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June 16, 2016

Mr. James Ihnot - Manager
Zhang Family, LLC
600 Market Street, Suite 100
Kirkland, Washington 98033

Geotechnical Engineering Evaluation
Zhang Family Residence
7908 – 53rd Avenue West
Mukilteo, Washington
NGA File No. 936515

Dear Mr. Ihnot:

We are pleased to submit the attached report titled "Geotechnical Engineering Evaluation – Zhang Family Residence – 7908–53rd Avenue West – Mukilteo, Washington." This report summarizes the existing surface and subsurface conditions within the site and provides recommendations for the proposed site development. Our services were completed in general accordance with the proposal signed by you on September 24, 2015.

We understand that the planned improvements will include removing an existing residence and detached garage within the western-central portion of the site and constructing a new single-family residence in the same approximate location. The existing residence setback is approximately 90 feet from the top of the steep, west-facing slope and we understand that you desire to place the new residence a little closer to the slope, it warranted. The proposed development area is relatively level to gently sloping to the west. Stormwater management plans had not been determined at the time this report was prepared.

We explored the proposed development portion of the site with three drilled borings using a track-mounted drill rig extending up to approximately 12.5 feet below the existing ground surface. Our explorations indicated that the site is generally underlain at shallow depths by competent native glacial soils.

It is our opinion that the planned development is feasible from a geotechnical standpoint, provided that our recommendations are incorporated into the design and construction of this project. We have recommended that the new residence be founded on medium dense or better native glacial soils for bearing capacity and settlement considerations. It is also our opinion that the soils that underlie the site and form the core of the site slope should be stable with respect to deep-seated earth movements, due to their inherent strength and slope geometry. However, there is a potential for shallow sloughing and erosion events to occur on the steep slope below the proposed residence. In our opinion a 75-foot residence setback from the top of the steep west-facing bluff is adequate. We recommend that light structures such as decks and patios be setback at least 50 feet from the top of the steep west-facing slope.

In the attached report, we have also included recommendations for site grading, foundation support, and site drainage.

We recommend that Nelson Geotechnical Associates (NGA) be retained to review the geotechnical aspects of the project plans prior to 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 during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

We appreciate the opportunity 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

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Geotechnical Engineering Evaluation
Zhang Family Residence
7908 – 53rd Avenue West
Mukilteo, Washington

INTRODUCTION

This report presents the results of our geotechnical engineering investigation and evaluation of the proposed Zhang Family Residence in Mukilteo, Washington. The project site is located at 7908 – 53rd Avenue West, 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 proposed site development.

The site is currently occupied by an existing single-family residence and detached garage within the western-central portion of the site. The existing residence and garage are to be removed and a new residence is to be constructed in the same approximate location. A steep west-facing slope is located below and to the west of the planned relatively level to gently sloping development area. Stormwater management plans have not been developed at the time this report was prepared. The proposed site layout is shown on the Site Plan in Figure 2.

SCOPE

The purpose of this study is to explore and characterize the site surface and subsurface conditions, and provide general recommendations for site development. Specifically, our scope of services includes the following:

1. Review available soil and geologic maps of the area.
2. Explored the subsurface soil and groundwater conditions with drilled borings using a track-mounted drill rig. Drill rig was subcontracted by NGA.
3. Perform laboratory analyses on selected samples, as needed.
4. Map the conditions on the slope and evaluate current slope stability conditions.
5. Provide recommendations for building setback from the steep slope.
6. Provide recommendations for earthwork, including cuts and fills.
7. Provide recommendations for temporary and permanent slopes.
8. Provide recommendations for foundation support, slab on grade, and pavement subgrades.
9. Provide recommendations for retaining walls.

10. Provide recommendations for site drainage and erosion control.

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

SITE CONDITIONS

Surface Conditions

The property is a generally rectangular-shaped parcel covering approximately 3.78 acres. The existing residence and the proposed development portion of the site consist of a relatively level to gently sloping upper bench area. A steep west-facing slope descends from the western portion of the bench area to railroad tracks and the Puget Sound below. In the eastern portion of the bench area, a steep east-facing slope descends to a lower ravine area. The steep east-facing slope is located approximately 200 feet to the east of the existing residence and proposed development portion of the site. The areas surrounding the existing residence are vegetated with grass, sparse underbrush and a few young and mature trees. The steep slopes within the eastern and western portions of the site are vegetated with mature trees and dense underbrush. The property is bordered to the north and south by residential properties, to the east by a ravine area and to the west by the Burlington-Northern Railroad Tracks and Puget Sound.

