Appendix E.5 Professional Opinion Regarding Effect on Groundwater Flow

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RE: PROFESSIONAL OPINION
PROPOSED NEW PARKING STRUCTURE CONSTRUCTION
EFFECT ON SURROUNDING LANDSCAPE AND GROUNDWATER FLOW
HARVARD WESTLAKE SCHOOL, STUDIO CITY

Keith G. Farrell, Consulting Geologist was asked to review the site conditions with respect to the proposed parking structure construction for the Harvard-Westlake School and provide an opinion regarding whether the proposed construction, including the proposed retaining walls, could affect the local groundwater movement and soil moisture conditions, specifically as it would relate to the potential for changing the soil moisture and possibly affecting the nearby landscape which relies on the existing environmental conditions.

The underlying site conditions have been explored by GPI, Inc. Their investigation dated July 27, 2012 was utilized, in addition to independent research and experience in the area, to prepare this opinion letter. The GPI investigation included mapping and drilling several borings to depths of 70+ feet coupled with soil sample acquisition and testing for moisture content at various depths from the various soil types that exist at the site providing excellent data regarding the subsurface conditions.

Project Description and Concern

The proposed project will consist of an excavation for a new, 3-level parking structure to be excavated into the hillside, on the west side of Coldwater Canyon, across from the existing school. The structure will require cuts into the hillside with surrounding perimeter retaining walls. The total depth of the cuts will vary from 30 to 60 feet deep. The resultant retaining walls will have back-drainage built behind the walls for hydrostatic pressure (water) relief.

There is concern that the new walls may affect groundwater movement or occurrence and thereby affect the surrounding landscape. Specifically, there is a concern that the project could change water flow or de-water possible perched water zones or cause increased drying (also considered de-watering) due to exposure during construction.

Geology and Hydrogeologic Conditions

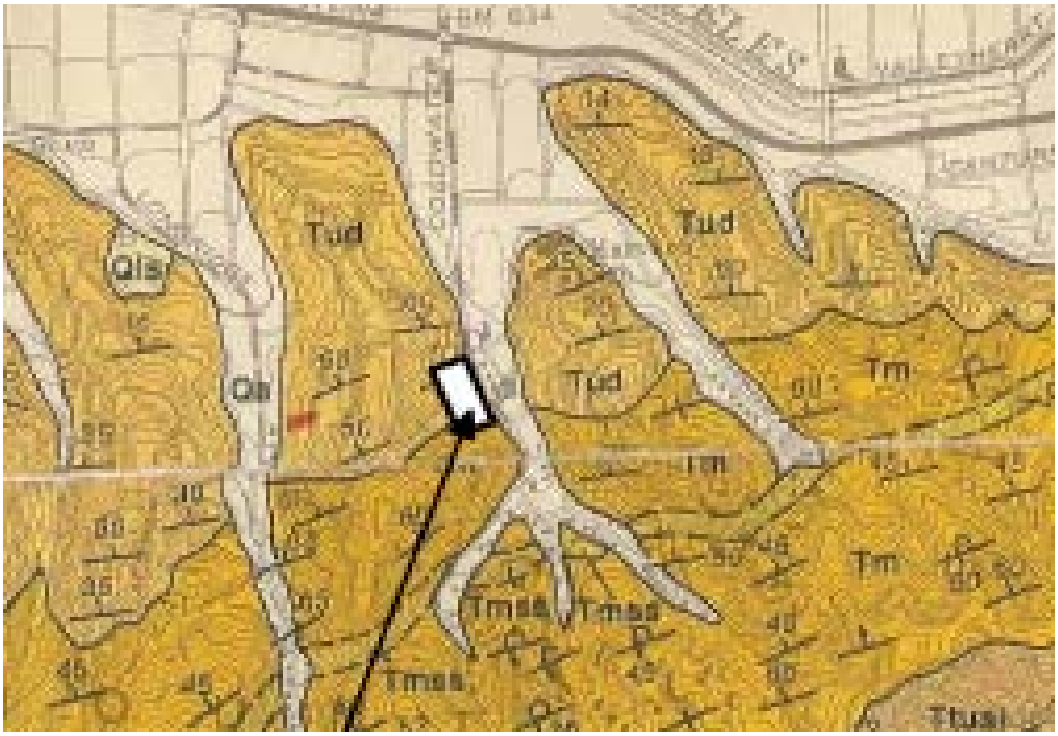
The site is located at the northerly base of the Santa Monica Mountains. The Santa Monica Mountains are generally considered outside the regional groundwater producing area and no recognized aquifers are present below the site. The recognized aquifer starts near the base of the Santa Monica Mountains, at the edge of the valley alluvium near Ventura Boulevard, and up alluvial filled canyons such as underlie the school site east of Coldwater Canyon.

