**Compaction Test Report**

**CLIENT:** GTC CONSTRUCTION  
3310 MESA ROAD  
SUITE 150  
COLORADO SPRINGS CO 80904

**DATE:** 11/10/11  
**PROJECT NUMBER:** CS178416.001

**PHONE:** 340  
**REPORT NUMBER:** 1  
**SHEET:** 1 OF 1

**SUBJECT:** SIGNATURE POINT  
KISSING CAMELS ESTATES  
NORTH OF BISHOP PINE POINT  
COLORADO SPRINGS, CO

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### STREET SUBGRADE PREPARATION

<table>
<thead>
<tr>
<th>TEST NO.</th>
<th>LOCATION</th>
<th>1 DEPTH FEET</th>
<th>TEST TYPE</th>
<th>MAX DENSITY PCF</th>
<th>OMC%</th>
<th>DRY DENSITY PCF</th>
<th>MC%</th>
<th>COMPACTION %</th>
<th>SOIL TYPE</th>
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<tr>
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<td>NUC</td>
<td>2</td>
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1. BELOW GRADE 2 ESTIMATED BY ONE POINT

Specifications: 95% of Maximum ASTM D 698

Moisture within -2% to +2% of Optimum

TYPE OF COMPACTING EQUIPMENT AND NO. OF UNITS:

(1) GRADER; (1) LOADER

**PROGRESS REPORT**

AT THE TIME OF THE REQUESTED SITE VISIT, THE CONTRACTOR WAS GRADING BASE COURSE MATERIAL OVER THE SUBGRADE MATERIAL TO BE TESTED. THE CONTRACTOR REPORTEDLY MOISTURE CONDITIONED AND APPLIED COMPACTION EFFORT TO THE SUBGRADE MATERIAL. A SAMPLE WAS OBTAINED FOR LABORATORY ANALYSIS. THE ON-SITE WEATHER WAS SUNNY WITH A MEASURED AMBIENT AIR TEMPERATURE OF 60 DEGREES FAHRENHEIT.

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☑ IN OUR OPINION, FILL COMPACTATION MEETS SPECIFICATIONS AS INDICATED BY OUR OBSERVATIONS AND TEST NO. (5)

☐ IN OUR OPINION, FILL COMPACTATION DOES NOT MEET SPECIFICATIONS AS INDICATED BY OUR OBSERVATIONS AND TEST NO.(5)

SCOPE OF OBSERVATION: ☑ FULL TIME; ☑ PERIODIC, ON CALL BASIS

SCOTT ROBILLARD  
FIELD REPRESENTATIVE

SR: LC  
RICHARD A. PHILLIPS, P.E.

5240 Mark Dabling Blvd. | Colorado Springs, CO 80917  
Phone: 719-528-8300 Fax: 719-528-5962
# Asphalt Compaction Test Report

**Client:**
GTC CONSTRUCTION
3310 MESA ROAD
SUITE 150
COLORADO SPRINGS CO 80904

**Subject:**
SIGNATURE POINT
KISSING CAMELS ESTATES
NORTH OF BISHOP PINE POINT
COLORADO SPRINGS, CO

## Asphalt Pavement

<table>
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<tr>
<th>Test No.</th>
<th>Location</th>
<th>Below Finish Grade Inches</th>
<th>Lift Thickness Inches</th>
<th>Max Densitypcf</th>
<th>Field Densitypcf</th>
<th>Compaction %</th>
<th>Time</th>
<th>Mix Temp F</th>
<th>Air Temp F</th>
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<tbody>
<tr>
<td>1</td>
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<td>3.0</td>
<td>151.6</td>
<td>144.2</td>
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<td></td>
<td>7' WEST OF EAST CURB</td>
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<td>25' S OF KISSING CAMELS DRIVE</td>
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<td>144.8</td>
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<td>4' EAST OF WEST CURB</td>
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**Progress Report:**

DURING THE REQUESTED SITE VISIT, THE CONTRACTOR WAS APPLYING COMPACTION EFFORT TO THE BOTTOM MAT FOR A 150-FOOT LONG SECTION OF ROADWAY RUNNING SOUTH FROM KISSING CAMELS DRIVE. THE ROLLING PATTERN WAS NOT OBSERVED. THE ON-SITE WEATHER WAS CLOUDY WITH A MEASURED AMBIENT AIR TEMPERATURE OF 55 DEGREES FAHRENHEIT.

**Mix Type:** SX-75

**Wind:** AM PM

**Specifications:** 92 - 98 % OF MAXIMUM

**Type of Equipment and Number of Units:**

1) VIB. SMOOTH DRUM ROLLER;

2) VIB. SMOOTH DRUM/PNEUMATIC COMBO ROLLER

This report presents opinions formed as a result of our observation of asphalt placement, as well as the tests shown above. We have relied upon the contractor to apply the necessary compactive effort to achieve specified compaction during times when our observer was not present, and at locations other than those tested. Test data are not the sole basis for opinions on whether the asphalt meets specifications.

**Scope of Observation:**

- [ ] Full Time
- [x] Periodic, on call

**Signature:**

Scott Robillard

Field Representative

SRILC

5240 Mark Dabling Blvd. | Colorado Springs, CO 80918 | Phone: 719-528-8300 Fax: 719-528-5362
## Asphalt Concrete Material Analysis

### Project Information
- **Project No.:** CS17816.001
- **Phase:** 355
- **Subject:** Signature Point
  - Kissing Camels Estates
  - Colorado Springs, Colorado

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<th>1-1/2 Inch</th>
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<th>3/8 Inch</th>
<th>No. 4</th>
<th>No. 8</th>
<th>No. 16</th>
<th>No. 30</th>
<th>No. 50</th>
<th>No. 100</th>
<th>No. 209</th>
<th>Asphalt Content</th>
<th>Field Mix Temp (°F)</th>
<th>Rice Unit Weight</th>
<th>Stability</th>
<th>Flow</th>
<th>% Air Voids</th>
<th>VMA</th>
<th>Lottman</th>
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1. Weight of aggregate and oil used to determine asphalt content.
SOILS AND FOUNDATION INVESTIGATION
LOTS 1, 2, 4, AND 16
SIGNATURE POINT
NORTH OF ALDER POINT
EAST OF KISSING CAMELS DRIVE
COLORADO SPRINGS, COLORADO

Prepared for:

GARDEN OF THE GODS, LLC
3310 Mesa Road, Suite 150
Colorado Springs, CO 80904

Attention: Mr. Mike Woelke

Project No. CS17816.002-120

May 4, 2012
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SCOPE

This report presents the results of our Soils and Foundation Investigation for four proposed single-family residences located within the Signature Point Subdivision, on the grounds of the Kissing Camels Golf Course development in Colorado Springs, Colorado (Fig. 1). The purpose of our investigation was to evaluate the subsurface conditions in order to provide geotechnical design and construction recommendations for the proposed residences. The scope was described in our proposal (CTL|T Proposal No. CS-12-0052) dated April 5, 2012.

