September 30, 1999

Mr. Walter McEnerney
Buttner Associates
A California Limited Partnership
3675 Mt. Diablo Blvd., Suite 270
Lafayette, CA 94549

RE: Report of Construction Observation & Compaction Testing Services
Grayson Ridge Estates, Lots 1-8
Subdivision 8123, Contra Costa County
Pleasant Hill, California

Dear Mr. McEnerney:

Geolith Consultants is pleased to present this report that summarizes our construction observations, compaction testing services, and geologic mapping of exposed excavations during earthwork site development of Grayson Ridge Estates Subdivision 8123 located in Pleasant Hill, California. The earthwork included construction of 8 residential building lots with a central access street. The mass grading was performed William G. McCullough Company of Antioch, California beginning on June 2, 1999 and extending through the middle of August 1999. The installation of storm drains and utilities (such as water, sewer, and joint trench) continued through the end of August 1999. The preparation of the subgrade for the access street was completed on September 22, 1999.

This report includes field and laboratory test data found in Appendices A and B. The original grading plan, prepared by Aliquot and dated April 14, 1999, was used as a base map to plot our geologic and geotechnical information, keyway location, and locations of subdrains (see Figure 2).

ACCOMPANING FIGURES AND APPENDICES

Figure 1 Site Location Map
Figure 2 Pad Certification Letter by Aliquot
Figure 3 As-Built Geotechnical Plan

Appendix A Laboratory Test Results
Appendix B Daily Field Reports and Compaction Test Data by Construction Materials Testing, Inc.

PURPOSE AND SCOPE

The purpose of our construction observation and compaction testing services was to validate assumptions concerning subsurface conditions, as stated in our Geotechnical Investigation Report, dated March 11, 1998, and to advise the contractor in regards to any changes in subsurface conditions that may be detected during grading, in accordance with Appendix Sections 3313 and 3317 of the 1997 Uniform Building Code. We also provided on-site testing of soil compaction (through our subcontractor, Construction Materials Testing, Inc. [CMT] of Martinez, California), to aid the contractor in placement of engineered fill, in accordance with Section 3313.4 of the UBC.

The scope of work for our geotechnical engineering services during the construction phases of the project, as outlined in our proposal dated May 21, 1999, included the following list of tasks that were performed at the site for this work:

- Observe, geologically map, and approve all excavations associated with the toe-of-fill keyway along Lots 1-4, unsuitable soils removal, and the removal of landslide debris prior to fill placement (UBC App. Ch. 33 Sec. 3315.3 and 3317.4).

- Perform (through CMT) and coordinate compaction testing on the fill soils, utility trench backfill, retaining wall backfill between Lots 3 and 4, and baserock in roadway areas according to ASTM D 1557-91 (UBC App Ch 33 Sec. 3305 and 3313.4).

- Observation and approval of the installation of the recommended subdrains and drain rock located within the west and east limbs of the toe-of-fill keyway along Lots 1-4, and within the main canyon cleanout area, including drain outlets and cleanouts; and the installation of a backdrain along the retaining wall between Lots 3 and 4 (UBC App Ch 33 Sec 3315.3).

- Preparation of this final report of compliance, which is also being submitted to the City of Pleasant Hill, in accord with UBC App Ch 33 Sec 3318, all sections. This report includes the field compaction test and laboratory test data, and an as-built site plan indicating the limits of compacted materials for the subdivision.

EARTHWORK GRADING

The earthwork generally included unsuitable soil removals along the main southeast-draining canyon and smaller ravine to the east, excavation of a toe-of-fill keyway along the back of Lots 1-4, construction of a maximum 2:1 fill slope along the back of Lots 1-4, removal of a small inactive landslide located within Lots 2 and 3, construction of a cut slope behind Lots 5 and 6, installation of subdrains, and the placement of engineered fill. The maximum depth of excavation was approximately 26 feet below the existing ground surface located in the central portion of the toe-of-fill keyway, under Lot 3. The maximum thickness of compacted fill is approximately 43 feet, located along the top-of-slope at the back of Lot 3. The maximum depth of cut is approximately 15 feet, located along the bedrock cut slope within Lot 5.

One of our engineering geologists was present on an intermittent basis to observe excavation operations, geologically map the exposed cut and excavation areas, observe fill placement and compaction, and observe the installation of subdrains. We subcontracted with Construction Materials Testing, Inc. (CMT) for compaction testing services for placement of engineered fill during mass grading, utility trench backfill, and placement of roadbase.