A steep, west-facing slope descends from the relatively level to gently sloping upper bench area down to the Burlington-Northern Railroad Tracks and the eastern shore of Puget Sound at inclinations in the range of approximately 35 to 49 degrees (70 to 115 percent), as shown on Cross-section A-A' in Figure 3. The overall height of the steep west-facing slope is approximately 390 feet. The steep, west-facing slope is generally vegetated with young to mature trees and dense underbrush. Due to the limited access to the slope area and site constraints, we were unable to observe the entire steep slope area below the proposed development area. We did not observe any standing water within the site or groundwater seepage emitting from the steep slope during our site visit on October 2, 2015. We did not observe signs of recent slope movement; however, we did observe some exposed soils below the top of slope indicating minor erosion and sloughing on the surface of the steep west-facing slope, indicative of past shallow surficial slouging events.

Subsurface Conditions

Geology: The geologic units for this area are shown on the Distribution and Description of Geologic Units in the Mukilteo Quadrangle, Washington, by James P. Minard (USGS, 1982). The site is mapped as Vashon Till (Qvt) with Advance Outwash (Qva) and Whidbey Formation (Qw) mapped within the steep slope area located to the west of the site. The Vashon till is described a non-sorted mixture of clay,

during our investigation, such as deep-seated landsliding. However, we did observe some exposed glacial soils within the upper portion of the slope indicating that some minor shallow erosion and sloughing events have occurred on the steep slope in the past. We did not observe any indications of recent shallow sloughing events within the steep slope area.

The core of the slope is inferred to consist primarily of medium dense or better native glacial deposits. Inclinations of up to 49 degrees on the slope indicate high strength and internal friction angle within the underlying soils. Relatively shallow sloughing failures as well as surficial erosion are natural processes and should be expected on this slope during extreme weather conditions. It is our opinion that while there is potential for erosion, soil creep, and shallow failures within the loose surficial soils on the slope, there is not a significant potential for deep-seated slope failure under current site conditions. Proper site grading and drainage as well as foundation placement and embedment as recommended in this report should help maintain current stability conditions.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion, from a geotechnical standpoint, that the site is generally compatible with the planned development. It is also our opinion that the soils that underlie the site and form the core of the site slope should be stable with respect to deep-seated earth movements, due to their inherent strength and slope geometry. However, there is a significant potential for shallow sloughing and erosion events to occur on the steep slope along the western side of the site. Proper erosion and drainage control measures, along with long-term maintenance of the slope and drainage systems as recommended in this report, should reduce this potential but not fully eliminate it. We recommend that we review the plans after they have been developed.

Our explorations within the site indicate that the site is generally underlain by medium dense to very dense native glacial soils. The native soils should provide adequate support for foundation and slab loads. We recommend that the structures be designed utilizing shallow foundations. Footings should extend through any undocumented fill or loose soil, and be founded on the underlying medium dense or better native soil, or structural fill extending to these soils. The medium dense or better soil should typically be encountered approximately two to three feet below the existing ground surface throughout the site with some potential localized areas of deeper loose soils in unexplored areas of the site especially within the location of the existing residence area.

It is our opinion that a residence building setback of 75 feet from the top of steep west-facing slope is adequate at this time to protect the structure against potential failures on the slope. A residence building setback of 50 feet from the top of steep west-facing slope could be utilized provided that the downhill foundation lines are deepened and embedded a minimum of four feet into the dense to very dense native unweathered glacial till soils. We recommend that a light structure setback of 50 feet from the top of the steep west-facing slope be established for structures such as wood decks and patios, and their related supporting structures (i.e. piers or footings) provided minimal earthwork is performed when installing these structures.