This report was prepared from data developed during field exploration, laboratory testing, engineering analysis, and our experience with similar conditions. It includes our opinions and recommendations for design criteria and construction details for foundations and floor systems, slabs-on-grade, lateral earth loads, and drainage precautions. The report was prepared for the exclusive use of Garden of the Gods, LLC in design and construction of single-family residences in the referenced subdivision. Other types of construction may require revision of this report and the recommended design criteria. A brief summary of our conclusions and recommendations follows. Detailed design criteria are presented within the report.

SUMMARY

1. The near-surface soils found in our borings consisted predominantly of non-expansive, sand and gravel underlain by natural clay and claystone. A sample of the claystone exhibited slight swell when tested in our laboratory.

2. Ground water was not encountered in the borings during drilling. When checked 14 days after the completion of drilling, the borings were again found to be dry.

3. The residences can be constructed with spread footings underlain by the existing natural sand and gravel. The recommended foundation system for each lot is presented on Fig. 2. Design and construction criteria for foundations are presented in the report.
4. Figure 3 presents our evaluation of the risk of poor slab performance at the basement level for the investigated lots. Our analysis indicates the slab performance risk is low for each of the lots.

5. Surface drainage should be designed, constructed, and maintained to provide rapid removal of surface runoff away from the proposed residences. Conservative irrigation practices should be followed to avoid excessive wetting.

6. The design and construction criteria for foundations and floor system alternatives in this report were compiled with the expectation that all other recommendations presented related to surface and subsurface drainage, landscaping irrigation, backfill compaction, etc. will be incorporated into the project and that home owners will maintain each structure, use prudent irrigation practices, and maintain surface drainage. It is critical that all recommendations in this report are followed.

SITE CONDITIONS

The four lots included in this investigation are situated between the 9th hole fairways for the east and south courses at the Kissing Camels Golf Club in Colorado Springs, Colorado. The site is north of Alder Point and Bishop Point, and east of Kissing Camels Drive (Fig. 1). The lots have been developed for single-family housing. At the time of our investigation, demolition of the 18, single-story, "cottage" style buildings was complete. Buried utilities and curb and gutter had been installed. The new streets were not paved. The site was mostly barren of vegetation, except for existing trees, due to demolition work. The area around the lots is landscaped and irrigated, as are the adjacent golf club fairways. The site was comparatively flat and sloped gently downward to the southeast at grades estimated to be less than 2 percent. Several existing single-family residences were present to the west of this site. Figure 1 shows the general layout of the lots and a vicinity map of the site.

PROPOSED CONSTRUCTION

The four lots included in this study are planned for single-family residences. We anticipate the residences will be wood-frame, one or two-story structures with full-depth basement levels and attached garages. The residences may have partial
brick or stone exterior veneer. Foundation loads are expected to vary between 1,000 and 3,000 pounds per lineal foot of foundation wall, with individual column loads of 25 kips or less. We anticipate excavations of 7 to 8 feet will be required for basement construction. Final grading and landscaping may result in slightly greater depth of backfill.

PREVIOUS INVESTIGATIONS

A Geologic and Preliminary Geotechnical Investigation was prepared for this site by CTL | Thompson, Inc. (Project No. CS17616-115; report dated July 29, 2011). Data developed during the previous work was used to prepare this report.

INVESTIGATION

We drilled one exploratory boring on Lots 1, 2, and 4 during this study. A boring drilled on Lot 16 during our previous investigation was also utilized. The borings were advanced to depths of 25 to 40 feet using 4-inch diameter, continuous-flight auger and a truck-mounted drill rig. Our field representative observed drilling, logged the soils encountered in the borings, and obtained samples. Graphical logs of the borings, including results of field penetration resistance tests and some laboratory test data, are presented on the Summary Logs of Exploratory Borings in Appendix A.

Soil samples obtained during drilling were returned to our laboratory and visually classified. Laboratory testing was then assigned and included moisture content and dry density, swell-consolidation, gradation analysis, and water-soluble sulfate content tests. Swell tests were performed by wetting the samples under estimated overburden pressure (the weight of the overlying soil). Results of laboratory tests are presented in Appendix B and summarized in Table B-1.
SUBSURFACE CONDITIONS

The near-surface soils found in our borings consisted predominantly of sand and gravel underlain by natural clay and claystone. The pertinent engineering characteristics of the soils encountered are described in more detail in the following paragraphs.

Sand and Gravel

Natural, comparatively clean to silty sand and gravel, with clayey lenses, was encountered in each of the borings. The sand extended to depths of about 25 to 31 feet below the existing ground surface. The sand was loose to very dense based on the results of field penetration resistance tests. The sand is considered to be non-expansive when wetted, based on our experience. Samples of the sand contained 4 to 28 percent silt and clay-sized particles (passing the No. 200 sieve).

Clay

Natural clay was encountered on Lot 2 at a depth of 27 feet and extended to the maximum depth explored of 30 feet below the existing ground surface. The clay was very stiff based on the results of field penetration resistance tests.

Bedrock

Claystone bedrock was encountered on Lot 16 at a depth of 31 feet and extended to the maximum depth explored of 40 feet below the existing ground surface. The initial 8 feet of the bedrock formation was severely weathered. The bedrock was hard based on the results of field penetration resistance tests. One sample of the claystone tested exhibited a low measured swell (0.2 percent) when wetted under the estimated overburden pressure.
Ground Water

Ground water was not encountered in the borings during drilling. When checked 14 days after the completion of drilling, ground water was not encountered in the borings. Ground water levels may rise due to seasonal variations and after construction in response to landscape irrigation and precipitation.

FOUNDATIONS

Our investigation indicates predominately non-expansive, natural sand and gravel are present at anticipated shallow foundation levels. As shown on Fig. 3, spread footings underlain by the natural sand and gravel are appropriate for all four lots.

Design criteria for spread footing foundations developed from analysis of field and laboratory data and our experience are presented below. The builder and structural engineer should also consider design and construction details established by the structural warrantor (if any) that may impose additional design and installation requirements.

Spread Footings

1. Footings should be underlain by the natural sand and gravel. If soft or loose soils are exposed in the excavations, they should be removed or compacted to at least 92 percent of maximum modified Proctor dry density (ASTM D 1557), within 2 percent of optimum moisture content, prior to placing concrete.

