Foster Gambee
GEOTECHNICAL, PC
Geotechnical & Geological Engineering Services

07-185498-RS

GT_001788

January 7, 2008

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3227/4

Pat and Earl Rossler
2505 SW Hillcrest Drive
Portland, OR 97201

SUBJECT: PLAN REVIEW, GARAGE RENOVATION, ROSSLER RESIDENCE, 2505 SW HILLCREST DRIVE, PORTLAND, OREGON

Foster Gambee Geotechnical, P.C., (Foster Gambee) has reviewed a copy of the project plans for the above-referenced garage renovation. The plans were prepared by Burry-Trice Architects and are undated. We understand a copy of the same plans was submitted to the City of Portland as part of a permit application on December 27, 2007. The project structural engineer is James G. Pierson Consulting Engineers, Inc.

As you know, Foster Gambee completed a geotechnical investigation for the project. The results of our study, including recommendations for suitably founding the garage, are presented in our October 3, 2007 report entitled "Geotechnical Investigation for Garage Renovation or Replacement, Rossler Residence, 2505 SW Hillcrest Drive, Portland, Oregon." The primary purpose of this plan review is to evaluate if the proposed foundation system is in general conformance with recommendations presented in our geotechnical report for the project.

Based on our review of the plans, foundation support for the renovated garage will be provided by 3-in.-diameter, schedule 40 steel pipe piles. The plans indicate that a total of 26 piles will be utilized; 21 piles will be installed vertically and five piles will be battered 20° from vertical to resist lateral loads. As noted on the plans, axial design loads (dead load plus live load) range from 4.0 to 12.5 kips.

Our review of the project plans indicates the proposed pipe pile foundation system is in general conformance with the recommendations presented in our October 3, 2007 geotechnical report. However, design axial loads for some of the foundation piles are higher (up to 12.5 kips vs. 8 kips) than discussed in our report. As discussed in our report, an allowable (design) axial capacity of 8 kips is appropriate for 3-in.-diameter steel pipe (schedule 40 minimum) piles driven to a minimum embedment of 8 ft into the underlying native silt soils (up to 17 ft below existing grades). In this regard, we recommend those piles with design axial loads of about 8.0 kips or less be driven a minimum of 8 ft into the underlying native silt soils or to refusal.

In our opinion, greater capacities can be achieved with the proposed 3-in.-diameter, schedule 40 steel pipe piles by increasing pile embedment into the underlying native soils. An allowable axial capacity of up to 12.5 kips can be achieved with 3-in.-diameter steel pipe (schedule 40 minimum) piles driven to a minimum embedment of 15 ft into the underlying native silt soils (up to 24 ft below existing grades) or to refusal. In this regard, we recommend those piles with design axial loads between about 8.0 kips and 12.5 kips be driven a minimum of 15 ft into the underlying native silt soils or to refusal.

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Refusal is defined as a penetration rate of less than ½ in. per minute with a 140-lb (minimum) pneumatic hammer. A 140-lb hammer may be used to determine refusal; however, a larger hammer may be required to achieve the minimum embedment into native soil or to confirm refusal on basalt bedrock.

Sincerely,
FOSTER GAMBEE GEOTECHNICAL, P.C.

REGISTERED PROFESSIONAL ENGINEER
14,957PE
OREGON
JULY 25, 1990
JOHN E. GAMBEE
Expires: 6/30/09

John E. Gambee, P.E.
Principal

07-185498-RS

Foster Gambee
GEOTECHNICAL, PC
Geotechnical & Geological Engineering Services

INVEST 0784

October 3, 2007

Pat and Earl Rossler
2505 SW Hillcrest Drive
Portland, OR 97201

SUBJECT: GEOTECHNICAL INVESTIGATION FOR GARAGE RENOVATION OR REPLACEMENT, ROSSLER RESIDENCE, 2505 SW HILLCREST DRIVE, PORTLAND, OREGON

At your request, Foster Gambee Geotechnical, P.C., (Foster Gambee) has conducted a geotechnical investigation for renovation of an existing garage or replacement of the existing garage with a new garage at the above-referenced residential property. The purpose of our investigation was to evaluate site conditions with respect to the renovatation/replacement plans and to provide geotechnical-related guidelines and criteria for suitably founding the garage on the site.

