DONALD HERZOG & ASSOCIATES, INC.
Consulting Geotechnical Engineers

REPORT
SOIL INVESTIGATION
PROPOSED LIGHTY RESIDENCE
LOT 171
BERRYESSA ESTATES SUBDIVISION
NAPA COUNTY, CALIFORNIA

DH&A Job No. 5112.1

Prepared for:

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By

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August 11, 1981

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INTRODUCTION

This report presents the results of our soil investigation for the proposed Lighty residential complex in Northern Napa County, California. The site is located on Lot 171 of the Berryessa Estates Subdivision, adjacent to the intersection of Bridle and Harness Drives. The proposed development will consist of four wood-frame buildings with concrete slab-on-grade floors. The buildings are designated as studio, bedroom, kitchen and tower. The tower will be one and one-half stories high and cover less than 100 square feet in area. The other buildings will each contain less than about 500 square feet of floor area, and be one-story structures. Grading will be the minimum amount needed for driveway access to gently-sloping terrain above the complex.

The object of our investigation, as outlined in our Confirming Proposal of April 22, 1981, was to explore subsurface conditions and develop conclusions and recommendations concerning:

1. Soil and ground-water conditions observed.
2. Site preparation and grading.
3. Foundation type(s) and design criteria.
4. Support of concrete slabs-on-grade, if required.
5. Retaining wall criteria.
6. Soil engineering drainage.

WORK PERFORMED

We explored subsurface conditions at the site by excavating three test pits at the locations shown on Plate 1. The pits were excavated with backhoe equipment to depths ranging from about four to nine feet. Our engineer located the pits, observed the excavations, logged the materials encountered, and obtained a few samples for visual classification and laboratory testing.

During initial excavation to develop level building pads, our engineer was at the site to observe conditions exposed and provide specific recommendations for foundation support. In addition, we have provided consultation with your architect and structural engineer during final design and initial construction to provide preliminary data, as needed.

SITE CONDITIONS

The site occupies the northern edge of an east-west ridge top and extends down onto a hilside. The slope at the building locations is inclined at about three horizontal to one vertical (3:1). The surface is covered with boulders, grass and brush. Numerous oak and bay trees dot the property and adjacent slopes. The test pits encountered the following conditions:

Material	Test Pit No. 1	Test Pit No. 2	Test Pit No. 3
Topsoil and Colluvium	0' - 4'	0' - 1'	0' - 4'
Bedrock	4' - 9'	1' - 5'	---

The depths are measured from the existing ground surface at the test pit locations. Our engineer logged the pits on the basis of visual classification of the excavated materials. The topsoil and colluvium are clayey and silty materials of moderate plasticity and low to moderate expansion potential. That is, they would tend to undergo low to moderate strength and volume changes with changes in moisture content. In general, the colluvium materials contain abundant boulder-size hard rock fragments. The bedrocks consist of tuff that is soft and weathered near the surface of the layer, and generally becomes firmer and less weathered with depth. Pit No. 3 encountered hard boulder-size angular rock fragments with minor clay filling around the boulders. No in-place bedrock was encountered.

We did not observe depressions, bulges, or other signs of large-scale instability at the site. Also, no free groundwater or seepage was observed in the pits.

CONCLUSIONS

Based on the results of our investigation, we conclude that, from a soil engineering standpoint, the site can be

used for the proposed residential construction. The tuffaceous bedrocks at the site will provide suitable downward bearing support for foundations. However, the topsoil and colluvial materials are undergoing long-term gradual downhill movement (termed creep) on the order of a fraction of an inch per year. Footings will need to be deeper than normal, bottomed below the creep zone, and be well-reinforced to tie the foundations together.

We believe there are no active faults at the site, and, therefore, little risk of fault-related ground rupture during earthquakes. Like the entire Napa County area, the site is subject to severe ground-shaking during earthquakes. It will be necessary to design and construct the project in strict accordance with current standards for earthquake-resistant construction.

RECOMMENDATIONS

Site Grading

Cuts and fills generally reduce site stability, and should be avoided or kept to a minimum. Where fills are required, the original ground should be cleared of vegetation and stripped of the upper few inches of soil containing abundant root growth. Stripping depth may be on the order of several inches to remove roots. We understand that building pads will be leveled by excavating into the hillsides. Fill

depths will be generally less than one foot, or be retained by walls.

Cut and fill slopes should be no steeper than 2:1 to help reduce sloughing and erosion. Where steeper banks are required, retaining walls should be used.

Foundations

Spread Footings - Spread footings can be used for foundation support; however, because of the tendency for lateral creep, spread footings must be well-embedded and well-reinforced. Spread footings should be at least 12 inches wide and be bottomed at least 12 inches into underlying tuffaceous bedrock. Spread footings should be bottomed at least 12 inches below lowest adjacent pad grade, and can be designed to impose dead plus code live load and total design load (including wind or seismic forces) bearing pressures of 3000 and 4500 pounds per square foot (psf), respectively. Perimeter and bearing wall foundations should be continuous. Upslope-downslope tie beams or grade beams should be spaced no greater than 12 feet apart. Tie beams should be at least 12 inches square, and contain at least two No. 5 bars.

Excavation for foundations and utilities will dislodge rock fragments, resulting in ravelling of the excavation sides and bottom, especially in the studio building area. Forming may be needed for the footings. Also, because excavating equipment tends to loosen the bottom of footing

trenches, all foundations not bottomed in bedrock should be thoroughly compacted. Footings should be stepped as necessary to produce level tops and bottoms, and should be deepened as necessary to provide at least eight feet of horizontal confinement from the face of the nearest slope.

