



January 25, 2017

G-4149

John and Crystal Leong
9216 – 132nd Avenue NE
Redmond, Washington 98052

Subject: Geotechnical Evaluation of Slope Stabilization Measures
9400 SE 47th Street, Mercer Island, Washington 98040

Dear Mr. and Ms. Leong:

GEO Group Northwest, Inc. has completed its evaluation of the slope stabilization measures you have had performed at your above-subject property (the project site) on Mercer Island, Washington. This work was completed per your request in response to a request from the City of Mercer Island.

SITE LOCATION AND DESCRIPTION

The project site is located on the eastern side of Mercer Island, Washington, on the north side of the 9400 block of SE 47th Street. The site consists of an approximately rectangular-shaped residential lot approximately 20,431 square feet in size. The site has a two-story residence with a basement-level garage and appurtenant at grade patio and decking areas on its west side.

The portion of the site north of the house includes a steeply rising slope. A rockery runs along the base of the slope and has heights that range from less than approximately 2 feet upward to approximately 6 feet. The slope continues upward beyond the north property line of the site onto the adjacent property, and also continues eastward and westward beyond the site property limits.

This slope experienced a debris flow type of landslide in December 2015. The top of the slide area is located near the existing residences on the two properties located immediately north and

northwest from the site (9231 and 9221 SE 46th Street, respectively). The bottom of the slide area is located at the north side of the residence on the site, as illustrated in Plate 2 – Site Plan. Debris from the slide impacted the residence and caused some damage, which subsequently has been repaired.

SITE RECONNAISSANCE

December 6, 2016: Mr. William Chang, P.E., and Mr. Keith Johnson, L.E.G., of our office visited the site to observe and evaluate the existing conditions on the steep slope to the north of the residence at the site. We observed that the debris from the December 2015 landslide had been removed from the site property. The slope area on the adjacent properties upslope to the northwest and north was observed to be covered with plastic sheeting which was secured with sandbags and staking. This area of plastic sheeting also extended onto the northern margin of the site property.

We observed that the storm drainage lines for the residences on the upslope adjacent properties appeared to have been temporarily re-tightlined on the ground surface to a connection to the existing buried storm drain line which runs downslope along an easement on the adjacent property to the west. This portion of storm drain line had been destroyed during the December 2015 landslide.

We observed that the slope areas on the site property have been stabilized by constructing a series of retaining terraces/walls using sand bags. We observed that these terraces/walls had been keyed into the slope and the bags had been neatly and snugly stacked in overlapping vertical sequences. Photographs depicting the sand bag terraces/walls are provided in Attachment 1 to this report.

DESCRIPTION OF SLOPE STABILIZATION MEASURES

The site property owners have taken measures to remove the slide debris from the site and stabilize the slope area which had been disturbed by the December 2015 slide. Based on conversations with the owners and our review of photographic documentation, we understand that debris removal, stabilization of the disturbed slope area, and repairs to the residence were performed during May to July of 2016.

Slope stabilization measures have consisted of the following:

- Covering exposed soils with plastic sheeting to prevent erosion due to precipitation;
- Creating a temporary shallow drainage swale which traverses the disturbed slope area on the northern margin of the site property, to convey potential runoff to a vegetated area for discharge; and
- Constructing several retaining walls using filled sandbags to form a set of terraces in a portion of the disturbed area.

The plastic sheeting was used mostly during the remainder of the wet weather season following the slide event, until the time that the sandbag retaining walls were built. Plastic sheeting, however, remains on the portion of the slope above these walls, pending landscaping and re-vegetation work to be performed after the current wet weather season. Also, plastic sheeting which covers the slope on the adjacent properties to the north and northwest extends onto the site property.

The drainage swale is located on the site property near to the north boundary of the property and at the downslope edge of the plastic sheeting that covers a portion of the northernmost part of the site property. We understand that this feature will be removed after the slope stabilization activities on the upslope adjacent properties are completed and the plastic sheeting covering the upslope areas is removed.

The sandbag retaining walls were constructed during May to July 2016. The sandbags have dimensions of 34 inches by 18 inches by 13 inches and are made from 10x10 weave, 850 denier count polypropylene. The bags are rated as having 1600 hours of ultraviolet (UV) radiation protection against sunlight and are dust-resistant and water-resistant. Sandy soils from the slide debris were used to fill the bags. Sandbag product information is provided in Attachment 2 to this report.

The sandbags were placed in horizontally-level tiers on a prepared subgrade of exposed competent native soils. The filled bags were placed in an overlapping pattern and snugged against adjacent bags by using a tamper to achieve close stacking.

Finished wall heights are 4 feet or less, except for a localized portion of one of the lower walls which has a maximum height of 5 feet. Grade elevations between the walls are indicated on Plate 3 – Site Plan Detail. Photographs showing the construction of the sandbag walls and the completed walls are provided in Attachment 1 to this report. The photograph locations are noted on Plate 3 – Site Plan Detail.

