**GEOTECH**
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June 29, 2016

JN 16283

Mark Blumenthal
2016 – 80th Avenue Southeast
Mercer Island, Washington 98040
*via email: markblumenthal@gmail.com*

Subject: **Seismic Liquefaction, Foundation and Erosion Considerations**
Proposed New Residence
Blumenthal Short Plat
2016 – 80th Avenue Southeast
Mercer Island, Washington

Dear Mr. Blumenthal:

This report presents our geotechnical engineering observations and conclusions related to the liquefaction potential, foundation design, and erosion considerations for the planned project. In order to develop the conclusions and recommendations presented in this report, we have accomplished the following tasks:

- Made a visit to the property on June 9, 2016 to observe the existing conditions:
- Discussed the planned site development with David Gee, your architect; and
- Reviewed the results of previous explorations conducted around the lot by both our firm and other geotechnical engineers.

Based on the information provided by David Gee, we expect that the irregularly-shaped property will be divided into two lots. The existing residence (#2016) will remain on the southern lot. The access will continue to be from 80th Avenue Southeast. A new home would be constructed on the northern of the two lots. We understand that the lower floor would be close to the existing grade, with no significant excavations planned.

## ***SITE CONDITIONS***

The subject property is a developed, irregularly-shaped lot situated on the southeast corner of 80th Avenue Southeast and Southeast 20th Street, to the north of downtown Mercer Island. The existing home sits on the southern half of the property, with a driveway extending to the house from 80th Avenue Southeast. The northern portion of the property, which will be the site of the new lot and house, is covered mostly by grass and some landscaping. This northern area slopes gently down toward the northwest to meet Southeast 20th Street. The surrounding lots are all developed with single-family homes.

There are no steep slope areas on, or close to, the proposed new lot. The subject property sits in a low, relatively flat area that used to be underneath the surface of Lake Washington, before its water level was lowered in the early 1900s. The nearest steep slope areas, which represent the old lake shore, are at least one lot to the east of the site. We saw no indications of recent instability on, or around, the property.

We are familiar with the subsurface conditions on the proposed new lot from review of explorations that were previously conducted adjacent to the existing residence, and from our borings and observations of deep foundation installation for the property immediately to the north of the site. Attached to this report is a preliminary site plan showing the approximate location of a boring conducted in 2003 as a part of an evaluation of the existing house. A copy of the boring log is also attached. For a previous expansion of the house to the north of the site, across Southeast 20th Street, we conducted borings and subsequently observed the installation of helical foundation piles. From this information, we know that the new lot is underlain by old unconsolidated lake sediments consisting of silt, silty sand and sand. These sediments contain occasional organics. Underlying the loose soils is very stiff to hard silt that has been glacially-compressed. The depth to this competent soil varies, but has been found at a typical depth of 20 to 30 feet in this area. Groundwater lies relatively close to the ground surface, being found at a depth of only 5 feet in the previous adjacent boring.

## CONCLUSIONS AND RECOMMENDATIONS

### *GENERAL*

*THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.*

The site is underlain by loose sediments that have not been glacially compressed. Below this soil is very stiff to hard, glacially-compressed silt. The loose soils are moderately compressible, and they have the potential for seismic liquefaction beneath the groundwater table. Considering these issues, we recommend that the new house be supported on driven, small-diameter pipe piles embedded into the very stiff to hard silt, which is non-liquefiable. All settlement-sensitive elements, including floors in living spaces, porches, and decks, should be supported on the piles to prevent excessive post-construction settlement. The use of piles mitigates the potential hazard of foundation collapse from seismic liquefaction.

