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JN 24185

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Sent To: Bryan Pendz
via email: bryan@onomaarchitecture.com

Subject: **Foundation Considerations and Critical Area Report**
Proposed Covered Entryway Addition
4226 – 85th Avenue Southeast
Mercer Island, Washington

Greetings:

This report presents our geotechnical engineering report related to the planned work associated with the proposed entryway addition. The scope of our services consisted of assessing the site surface and subsurface conditions, and then developing this summary report.

Based on the April 15, 2024 drawings developed by Onoma Architects, we understand that a new entryway addition and covered patio is proposed to be constructed in place of the existing entryway and porch. This addition will extend out from the southeastern corner of the house at the main level only and will not be underlain by basement space. Several new foundations will be needed for the building addition as well as the new covered walkway. Excavations are not anticipated to extend more than a few feet beneath the existing ground surface at this time.

The City of Mercer Island GIS maps the western perimeter of the subject property as a Potential Landslide Hazard and Erosion Hazard area. This mapping is isolated from several of the adjacent residential parcels and does not appear to be based on any geologic, Lidar, or topographic information. Based on the provided site plan, the western perimeter of the lot is moderately sloped, with terraced timber walls lining the western perimeter of the property.

The undersigned geotechnical engineer visited the subject property on May 21, 2024 to observe the existing site conditions and to excavate two shallow hand auger holes near the proposed addition. The property is rectangular shaped, with dimensions of 88.6 feet in the north-south direction, and 135 feet in the east-west direction. The site is bordered on the north, east, and south by single family parcels, and on the west by 85th Avenue Southeast. The existing residence, which consists of one above-grade floor overlying a west-facing daylight basement, is located in the approximate center of the lot. A detached garage is located to the east of the residence and is accessed via a paved driveway extending into the site from the southwestern property corner.

The ground surface on the lot, and in the vicinity, generally slopes down toward the west, trending with the general downgradient of the area. The ground surface on the developed portion of the lot slopes only gently to moderately. The west perimeter of the lot slopes down moderately to the adjacent street. No steep slopes are present on the subject site.

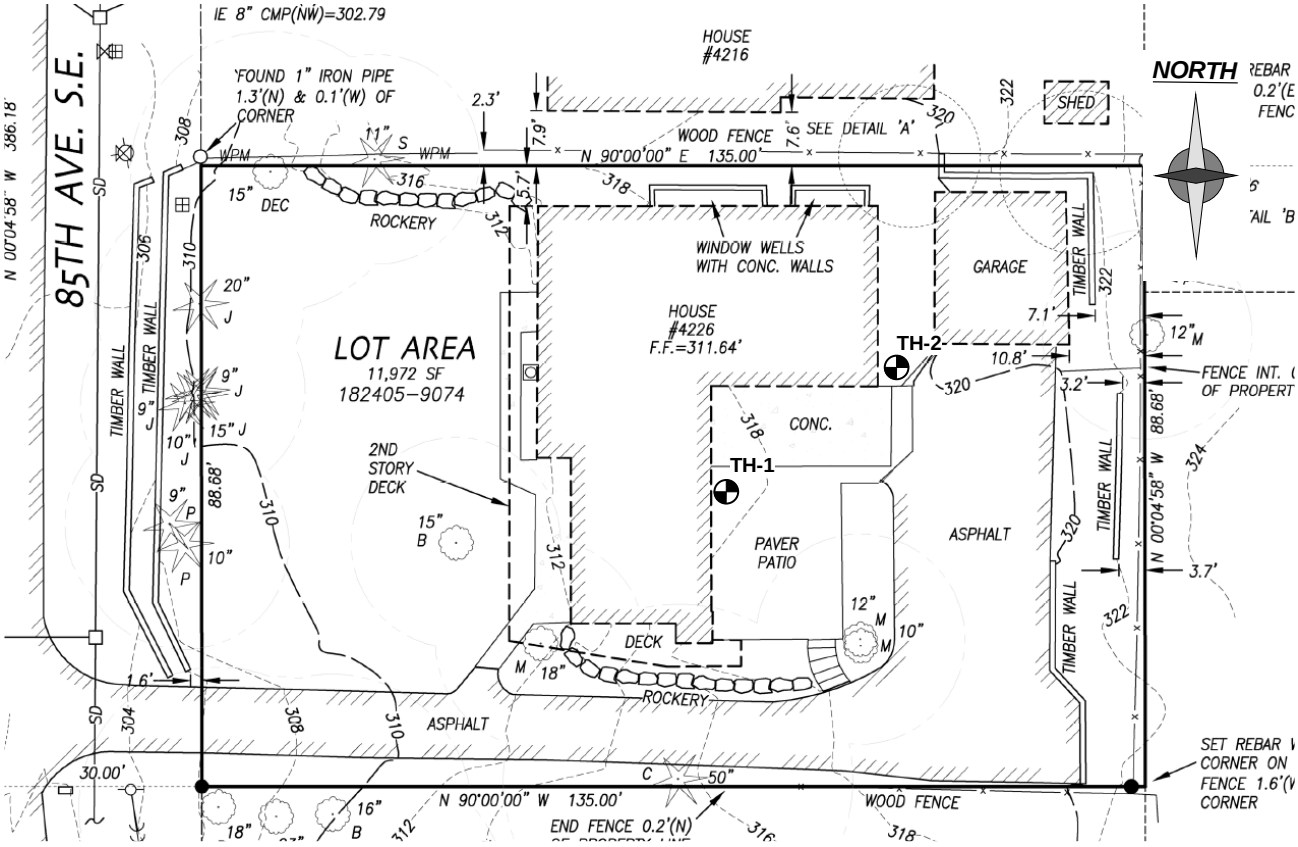
We saw no indications of recent instability on, or around, the subject property.

