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earth sciences
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November 14, 2025
Project No. 20210371E001

Herzl-Ner Tamid Conservative Congregation
3700 East Mercer Way
Mercer Island, Washington 98040

Attention: Audrey Covner

Subject: Recommendations for Temporary Soldier Pile Shoring Wall Design
Barnabie Point Project
Herzl-Ner Tamid Conservative Congregation
3700 East Mercer Way
Mercer Island, Washington

Reference: Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report
Herzl-Ner Tamid Conservative Congregation K-8 Expansion
3700 East Mercer Way
Mercer Island, Washington
AESI Report dated December 12, 2024

Dear Audrey Covner:

Associated Earth Sciences, Inc. (AESI) is pleased to present this letter summarizing our understanding and geotechnical design recommendations for the proposed temporary soldier pile shoring wall as part of the above-referenced project. This letter should be read in conjunction with our above-referenced geotechnical report, dated December 12, 2024.

Project Understanding

Due to spatial constraints near the northern property line, we understand that the northwest corner of the project will require a temporary shoring wall to retain the excavation required to reach the bottom of excavation (BOE) for the below-grade portion of the building. The approximate alignment of the shoring wall and locations of exploration borings completed by AESI along with approximate elevations to reach suitable native bearing soils is provided on the "Mass Excavation and TESC Plan," Sheet C2.0, attached to this letter. Based on the nearest boring EB-4, site excavations will range from about 10 to 16 feet below existing grade in this area to reach suitable native bearing soils for building foundation support. We anticipate that a

cantilever soldier pile wall with timber lagging will be suitable for the excavations needed in this area. Our design recommendations are provided below.

Recommendations for Temporary Soldier Pile Shoring Wall Design

Based on our review of the civil plan set prepared by Jacobson Consulting Engineers, dated June 4, 2025, the planned BOE for mass excavation at the northwest corner of the site is about 91.3 feet and the planned bottom of footing (BOF) for the building is about 90.5 feet. Existing site grade elevations along the proposed shoring wall alignment range from about 98 to 101 feet. Based on exploration EB-4, we anticipate that the soldier pile wall will retain excavations that extend down to an elevation ranging from 85 to 88 feet (as further discussed below), corresponding to a maximum retained wall height of about 16 feet. The shoring walls will retain existing site grades ranging from approximately level to minus 20 percent backslopes and there appears to be no surcharge loads imposed on the walls from existing structures.

Anticipated Subsurface Conditions

We reviewed nearby exploration EB-4, located just south of the shoring wall alignment, and the subsurface soils generally consisted of existing fill (loose silty sand) underlain by native, glacially consolidated, pre-Fraser fine-grained sediments (primarily very stiff to hard silt) beginning at a depth of about 12 to 15 feet below the existing ground surface. The ground surface elevation at this boring location is estimated at 100 feet; therefore, the elevation to reach suitable bearing soils is estimated at 85 to 88 feet. The exploration log for EB-4 is attached to this letter for reference. Where site excavations are required to be extended below the planned BOF to reach suitable native bearing soils, the building foundations will be supported on new structural fill, as discussed in our referenced geotechnical report.

Geotechnical Parameters for Cantilever Soldier Pile Wall Design

Cantilever soldier pile systems typically consist of wide-flange steel soldier piles placed in predrilled holes that extend beyond the BOE. The portion of each soldier pile extending below the BOE is grouted in place with sufficient-strength concrete to transmit the vertical loads of the soldier beams to the soil below the excavation level. The upper portion of the soldier pile is then backfilled with a relatively weak grout so that it may be removed, as necessary, for placement of lagging. Lagging is recommended throughout the excavation. We recommend that timber lagging be backfilled with a flowable "lean-mix" sand during installation to reduce the potential for movement of the cut soil and provide drainage behind the wall. The lagging should span a maximum distance of 8 feet between soldier piles. A 50-percent reduction of the lateral pressures presented subsequently can be used for timber lagging design to account for soil arching.

