



associated
earth sciences
incorporated

February 8, 2019
Revised April 24, 2019
Project No. 180127E001

Ron Beresky
8100 SE 48th Street
Mercer Island, Washington 98040

Subject: Revised Segmental Block Retaining Wall Design
8100 SE 48th Street
Mercer Island, Washington

Reference: Geotechnical Engineering Report
New Retaining Wall Feasibility
8100 SE 48th Street
Mercer Island, Washington
Date: October 2, 2018

Dear Mr. Beresky:

As requested, Associated Earth Sciences, Inc. (AESI) is pleased to present the attached revised design details, sections, elevations (Figures 1 and 2) and associated calculations for a new terraced Allan Block™ mechanically stabilized earth (MSE) wall system for your property. Our latest design reflects the use of three terraced gravity walls to be constructed with a minimum 2-foot-wide section of “no fines concrete” with a Classic Allan Block facing as shown on Figures 1 and 2, attached.

Our work has been performed in accordance with our proposal, dated October 2, 2018. We have revised our original drawings transmitted to you on October 2, 2018, to reflect design changes based on multiple meetings with your wall construction contractor, Western Landscaping and Pavers. We understand that the City of Mercer Island must approve our design prior to construction.

Global slope stability modeling was completed on critical Section B-B’ (Figure 2) utilizing GeoStudio 2018 R2 software. This program accepts inputs that we provide based on published geologic mapping, available topographic information, our engineering experience in similar soils, and other sources. The model identifies critical slope failure surfaces that are then analyzed to determine

their factor of safety against failure under the input conditions. The factor of safety is a ratio between forces driving slope failure and forces resisting slope failure. A factor of safety of 1.0 is indicative of a failure surface with driving and resisting forces that are equal, and a slope failure is predicted. Factors of safety that exceed 1.0 indicate that resisting forces are greater than driving forces. For new construction, a static factor of safety of 1.5 or more is considered typical. Under design earthquake loads, pseudostatic (dynamic) factors of safety of 1.1 are required for work within the City of Mercer Island. For this project, we modeled the design earthquake using an acceleration of 0.30g or one-half of the Peak Ground Acceleration (PGA) as determined using the United States Geological Survey's (USGS's) online Design Maps tool, which is consistent with local standards of practice for slope modeling applications, in our opinion.

Existing topography inputs for slope stability modeling were developed based on a "Topographic Survey" by Harmsen and Associates, dated May 17, 2018. Slope stability modeling requires soil strength parameters. For this project, the site sediments that were modeled included surficial colluvium and the underlying very dense pre-Olympia till encountered at a depth of approximately 3 feet in two hand borings excavated on March 21, 2019, at the locations shown on Figure 1. Both hand borings encountered 3 feet of loose, silty sand with abundant organic material and roots (colluvium) overlying very dense, gray, silty sand with gravel (native pre-Olympia till). Both hand borings were terminated at a depth of 4 feet in the till due to refusal. We did not generate soil logs of the hand borings.

The model geometry is shown on Figure SS1, attached. For Sections B-B', the footing loads for the proposed deck and existing home were modeled as direct line loads applied at the locations shown on Figure 2 and the slope stability output Figures SS1 through SS4, attached.

Soil parameters used for our stability analyses are summarized on the slope stability model output Figures SS1 through SS4, attached. The composite "no fines concrete" with block facing was modeled with a conservative cohesion value of 2,000 pound per square foot (psf) that would be resistant to internal shearing. Soil parameters used to model the pre-Olympia glacial till deposits are based on the soils encountered in our borings (refer to our referenced geotechnical report), established published correlations, and previous experience with similar soils in the Puget Sound area. The parameters used represent mid-range values of the published information as shown in "Geotechnical Properties of Geologic Materials, Engineering Geology in Washington, Volume I, Bulletin 78, 1989" by Kowalski, J.W., Schwarz, S.D., and Tubbs, D.W.

Based on our slope stability modeling, a minimum static factor of safety of 1.5 was generated with the failure circle primarily involving the surficial colluvium (Figure SS2). Under seismic conditions, the minimum factor of safety involving failure circles in the pre-Olympia till is 1.1 (Figure SS3). Based on the modeling, it is likely that surficial land sliding similar to what has occurred on the property in the past could occur during a design level earthquake (Figure SS4). However, these failure circles are confined to the surface colluvium below the proposed new walls. Therefore, it is imperative that the lowest tier of the wall system is founded in competent, undisturbed pre-

Olympia till and that the wedge of soil at the toe of the proposed walls must be constructed in accordance with the sections shown on Figures 1 and 2 with either sufficiently compacted crushed rock or concrete.

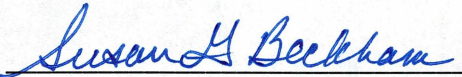
The attached design calculations for Sections A-A' through C-C' were completed utilizing the software program AB Walls™ version 19.00.08 - 4/15/2019. Our latest design reflects the use of three terraced gravity walls to be constructed with a minimum 2-foot-wide section of “no fines concrete” with a Classic Allan Block facing as shown on Figures 1 and 2, attached. AB Walls™ software output for Sections A-A' through C-C' is also attached to this letter.

We modeled the loading from the upper gravity walls as a 600 psf uniform surcharge pressure starting 4 feet behind the lower-most wall. For Sections B-B' and C-C', the deck foundation was superimposed on the upper terrace loads as a 1,000 psf line load. On Section B-B', this line load does not appear to influence the loading on the base wall because of its positioning a minimum horizontal distance of 12 feet from the bottom wall, although it was included in the calculation. Section C-C' also includes a surcharge pressure for the proposed 2H:1V (Horizontal:Vertical) slope to be constructed above the wall in addition to the deck foundation load (Figure 2). As demonstrated by the AB Walls software output, the proposed configuration demonstrates adequate factors of safety for sliding and overturning under static and seismic (earthquake) loading conditions.

