BAUER
associates, inc.
GEOTECHNICAL CONSULTANTS

May 23, 2019
Job No. 3621.0

Mr. Shahram Bijan
1211 Broadway
Sonoma, CA 95476

Report
Geotechnical Investigation
Proposed Residential Development
1211 Broadway
Sonoma, California

This report presents the results of our geotechnical investigation for the subject project. The planned improvements are shown on Sheet C1.0, dated February 7, 2019, prepared by Adobe Associates, Inc. The plan is partially reproduced and shown on Plate 1.

We understand that the project includes construction of two duplexes, and one single family residence. Further, an existing residence will be re-located on the property. The new structures will be one- or two-stories high with concrete slab-on-grade floors. Foundation loads are expected to be typical for the type of construction indicated. Associated development includes asphalt paved parking and driveway areas. We understand that unretained cuts and fills will be relatively minor and less than about 2 feet high. Retaining walls are not planned.

The scope of our investigation, as outlined in our March 22, 2019 agreement included reviewing selected published geologic information from our files, exploring subsurface conditions at the site, and performing laboratory testing on selected samples. Based upon our work, we have developed conclusions and recommendations concerning:

1. Proximity of the site to published active faults.

2. Soil/rock and ground water conditions observed.

3. Site preparation and grading.

Westside Center
6470 Mirabel Road
Post Office Box 460
Forestville, CA 95436
707.887.2505

4. Foundation type(s) and design criteria for the new and re-located structures.

5. Concrete slabs-on-grade.

6. Pavement thickness design.

7. Geotechnical engineering drainage.

8. Supplemental services.

Our scope of work did not include an evaluation of any potential hazardous waste contamination or corrosion potential of the soil or groundwater at the site. Further, our scope of services did not include evaluation of areas beyond the planned improvements (i.e. existing development).

WORK PERFORMED

We reviewed the following selected geotechnical data:

Huffman, M. E., and Armstrong, C. F., 1980; Geology for Planning in Sonoma County: California Division of Mines and Geology, Special Report 120, Scale 1:62,500.

USGS Open-File Reports 00-444 and 2006-1037, Interactive Liquefaction Susceptibility Map, http://quake.abag.ca.gov/earthquakes/

United States Geological Survey, 2007, Design Maps Web Application, Version 3.1.0, updated June 23, 2014, http://earthquake.usgs.gov/designmaps/us/application.php

Wagner, D.L., et. al., 2004, Geologic Map of the Sonoma 7.5’ Quadrangle, Sonoma and Napa Counties, California: A Digital Database, California Geological Survey, Scale 1:24,000.

On April 3, 2019, our geotechnical engineer explored the subsurface conditions to the extent of three test borings within the improvement areas. The test borings were drilled with a track mounted drill rig equipped with 6-inch diameter solid stem augers. The completed test holes were drilled to depths ranging to about 14 feet.

The test boring locations, as approximately shown on Plate 1, were located by pacing or estimating distances from features indicated on the site plan provided to us. The test boring locations should be considered accurate only to the degree implied by the method used.

Our engineer logged the conditions exposed and obtained relatively undisturbed samples at selected intervals for visual identification and laboratory testing. Relatively undisturbed samples were obtained with either a 2.4-inch, inside-diameter, split-spoon sampler driven with a 70-pound hammer. The stroke during driving was about 30 inches. The blows required to drive the sampler were recorded. Logs of the borings showing the materials encountered, sample depths, and converted blow counts are presented on Plates 2 through 4. The materials are classified in accordance with the Unified Soil Classification System, presented on Plate 5.

The logs show our interpretation of the subsurface conditions on the date and locations indicated, and it is not warranted that they are representative of the subsurface conditions at other locations and times. Also, the stratification lines on the logs represent the approximate boundaries between soil types; the transition may be gradual. The test borings were backfilled with spoils from the borings.

Representative samples of the soils encountered were laboratory tested to determine their classification, moisture content, density, and strength. The test results are presented on the logs in the manner described in the Key to Test Data, Plate 5.

