NELSON GEOTECHNICAL
ASSOCIATES, INC.

17311-135th Ave. N.E. Suite A-500
Woodinville, WA 98072
(425) 486-1669
www.nelsongeotech.com

March 7, 2024

Abhi Sharma
VIA Email: abhisharma@outlook.com

Geotechnical Engineering Evaluation
Sharma Retaining Wall
7905 West Mercer Way
Mercer Island, Washington
NGA File No. 1496924

Dear Abhi:

We are pleased to submit the attached report titled **"Geotechnical Engineering Evaluation – Sharma Retaining Wall – 7905 West Mercer Way – Mercer Island, Washington."** This report summarizes our observations of the existing surface and subsurface conditions within the site and provides general recommendations for the proposed site development. Our services were completed in general accordance with the proposal signed by you on February 1, 2024.

The property is irregular in shape and covers 0.48 acres in area. It is currently occupied by a single-family residence. The property is bordered by an access road leading from West Mercer Way to the east, Lake Washington to the west, and by neighboring residential properties on all other sides. Topographically, the site slopes moderately to steeply down to the west. We understand you were in the process of installing a new retaining wall along the lower part of the slope on the western side of the property when the City of Mercer Island red tagged your project due to the presence to Erosion Hazard areas and the height of the wall. Our explorations indicated that the site was generally underlain by older clay till and gravel deposits at relatively shallow depths.

We concluded that the retaining wall project is currently unstable due to failing results in our block wall stability program as well as loose to medium dense material being encountered beneath the wall. A retaining wall in roughly the same location is feasible from a geotechnical standpoint given that the retaining wall is reconstructed, and our recommendations provided in this report are strictly followed as well as implemented into the new design. All retaining walls should incorporate structural fill backfill and wall drains. Further details and recommendations regarding retaining wall design and installation are provided in the attached report.

In the attached report, we have also provided general recommendations for temporary and permanent slopes, hot tub support, erosion control, and drainage. We should be retained to review and comment on final development plans and observe the earthwork phase of construction. We also recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

It has been a pleasure to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Khaled M. Shawish, PE
Principal

TABLE OF CONTENTS

INTRODUCTION **1**

SCOPE **1**

SITE CONDITIONS **2**

Surface Conditions 2
Subsurface Conditions 3
Hydrogeologic Conditions 4

SENSITIVE AREA EVALUATION **4**

Seismic Hazard 4
Erosion Hazard 5

CONCLUSIONS AND RECOMMENDATIONS **5**

General 5
Erosion Control 6
Site Preparation and Grading 7
Temporary and Permanent Slopes 8
Retaining Walls 8
Hot Tub Support 10
Pergola Support 10
Structural Fill 10
Site Drainage 11

CONSTRUCTION MONITORING **11**

USE OF THIS REPORT **12**

LIST OF FIGURES

Figure 1 – Vicinity Map

Figure 2 – Site Plan

Figure 3 – Cross-Section A-A'

Figure 4 – Soil Classification Chart

Figure 5 – Log of Explorations

Figure 6 – Reinforced Retaining Wall Detail

Geotechnical Engineering Evaluation
Sharma Retaining Wall
7905 West Mercer Way
Mercer Island, Washington

INTRODUCTION

This report presents the results of our geotechnical engineering investigation and evaluation of the Sharma retaining wall project in Mercer Island, Washington. The parcel number for the property is **545130-0005.** The project site is located at **7905 West Mercer Way in Mercer Island, Washington,** as shown on the Vicinity Map in Figure 1. The purpose of this study is to explore and characterize the site's surface and subsurface conditions and to provide geotechnical recommendations for the constructed retaining wall.

The property is irregular in shape and covers 0.48 acres in area. It is currently occupied by a single-family residence and an associated garage. The property is bordered by an access road from West Mercer Way to the east, Lake Washington to the west, and by neighboring residential properties on all other sides. Topographically, the site slopes moderately to steeply down towards Lake Washington. We understand that you have already constructed a retaining wall along the western portion of the property that ranges in height from 4.5- to 5.0-feet and is approximately 65-feet long. We also understand that the retaining wall was constructed to make a wider, relatively level bench in the slope to provide safer access to your dock as well as to develop a spa/hot tub area. We have been requested to provide this report for a geotechnical evaluation of the property and existing retaining wall, as well as development considerations for the proposed spa/hot tub. The existing site layout is shown on the Site Plan in Figure 2.

SCOPE

The purpose of this study was to explore and characterize the site surface and subsurface conditions and provide general recommendations for site development.

Specifically, our scope of services included the following:

1. Reviewing available soil and geologic maps of the area as well as other relevant geotechnical information, as provided.

2. Exploring the subsurface soil and groundwater conditions within the site using hand tools.

3. Mapping the conditions on the site slopes using shallow, hand-tool explorations where necessary to construct geological cross sections and qualitatively evaluate slope stability.

4. Providing our opinion on the stability of the existing retaining wall.

5. Providing recommendations for retaining wall improvements, as necessary.

6. Providing recommendations for hot tub support.

7. Providing recommendations for mitigation of geological hazards, as necessary.

8. Providing recommendations for temporary and permanent slopes.

9. Providing recommendations and opinion regarding wet season grade, as warranted.

10. Providing general recommendations for site drainage and erosion control.

11. Documenting the results of our findings, conclusions, and recommendations in a written geotechnical report.

12. Providing a written field report to the City of Mercer Island, documenting existing erosion control and opinion regarding wet season stabilization.