We recommend designing the wall using an “active” equivalent fluid pressure presented as a triangular distribution, where H is the retained excavation depth. We recommend an active pressure of 40 pounds per cubic foot (pcf) for the existing fill soils (loose silty sand), and an active pressure of 25 pcf for the underlying pre-Fraser sediments (very stiff to hard silt). The soldier piles need to be located a sufficient depth below the BOE to provide adequate lateral and overturning resistance to horizontal loads. In this regard, the lateral resistance may be computed on the basis of passive pressure in the form of an allowable “passive” earth pressure equivalent to 300 pcf for the very stiff to hard pre-Fraser fine-grained sediments, where D is the depth of embedment below the BOE. This pressure may be considered to be acting against twice the diameter of the grouted soldier pile section. The passive earth pressure should be ignored (truncated) for the upper 2 feet below the BOE. Refer to the attached Figure W1 for additional design details and a graphical representation of the recommended lateral earth pressures for structural design of the soldier pile wall system.

The apparent pressure distribution should be assumed to act over the tributary area of the piles above the excavation base and one concreted pile diameter below the base. The use of apparent “active” earth pressure for the shoring system assumes some minor deformation of the soil will occur. Typically, deformation on the order of 0.001 to 0.002 times the height of the excavation is possible. This could result in deflections on the order of about 0.25 to 0.5 inches for a 16-foot-tall wall. Theoretically, an equal amount of settlement occurs behind the wall. The settlement is typically greatest immediately adjacent to the wall and decreases with distance away from the wall. The limits of settlement are typically within a distance of one-half to one wall height behind the top of wall.

Monitoring Program

With all excavations, ground displacement will occur behind the earth support system as a result of changes in stresses within the soil mass. The magnitudes of the displacements depend on the properties of the soil, design lateral earth pressure, the sequence, stages, and depth of excavation, wall stiffness, groundwater, and general quality of the excavation and shoring installation. Therefore, a survey program should be established to monitor the horizontal and vertical movement of the excavation sidewalls and the installed shoring wall. This monitoring program may be required by the City of Mercer Island. The monitoring should be performed by a licensed surveyor with monitoring points established on settlement-sensitive structures (manholes, hardscapes, poles, etc.) around the excavation and at regular intervals along the shoring wall. Monitoring should be performed at least twice a week and the specifics of the monitoring program should be provided to AESI for review prior to implementation. We recommend the monitoring program be prepared as part of the final shoring wall design.

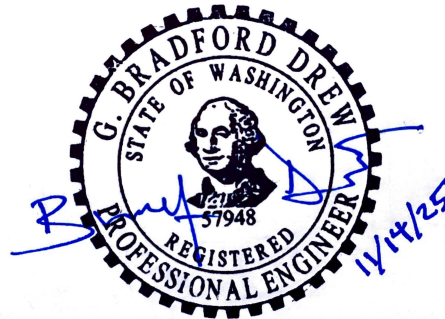
CLOSURE

We appreciate the opportunity to continue assisting the design team in this phase of the project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington



Matthew A. Miller, P.E.
Principal Engineer



G. Bradford Drew, P.E.
Associate Engineer

ATTACHMENTS

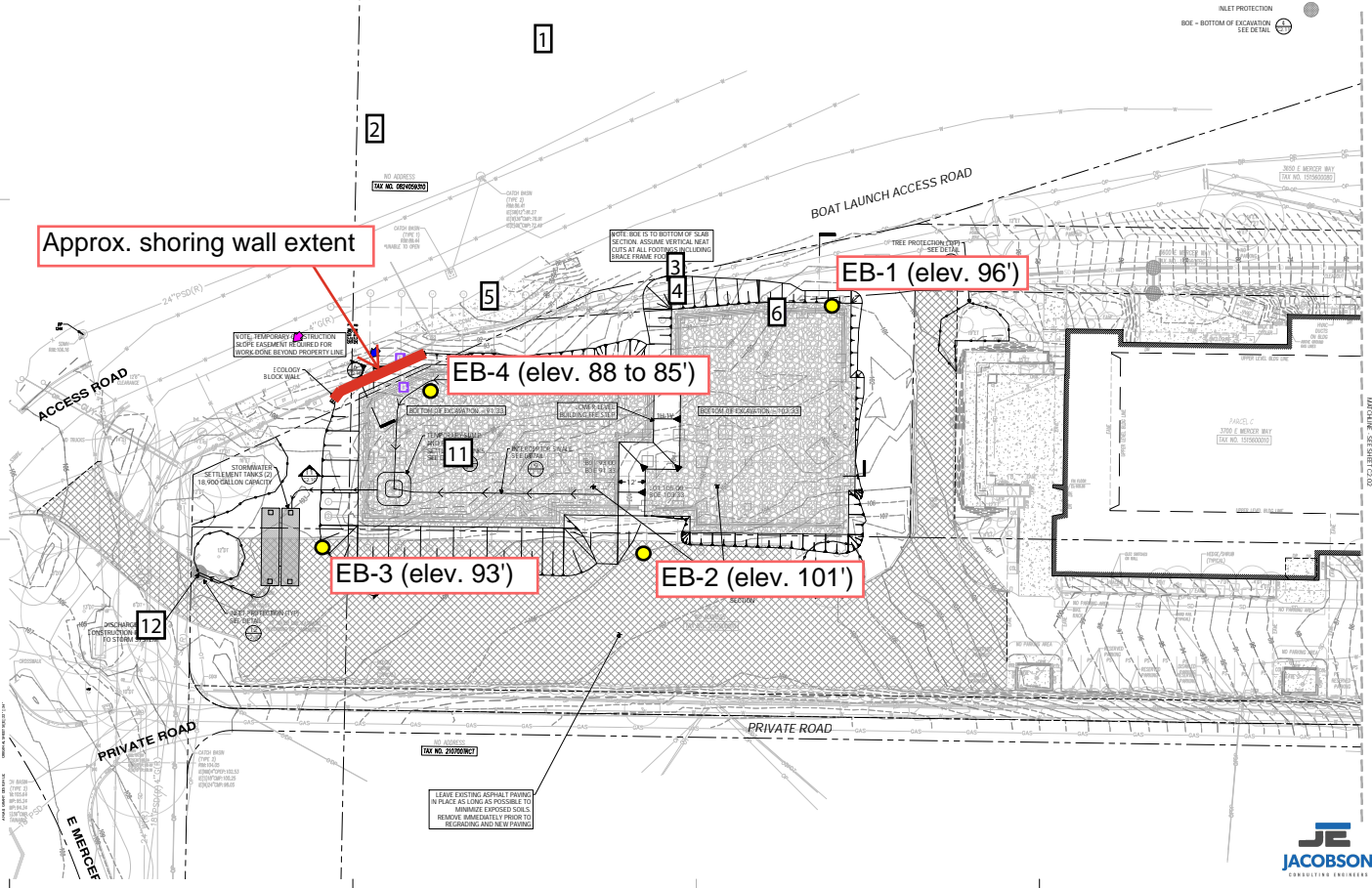
Civil Plan Sheet C2.0 – Mass Excavation and TESC Plan
Exploration Log EB-4
Figure W1 – Temporary Cantilever Soldier Pile Wall Design Criteria

Note:

● = AESI Boring No. (estimated elevation to suitable native bearing soils)