SITE CONDITIONS

The subject property is located on the west side of Broadway (approximate Google Earth coordinates: 38.279901°; 122.460389°), approximately 250 feet north of the Woodworth Lane. The nearly level property is currently developed with a residence. In the backyard is a concrete slab, well, and scattered trees.

The geologic maps reviewed indicate that the property is underlain by alluvial fan deposits. These deposits consist of sands, gravels, silts, and clays.

As shown on the test boring logs, Plates 2 through 4, the site is typically covered by surface soils consisting of loose to medium dense clayey sands. These soils, typically ranging from about 1-1/2 to 3 feet deep are weak. Weak/porous soils and variable density fills, if present, are typically prone to collapse and/or consolidation when saturated and under load. The estimated depth of weak soils is shown on the right side of the test boring logs.

Our visual classification and laboratory test results indicate that the surface soils generally exhibit low expansion potential. Moderately to highly expansive soils, if present, can heave and crack lightly loaded, shallow foundations and slabs-on-grade.

Underlying the surface soils to the maximum depths explored are heterogeneous layers of medium dense to dense clayey and silty sands and gravels, and very stiff sandy silt. The underlying materials are considered only slightly compressible for the anticipated building loads.

Groundwater was encountered only in Test Borings 1 and 3 at depths of 7 and 5 feet, respectively. Groundwater conditions are expected to vary seasonally and at different locations. We have previously observed shallow temporary perched water in the project vicinity. Our work did not include an evaluation of flooding.

A review of liquefaction susceptibility maps prepared by USGS indicates that the site is located in an area of low liquefaction potential. As throughout Sonoma County, ground shaking from earthquakes represents a significant geologic hazard to developments. The intensity of future ground shaking will be dependent on several factors such as distance from the site to the earthquake focus, magnitude of the earthquake, and response of the underlying soil and rock. We did not observe adverse subsurface conditions prone to densification or liquefaction below the weak surface and near surface soils. It will be necessary to design and construct the project in strict accordance with current standards for earthquake-resistant construction.

The published maps do not indicate active faults at this site. The property is not within an Alquist-Priolo (AP) Earthquake Fault Zone, which could require a detailed investigation to evaluate the hazard of fault surface rupture in relation to nearby active faults. The nearest fault zones considered seismically active (experiencing surface rupture within about the last

11,000 years) are the West Napa and Rodgers Creek faults, located about 7-1/2 miles to the southwest, and 4 miles to the southeast, respectively. The historically active San Andreas Fault is about 24 miles to the southwest.

Other faults, not currently considered active, may be located closer to the site and the published map by Huffman indicates an unnamed queried, concealed fault approximately 2,300 feet northeast of the site. Published geologic maps by the California Geological Survey do not show this unnamed fault.

As throughout the entire Northern California area, ground shaking from earthquakes represents a significant geologic hazard to developments. The intensity of ground shaking will be dependent on several factors such as distance from the site to the earthquake focus, magnitude of the earthquake and response of the underlying soil and rock. Severe ground shaking could induce slope failures in weak soils and/or steep slopes. Older faults, considered to have experienced surface rupture within about the last 2 million years are located nearer the site. Such faulting is considered much less prone to renewed movement.

DISCUSSION AND CONCLUSIONS

Based on the results of our investigation, we conclude that the planned development is feasible from a geotechnical engineering viewpoint. The primary geotechnical concerns are the presence of weak natural surface soils and possibly variable density old fills.

Upon saturation, weak/porous soils and variable density old fills will lose strength and consolidate rapidly under loads of new fill and structural elements. Saturation will occur when the natural evaporation of soil moisture is inhibited by new fill and structural elements. Such movements can result in unacceptable cracking of lightly-loaded structural elements, such as foundations and concrete slabs. We conclude that the existing surface materials are unsuitable for support of fills, foundations, and concrete slabs in their present condition.

Suitable shallow foundation and critical slab support can be achieved by upgrading weak/porous surface soils/variable density fills in building areas by removal and recompaction for their full depth. Alternatively, deepened foundations could be used if raised wood floors or structural slabs were used. Deepened spread footings or drilled, cast-in-place could be considered.