All grading operations and drainage improvements planned as part of this development should be planned and completed in a manner that enhances the stability of the steep slopes, not reduces it. Excavation spoils should not be stockpiled near the top of the slope, or be allowed to reach the slope. Water should not be allowed to concentrate or flow over the steep slope. Future vegetation management on the slope should be the subject of a specific evaluation and a plan approved by the City of Mukilteo. The slope should be monitored on an on-going basis, especially during the wet season, for any signs of instability, and corrective actions promptly taken should any signs of instability be observed. Lawn clipping and any other debris should never be cast over the slope.

The surficial soils encountered on this site are considered moisture-sensitive and will disturb easily when wet. To lessen the potential impacts of construction on the slope and to reduce cost overruns and delays, we recommend that construction take place during the drier summer months if possible. If construction takes place during the rainy months, additional expenses and delays should be expected. Additional expenses could include the need for placing additional erosion control and temporary drainage measures to protect the slopes, the need for placing a blanket of rock spalls on exposed subgrades and construction traffic areas, and the need for importing all-weather material for structural fill.

Under no circumstances, should water be allowed to flow over, or concentrate on the site slopes, both during construction and after construction has been completed. We recommend that stormwater runoff from roof, footings and yard drains be collected and tightlined to a suitable discharge point at the bottom of the slope or to an existing system. The slopes should be protected from erosion. We recommend that all disturbed areas be replanted with vegetation to re-establish vegetation cover as soon as possible. Specific recommendations for erosion control are presented in the **Erosion Control and Slope Protection Measures** subsection of this report.

Erosion Control and Slope Protection Measures

The erosion hazard for the on-site soils is listed as moderate, but the actual hazard 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 or flowing over the steep slope. Stockpiles should be covered with plastic sheeting during wet weather and stockpiled material should be placed no closer than 40 feet from the top of the slope. Disturbed areas should be planted as soon as practical and the vegetation should be maintained until it is established. The erosion potential for areas not stripped of vegetation should be low.

Protection of the setback and steep slope area should be performed as required by the City of Mukilteo. Specifically, we recommend that the setback area and top of slope not be disturbed or modified through placement of any fill or removal of the existing vegetation. No additional material of any kind should be placed on the slope or be allowed to reach the slope, such as excavation spoils, lawn clippings, and other yard waste, trash, and soil stockpiles. Trees should not be cut down or removed from the slope unless a mitigation plan is developed, such as the replacement of vegetation for erosion protection. Vegetation should not be removed from the slopes. Replacement of vegetation should be performed in accordance with City of Mukilteo code. Any proposed development within the slope setback area, other than light decks or patios, should be the subject of a specific geotechnical evaluation. Under no circumstances should water be allowed to concentrate on the steep slope.

Site Preparation and Grading

After erosion control measures are implemented, site preparation should consist of stripping any loose soils to expose medium dense or better native soil in foundation, slab-on-grade, and pavement areas. The stripped materials should be removed from the site or stockpiled for later use as landscaping fill. Stockpiles should be kept away from the top of the steep slopes and should be covered with plastic during wet weather.

If the exposed subgrade, after site stripping, should appear to be loose, it should be compacted to a non-yielding condition. Areas observed to pump or weave during compaction should be over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in the subgrade, the loose soils should be removed and replaced with rock spalls or granular structural fill. If

should be over-excavated to expose suitable bearing soil. If footings are supported on structural fill, the fill zone should extend outside the edges of the footing a distance equal to one-half of the depth of the over-excavation below the bottom of the footing.

Footings should extend at least 18 inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Foundations should be designed in accordance with the 2012 IBC. Footing widths should be based on the anticipated loads and allowable soil bearing pressure. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend an allowable design bearing pressure of not more than 2,000 pounds per square foot (psf) be used for the design of footings founded on the medium dense/stiff or better native soils or structural fill extending to the competent native material. The foundation bearing soil should be evaluated by a representative of NGA. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than one-inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured "neat" against the native medium dense/stiff or better soils or compacted fill should be placed against the footing. We recommend that the upper one-foot of soil be neglected when calculating the passive resistance.