Colluvial soil and areas of old fill underlie portions of the site to depths of 20 feet. The soil is primarily clayey soil. The fill soils and most of the colluvium will be removed during construction.

Bedrock underlies the entire site at depth and consists of layered sedimentary rock consisting of Miocene age marine sedimentary bedrock that is composed of diatomaceous shale and siltstone, known as Modelo Formation. The bedrock is present along the majority of the north side of the Santa Monica Mountains from Studio City to Woodland Hills and is well understood with its respect to engineering properties and how it affects construction. The bedding (layering) is oriented approximately East-West and dips to the north at very steep angles at the site (see geologic map below and cross sections).

No free groundwater is known at the site in the upper 70 feet. Water that enters the soil at the site will be due to local rainfall and subsequent infiltration which is minimal due to the relatively steep topographic conditions and clayey soil. At the site, no flowing groundwater was found. No free moisture (indicative of nearly saturated zones) was reported, although a few wet zones were detected at depth in areas near the base of alluvial channels or old fill, and particularly where clayey soil was adsorbing the water and impeding further downward movement (such as in Borings B-1 and B-2). Moisture content in the soils varied based on the soil type, and indicated moist, but non-saturated conditions. The bedrock is highly diatomaceous as can be seen by very low dry densities (less than 67 pounds per cubic foot which is similar to the weight of water). In theory, some of the rocks would actually float if they were dry. Such rock is composed of fossilized diatom tests (skeletons) that are siliceous and very light weight. This rock has a propensity to adsorb very high amounts of water. The resultant moisture is expressed as the weight of the water divided by the weight of the soil, and so very high moisture contents do not necessarily imply saturated conditions.

Based on the general topography, if groundwater was present under saturated conditions, groundwater would be expected to flow to the north. However, at the site, the steeply dipping bedding would have significant control on the groundwater movement because groundwater flow is impeded by the layering in the rock. The current hillside orientation and geologic structure would most likely cause groundwater movement to flow down-slope to the east, parallel to the layering. If some bedrock layers were to contain accumulated water, the water would most likely flow down-slope, in an easterly direction and automatically flow into the alluvium in Coldwater Canyon. If significant groundwater was present within the upper 70 feet, it would likely flow toward the east and exit the toe of the existing slope along Coldwater Canyon Boulevard in the form of a spring (none known).



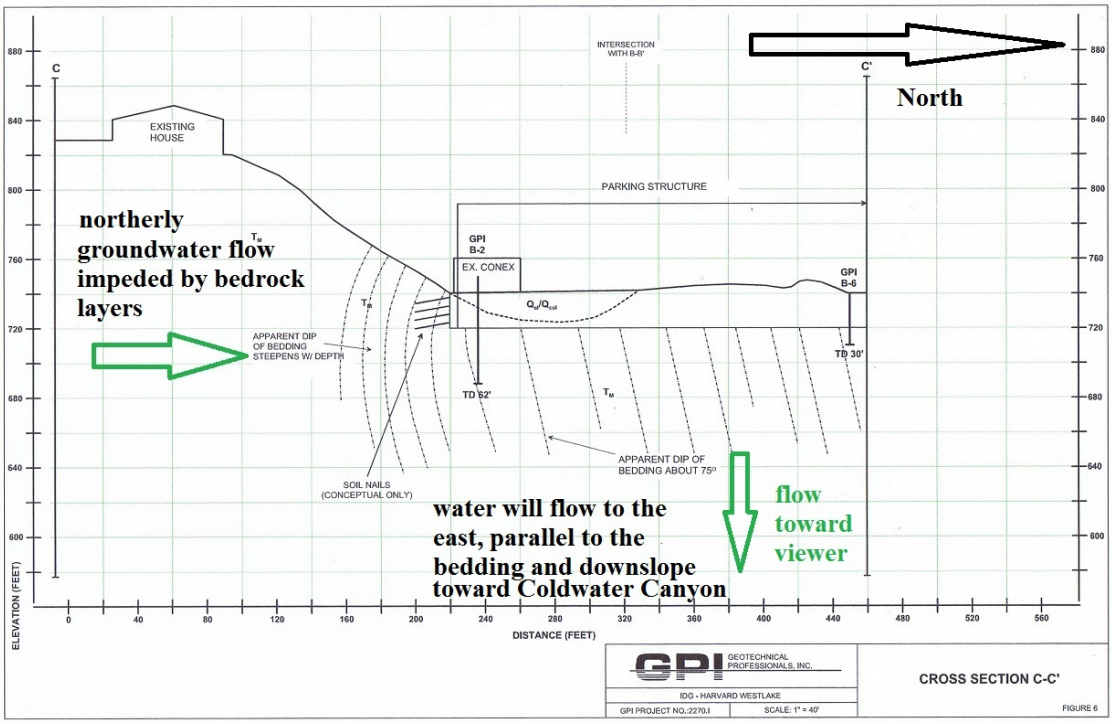
Geologic Map showing Site Location (east side of ridge). Site is underlain by rock (yellow) and alluvium is present to the east in Coldwater Canyon. If groundwater was present, it would likely flow easterly, along bedding strike and toward the alluvium (pink) in the canyon