Non-critical slabs (such as for exterior areas) may be constructed on properly prepared subgrade provided that: 1) the slabs are separated from foundations; 2) slabs are designed to minimize cracking (i.e. reinforced and provided with control joints); and 3) some soil related cracking and settlement is considered acceptable. Improved performance of slabs could be attained by removal and replacement of the weak soils as engineered fill.

Control of surface run-off will significantly enhance the stability of the site. Roof gutter downspouts must be collected into non-perforated pipes and discharged into the site storm drainage, or onto concrete slabs-on-grade or asphalt pavements that drain away from the foundations. Underfloor areas should be sloped to drain and provided with outlets. Outlets should be provided in slab rock (where interior slabs are used) to reduce the risk of water build up in the slab rock.

Groundwater was encountered in two of our test borings at depths of 5 and 7 feet. However, groundwater conditions are expected to vary. We have previously encountered shallow perched groundwater in the project vicinity. Excavations performed in the summer or autumn months will typically result in a lower risk of encountering groundwater.

The published geologic maps do not indicate active faults on the site, therefore the risk of fault rupture during earthquakes is considered to be low. Like the entire Sonoma County, the site is subject to severe ground shaking during earthquakes generated by faults in the region. The intensity of future ground shaking will depend on the distance from the earthquake to the site, magnitude of the earthquake, and response of the structure to the underlying soil and rock. It will be necessary to design and construct the structure in accordance with current standards for earthquake-resistant construction.

RECOMMENDATIONS

Site Preparation and Grading

The following is presented for general grading. We must review and approve any grading planned, since site grading may have a negative impact on site stability.

Areas to be graded should be cleared of designated brush, rubble, debris and old fills. Material generated by the clearing operations should be removed from the site. Wells, cesspools, and other voids encountered or generated during clearing should be either backfilled with granular material or compacted soil, or capped with concrete as determined by us and in accordance with Sonoma County requirements.

Areas to be graded should be stripped of the upper soils containing root growth and organic matter. The strippings should be removed from the site, stockpiled for reuse as topsoil, or mixed with at least two parts soil and used as fill in areas 10 feet beyond structures, walks and paved areas.

For the purpose of definition, "select fill areas" referred to in this report are buildings with shallow foundation type and critical-use concrete slab areas. Select fill areas also include the zones extending for a distance of at least 5 feet beyond outside edges of slabs and perimeter footings or other footings extending from buildings. Within the select fill areas, existing weak surface and old fill soils should be removed for their full depth. The depth and extent of overexcavation should be approved in the field by us. Where deepened foundations and either raised wood floors or structural slabs are used, overexcavation of weak soils will not be required.

If isolated deeper zones of soft, saturated, dry (shrinkage cracks), highly porous or organic soils are encountered during excavation and recompaction, those soils should be removed to expose firm soils.

Within the stripping and excavation areas, the exposed bottoms should be moisture conditioned to 2 percent above optimum moisture content, scarified and compacted to at least 90 percent relative compaction. Relative compaction refers to the in-place dry density of the soil expressed as a percentage of the maximum dry density of the same soil, as determined by ASTM D 1557-12. Optimum moisture content is the water content (percentage by dry weight) corresponding to the maximum dry density.

The on-site soils should be suitable for reuse as general fill provided that: 1) all rock sizes greater than 6 inches in largest dimension and perishable materials are removed; and 2) the fill materials are approved by us prior to use. Select fill should be used within 30 inches of subgrade in 'select fill' areas. Imported fill should be free of organic matter, non-expansive and should generally conform to the following requirements:

Sieve Size	Percent Passing
6-inch	100
4-inch	90-100
No. 200	15-60

Liquid Limit - 40 Maximum
Plasticity Index - 15 Maximum
(ASTM D 4318-10 Wet Test Method)

Fill should be placed in thin lifts (normally 6 to 8 inches depending on compaction equipment), uniformly moisture conditioned to 2 percent above optimum, and compacted to at least 90 percent relative compaction. All surfaces should be finished to present a smooth, unyielding subgrade.