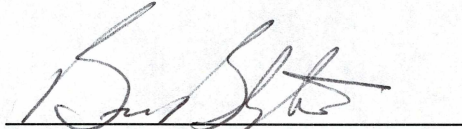
Our design is predicated on AESI being present onsite full-time during wall construction to verify bearing soils have been exposed in the foundation cut for all terraces, during no fines concrete and drainage installation, and during installation during backfill of the area at the toe of the new wall system. All soils excavated from the site must be removed from the site and specifically not placed on the slope beneath the new walls. In addition, surface and groundwater must be controlled at all times and must not be allowed to flow over the on- or off-site slopes under any circumstances. If utilities are identified within the slope that will conflict with our design, we should be notified prior to commencement of any further work. All work must be performed during the dry summer months between May and September unless specific permission is granted by the City of Mercer Island.

We appreciate the opportunity to be of continued service to you on this project. Should you have any questions regarding the attached documents, please call us at your earliest convenience.

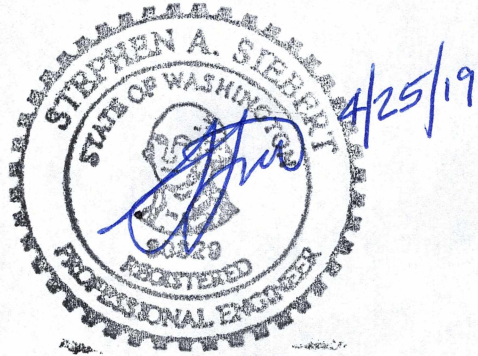
Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington



Susan G. Beckham, P.E.
Senior Geotechnical Engineer

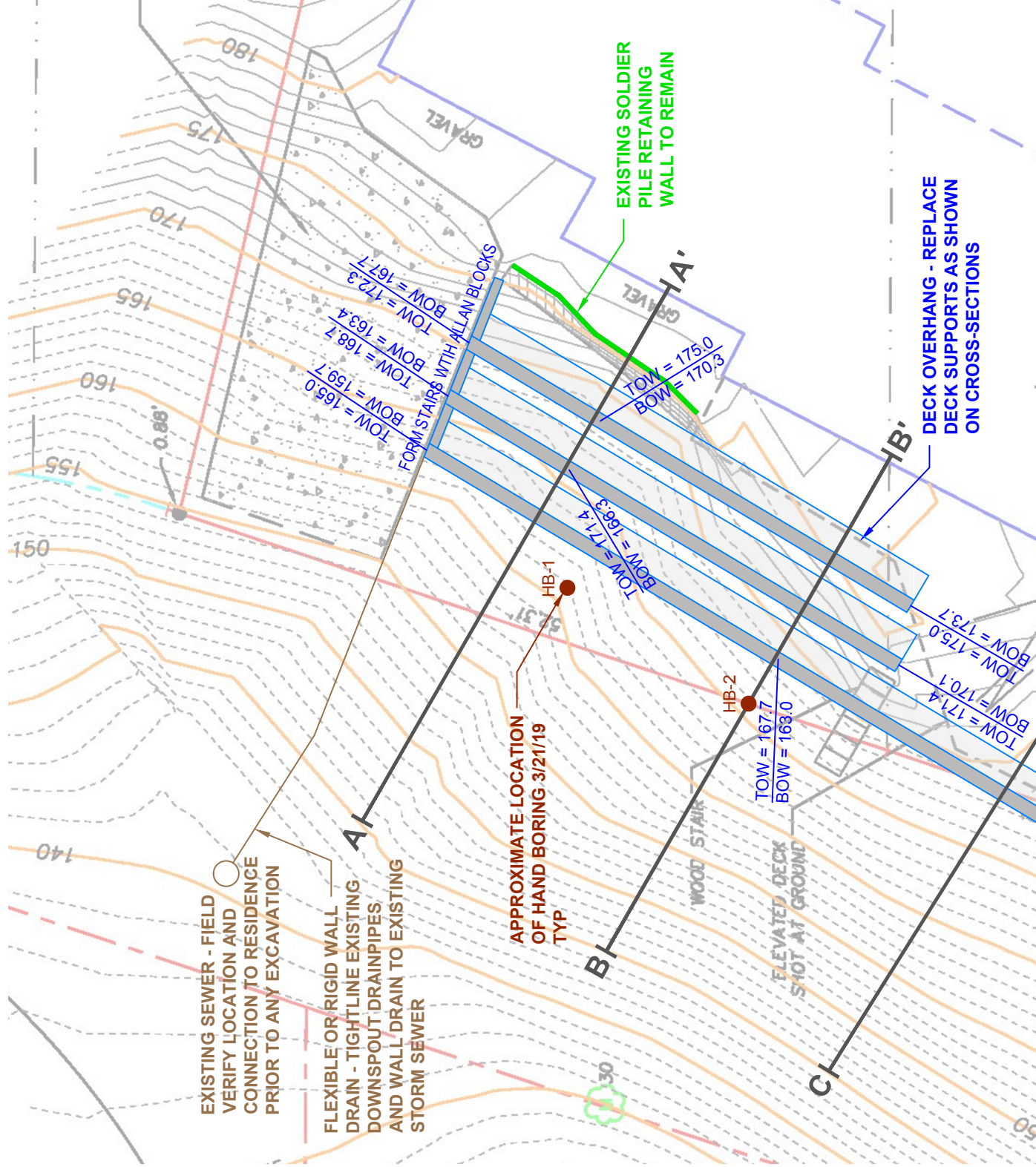


Bruce L. Blyton, P.E.
Senior Principal Engineer



Stephen A. Siebert, P.E.
Associate Geotechnical Engineer

Attachments: Figures 1 & 2: Allan Block Wall, Beresky Residence -
8100 SE 48th Street, Mercer Island, Washington
Figures SS1-SS4: Slope Stability Output
AB Walls™ computer analysis output Sections A-A' through C-C'