2. Footings should be designed for a maximum soil pressure of 3,000 psf.

3. Footings should have a minimum width of at least 16 inches. Foundations for isolated columns should have minimum dimensions of 20 inches by 20 inches. Larger sizes may be required, depending upon the loads and structural system used.

4. Foundation walls should be well reinforced, top and bottom. We recommend reinforcement sufficient to span an unsupported distance of at least 10 feet. Reinforcement should be designed by the
structural engineer considering the effects of large openings and lateral loads on wall performance.

5. Foundations should be designed considering 1-inch of total settlement. Differential settlement of 1/2-inch should be expected.

6. Exterior footings must be protected from frost action. Normally, 30 inches of frost cover is provided in this area.

7. The completed foundation excavations should be observed by a representative of our firm prior to placing the forms to verify subsurface conditions are as anticipated from our borings. The placement and compaction of below-footing fill should be observed and tested by our representative during construction.

8. Proper surface drainage around the residences and between lots is critical to control wetting. The foundation drain and utility service trenches should be braced or installed away from the footings to reduce the risk of undermining the footings and backfill should be compacted. Sump pit and sewer service excavations should avoid undermining the footings or compromising the soil support below and adjacent to footings. The voids around the sump pit excavation should be backfilled with squeegee or “flow fill” to reduce settlements.

SLAB PERFORMANCE RISK

Laboratory test results, subsoil profiles, and our experience with residence construction and performance were used to provide an evaluation of basement slab performance risk. Slab performance risk evaluation is an engineering judgment that is used as a predictor of the general magnitude of potential slab-on-grade movement and the risk of poor slab-on-grade performance. Figure 3 shows our estimate of risk for each lot based upon field data, laboratory test results, and our experience. We believe a low risk of poor slab performance will exist for floor slabs underlain by the natural sand and gravel.
FLOOR SYSTEMS AND SLABS-ON-GRADE

Basement Floor Systems and Slabs-on-Grade

We understand a full-depth basement is planned on each of the investigated lots. We believe a low risk of poor slab performance will exist for floor slabs underlain by the natural sand and gravel. Our experience indicates basement slab performance has generally been satisfactory on low risk sites. The builder may use slab-on-grade floors for basements constructed within the investigated lots. More heavily loaded foundation walls underlain by granular soils can settle relative to lightly loaded slab-on-grade floors. The settlement can result in cosmetic cracking of drywall partitions in stairwells and in finished basements. We recommend slab-on-grade floors be separated from exterior walls and interior bearing members with joints that allow for independent vertical movements of the slab relative to the foundation. Slab bearing partitions should be minimized. Where such partitions are necessary, a slip joint (or float) allowing at least 1-1/2 inches of free vertical slab movement should be used to reduce the risk of cracking the drywall. Doorways should also be designed to allow vertical movement of slabs. To limit damage in the event of movement, sheetrock should not extend to the floor.

Underslab plumbing should be avoided as much as possible. If underslab plumbing is necessary, service lines should be pressure tested for leaks during construction and be provided with flexible couplings. Any utility lines that penetrate the slabs should be isolated from the slabs with joints to allow for free vertical movement. Gas and water lines leading to slab-supported appliances should be constructed with flexibility. Heating and air conditioning systems constructed on slabs should be provided with flexible connections capable of at least 1-1/2 inches of vertical movement so that slab movement is not transmitted to the ductwork.

Slabs should be placed directly on the exposed subsoils or properly moisture conditioned, compacted fill. The 2009 International Building Code (IBC) or 2009 International Residential Code (IRC) requires a vapor retarder be placed between base course or subgrade soils and the concrete slab-on-grade floor. The
merits of installation of a vapor retarder below floor slabs depend on the sensitivity of floor coverings and building use to moisture. A properly installed vapor retarder (10 mil minimum) is more beneficial below concrete slab-on-grade floors where floor coverings, painted floor surfaces or products stored on the floor will be sensitive to moisture. The vapor retarder is most effective when concrete is placed directly on top of it, rather than placing a sand or gravel leveling course between the vapor retarder and the floor slab. The placement of concrete on the vapor retarder may increase the risk of shrinkage cracking and curling. Use of concrete with reduced shrinkage characteristics including minimized water content, maximized coarse aggregate content, and reasonably low slump will reduce the risk of shrinkage cracking and curling. Considerations and recommendations for the Installation of vapor retarders below concrete slabs are outlined in Section 3.2.3 of the 2006 report of the American Concrete Institute (ACI) Committee 302, “Guide for Concrete Floor and Slab Construction (ACI 302.R-96)”.

Frequent control joints should be provided in the floor slabs to reduce the effects of curling and to help control shrinkage cracking. Panels that are approximately square generally perform better than rectangular areas. We suggest an additional joint about 3 feet away from and parallel to foundation walls.

**Structurally Supported Floors**

Structural floors should be used in non-basement, finished living areas. The structural floor is supported by the foundation system. Design and construction issues associated with structural floors include ventilation and lateral loads. Where structurally supported floors are installed, the required air space depends on the materials used to construct the floor. Building codes require a clear space of at least 18 inches above exposed earth if untreated wood floor components are used. For non-organic systems, a minimum clear space of 8 inches should be maintained. This minimum clear space should be maintained between any point on the underside of the floor system (including beams and floor drain traps) and the soils.
Where structurally supported floors are used, utility connections, including water, gas, air duct, and exhaust stack connections to floor supported appliances, should be capable of absorbing some deflection of the floor. Plumbing that passes through the floor should ideally be hung from the underside of the structural floor and not placed on the bottom of the excavation. This configuration may not be achievable for some parts of the installation. It is prudent to maintain the minimum clear space below all plumbing lines. If trenching below the lines is necessary, we recommend sloping these trenches so they discharge to the foundation drain.

Control of humidity in crawl spaces is important for indoor air quality and performance of wood floor systems. We believe the best current practices to control humidity involve the use of a vapor retarder (10 mil minimum), placed on the exposed soils below accessible sub-floor areas. The vapor retarder should be sealed at joints and attached to concrete foundation elements. If desired, we can provide designs for ventilation systems that can be installed in association with a vapor retarder, to improve control of humidity in crawl space areas. The Moisture Management Task Force of Metro Denver\(^1\) has compiled additional discussion and recommendations regarding current best practices for the control of humidity in below-grade, under-floor spaces.