Groundwater Movement Mechanisms

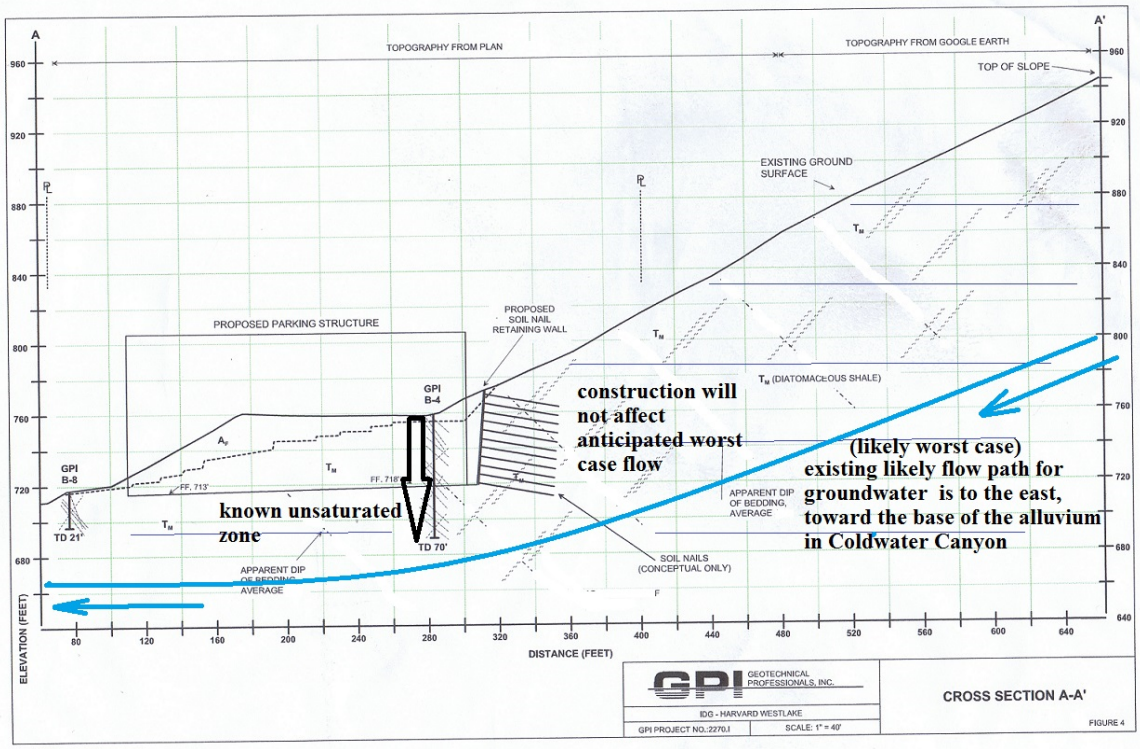
The occurrence of groundwater is based on many site specific conditions including topography, rainfall, climate and the geologic conditions. The geologic conditions that affect groundwater movement include bedrock and soil type; moisture content; orientation of geologic units and structural conditions such as rock fractures or bedding (layering) orientation.