EVALUATION OF SLOPE STABILIZATION MEASURES

In our opinion, the conditions on the portion of the slope located on the site have been stabilized for the current wet weather season. Upon the completion of final landscaping work after the end of the current wet weather season, and the absence of further damaging activity originating from upslope areas beyond the site, it is our opinion that the slope stabilization measures completed on the site will provide long-term stability to the slope area that was disturbed by the December 2015 landslide, provided that the recommendations presented below are properly implemented.

RECOMMENDATIONS

We recommend that the existing sand bag walls be protected from potential degradation by UV radiation from direct sunlight over the long term. Protection can be achieved by 1) placing a cover of at least 4 inches of topsoil or mulching on top of the sandbags, 2) placing a layer of UV-blocking durable material against the exposed faces of the walls, and 3) establishing a dense and permanent vegetation cover over the tops and faces of the walls. The UV-blocking material can consist of a durable shade cloth having at least 90% protection from UV radiation, or a shotcrete and wire mesh facing, or some other appropriate material.

We also recommend that annual inspection of the walls be performed to check for evidence of damage or degradation. If such areas are found, they should be repaired.

We recommend that the subsurface drainage line that was installed along the eastern side of the upper sandbag walls (as noted in Photograph #22 in Attachment 1) should be tightlined to a discharge location at the bottom of the slope. We understand that no water has been observed to be discharging from the line to date, but recommend moving the discharge point downslope as a precaution against potential soil erosion if drainage flow develops in the future.

CONCLUSIONS

In our opinion, the conditions on the portion of the slope located on the site currently are stable. Upon the completion of the above-recommended activities and final landscaping work after the end of the wet weather season, and with the absence of further damaging activity originating

from the upslope area beyond the site, it is our opinion that the slope stabilization measures completed on the site will provide long-term stability to the slope.

CLOSING

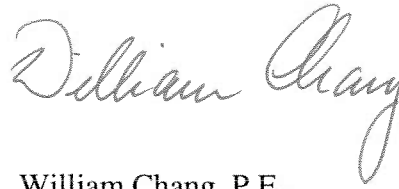
Please feel welcome to contact us if you have any questions regarding this letter.

Sincerely,

GEO GROUP NORTHWEST, INC.



Keith Johnson
Project Geologist



William Chang, P.E.
Principal

Plates and Attachments:

- Plate 1 – Site Location Map
- Plate 2 – Site Plan
- Plate 3 – Site Plan Detail

- Attachment 1 – Photographs
- Attachment 2 – Sandbag Product Information



Source: King County GIS, 2015.



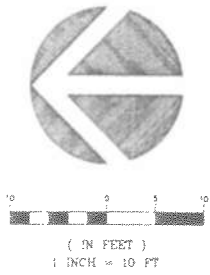
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SITE LOCATION MAP

**SLOPE STABILIZATION EVALUATION
9400 SE 47TH STREET
MERCER ISLAND, WASHINGTON**

SCALE: 1" = 1,000' (±)	DRAWN: KJ	CHECKED: WC	DATE: 1/24/2017	PROJECT NO.: G-4149	PLATE 1
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LIMIT OF DECEMBER 2015
LANDSLIDE (APPROX.)¹

NOTE 1 - Approximate limit of landslide observed February 2016 and indicated on topographic survey for 9221 and 9231 SE 46th Street, Mercer Island, WA, by PLS, Inc., dated August 10, 2016

Source: Topographic & Boundary Survey, Leong Residence, 9400 SE 47th Street, Mercer Island, WA 98040, by Terrane, dated 12/21/16.



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SITE PLAN
SLOPE STABILIZATION EVALUATION
9400 SE 47TH STREET
MERCER ISLAND, WASHINGTON

SCALE	1" = 20'	DRAWN BY	KJ	CHECKED BY	WC	DATE	1/16/2017	PROJECT NO.	G-4149	PLATE	2
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BUILDING
FOOTPRINT AREA=
9400 SE 47
MERCER ISLAND,

LOT 17

LIMIT OF DECEMBER 2015
LANDSLIDE (APPROX.) 1

LEGEND

➔ APPROX. LOCATION AND VIEW DIRECTION OF PHOTOGRAPHS
IN ATTACHMENT 1 OF REPORT (TYP.)

NOTE 1 - Approximate limit of landslide observed February 2016 and indicated on topographic survey for 9221 and 9231 SE 46th Street, Mercer Island, WA, by PLS, Inc., dated August 10, 2016

Source: Topographic & Boundary Survey, Leong Residence, 9400 SE 47th Street, Mercer Island, WA 98040, by Terrane, dated 12/21/16.

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SITE PLAN DETAIL
SLOPE STABILIZATION EVALUATION
9400 SE 47TH STREET
MERCER ISLAND, WASHINGTON

SCALE	1" = 10'	DRAWN BY	KJ	CHECKED BY	WC	DATE	1/19/2017	PROJECT NO.	G-4149	PLATE	3
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ATTACHMENT 1

G-4149

PHOTOGRAPHS



Photo #1: View of the slope behind the residence at the project site (Nov 7 2016).