The scope of work for this investigation consisted of a review of the available geologic literature for the property area, a reconnaissance of the garage area, the development of one slope profile, subsurface explorations, limited laboratory testing, and engineering studies and analyses. The fee for this work and terms under which services were provided are in accordance with our August 17, 2007 proposal. This letter report describes the work accomplished and provides our conclusions and recommendations regarding suitably founding the garage on the site.

PROJECT DESCRIPTION

Based on discussions with Charles Hagen of Burry-Trice Architects, we understand the existing detached, two-story garage (street level garage with lower level studio) will be renovated, including new foundations, or replaced by a new garage at the same approximate location. As with the existing garage, the proposed garage will be a two-story structure elevated above the steeply sloping ground surface.

SITE CONDITIONS

Geologic Setting and Hazards

A review of the available geologic literature indicates the property area is mantled by wind-deposited silt, referred to as Portland Hills Silt, which is underlain by the Columbia River Basalt.[1] The Portland Hills Silt consists of brown silt containing variable amounts of clay and fine-grained sand. The Columbia River Basalt is a dense, fine-grained igneous rock that is typically dark gray where fresh and brown or reddish-brown where weathered. Severe weathering of the basalt results in a brown or reddish-brown, clayey silt residual soil that contains basalt gravel and cobbles near the contact with the underlying weathered bedrock.

On the Relative Earthquake Hazard Map of the Portland Metro Region, Clackamas, Multnomah, and Washington Counties, Oregon, the property is mapped in zone B.[2] (Range: A–D, with A being the highest relative hazard.) This designation is due primarily to the risks of ground motion amplification and slope instability during a relatively strong seismic event. Although it is now widely accepted that damaging earthquakes much larger than any in the historical record are possible in the Portland area, accurately predicting their magnitude, location, and probability is difficult due to the lack of a complete historical record. For this reason, the Relative Earthquake Hazard Maps do not quantify the earthquake hazard at any given site, but are limited to depicting general areas with relatively higher risk of earthquake damage due to local geologic and topographic conditions.

Surface Conditions

A ground-level reconnaissance in the immediate vicinity of the garage was conducted on September 18, 2007. The purpose of the reconnaissance was to observe and evaluate site topography, materials exposed at the ground surface, indications of slope instability and/or erosion, site drainage, the condition of existing foundations and retaining walls supporting the existing garage, and any other geotechnical-related conditions that might affect renovation or replacement of the garage. The Site Plan, Figure 1, shows the layout of the southwest corner of the property, including the footprint of the existing garage and the adjacent stretch of Hillcrest Drive. Observations made at the time of our reconnaissance are summarized in the following paragraphs.

- The subject property is situated on a moderate to steep, north-facing hillside and is bordered by SW Hillcrest Drive to the north, south, and east. As shown by the topographic contours presented on Figure 1, the existing garage is located on the upslope (south) side of the site in an area of steeply sloping ground. Overall, the ground surface in the immediate garage area slopes down to the north at about 27° with areas of flatter and steeper ground present locally.

- As depicted by Cross Section A-A', Figure 2, the existing two-story garage as well as the existing driveway are elevated over the steeply sloping ground surface. The garage has a dirt floor crawlspace and is supported by concrete pad and line foundations that appear to have limited embedment. An unretained, near-vertical cut up to about 5-ft-high is present within the crawlspace near the approximate midline of the garage.

- The upslope side of the elevated driveway is supported by a cast-in-place concrete retaining wall that retains the downslope side of Hillcrest Drive along the south side of the subject property as well as the adjacent property to the west. The exposed height of the concrete retaining wall in the driveway area is up to about 5 ft. The retaining wall adjacent the subject garage was observed to be free of significant (wider than 1/8 in.) cracking and exhibits no discernible outward rotation.