EXISTING SEWER - FIELD
VERIFY LOCATION AND
CONNECTION TO RESIDENCE
PRIOR TO ANY EXCAVATION

FLEXIBLE OR RIGID WALL
DRAIN - TIGHTLINE EXISTING
DOWNSPOUT DRAINPIPES
AND WALL DRAIN TO EXISTING
STORM SEWER

APPROXIMATE LOCATION
OF HAND BORING 3/21/19
TYP

EXISTING SOLDIER
PILE RETAINING
WALL TO REMAIN

DECK OVERHANG - REPLACE
DECK SUPPORTS AS SHOWN
ON CROSS-SECTIONS

FORM STAIRS WITH ALLAN BLOCKS

WOOD STAIR

ELEVATED DECK
SHOT AT GROUND

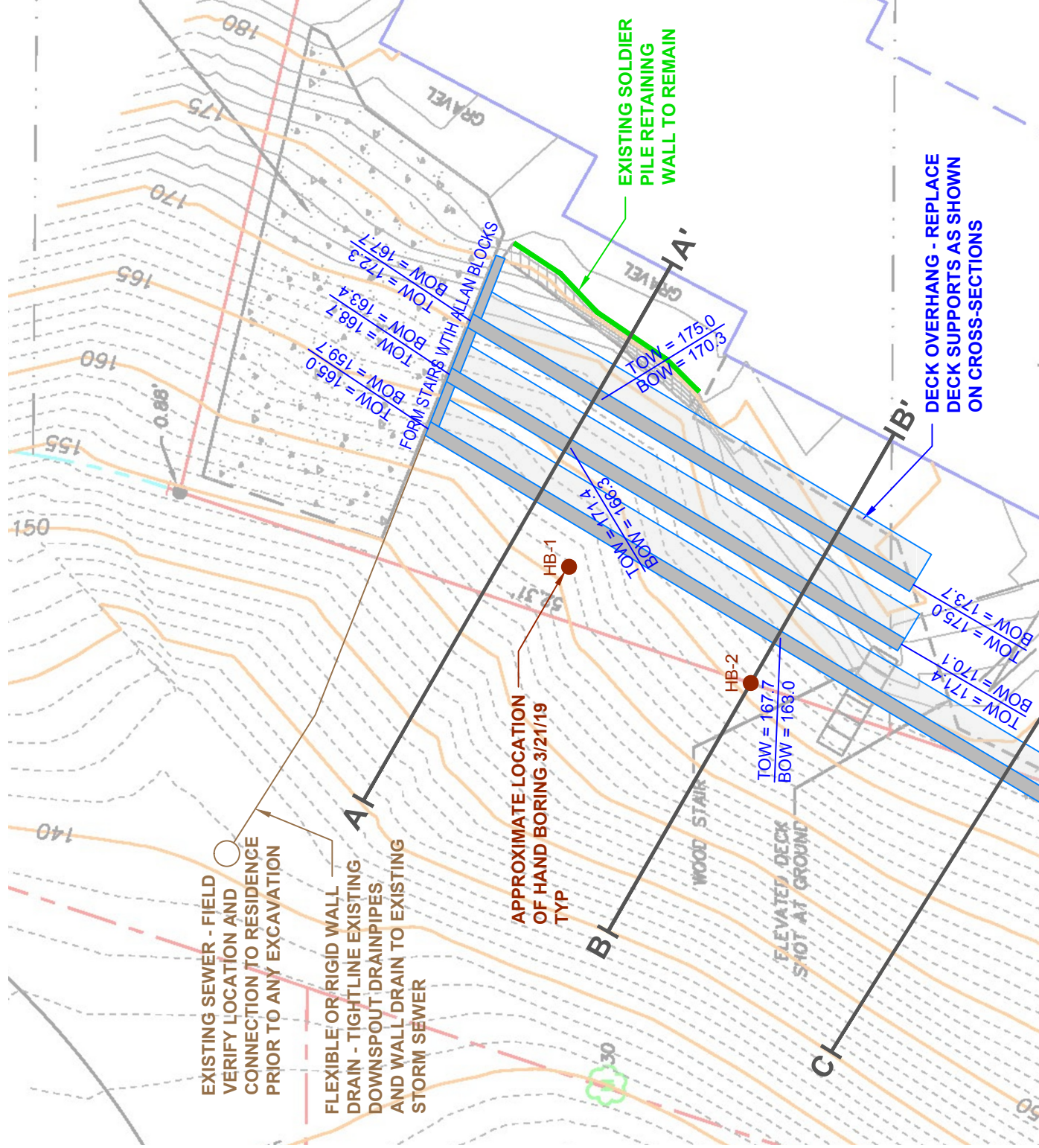
A-A

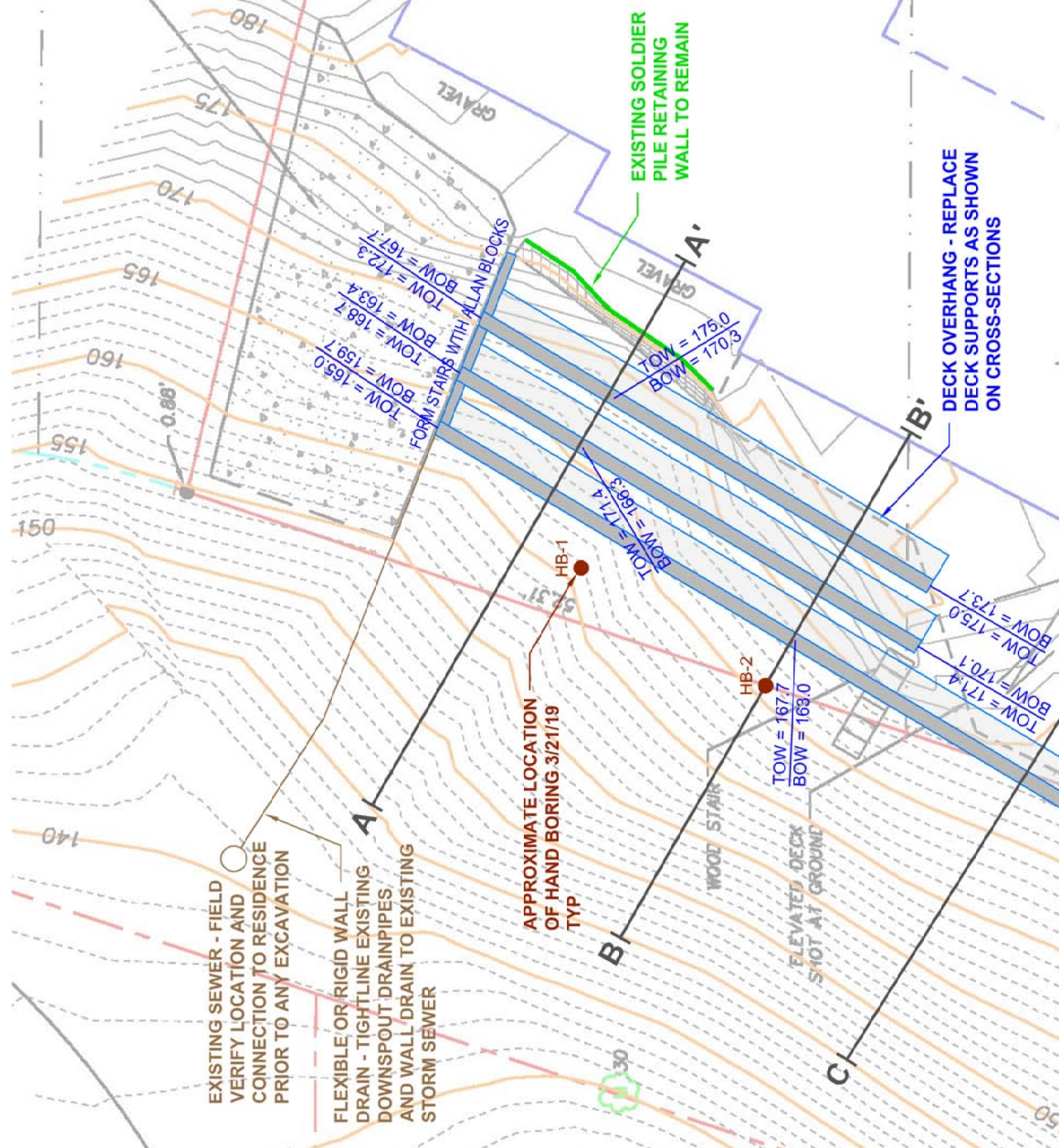
B-B

C-C

A-A'

B-B'



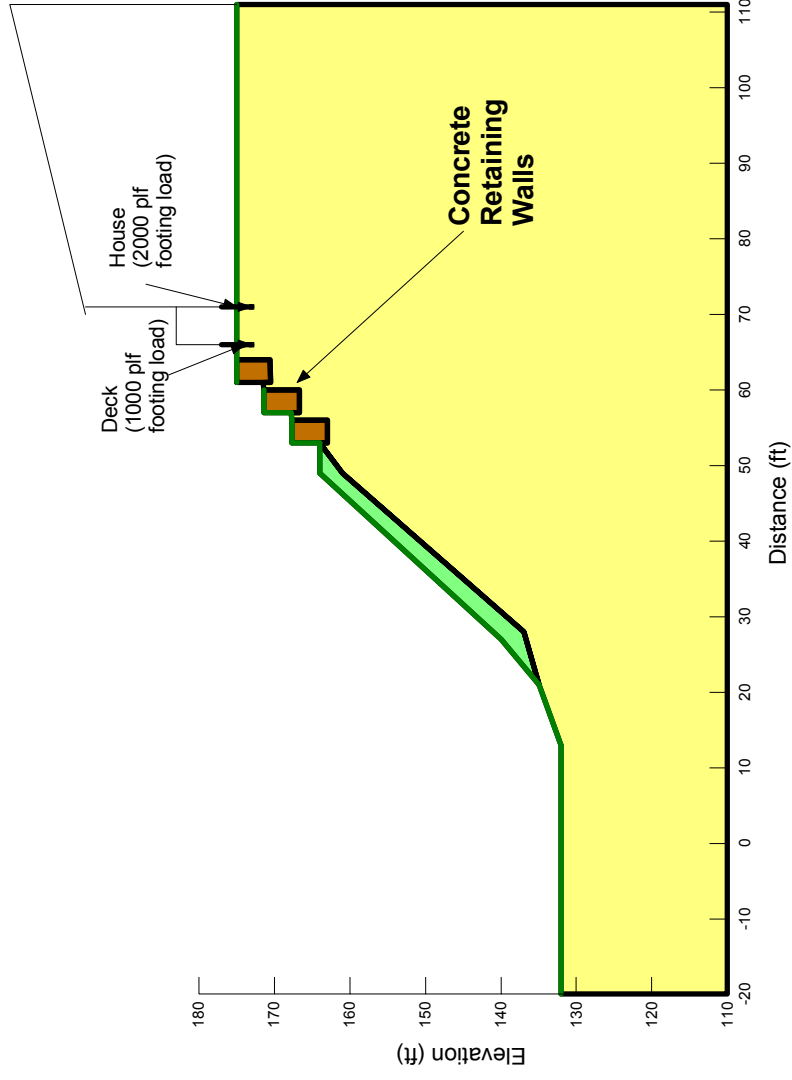


Beresky Retaining Walls 180127E001 Critical Section B-B'

Slope Geometry

Figure SS1 - 4/19/19

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
Green	colluvium	110	0	30	0
Brown	concrete walls	135	2,000	0	0
Yellow	pre-Olympia Till	120	500	32	0