Call before you dig 8-1-1
 SCALE 1" = 20'
 811

LEGEND
 ○ TREE PROTECTION
 ⊕ SALT FENCE
 ⊖ INLET PROTECTION
 ⊕ BOX - BOTTOM OF EXCAVATION SEE DETAIL



347 BARNABIE WAY
 BARNABIE, MA 01930
 508-548-1000
 www.jacobson-engineers.com

ananti grant design llc

3704 EAST ABERDEEN WAY
 BARNABIE POINT PROJECT

NO. DATE DESCRIPTION
 4 JUNE 2025
 BUILDING PERMIT

PROJECT
 MASS EXCAVATION AND TESC
 PLAN

C2.0

JE
 JACOBSON
 CONSULTING ENGINEERS

Coarse-Grained Soils - More than 50% ⁽¹⁾ Retained on No. 200 Sieve	Gravels - More than 50% ⁽¹⁾ of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines ⁽²⁾	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
			GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
Sands - 50% ⁽¹⁾ or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines ⁽²⁾	SW	Well-graded sand and sand with gravel, little to no fines	
		SP	Poorly-graded sand and sand with gravel, little to no fines	
		SM	Silty sand and silty sand with gravel	
		SC	Clayey sand and clayey sand with gravel	
Fine-Grained Soils - 50% ⁽¹⁾ or More Passes No. 200 Sieve	Sils and Clays Liquid Limit Less than 50	ML	Silt, sandy silt, gravelly silt, silt with sand or gravel	
		CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay	
		OL	Organic clay or silt of low plasticity	
	Sils and Clays Liquid Limit 50 or More	MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt	
		CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel	
		OH	Organic clay or silt of medium to high plasticity	
Highly Organic Soils		PT	Peat, muck and other highly organic soils	

Terms Describing Relative Density and Consistency

Coarse-Grained Soils	<u>Density</u>	<u>SPT⁽³⁾blows/foot</u>	Test Symbols G = Grain Size M = Moisture Content A = Atterberg Limits C = Chemical DD = Dry Density K = Permeability
	Very Loose	0 to 4	
	Loose	4 to 10	
	Medium Dense	10 to 30	
	Dense	30 to 50	
Fine-Grained Soils	Very Dense	>50	
	<u>Consistency</u>	<u>SPT⁽³⁾blows/foot</u>	
	Very Soft	0 to 2	
	Soft	2 to 4	
	Medium Stiff	4 to 8	
	Stiff	8 to 15	
Very Stiff	15 to 30		
Hard	>30		

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

(4) Estimated Percentage

Component	Percentage by Weight
Trace	<5
Some	5 to <12
<i>Modifier</i> (silty, sandy, gravelly)	12 to <30
Very <i>modifier</i> (silty, sandy, gravelly)	30 to <50

Moisture Content

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

Slightly Moist - Perceptible moisture

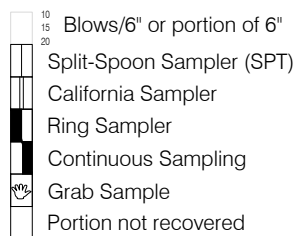
Moist - Damp but no visible water

Very Moist - Water visible but not free draining

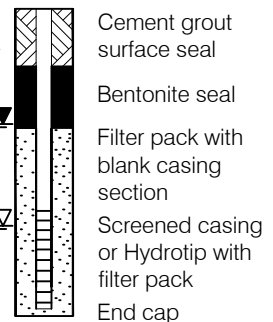
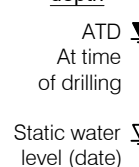
Wet - Visible free water, usually from below water table

Symbols

Sampler Type and Description

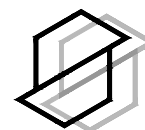


Groundwater depth



Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

- (1) Percentage by dry weight
- (2) Combined USCS symbols used for fines between 5% and 12%
- (3) (SPT) Standard Penetration Test (ASTM D-1586)
- (4) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)



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Exploration Boring

EB-4

Herzl-Ner Tamid Conservative Congregation K-8

Sheet: 1 of 1

Mercer Island, WA

Start Date: 12/8/23

Logged By: BCY

20210371E001

Ending Date: 12/8/23

Approved By: CMM

Driller/Equipment: Geologic Drill Partners/Mini-Track

Total Depth (ft): 36.5

Hammer Weight/Drop: 140#/30"

