Exhibit D

SubSurface Designs Inc.

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May 12, 2020

PIN# 7387

This Old House, LLC
8640 National Boulevard
Culver City, California 90232

Subject: Supplemental I - Alternative Foundation Recommendations
801 S. San Rafael Avenue
Pasadena, California

Reference: SubSurface Designs, Inc., September 26, 2019, Soils Engineering Investigation, Proposed Additions, Garage and Guest Structure, San Rafael Heights Tract No 5, Lot 42, 801 S. San Rafael Avenue, Pasadena, California.

Dear Sirs:

This letter has bee prepared at the request of Ms. Deborah Rachlin Ross in order to outline the potential for alternative foundation recommendations for the proposed detached garage and detached guest house. Recommendations for support of the proposed detached garage and detached guest house outlined in the above referenced report include foundations extending into the proposed compacted fill pad. The compacted fill recommendation was to remove and recompact the upper five feet (5') in the area of the proposed detached garage, and four feet (4') in the area of the proposed guest house.

As an alternative to the removing and recompaction of the near surface soils for support of the proposed structures, deepened foundations may be utilized. For the proposed detached garage, the structure may be supported by foundations that extend into the underlying alluvium. Additionally, the floor slab shall consist of a structural slab spanning the foundations system. The foundations shall extend below grade a minimum of thirty six inches (36"). Design values for foundations are provided in the following table. Design of the structural slab shall be provided by the project Structural Engineer.

Foundation Design Values - Detached Garage

Foundation Type	Bearing Material	Depth Below Grade	Bearing Value (psf)	Maximum Bearing Value (psf)	Coefficient of Friction	Passive Resistance (pcf)
Continuous	Alluvium	36"	1500	2000	0.30	300
Pad	Alluvium	36"	1800	2400	0.30	300

For the proposed detached guest house, the structure may be supported by foundations that extend into the underlying bedrock. Based on the depth to bedrock, foundations ranging in depth from four to five (4'-5') deep should be anticipated. Shallower or deeper depths to bedrock may be encountered over the footprint of the proposed structure. Additionally, the floor slab shall consist of a structural slab spanning the foundations system. Design values for foundations are provided in the following table. Design of the structural slab shall be provided by the project Structural Engineer.

Foundation Design Values - Detached Guest House						
Foundation Type	**Bearing Material**	**Embedment Depth Into Bedrock**	**Bearing Value (psf)**	**Maximum Bearing Value (psf)**	**Coefficient of Friction**	**Passive Resistance (pcf)**
Continuous	Bedrock	12"	3000	5000	0.40	400
Pad	Bedrock	12"	3500	6000	0.40	400

Foundation excavations shall be cleared of all loose material prior to the placement of steel, then prior to the placement of concrete to reduce the potential for future settlement and differential settlement. Water shall not be allowed to pond or drain into or through the footing trench excavations.

All earth materials derived from the excavations of foundations shall be removed from the site or placed as certified compacted fill. Fill temporarily stockpiled on site should be placed in a stable area, away from slopes, excavations and improvements. Earth materials shall not be cast over any descending slopes in an uncontrolled manner.

The minimum continuous footing size is twelve inches (12") wide for one story structures and fifteen inches (15") wide for two story structures. Pad foundations shall be a minimum of twenty four inches (24") square. All depths of embedment for footings are to be measured from the lowest adjacent grade or into the specified bearing material.

Increases in the bearing value are allowable at a rate of twenty percent (20%) for each additional foot of footing width or depth into the recommended bearing material to the maximum bearing value.

The depths specified in the above table are minimum embedment depths required by this office. Deeper foundations may be required during the construction phase of the project due to the presence of unconsolidated soil, uncertified fill or weathered bedrock. Additionally, the project Structural Engineer may need to make the depths deeper to accommodate specific structural loads. The bearing values given above are net bearing values; the weight of concrete below grade may be neglected. These bearing values may be increased by one-third (⅓) for temporary loads, such as wind and seismic forces.

Based upon past experience, all continuous footings shall be reinforced with a minimum of four #4 bars, two placed near the top and two near the bottom. Reinforcing recommendations are minimums and may be revised by the structural engineer.

Lateral loads may be resisted by friction at the base of the foundations and by passive resistance within the alluvium or compacted fill. The coefficient of friction shall be used between the base of the foundation and the recommended bearing material. When combining passive and friction for resistance of lateral loads, the passive component should be reduced by one-third. For isolated poles, the allowable passive earth pressure may be doubled.

All footing excavation depths will be measured from the lowest adjacent grade of recommended bearing material. Footing depths will not be measured from any proposed elevations or grades. Any foundation excavations that are not the recommended depth <u>into</u> the recommended bearing materials will not be acceptable to this office.

If you have any questions, please do not hesitate to contact this office.

Respectfully submitted:
SUBSURFACE DESIGNS, INC.