SITE CONDITIONS

Surface Conditions

The property is irregular in shape and covers 0.48 acres in area. It is currently occupied by a single-family residence and an associated garage. The property is bordered by an access road from West Mercer Way to the east, Lake Washington to the west, and by neighboring residential properties on all other sides. Topographically, the site slopes moderately to steeply down to the west. The slopes in the eastern portion of the site reach gradients of up to 58 degrees (129 percent grade). However, it should be noted that there was a soldier pile wall supporting the garage right above this steep area and it was heavily vegetated with ivy. The total vertical relief of site slope up to the back of the garage is approximately 75-feet. The lower portion of site slopes on the western side of the site is supported by a rockery roughly 6.0-feet tall and by the new retaining wall that ranges from 4.5- to 5.0-feet tall and is approximately 65-feet long. Only part of the ground surface within the area of development consisted of exposed soils as the site was red tagged mid construction.

Vegetation across the site consists of grass, ivy, and scattered young to mature trees covering the slope. Part of the exposed soils in the area of development was covered with hardscaping tiles. No other temporary erosion control measures were observed during the time of our visit on February 9, 2024. However, we did not observe any signs of significant erosion or deep-seated instability during our visit. We also did not observe any surface water or seepage emitting from site slopes, but we did observe water coming out of two drains located on either end of the retaining wall and discharging into Lake Washington.

Subsurface Conditions

Geology: The geologic units for this area are shown in the Preliminary Geologic Map of Seattle and Vicinity, Washington, by Waldron, H.H, Liesch, B.A., Mullineaux, D.R., and Crandell, D.R. (USGS, 1962). The site is mapped as older clay till and gravel (Qc) with older sand (Qos) mapped nearby. The older clay till and gravel is generally described as an unsorted mixture of silt, sand, gravel, cobbles, boulders, and some interbedded layers of sand. The older sand is described as clean sand with varying amounts of gravel and cobbles with occasional silt. Our explorations generally encountered silty, fine to medium sand with gravel, cobbles, and trace organics consistent with the description of the older clay till and gravel deposits.

Explorations: The subsurface conditions within the site were explored on February 9, 2024, with three hand augered excavations throughout the property. Explorations extended to depths ranging from 2.5- to 4.0-feet below the existing ground surface. The approximate locations of our explorations are shown on the Site Plan in Figure 2. A geologist from NGA was present during explorations, examined soils and geologic conditions encountered, obtained samples of different soil types, and maintained exploration logs. The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 4. The logs of our hand auger explorations are attached to this report and are presented as Figure 5. We present a summary of the subsurface conditions in the following paragraphs. For a detailed description of the subsurface conditions, exploration logs should be reviewed.

At the surface of all of our explorations we encountered 1.2- to 4.0-feet of dark brown fine to coarse sand with gravel, organics, and varying amounts of silt, which we interpreted to be undocumented fill soils. Hand Auger One met refusal on cobbles within the undocumented fill at 4.0-feet. Underlying the undocumented fill soils in Hand Auger's Two and Three, we encountered gray-brown to brown, silty, fine to medium sand with gravel, cobbles, and trace organics, which we interpreted as older clay till and gravel deposits. Hand Auger's Two and Three met refusal on cobbles within the native older clay till and gravel deposits at depths ranging from 2.5- to 3.25-feet below the existing ground surface.

Hydrogeologic Conditions

We only observed water emitting from the drains that come out from either end of the retaining wall and discharge into Lake Washington, we did not encounter groundwater within any of our explorations. If groundwater seepage were to be observed or encountered within the site, we would interpret it to be perched water. Perched water occurs when surface water infiltrates through less dense, more permeable soils and accumulates on top of a relatively low permeability material. Perched water does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of rainfall. We would expect the amount of perched groundwater to decrease during drier times of the year and increase during wetter periods.

SENSITIVE AREA EVALUATION

Seismic Hazard

We reviewed the 2018 International Building Code (IBC) and ASCE 7-16 for seismic site classification for this project. Since medium dense or better soils are interpreted to underlie the site at depth, the site best fits the IBC description for Site Class D.

Table 1 below provides seismic design parameters for the site that are in conformance with the 2018 IBC, which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years), and the 2008 USGS seismic hazard maps.

Table 1 – 2018 IBC Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec. (g) S_s	Spectral Acceleration at 1.0 sec. (g) S_1	Site Coefficients		Design Spectral Response Parameters	
			F_a	F_v	S_{DS}	S_{D1}
D	1.475	0.509	1.000	Null	0.984	Null

The spectral response accelerations were obtained from the OSHPD Seismic Design Maps website for the project latitude and longitude.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the medium dense or better older clay till and gravel deposits interpreted to underlie the site have a low potential for liquefaction or amplification of ground motion.

Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. Data from the Natural Resources Conservation Service (NRCS) map of the King County area classifies the site as Kitsap silt loam, 15 to 30 percent slopes. The erosion hazard for the soils on the property are listed as severe, although is our opinion that the erosion hazard for the site soils should be low in areas where vegetation is not disturbed. It is our opinion that the erosion hazard for the exposed soils across the site should be moderate to severe.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion that the existing retaining wall is currently unstable due to failing factors of safety for bearing capacity, overturning, and base sliding found in our analysis of the wall using KeyWallPro block wall program, as well as loose to medium dense material being encountered below the existing retaining wall. A retaining wall in roughly the same location is feasible from a geotechnical standpoint given that the retaining wall is properly reconstructed, and our recommendations provided in this report are strictly followed as well as implemented into the new design. All retaining walls should incorporate structural fill backfill and a drainage system. Further details and recommendations regarding retaining wall design and installation are provided in the **Retaining Wall** subsection of this report.

