the Project site.

Summary and Conclusions

Direct and remote land subsidence data indicate that the Project area is currently subject to a small amount of annual subsidence. From the remote data, reports suggest that subsidence has been between approximately one to five inches per year; however, the CGPS station indicates it is likely closer to one inch per year. Future land subsidence can be expected at a rate of approximately one inch per year during drought periods based on the data and reports reviewed. This Project would reduce the amount of groundwater pumping that is currently conducted at the Project site, and thus should not exacerbate the current rate of subsidence.

If you have any questions or require additional information, we would be pleased to respond.

Sincerely,

Lawrence H. Ernst

Lawrence H. Ernst, PG, CEG, CHG
Principal Hydrogeologist

Cc: Mr. James Pace

Enclosures

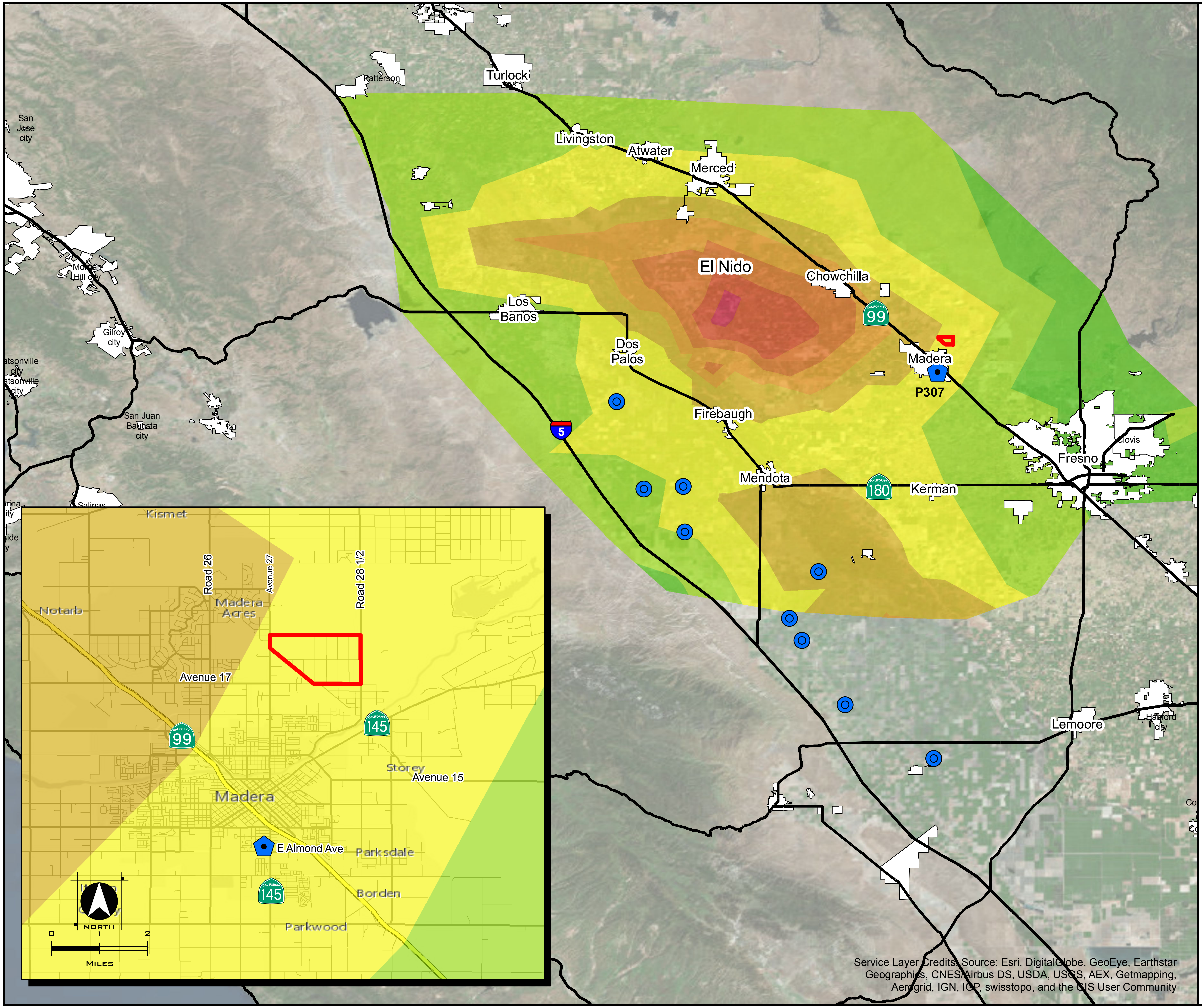
References

Faunt, C.C., Sneed, M., Traum, J. et al. Hydrogeol J (2016) 24: 675. doi:10.1007/s10040-015-1339-x

Farr, TG., C. Jones, Z Liu, 2015, Progress Report: Subsidence in the Central Valley, California, accessed at http://water.ca.gov/groundwater/docs/NASA_REPORT.pdf

San Joaquin River Restoration Program, Subsidence Monitoring Data, accessed at http://www.restoresjr.net/monitoring-data/subsidence-monitoring/

U.S. Department of the Interior, U.S. Geological Survey, Land Subsidence Measuring, accessed at http://ca.water.usgs.gov/land_subsidence/california-subsidence-measuring.html



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LAND SUBSIDENCE
CASTELLINA MASTER PLANNED COMMUNITY
MADERA COUNTY, CALIFORNIA
SEPTEMBER, 2016

NORTH

0 5 10

MILES

- ⬟ UNAVCO Monitored CGPS Station
- ◎ USGS Monitored Extensometer
- ☐ Incorporated City
- 🟥 Project Location

Annual Rate of Subsidence

December 2014 to December 2015

- 🟦 0.3 to 0.15 Feet
- 🟩 0.15 to 0.0 Feet
- 🟩 0.0 to -0.15 Feet
- 🟨 -0.15 to -0.3 Feet
- 🟫 -0.3 to -0.45 Feet
- 🟧 -0.45 to -0.6 Feet
- 🟧 -0.6 to -0.75 Feet
- 🟥 -0.75 to -0.9 Feet
- 🟥 -0.9 to -0.95 Feet

SOURCES: Annual rate of subsidence provided by the San Joaquin River Restoration Program (SJRRP) for December 2014 to December 2015 (website: www.restorejr.net/monitoring-data/subsidence-monitoring).

Continously monitored Golbal Positioning System (CGPS) Station location provided by UNAVCO (http://www.unavco.org/instrumentation/networks/status/pbo/overview/P307)

Extensometer Locations provided by the USGS (http://ca.water.usgs.gov/land_subsidence/california-subsidence-measuring.html)

WOOD RODGERS

J:\3000-s\3314_Castellina_LLC\3314.003_Castellina_Subsidence_Assessment\GIS\Tasks\Castellina_Subsidence_Map_20160907.mxd 9/7/2016 11:38:08 AM sspaeth

FIGURE 1