Appendix F

Infiltration/Percolation Testing for Stormwater Retention
December 30, 2017  
Lake Elsinore-1-01  

Attention: Mr. Ron Kassab  

**Subject:** Infiltration/Percolation Testing for Stormwater Retention  
Proposed Kassab Travel Center  
29301 Riverside Drive  
Lake Elsinore, California  

As requested, we have performed percolation/infiltration testing on the subject site in order to determine the infiltration potential of the surface soils. The percolation rates determined should be useful in assessing stormwater retention needs. It is our understanding that on-site stormwater retention will be required. It is proposed to collect the stormwater runoff within subsurface percolation chambers. This report presents the results of our study, discussion of our findings, and provides percolation rates for the subject system.

**PURPOSE AND SCOPE OF SERVICES**

The purpose of this study was to determine the general percolation rates and physical characteristics of the onsite soils in order to provide design parameters for the proposed onsite infiltration system. Services provided for this study are in accordance with our agreement and consisted of the following:

- Site exploration consisting of the excavation and logging of three test holes;
- Percolation testing in the test holes (P-1, P-2 and P-3);
- Compilation of this report, which presents the results of our study and provides percolation rates for the design of an onsite infiltration system.

**SITE DESCRIPTION AND PROPOSED DEVELOPMENT**

The site is located at 29301 Riverside Drive in Lake Elsinore, California. The subject property is presently occupied by a vacant land. The project consists of construction of Gas Station, RV Fueling Station and associated improvements. Further information regarding proposed development and test hole locations is shown on Figure 1, Percolation Test Holes Location Map.

**FIELD INVESTIGATION**

Our field investigation consisted of excavating three shallow exploratory test holes, which were also used as percolation test holes. Hollow-stem drilled equipment was utilized to excavate the exploratory test holes. An engineer logged and observed the test holes excavations. Soil classification was based on visual observation. The approximate locations of the exploratory and
percolation test holes are shown on Figure 1 (Percolation Test Holes Location Map). Logs of the exploratory test holes are presented in Appendix A.

SUBSURFACE SOILS CONDITIONS

SOIL PROFILE

The soils encountered within our test holes consisted of native soil materials. Native soils encountered within the exploratory test holes consisted primarily of sandy clay and clay. A more detailed description of these materials is provided in the exploratory test holes logs included in the enclosed Appendix A. Soils encountered were classified according to the Unified Soil Classification System (USCS).

GROUNDWATER

Groundwater was not encountered within the exploratory test holes to the maximum explored depth of 5 feet below ground surface (bgs). Fluctuations of the groundwater table, localized zones of perched water, and rise in soil moisture content should be anticipated during the rainy season. Irrigation of landscaped areas can also lead to an increase in soil moisture content and fluctuations of intermittent shallow perched groundwater levels.

PERCOLATION TESTING AND PROCEDURE

Percolation testing was performed to assess the general percolation rates of the onsite soils for the design of an onsite infiltration system.

The continuous pre-soak (falling-head) test procedure was utilized for testing. Water was allowed to presoak in each test hole prior to obtaining test readings. Following the presoak period, the drop in water level in each hole was monitored every 10 to 30 minutes to determine the appropriate method for testing. Test holes were refilled following each reading or when the water depth was below 6 inches. Test times ranged from 120 to 150 minutes. The drop in water level was recorded to the nearest 1/10th inch to produce conservative water level readings.

SUMMARY OF PERCOLATION TEST RESULTS

Tests results are summarized below:

<table>
<thead>
<tr>
<th>Test Hole No.</th>
<th>Rate (Inch/Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>3</td>
<td>1.2</td>
</tr>
</tbody>
</table>
Based on the obtained field data, 1.2 inches per hour should be utilized in the design of the proposed onsite drain system. The base of the system should be founded into natural soils.

It should be noted that the infiltration rates determined are ultimate rates based upon field test results. An appropriate safety factor should be applied to account for subsoil inconsistencies and potential silting of the percolating soils. The safety factor should be determined with consideration to other factors in the stormwater retention system design (particularly stormwater volume estimates) and the safety factors associated with those design components.

The Stormwater Manager's Resource Center (SMRC) web site (http://www.stormwatercenter.net/) includes guidelines for disposal of storm water with respect to setback of structures. It is included in the criteria that infiltration facilities should be setback 10 feet down-gradient from structures. In order to avoid potential adversely impacting any existing structures, we recommend that any infiltration system be kept a horizontal distance of at least 10 feet from the edge of new building and the property line.

**LIMITATIONS**

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principals and practice within our opinion at this time in Southern California. Our conclusions and recommendations are based on the results of the field investigations, combined with an interpolation of subsurface conditions between and beyond exploration locations.

As the project evolves, our continued consultation and construction monitoring should be considered. GeoBoden should review plans and specifications to ensure the recommendations presented herein have been appropriately interpreted, and that the design assumptions used in this study are valid. Where significant design changes occur, GeoBoden may be required to augment or modify these recommendations. Subsurface conditions may differ in some locations from those encountered in the explorations, and may require additional analyses and/or modified recommendations. This report was written for Client, and the design team members, and only for the proposed development described herein. We are not responsible for technical interpretations made by others, or exploratory information that has not been described or documented in this report. Specific questions or interpretations concerning our findings and conclusions may require written clarification.
We appreciate the opportunity to provide service to you on this project. If you have questions regarding this letter or the data included, please contact the undersigned.