Canyon Cleanouts and Toe-Of-Fill Keyway

The grading of the project began with substantial removals of natural soils unsuitable for support of proposed structures along the southeast-draining swale that extended from Lot 5/6 boundary to the southeast corner of

Lot 3. These soils consisted of thick accumulations (approximately 4 to 18 feet) of black silty clays and clayey silts that were completely removed down to bedrock. These soils are commonly expansive, and following excavation, were mixed with the other less expansive materials and incorporated into the compacted fill for the subdivision.

Additionally, soils unsuitable for support of proposed structures were removed from near the northeast corner of Lot 1. This area was previously labeled "artificial fill" in our original geotechnical report (Geolith Consultants, 1998). It appears that an old ravine had been backfilled with maroon-colored silty clay soils. These soils were removed down to bedrock, a maximum depth of approximately 9 feet below the existing ground surface, and incorporated into the compacted fill for the subdivision.

A toe-of-fill keyway was constructed near the design toe-of- fill slope along the back of Lots 1-4. The deepest portion of the keyway is near the southeast corner of Lot 3, where the old swale passed out of the area, southeastward. Here, the keyway is approximately 25 feet below the existing ground surface (elevation 155). The keyway was embedded at least 3 feet into competent bedrock for its entire length.

Subdrains and Cleanouts

A total of three (3) separate subdrains were installed during the grading operations. These include approximately 230 feet of drain pipe installed along the west limb of the toe-of-fill keyway under Lot 4; approximately 225 feet of drain pipe installed along the east limb of the toe-of-fill keyway under Lot 1; and approximately 560 feet of drain pipe installed along the canyon cleanout under portions of Lots 2, 3, and 4. All of the subdrains were surveyed by Aliquot, Inc. for location and elevation, as shown on the as-built plan (Figure 3).

These subdrains were generally comprised of a 6-inch diameter perforated collector pipe, surrounded by Caltrans Class 2 Permeable drainrock, placed in a backhoe trench. Two subdrain cleanouts were installed, one for each of the keyway subdrains. The cleanout for the west keyway drain is located to the west of the building envelope for Lot 4. The cleanout for the east keyway drain is located to the east of the building envelope of Lot 1, near the street. All subdrains were tied into existing or newly constructed storm drain catch basins located along the southerly tract boundary. These catch basins drain to the southeast, into the storm drain system located within Donkey Flats Court off-site.

Engineered Fill

Field density tests were performed on compacted fill using a nuclear density gauge in accordance with ASTM Test Methods D2922 and D3017, to measure density and moisture content, respectively. Field density tests results are summarized in Appendix B. Prior to and during field compaction operations, laboratory compaction tests were performed on samples of the native soil in accordance with ASTM Test Method D1557-91 to determine their maximum dry density and optimum moisture content. Laboratory compaction test values are also summarized in Appendix A.

Field density values were compared to the maximum dry density values developed from the laboratory compaction tests (Appendix B) and the degree of relative compaction at specific moisture contents was determined. As recommended in our original report (Geolith Consultants, 1998), the fill soils were placed at moisture contents that exceeded the optimum values by at least 2 percent, and commonly were on the order of 5 percent over optimum moisture content.

This above optimum moisture content criteria was specifically applied to fill soils placed in the deeper portions of the development, within the toe-of-fill keyway and lower canyon cleanout areas beneath Lots 2 and 3, below elevation 180. Here, it was determined that the subexcavations below the 180-foot elevation could not be drained via gravity to suitable off-site facilities. As a consequence, it was decided to opt for higher than optimum moisture contents within these fill soils, so that future volume changes would be minimized within the undrained, lower portions of the fill wedge. Moisture contents below the 180-foot elevation reached values of up to 10.6 percent above optimum. This was deemed acceptable because it was felt close to the moisture level that he fill would absorb long term, on its own.

The field density test results indicate that the fill was compacted to a minimum of 90 percent relative compaction, with the exception of some isolated tests located in the deepest portions of the toe-of-fill keyway (below the –166 elevation), well outside of the building envelope of Lot 3. These test results indicate that the overly-wet fill was compacted to maximum achievable densities between 86 to 90 percent relative compaction as shown on the Daily Field Reports by Construction Materials Testing, Inc., located in Appendix B. We felt that this was acceptable because these soils were placed in a zone of active seepage which could not be drained, and which could be expected to absorb large volumes of moisture at great depth (more than 40 feet below the building pad).