The site lies within a Potential Landslide Hazard as shown on the Mercer Island GIS. The Mercer Island Landslide Hazard Map maps this irregular Potential Landslide Area and lists it as an area where the slope is inclined 15 percent and higher, however, no other qualifying criteria is listed for this mapping, as well as for

several other nearby isolated Potential Landslide Areas. No signs of recent slope instability were observed during our time at the site.

We are familiar with the subsurface conditions on the site from: 1) the excavation of two test holes on the property, and 2) review of geologic mapping for the area. In general, explorations conducted in the upland neighborhoods on Mercer Island reveal competent glacially compressed soils beneath a mantle of loose fill or weathered soils. The Washington Department of Natural Resources Subsurface Viewer maps this area of Mercer Island as being underlain by Glacial Till.

During our site visit, two test holes were excavated near the proposed addition area. The undersigned staff geotechnical engineer from our firm excavated and logged the test holes. The location and logs of both test holes are presented below.



TEST HOLE 1

Depth (feet)	Soil Description
0.0 – 7.5+	Brown and dark-brown, gravelly, very silty SAND with roots and decayed organics, fine-grained, moist, jumbled, loose to medium-dense **[FILL]**

Test Hole was terminated at 7.5 feet May 21, 2024 due to auger refusal on gravels.
No groundwater seepage was encountered in the test hole.

TEST HOLE 2

Depth (feet)	Soil Description
0.0 – 9.0	Brown and dark-brown, gravelly, very silty SAND with roots and decayed organics, fine-grained, moist, jumbled, loose to medium-dense **[FILL]**
9.0 – 9.5	Gray, slightly gravelly, silty SAND, fine-grained, moist, medium-dense to dense **[SM]**

Test Hole was terminated at 9.5 feet on May 21, 2024.
No groundwater seepage was encountered in the test hole.

***NOTE** – Letters in brackets **[ ]** denote the USCS soil classification.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. The relative densities and moisture descriptions indicated on the test hole logs are interpretive descriptions based on the conditions observed during excavation.