Ground Surface Elevation (ft): ≈100

Hole Diameter (in): 6

Datum: NAVD88

∇ Groundwater Depth ATD (ft): Not encountered

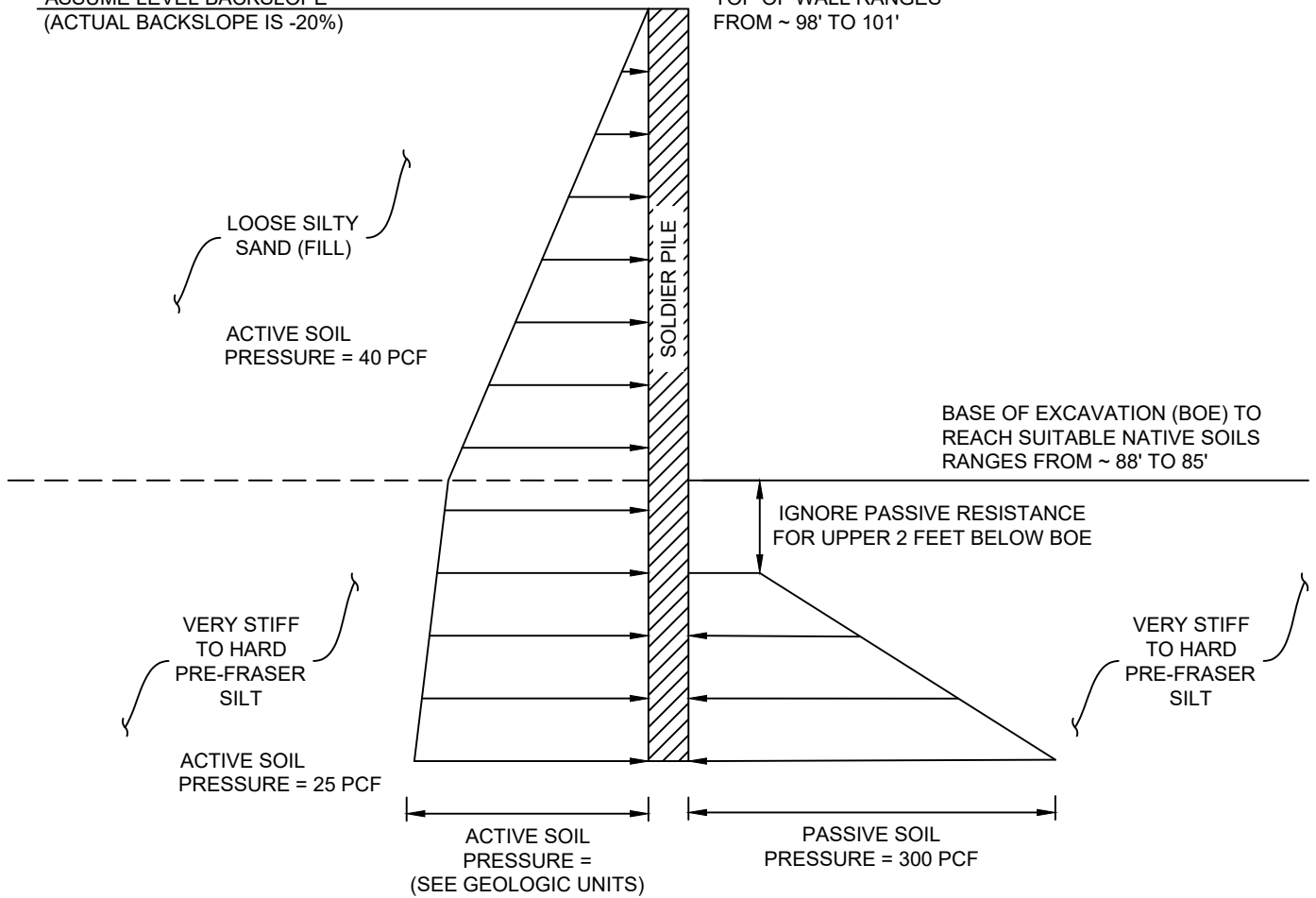
∇ Groundwater Depth Post Drilling (ft) (Date): ()