Fill and cut slopes should be constructed no steeper than 2:1. Slopes steeper than 2:1 should be retained.

Foundations

As discussed previously, considering the site conditions, we anticipate that either spread footings or drilled piers are suitable foundation types for the planned structures. Combination of foundation types should not be used on individual structures.

Spread Foundations

Spread footings should be at least 12 inches wide, 12 inches deep, and penetrate at least 12 inches into engineered fill or firm soils below weak soils. Perimeter wall footings should be continuous.

Spread footings bearing into engineered fill or firm soils can be designed using an allowable bearing pressure of 2,000 and 3,000 pounds per square foot (psf) for dead plus long-term live loads and total design loads, respectively. We should observe the footing excavations prior to the placement of reinforcing steel and concrete.

The portion of the foundations extending into engineered fill or firm soils may impose a passive equivalent fluid pressure of 350 pounds per cubic foot (pcf), triangular distribution, and a friction factor of 0.35 times the net vertical dead load. Passive pressures should be neglected within the upper 1 foot, unless footings are confined by other construction.

Drilled Pier and Gradebeam Foundations

Foundation support can be obtained from drilled, cast-in-place, reinforced concrete piers. Piers should be at least 14 inches in diameter and extend at least 4 feet into firm soil below the weak soils. All piers should be at least 8 feet deep and should not be closer than 3 pier diameters, center to center.

The portion of the piers extending into firm soil, below the weak soils can impose 750 psf in skin friction. Perimeter piers should be interconnected with gradebeams designed to support the design structural loads per current code requirements. Pullout capacity of the piers should be considered as one-half the downward capacity. End bearing should be neglected because of the difficulty of cleaning out small diameter pier holes, and the uncertainty of mobilizing end bearing and skin friction simultaneously.

The pier holes should contain no more than 3 inches of slough, and the remaining slough should be tamped with a heavy timber, or similar, prior to concrete placement to prevent wet concrete from settling. Excess concrete must be removed to planned dimensions, from the bottom of gradebeams and tops of piers.

The portion of the piers extending into firm material may impose a passive equivalent fluid pressure of 350 pcf acting on two pier diameters. Passive pressure should be neglected within the upper 12 inches of pad grade unless foundations are confined by other construction.

At the time of our exploration, groundwater was encountered in our test borings as shallow as about 5 feet. If groundwater is encountered, it will be necessary to place the concrete by the tremie method or dewater the holes. If caving soils are encountered during pier drilling, it may be necessary to case the holes.

We should observe the start of pier drilling operations to note the conditions exposed and provide recommendations to the contractor. We should observe the completed pier excavations prior to the placement of reinforcing steel and concrete.

Seismic Design Criteria

The following criteria is based on 2016 CBC guidelines, ASCE 7-10, and USGS Earthquake Ground Motion Parameters:

Spectral Response Acceleration, S_S (0.2 sec.) – 1.500g
Spectral Response Acceleration, S_1 (1.0 sec.) – 0.600g
Seismic Design Category – D

Title 24, Part 2, Section 1613.5.2, of the 2016 CBC indicates that site categorization for seismic design should be based on the average soil values within the upper 100 feet of the site. Although the scope of our investigation was limited to relatively shallow test pits (ranging to about 14 feet deep), we estimate that a Site Classification "D" will be appropriate for design. Upon request, we could perform supplemental exploration to determine the actual subsurface conditions ranging to 100 feet.

Asphalt Pavement Structural Sections

Based on our experience with similar soils, we estimate that a Resistance (R-) Value of 10 would be appropriate for design. Using this R-Value and the assumed Traffic Indices (T.I.'s) below, we recommend the following pavement sections. Traffic Indices are typically provided by the Project Civil Engineer. We would be pleased to evaluate and provide recommended T.I.'s for the project if anticipated traffic loadings are available.