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 test holes encountered loose fill soils to a depth of upwards of 9 feet. This fill soil appears to consist of backfill placed behind the basement walls of the residence during its original construction. Due to the depth of the backfill soils in this area, it is infeasible to excavate to expose the underlying native soils. Considering this, it would be practical to support the proposed addition foundations upon a deep foundation system consisting of small diameter pipe piles. These pipe piles would reduce the excavation extents and would develop their capacity by being driven to refusal in the underlying native soils. We recommend that unless post construction settlement can be tolerated in the addition floors, that the settlement sensitive floors for the addition be supported by the pipe pile foundations. Pipe piles could be installed using hand-held jackhammers, or larger piles could be installed with tracked equipment if desired. Additional recommendations can be found in the ***Pipe Piles*** section of this report.

CRITICAL AREA STUDY (MICC 19.07)

Potential Landslide Hazard: The planned new foundations will be located close to, but not within the mapped Potential Landslide Hazard Area mapped on the GIS. The stability of the mapped critical area, as well as the gentle to moderate site slopes, and slopes in the vicinity of the site will not be adversely affected by the limited excavation and the pipe pile installation for the new addition. No additional buffer or other mitigation measures are required to address the Potential Landslide Hazard mapping of the site.

Erosion Hazard: The site disturbance for the proposed development will be limited and will occur primarily on flat to gently-slope ground that has been previously developed and modified. The mapped Erosion Hazard can be mitigated by implementing proper temporary erosion control measures that will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any work areas. Existing ground cover and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Small soil stockpiles should be covered with plastic during wet weather. Soil and mud should not be tracked onto the adjoining streets, and silty water must be prevented from traveling off the site. It should be possible to complete the planned addition during the wet season without adverse impacts to the site and neighboring lots. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

We provide the following “statement of risk” to satisfy City of Mercer Island conditions:

> “It is our professional opinion that the development practices proposed in this report for the new addition would render the proposed addition 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 class within 100 feet of the ground surface is best represented by Site Class Type D (Stiff Soil).

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The dense soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of the absence of near-surface groundwater.

PIPE PILES

A 2-inch-diameter pipe pile driven with a minimum 90-pound jackhammer or a 140-pound Rhino hammer to a final penetration rate of 1-inch or less for one minute of continuous driving may be assigned an allowable compressive load of 3 tons.

Three-inch-diameter pipe piles driven with an 850- or 1,100- or 2,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE (850# hammer)	FINAL DRIVING RATE (1,100# hammer)	FINAL DRIVING RATE (2,000# hammer)	ALLOWABLE COMPRESSIVE CAPACITY
3 inches	10 sec/inch	6 sec/inch	2 sec/inch	6 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.

Extra-strong, Schedule 80 steel pipe should be used for 2-inch-diameter piles. At a minimum, Schedule 40 pipe should be used for 3-inch-diameter or larger piles. The site soils are not highly organic and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard “black” pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles.

Mercer Island has adopted Seattle Director’s Rule 10-2009. Directors Rule 10-2009 contains several prescriptive requirements related to the use of pipe piles having a diameter of less than 10 inches. Under Director’s Rule 10-2009, load tests are not required for 2-inch-diameter piles that are designed for an allowable 3-ton capacity. Load tests and a code alternate or modification would be required if alternative installation methods are used, or if a higher capacity is desired. The City of Seattle limits the length of 2-inch-diameter pipe piles to 30 feet. If pile lengths exceed 30 feet, a code alternate or modification must be applied for. Under Director’s Rule 10-2009, load tests are required on 3 percent of the installed piles (3-inch-diameter or larger) up to a maximum of 5 piles, with a minimum of one pile load test on each project. Additionally, full-time observation of the pile installation by the geotechnical engineer-of-record is required by Director’s Rule 10-2009.

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 250 pounds per cubic foot (pcf) for this resistance. We recommend a safety factor of at least 1.5 for the foundation's resistance to lateral loading, when using the above ultimate passive value.

LIMITATIONS

This report has been prepared for the exclusive use of Paul Sim and his representatives for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. 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

In addition to reviewing the final plans, 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 sitework 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. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

5/23/2024

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