The ground surface on the site slopes only gently. As a result, the potential for erosion control problems during, and following, construction is low. The risk of adverse erosion impacts to the site and surrounding properties can be mitigated by typical properly installed and maintained temporary erosion control measures. An engineered TESC (Temporary Erosion and Sedimentation Control) plan should be prepared as a part of the permit submittal for this project. The existing vegetation should be left in place outside of the planned work areas. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. However, silt fences do not prevent silty runoff from being generated. In wet conditions, such as should be expected, the only way to prevent silty runoff is to immediately cover all areas of bare soil, and to prevent precipitation and surface runoff from reaching bare soil in the first place. The bottom of the completed excavation should be covered with a layer of clean rock (quarry spalls or railroad ballast rock), which will also provide a more stable working surface for the installation of the pipe piles. The excavation should slope inward on itself to prevent any silty runoff from traveling off site. In rainy weather, it may be necessary to utilize a temporary holding tank at the site to collect accumulated silty water, as it cannot be discharged into the storm drainage system. Tracking of soil and mud off of the site can be limited by placing rock, hog fuel, wood chips, straw or a similar material on the ground in the traffic areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be

immediately covered with landscaping or an impervious surface. As with any site, additional erosion control measures may be needed to address actual site and weather conditions at the time of earthwork.

The proposed work will involve only minimal site disturbance, and should not have any adverse impacts to the stability of the surrounding properties. In order to satisfy the City of Mercer Island's requirements, we make the following statement:

> In our judgment, the development practices that we have recommended in this report should render the new construction as safe as if it were not located in a geologic hazard area.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

## *SEISMIC CONSIDERATIONS*

In accordance with the International Building Code (IBC), the site soil profile within 100 feet of the ground surface is best represented by Soil Profile Type D (Stiff Soil Profile).

The loose to medium-dense soils that lie beneath the groundwater table have a moderate potential for liquefaction under the Code-required Maximum Considered Earthquake (MCE), which has a 2 percent probability of occurrence in a 50-year time period (once in 2,475 years). The use of deep foundations embedded into the dense, non-liquefiable soils will mitigate the potential hazard of soil bearing loss resulting from liquefaction.

## *PIPE PILES*

Three- or 4-inch-diameter pipe piles driven with a 650- or 800- or 1,100-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacity.

| INSIDE PILE DIAMETER | FINAL DRIVING RATE (650-pound hammer) | FINAL DRIVING RATE (800-pound hammer) | FINAL DRIVING RATE (1,100-pound hammer) | ALLOWABLE COMPRESSIVE CAPACITY |
|---|---|---|---|---|
| 3 inches | 12 sec/inch | 10 sec/inch | 6 sec/inch | 6 tons |
| 4 inches | 20 sec/inch | 15 sec/inch | 10 sec/inch | 10 tons |

**Note:** The refusal criteria indicated in the above table are valid only for pipe piles that are installed using a hydraulic impact hammer carried on leads that allow the hammer to sit on the top of the pile during driving. If the piles are installed by alternative methods, such as a vibratory hammer or a hammer that is hard-mounted to the installation machine, numerous load tests to 200 percent of the design capacity would be necessary to substantiate the allowable pile load. The appropriate number of load tests would need to be determined at the time the contractor and installation method are chosen.

As a minimum, Schedule 40 pipe should be used for pipe piles. We recommend that galvanized pipe be used for the piles to provide additional corrosion resistance.

Pile caps and grade beams should be used to transmit loads to the piles. Isolated pile caps should include a minimum of two piles to reduce the potential for eccentric loads being applied to the piles. Subsequent sections of pipe can be connected with slip or threaded couplers, or they can be welded together. If slip couplers are used, they should fit snugly into the pipe sections. This may require that shims be used or that beads of welding flux be applied to the outside of the coupler.

Lateral loads due to wind or seismic forces may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level compacted fill. We recommend using a passive earth pressure of 300 pounds per cubic foot (pcf) for this resistance. This is an ultimate value that does not include a safety factor. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate.