T.I.	Asphalt Concrete (inches)	Class II* Aggregate Base (inches)
4.0	3.0	6
4.5	3.0	8
5.0	3.0	9
5.5	3.0	11
6.0	3.0	13
6.5	3.5	14
7.0	4.0	15

*R-Value = 78 minimum

The flexible pavement materials and construction methods should conform to the quality requirements of the State of California, Caltrans Standard Specifications, current edition, and that of the City of Sonoma. We have not developed pavement thicknesses for the paved areas adjacent the dumpsters. We understand that recommendations are available from the waste disposal service companies for dumpster areas.

Prior to preparation of the subgrade, all underground utilities in the paved areas should be installed and properly backfilled, and the concrete curbs and gutters or header-boards should be in place. Subgrade soil should be uniformly moisture conditioned to 2 percent above optimum moisture content and compacted to at least 95 percent relative compaction, providing a firm and unyielding surface. This may require scarifying and recompacting to achieve uniformity. The aggregate base materials should be placed in thin lifts in a manner to prevent segregation, uniformly moisture conditioned, and compacted to at least 95 percent relative compaction to provide a smooth, unyielding surface.

Permeable Pavers

Truegrid Pro Plus grass fill blocks are planned for vehicle areas. The Truegrid product provides a permeable 'pavement' system. We understand from Mr. Nathan Wood of Truegrid that this product is considered appropriate for the intended use (i.e., six residential units and the potential for a 48,000-pound fire truck) and may not be appropriate for garbage truck loading. We understand from Ms. Casey McDonald of Adobe Associates, that garbage trucks are not anticipated.

Truegrid Pro Plus should be installed in accordance with the manufacturer's requirements and the following recommendations. Subgrade soils should be prepared as outlined in the previous sections. Geotextile fabric (Mirafi 180N or equivalent) should be placed between the subgrade and aggregate. A minimum of 12 inches of aggregate should be placed and compacted. Clean gravel (i.e. no fines) is typically not used in paved vehicle areas since the gravel is potentially susceptible to some movement. Class 2 Aggregate Base would typically be recommended, however, baserock will reduce the desired permeability qualities of the permeable pavers. Gravel materials should be crushed materials to reduce movements under traffic loads. We should be contacted to observe placement of the rock and proof roll the materials.

Concrete Slab-On-Grade

Provided surface materials are prepared as recommended in the "Site Preparation and Grading" section of this report, slabs-on-grade can be used. Slab-on-grade subgrade should be smooth, uniform and compacted to at least 90 percent relative compaction. Subgrade should be maintained at a uniform moisture, at least 2 percent above optimum moisture content, until the concrete slabs are placed.

Non-critical slabs (such as for exterior areas) may be constructed on properly prepared subgrade provided that: 1) the slabs are separated from foundations; 2) slabs are designed to minimize cracking (i.e. reinforced and provided with control joints); and 3) some soil related cracking and settlement is considered acceptable. Improved performance of slabs could be attained by removal and replacement of some, or all, of the weak soils with non-expansive engineered fill.

Slabs should be underlain with a capillary moisture break and cushion layer consisting of at least four inches of clean, free-draining crushed rock. The crushed rock should be at least 1/4-inch, and no larger than 3/4-inch, in size.

Moisture will condense on the underside of slabs. Where moisture migration through slabs is detrimental, waterproofing methods and specifications should be determined by others for incorporation into the project plans. Slabs should be at least 4 inches thick and reinforced to reduce cracking. Exterior and utility area slabs should be carefully separated from foundations with felt paper, mastic, or other positive and low friction separation.

Some cracking of slabs must be anticipated considering concrete shrinkage. Reinforcing must be carefully installed in accordance with the structural engineer's recommendations to minimize the potential of cracking. We typically recommend the use of steel rebar reinforcement (rather than welded wire mesh) as directed by the structural engineer. We have previously observed that wire mesh is often not properly located in the slabs.

Geotechnical Engineering Drainage

Ponding water will be detrimental to foundations, therefore the site should be graded to provide positive drainage away from foundations. Roofs should be provided with gutters, and the downspouts connected to non-perforated pipes discharging in erosion resistant areas well away from the structures and slopes.