Overexcavation of Transition Lots 5 and 6

As a result of extensive colluvial soil removals along the upper portion of the old southeast-draining canyon, Lots 5 and 6 became transition lots. Bedrock was located in the rear of these pads and compacted fill was located in the front after rough grading. We recommended that the bedrock portions of Lots 5 and 6 be overexcavated a minimum of 3 feet within the building envelope and be replaced with compacted fill. Aliquot surveyors staked the building corners for the proposed homes on Lots 5 and 6 approximately 10 feet outside building corners. Those portions of the building envelope underlain by exposed bedrock cut were overexcavated approximately 5 feet beyond the building envelopes and replaced with compacted fill.

Below is an inventory of fill lots, transition lots, and bedrock cut lots within the subdivision:

- **Lots 1 - 4**: "Fill Lots" underlain entirely by compacted fill.
- **Lots 5 and 6**: "Transition Lots" where that portion of the building envelope on bedrock plus 5 feet was overexcavated and replaced with compacted fill, as discussed in the above paragraph.
- **Lots 7 and 8**: "Cut Lots" underlain entirely by bedrock.

Retaining Wall and Backdrain

The footing excavation for the retaining wall located between Lots 3 and 4 was observed by us on July 26, 1999 and found to be located entirely within compacted fill. After the wall was constructed, a 4-inch diameter backdrain was placed behind the wall and surrounded by Class 2 Permeable drainrock to within 1 foot of the top of wall, as shown on the grading plans (Sheet 6 of 7). This backdrain outlets at the south end of the wall. The area behind the retaining wall was backfilled with the same on-site fill materials used throughout the entire project. These fill soils were compacted to a minimum of 90 percent relative compaction. (by ASTM D-1557-91)

LABORATORY TESTING

R-Value

A sample of clay-rich soil (representative of the weakest material underlying the street) was collected within the street alignment near Lot 1 and tested by Construction Materials Testing, Inc. for an R-value. The test results indicate a value of 6, as shown in Appendix A. Coincidentally, this is the same value assumed when developing the pavement schedule for the project, and shown on Sheet 1 of 7 from the grading plans dated March 26, 1999 (Aliquot, 1999).

Sulfate Testing

Representative samples of soil near foundation grade for each of the 8 lots were collected for sulfate concentration testing by Construction Materials Testing, Inc. The actual testing was performed by Sequoia Analytical of Walnut Creek using EPA Method 300.0. The test results, included in Appendix A of this report, indicate sulfate concentrations (SO_4) varying from 361 to 3810 ppm, or less than 0.004 percent by weight of soil. According to Table 19-A-4 of the 1997 Uniform Building Code, this sulfate concentration is "negligible" and sulfate resistant concrete was not deemed necessary at the site.

MAPPED GEOLOGY

The one of our engineering geologists mapped the keyway excavation, subexcavations, and temporary cuts made during grading for the subdivision. Bedrock encountered at the site generally consisted of thin-bedded claystone and siltstone with minor interbeds of sandstone along the south portion of the site (predominately underlying Lots 3 and 4, and underlying portions of Lots 2 and 5), and thick-bedded sandstone and siltstone with minor claystone interbeds, along the north portion of the site (predominately underlying Lots 1, 6, 7, and 8, and under portions of Lots 2 and 5). The bedrock beneath this site has most recently been assigned to the upper member of the Meganos Formation (a.k.a. Martinez Formation) of lower Eocene age (Geolith Consultants, 1998).

Bedrock Structure

Geologic attitudes recorded from bedrock exposed during grading suggest that bedding strikes predominately northwest with occasional north-northeast strikes. The bedrock is generally inclined toward the southwest, at dips ranging from 30 to 80 degrees. However, bedrock exposures observed near the keyway across Lot 2 suggest that bedding also dips toward the northeast, from 37 to 64 degrees. Additionally, the orientation of sedimentary flute structures along the assumed base of a single marker sandstone bed on Lot 2 suggests that these northeast-dipping beds are overturned. The bedding orientations within the site can be best explained as a monocline structure, with the exception of some isolated, overturned folding along the extreme south portion of the property, as shown on as-built plan (Figure 3). We originally proposed that a northwest-trending anticlinal structure passed through the site, but this does not appear to be the case. The overall structural bedrock grain is generally consistent with the anticipated bedrock orientations encountered during our preliminary investigation and also with published geologic maps for this area.