**Porches, Decks and Patios**

Porches or decks with overhanging roofs, or that are otherwise integral with the residence such that foundation movement cannot be tolerated, should be constructed with the same foundation type as the house. Isolated piers or pads may be installed beneath a roof overhang provided the slab is independent of the foundation elements. Patio or porch roof columns may be positioned on the slab, directly above the foundation system, provided the slab is structural and supported by the foundation system. Porch or patio slabs should be constructed to reduce the likelihood that backfill settlement will affect the slab. One approach (for smaller porches located over basement backfill zones) is to construct the porch as a

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structurally supported slab that is independent of the underlying backfill. Non-structural porches, patio slabs, and other exterior flatwork should be isolated from the foundation. Movements of slabs should not be transmitted to the foundation. Wooden decks are more flexible and more easily adjusted in the event of movement.

Deck foundations should be designed by a structural engineer. For simple decks that are not integral with the residence and can tolerate some movement, the use of short pliers or footing pads bottomed at least 3 feet below grade can be considered, as long as they are located outside foundation wall backfill areas. Deck foundations should be bottomed below foundation wall backfill to reduce risk of settlement; longer (8 to 10 feet or more) deck pliers may be necessary to provide adequate support. The inner edge of the deck may be constructed on haunches or steel angles bolted to the foundation walls and detailed such that movement of the deck foundation will not cause distress to the residence. We suggest use of adjustable bracket-type connections or other details between foundations and deck posts so the posts can be trimmed or adjusted if movement occurs.

**Garage Floors and Exterior Flatwork**

Garage slabs, driveways, and sidewalks are normally constructed as slabs-on-grade. Performance of conventional slabs-on-grade is erratic. Various properties of the soils and environmental conditions influence magnitude of settlement and other performance characteristics. Increases in the moisture content in the underlying soils can result in settlement and possible cracking of slabs-on-grade. Backfill below slabs should be moisture conditioned and compacted to reduce settlement, as discussed in BACKFILL COMPACTION. Driveways and exterior slabs founded on backfill may settle and crack if the backfill is not properly moisture treated and compacted.
BELOW-GRADe WALLS

Basement and/or foundation walls and grade beams that extend below grade should be designed to resist lateral earth pressures where backfill is not present to about the same extent on both sides of the wall. Many factors affect the value of the design lateral earth pressure. These factors include, but are not limited to, the wall type, backfill compaction and composition, slope and drainage of the backfill, and the rigidity of the wall against rotation and deflection. For a very rigid wall where negligible or very little deflection will occur, an "at-rest" lateral earth pressure should be used in design. For walls that can deflect or rotate 0.5 to 1 percent of the wall height (depending upon the backfill types), lower "active" lateral earth pressures are appropriate. Our experience indicates basement walls can deflect or rotate slightly under normal design loads, and that this deflection typically does not affect the structural integrity of the walls. Thus, the earth pressure on the walls will likely be between the "active" and "at-rest" conditions.

If the on-site sands and gravels are used as backfill and the backfill is not saturated, we recommend design of basement walls at this site using an equivalent fluid density of at least 50 pcf. This value assumes deflection; some minor cracking of walls may occur. If very little wall deflection is desired, a higher design value is appropriate. The structural engineer should also consider site-specific grade restrictions and the effects of large openings on the behavior of the walls.

BACKFILL COMPACTION

Settlement of foundation wall and utility trench backfill can cause damage to concrete flatwork and/or result in poor drainage conditions. Compaction of backfill can reduce settlement. Attempts to compact backfill near foundations to a high degree can cause damage to foundation walls and window wells and may increase lateral pressures on the foundation walls. The potential for cracking of a foundation wall can vary widely based on many factors including the degree of compaction achieved, the weight and type of compaction equipment utilized, the structural
design of the wall, the strength of the concrete at the time of backfill compaction, and the presence of temporary or permanent bracing.

Proper moisture conditioning of backfill is as important as compaction, because settlement commonly occurs in response to wetting. The addition of water complicates the backfill process, especially during cold weather. Frozen soils are considered unsuitable for use as backfill because excessive settlement can result when the frozen materials thaw. Exhibit B describes four alternative methods to place, moisture condition, and compact backfill along with a range of possible settlements, and advantages and disadvantages of each approach, all based upon our experience. These are just a few of the possible techniques, and represent a range for your evaluation. We recommend Alternatives C or D if you wish to control potential settlement. We do not recommend Alternative A.

Precautions should be taken when backfilling against a basement wall. Temporary bracing of comparatively long, straight sections of foundation walls should be used to limit damage to walls during the compaction process. Waiting at least seven days (or longer during cold weather months) after the walls are placed to allow the concrete to gain strength can also reduce the risk of damage. Compaction of fill placed beneath and next to window wells, counterforts, and grade beams may be difficult to achieve without damaging these building elements. Proper moisture conditioning of the fill prior to placement in these areas will help reduce potential settlement.

Ideally, drainage swales should not be located over the backfill zone (including excavation ramps), as this can increase the amount of water infiltration into the backfill and cause excessive settlement. Swales should be designed to be a minimum of at least 5 feet from the foundation to help reduce water infiltration. Irrigated vegetation, sump pump discharge pipes, sprinkler valve boxes, and roof downspout terminations should also be at least 5 feet from the foundation.
SUBSURFACE DRAINS AND SURFACE DRAINAGE

Water from surface irrigation of lawns and landscaping frequently flows through relatively permeable backfill placed adjacent to a residence, and collects on the surface of less permeable soils occurring at the bottom of basement or foundation excavations. This process can cause wet or moist basement conditions after construction. To reduce the likelihood water pressure will develop outside foundation walls and the risk of accumulation of water at the basement level, we recommend provision of a foundation drain around the entire basement perimeter. The provision of a drain will not eliminate slab movement or prevent moist conditions in crawl spaces. The drain should consist of a 4-Inch diameter, perforated or slotted pipe encased in free-draining gravel. The drain should lead to a positive gravity outlet, such as a subdrain located beneath the sewer, or to a sump where water can be removed by pumping. Sump pumps must be maintained by home owners. Typical foundation drain details for basement construction are presented on Fig. 4.

Our experience indicates moist conditions can develop in non-basement crawl space areas, resulting in isolated instances of damp soils, musty smells and, in rare cases, standing water. These crawl space areas should be well ventilated, depending on the use of a vapor retarder/barrier and the floor material selected. Some builders install drain systems around non-basement crawl space areas as a precaution; we regard these installations as optional. If no basements are planned, drains should be installed in crawl spaces. We can provide recommendations for crawl space drain systems, if desired.