- A floor level survey was conducted on the garage's lower level with a hand-held, optical leveling instrument (accuracy estimated at +/- ½ in.). The survey indicates the lower level floor is high in the middle, sloping down approximately 1 in. to the east and west sides of the garage.

- Surface soils in the immediate vicinity of the garage consist primarily of silt fill with some clay and scattered gravel. Pieces of broken concrete mantle the ground surface locally, particularly within the crawlspace under the existing driveway. In general, the surface soils appear moderately well drained, with no springs or ponded water observed at the time of our reconnaissance.
- No obvious indications of significant erosion or active or recent (within the past 20 years) landsliding, such as fresh ground breaks or scarps, widespread tilted or bowed trees, excessively cracked and rotated walls, or disrupted walkways and pavements, were observed within or immediately adjacent the garage area.
- The adjacent residence to the west (2515 SW Hillcrest Drive) is elevated over the sloping ground surface and appears to be supported by steel H-pile foundations. No geotechnical reports or pile driving information was available for this property at the City of Portland.

Subsurface Exploration and Conditions

Subsurface conditions in the garage area were explored on September 13, and 18, 2007 with four hand-auger borings, designated B-1 through B-4 and drilled to depths of 6.2 to 11.5 ft. Approximate boring locations are shown on Figure 1. The relative consistency of subsurface materials was evaluated by observing auger cuttings and noting the relative ease of auger advancement. Detailed logs of conditions and materials encountered in the borings were maintained. Representative soil samples were obtained for further examination in our laboratory, where their physical characteristics were noted and field classifications modified where necessary. The natural moisture content of each soil sample was determined in our laboratory in substantial conformance with ASTM D 2216. Materials and conditions encountered in the borings are summarized in Table 1. Terms used to describe soil materials are defined in Table 2.

As disclosed by the borings drilled as part of this investigation and as depicted on Figure 2, the garage area is mantled by fill soils ranging in thickness from 3.0 ft (borings B-1 and B-2) up to at least 7.5 ft and possibly 8.5 ft. The greater fill thicknesses were encountered on the west side of the garage. The fill is comprised primarily of silt with a trace to some clay and up to a trace of gravel. The fill contains scattered pieces of concrete, scattered organics, and is locally organic rich. The relative consistency of the fill is generally medium stiff, but locally soft. Based on its relative soft consistency and organic content, the fill does not appear to have been placed and compacted as structural fill. Natural moisture contents for the silt fill are in the range of 16 to 30%.

Native soils encountered below the fill consist of gray-brown typically mottled rust silt with a trace to some clay. The relative consistency of the native silt is generally medium stiff to stiff, but locally very stiff. Natural moisture contents for the native silt are in the range of 11 to 35%. All four of the borings were terminated in the native silt.

Groundwater was not encountered in any of the borings completed for this study. Based on our experience, the regional groundwater table is at least several tens of ft below the ground surface yearround. However, perched groundwater is likely to develop within the near-surface soils during periods of prolonged or intense precipitation.

SUMMARY AND CONCLUSIONS

General

The ground surface in and immediately adjacent the garage area slopes steeply down to the north. The garage area is mantled by a few to several ft of fill, comprised primarily of medium stiff silt with a trace to some clay and up to a trace of gravel. The fill is locally organic-rich and does not appear to have been placed and compacted as structural fill. In our opinion, the existing fill is unsuitable for providing foundation support for the proposed renovated or replacement garage. Native soils encountered below the fill consist of medium stiff to stiff (locally very stiff) silt with a trace to some clay. Perched groundwater is likely to develop within the near surface soils during periods of prolonged or intense precipitation.

Spread footings that support the existing garage have minimal to no embedment, are immediately underlain by fill, and based on our floor level survey have settled differentially on the order of 1 in. Total settlement is likely greater. Existing foundations are not suitable for the support of the proposed renovated or replacement garage. The existing retaining wall that supports the downslope edge of Hillcrest Drive and the south end of the existing driveway has performed satisfactorily to date.