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SOILS ENGINEERING INVESTIGATION

PROPOSED ADDITIONS, GARAGE AND GUEST STRUCTURE

SAN RAFAEL HEIGHTS TRACT NO 5, LOT 42

801 S. SAN RAFAEL AVENUE

PASADENA, CALIFORNIA

FOR

THIS OLD HOUSE, LLC

8640 NATIONAL BOULEVARD

CULVER CITY, CALIFORNIA 90232

PIN# 7387

SEPTEMBER 26, 2019

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

This report presents the results of our Soils Engineering Investigation performed at 801 S. San Rafael Avenue in the Pasadena area of Los Angeles County, California. The purpose of the investigation was to determine the subsurface conditions as they relate to the proposed construction of additions, a detached garage and detached guest house on the subject property. This investigation is limited to the area of the proposed development and does not warrant the remaining portions of the property.

SCOPE

This investigation is based upon:

- A topographic site plan by M&M & Co., a licensed land surveyor, that was utilized as our base map. This map appears to accurately reflect topographic conditions as observed at the subject property.
- A review of preliminary plans by Deborah Racklin.
- The review of six (6) hand-dug test pits. The materials encountered were logged by a representative of this office, and the explorations were backfilled with the excavated materials. However, backfill was not compacted and should be monitored for future settlement.
- Preparation of the enclosed Site Plan which locates the proposed development and our explorations (see APPENDIX I).
- Preparation of site exploration logs (see APPENDIX I).
- Laboratory testing and analysis of samples obtained within the excavations (see APPENDIX II).
- Calculations which may include, but are not limited to, bearing value, lateral pressure, active earth pressure, slope stability (see APPENDIX III).
- The review available maps and reports prepared by this office and others (see APPENDIX IV).
- Preparation of this report.

The data that supports the following SUMMARY OF FINDINGS, CONCLUSIONS and RECOMMENDATIONS are contained within Appendices I through IV.

The scope of our exploration is limited to the areas explored for the proposed development as delineated on the enclosed Site Plan. This report should not be considered as a comprehensive evaluation of the entire property. This report has not been prepared for use by other parties or for other purposes (or developments), and may not contain sufficient information for other than the intended use. If construction is delayed more than one year, this office should be contacted to perform an update and to verify the current site conditions.

LOCATION AND TOPOGRAPHY

The subject property is located at the eastern end of a block of and east-west trending portion of the San Rafael Hills in Pasadena, California. The subject site is a developed parcel situated along the southern side of San Rafael Avenue, approximately six hundred and twenty five feet southeast of its intersection with San Remo Road. For reference, see the attached Vicinity Map for the location of the subject property (see APPENDIX I).

Improvements to the property consist of a two-story, single-family residence situated upon a relatively level pad. Further improvements consist of a detached one-story guest house, swimming pool and concrete and asphalt flatwork. Access to the residence is provided by a concrete driveway that extends from the northeast corner of the site. For specific topographic conditions, refer to the attached Site Plan, Plate A (see APPENDIX I).

PROPOSED DEVELOPMENT

Final building plans have not been prepared and await the conclusions and recommendations of this investigation. However, it is our understanding that the proposed development will consist of constructing additions to the eastern side of the existing single-family residence. Additionally, a new detached garage will be constructed northerly of the residence and a new one story guest house will be constructed on the southern portion of the property in the rear yard area.

Grading will include the removal and recompaction of the near surface soil for support of the proposed detached garage and guest house. Grading will also include excavation of future foundations. For reference, the locations of proposed improvements are shown on the attached Geologic Map, Plate A.

SUMMARY OF FINDINGS

Research

A representative from this office conducted research of available geotechnical engineering reports prepared for the subject property and adjacent properties at the City of Pasadena on September 24, 2019. In addition, research of available maps and publications prepared for the area was conducted. SubSurface Designs, Inc. has reviewed the referenced reports and has incorporated applicable information from these sources into this report.

It should be noted that other reports may have been prepared for the subject site in the past but were not found during records research, or were not submitted to the governing reviewing agency, and thus are not part of public record.

Field Investigation

Site exploratory studies were conducted on August 15, 2019. Field investigation consisted of reconnaissance and surface mapping of the subject site and adjacent areas. Additionally, six (6) hand-dug test pits were excavated within the area of proposed construction. The test pits ranged from three and one half to ten feet (3½'-10') deep. For reference, the exploratory openings are located on the enclosed Site Plan, Plate A.

Subsurface conditions encountered in these explorations were logged in detail by a representative of this office. Further, representative samples of the earth materials encountered were obtained. The explorations were backfilled with the excavated materials. Backfill was not compacted and should be monitored for future settlement.

Undisturbed samples were obtained within the test pits through the use of a thin-walled, steel, hand-held sampler. The soil is retained in 1" high brass rings with a 2.50" outside diameter and a 2.37" inside diameter. Bulk samples were obtained for testing and analysis. All undisturbed and bulk samples were sent to the laboratory for examination, testing, and classification, using the Unified Classification system.

Site Conditions

Drainage within the site comprises of sheet flow runoff of precipitation derived primarily within property boundaries. The existing residence is equipped with a roof gutter/downdrain system. Downdrains are connected to subsurface drains. Planters are present adjacent structure on the east and west sides.

As part of the new construction, it is recommended that a roof gutter/downdrain system be installed that will collect and direct water away from residence foundations. All downdrains should be connected to solid pipe for out letting purposes and discharge water at the street or an approved discharge area.