Proper design, construction, and maintenance of surface drainage are critical to the satisfactory performance of foundations, slabs-on-grade, and other improvements. Landscaping and Irrigation practices will also affect performance. Exhibit A contains our recommendations for surface drainage, irrigation, and maintenance.
CONCRETE

Concrete in contact with soil can be subject to sulfate attack. We measured the water-soluble sulfate concentration in two samples from this site at less than 0.1 percent. For this level of sulfate concentration, ACI 332-06 Code Requirements for Residential Concrete indicates there are no special requirements for sulfate resistance.

In our experience, superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high water tables. Concrete should have a total air content of 6 percent +/- 1.5 percent. We recommend all foundation walls and grade beams in contact with the subsoils (including the inside and outside faces of garage and crawl space grade beams) be damp-proofed.

EXCAVATIONS

Excavations made at this site, including those for foundations and utilities, may be governed by local, state, or federal guidelines or regulations. Subcontractors should be familiar with these regulations and take whatever precautions they deem necessary to comply with the requirements and thereby protect the safety of their employees and that of the general public.

CONSTRUCTION OBSERVATIONS

This report has been prepared for the exclusive use of Garden of the Gods, LLC for the purpose of providing geotechnical design and construction criteria for the proposed project. The information, conclusions, and recommendations presented herein are based upon consideration of many factors including, but not limited to, the type of structures proposed, the geologic setting, and the subsurface conditions encountered. The conclusions and recommendations contained in the report are not valid for use by others. Standards of practice evolve in the area of
geotechnical engineering. The recommendations provided are appropriate for about three years. If the proposed residences are not constructed within about three years, we should be contacted to determine if we should update this report.

We recommend that CTL | Thompson, Inc. provide construction observation services to allow us the opportunity to verify whether soil conditions are consistent with those found during this investigation. If others perform these observations, they must accept responsibility to judge whether the recommendations in this report remain appropriate.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that the structures will perform satisfactorily. It is critical that all recommendations in this report are followed during design and construction. Home owners must assume responsibility for maintaining the structures and use appropriate practices regarding drainage and landscaping. Improvements performed by home owners after construction, such as finishing a basement or construction of additions, retaining walls, decks, patios, landscaping and exterior flatwork, should be completed in accordance with recommendations in this report.

LIMITATIONS

One boring was drilled on each of the four investigated lots to obtain a reasonably accurate indication of foundation soil conditions. Variations in the subsoil conditions not indicated by our borings are possible. A representative of our firm should observe the foundation excavations to verify the exposed subsoils
are as anticipated. Our representative should also test the compaction of foundation wall backfill during construction.

We believe this investigation was conducted with that level of skill and care ordinarily used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made.

If we can be of further service in discussing the contents of this report or in the analysis of the influence of subsoil conditions on design of the structures, please call.

CTL | THOMPSON, INC.

Patrick Foley, E.I.T
Staff Engineer

Reviewed By:

Richard A. Phillips, P.Eng
Senior Principal Engineer

PAF:RAP:lc
(4 copies sent)

Via e-mail: mwoelke@sunriseco.com
EXHIBIT A

SURFACE DRAINAGE,
IRRIGATION AND MAINTENANCE

Performance of foundations and concrete flatwork is influenced by the moisture conditions existing within the foundation soils. Surface drainage should be designed to provide rapid runoff of surface water away from proposed residences. Proper surface drainage and irrigation practices can help control the amount of surface water that penetrates to foundation levels and contributes to settlement or heave of soils and bedrock that support foundations and slabs-on-grade. Positive drainage away from the foundation and avoidance of irrigation near the foundation also help to avoid excessive wetting of backfill soils, which can lead to increased backfill settlement and possibly to higher lateral earth pressures, due to increased weight and reduced strength of the backfill. CTL Thompson, Inc. recommends the following precautions. The home buyer should maintain surface drainage and, if an irrigation system is installed, it should substantially conform to these recommendations.

1. Wetting or drying of the open foundation excavations should be avoided.

2. Excessive wetting of foundation soils before, during and after construction can cause softening of fill and foundation soils and result in foundation and slab movements. Proper surface drainage around the residence and between lots is critical to control wetting.

3. The ground surface surrounding the exterior of each residence should be sloped to drain away from the building in all directions. We recommend a minimum constructed slope of at least 12 inches in the first 10 feet (10 percent) in landscaped areas around each residence, where practical. The recommended slope is for the soil surface slope, not the surface of the landscaping rock.

We do not view the recommendation to provide a 10 percent slope away from the foundation as an absolute. It is desirable to create this slope where practical, because we know that backfill will likely settle to some degree. By starting with sufficient slope, positive drainage can be maintained for most settlement conditions. There are many situations around a residence where a 10 percent slope cannot be achieved practically, such as around patios, at inside foundation corners, and between a house and nearby sidewalk. In these areas, we believe it is desirable to establish as much slope as practical and to avoid irrigation. We believe it is acceptable to use a slope on the order of 5 percent perpendicular to the foundation in these limited areas.

For lots graded to direct drainage from the rear yard to the front, it is difficult to achieve 10 percent slope at the high point behind the
house. We believe it is acceptable to use a slope of about 6 inches in the first 10 feet (5 percent) at this location.

Between houses that are separated by a distance of less than 20 feet, the constructed slope should generally be at least 10 percent to the swale used to convey water out of this area. For lots that are graded to drain to the front and back, we believe it is acceptable to install a slope of 5 to 8 percent at the high point (aka “break point”) between houses.

Construction of retaining walls and decks adjacent to the residence should not alter the recommended slopes and surface drainage around the residence. The ground surface under the deck should be compacted and slope away from the residence. A 10-mil plastic sheeting and landscaping rock are recommended above the ground under the decks to reduce water dripping from the deck causing soil erosion and/or forming depressions under the deck. The plastic sheeting should direct water away from the residence. Retaining walls should not flatten the ground surface around the residence and block or impede the surface runoff.

4. Swales used to convey water across yards and between houses should be sloped so that water moves quickly and does not pond for extended periods of time. We suggest minimum slopes of about 2 to 2.5 percent in grassed areas and about 2 percent where landscaping rock or other materials are present. If slopes less than about 2 percent are necessary, concrete-lined channels or plastic pipe should be used. Fence posts, trees, and retaining walls should not impede the runoff in the swale.

5. Backfill around the foundation walls should be moistened and compacted, as discussed previously in the BACKFILL COMPACTION section of the report.

6. Roof downspouts and drains should discharge well beyond the limits of all backfill. Splash blocks and/or extensions should be provided at all downspouts so water discharges onto the ground beyond the backfill. We generally recommend against burial of downspout discharge. Where it is necessary to bury downspout discharge, solid, rigid pipe should be used and it should slope to an open gravity outlet. Downspout extensions, splash blocks and buried outlets must be maintained by the home owner.