In our opinion, the site is suitable for support of the proposed renovated or replacement garage from a geotechnical standpoint. With no obvious indications of active or recent, deep-seated slope instability in the immediate vicinity of the property, the risk of slope instability damaging the proposed garage is considered to be low (but not absent) and no higher than that of the existing residence and many existing structures on developed properties in the surrounding neighborhood. This risk assessment is based on the planned location of the garage, as shown on Figure 1, and the implementation of the recommendations provided herein. Quantification (numerical analysis) of this risk is beyond the scope of this investigation.

Geotechnical considerations at this site that need to addressed during the design and construction of the renovated or replacement garage include the moisture-sensitive nature of the near-surface soils, the steeply sloping nature of the site, and the presence of fill soils unsuitable for foundation support. Specific recommendations for suitably founding the proposed garage are presented in the following paragraphs.

RECOMMENDATIONS

General

Recommendations for site preparation, structural fill, foundation support, seismic design criteria, stormwater disposal, final grading and erosion control, and construction observation, are provided in the following paragraphs.

Site Preparation

Due to the presence of fine-grained, moisture-sensitive soils (soils that when wet are easily disturbed, rutted, and weakened by construction activities) and the potential for encountering perched groundwater during the wet winter months, all site preparation, foundation excavation, and grading work should be limited to the drier periods of the year, usually late spring to early fall, if feasible. During periods of wet weather or in areas with wet ground conditions, care must be taken to minimize subgrade disturbance during site preparation, excavation, and grading work.

Temporary excavation slopes greater than 4-ft-high should be made no steeper than about ½H:1V (63°), and all new permanent cut and fill slopes outside the footprint of the garage should be no steeper than 2H:1V (27°). Existing, near-vertical, unretained slopes within the crawlspace should be flattened to no steeper than 1½H:1V(34°). For slope stability considerations, unretained fills should not be placed on the steeply sloping property.

Structural Fill

Due to the moisture-sensitive nature of the on-site silt soils and the limited amount of structural fill anticipated for this project, we recommend that import granular material be used as fill below foundations. Imported granular material used to construct structural fills should consist of crushed rock with a maximum size of 2 in. and with not more than about 5% passing the No. 200 sieve (washed analysis). The granular fill material should be placed in lifts and compacted with suitable equipment to at least 95% of the maximum dry density as determined by ASTM D 698. The moisture content of structural fill materials at the time of compaction should be within about 3% of optimum.

Foundation Support

Due to the presence of fill materials that are unsuitable for foundation support, slope stability considerations, and site access considerations, we recommend that foundation support for the proposed renovated or replacement garage be provided by small-diameter, steel pipe piles driven through the fill and into the underlying native soils.

Allowable (design) axial capacities for piles depend on the type and length of piles chosen. Based on our experience and for preliminary design purposes, an allowable (design) axial capacity of 8 kips is appropriate for 3-in.-diameter steel pipe (schedule 40 minimum) piles. The piles should be driven to a minimum embedment of 8 ft into the underlying native silt soils (up to 17 ft below existing grades) and to refusal. Refusal is defined as a penetration rate of less than ½ in. per minute with a 140 lb (minimum) pneumatic hammer. A 140-lb hammer may be used to determine refusal; however, a larger hammer may be required to achieve the minimum 12 ft embedment into native soil. The above allowable axial pipe pile capacity is appropriate for piles with a center-to-center spacing of at least four times the pile diameter; can be increased by one-third for transient loads, such as wind and seismic; and includes an estimated factor of safety of at least two, based on soil-supporting properties.

If required, pipe piles may be driven at inclinations of up to 20° from the vertical to provide lateral resistance. In our opinion, vertical or near-vertical, small-diameter pipe piles are not effective at providing significant lateral resistance for the given site conditions.