Retaining Walls

Final grading plans were not available at the time this report was prepared but retaining walls may be needed for the residence construction. The lateral pressure acting on subsurface retaining walls is dependent on the nature and density of the soil behind the wall, the amount of lateral wall movement which can occur as backfill is placed, wall drainage conditions, the inclination of the backfill, and other possible surcharge loads. For walls that are free to yield at the top at least one thousandth of the height of the wall (active condition), soil pressures will be less than if movement is limited by such factors as wall stiffness or bracing (at-rest condition). We recommend that walls supporting horizontal backfill and not subjected to hydrostatic forces be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 40 pcf for yielding (active condition) walls, and 60 pcf for non-yielding (at-rest condition) walls.

These recommended lateral earth pressures are for a drained granular backfill and are based on the assumption of a horizontal ground surface behind the wall for a distance of at least the subsurface height of the wall, and do not account for surcharge loads. Additional lateral earth pressures should be considered for surcharge loads acting adjacent to subsurface walls and within a distance equal to the subsurface height of the wall. This would include the effects of surcharges such as traffic loads, floor slab and foundation loads, slopes, or other surface loads. We are available to provide consultation regarding additional loads on retaining walls during final design, if needed.

The lateral pressures on walls may be resisted by friction between the foundation and subgrade soil, and by passive resistance acting on the below-grade portion of the foundation. Recommendations for frictional and passive resistance to lateral loads are presented in the **Foundations** subsection of this report.

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 thin loose lifts and compacting it 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.

Permanent drainage systems should be installed for retaining walls. Recommendations for these systems are found in the **Subsurface Drainage** subsection of this report. We recommend that we be retained to evaluate the proposed wall drain backfill material and drainage systems.

Structural Fill

General: We do not anticipate large scale fill placement for this project; however, fill placed beneath or behind foundations 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. Sloping ground to receive fill should be benched with a minimum 8-foot wide level benches prior to placing structural fill.

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 structural 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 use of some of the on-site soils as structural fill may be feasible but will be highly dependent on moisture content of the material at the time construction takes place. We should be retained to evaluate 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 eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill 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 of a type and size sufficient to attain the desired degree of compaction.

Slab-on-Grade

Slabs-on-grade should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. We recommend that all floor slabs 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. We recommend that the capillary break be hydraulically connected to the footing drain system to allow free drainage from under the slab. A suitable vapor barrier, such as heavy plastic sheeting (6-mil minimum), should be placed over the capillary break material. An additional 2-inch-thick moist sand layer may be used to cover the vapor barrier. This sand layer is optional and mainly intended to protect the vapor barrier membrane during construction.

Pavements

Pavement subgrade preparation, and structural filling where required, should be completed as recommended in the **Site Preparation and Grading** and **Structural Fill** subsections of this report. The pavement subgrade should be proof-rolled with a heavy, rubber-tired piece of equipment, to identify soft or yielding areas that require repair. We should be retained to observe the proof-rolling and recommend repairs prior to placement of the asphalt or hard surfaces.

Utilities

We recommend that underground utilities be bedded with a minimum 12 inches of pea gravel prior to backfilling the trench with on-site or imported material. Trenches within settlement sensitive areas should be compacted to 95% of the modified proctor as described in the **Structural Fill** subsection of this report. Trenches located in non-structural areas should be compacted to a minimum 90% of the maximum dry density.

Site Drainage

Surface Drainage: Final site grades should allow for drainage away from the top of the slopes and away from the planned structures. We suggest that the finished ground be sloped at a minimum gradient of three percent for a distance of at least 10 feet away from the building and top of the slopes. Runoff generated on this site should be collected and routed into a permanent discharge system away from the steep slope. This should include all downspouts and footing drains, and runoff generated on all hard surfaces and yards areas. Under no circumstances should water be allowed to flow uncontrolled over the steep slope. Water should not be allowed to collect in any area where footings or slabs are to be constructed. Stormwater handling plans were not developed when this report was prepared and therefore we should be retained to review such plans during final design.

Subsurface Drainage: If groundwater 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 of the excavation and routed into a suitable outlet. We recommend that the residence down spouts and footing drains be tightlined to an appropriate discharge location away from the slope.

We recommend the use of footing drains around structures. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum four-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material placed along the back of walls. Washed rock is an acceptable drain material or drainage composite may be used instead. The free-draining material should extend up the wall to one foot below the finished surface. The top foot of soil should consist of low permeability soil placed over plastic sheeting or building paper to minimize the migration of surface water or silt into the footing drain. Footing drains should discharge into tightlines leading to an appropriate collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

CONSTRUCTION MONITORING

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 Mr. James Ihnot and his agents for use in the planning and design of the development planned 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.