Photo #2: View of one of the sandbag retaining walls on the lower part of the slope (Nov 7 2016).



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PHOTOGRAPHS

9400 SE 47th STREET
MERCER ISLAND, WASHINGTON

Project No. G-4149

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Date



Photo #3: View of the upper part of the slope on the project site and adjacent upslope properties (Nov 7 2016).



Photo #4: View of one of the sandbag retaining walls on the lower part of the slope (Nov 11 2016).



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PHOTOGRAPHS

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Photo #5: View of tiered sandbag walls on the project site (Nov 11 2016).



Photo #6: Eastward view of the lower sandbag walls (Nov 11 2016).



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Photo #7: View of the upper tiered sandbag walls on the project site (Nov 11 2016).



Photo #8: Downward and eastward view of the upper sandbag walls (Nov 11 2016).



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PHOTOGRAPHS

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Photo #9: Eastward view across slope above tiered sandbag walls, north margin of project site (Nov 11 2016).



Photo #10: Eastward view of drainage berm and plastic sheeting on site property (Nov 11 2016).



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PHOTOGRAPHS

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Photo #11: Eastward view of plastic sheeting and sandbags on adjacent north property (Nov 11 2016).



Photo #12: Sandbag berm and plastic sheeting on northern margin of site and adjacent properties (Nov 11 2016).



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PHOTOGRAPHS

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Photo #13: Sandbag berm and plastic sheeting on northern margin of site and adjacent properties (Nov 11 2016).



Photo #14: Westward view of sandbag berm and plastic sheeting (Nov 11 2016).



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PHOTOGRAPHS

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Photo #15: Downslope view of slide area on site property (Feb 2 2016).



Photo #16: Upslope view of slide area on site and adjacent properties (Feb 9 2016).



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PHOTOGRAPHS

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Photo #18: Construction of upper sandbag walls (May 13 2016).



Photo #17: Construction of upper sandbag walls (May 13 2016).



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PHOTOGRAPHS

160 NW GILMAN BLVD.
ISSAQUAH, WASHINGTON

Project No. E-3521

Made By KJ

Date 3/27/2014



Photo #19: Continued construction of upper sandbag walls (May 17 2016).



Photo #20: Construction of lower sandbag walls (May 25 2016).



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PHOTOGRAPHS

9400 SE 47th STREET
MERCER ISLAND, WASHINGTON

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Date



Photo #22: Subsurface drainage next to upper sandbag walls (Jun 6 2016).



Photo #21: Construction of upper sandbag walls (Jun 2 2016).



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PHOTOGRAPHS

160 NW GILMAN BLVD.
ISSAQUAH, WASHINGTON

Project No. E-3521

Made By KJ

Date 3/27/2014



Photo #23: Completed upper sandbag walls (Jun 22 2016).



Photo #24: Completed lower sandbag walls (May 25 2016).



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PHOTOGRAPHS
9400 SE 47th STREET
MERCER ISLAND, WASHINGTON

Project No. G-4149

Made By KJ

Date

ATTACHMENT 2

G-4149

SANDBAG PRODUCT INFORMATION

Sandbag Specifications used at 9400 SE 47th Street, Mercer Island

Crystal Leong [silverstoneafh@hotmail.com]

Sent: Tuesday, December 27, 2016 9:44 PM

To: kjohnson

Cc: johnle300@hotmail.com

Hello Kevin,

These are the bags I purchased and used. Is there anything else you need from me? Terrance has completed their survey. What is the next step?

Thank-you,
Johnny Leong

HEAVY DUTY BUILD: Hemmed top for easy fill , **DOUBLE-SEWN** bottom for extra strength
HEAVY DUTY MATERIALS: 33 grams each, 850 denier count, 10 x 10 tubular weave
AFFORDABLE, RE-USABLE, VERSATILE: flood protection, construction projects
DESIGNED to be water-resistant, dust-resistant, and pest-resistant sandbags
WHITE color empty sacks , with 1600 HOURS of UVI protection against the sun

Product Information

Size:1000

Technical Details

Technical Details		Additional Information	
Part Number	TDSB14X16	ASIN	B0ILWX17DK
Item Weight	72 pounds	Customer Reviews	114 customer reviews 4.5 out of 5 stars
Product Dimensions	18 x 13 x 34 inches	Best Sellers Rank	#107,034 in Home Improvements (See top 100) #420 in Home Improvement > Power & Hand Tools > Tool Organizers > Tool Bags
Size	1000		
Color	White		
Item Package Quantity	1000		
Batteries Included?	No		

Batteries Required? No

Sent from my iPad Pro

#3,548 in Home Improvement > Storage & Home Organization

Shipping Weight 72 pounds (View shipping rates and policies)

Date First Available November 22, 2014

Warranty & Support

Product Warranty: For warranty information about this product, please click here

Feedback

If you are a seller for this product, would you like to **suggest updates through seller support?**
Would you like to **tell us about a lower price?**