7. The importance of proper home owner irrigation practices cannot be over-emphasized. Irrigation should be limited to the minimum amount sufficient to maintain vegetation; application of more water will increase likelihood of slab and foundation movements. Landscaping should be carefully designed and maintained to minimize irrigation. Plants placed close to foundation walls should be limited to those with low moisture requirements. Irrigated grass should not be located...
within 5 feet of the foundation. Sprinklers should not discharge within 5 feet of foundations. Plastic sheeting should not be placed beneath landscaped areas adjacent to foundation walls or grade beams. Geotextile fabric will inhibit weed growth yet still allow natural evaporation to occur.

8. The design and construction criteria for foundations and floor system alternatives were compiled with the expectation that all other recommendations presented in this report related to surface and subsurface drainage, landscaping irrigation, backfill compaction, etc. will be incorporated into the project. It is critical that all recommendations in this report are followed.
## EXHIBIT B

### EXAMPLE BACKFILL COMPACTION ALTERNATIVES

<table>
<thead>
<tr>
<th>Alt.</th>
<th>Description</th>
<th>Possible Settlement</th>
<th>Pros (+) / Cons (-)</th>
</tr>
</thead>
</table>
| A    | Place in 18 to 24-inch lifts, without moisture conditioning. Compact lift surface to about 85 percent of maximum standard Proctor (ASTM D698) dry density. (Not recommended) | 5 to 15 percent of depth (for 8 feet of backfill, 5 to 15 inches) | + Fast  
+ Water not required  
- Excessive Settlement  
- Highest water penetration  
- Highest probability of warranty repair |
| B    | Moisture condition within 2 percent of optimum, place in 12 to 18-inch lifts. Compact lift surface to about 85 to 90 percent. | 5 to 10 percent of depth | + Relatively Fast  
- Moderate water penetration  
- Excessive settlement  
- Need for water  
- Warranty repairs probable |
| C    | Moisture condition to within 2 percent of optimum and place in 8 to 12-inch lifts. Compact lift surface to 90 to 95 percent. | 2 to 5 percent of depth | + Reduced warranty  
+ Reduced water infiltration  
+ Reduced settlement  
- Possible higher lateral pressure  
- Slower  
- Need for water  
- Potential damage to walls |
| D    | Moisture condition and place as in C. Compact lift surface to at least 95 percent. | 1 to 2 percent of depth | + Reduced warranty  
+ Reduced water infiltration  
+ Lowest comparative settlement  
- Possible higher lateral pressure  
- Slower  
- Need for water  
- Potential damage to walls |
COVER ENTIRE WIDTH OF GRAVEL WITH NON-WOVEN GEOTEXTILE FABRIC (MIRAFI 140N OR EQUIVALENT).

ATTACH PVC SHEETING TO FOUNDATION WALL

SLOPE TO DRAIN

8-INCH MIN.
OR BEYOND 1:1 SLOPE
FROM BOTTOM OF FOOTING
(WHICHEVER IS GREATER)

3 OR 4-INCH DIAMETER PERFORATED DRAIN PIPE. THE PIPE SHOULD BE PLACED IN A TRENCH WITH A SLOPE OF AT LEAST 1/9-INCH DROP PER FOOT OF DRAIN.

ENCASE PIPE IN 1/2" TO 3/4" WASHED GRAVEL. EXTEND GRAVEL LATERALLY TO FOOTING AND AT LEAST 1/2 HEIGHT OF FOOTING. FILL ENTIRE TRENCH WITH GRAVEL.

NOTE:
THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 2 INCHES BELOW BOTTOM OF FOOTING AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING. SUMP MAY BE DISCHARGED TO UNDERDRAIN SYSTEM, DOWN GRADIENT OF THE FOUNDATION DRAIN CONNECTION.
APPENDIX A

SUMMARY LOGS OF EXPLORATORY BORINGS
GARDEN OF THE GODS, LLC
LOTS 1, 2, 4, 5, 6, 18, SIGNATURE POINT
CTBT PROJECT NO. 070158-39D
LEGEND:

- TSWL:

SAID, SLIGHTLY SILTY TO SITTLY WITH CLAYER LENSES, SLIGHTLY GRAVELLY TO VERY GRAVELLY, MEDIMUM DENSE TO VERY DENSE WITH LOOSE LENSES, SLIGHTLY MOIST TO MOIST, LIGHT BROWN, PINK, RED-BROWN (SM, SW, 6R, 7.5R 3/4, 7.5R 1/4)

- CLAY, SLIGHTLY SANDY TO SANDY, VERY STIFF TO STIFF, MOIST TO VERY MOIST, RED-BROWN, RUST, OLIVE GRAY, (CU)

- WEATHERED CLAYSTONE, SANDY, VERY STIFF TO MEDIUM HARD, MOIST TO VERY MOIST, LIGHT GRAY, RUST, OLIVE GRAY,

- REDDISH CLAYSTONE, SANDY, HARD, SLIGHTLY MOIST TO MOIST, GRAY, OLIVE GRAY.

- DRIVE SAMPLE, THE SYMBOL 2B/12 INDICATES 2B SLOWS OF A 60-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH D.O.D. SAMPLER 12 INCHES.

NOTES:
1. THE BORINGS WERE DRILLED APRIL 15, 2012 USING A 4-INCH DIAMETER, CONTINUOUS FLIGHT AUGER AND A CME-60, TRUCK-MOUNTED DRILL RIG.
2. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THIS REPORT.
3. GROUND WATER WAS NOT ENCOUNTERED IN THE EXPLORATORY BORINGS DURING THIS INVESTIGATION.