Small Landslide Removal

The small inactive landslide discovered during our initial subsurface exploration and tentatively outlined in our Preliminary Geologic Map (Geolith Consultants, 1998) was completely removed during the grading operations an area of approximately 2000 to 3000 square feet. This landslide was smaller in areal extent than previously thought. The landslide removal area was predominately located within Lot 2, as surveyed by Aliquot, Inc.

AS-BUILT PLAN

Geolith Consultants has prepared an as-built plan for the earthwork utilizing the original grading plan prepared by Aliquot and dated April 14, 1999. This topographic plan depicting the cut-fill transitions, subexcavation contours, buried subdrains, cleanout risers (with spot elevations) and geologic structure are overlain on the As-Built Geotechnical Plan, Figure 3. All measurements and elevations shown on the as-built plans were taken in the field by tape and hand-level methods and, therefore, should be considered approximate.

CONCLUSIONS

Based on our field observations and compaction test results included in this report, the following list of operations were performed in general conformance with our recommendations. We conclude that the subsurface conditions encountered during construction were fairly consistent with the design assumptions and that the earthwork was completed in essential compliance with the project plans.

- Removal of unsuitable soils (colluvium) along the central southeast-draining swale and smaller ravine to the east.
- The excavation of the toe-of-fill keyway to support the engineered fill slope along Lots 1-4.
- Installation of subdrains along the keyways and swale cleanout.
- Compaction and placement of engineered fill for the development including mass grading, on-site utility trench backfill, and on-site retaining wall backfill.
- Three feet deep overexcavation of exposed bedrock on the rough cut side of Lots 5 and 6, extending 5 feet beyond the surveyed building envelope. These zones were then replaced with engineered fill, to provide a more uniform “fill cushion” for the slab on grade foundations.
- Compaction and placement of baserock for the access street.
- The footing excavation for the retaining wall between Lots 3 and 4.
- Installation of backdrain behind the retaining wall between Lots 3 and 4.

RECOMMENDATIONS

Foundation Recommendations

The foundation recommendations stated in our original report dated March 11, 1998 were for pier and grade beam foundations. At the request of the client, we subsequently provided recommendations for post-tensioned slab-on-grade type foundations to be constructed at the site. These recent foundation recommendations were discussed in letters by our firm dated April 7 and May 5, 1999 (to TEAC Consulting Eng’rs) and July 9 and July 27 (to CEC Int’l), and are not repeated here (see references).

Surface Drainage Recommendations

All developed lots should be sloped to drain, or otherwise be designed to prevent ponding of surface water. Storm runoff or excessive landscape watering from the adjacent upslope neighbor should be intercepted along the property line and routed through properly designed facilities to suitable discharge points. Suitable discharge points include v-ditches, stormdrain catch basins and streets. Likewise, surface runoff generated on and resulting from construction on individual lots should be contained within the lot, and drained through properly designed facilities to discharge outlets. Any future landscaped areas and areas planned for hardscape should be sloped to drain away from the residence, and away from any other planned structures. Runoff from roofs should be collected in gutters and downspouts and outletted through solid-wall discharge pipes to suitable discharge points. Drainage should not be allowed to discharge onto the natural, unprotected slopes. Area drains or other appropriate drainage devices may be installed to collect surface runoff. These drainage devices should be connected to solid pipes discharging to the street or storm drain catch basins.

During landscaping and after the construction phase, the as-graded conditions of the lot are often altered in such a way as to adversely affect drainage. After construction and landscaping has been completed, the surface drainage configuration of the lot should be re-established to efficiently control runoff. Considerable maintenance of the surface drainage measures will be necessary and should be expected after construction. This includes, but is not limited to, clearing of area drains, drain lines, and discharge pipes. Should ownership of this property change hands, the new owner(s) should be informed of the existence of this report so that the designed drainage conditions are not compromised.