All people who own or occupy homes on hillsides should realize that landslide movements are always a possibility. The landowner should periodically inspect the slope, especially after a winter storm. If distress is evident, a geotechnical engineer should be contacted for advice on remedial/preventative measures. The probability that landsliding will occur is substantially reduced by the proper maintenance of drainage control measures at the site (the runoff from the roofs should be led to an approved discharge point). Therefore, the homeowner should take responsibility for performing such maintenance. Consequently, we recommend that a copy of our report be provided to any future homeowners of the property if the home is sold.

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 during the work 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, expressed 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.

Clinton N. Lindgren
Staff Geologist

State of Washington
2883
Licensed Geologist
LEE S. BELLAH

Lee S. Bellah, LG
Project Geologist

KHALED M. SHAWISH
STATE OF WASHINGTON
35215
REGISTERED
PROFESSIONAL ENGINEER
Exp. July 28, 2017

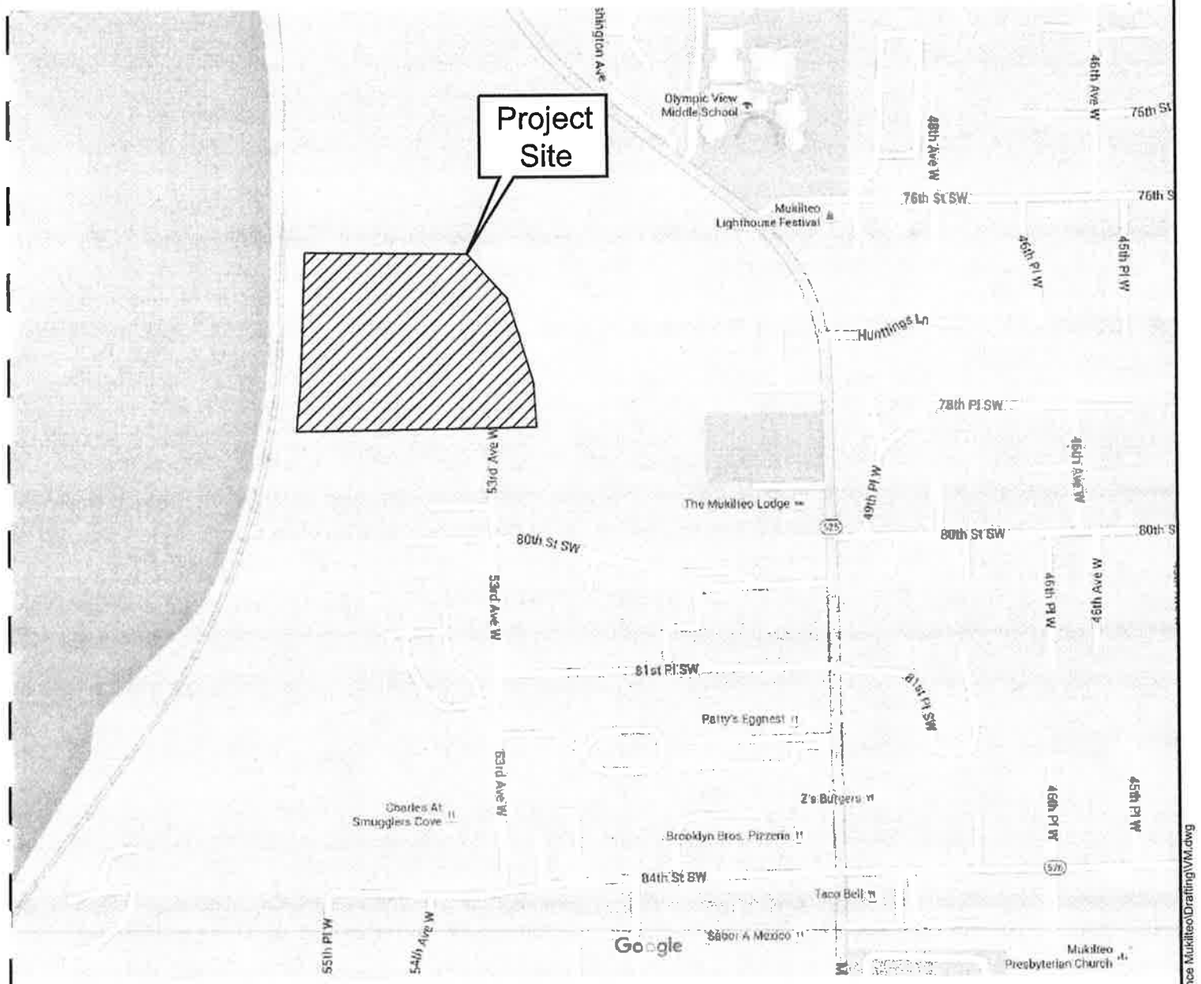
Khaled M. Shawish, PE
Principal

Seven Figures Attached

CJL:LSB:KMS:dy

VICINITY MAP

Not to Scale



Mukilteo, WA

Project Number	Cove Club Residence Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC.	No.	Date	Revision	By	CK
936515		GEOTECHNICAL ENGINEERS & GEOLOGISTS	1	10/12/15	Orignal	DPN	LSB
Figure 1		17311-136th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax 461-2510 · Snohomish County (425) 339-1669 Wenatchee/Chelan (509) 665-7696 www.nelsongeotech.com					

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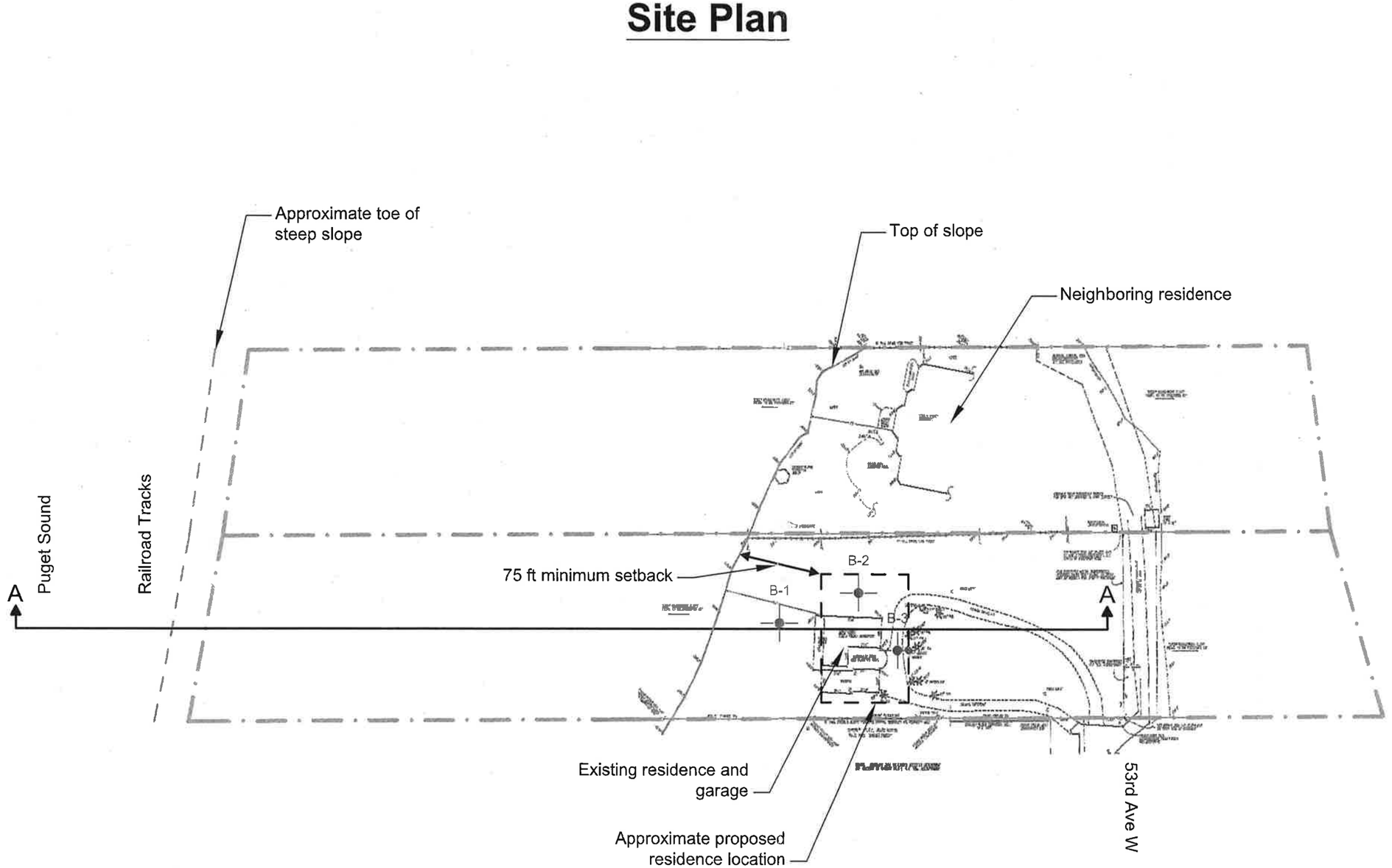
Site Plan