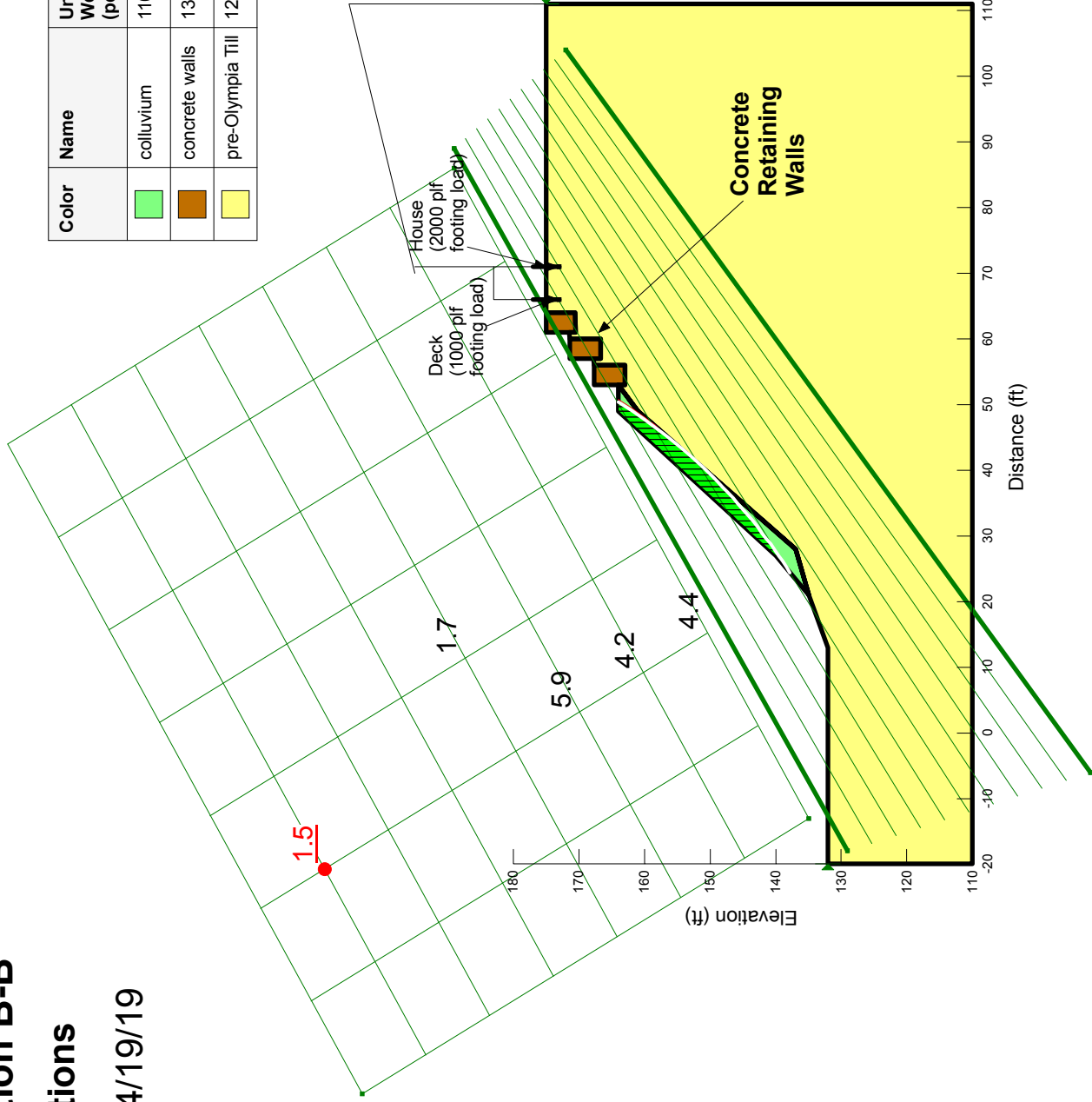


Beresky Retaining Walls 180127E001 Critical Section B-B'

Static Conditions

Figure SS2 - 4/19/19

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
	colluvium	110	0	30	0
	concrete walls	135	2,000	0	0
	pre-Olympia Till	120	500	32	0