Our explorations indicated that the site was underlain by a surficial layer of topsoil or undocumented fill with deposits of medium dense or better older clay till and gravel deposits at depth. These native soils should provide adequate support for the planned retaining wall and hot tub. We recommend that the retaining wall be supported on 12-inches of clean crushed rock. The crushed rock should extend through any loose soil and be placed on the underlying medium dense or better native bearing soil, or structural fill extending to these soils. Based on our explorations, competent soils should typically be encountered approximately 2.0- to 4.0-feet below the existing surface throughout the site. Deeper, localized areas of undocumented fill may also exist in unexplored areas of the site. These loose fill soils, if encountered, would require deeper excavations in foundation, slab, and pavement areas to remove the unsuitable soils.

The soils encountered on this site are considered very moisture-sensitive and may disturb easily when wet. We recommend that construction take place during the drier summer months, if possible. If construction is to take place during wet weather, the soils may disturb, and additional expenses and delays may be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls to protect exposed subgrades and construction traffic areas, as well as erecting additional erosion control measures.

Erosion Control

The erosion hazard for the on-site soils is listed as severe for exposed soils, but actual erosion potential will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site. Disturbed areas should be planted as soon as practical, and the vegetation should be maintained until it is established. Erosion potential of areas not stripped of vegetation should be low.

Protection of the slope areas should be performed as required by the City of Mercer Island. Specifically, we recommend that the site slopes and associated buffers, not be disturbed or modified through excavations into the slopes or removal of the existing vegetation. No material of any kind, such as excavation spoils, lawn clippings, debris, and soil stockpiles, should be placed on or near the slope. Any areas disturbed during grading activities should be planted as soon as practical to reduce the potential for erosion. The new vegetation should be maintained until it is established. Replacement of vegetation should be performed in accordance with the City of Mercer Island code. Under no circumstances should water be allowed to concentrate on the slopes. The clearing of vegetation within the proposed development area should not affect slope stability, provided the disturbed areas outside the building footprints are revegetated as soon as practical and protected from erosion. Areas that are disturbed during or after construction, planting, hydro seeding, and/or straw mulching are effective ways to minimize erosion and allow vegetation to be reestablished rapidly.

The site soils are considered to be moisture-sensitive and will disturb easily when wet. We recommend that construction take place during the drier summer months if possible. However, if construction takes place during the wet season, additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls on exposed subgrades, construction traffic areas, and paved areas prior to placing structural fill. Wet weather grading will also require additional erosion control and site drainage measures. Some of the on-site soils may be suitable for use as structural fill, depending on the moisture content of the soil at the time of construction. NGA should be retained to evaluate the suitability of all on-site and imported structural fill material during construction.

Site Preparation and Grading

After erosion control measures are implemented, site preparation for the new retaining wall and hot tub should consist of removing loose soils, topsoil, and any undocumented fill from the area of development, to expose medium dense or better native bearing soils at depth. The stripped soil should be removed from the site or stockpiled for later use as a landscaping fill. Based on our observations, we anticipate native, medium dense or better native soil to be encountered at approximately 2.0- to 4.0-feet below existing ground surface throughout explored areas of the site. We should note that additional deeper areas of unsuitable soils and/or undocumented fill could be encountered in unexplored areas of the site as well. This condition, if encountered, would require deeper excavations in foundation, slab, and pavement areas to remove the unsuitable soils.

After site preparation, if the exposed subgrade is deemed loose, it should be compacted to a non-yielding condition and then proof-rolled with a heavy, rubber-tired piece of equipment. Areas observed to pump or weave during the proof-roll test should be reworked to structural fill specifications or over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in the foundation areas, the loose soils should be removed and replaced with rock spalls. If significant surface water flow is encountered during construction, this flow should be diverted around work areas, and exposed subgrades should be maintained in a semi-dry condition.

If wet conditions are encountered, alternative site grading techniques might be necessary. These could include using large excavators equipped with wide tracks and a smooth bucket to complete site grading and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted, as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from

disturbance by machine or foot traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

Temporary and Permanent Slopes

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations at all times as indicated in OSHA guidelines for cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts be no steeper than 1.5H:1V. If significant groundwater seepage or surface water flow were encountered, we would expect that flatter inclinations would be necessary. We recommend that cut slopes be protected from erosion. The slope protection measures may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations.

Permanent cut and fill slopes should be no steeper than 3H:1V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be vegetated, and the vegetative cover maintained until established.

Retaining Walls

Based on our analysis of the existing retaining wall, it is our opinion that the wall is not stable from an engineering standpoint. A retaining wall in roughly the same location is feasible from a geotechnical standpoint given that the retaining wall is reconstructed in compliance with the City of Mercer Island code and our recommendations provided are strictly followed as well as implemented into the new design.