Seismic Design Criteria

Based on the results of our subsurface investigation, our experience in the project area, and our review of the State of Oregon 2004 Structural Specialty Code, we recommend using a Site Class C to evaluate the seismic design of the garage. As described in the Geologic Setting and Hazards section of this report, the major seismic hazards at the site during a relatively strong seismic event are ground motion amplification and slope instability. In our opinion, the potential is low for earthquake-induced ground rupture, liquefaction, settlement, subsidence, and damage by tsunamis and/or seiches at the site during the anticipated ground motions associated with a design-level seismic event.

Stormwater Disposal

Due to the steeply sloping nature of the property, associated slope stability considerations, and the potential for perched groundwater during the wet winter months, we recommend that stormwater from roof gutter downspouts not be disposed of in on-site subsurface soakage trenches or drywells. In our opinion, stormwater should be disposed of off site.

Final Grading and Erosion Control

All property grading should be designed to maintain positive drainage away from the garage and should eliminate areas that could pond water. Newly exposed soils at this site will be susceptible to erosion and should be revegetated as soon as practicable after construction. If an adequate vegetative cover cannot be established before the onset of the wet winter season, a heavy mulch or commercially available mulching mesh may be required to minimize erosion.

Construction Observation

A qualified geotechnical engineer should review final foundation plans prior to the start of construction. During construction, a qualified geotechnical engineer should observe the installation of foundation piles.

LIMITATIONS

Foster Gambee has prepared this report to aid in the design of this project. The scope is limited to the specific project and location described herein. Our description of the project represents our understanding of significant aspects relevant to the design and construction of the renovated or replacement garage at the specified location. If changes are planned in the design and location of the garage, as outlined in this report, we should be given the opportunity to review those changes and to modify or reaffirm, in writing, our conclusions and recommendations.

Our conclusions and recommendations are based on data obtained from the borings made at the locations indicated on Figure 1 and from other sources of information discussed herein. In the performance of subsurface explorations, specific information is obtained from specific locations at specific times. However, it is acknowledged that variations in soil conditions may exist away from the boring locations. This report does not reflect any variations that may occur away from these explorations, the nature and extent of which may not be evident until construction. If, during construction, subsurface conditions different from those found in the explorations are observed or encountered, we should be advised at once so that we can observe and review those conditions and reconsider our recommendations if necessary.

Please contact us if you have any questions.

Sincerely,
FOSTER GAMBEE GEOTECHNICAL, P.C.

Expires: 5/31/08

John E. Gambee, P.E.
Principal

Kevin M. Foster, P.G., C.E.G., P.E.
Principal

References

1 Madin, Ian P., Earthquake-Hazard Geology Maps of the Portland Metropolitan Area, Oregon, Open File Report 0-90-2, State of Oregon Department of Geology and Mineral Industries, 1990.

2 Mabey, Matthew A. and others, Relative Earthquake Hazard Map of the Portland Metro Region, Clackamas, Multnomah, and Washington Counties, Oregon, IMS-1, State of Oregon Department of Geology and Mineral Industries, 1997.