Existing Foundation

The residence foundation was observed in our explorations TP 02 and TP 03. The residence appears to be supported by continuous footings that extend thirty six inches (36") below grade. The footings observed in the test pits extend into the underlying alluvium.

Earth Materials

Earth fill (ef) was encountered up to one and one half feet (1½') thick. Alluvial deposits (Qa) underlie the entire property and surrounding areas. Bedrock underlies the surficial soils on the subject site and surrounding areas.

The earth materials encountered on the subject property are briefly described below. For approximate depths and more detailed descriptions, refer to the enclosed Exploration Logs Figure E.1 through E.6 (see APPENDIX I).

Earth Fill (ef)

The earth fill consists of a Silty Sand that is medium brown, fine- to coarse-grained, contains some gravel is slightly moist to moist, moderately compact and contains some rootlets.

Alluvium (Qa)

The alluvium consists of a Silty Sand that is medium brown, fine- to medium-grained, has a clay binder, is moist and moderately dense.

The earth fill materials and alluvial deposits were visually classified in accordance with the Unified Soils Classification System.

Bedrock

The bedrock consists of a Sandstone that is grayish-brown to medium brown, fine- to medium-grained, massive and moderately hard.

Earth material profiles can only be obtained from individual explorations placed on the subject property. Care should be exercised when using these profiles to determine changes in depth or thickness of the earth materials between the explorations.

Site Drainage & Groundwater

All water below the surface of the Earth is referred to as groundwater, or subsurface water. The equivalent term for water on the land surface is surface water. Groundwater occurs in two different zones below the subsurface which are referred to as the unsaturated zone and the saturated zone. The unsaturated zone contains both water and air, and is almost invariably underlain by a saturated zone where all interconnected openings within an earth material are full of water. Water in the saturated zone is the only groundwater available to supply wells and springs, and is the only water to which the term groundwater is correctly applied. The level of water in the saturated zone at which the hydraulic pressure is equal to the atmospheric pressure is referred to as the water table.

Groundwater occurs in aquifers under two different conditions. Where water only partly fills an aquifer, the upper surface of the saturated zone is free to rise and decline. The water in such aquifers is said to be unconfined, and the aquifers are referred to as unconfined aquifers. Where water completely fills an aquifer that is overlain by a confining bed, the water is said to be confined, and the aquifers are referred to as confined aquifers or as artesian aquifers.

The upper surface of a saturated zone in an unconfined condition is referred to as the potentiometric surface. The potentiometric surface is the elevation of water in the subsurface at which the hydraulic pressure of the water is equal to atmospheric pressure. The potentiometric surface or groundwater table is also the level or elevation of the water observed in a well, or exploratory excavation.

The presence, elevation and movement of groundwater are controlled by one or more of the following; climatic conditions, geologic structure, the hydraulic conductivity of the subsurface materials, irrigation and land use. The presence, elevation and movement of groundwater can vary significantly over short distances. Fluctuations in groundwater levels can occur due to tidal action, seasonal variations in the amount of rainfall, runoff, irrigation rates, alterations in the existing groundwater recharge area (i.e. modifications to the surface drainage and surface water infiltration conditions), and other factors not evident at the time site exploration was conducted. In addition, perched water conditions can develop in areas where bedrock is relatively shallow.

Groundwater was not encountered to the maximum depth of the explorations. The depth to groundwater, if encountered in site explorations, is only valid for the date of exploration. Consequently, the designer, engineer and contractor should be aware of the possibility for groundwater fluctuations while designing and constructing the proposed structure(s).

SEISMIC EVALUATION

General

The Southern California region is located within a tectonically active portion of the earth's crust which has produced both small and sizeable earthquakes throughout time. Faults are generally classified as active, potentially active, or inactive. A fault is considered "active" if it has produced seismic activity within the past 11,000 years. A "potentially active" fault is one where there has been seismic activity along the fault between 11,000 and 1,000,000 years. "Inactive" faults have not produced any seismic activity within the past 1,000,000 years. Active faults are considered to have a high probability of future seismic activity, potentially active faults are considered to have a low probability of future seismic activity, and inactive faults are considered to be no longer capable of producing seismic activity.

The potential exists throughout Southern California for strong ground motion similar to that which occurred during the 1994 Northridge Earthquake. Earthquakes with a magnitude of 5.0 and greater have occurred in Southern California throughout historic time. Strong ground shaking from a moderate to major earthquake can be expected during the lifetime of the structure. This may result in significant damage to structures, hardscape and slopes areas. Since there are so many variables associated with ground movement during an intense earthquake, it is almost impossible to predict the impact of a seismic event to a particular site.

Earthquake Fault Zones

Following the 1971 Sylmar Earthquake, the State of California passed the Alquist-Priolo Special Studies Act in 1972. Active faults within the state were identified and zones were established which prohibited construction of most structures for human occupancy across a known active fault. The Alquist-Priolo Special Studies Act requires the State Geologist to delineate "special studies zones" along active faults, whereby development therein must include geologic investigation demonstrating the absence of a surface displacement threat prior to construction of habitable structures. "Special Studies Zones" have since been renamed "Earthquake Fault Zones".