According to the City of Mercer Island, the exposed height of the proposed replacement retaining wall should be less than 30-inches. The total height of the new retaining wall should be 38-inches, including a minimum recommended embedment of 8-inches below the finished grade. We have provided wall designs for Regal Stone block facing, or equivalent. It is our opinion that the blocks on site are equivalent to the Regal Stone blocks. We recommend that all block walls on this site and backslope above wall be constructed utilizing geogrid-reinforced backfill. The block facing should consist of Regal Stone blocks, or of an equivalent size. The block facing should be placed on a minimum of 12-inches of 1.25-inch clean crushed rock leveling pads placed over competent soils, or structural fill material prepared under the supervision of NGA. Medium dense to dense, bearing soils should be encountered roughly 2.0- to 4.0-feet below the ground surface based on our explorations; however, loose soil may be encountered in unexplored areas of the site.

Above the retaining wall we recommend sloping the backfill back at a 1H:1V slope up to 30-inches. The backfill above the retaining wall should also be reinforced utilizing geogrid every 12-inches. Additionally, filter fabric should be wrapped around the front of the exposed soils, and it should overlap with the geogrid by 24-inches. A minimum of 6-inches of 1.25-inch clean crushed rock should be placed over the top layer of geogrid and filter fabric to prevent them from becoming disturbed.

To protect the face of the backfilled slope, we also recommend placing jute netting over the placed backfill. The jute netting should be staked with 18-inch-long metal rebar that has a metal “T” welded to the end. The mat should be staked to the surface every 3.0 feet. After the matting is placed, we recommended that deep-rooted vegetation be planted on the slope and grass seed be placed to re-establish vegetation growth. The vegetation should be maintained until established. The reinforced fill wall detail, with associated design parameters and construction notes is provided in Figure 6. We have assumed that the retained fill zones will consist of granular material compacted to structural fill specifications.

Mirafi 3xT geogrid (or equivalent) is required and incorporated in the wall design. Each layer of geogrid should be a minimum of 5.0-feet in length, attached to the blocks as recommended by the manufacturer, and extended back into the reinforced fill zone. The grid should be pulled tight before the fill is placed over the geogrid. Care should be taken not to damage the geogrid by operating construction equipment on the exposed grid, or by allowing large rocks to be placed directly on the grid.

In our opinion, a direct replacement of the existing unstable retaining wall with a geogrid-reinforced retaining wall and backfill would improve existing stability conditions, provided no additional material is added to the slope and all recommendations are closely followed during construction.

All wall backfill should be well compacted as outlined in the **Structural Fill** subsection of this report. Care should be taken to prevent the buildup of excess lateral soil pressures due to over-compaction of the wall backfill. This can be accomplished by placing wall backfill in 8-inch loose lifts and compacting the backfill with small, hand-operated compactors within a distance behind the wall equal to at least one-half the height of the wall. The thickness of the loose lifts should be reduced to accommodate the lower compactive energy of the hand-operated equipment. The recommended level of compaction should still be maintained.

Hot Tub Support

The proposed hot tub should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. Alternatively, the hot tub could be supported on hardscaping tiles that are supported on the prepared subgrade soils, or it could be supported by a slab-on-grade. If the hot tub is supported on a slab-on-grade, then we recommend that the slab be underlain by at least six inches of free-draining gravel with less than three percent by weight of the material passing Sieve #200 for use as a capillary break. For interior applications, a suitable vapor barrier, such as heavy plastic sheeting (6-mil, minimum), should be placed over the capillary break material.

Pergola Support

The proposed pergola should be supported on sonotubes that extend down to either the 12-inches of crushed rock underlying the retaining wall or be founded on medium dense or better native bearing soils that are prepared as described in the **Site Preparation and Grading** subsection of this report. Any Mirafi 3xT geogrid placed for the retaining wall should be placed around the sonotubes for the proposed pergola and not cut in as this would compromise the reinforcement capability of the geogrid. In any case, the sonotubes should be extended down to the bottom of the retaining wall, or deeper, to avoid loading the wall.

Structural Fill

General: Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection prior to beginning fill placement.

Materials: Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). The on-site soils are not suitable for use as structural fill. We should be retained to evaluate all proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All filling should be accomplished in uniform lifts up to eighteen inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment sufficient to attain the desired degree of compaction and should be tested.

Site Drainage

The finished ground surface should be graded such that stormwater is directed to an approved stormwater collection system. Water should not be allowed to stand in any areas where the retaining wall is to be constructed. Final site grades should allow for drainage away from the proposed pergola and hot tub. For the purposes of drainage, we suggest that the finished ground be sloped at a minimum downward gradient of three percent, for a distance of at least 10 feet away from the proposed structures. Surface water should be discharged into an approved stormwater management system away from the structures, property boundaries, or any sloping ground. If groundwater seepage is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped out and routed into a permanent storm drain.

CONSTRUCTION MONITORING

We recommend NGA be retained to provide monitoring and consultation services during construction to confirm that conditions encountered are consistent with those indicated by explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork and retaining wall installation activities comply with contract plans and specifications. Specifically, we should be retained to provide construction monitoring services during the earthwork phase of the project to evaluate subgrade conditions, temporary cut conditions, fill compaction, and drainage system installation.

USE OF THIS REPORT

NGA has prepared this report for **Abhi Sharma** and associated agents, for use in the planning and design of the development on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule.

We recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, express or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-o-o

It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Faith K. Stelter
Staff Geologist II

3.07.2024

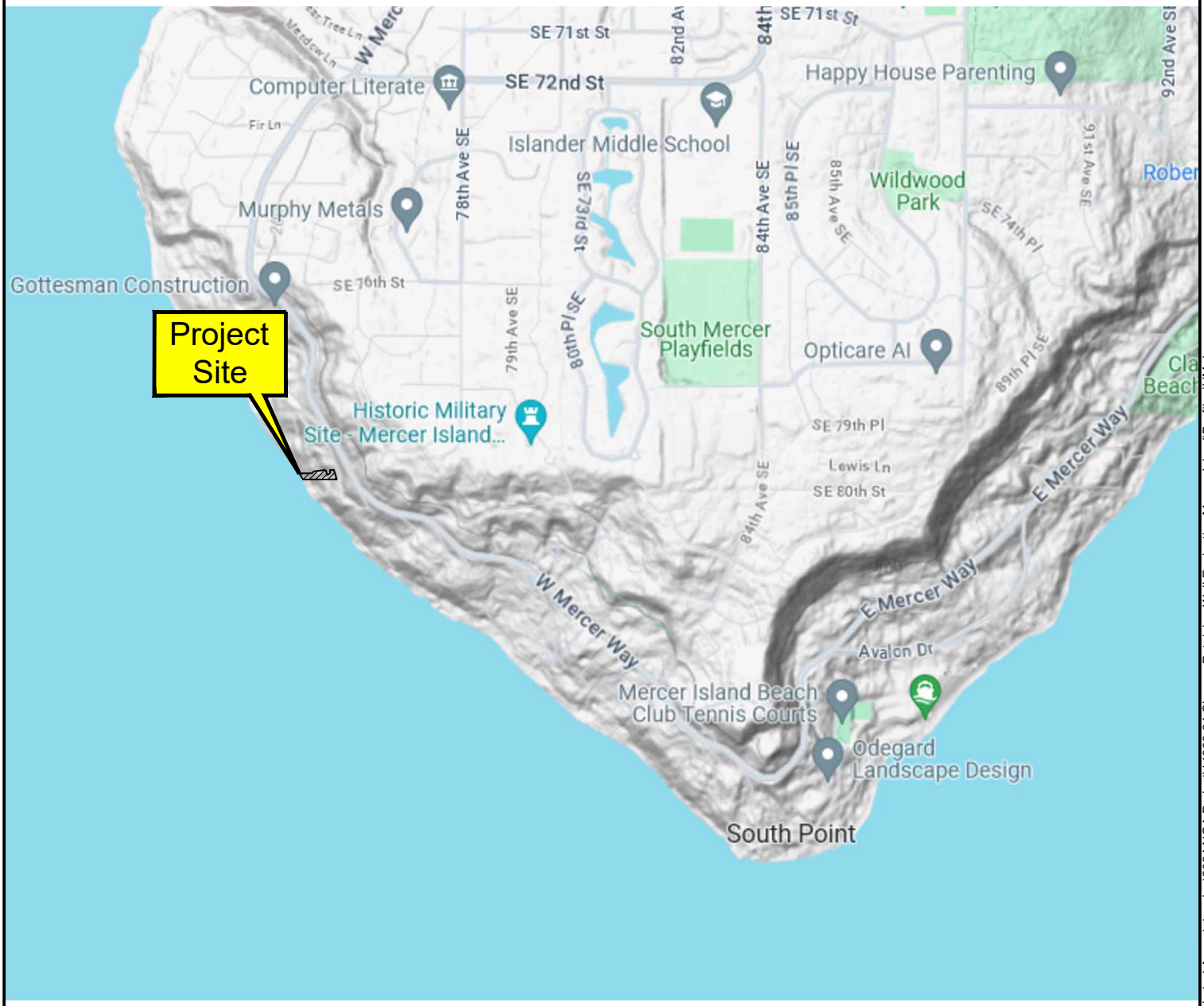
Khaled M. Shawish, PE
Principal

FKS:KMS:dy

Six Figures Attached

VICINITY MAP

Not to Scale



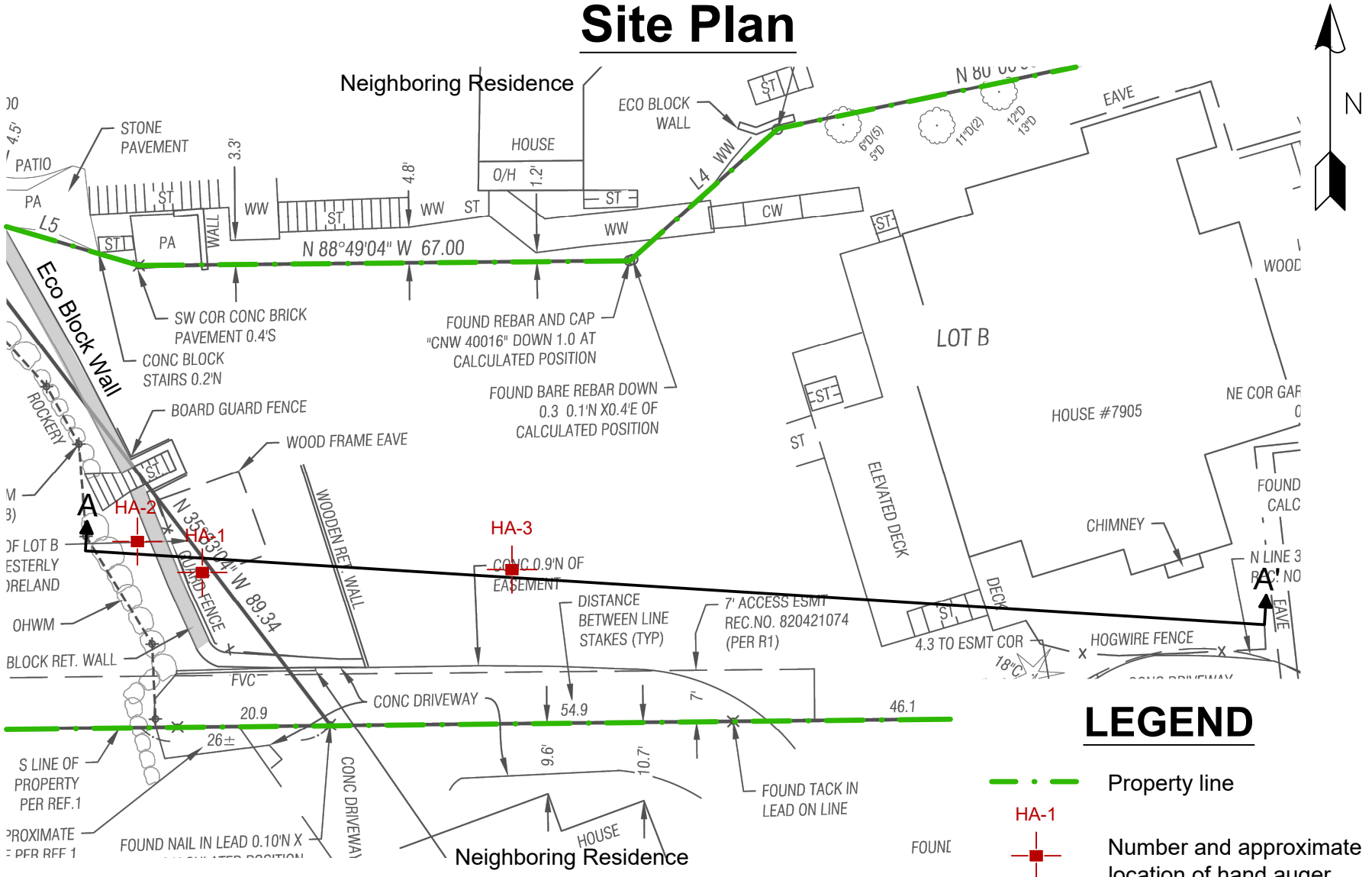
Mercer Island, WA

Project Number 1496924	Sharma Retaining Wall Evaluation Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC Woodinville Office: 17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax: 481-2510 Wenatchee Office: 105 Palouse St. Wenatchee, WA 98801, (509) 665-7696 / Fax: 665-7692 www.nelsongeotech.com
Figure 1		

No.	Date	Revision	By	CK
1	2/19/24	Original	ABT	DJO

C:\Users\Alexander(Alex)Bauce\OneDrive - Nelson Geotechnical Associates, Inc\2024 NGA Project\14969-24 Sharma Retaining Wall Evaluation Mercer Island\Drafting\VM.dwg

Site Plan



LEGEND

- Property line
- HA-1 — Number and approximate location of hand auger
- A — A' — Approximate location of cross-section

0 20 40

Approximate Scale: 1 inch = 20 feet

Reference: Site plan based on a survey dated January 15, 2024 titled "7905 Mercer Way," prepared by GEOLS.

No.	Date	Revision	By	CK
1	2/19/24	Original	ABT	DJO
2	3/4/24	First Revision	ABT	DJO