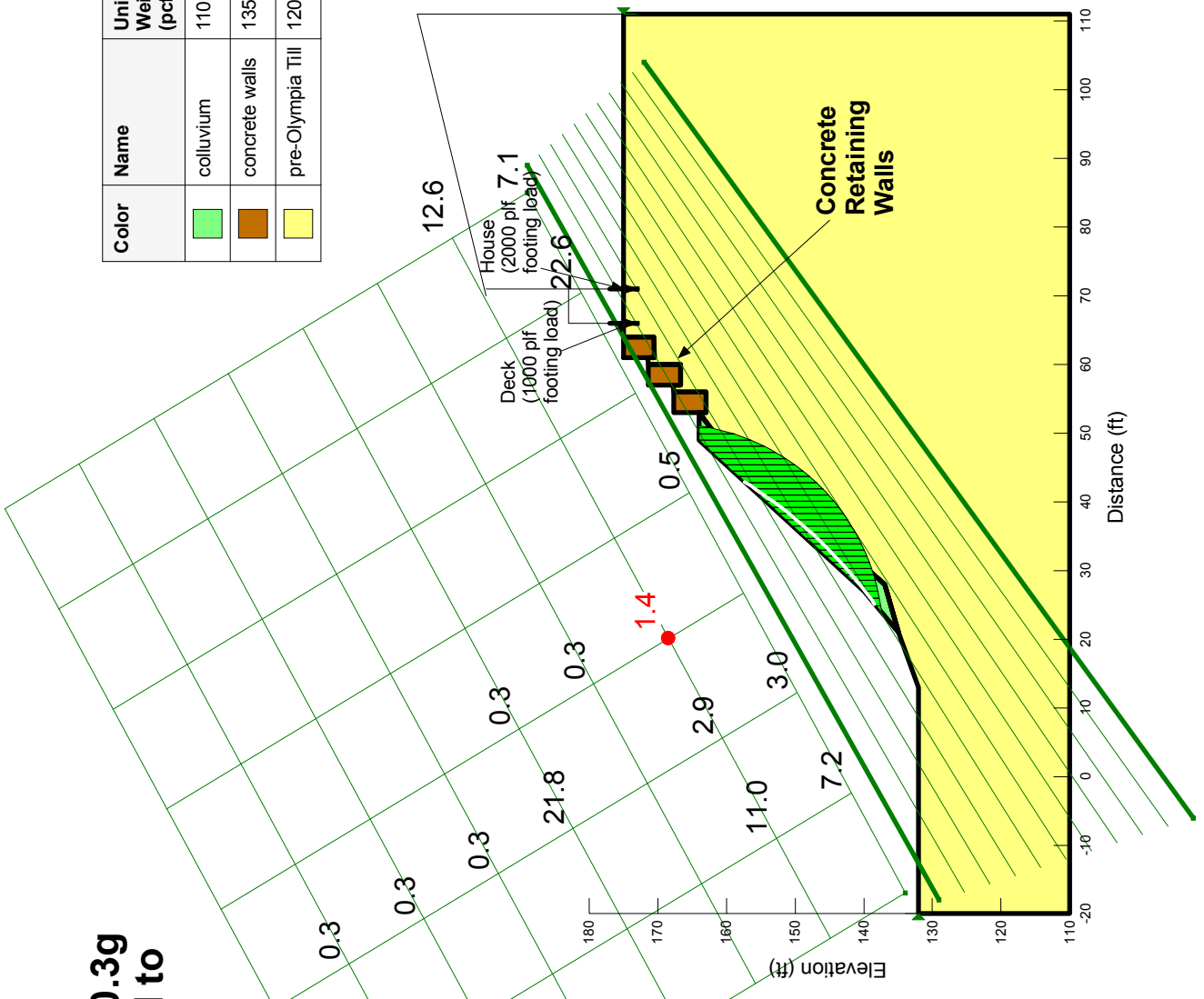


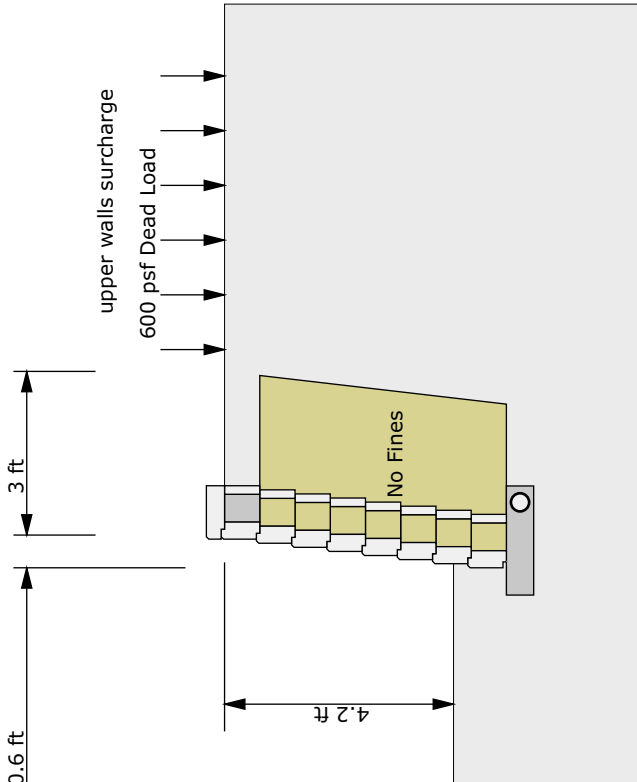
**Beresky Retaining Walls
180127E001
Critical Section B-B'**

**Seismic Conditions - 0.3g
All FOS < 1.1 confined to
colluvium**

Figure SS3 - 4/19/19

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Phi-B (°)
Green	colluvium	110	0	30	0
Brown	concrete walls	135	2,000	0	0
Yellow	pre-Olympia Till	120	500	32	0



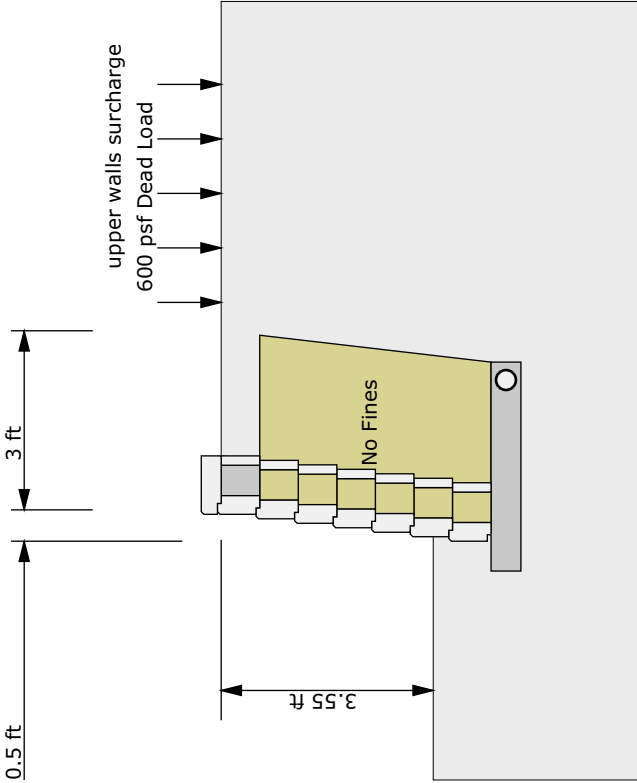


AB Classic
Section A-A'
 Base Information:
 Base Width: 2 ft
 Base Depth: 0.5 ft
 Base From Toe: 0.5 ft