The subject property is not located within the confines of an "Earthquake Fault Zone," and no zoned faults extend through the site or are in close proximity to the property. Although the site is not located within a State designated "Earthquake Fault Zone" it is located in an active seismic region where large numbers of earthquakes occur each year.

Seismic Hazard Zones

Following the 1989 Loma Prieta Earthquake, the State of California enacted the Seismic Hazard Mapping Act (SHMA) in 1990. As a result, the California Geological Survey (a.k.a. Department of Conservation) prepared a set of maps designating areas within the state that may be susceptible to seismic slope instability and/or liquefaction during a strong seismic event. The seismic safety zones were published in a series of maps initially released in 1996.

The Seismic Hazards Mapping Act was prompted by damaging earthquakes in northern and southern California, and is intended to protect public safety from the effects of strong ground shaking, liquefaction, landslides, and other earthquake-related hazards. The Seismic Hazards Mapping Act requires that the State Geologist delineate the various "seismic hazards zones." The maps depicting the zones are released by the California Geological Survey (CGS). The fact that a site lies outside of a zone does not mean it is free of seismic or geologic hazards such as landslides, rockfall, liquefaction or lateral spreading. Southern California has not been completely mapped, although new maps are issued and existing maps are refined occasionally.

The Seismic Hazards Mapping Act requires a site investigation by a certified Engineering Geologist and/or Civil Engineer prior to development of a project within a hazard zone. The investigation is to include recommendations for a "minimum level of mitigation" that should reduce the risk of ground failure during an earthquake to a level that does not cause the collapse of buildings for human occupancy. The Seismic Hazards Mapping Act does not require mitigation to a level of no ground failure and/or no structural damage.

Seismic Hazard Zone delineations are based on correlation of a combination factors, including: surface distribution of soil deposits and bedrock, slope steepness, depth to groundwater, bedding orientation with respect to slopes, bedrock shear strength, and occurrence of past seismic failure. Maps within the series are further designated as Reconnaissance, Preliminary or Official.

Official Seismic Hazard Zone Maps are the culmination of mapping, analysis, review and comment of California Geological Survey, other State agencies, and the public following review and revision of the Preliminary Review Map. The Official Maps are the most rigorous and have the highest confidence level.

As defined, a "Liquefaction Hazard" area is an area where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693© would be required. As defined, an "Earthquake-Induced Landslide" area is an area where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693© would be required.

This office has reviewed the Seismic Hazards Map of the Pasadena Quadrangle prepared by the California Geological Survey (a.k.a. State of California Division of Mines and Geology). According to this map, the site is not located within an area of study for earthquake-induced liquefaction or earthquake-induced landsliding.

Recent Seismic Activity

The most recent largest earthquake within the specified search radius and time period is the Northridge Earthquake. The 6.7 magnitude Northridge Earthquake occurred on January 17, 1994 at 4:31 a.m., PST, and created strong ground shaking for approximately 10 seconds in the Los Angeles area resulting in wide spread, random damage. The earthquake occurred along a previously unrecognized south dipping thrust fault. The causative fault, as defined by a pattern of aftershocks, moved under an area roughly 19-miles across its front (approximately east-west in orientation) and 13 miles from front to back (approximately north-south in orientation). Although slip magnitude was approximately 9- to 10-feet, surface rupture along the causative fault did not occur as a result of the earthquake.)

Active Faults with Historic Surface Rupture

The 1857 Fort Tejon Earthquake (8.3±M) occurred along the San Andreas Fault Zone. The San Andreas Fault Zone, located northerly of the property, has a maximum probable event magnitude of 7.8. The 1933 Long Beach Earthquake (6.3M) occurred along the Newport-Inglewood Fault Zone. The Newport-Inglewood Fault, located southerly of the property, has a maximum probable event magnitude of 6.9. The 1971 San Fernando Earthquake (6.4M) occurred along the San Fernando Fault Zone. The San Fernando-Sierra Madre Fault Zone, located northerly of the property, has a maximum probable event magnitude of 6.7.

CBC Seismic Design Parameters

The majority of southern California, including all of Los Angeles and Ventura counties, is within a zone requiring structural design to resist earthquake loads. The spectral acceleration parameters and site coefficients can be determined using the program "U.S. Seismic Design Maps" obtained from the U.S. Geological Survey website (http://geohazards.usgs.gov/designmaps/us/application.php).

The following seismic coefficient values were obtained from use of the U.S. Seismic Design Maps utilizing the design code reference document (2010 ASCE 7 w/2013 errata). It is recommended that the project Structural Engineer independently verify the accuracy of all the parameters outlined in the following table, excluding Site Class, prior to use.

California Building Code (Section 1613) - Site Coefficients & Data	
Site Latitude	34.1301°
Site Longitude	-118.1692°
Site Class (average soil properties within the upper 100')	D
0.2 Second Spectral Response - S_s	2.71
1.0 Second Spectral Response - S_1	0.998
Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter	
$S_{MS} = F_a S_s$ (0.2 Second Spectral Response)	2.71
$S_{M1} = F_v S_1$ (1.0 Second Spectral Response)	1.497
Five Percent Damped Design Spectral Response Acceleration	
$S_{DS} = \frac{2}{3} S_{MS}$ (0.2 Second Spectral Response)	1.807
$S_{D1} = \frac{2}{3} S_{M1}$ (1.0 Second Spectral Response)	0.998

Conformance with the presented criteria for seismic structural design does not constitute any kind of warranty, guarantee, or assurance that significant damage, or ground failure, will not occur in the event of a maximum level earthquake. The primary goal of the code-required minimum seismic design is to protect life and limb, and catastrophic failure, and not avoid all damage, as such design may be economically prohibitive. The Project Structural Engineer and owner must decide if the level of risk associated with utilizing the minimum required code values is acceptable and, if not, assign appropriate seismic values above the minimum code values for use in the structural design.