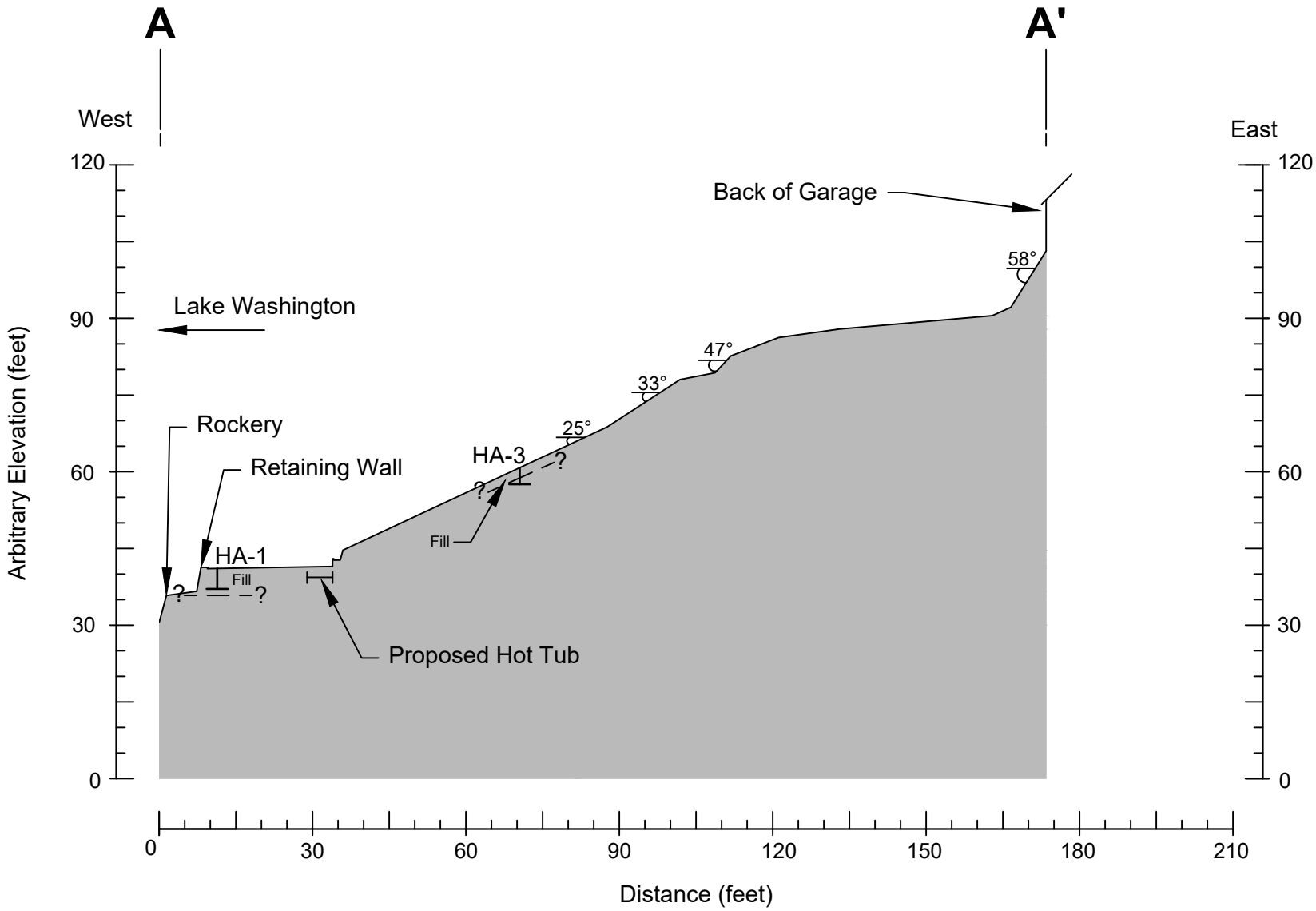
NELSON GEOTECHNICAL ASSOCIATES, INC
Wenatchee Office
105 Palouse St
Wenatchee, WA 98801
(509) 665-7696 / Fax: 665-7692
Woodinville Office
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510
www.nelsongeotech.com

Sharma Retaining Wall Evaluation
Site Plan

Project Number 1496924

Figure 2

C:\Users\Alexander(Alex)Baucc\OneDrive - Nelson Geotechnical Associates, Inc\2024 NGA Project\14969-24 Sharma Retaining Wall Evaluation Mercer Island\Drafting\sp.dwg



Exploration

Hand Auger Designation → HA-1

Groundwater Level During Exploration →

Geologic Contact (approximate) → ? – – ?

NOTES:
1) Stratigraphic conditions are interpolated between the explorations. Actual conditions may vary.
2) Elevations are arbitrary.

Reference: Cross Section is based on field measurements using a hand-held clinometer and 100-ft tape measure.

No.	Date	Revision	By	CK
1	2/20/24	Original	ABT	DJO

NELSON GEOTECHNICAL ASSOCIATES, INC
Woodinville Office
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510
Wenatchee Office
105 Palouse St.
Wenatchee, WA 98801
(509) 665-7696 / Fax: 665-7692
www.nelsongeotech.com

Sharma Retaining Wall Evaluation
Cross-Section A-A'

Project Number 1496924

Figure 3

C:\Users\Alexander(Alex)Baucc\OneDrive - Nelson Geotechnical Associates, Inc\2024 NGA Project\14969-24 Sharma Retaining Wall Evaluation Mercer Island\Drafting\cs.dwg

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
2) Soil classification using laboratory tests is based on ASTM D 2488-93.
3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 1496924	Sharma Retaining Wall Evaluation Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC
Figure 4		www.nelsongeotech.com **Woodinville Office** 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510 **Wenatchee Office** 105 Palouse St. Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692