Allan Block Disclaimer:
 Allan Block provides this software as a service for its clients. The sole purpose of this software is to assist engineers in the design of mechanically stabilized retaining walls. The software uses evaluation techniques and engineering principles found in the Allan Block Engineering Manual. (Refer to R909s and supporting references). It is the responsibility of the engineer of record to determine the applicability of the software to the project. IT'S LICENSEES OR AGENTS DO NOT ASSUME ANY LIABILITY OR RESPONSIBILITY FOR DAMAGES WHICH MAY RESULT FROM THE USE OR MISUSE OF THIS SOFTWARE.
 This software only considers internal, external and internal compound stability of the reinforced composite mass. The internal compound stability calculations are limited to an evaluation zone above the base material and back no further than 2 * H or the +, - limits for internal compound stability. Global Stability should be evaluated to determine if the overall site is stable. It is the responsibility of the owner to ensure the global stability is analyzed. The engineer of record must evaluate the project site for proper design and construction. The engineer of record should provide a full global stability opinion of the site including the effects on the segmental retaining wall.
 AB Walls contains DEFAULT values for all data inputs that the user MUST change or verify as appropriate for the project conditions being analyzed. These DEFAULT values do NOT ensure a conservative design for any site condition. The final design must provide for proper construction and installation. The software does not provide any warranty over the software values or the design of the wall. Proper design and construction of the retaining wall is the responsibility of the engineer of record. It is also recommended that an independent assessment of the foundation soil for settlement potential and wall deflections for the proposed structure be performed. Changes in the subsurface conditions are not included in the design. The engineer of record should consult with the geotechnical engineer. All installations must conform to the Allan Block Spec Book. (Refer to R909i).
 MathCAD files for hand calculations to support the software's consideration of internal, external and internal compound stability of the reinforced composite mass are provided on this software disc. These files are to be configured so that the engineer of record can evaluate the output of the software. Individual equations may be altered at the discretion of the engineer of record.

Wall Design Variables	
AB Classic	Total Panel Height 5.17 ft Block Height 0.646 ft Angle of Setback 6 Deg. Depth of Block 0.98 ft Length of Block 1.47 ft
Surcharge Parameters	600 psf Dead Load @ 4 ft (Distance measured from toe of wall)
Safety Factors Static External	Actual Sliding 1.53 > = 1.5 Actual Overturning 2.6 > = 2
Safety Factors Seismic External	Peak Ground Acceleration = 0.3 Actual Sliding 1.16 > = 1.125 Actual Overturning 1.84 > = 1.5
Infill Soil	Friction Angle 75 Deg. Unit WT 110 pcf
Retained Soil	Friction Angle 32 Deg. Unit WT 120 pcf
Foundation Soil	Friction Angle 32 Deg. Unit WT 120 pcf Cohesion 0 psf
Bearing Capacity	Factor of Safety 4.37 Sigma ult - 6727.47 psf Sigma max - 1539.2 psf
Internal Compound Stability	ics not calculated
Wall Rock Requirements	Variable Height 4.52 ft Depth 1 ft

Project Name: Beresky Residence
 Location: Section A-A'
 Location: Mercer Island, WA
 Wall Number:
 Project Number: 180127E001
 Designer: AESI
 Date: 4/18/19



AB Classic
Section B-B'
 Base Information:
 Base Width: 3.5 ft
 Base Depth: 0.5 ft
 Base From Toe: 0.5 ft

Allan Block Disclaimer:
 Allan Block provides this software as a service for its clients. The sole purpose of this software is to assist engineers in the design of mechanically stabilized retaining walls. The software uses evaluation techniques and engineering principles found in the Allan Block Engineering Manual. (Refer to R909s and supporting references). It is the responsibility of the engineer of record to determine the appropriateness of the software for the project. IT'S LICENSEES OR AGENTS DO NOT ASSUME ANY LIABILITY OR RESPONSIBILITY FOR DAMAGES WHICH MAY RESULT FROM THE USE OR MISUSE OF THIS SOFTWARE.

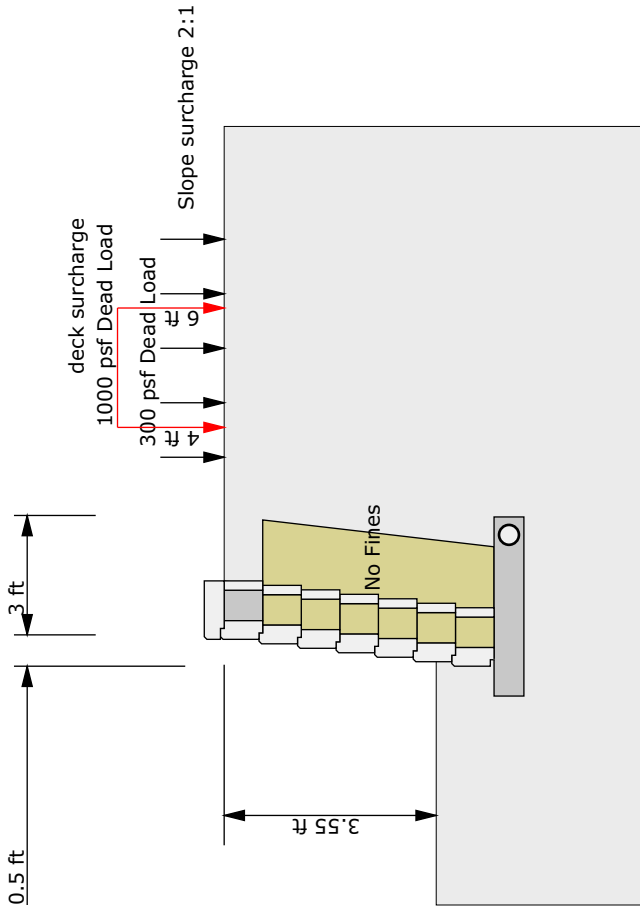
This software only considers internal, external and internal compound stability of the reinforced composite mass. The internal compound stability calculations are limited to an evaluation zone above the base material and back no further than 2 * H or the +L limits for internal compound stability. Global Stability should be evaluated to determine if the overall site is stable. It is the responsibility of the owner to ensure the global stability is analyzed. The engineer of record must evaluate the project site for proper engineering firm contracted by the owner should provide a full global stability opinion of the site including the effects on the segmental retaining wall.

