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ENGINEER**

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**Community Health & Safety**  
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May 16, 2000

Mr. James Davis  
City Engineer  
9770 Culver Blvd.  
City of Culver City, CA 90232  
fax 310-253-5626

RE: "The Hill" Development

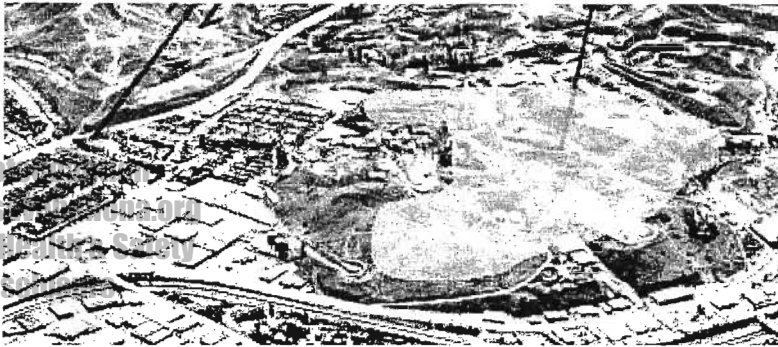
Dear Mr. Davis;

Following are comments, generally technical in nature, regarding continuing safety concerns relating to the "Hill" project. When referring to "the applicant" I mean various consultants and spokespersons for the project at our April 26 2000 meeting.

### Slope and Wall Design Issues

The development involves reshaping the northwest nose of the Baldwin Hills to create building lots maximizing building area by balanced grading. Steep slopes will separate the development from the community below. Much of the development will be at the top of 200 foot high slopes constructed of soils varying from sands to silts native to the Baldwin Hills. Steeper zones will be reinforced heavily with geosynthetic materials and retained by "Segmental Retaining Walls" (SRW's) up to 40 feet high. Slopes are designed to yield a factor of safety of 1.5 static (drained condition) and 1.2 with a pseudostatic loading of 0.15g (also using drained parameters).





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<http://www.stanford.edu/~meehan/class/mitjan2000/davis2.htm>  
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Developed areas existing at the foot of such engineered slopes include a school and single family homes. Seismic safety of utility lines will be a concern because line breaks could allow water infiltration into slopes which are assumed in design to remain free of water pressures. Buildings at the top of slopes will presumably be subject to significant damage if post-construction displacement cracks of two inches or more, or ground settlements of more than about 1 inch in 20 ft, occur either gradually or following an earthquake.

In my opinion standard subdivision building codes and trade association standards are neither capable or intended to be capable of fully addressing the technical problems that are critical to a safe development on this proposed project. The technical bases for this view follows.

### Soil types

We raised this issue in the April 26, 2000 meeting in requesting information on undrained soil strength (SPT tests, or other appropriate tests of rapid loading strength).

Slopes and possibly fills will consist of, and walls will be founded on, fine grained saturated soils, silts and clays, generally of stiff consistency but with variable softer zones in faulted or fractured areas as discovered in nearby problematical tunnelling operations and possibly manifested in previous local landslides. These fine-grained soils are, in the Southern California context, uncommon hillside construction materials. They are in fact a geologic oddity: relatively young basin sediments, unoxidized, recently uplifted several hundred feet above the surrounding plain. They are subject to saturated undrained deformation under both static and seismic

undrained deformation under both static and seismic loading. Their undrained characteristics are not considered in the standardized computer programs used by this developer's consultants and county reviewers for both internal or external stability analysis.

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The site does not provide the generally assumed "firm bedrock" conditions for geosynthetic walls. In general fine-grained soils stressed locally to a factor of safety of 1.5 or less are subject to significant deformation. The undrained condition appropriate to fine-grained soils is unaddressed in either testing or analysis. This needs to be done.

Despite the applicants assurances to the contrary this implies that experience to date on other geosynthetic-reinforced sites in Southern California has little applicability here because, among other factors, of unusual foundation soil conditions local to the Baldwin Hills. This does not mean to imply that geosynthetic technologies for creating steep slopes don't have promising applications here or elsewhere, but rather that the exceptional soil conditions at this site are unaddressed by either the project submittals or in the latest published technical engineering guidance for this emerging technology.