## ***LIMITATIONS***

If the subsurface conditions encountered during construction are significantly different from those anticipated, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of Mark Blumenthal, and his representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the limited scope of our services and within budget and time constraints. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

## ***ADDITIONAL SERVICES***

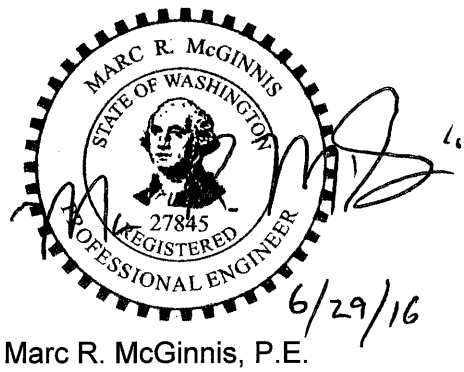
Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

We appreciate the opportunity to be of service on this project. If you have any questions regarding this report, or if we can be of further service, please do not hesitate to contact us.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

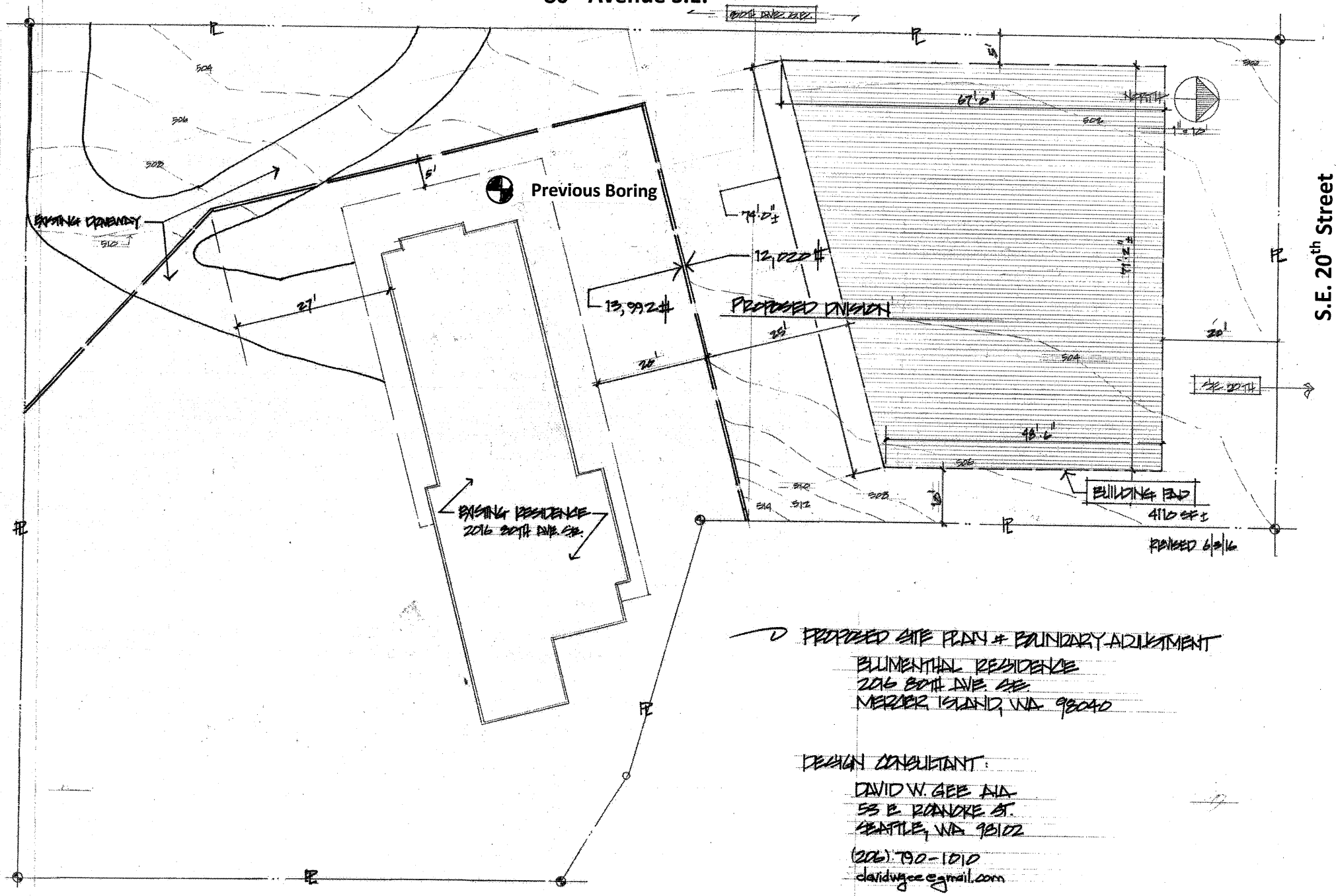



Marc R. McGinnis, P.E.
Principal

cc: **David Gee**
*via email david.gee@earthlink.net*

Attachments: Site Plan, Previous Boring Log

MRM: mc




PROPOSED SITE PLAN & BOUNDARY ADJUSTMENT

BLUMENTHAL RESIDENCE
2016 80TH AVE. SE.
MERCER ISLAND, WA 98040

DESIGN CONSULTANT:

DAVID W. GEE AIA
53 E. ROANOKE ST.
SEATTLE, WA 98102
(206) 790-1010
davidwgee@gmail.com

**PROJECT:** Blumenthal Residence | **JOB NO.** J-1732 | **BORING** B-1 | **PAGE 1 OF 2**

**Location:** Mercer Island, Washington | **Approximate Elevation:** 505 feet

| Depth (ft) | Soil Description | Sample Type | Sample Number | Ground Water | N-values | Testing |
|---|---|---|---|---|---|---|
| | Medium dense, moist to damp, brown, silty gravelly SAND with some burnt wood pieces and a piece of glass (Fill) | | S-1 | | 12 | MC |
| | | | S-2 | | 7 | |