If raised wood floors are used, crawl space areas beneath structures should be graded to drain and be provided with a means to outlet any water which may accumulate. Outlets should be provided in the slab rock if concrete slab-on-grade floors are constructed, to reduce the risk of water build up in the slab rock. Increased mitigation should be provided by the installation of trench subdrains beneath the slab rock. The subdrains should consist of 12-inch deep by 12-inch wide trenches that cross the slab area, as directed by us. The slab rock should be connected to the subdrain rock. The pipe, rock, and fabric should conform to those described below. The pipe should consist of PVC Schedule 40 or ABS with a SDR of 35 or better. The trench should be backfilled with clean, free-draining, 3/4 or 1-1/2-inch crushed drain rock, separated from adjacent soil/rock by a non-woven filter fabric. As an alternative, Class II permeable material complying with Caltrans Section 68, may be used without filter fabric.

Supplemental Services

We should be contacted during design to discuss alternative approaches and our recommendations. We should review the final plans for conformance with the intent of our recommendations.

During grading and foundation construction, we should provide intermittent geotechnical engineering observations, along with necessary field and laboratory testing, during: 1) removal of weak soils; 2) fill placement and compaction; 3) preparation and compaction of subgrade; and 4) excavation of foundations. These observations and tests would allow us to check that the contractor's work conforms with the intent of our recommendations and the project plans and specifications. These observations also permit us to check that conditions encountered are as anticipated, and modify our recommendations, as necessary. Upon completion of the project, we should perform a final observation prior to occupancy. We should summarize the results of this work in a final report.

These supplemental services are performed on an as-requested basis, and we can accept absolutely no responsibility for items that we are not notified to observe. These supplemental services are in addition to this investigation, and are charged for on an hourly basis in accordance with our Schedule of Charges. We must be provided with at least 48 hours notice for scheduling our initial site visit, and 24 hours thereafter.

MAINTENANCE

Periodic land maintenance will be required. Surface and subsurface drains should be checked frequently, and cleaned and maintained as necessary.

LIMITATIONS

We performed the investigation and prepared this report in accordance with generally accepted standards of the geotechnical engineering profession. No other warranty, either express or implied, is given.

If the project is revised, or if conditions different from those described in this report are encountered during construction, we should be notified immediately so that we can take timely action to modify our recommendations, if warranted. Site conditions and standards of practice change. Therefore, we should be notified to update this report if construction is not performed within 18 months of the submittal date.

We trust this provides the information you require at this time. If you have questions or wish to discuss this further, please call.

Very truly yours,

BAUER ASSOCIATES, INC.

REGISTERED PROFESSIONAL ENGINEER
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5/23/19
GEOTECHNICAL
STATE OF CALIFORNIA