Sincerely,
GEOBODEN, INC.

[Cyrus Radvar's signature]

Cyrus Radvar
Principal Engineer, G.E. 2742

Copies: 3/Addressee

Attachments:

Figure 1 – Percolation Test Holes Location Map
Appendix A – Test Holes Logs
PERCOLATION BORING LOCATION PLAN
Proposed Kassab Travel Center
29301 Riverside Drive
Lake Elsinore, California

LEGEND
NUMBER AND APPROXIMATE LOCATION OF BORING

GEOBODEN INC.
Geotechnical Consultants

PERCOLATION BORING LOCATION PLAN
Projected Kassab Travel Center
29301 Riverside Drive
Lake Elsinore, California

PROJECT DATA

PERCOLATION BORING LOCATION PLAN
Projected Kassab Travel Center
29301 Riverside Drive
Lake Elsinore, California

LEGAL DESCRIPTION

PERCOLATION BORING LOCATION PLAN
Projected Kassab Travel Center
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LEGAL DESCRIPTION

PERCOLATION BORING LOCATION PLAN
Projected Kassab Travel Center
29301 Riverside Drive
Lake Elsinore, California
**GEOBODEN, INC.**

**BORING NUMBER P-1**

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>PROJECT NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Ron Kassab</td>
<td>Proposed Kassab Travel Center</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROJECT NUMBER</th>
<th>PROJECT LOCATION</th>
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<tbody>
<tr>
<td>Lake Elsinore-1-01</td>
<td>29301 Riverside Drive, Lake Elsinore, CA</td>
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</table>

<table>
<thead>
<tr>
<th>DATE STARTED</th>
<th>COMPLETED</th>
<th>GROUND ELEVATION</th>
<th>HOLE SIZE</th>
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<tbody>
<tr>
<td>12/18/17</td>
<td>12/18/17</td>
<td></td>
<td>8 inches</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>DRILLING CONTRACTOR</th>
<th>GROUND WATER LEVELS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeoBoden Inc.</td>
<td>AT TIME OF DRILLING ---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHECKED BY</th>
<th>AT END OF DRILLING ---</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

**NOTES**

**GROUND ELEVATION LOGGED BY**

**PROJECT NUMBER**

**LOGGED BY**

**CHECKED BY**

**DATE STARTED**

**COMPLETED**

**GROUND ELEVATION**

**HOLE SIZE**

**HOLE SIZE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
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<tbody>
<tr>
<td>0.0</td>
<td></td>
<td>SANDY CLAY (CL): yellowish brown, moist, ~30% sand, ~70% fines</td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td>Bottom of borehole at 5 feet below ground surface. Ground water was not encountered. Boring was backfilled with cuttings. Bottom of borehole at 5.0 feet.</td>
</tr>
</tbody>
</table>

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<th>DEPTH (ft)</th>
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</thead>
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<tr>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

**DEPTH (ft)**

**GRAPHIC LOG**

**MATERIAL DESCRIPTION**

**SAMPLE TYPE NUMBER**

**RECOVERY % (RQD)**

**BLOW COUNTS (N VALUE)**

**POCKET PEN (tsf)**

**DRY UNIT WT. (pcf)**

**LIQUID LIMIT**

**PLASTIC LIMIT**

**PLASTICITY INDEX**

**FINES CONTENT (%)**

**ATERBERG LIMITS**

**PLASTICITY INDEX**

**FINES CONTENT (%)**
**GEOBODEN, INC.**

**BORING NUMBER P-2**

**CLIENT**  Mr. Ron Kassab  
**PROJECT NAME**  Proposed Kassab Travel Center  
**PROJECT NUMBER**  Lake Elsinore-1-01  
**PROJECT LOCATION**  29301 Riverside Drive, Lake Elsinore, CA  
**DATE Started**  12/18/17  
**COMPLETED**  12/18/17  
**GROUNd ELEVATION**  
**HOlE SIZE**  8 inches  
**DRILLING CONTRACTOR**  GeoBoden Inc.  
**LOGGED BY**  C.R.  
**CHECKED BY**  
**NOTES**  

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE NUMBER</th>
<th>RECOVERY% (RQD)</th>
<th>BLOW COUNTS (N VALUE)</th>
<th>POCKET PEN (tsf)</th>
<th>DRY UNIT WT. (pcf)</th>
<th>MOISTURE CONTENT (%)</th>
<th>LIQUID LIMIT</th>
<th>PLASTIC LIMIT</th>
<th>PLASTICITY INDEX</th>
<th>FINES CONTENT (%)</th>
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<tbody>
<tr>
<td>0.0</td>
<td></td>
<td>SANDY CLAY (CL): brown, moist, fine sand</td>
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<td>2.5</td>
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