LEGEND

- Property line
- B-1 — Number and approximate location of boring
- A A' — Approximate location of cross-section

0 100 200

Scale: 1 inch = 100 feet

Reference: Site plan based on a plan dated September 21, 2015 titled "Xiaobin Zhang," prepared by Harmsen & Associates, Inc.

No.	Date	Revision	By	CK
1	10/15/15	Original	LSB	KMS

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Cove Club Residence
Site Plan

Project Number 936515

Figure 2

Project Number 936515

Figure 3

Cove Club Residence
Cross-Section A-A'

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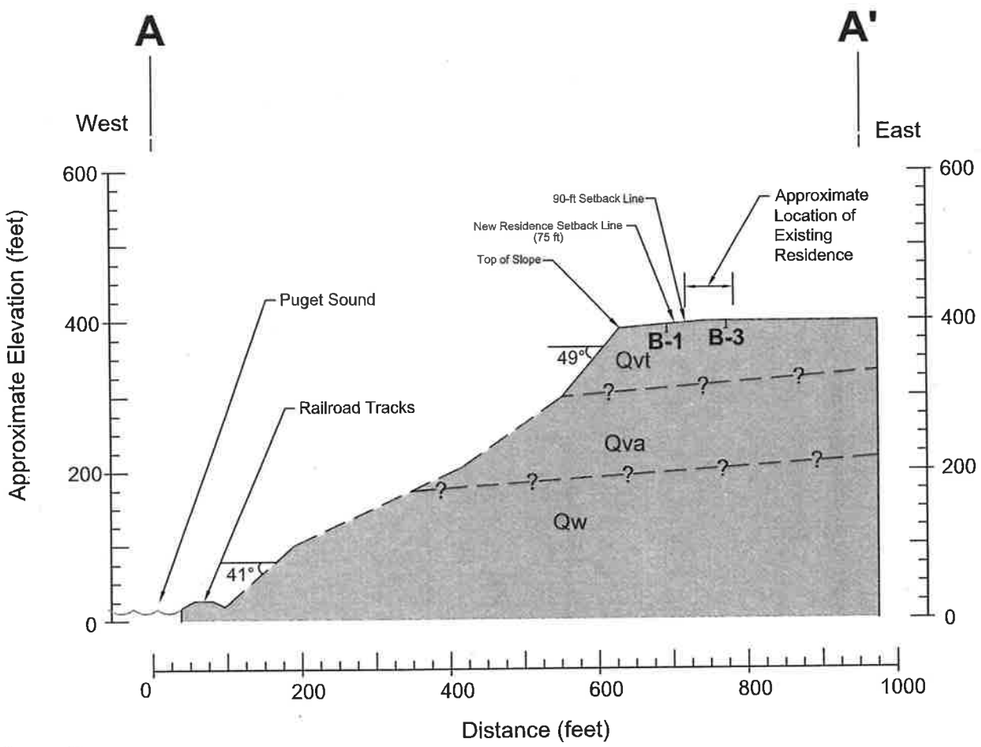
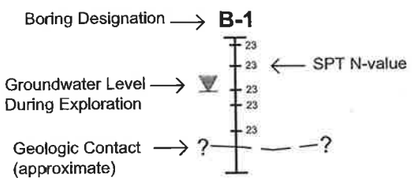
No.	Date	Revision	By	CK
1	10/15/15	Original	LSB	KMS