| 5 | Loose to medium dense, wet to saturated, mottled brown and gray with iron oxide staining, silty gravelly SAND to gravelly SAND with some silt and 1-6 inch layers of SILT with some sand and SILT lenses | | S-3 | ▼ 2 hours after drilling | 24 | |
| | | | S-4 | | 18 | 200W |
| 10 | | | S-5 | | 11 | |
| | | | S-6 | | 21 | 200W |
| 15 | Medium dense, wet to saturated, gray, gravelly SAND with some silt and 1-4 inch layers of SILT with some sand | | S-7 | | 11 | |
| 20 | Very stiff, moist, blue/gray, SILT with some sand and gravel | | S-8 | | 29 | |
| 25 | | | | | | |

**Penetration Resistance**

▲ Standard | △ Other | Blows per foot

0 10 20 30 40 50

**Moisture Content**

0 10 20 30 40 50

Plastic Limit — Natural — Liquid Limit

## Explanation

- 2-inch O.D. split spoon sample
- 3-inch I.D Shelby tube sample
- ⊗ No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing

Drilling Method:

GSA: Grain Size

200 Wash: Fines Content

| Zipper Zeman Associates, Inc. Geotechnical & Environmental Consulting | BORING LOG | Figure A-1 |
|---|---|---|
| | Date Drilled: 10/23/03 | Logged By: JW |

| PROJECT: Blumenthal Residence | JOB NO. J-1732 | BORING B-1 | PAGE 2 OF 2 |
|---|---|---|---|
| Location: Mercer Island, Washington | Approximate Elevation: 505 feet | | |

| Depth (ft) | Soil Description | Sample Type | Sample Number | Ground Water | Penetration Resistance (▲ Standard, △ Other; Blows per foot: 0 10 20 30 40 50) | N-values | Testing |
|---|---|---|---|---|---|---|---|
| | Very stiff to hard, moist, blue/gray, SILT with some sand and gravel | | S-9 | | ▲ | 27 | |
| 30 | | | S-10 | | ▲ | 37 | |
| | Boring completed at 31.5 feet on 10/23/03<br>Groundwater observed at 5.3 feet 2 hours after drilling. | | | | | | |
| 35 | | | | | | | |
| 40 | | | | | | | |
| 45 | | | | | | | |
| 50 | | | | | | | |

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