Peak Ground Acceleration, Magnitude and Distance

The earthquake magnitude and distance to the fault was determined using the USGS 2008 Interactive Deaggregations program with an exceedance probability of 10% in 50 years. The peak ground acceleration was determined as $S_{DS}/2.5$. The value of S_{DS} was obtained from the "U.S. Seismic Design Maps" from the U.S. Geological Survey website as discussed above.

Fault Values	
Peak Ground Acceleration	0.723 g
PGA_M	1.048 g
Magnitude	6.9
Distance	5.76 km

SITE STABILITY

Liquefaction Potential

Liquefaction refers to the momentary loss of shear strength. The necessary components for liquefaction include: a shallow groundwater condition; relatively loose soils; fine grained sands and silty sands; and repeated cyclic loading. During an earthquake cyclic loading occurs, allowing pore pressures to increase as a result of individual soil grain particles realign themselves. The realignment of the soil particles allows the water to completely separate and surround the grains. As cyclic loading continues the shear resistance of the soil decreases until the pore pressures equal the confining pressures. The result of the increases in the pore pressure and the decrease in the shear resistance is termed "Liquefaction".

A cursory review of maps contained within our offices indicates that the subject property is not mapped within a special studies zone for seismic induced liquefaction. Therefore, an analysis of the potential for earthquake inducted liquefaction has not been performed as the potential for liquefaction to occur at the subject property is considered to be low. This satisfies the requirement of the State of California Public Resources Code, Section 2690 et seq. (Seismic Hazard Mapping Act). Additionally, the subject property is underlain by bedrock. Therefore, the potential for liquefaction to occur at the subject property is remote.

Expansive Soils

Expansive soils are considered to be one of the most costly natural hazards as related to light structures, slabs, retaining walls, paving etc. Expansive soils are influenced greatly by changes in moisture content and can lead to damage when the moisture content changes significantly over short durations of time (i.e. seasonal).

These changes can result from many factors including the initial moisture content of the soil, climate, groundwater, drainage conditions, irrigation and vegetation to name a few. Therefore, it is imperative that soils underlying the subject property are maintained at a consistent moisture content in order to reduce the potential damage caused by expansive soils. A watering schedule that allows the soil to become saturated, then dry out can result in foundation movement and distress. In addition, the recommendations outlined in the DRAINAGE AND MAINTENANCE section should be followed.

Based upon our investigation and laboratory testing the subject site is underlain by soil in the low to medium expansive range. All foundations and slabs should be designed for expansive conditions. To mitigate the effects of expansive soils, good site drainage should be maintained at all times. Roof gutters and downspouts should be incorporated in the design and construction of the structure. Planters should not be placed near existing or future foundations. Existing planters should be equipped with concrete sides and bottoms. Planters should be connected to a drainage system to convey water away from the foundations. Utility pipes should be checked periodically for leaks.

CONCLUSIONS

General

It is the professional opinion of this office that construction of the proposed additions, detached garage and guest house is feasible provided that the recommendations contained herein are followed. In addition, all applicable elements of the governing agency Building Codes shall be followed.

Based upon our field observations, laboratory testing and analysis, the bedrock and alluvium found at depth in the explorations should possess sufficient strength to support the proposed improvements and compacted fill. The artificial fill encountered in the explorations excavated on site are not considered suitable for foundation support as these materials may possess adverse deformational characteristics.

Excavation Characteristics

Subsurface exploration was performed utilizing hand labor. Extremely hard layers of bedrock were encountered with depth. Thus, excavating into the bedrock during construction may be difficult. Should hard cemented bedrock be encountered, coring or the use of jack-hammers may be necessary.

RECOMMENDATIONS

1. The upper five feet (5') of the existing earth material shall be removed and recompacted to support the proposed detached garage. The upper four feet (4') of the existing earth material shall be removed and recompacted to support the proposed detached guest house. The compacted fill shall extend outside the footprint of the structure a distance equal to the depth of the removal, and not less than five feet (5'). The compacted fill limits shall be extended to include foundations for support of any attached patio covers or porches.

   The upper twenty four inches (24") of the existing earth material shall be removed and recompacted for support of slabs in the area of the proposed additions, or decking on grade where utilized. Grading shall be carried forth as described in the GRADING AND EARTHWORK section below.

2. The proposed detached garage and guest house shall be supported by foundations extending into the proposed compacted fill pad. The proposed additions shall be supported by foundations extending into the underlying alluvium. Foundations should be designed as outlined in the FOUNDATIONS section below.