Exploration



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

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

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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, FLAT 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	Cove Club Residence Soil Classification Chart
936515	
Figure 4	

NELSON GEOTECHNICAL ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS & GEOLOGISTS
17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax 481-2510
Snohomish County (425) 337-1669, Wenatchee/Cholan (509) 665-7696, www.nelsongeotech.com

No.	Date	Revision	By	CK
1	10/12/15	Original	DPN	LSB

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BORING LOG

B-1

Logged by: CJL on 10/2/2015

Approximate Ground Surface Elevation: ~402 ft

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Location (Depth in feet)	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Topsoil							
Brown-gray, silty fine to medium sand with gravel and iron-oxide staining (dense, dry to moist)		SM	44				
-becomes gray-brown			44				
-becomes very dense		SM	18/50 - 5"				
Boring terminated below existing grade at 8.4 feet on 10/2/15. Groundwater seepage was not encountered during drilling.							

5 10 15 20 25

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- * Liquid Limit
- + Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level
- M Moisture Content
- A Atterberg Limits
- G Grain-size Analysis
- DS Direct Shear
- PP Pocket Penetrometer Readings, tons/ft
- P Sample Pushed
- T Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Cove Club Residence Boring Log	NELSON GEOTECHNICAL ASSOCIATES, INC. GEOTECHNICAL ENGINEERS & GEOLOGISTS
936515		17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax 481-2510
Figure 5		Snohomish County (425) 339-1669, Wenatchee/Chelan (509) 665-7696, www.nelsongeotech.com
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No.	Date	Revision	By	CK
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BORING LOG

B-2

Logged by: CJL on 10/2/2015

Approximate Ground Surface Elevation: ~402 ft

Soil Profile			Sample Data		Penetration Resistance (Blows/foot - ●) 10 20 30 40 50 50+ / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Description	Graphic Log	Group Symbol	Blow Count	Sample Location (Depth in feet)			
Topsoil							
Brown-gray, silty fine to medium sand with gravel and iron-oxide staining (medium dense, moist)		SM	27				
-becomes very dense			66				
-becomes gray		SM	26/50 - 5"				
			64				
Boring terminated below existing grade at 11.5 feet on 10/2/15. Groundwater seepage was not encountered during drilling.							

5 10 15 20 25

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level
- M Moisture Content
- A Atterberg Limits
- G Grain-size Analysis
- DS Direct Shear
- PP Pocket Penetrometer Readings, tons/ft
- P Sample Pushed
- T Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Cove Club Residence Boring Log	NELSON GEOTECHNICAL ASSOCIATES, INC.
936515		NGA GEOTECHNICAL ENGINEERS & GEOLOGISTS
Figure 6		17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax 481-2510
Page 1 of 1		Snohomish County (425) 339-1689, Wenatchee/Chelan (509) 665-7696, www.nelsongeotech.com

No.	Date	Revision	By	CK
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BORING LOG

B-3

Approximate Ground Surface Elevation: ~402 ft

Logged by: CJL on 10/2/2015

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Data: Sample Location (Depth in feet)	Penetration Resistance (Blows/foot - ●) / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Topsoil							
Gray-brown, silty fine to medium sand with gravel and iron-oxide staining (very dense, moist)		SM	20/50 - 5"				
-becomes gray			30/44/50 - 3"	5			5
			50 - 6"				
			32/50 - 6"	10			10
Boring met refusal below existing grade at 12.5 feet on 10/2/15. Groundwater seepage was not encountered during drilling.				15			15
				20			20
				25			25

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level
- M Moisture Content
- A Atterberg Limits
- G Grain-size Analysis
- DS Direct Shear
- PP Pocket Penetrometer Readings, tons/ft
- P Sample Pushed
- T Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Cove Club Residence Boring Log	Nelson Geotechnical Associates, Inc.
936515		Geotechnical Engineers & Geologists
Figure 7		17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax 481-2610
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No.	Date	Revision	By	CK
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