Bryce Bauer
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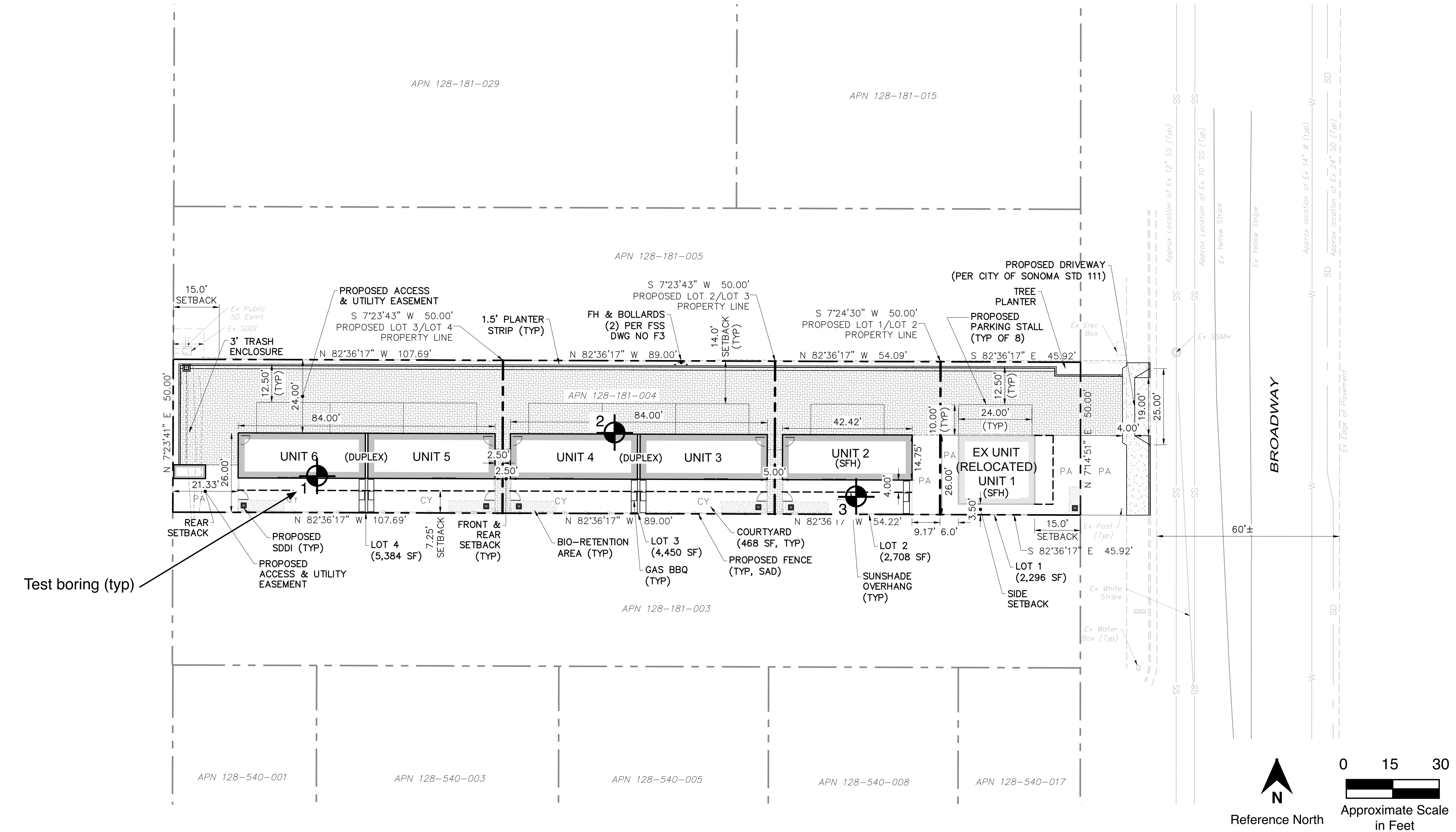
Arthur H. Graff
Geotechnical Engineer

BB/AHG (gi/broadway)
Attachments: Plates 1 through 5
Copies submitted: email only



Notes:
Adapted from Sheet C1.0, Overall Site Plan; Adobe Associates, Inc.; February 7, 2019.
The location of all features is approximate.

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3621.0 Date: 4/19 By: VPM	**SITE PLAN** 1211 BROADWAY Sonoma, California	PLATE **1**

Equipment: 6" solid stem auger

Date: April 3, 2019

Elevation: Not Available

Laboratory Tests	Blows/Foot*	Moisture Content (%)	Dry Density (pcf)
Atterberg Limits LL = 24 PL = 17 PI = 7 Minus No. 200 =29 percent	19/6"		
	19/4"		
	32/6"	11.7	103
	26/3"		

Depth: 3, 6, 9, 12, 15, 18, 21

Sample

DARK BROWN CLAYEY SAND (SC)
medium dense, saturated, porous

Weak Soils

YELLOW BROWN GRAVELLY SAND (SC)
with clay, medium dense, saturated

dense below about 5'

driller noted fewer gravels below about 7'

water level 1 hour after drilling

BROWN SANDY GRAVEL (GP)
dense, saturated

Moderately difficult drilling below about 10'