3. The site shall be maintained as outlined in the DRAINAGE AND MAINTENANCE section below.

It should be noted that, the recommendations contained within this report may be more restrictive than applicable building codes. All recommendations of this report which are in addition to or more restrictive than those outlined in a subsequent review letter, by your governing reviewing agency, shall be incorporated into the plans.

GRADING AND EARTHWORK

Proposed Grading

Proposed grading will consist of the removal and recompaction of the upper five feet (5') of the existing earth material to support the proposed detached garage. The upper four feet (4') of the existing earth material shall be removed and recompacted to support the proposed detached guest house. The compacted fill shall extend outside the footprint of the structure a distance equal to the depth of the removal, and not less than five feet (5'). The compacted fill limits shall be extended to include foundations for support of any attached patio covers or porches. The upper twenty four inches (24") of the existing earth material shall be removed and recompacted for support of slabs in the area of the proposed additions, or decking on grade where utilized. Additionally, foundation excavations will be made. All grading shall be carried forth as outlined herein.

1. Prior to commencement of work, a pre-grading meeting shall be held. Participants at this meeting will consist of the contractor, the owner or his representative, and the soils engineer. The purpose of this meeting is to avoid misunderstanding of the recommendations set forth in this report that might cause delays in the project.

2. Prior to placement of fill, all vegetation, rubbish, and other deleterious material should be disposed of off site. The proposed structures should be staked out in the field by a surveyor. This staking should, as a minimum, include areas for overexcavation, toes of slopes, tops of cuts, setbacks, and easements. All staking shall be offset from the proposed grading area at least five feet (5').

   The proposed construction areas should be excavated down to bedrock in the area of the proposed guest house, and not less than four feet (4') below grade. The proposed construction areas should be excavated down five feet (5') below grade in the area of the proposed detached garage. The existing soil shall be removed twenty four inches (24") below grade for support of slabs in the area of the proposed additions, or decking on grade where utilized.

3. The natural ground, which is determined to be satisfactory for the support of the filled ground, shall then be scarified to a depth of at least six inches (6") and moistened as required. The scarified ground should be compacted to at least 90 percent of the maximum laboratory density.

4. The fill soils shall consist of materials approved by the project Soils Engineer or his representative. These materials may be obtained from the excavation areas and any other approved sources, and by blending soils from one or more source. The material used shall be free from organic vegetable matter and other deleterious substances, and shall not contain rocks greater than eight inches (8") in diameter nor of a quantity sufficient to make compaction difficult.

5. The approved fill material shall be placed in approximately level layers six inches (6") thick, and moistened as required. Each layer shall be thoroughly mixed to attain uniformity of moisture in each layer.

   When the moisture content of the fill is below the optimum moisture content, as specified by the Soils Engineer, water shall be added and thoroughly mixed in until the moisture content is within three percent (3%) above the optimum moisture content. When the moisture content of the fill is more than three percent (3%) above the optimum moisture content, as specified by the Soils Engineer, the fill material shall be aerated by scarifying or shall be blended with additional materials and thoroughly mixed until the moisture content is within three percent (3%) above the optimum moisture content.

   Each layer shall be compacted to 90 or 95 percent of the maximum density, as determined by the latest version of ASTM D 1557, using acceptable compaction equipment. The higher compaction is required for fill material that has less than fifteen percent (15%) of the material finer than 0.005mm.

6. Review of the fill placement should be provided by the Soils Engineer or his representative during the progress of grading. In general, density tests will be made at intervals not exceeding two feet (2') of fill height or every 500 cubic yards of fill placed.

7. The materials can experience a shrinkage of ten to fifteen percent (10-15%).

8. During the inclement part of the year, or during periods when rain is threatening, all fill that has been spread and awaits compaction shall be compacted before stopping work for the day or before stopping because of inclement weather. These fills, once compacted, shall have the surfaces sloped to drain to one area where water may be removed.

   Work may start again, after the rainy period, once the site has been reviewed by the Soils Engineer and he has given his authorization to resume. Loose materials not compacted prior to the rain shall be removed and aerated so that the moisture content of these fills will be within three percent (3%) above the optimum moisture content.

   Surface materials previously compacted before the rain, shall be scarified, brought to the proper moisture content, and re-compacted prior to placing additional fill, if deemed necessary by the Soils Engineer.

9. Review of geotechnical data available for the local vicinity of the site indicates that septic tanks, seepage pits, or leach fields may be encountered during site grading. If encountered, these should be drained of effluent or drilled out if they have been backfilled. The cleaned-out area should be inspected by the soils engineer and governing inspector prior to backfill. The excavation may be filled with approved compacted fill, lean concrete, or gravel. Whichever backfill material is selected, at least five feet (5') of approved manmade fill, placed at the required percent relative compaction, should cap the excavation.

FOUNDATIONS

It is recommended that the proposed detached garage and guest house be supported by foundations extending into the proposed compacted fill pad. The proposed additions shall be supported by foundations extending into the underlying alluvium.

Foundation excavations shall be cleared of all loose material prior to the placement of steel, then prior to the placement of concrete to reduce the potential for future settlement and differential settlement. Water shall not be allowed to pond or drain into or through the footing trench excavations.