No.	Date	Revision	By	CK
1	2/20/24	Original	ABT	DJO

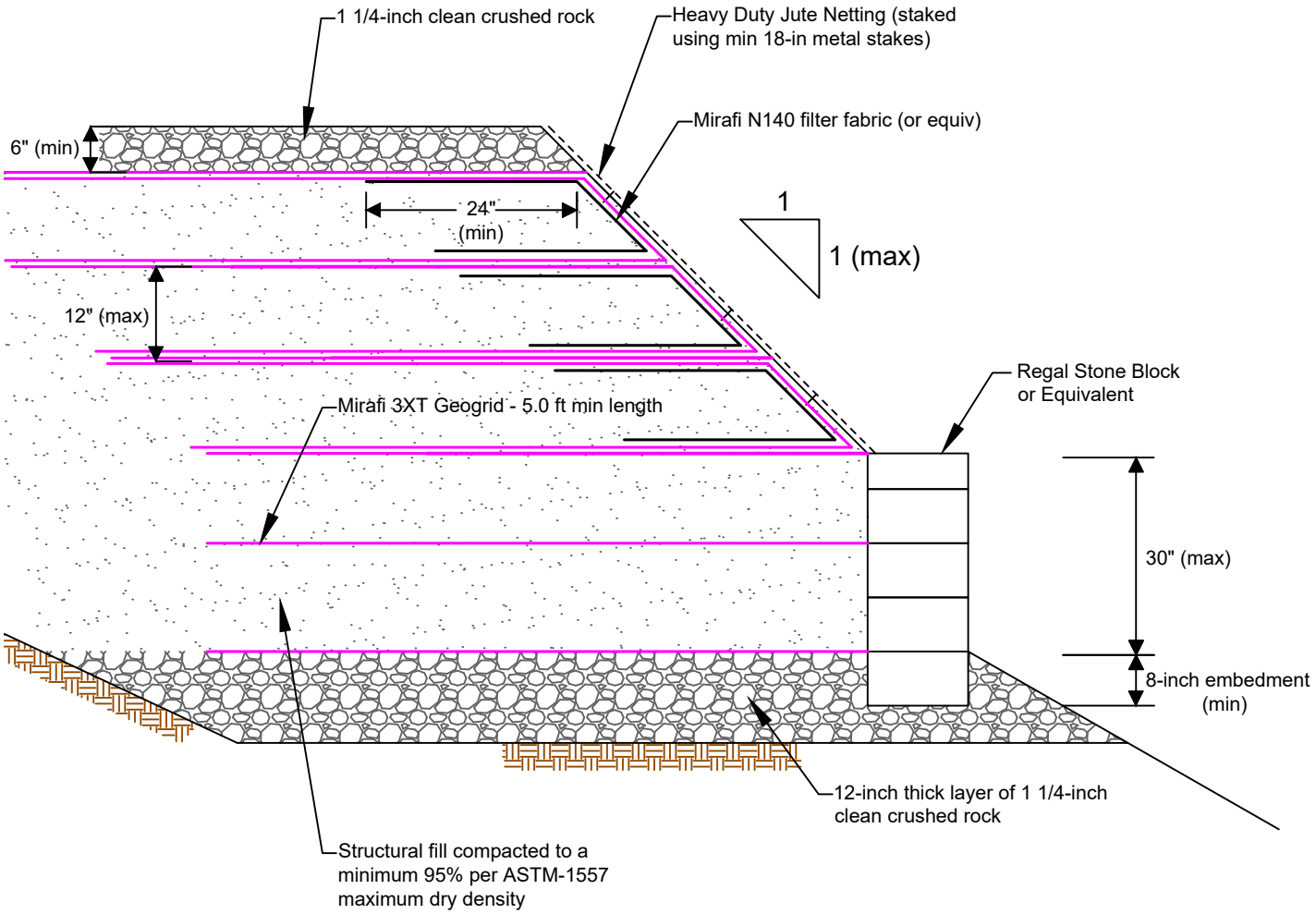
C:\Users\Alexander(Alex)Bucc\OneDrive - Nelson Geotechnical Associates, Inc\2024 NGA Project\14969-24 Sharma Retaining Wall Evaluation Mercer Island\Drafting\SC.dwg

LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
HAND AUGER ONE		
0.0 – 0.5		BROWN, MEDIUM TO COARSE SAND (**FILL**)
0.5 – 4.0		DARK BROWN TO BROWN, SILTY, FINE TO COARSE SAND WITH GRAVEL, COBBLES, AND ORGANICS (LOOSE, MOIST) (**FILL**)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED HAND AUGER CAVING WAS NOT ENOCUNTERED HAND AUGER WAS COMPLETED AT 4.0 FEET ON 2/9/24
HAND AUGER TWO		
0.0 – 1.2		DARK BROWN, FINE TO COARSE SAND WITH SILT, GRAVEL, AND ORGANICS (LOOSE, MOIST) (**FILL**)
1.2 – 1.3		CRUSHED ROCK (LOOSE TO MEDIUM DENSE) (**FILL**)
1.3 – 2.5	SM	BROWN, SILTY, FINE TO MEDIUM SAND WITH GRAVEL, COBLES, AND TRACE ORGANICS (LOOSE TO MEDIUM DENSE, MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED HAND AUGER CAVING WAS NOT ENCOUNTERED HAND AUGER WAS COMPLETED AT 2.5 FEET ON 2/9/24
HAND AUGER THREE		
0.0 – 2.0		GRASS UNDERLAIN BY DARK BROWN TO BROWN, SILTY, FINE TO MEDIUM SAND WITH GRAVEL AND ORGANICS (LOOSE TO MEDIUM DENSE, MOIST) (**FILL**)
2.0 – 3.25	SM	GRAY-BROWN TO BROWN, SILTY, FINE TO MEDIUM SAND WITH GRAVEL, COBBLES, AND TRACE ORGANICS (MEDIUM DENSE, MOIST)
		SAMPLE WAS COLLECTED AT 3.25 FEET GROUNDWATER SEEPAHE WAS NOT ENCOUNTERED HAND AUGER CAVING WAS NOT ENCOUNTERED HAND AUGER WAS COMPLETED AT 3.25 FEET ON 2/9/24

Schematic Block Wall Detail

Not to Scale



Project Number	Sharma Retaining Wall Evaluation Reinforced Retaining Wall Detail	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
1496924			1	3/4/24	Original	ABT	DJO
Figure 6		

www.nelsongeotech.com

Woodinville Office
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510

Wenatchee Office
105 Palouse St.
Wenatchee, WA 98801
(509) 665-7696 / Fax: 665-7692

C:\Users\Alexander(Alex)Baucc\OneDrive - Nelson Geotechnical Associates, Inc\2024 NGA Project\14969-24 Sharma Retaining Wall Evaluation Mercer Island\Drafting\Schematic Retaining Wall Detail.dwg