Bottom of boring at 14 feet
Boring caved to about 11'

* Blows converted to Standard Penetration Resistance Values

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Job No: 3621.0

Date: 4/19

By: VPM

LOG OF TEST BORING 1

1211 BROADWAY
Sonoma, California

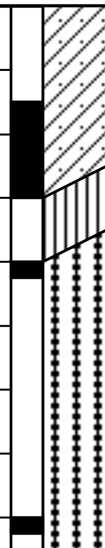
PLATE **2**

Equipment: 6" solid stem auger

Date: April 3, 2019

Elevation: Not Available

Laboratory Tests	Blows/Foot*	Moisture Content (%)	Dry Density (pcf)	Depth	Sample
	6/6" 8/6"	19.8	101		
				3	
	22/3"				
				6	
	22/3"				
				9	
				12	
				15	
				18	
				21	



DARK BROWN CLAYEY SAND (SC)
medium dense, saturated

YELLOW BROWN SANDY GRAVELLY SILT (ML)
very stiff, wet

YELLOW BROWN SILTY GRAVEL (GM)
medium dense to dense, wet

difficult drilling below about 6'

Bottom of boring at 8-1/2 feet
No Free Water Encountered
No Caving

Weak Soils

BAUER ASSOCIATES, INC.

GEOTECHNICAL CONSULTANTS

Job No: 3621.0

Date: 4/19

By: VPM

LOG OF TEST BORING 2

1211 BROADWAY
Sonoma, California

PLATE

3

Equipment: 6" solid stem auger

Date: April 3, 2019

Elevation: Not Available

Laboratory Tests	Blows/Foot*	Moisture Content (%)	Dry Density (pcf)	Depth	Sample	Description
						DARK BROWN CLAYEY SAND (SC) loose to medium dense, saturated
	6					
				3		YELLOW BROWN GRAVELLY SANDY CLAY (SC) medium dense, wet to saturated
Tx 1360(576)	16/6"	18.4	76			
				6		water level immediately after drilling
	16/3"					YELLOW BROWN CLAYEY GRAVEL (GC) medium dense to dense, wet to saturated
				9		larger gravels encountered below about 8'
				12		
						Bottom of boring at 11-1/4 feet No Caving
				15		
				18		
				21		

Weak Soils

BAUER ASSOCIATES, INC.

GEOTECHNICAL CONSULTANTS

Job No: 3621.0

Date: 4/19

By: VPM

LOG OF TEST BORING 3

1211 BROADWAY
Sonoma, California

PLATE **4**

MAJOR DIVISIONS				TYPICAL NAMES
COURSE GRAINED SOILS	**GRAVELS** more than half course fraction is larger than no. 4 sieve size	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES
	SANDS more than half course fraction is smaller than no. 4 sieve size	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVEL-SAND MIXTURES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS	**SILTS AND CLAYS** LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, VERY FINE SANDS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC SCLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS OR LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT 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

KEY TO TEST DATA

LL - Liquid Limit (in %)
PL - Plastic Limit (in %)
SA - Sieve Analysis

	Shear Strength, psf	Confining Pressure, psf	
Tx	320	(2600)	Unconsolidated Undrained Triaxial
Tx CU	320	(2600)	Consolidated Undrained Triaxial
DS	2750	(2600)	Consolidated Drained Direct Shear
UC	2000		Unconfined Compression

Notes: (1) All strength tests on 2.8" or 2.4" diameter sample unless otherwise indicated
(2) * Indicates 1.4" diameter sample

DRILLING METHOD SYMBOLS

- Auger Drilling
- Diamond Core
- Rotary Drilling

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- HQ Rock Core
- Standard California Sampler (ID 2.5 in.)
- No Sample Recovery

BAUER ASSOCIATES, INC. GEOTECHNICAL CONSULTANTS	Job No: 3621.0 Date: 4/19 By: VPM	**SOIL CLASSIFICATION CHART & KEY TO TEST DATA** 1211 BROADWAY Sonoma, California	PLATE **5**