- WAC - INDICATES WATERSHED CONTENT, (%)
- DD - INDICATES DRY DENSITY, (pcf)
- SW - INDICATES SWELL WHEN VIBRATED UNDER ESTIMATED OVERBURDEN PRESSURE, (in)
- PD - INDICATES POURING NO. 253 SIEVE, (%)
- WS - INDICATES WATER-SOLUBLE SULFATE CONTENT, (%)

Summary Logs of Exploratory Borings

FIG. A-1
APPENDIX B

LABORATORY TEST RESULTS

TABLE B-1 – SUMMARY OF LABORATORY TESTING
Gradation Test Results

Sample of SAND, SLIGHTLY SILTY (SP-SM) from LOT - 1 AT 9 FEET

Sample of SAND, VERY GRAVELLY (SW-SM) from LOT - 2 AT 4 FEET

GARDEN OF THE GODS, LLC
LOTS 1, 2, 4, 16, SIGNATURE POINT
CTU1 PROJECT NO. CS17816.002-120
S:\CS17500-17699\CS17816.002\152\REPORTS\CS17816.002-120_GRADATION.XLS

FIG. B-1
Sample of: SAND, SILTY (SM) From: LOT - 2 AT 14 FEET

Sample of: SAND, GRAVELLY (SW-SM) From: LOT - 4 AT 9 FEET
Gradation Test Results

**HYDROMETER ANALYSIS**

<table>
<thead>
<tr>
<th>25 HR.</th>
<th>7 HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN.</td>
<td>HR.</td>
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<tr>
<td>45</td>
<td>15</td>
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<tr>
<td>60</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
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**SIEVE ANALYSIS**

<table>
<thead>
<tr>
<th>U.S. STANDARD SERIES</th>
<th>CLEAR SQUARE OPENINGS</th>
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<tr>
<td>0.005</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>PERCENT PASSING</strong></td>
<td><strong>PERCENT RETAINED</strong></td>
</tr>
<tr>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>90</td>
<td>10</td>
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<td>80</td>
<td>20</td>
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<tr>
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<tr>
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<td>90</td>
</tr>
<tr>
<td>0</td>
<td>100</td>
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**Diameter of Particle in Millimeters**

<table>
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<tr>
<th>CLAY (PLASTIC) TO SILT (NON-PLASTIC)</th>
<th>SANDS</th>
<th>GRAVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINE</td>
<td>MEDIUM</td>
<td>COARSE</td>
</tr>
</tbody>
</table>

Sample of SAND, SILTY, GRAVELLY (SM)
From LOT - 4 AT 14 FEET

- GRAVEL 13% SAND 59%
- SILT & CLAY 28% LIQUID LIMIT %
- PLASTICITY INDEX %

---

**HYDROMETER ANALYSIS**

<table>
<thead>
<tr>
<th>25 HR.</th>
<th>7 HR.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>HR.</td>
</tr>
<tr>
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<td>15</td>
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<tr>
<td>60</td>
<td>18</td>
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**SIEVE ANALYSIS**

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<tr>
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<th>CLEAR SQUARE OPENINGS</th>
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<tr>
<td>0.005</td>
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<tr>
<td><strong>PERCENT PASSING</strong></td>
<td><strong>PERCENT RETAINED</strong></td>
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**Diameter of Particle in Millimeters**

<table>
<thead>
<tr>
<th>CLAY (PLASTIC) TO SILT (NON-PLASTIC)</th>
<th>SANDS</th>
<th>GRAVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FINE</td>
<td>MEDIUM</td>
<td>COARSE</td>
</tr>
</tbody>
</table>

Sample of SAND, GRAVELLY (SW)
From LOT - 16 AT 9 FEET

- GRAVEL 13% SAND 83%
- SILT & CLAY 4% LIQUID LIMIT %
- PLASTICITY INDEX %

---

GARDEN OF THE GODS, LLC
LOTS 1, 2, 4, 16, SIGNATURE POINT
GTJF PROJECT NO. CS17546.002-120
S:\CS17546-17549\CS17546.002\1201\REPORTS\CS17546.002-120_GRADATION.XLS

FIG. B-3
EXPANSION UNDER CONSTANT PRESSURE DUE TO WETTING

APPLIED PRESSURE - KSF
Sample of CLAYSTONE, SANDY
From LOT-16 AT 39 FEET

DRY UNIT WEIGHT = 118 PCF
MOISTURE CONTENT = 16.2 %

Swell Consolidation Test Results

FIG. B-4
<table>
<thead>
<tr>
<th>LOT</th>
<th>DEPTH (FEET)</th>
<th>MOISTURE CONTENT (%)</th>
<th>DRY DENSITY (PCF)</th>
<th>ATTERBERG LIMITS</th>
<th>SWELL TEST RESULTS*</th>
<th>PASSING NO. 200 SIEVE (%)</th>
<th>WATER SOLUBLE SULFATES (%)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>4.9</td>
<td>107</td>
<td></td>
<td></td>
<td>12</td>
<td>&lt;0.1</td>
<td>SAND, SLIGHTLY SILTY (SP-SM)</td>
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<tr>
<td>2</td>
<td>4</td>
<td>2.7</td>
<td>126</td>
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<td>7</td>
<td></td>
<td>SAND, VERY GRAVELLY (SW-SM)</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
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<td>5000</td>
<td>7.000</td>
<td></td>
<td>CLAYSTONE, SANDY</td>
</tr>
</tbody>
</table>

* SWELL PRESSURE (PSF)
May 7, 2012

Garden of the Gods Club, LLC
3310 Mesa Road, Suite 150
Colorado Springs, Colorado 80904

Subject: Excavation Observation
3416 Signature Golf Point
Lot 1, Signature Point Subdivision
Colorado Springs, Colorado
Project No. CS17816.002-305

Gentlemen:

As requested, a representative of our office visited the subject site on May 3, 2012 to observe soil conditions exposed in the completed foundation excavation. Soils exposed in the excavation were compared to those encountered in a test boring for this site drilled by CTL | Thompson, Inc. and reported under Project No. CS17816.002-120, dated May 4, 2012. The purpose of our observation was to confirm the exposed materials were appropriate for the construction of foundations as recommended in our report. This letter summarizes our observations and recommendations.

PROPOSED CONSTRUCTION

Proposed for this site is a wood-frame, single-family residence with a full-depth basement and attached garage.

SOIL CONDITIONS

Soils exposed within the excavation consisted of silty sand and gravel. The materials appeared to be natural. We observed materials in the excavation that were loosened during the excavation process.

No ponded water or seepage was noted in the excavation.

FOUNDATIONS

In our opinion, a spread footing foundation designed for a maximum allowable soil pressure of 3,000 psf can be used. Foundations must be designed by a qualified architect or engineer. Foundation elements must penetrate materials loosened during the excavation process or the materials should be compacted to at least 92 percent of ASTM D 1557 maximum dry density.
BELOW-GRADE CONSTRUCTION

A subsurface drain is recommended around the perimeter of the basement at foundation level, including any frost trench, for walkout basement construction. Figure 1 presents a typical detail. The drain should discharge to a positive gravity outlet, such as the subdrain located beneath the sewer, or to a sump where water can be removed by pumping.