AB Walls contains DEFAULT values for all data inputs that the user MUST change or verify as appropriate for the project conditions being analyzed. These DEFAULT values do NOT ensure a conservative design for any site condition. The final design must provide for proper consideration of the specific site conditions over the entire height of the wall. The software does not provide for additional input or modification to the existing design. The software is provided as a design tool from this software and is not intended to be used as a design tool. It is also recommended that an independent assessment of the foundation soil for settlement potential and wall deflections for the proposed structure be performed. Changes in the soil conditions are not included in the design. The engineer of record must ensure that the design is consistent with the construction and may require site inspection by the on-site soil engineer. All installations must conform to the Allan Block Spec Book. (Refer to R909i).

MathCAD files for hand calculations to support the software's consideration of internal, external and internal compound stability of the reinforced composite mass are provided on this software disc. These files are to be configured so that the engineer of record can evaluate the output of the software. Individual equations may be altered at the discretion of the engineer of record.

Wall Design Variables	
AB Classic	Total Panel Height 4.52 ft Block Height 0.646 ft Angle of Setback 6 Deg. Depth of Block 0.98 ft Length of Block 1.47 ft
Surcharge Parameters	600 psf Dead Load @ 4 ft 1000 psf Dead Load: 12 ft - 13 ft (Distance measured from toe of wall)
Safety Factors Static External	Actual Sliding 1.68 >= 1.5 Actual Overturning 3.34 >= 2
Safety Factors Seismic External	Peak Ground Acceleration = 0.3 Actual Sliding 1.27 >= 1.125 Actual Overturning 2.34 >= 1.5
Infill Soil	Friction Angle 75 Deg. Unit WT 110 pcf
Retained Soil	Friction Angle 32 Deg. Unit WT 120 pcf
Foundation Soil	Friction Angle 32 Deg. Unit WT 120 pcf Cohesion 0 psf
Bearing Capacity	Factor of Safety 8.3 SigmaUlt - 8709.49 psf SigmaMax - 1049.35 psf
Internal Compound Stability	ics not calculated
Wall Rock Requirements	Variable Height Depth Bottom 3.87 ft 1 ft

Project Name: Beresky Residence
 Location: Section B-B'
 Location: Mercer Island, WA
 Wall Number: 180127E001
 Project Number: 180127E001
 Designer: AESI
 Date: 4/18/19



AB Classic
Section C-C
 Base Information:
 Base Width: 3 ft
 Base Depth: 0.5 ft
 Base From Toe: 0.5 ft

Allan Block Disclaimer:
 Allan Block provides this software as a service for its clients. The sole purpose of this software is to assist engineers in the design of mechanically stabilized retaining walls. The software uses evaluation techniques and engineering principles found in the Allan Block Engineering Manual. (Refer to R909s and supporting references). It is the responsibility of the engineer of record to determine the applicability of the software to the project. IT'S LICENSEES OR AGENTS DO NOT ASSUME ANY LIABILITY OR RESPONSIBILITY FOR DAMAGES WHICH MAY RESULT FROM THE USE OR MISUSE OF THIS SOFTWARE.

This software only considers internal, external and internal compound stability of the reinforced composite mass. The internal compound stability calculations are limited to an evaluation zone above the base material and back no further than 2 * H or the +L, whichever is less, from the face of the wall. Global Stability should be evaluated to determine if the overall site is stable. It is the responsibility of the owner to ensure the global stability is analyzed. The engineer of record must evaluate the project site for proper engineering of the retaining wall. The engineer of record should provide a full global stability opinion of the site including the effects on the segmental retaining wall.

AB Walls contains DEFAULT values for all data inputs that the user MUST change or verify as appropriate for the project conditions being analyzed. These DEFAULT values do NOT ensure a conservative design for any site condition. The final design must provide for proper consideration of the specific site conditions over the entire height of the wall. The software does not provide for additional input or modification to the existing design. The software does not provide for design from this software being used for installation otherwise noted by the engineer of record. It is also recommended that an independent assessment of the foundation soil for settlement potential and wall deflections for the proposed structure be performed. Changes in the soil conditions are not included in the design. The engineer of record should provide a full global stability opinion of the site including the effects on the construction and may require site inspection by the on-site soil engineer. All installations must conform to the Allan Block Spec Book. (Refer to R909i).

MathCAD files for hand calculations to support the software's consideration of internal, external and internal compound stability of the reinforced composite mass are provided on this software disc. These files are to be configured so that the engineer of record can evaluate the output of the software. Individual equations may be altered at the discretion of the engineer of record.

Wall Design Variables	
AB Classic	Total Panel Height 4.52 ft Block Height 0.646 ft Angle of Setback 6 Deg. Depth of Block 0.98 ft Length of Block 1.47 ft
Surcharge Parameters	300 psf Dead Load @ 3.5 ft 1000 psf Dead Load: 4 ft - 6 ft (Distance measured from toe of wall)
Safety Factors Static External	Actual Sliding 1.54 >= 1.5 Actual Overturning 4.53 >= 2
Safety Factors Seismic External	Peak Ground Acceleration = 0.3 Actual Sliding 1.15 >= 1.125 Actual Overturning 2.63 >= 1.5
Infill Soil	Friction Angle 75 Deg. Unit WT 110 pcf
Retained Soil	Friction Angle 32 Deg. Unit WT 120 pcf
Foundation Soil	Friction Angle 32 Deg. Unit WT 120 pcf Cohesion 0 psf
Bearing Capacity	Factor of Safety 9.69 SigmaUlt - 8048.82 psf SigmaMax - 830.76 psf
Internal Compound Stability	ics not calculated
Wall Rock Requirements	Variable Height Depth Bottom 3.87 ft 1 ft

Project Name: Beresky Residence
 Location: Section C-C
 Location: Mercer Island, WA
 Wall Number: 180127E001
 Project Number: 180127E001
 Designer: AESI
 Date: 4/18/19