Table 1
Subsurface Materials and Conditions

Boring No.	Depth Range, ft	Material Description	Moisture Content (ASTM D 2216)
B-1	0 to 3.0	FILL: Medium stiff, mixed brown and gray-brown SILT; trace to some clay, scattered to trace gravel, scattered organics to locally organic rich	w = 16% @ 2.5 ft
	3.0 to 6.3	Stiff, gray-brown with some rust SILT; trace to some clay, scattered organics	w = 20% @ 4.3 ft w = 28% @ 6.0 ft
		Bottom of boring 6.3 ft (9/13/07). Groundwater not encountered.	
B-2	0 to 3.0	FILL: Medium stiff, gray-brown SILT; trace to some clay, some gravel, scattered pieces of broken concrete, scattered organics, heavily rooted in upper 1 ft	
	3.0 to 6.2	Stiff to very stiff, gray-brown SILT; trace to some clay, scattered organics …some gray and rust below 4.5 ft	w = 13% @ 3.5 ft w = 11% @ 6.0 ft
		Bottom of boring 6.2 ft (9/13/07). Groundwater not encountered.	
B-3	0 to 7.5	FILL: Medium stiff, mixed gray-brown and dark brown SILT; trace to some clay, trace gravel, scattered organics …gray-brown with some dark brown and rust below 2.8 ft	w = 17% @ 3.0 ft w = 19% @ 5.2 ft w = 21% @ 7.0 ft
	7.5 to 8.5	POSSIBLE FILL: Medium stiff, gray-brown mottled rust SILT; trace to some clay …piece of gravel at 8.5 ft	
	8.5 to 11.5	Medium stiff to locally stiff, gray-brown mottled rust SILT; trace to some clay	w = 34% @ 10.5 ft
		Bottom of boring 11.5 ft (9/13/07). Groundwater not encountered.	

Table 1 Continued
Subsurface Materials and Conditions

Boring No.	Depth Range, ft	Material Description	Moisture Content (ASTM D 2216)
B-4	0 to 4.2	FILL: Soft to medium stiff, mixed gray-brown, brown, and dark brown SILT; some clay, scattered pieces of broken concrete, scattered organics ...brown with some dark brown below 2.3 ft	w = 21% @ 2.8 ft
	4.2 to 7.0	POSSIBLE FILL: Medium stiff, gray-brown with some rust SILT; trace to some clay ...mottled rust below 4.6 ft ...medium stiff to stiff, gray-brown, brown, and rust below 6.5 ft	w = 30% @ 4.8 ft
	7.0 to 11.2	Medium stiff to stiff, gray-brown mottled rust SILT; trace to some clay ...stiff below 7.5 ft ...stiff to very stiff below 9.5 ft	w = 35% @ 7.2 ft w = 26% @ 10.2 ft
		Bottom of boring 11.2 ft (9/18/07). Groundwater not encountered.	