FLOOR SLABS

Structurally supported floors should be considered if movement and cracking of slab-on-grade floors cannot be tolerated. For parts of the house that require slabs-on-grade for economic or practical considerations, and if risk of movement is acceptable to the builder and owner, we recommend the following precautions for slab-on-grade construction. Homeowners should also follow these recommendations if they finish slab-on-grade areas. These measures will not eliminate movement of slabs-on-grade; they tend to mitigate damage due to slab movement.

1. Slab-on-grade floor construction should be limited to areas such as garages and basements where slab movement and cracking are acceptable to the builder and homebuyers.

2. Interior slabs should be separated from exterior walls and interior bearing members with a slip joint that allows free vertical movement of the slabs. These joints must be maintained by the homeowners to avoid transfer of movement.

3. Interior slab-bearing partitions should be minimized. Where such partitions are necessary, a slip joint (or float) allowing at least 1.5 inches of free vertical slab movement should be used. Doorways and stairwells should also be designed to allow for vertical movement of slabs. To limit damage in the event of movement, sheetrock should not extend to the floor. Homeowners should monitor partition voiding and other connections, and re-establish the gap before it closes to less than 1/2 inch.

4. Under-slab plumbing should be thoroughly pressure tested for leaks during construction and be provided with flexible couplings. Gas and waterlines leading to slab-supported appliances should be constructed with flexibility. The homebuyers must maintain these connections.

5. Plumbing and utilities that pass through slabs should be isolated from the slabs. Heating and air conditioning systems supported by slabs should be provided with flexible connections capable of at least 1.5 inches of vertical movement so slab movement is not transmitted to the ductwork. These connections must be maintained by the homeowners. Appliances supported on structural floors should be constructed with flexible connections to allow for some potential flex in the floor.
6. Roofs that overhang a patio or porch should be constructed on the same foundation system as the residence. Isolated piers or pads may be installed beneath a roof overhang provided the slab is independent of the foundation elements. Patio or porch roof columns may be positioned on the slab, directly above the foundation system, provided the slab is structural and supported by the foundation system. Structural porch or patio slabs should be constructed to reduce the likelihood that settlement or heave will affect the slab by placing loose backfill under the structurally supported slab or constructing the slab over void-forming materials.

7. Patio and porch slabs without roofs and other exterior flatwork should be isolated from the foundation. Movements of slabs should not be transmitted to the foundations. Wood decks are more flexible and more easily adjusted in the event of movement.

8. Frequent control joints should be provided in conventional slabs-on-grade to reduce problems associated with shrinkage cracking and curling. Panels that are approximately square generally perform better than rectangular areas. We suggest an additional joint about 3 feet away from and parallel to foundation walls.

SURFACE DRAINAGE

The ground surface around the residence should be sloped to provide positive drainage away from the foundation. We recommend an equivalent slope of 12 inches in the first 10 feet (10 percent) surrounding the residence, where possible, or as required to quickly remove surface water. Where a 10 percent slope cannot be achieved practically, such as around patios, at inside foundation corners, and between the house and nearby sidewalk, we believe it is desirable to establish as much slope as possible and to avoid irrigation in the area. We believe it is acceptable to use a slope on the order of 5 percent perpendicular to the foundation in these areas. Roof downspouts should discharge beyond the limits of backfill. We recommend providing splash blocks and downspout extenders.

Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase the likelihood of slab and foundation movement. Landscaping that requires frequent supplemental watering should not be used. A natural landscape or xeriscape design is preferable.

BACKFILL COMPACTION

We recommend foundation wall backfill be placed and compacted to reduce settlement. However, compaction of the backfill soils adjacent to concrete walls may result in cracking of the wall. The potential for cracking can vary widely based on many factors including the degree of compaction achieved, the weight and type of compaction equipment utilized, the structural design of the wall, the strength of the
concrete at the time of backfill compaction, and the presence of temporary or permanent bracing.

Our experience indicates wall backfill soils that have been moisture conditioned to within 2 percent of optimum moisture content and compacted to about 90 percent of maximum standard Proctor dry density (ASTM D 698) are typically sufficiently dense to reduce settlement. Compacting the backfill soils to higher density increases the risk of cracking the concrete wall. Particles in excess of 6 inches in diameter should be excluded from the backfill soils. Frost or frozen soils should not be used for backfill.

EXCAVATIONS

Excavations made at this site, including those for foundations and utilities, may be governed by local, state, or federal guidelines or regulations. Subcontractors employed at this site should be familiar with these regulations and take whatever action they deem necessary to comply with their requirements and protect the safety of their employees and that of the general public.

LIMITATIONS

The recommendations presented were developed considering conditions exposed in the completed foundation excavation, and the type of structure planned. Revisions in the excavation or structure could influence our recommendations. If changes are made, we should be contacted to review the new configuration.

If we can be of further service in discussing the contents of this letter or the project from a geotechnical point-of-view, please call.

Very truly yours,

CTL | THOMPSON, INC.

Richard A. Phillips, P.E.
Senior Principal Engineer

PF:RAP:lc
(1 copy sent)
COVER ENTIRE WIDTH OF GRAVEL WITH NON-WOVEN GEOTEXTILE FABRIC (MIRAFI 140N OR EQUIVALENT).

ATTACH PVC SHEETING TO FOUNDATION WALL

8-INCH MIN. OR BEYOND 1:1 SLOPE FROM BOTTOM OF FOOTING (WHICHER IS GREATER)

3 OR 4-INCH DIAMETER PERFORATED DRAIN PIPE. THE PIPE SHOULD BE PLACED IN A TRENCH WITH A SLOPE OF AT LEAST 1/8-INCH DROP PER FOOT OF DRAIN.

ENCASE PIPE IN 1/2" TO 3/4" WASHED GRAVEL. EXTEND GRAVEL LATERALLY TO FOOTING AND AT LEAST 1/2 HEIGHT OF FOOTING. FILL ENTIRE TRENCH WITH GRAVEL.

NOTE:
THE BOTTOM OF THE DRAIN SHOULD BE AT LEAST 2 INCHES BELOW BOTTOM OF FOOTING AT THE HIGHEST POINT AND SLOPE DOWNWARD TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING. SUMP MAY BE DISCHARGED TO UNDERDRAIN SYSTEM, DOWN GRADIENT OF THE FOUNDATION DRAIN CONNECTION.

Exterior Foundation Wall Drain

GARDEN OF THE GODS, LLC
3416 SIGNATURE GOLF POINT, LOT 1, SIGNATURE POINT
CT, JD PROJECT NO. 0517818.003-305
S/CS17699-17699/CS17619.002109/LOT 1 LETTERS & DNS DOC 31CS17618.003-305 LOT 1 FIG 1.1.png

FIG. 1