Depth (ft)	Sample Type	Sample	% Recovery	Graphic Symbol	Description	Water Level	Blows/6"	Blows/Foot					Other Tests		
								10	20	30	40	50+			
0					Forest Duff - 4 inches										
					Fill										
1		1			Moist, dark brown to brown, silty, fine SAND, some gravel; abundant organics (rootlets); thinning with depth; becomes lighter brown with depth (SM). Less gravel.	8	14								
5		2			Moist, tan to brown with minor orange oxidation staining, silty, fine SAND; occasional interbed of gray, silt or orange brown, fine sand; trace organics throughout (SM).	2	7								
		3			Slightly moist, tan with some gray, fine SAND, some silt, some gravel; unsorted (SP-SM).	11	14								
10		4			Moist, brown with occasional grayish brown layer, silty, fine SAND, trace gravel; rare fine black organics; grayish brown layers are fine sandy, silt; disturbed texture (SM).	4	7								
					Pre-Fraser NonGlacial										
15		5			Upper 9 inches: Moist, brown to grayish brown, silty, fine SAND; rare fine black organics (SM). Lower 9 inches: Moist, brownish gray with heavy orange oxidation staining, SILT, some fine sand; massive; scattered fine black organics; trace fine organics (ML).	7	20								
		6			Moist, light brown with occasional gray inclusions and minor orange oxidation staining, SILT, some fine sand; massive (ML).	11	36								
25		7			Moist, grayish brown with sub horizontal oxidation staining, SILT, some fine sand transitioning to gray, silt, trace fine sand; massive (ML).	11	43								
30		8			Moist, gray, SILT, trace to some sand; massive (ML).	19	62								
35					No groundwater encountered.										

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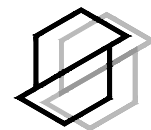
ASSUME LEVEL BACKSLOPE
(ACTUAL BACKSLOPE IS -20%)

TOP OF WALL RANGES
FROM ~ 98' TO 101'



NOTES

1. ABOVE THE BOE, ACTIVE PRESSURE ACTS OVER PILE SPACING.
2. BELOW THE BOE, PASSIVE AND ACTIVE PRESSURES ARE APPLIED TO AN EFFECTIVE PILE WIDTH EQUAL TO 2 AND 1 PILE DIAMETERS, RESPECTIVELY. TOE EMBEDMENT IS DETERMINED BY ACHIEVING FORCE AND MOMENT BALANCE THROUGHOUT TOE OF PILE.
3. PASSIVE PRESSURE INCLUDES SAFETY FACTOR OF 1.5.
4. EARTH PRESSURE FOR DESIGN OF LAGGING CAN BE REDUCED BY 50 PERCENT TO ACCOUNT FOR ARCHING EFFECTS BETWEEN SOLDIER PILES. SOLDIER PILE SPACING SHOULD NOT EXCEED 8 FEET.
5. VOIDS BEHIND LAGGING SHOULD BE FILLED WITH FREE DRAINING MATERIAL TO RELIEVE ANY HYDROSTATIC PRESSURE BUILDUP.
6. DIAGRAM IS ILLUSTRATIVE AND NOT REFERENCED TO A PARTICULAR LOCATION.
7. DIAGRAM DOES NOT INCLUDE PRESSURES DUE TO SURFACE SURCHARGES FROM ANY ADJACENT EQUIPMENT OR STRUCTURES. THESE PRESSURES MUST BE PROVIDED BY THE STRUCTURAL ENGINEER.



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**TEMPORARY CANTILEVER SOLDIER
PILE WALL DESIGN CRITERIA**
HERZL-NER TAMID CONSERVATIVE CONGREGATION K-12
KENMORE, WASHINGTON

PROJ NO. 20210371E001

DATE: 11/25

FIGURE: W1