Table 2
Guidelines for Classification of Soil

Description of Relative Consistency for Fine-Grained (Cohesive) Soils

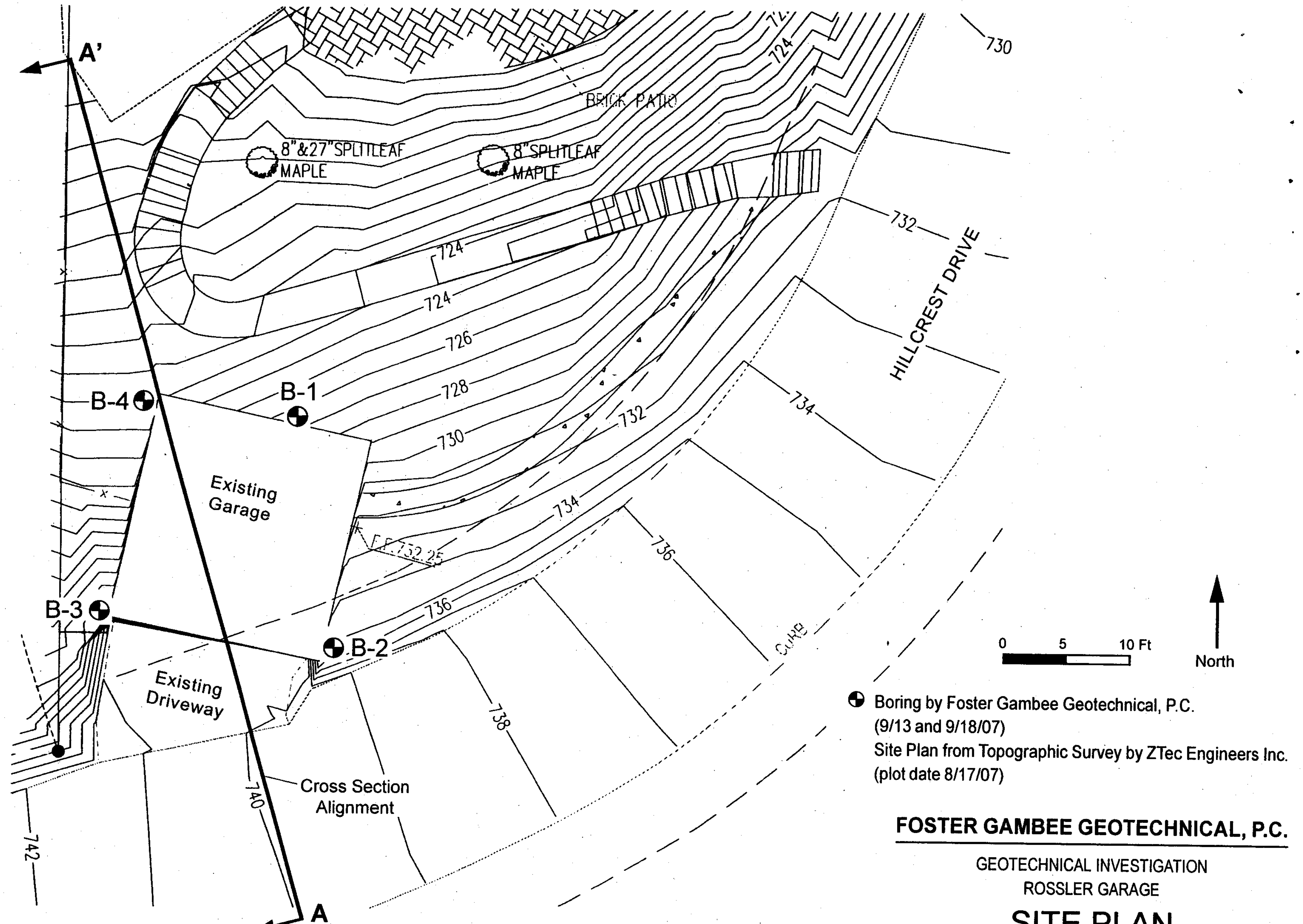
Relative Consistency	Standard Penetration Resistance (N-values), blows/ft	Torvane Undrained Shear Strength, tsf
Very soft	2	Less than 0.125
Soft	2 to 4	0.125 to 0.25
Medium stiff	4 to 8	0.25 to 0.50
Stiff	8 to 15	0.50 to 1.0
Very stiff	15 to 30	1.0 to 2.0
Hard	Over 30	Over 2.0

Sandy silt materials that exhibit general properties of granular soils are given relative density description.

Description of Relative Density for Granular Soils

Relative Density	Standard Penetration Resistance (N-values), blows/ft
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	over 50

Grain-Size Classification	Modifier For Subclassification	
Boulders		**Percentage of**
12 to 36 in.		**Other Material**
Cobbles	**Adjective**	**In Total Sample**
3 to 12 in.	Clean	0 to 2
Gravel	Trace	2 to 10
¼ to ¾ in. (Fine)	Some	10 to 30
¾ to 3 in. (Coarse)	Sandy, Silty	30 to 50
Sand	Clayey, etc.	
No. 200 to No. 40 sieve (Fine)		
No. 40 to No. 10 sieve (Medium)		
No. 10 to No. 4 sieve (Coarse)		
Silt/Clay		
Pass No. 200 sieve		



Boring by Foster Gambee Geotechnical, P.C. (9/13 and 9/18/07)