All earth materials derived from the excavations of foundations shall be removed from the site or placed as certified compacted fill. Fill temporarily stockpiled on site should be placed in a stable area, away from slopes, excavations and improvements. Earth materials shall not be cast over any descending slopes in an uncontrolled manner.

Conventional

The minimum continuous footing size is twelve inches (12") wide for one story structures and fifteen inches (15") wide for two story structures. Pad foundations shall be a minimum of twenty four inches (24") square. All depths of embedment for footings are to be measured from the lowest adjacent grade or into the specified bearing material.

Foundation Design Values						
Foundation Type	**Bearing Material**	**Depth Below Grade**	**Bearing Value (psf)**	**Maximum Bearing Value (psf)**	**Coefficient of Friction**	**Passive Resistance (pcf)**
Continuous	Alluvium (additions)	36"	1500	2000	0.30	300
Pad	Alluvium (additions)	36"	1800	2400	0.30	300
Continuous	Compacted Fill	24"	1500	2000	0.25	250
Pad	Compacted Fill	24"	1800	2400	0.25	250

Increases in the bearing value are allowable at a rate of twenty percent (20%) for each additional foot of footing width or depth into the recommended bearing material to the maximum bearing value.

The depths specified in the above table are minimum embedment depths required by this office. Deeper foundations may be required during the construction phase of the project due to the presence of unconsolidated soil, uncertified fill or weathered bedrock. Additionally, the project Structural Engineer may need to make the depths deeper to accommodate specific structural loads. The bearing values given above are net bearing values; the weight of concrete below grade may be neglected. These bearing values may be increased by one-third (⅓) for temporary loads, such as wind and seismic forces.

Based upon past experience, all continuous footings shall be reinforced with a minimum of four #4 bars, two placed near the top and two near the bottom. Reinforcing recommendations are minimums and may be revised by the structural engineer.

Lateral loads may be resisted by friction at the base of the foundations and by passive resistance within the alluvium or compacted fill. The coefficient of friction shall be used between the base of the foundation and the recommended bearing material. When combining passive and friction for resistance of lateral loads, the passive component should be reduced by one-third. For isolated poles, the allowable passive earth pressure may be doubled.

All footing excavation depths will be measured from the lowest adjacent grade of recommended bearing material. Footing depths will not be measured from any proposed elevations or grades. Any foundation excavations that are not the recommended depth <u>into</u> the recommended bearing materials will not be acceptable to this office.

<u>Raised Floor Construction</u>

Construction utilizing raised floors where the grade under the floor is lowered for joist clearance often leads to moisture problems. Surface moisture can seep through or migrate beneath footings and pond in the lowered underfloor area. The problem increases with increasing difference between the interior and exterior grades. Excessive moisture accumulation or ponding water in the underfloor area can lead to warping or cupping of wood floors. Further, consistent moist conditions can lead to the growth of wood destroying fungus, rotting of wood framing elements, and/or mold growth.

Due to the potential problems discussed above, SubSurface Designs, Inc., does not recommend the use of this construction technique. Should you decide to disregard the advice presented herein, positive drainage of the ground surface away from the footings, waterproofing the footings, sealing of utility line penetrations through footings, compaction of trench backfill, placement of foundation drains and the placement of planter drains can help to reduce moisture intrusion. Planters which are not sealed and drained should not be used adjacent to any structures. Subdrains placed directly adjacent to footing stemwalls are beneficial but will generally not completely prevent water from migrating beneath foundations. Lined planters with drains that are located away from the footings and extend deeper than the footings are generally the most effective mitigation technique.

Adequate ventilation of the underfloor area is also critical in preventing high moisture conditions below proposed structures. Creating adequate ventilation is difficult, particularly in larger homes with interior continuous footings. Telescoping vents are generally ineffective, particularly if provided with louvered covers. Consideration should be given to providing more than the minimum Code-required amount of vent space. Mechanical ventilation may be necessary, particularly in larger homes.

SETTLEMENT

Settlement and differential settlement can result in cracks in the exterior and interior finishes, flooring, etc. Controlling drainage around the structure as outlined in the DRAINAGE AND MAINTENANCE section below can help to control settlement/differential settlement. Additionally, foundation excavations cleared of all loose material prior to the placement of steel, then prior to the placement of concrete is required and can significantly minimize future settlement and differential settlement.

Future settlement and/or differential settlement of the structure and secondary features due to long term deformation and natural occurrences are still possible. Any site drainage improvements, such as those outlined in the DRAINAGE AND MAINTENANCE section below, will result in a lower risk of future foundation problems.

Settlement of the proposed additions to the existing single-family residence, proposed detached garage and guest house will occur. Settlement of ½" to ¾" between walls, within 30 feet or less of each other and under similar loading conditions, are considered normal. Total settlement on the order of ¾" should be anticipated. Differential settlement is not expected to exceed ¾".

FLOOR SLABS

Floor slabs should be a minimum of four inches (4") thick, reinforced with minimum #3 reinforcing bars placed at sixteen inches (16") on center each way. Floor slabs underlain by two inches (2") of crusher-run base, compacted into place by mechanical means may be supported directly on compacted fill. Although precautions can be taken, the recommendations are not intended to stop movement, only to reduce cracking as a result of expansion and contraction of the soil.