MAINTENANCE RECOMMENDATIONS

Slope Maintenance and Irrigation

Graded slopes that are left unprotected are highly prone to erosion. This is especially true for the bedrock cut slope behind Lots 5, 6, and 7. We recommend that all graded slopes be planted as soon as possible. In the meantime, the slopes should be hydro-seeded and covered with a burlap or coconut fiber geojute jute mesh. Prolonged periods of drying and wetting of the slope face should be avoided in order to reduce the likelihood of developing a surface layer that may be prone to erosional ravelling. A relatively constant soil moisture content should be maintained by landscape irrigation through the hot summer months.

Irrigation along slopes should be managed and controlled to prevent over-watering of the slopes. This includes all graded and natural slopes that are artificially irrigated. The down slope creep processes that naturally affect slopes tend to accelerate when slopes are subjected to excessive irrigation water or irrigation system leaks.

Concrete V-Ditch Maintenance

The concrete-lined V-ditches located along the toe-of-fill slope adjacent to Lots 1, 2, 3, and 4 should be maintained in perpetuity, in accordance with County Code Article 716-8.712. Normally, the concrete-lined V-ditches that collect surface runoff should be cleaned of debris at least twice a year to prevent clogging and storm water overflow. This should certainly be done prior to the onset of the rainy season and periodically during the wet winter months. Any cracks that may develop in the concrete should be patched and sealed to minimize infiltration of the runoff into the subgrade soils. We normally assume that approximately 2% of the v-ditches require replacement per year, due to weathering, expansive soils and slope creep.

Subdrain Maintenance

Two of the three subdrains have been provided with cleanout risers consisting of near-vertical solid pipes that extend to the ground surface. The third subdrain has designated outlets to be used as cleanouts. The locations of these cleanouts are shown on the Subdrain Map of Figure 3 and on Plate 4. We recommend that all subdrains be serviced every 3-5 years to reduce the chance of the subdrainage systems clogging.

FUTURE CONSTRUCTION TO BE OBSERVED BY GEOLITH CONSULTANTS

Listed below is a summary of items that should be observed by Geolith Consultants personnel to verify that our report recommendations have been followed:

- Review of foundation plans for retaining walls, swimming pools, or other proposed amenities.
- Observations of wall foundations excavations, swimming pool excavations, or other foundation excavations for other proposed structures.
- Observation and compaction testing of any areas to receive engineered fill.

CLOSURE and LIMITATIONS

We have employed accepted engineering geologic and hydrogeologic procedures, and our opinions and conclusions are made in accordance with generally accepted principles and practices of the profession. This report does not relieve the contractor of their responsibility to produce a completed project conforming to the project plans and specifications. This warranty is in lieu of all other warranties, either expressed or implied.

We have enjoyed being of continued service to Focus Realty Services and trust that this information will be helpful to you. If you have any questions, please contact us at (925) 682-7601.

Very truly yours,

GEOLITH CONSULTANTS, INC.

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REFERENCES

Aliquot {Planners, Civil Engineers, Surveyors}, 1999, Subdivision 8123 Improvement & Grading Plans, City of Pleasant Hill, Contra Costa County, California: Dated April 14, 1999, Sheets 7 of 7.

Geolith Consultants, Inc., 1999, Geotechnical Review, Posttension slab on grade foundations, Grayson Ridge Estates, Subdivision 8123, Pleasant Hill, California: to City of Pleasant Hill, dated August 17, 1999, 2 p.

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Geolith Consultants, Inc., 1999, Fax Cover sheet to CEC International, containing edge lift and center lift recommendations for Posttension slabs, along with copy of Supplemental Recommendations, Subgrade Preparation Beneath Thickened Slabs, Grayson Ridge Estates, Subdivision 8123, Pleasant Hill, California: Dated May 5, 1999, 3 p.

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Geolith Consultants, Inc., 1999, Supplemental Recommendations, UBC-mandated seismic loading factors, Subdivision 8123 (Buttner Court), Pleasant Hill, California: to TEAC Consulting Engineers, dated April 8, 1999, 4 p.

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Geolith Consultants, Inc., 1999, Geotechnical Recommendations, 5-feet high retaining wall between Lots 4 and 5, Subdivision 8123 (Buttner Court), Pleasant Hill, California: to Aliquot, Inc., dated April 8, 1999, 3 p.

Geolith Consultants, Inc., 1998, Geotechnical Investigation and Grading Plan Review, Proposed 8-Lot Residential Development, Subdivision 8123, 1860 Buttner Road, Pleasant Hill, California: Dated March 11, 1998, 21 p.

FIGURES

APPENDIX A

APPENDIX B