Surface infiltration does occur during the rainy season and the resultant moisture moves through the soil via various mechanisms, principally capillarity and generally downward via gravity. Movement direction is controlled primarily by the available pathways which are controlled by soil type and grains size. Capillarity is the molecular attraction of water to solid surfaces and this force actually overcomes gravity which is why water "sticks" to the soil. Typically, the finer the soil grains, the more capillary attraction and the higher the soil moisture in the field.

Groundwater moves very slowly through the soil and bedrock at the site due to its fine grained clayey characteristics. The water is primarily adsorbed by the soil and moves primarily through capillary attraction, but if the soil becomes saturated, it will flow downward and laterally along the path of least resistance. At the site, lateral movement is controlled by the bedding layers. Because of the orientation of the steep bedding layers, if water flow was to occur, it would be impeded in a northerly direction. If sufficient groundwater was present, it would tend to flow downhill in an easterly direction toward Coldwater Canyon where the water would drain into the alluvium in the canyon.



Section C-C' - Northerly downslope flow would be impeded by bedrock layering



Section A-A' -Likely flow would be to the east, toward base of Coldwater Canyon

Opinion

No free groundwater was found or is anticipated in the upper 70 feet at the site. As such, the project is not expected to affect offsite conditions that could result in a change in moisture content in surrounding soils. The underlying soil is very fine grained and essentially traps the surface water (capillarity) that enters the soil. The fine grained nature of the soil does not allow significant infiltration (most rainfall will runoff) or free flowing conditions in the soil. While the proposed cuts in the hillside would expose layers of soil and rock, it is not anticipated that such cuts would result in substantial alterations to the moisture content of the upslope soils.

The surrounding soil conditions are primarily dependent upon surface infiltration only. The underlying soil is very clayey and water which enters from the surface is contained in the fine grained soil through capillary attraction with low likelihood of storage or drainage from adjacent structures or altered pathways such as might be created by the new construction.

Although not expected, if groundwater was present at depth under saturated conditions, the project would still not likely affect the overall groundwater flow patterns due to an alternate groundwater pathway below the project elevation. If saturated soil conditions were to be present at depth, and transmissive soils were present, groundwater would flow to the east and outlet into Coldwater Canyon. The flow-path would likely be below the project elevation as shown in cross section A-A' (above) with no effect by the project on the local groundwater flow direction which is naturally drained to the east, below the site.

Limitations

This report has been prepared for the client, subject to the terms and conditions of the proposal for services for this project. It is the client's responsibility to assure that the information and recommendations contained herein are made available to the designers and reviewers of this project. This letter report is based on the information obtained from exploratory borings and pits, and sampling locations using generally-accepted soils engineering practices. No warranty, expressed or implied is made or intended in connection with this report or by any other oral or written statement. Any liability in connection herein shall not exceed the fees for the investigation.

If you should have questions regarding this report, please do not hesitate to contact our firm.