We understand that it is desired to bottom some spread footings on colluvial soils in lieu of the recommended penetration into bedrock. From our discussions with your architect, Mr. Chris Alexander, we understand that footings for the studio and the downhill edge of the kitchen building may not penetrate into bedrock. Where footings are not bottomed at the minimum recommended penetration into bedrock, some heave, settlement or lateral yielding should be anticipated. We anticipate that such movements would be small and the resulting distress could be cosmetically corrected. Where footings do not penetrate into bedrock, bearing pressures should be reduced to 1000 psf.

Drilled Piers - As an alternative, drilled pier foundations can be used. Piers should be at least 12 inches in diameter, and should extend at least five feet into firm, underlying bedrock.

The portion of the piers extending into firm rock can impose vertical dead plus code live load bearing pressures of 800 psf in skin friction. For total design loads, the skin friction value can be increased to 100 psf. 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. We do not anticipate that ground-water or caving soils would be encountered. However, if ground-water is encountered, it may be necessary to dewater the holes and/or to place the concrete by the tremmie method. If caving soils are encountered, it may be necessary to case the holes. To prevent the wet concrete from settling, the pier holes should contain no more than three inches of slough. The slough should be tamped with a heavy timber prior to concrete placement. Piers beneath perimeter and bearing walls should be interconnected with grade beams designed to support the calculated structural loads. Piers should be reinforced full depth with at least one No. 4 reinforcing bar. The pier reinforcing should be extended into the grade beams.

Retaining Walls

Retaining walls supporting level backfill should be designed for an equivalent fluid pressure of 35 pounds per cubic foot (pcf) acting in a triangular distribution. Where the backfill slopes up steeper than 4:1, the pressure should be increased to 50 pcf. Resistance to lateral loads can be obtained from passive earth pressure and base friction. We recommend the following values for design:

Passive Soil Pressure	=	250 pcf, equivalent fluid, neglect upper one foot
Passive Rock Pressure	=	1000 psf in tuffaceous bedrock, uniform pressure
Base Friction Factor	=	0.25 in soil; 0.45 in tuffaceous bedrock

Retaining walls should be fully backdrained. The backdrains should consist of three-inch-diameter perforated pipe sloped to drain to oulets by gravity, and free-draining gravel or crushed rock. The granular materials should extend to one foot below the surface. The upper one foot should be backfilled with compacted soil to exclude surface water infiltration. Granular materials should be capped with building paper, visqueen or straw to retard infiltration. The ground surface behind retaining walls should be sloped to drain away from the tops of the walls. Where migration of moisture through retaining walls would be detrimental, the walls should be waterproofed.

Slab-on-Grade

Slab-on-grade subgrade should be uniformly moisture conditioned and thoroughly compacted. The subgrade should be kept moist until concrete placement. Moisture conditioning should extend to the bottom of any shrinkage cracks exposed such that the soils are preswelled to close the cracks for their full depth. Slabs should be underlain by a capillary

moisture break and cushion layer consisting of at least four inches of free-draining gravel or crushed rock. Moisture vapor will condense on the underside of the slab. Where passage of moisture vapor through the slab would be detrimental, an impermeable vapor barrier should be provided.

Soil Engineering Drainage

Surface water should be diverted away from slopes, buildings and foundations. Roofs should be provided with gutters, and the downspouts should discharge well below the building locations. To prevent any water that seeps under slabs from ponding, an outlet discharging conveniently by gravity, should be provided from the slab drainrock.

Supplemental Services

We should review the final plans for conformance with the intent of our recommendations. During final construction, we should observe preparation of building pads. We should observe footing excavations or pier drilling operations to verify the conditions encountered, and to modify our recommendations, if warranted.

These services are performed on an as-requested basis, and we can accept absolutely no responsibility for items we are not notified to check. These supplemental services are in addition to this investigation, and are charged for on a time-and-expense basis in accordance with our standard schedule of charges.

MAINTENANCE

Periodic land maintenance will be required. Drains should be checked frequently, and cleaned and maintained as necessary. Sloughing or erosion that occurs should be repaired before it can enlarge. A dense growth of deep-rooted ground cover should be maintained on all exposed slopes.

LIMITATIONS

Subsurface conditions are complex and may differ from those indicated by surface features and those encountered at test hole locations. Therefore, we are unable to guarantee the performance of any site or foundation system. For houses constructed on hillsides, we recommend that mudflow and earthquake insurance be obtained, where available.

If conditions different from those described in this report are encountered during construction, we should be notified immediately.

Site and soil conditions can change with time. Therefore, we should be contacted to update this report if construction is not performed within 24 months.

LIST OF PLATES

Plate 1 — Test Pit Location Sketch

DISTRIBUTION

Copies submitted - 6:

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SCALE 1" = 16' ±

2

3

TEST PIT 1

HARNESS

CONTOUR INTERVAL = 2'

VERTICAL DATUM: 60d NAIL SET IN A JOINT POLE - ELIVATION = 100.00 ASSUMED

LEGEND: △ TOPO CONTROL POINT

REFERENCE: TOPOGRAPHIC MAP by
Michael W. Brooks, Land Surveyor

DONALD HERZOG & ASSOCIATES
consulting engineers

Job No: 5112.1 Appr: _____ Date 9/2/81

TEST PIT LOCATION SKETCH

PROPOSED LIGHTY RESIDENCE
Napa County, California

PLATE
1