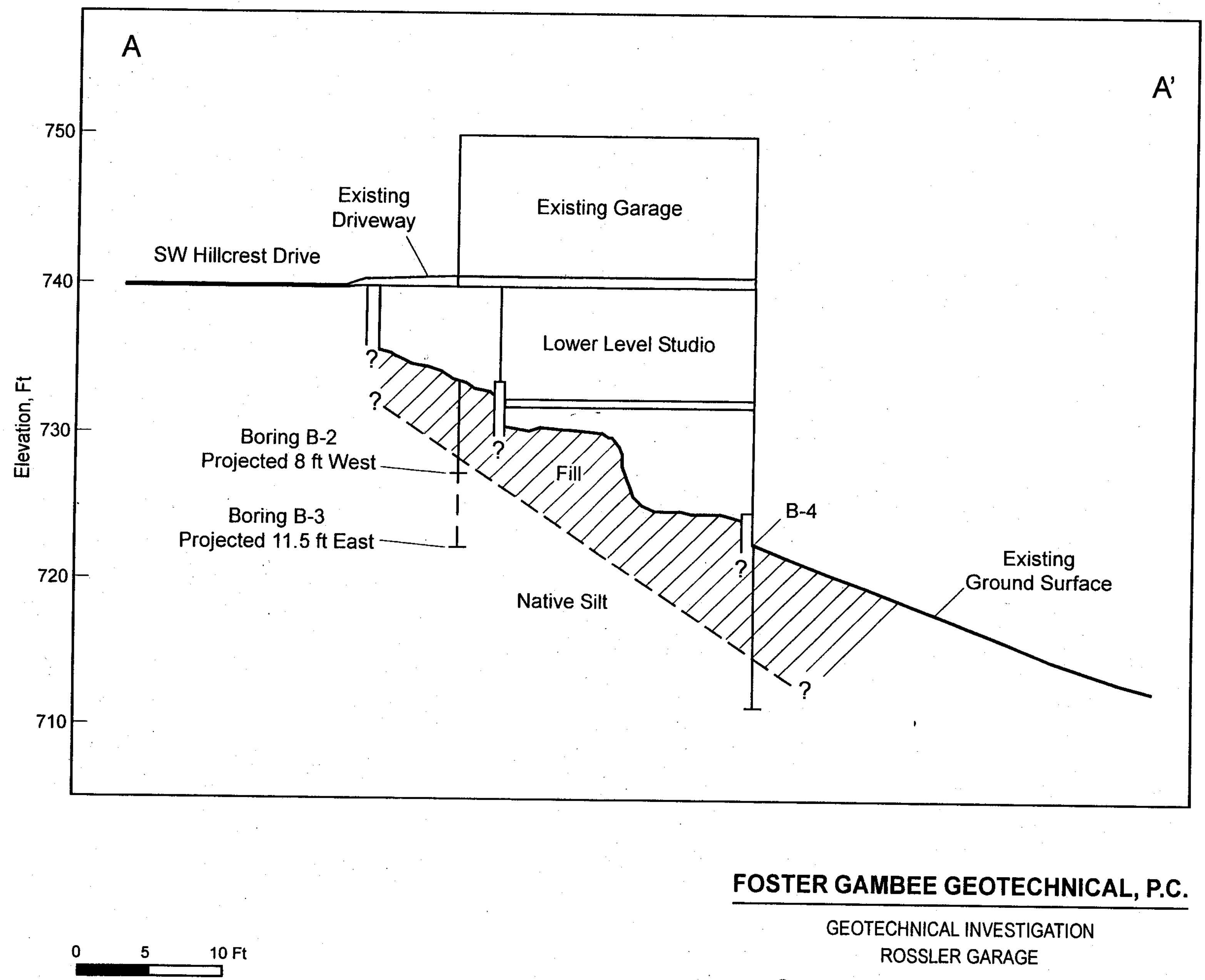
Site Plan from Topographic Survey by ZTec Engineers Inc. (plot date 8/17/07)

FOSTER GAMBEE GEOTECHNICAL, P.C.

GEOTECHNICAL INVESTIGATION
ROSSLER GARAGE

SITE PLAN

October 2007 | Job No. 0784 | Fig. 1



All locations and elevations are approximate.
At borings B-2 and B-3, the cross section reflects average fill thickness.

FOSTER GAMBEE GEOTECHNICAL, P.C.

GEOTECHNICAL INVESTIGATION
ROSSLER GARAGE

CROSS SECTION A-A'

October 2007 | Job No. 0784 | Fig. 2