Sincerely,

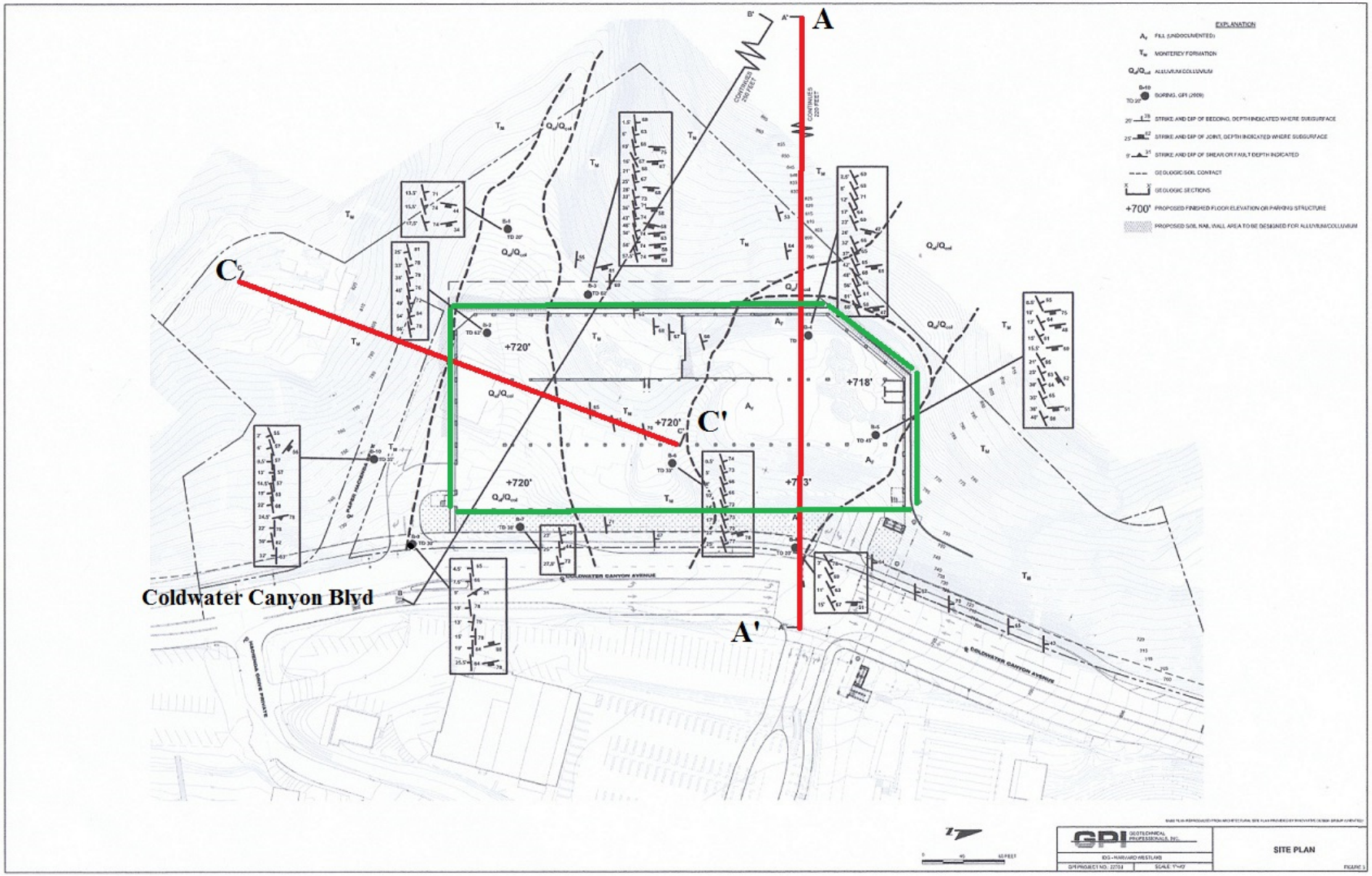
Keith G. Farrell CEG No. 1314
Certified Engineering Geologist

Attachments: Bibliography
Site Plan
Resume

Bibliography

- Preliminary Geotechnical Investigation, Proposed Parking Structure, Harvard-Westlake School, 3700 Coldwater Canyon Avenue North Hollywood, California, prepared by Geotechnical Professionals Inc, dated July 27, 2010.

- Geologic Map of the Beverly Hills and Van Nuys Quadrangles, by the Dibblee Foundation, 1991.


A
A'
B'
C
C'
Coldwater Canyon Blvd
+720'
+718'
+720'
+720'
+720'
EXPLANATION
Af FILL (UNDOCUMENTED)
Tm MONTEREY FORMATION
Qa/Qcol ALLUVIUM COLLUVIUM
B-49 TO 20' BORING, GPI (2009)
STRIKE AND DIP OF BEDDING, DEPTH INDICATED WHERE SUBSURFACE
STRIKE AND DIP OF JOINT, DEPTH INDICATED WHERE SUBSURFACE
STRIKE AND DIP OF SHEAR OR FAULT, DEPTH INDICATED
GEOLOGIC/SOIL CONTACT
GEOLOGIC SECTIONS
+700' PROPOSED FINISHED FLOOR ELEVATION OR PARKING STRUCTURE
PROPOSED SOIL NAIL WALL AREA TO BE DESIGNED FOR ALLUVIUM/COLLUVIUM
GPI GEOTECHNICAL PROFESSIONALS, INC.
SITE PLAN