Two-car garage slabs should be quartered with weakened plane joints and isolated from the stem walls for crack control. The slab should maintain positive drainage toward the entry of the garage.

Residential floor slab should be protected by a 10 mil vapor retarder/barrier placed beneath the slab. These types of retarders/barriers should be protected to prevent punctures in the vapor retarder/barrier. It should be noted that this type of barrier will not preclude moisture damage to wood floors or vapor sensitive flooring. The commonly used 6-mil and 10-mil polyethylene plastic sheeting can produce less-than-satisfactory results due to its low puncture resistance, inconsistent vapor permeability, and variable product longevity. It is recommend that the retarder/barrier conform with ASTM E1745 Class A and be installed in accordance with ASTM E1643. In particular, care should be utilized to seal sheet boundaries and seal around penetrations.

It should be noted that cracking of concrete floor slabs is very common during curing. The cracking occurs because concrete shrinks as it dries. It is important that additional water not be added to concrete at the site to make pumping easier as this will increase the magnitude of shrinkage.

Crack-control joints which are commonly used in exterior decking to control such cracking are normally not used in interior slabs. The reinforcement recommended above is intended to reduce cracking, and its proper placement is critical to concrete slab performance. The minor shrinkage cracks which often form in interior slabs generally do not present a problem when carpeting, linoleum, or wood floor coverings are used. The slab cracks can, however, lead to surface cracks in brittle floor coverings such as stone or tile. A mortarbed or slip sheet is recommended between the slab and brittle floor covering to limit the potential for cracking.

Footing trench spoils should either be removed from the slab areas or compacted into place by mechanical means and tested for compaction.

EXCAVATION EROSION CONTROL

During inclement periods of the year, when rain is threatening (between October 1, and April 15), an erosion control plan shall be implemented and approved by the reviewing agency to reduce the potential of site erosion. The following are several recommendations prepared by this office. The following recommendations are valid for any time of the year that rain threatens an excavation.

Open Excavations

All open excavations shall be protected from inclement weather. This is required to keep the surface of the open excavation from becoming saturated during rainfall. Saturation of the excavation may result in a relaxation of the soils which may result in failures.

Hillside Excavations

All hillside excavations shall be covered during the rainy seasons. Stakes, ropes, and sandbags, along with plastic may be employed to help facilitate the coverage of the excavations. Coverage of the open excavations shall over-extend from the edges of the excavations in all directions.

The project Civil Engineer shall be consulted for the limits of coverage. If possible, slopes around the open excavations shall be trimmed to slope away from the open excavation, so water runoff will not drain into the excavation. Any trees or planters that might cause failure around the open excavations, due to the saturated hillside, shall be anchored safely. After the rain has ceased, the excavations shall be reviewed by the project soil engineer and geologist for safety prior to recommencement of work.

Open Trenches

No water shall be allowed to pond or saturate open trenches. All open trenches shall be covered with plastic and sandbags. Areas around trenches shall be sloped in such a way that water will not runoff into the trenches. After the rain has ceased, trenches shall be reviewed by project soil engineer for safety prior to recommencing work. All footing excavations must be reviewed by the project soil engineer again, prior to pouring concrete.

Open Pile/Caisson Excavations

All open excavations for piles or caissons shall be reviewed and poured prior to rainfall. We do not recommend any pile excavations being left open through any rain storms. However, if it is necessary to leave pile excavations open through any rain storms, all water and runoff must be prevented from entering these pile excavations.

Grading in Progress

During the inclement part of the year, or during periods when rain is threatening, all fill that has been spread and awaits compaction shall be compacted before stopping work for the day or before stopping because of inclement weather. These fills, once compacted, shall have the surfaces sloped to drain to one area where water may be removed.

Work may start again, after the rainy period, once the site has been reviewed by the project soils engineer. Loose materials not compacted prior to the rain shall be removed and aerated so that the moisture content of these fills will be within three percent (3%) above the optimum moisture content.

Surface materials previously compacted before the rain, shall be scarified, brought to the proper moisture content, and re-compacted prior to placing additional fill, if deemed necessary by the Soils Engineer.

Additionally, it is suggested that all stock-piled loose fill materials, not compacted prior to anticipated rainfall, shall be covered with plastic. This action will keep the loose fill from being saturated with water, and will allow the grading to resume when the rain stops. It is always easier and less time consuming to increase moisture content of the fill than to aerate the fill to achieve optimum moisture.

All of the above recommendations shall be considered as part of the erosion control plan for the subject property. However, these recommendations shall and will not supersede, nor limit any erosion control plans produced by the Project Civil Engineer.

EXCAVATIONS

Excavations ranging in vertical height up to five feet (5') will be required for the proposed development. Conventional excavation equipment may be used to make these excavations. Excavations should expose alluvium and earth fill. The alluvium or earth fill is suitable for unsurcharged vertical excavations up to five feet (5'). Excavations that exceed the stated height limits, and all loose surficial material, shall be trimmed back at a gradient of 1:1 (h:v). This should be verified by a representative of this office during construction so that modifications can be made if variations in the soil occur. The earth material exposed in the proposed cuts should be kept moist, but not saturated, to reduce the potential for raveling and sloughing that may occur during construction.