We note that the L.A. County geotechnical review explicitly excludes consideration of the issue of foundational soil testing data.

### Earthquake Safety

The applicant has designed slopes and walls for 0.15g pseudostatic loading. This implies that the site will be affected only by earthquake shaking on the order of 0.3 to 0.4g, that ground displacements in such an event would not be significant, and that stronger shaking is such a remote possibility that it can be disregarded. On the other hand the 1997 NCMA manual used by applicant calls for comprehensive dynamic analysis where SRWs are adjoining critical structures or site is subject to high seismic loadings. Applicant by way of disputing the need for such an analysis indicate that "critical structures" refers to restrictive UBC standard terms which would appear to exclude housing. But the NCMA manual authors do not support this interpretation.

The applicant further denies that the site is subject to high seismic loadings. We don't agree.

to high seismic loadings. We don't agree.

There is a good deal of uncertainty regarding future earthquakes in the western Los Angeles basin. If the earthquake potential of the Newport Inglewood fault zone is considered in isolation and the site were on "firm bedrock" applicant's analysis would be reasonable. But current thinking is that most damaging earthquakes (1933 Long Beach, Whittier Narrows, Northridge, etc) in LA originate on so-called "blind thrust" faults which also exist close to the site (Elysian Park, Compton). This suggests that the Baldwin Hills area is not insulated from the realistic potential for strong shaking in the range of 0.6 to 0.8g with significant vertical component. Ignoring this possibility as proposed by applicant is a questionable policy decision in my opinion.

The applicant recommended as a standard the 1997 NCMA guidelines but has not referred to the more current (1998) NCMA manual which addresses seismic design of SRWs in great detail. The new manual explicitly excludes consideration of several complicating conditions present at Baldwin Hills. (see pages 3 and 4, among others) It calls for displacement analysis for design accelerations greater than 0.29g.

Note that the Northridge earthquake caused accelerations of 0.24g at the Baldwin Hills. Note also that a local earthquake (in 1943) caused damage to oil well casings in the Baldwin Hills.

I have reviewed all of the information available for earthquake performance of SRWs in California. Only two such walls comparable in any sense with the applicant's proposal have been subject to strong ground shaking. Both of these showed some damage (ground cracking) in the Northridge earthquake. However the documentation is insufficient to support a valid engineering comparison with the proposed project.

### Subsidence "Earth Crack" Issues

The applicant has presented a view that the cracking in pavement, gutters, and wall on Wright Terrace is coincidental and does not represent subsidence earth cracking along the "Castle fault". The applicant does not believe that examination of the ground beneath these cracks or resurvey of monuments are necessary.

these cracks or resurvey of monuments are necessary. The applicant believes that pressure injection adjoining the project is beneficial and presented selective quotations for the 1976 Castle and Yerkes study. They did not include the following quote (p 91 of the castle/Yerkes study):

"It is also likely that the initial restriction of waterflooding to the east block aggravated, and conceivably provoked, the faulting there. This flooding, which was carried out at pressures generally

above hydrostatic, probably promoted failure in two ways: (1) by increasing the isobase and compaction gradients and, hence, the extension strain, over a limited reach of the east limb of the subsidence bowl;

and (2) by elevating the pore-water pressures along potential failure surfaces."

We have requested that the applicant provide data demonstrating that oilfield operations are not inducing the effects cited in this quotation. To date we have received data indicating that the overall operations are not generating significant subsidence. We do not dispute this conclusion but it is not sufficient.

I do not believe that the earth crack issue is a "fatal flaw" in development of the project. Whatever the current or recent state of activity of cracking in the area, it is not likely that it will get significantly worse or produce any new or unexpected hazards. But it is not clear to me why the applicant is resistant to fully examining this issue.

#### Methane Gas Issues

The applicant has indicated that certain soil borings made in previous investigations for tunnelling indicate no gas as being present in the subsurface. I have requested that all of the available borings be reviewed for presence of methane but have not yet received this information.

The City should consider the potential impact of earthquakes or slope deformation on the integrity of old well casings.

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