

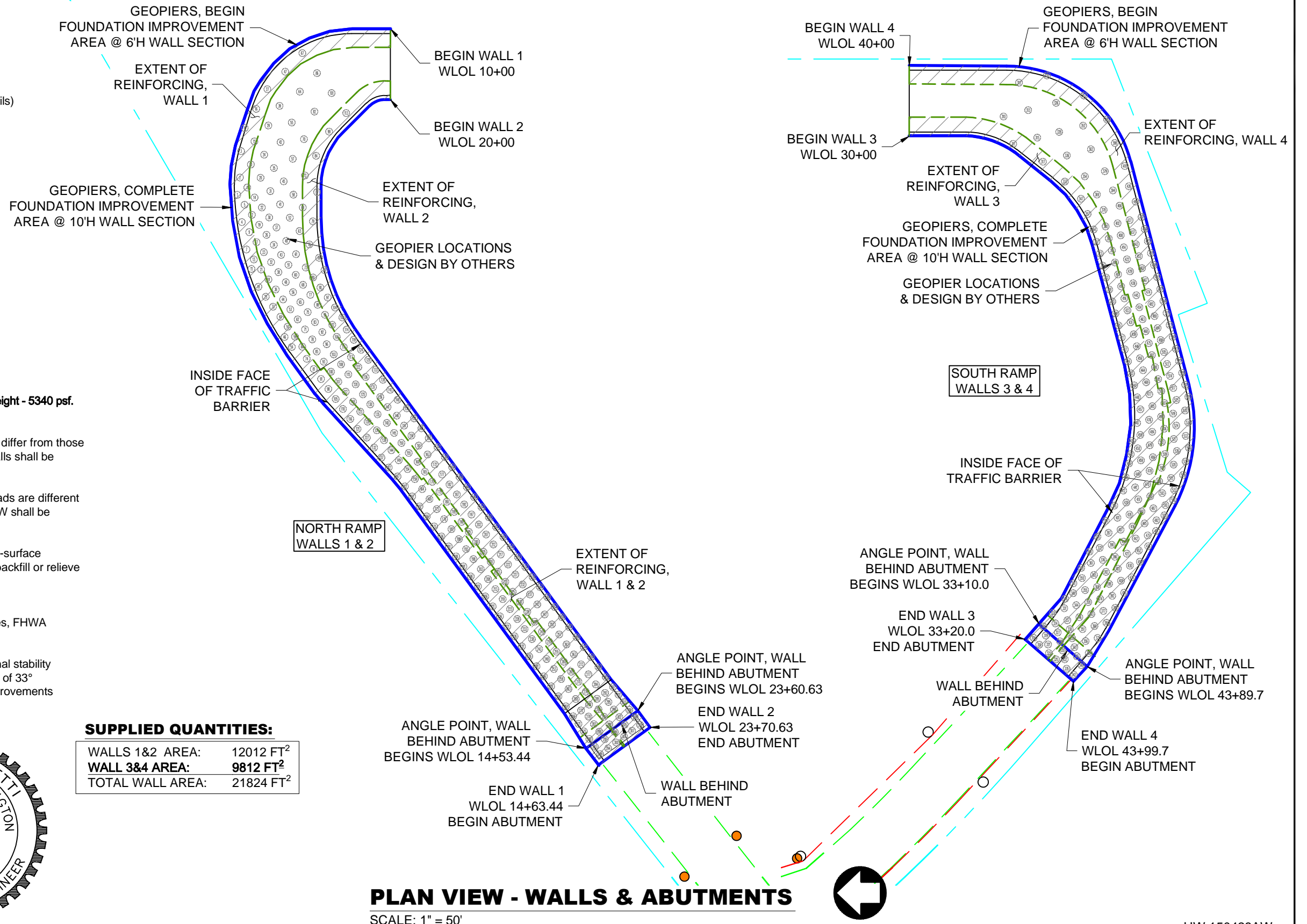
DESIGN NOTES

- Design is based on the assumption that backfill within the reinforced soil mass, methods of construction and quality of materials conform to the requirements of the Technical Specifications.
- Assumed Soil Characteristics:
 Wall Backfill: (See Sheet 9 for Technical Specification Details)
 Unit Weight: 120 pcf
 Internal Friction Angle: 34°
 Cohesion = 0 psf
 Retained Backfill:
 Unit Weight: 120 pcf
 Internal Friction Angle: 34°
 Cohesion = 0 psf
 Unimproved Foundation Soils:
 Unit Weight: 120 pcf
 Friction Angle for Sliding: 32°
 Cohesion = 0 psf
 Improved Foundation Soils:
 Unit Weight: 120 pcf
 Friction Angle for Sliding: 33°
 Cohesion = 0 psf
 Traffic Surcharge Live Load (LL) - 250 psf
 Walls - Bridge Sill (8'x27' @ 2' from Face of Wall)
 Loads: LL = 1250 psf
 DL = 2365 psf

Worst Case Applied Bearing Pressure by MSE Wall - @ 14.0' Height - 5340 psf. Under Sill Loading

If actual characteristics, grades or dimensions of soil materials differ from those listed above or shown on the plans, Hilfiker Retaining (HW) walls shall be notified to evaluate the need to redesign.

- If during construction, the wall location, structure location or loads are different than that proposed in this plan set and calculation package, HW shall be notified to evaluate the need for a redesign.
- The design requires a non-saturated backfill. Surface and sub-surface drainage control may be required to prevent saturation of the backfill or relieve hydrostatic pressures.
- Design Procedure:
 Mechanically Stabilized Earth walls and Reinforced Soil Slopes, FHWA report No. FHWA-NHI-00-043.
- Hilfiker Retaining Walls shall be responsible only for the internal stability of the retaining wall. Foundation Soil Internal Angle of Friction of 33° provided by Geopier Ground Improvement Design, where improvements are required.



SUPPLIED QUANTITIES:

WALLS 1&2 AREA:	12012 FT ²
WALL 3&4 AREA:	9812 FT ²
TOTAL WALL AREA:	21824 FT ²

PLAN VIEW - WALLS & ABUTMENTS

SCALE: 1" = 50'

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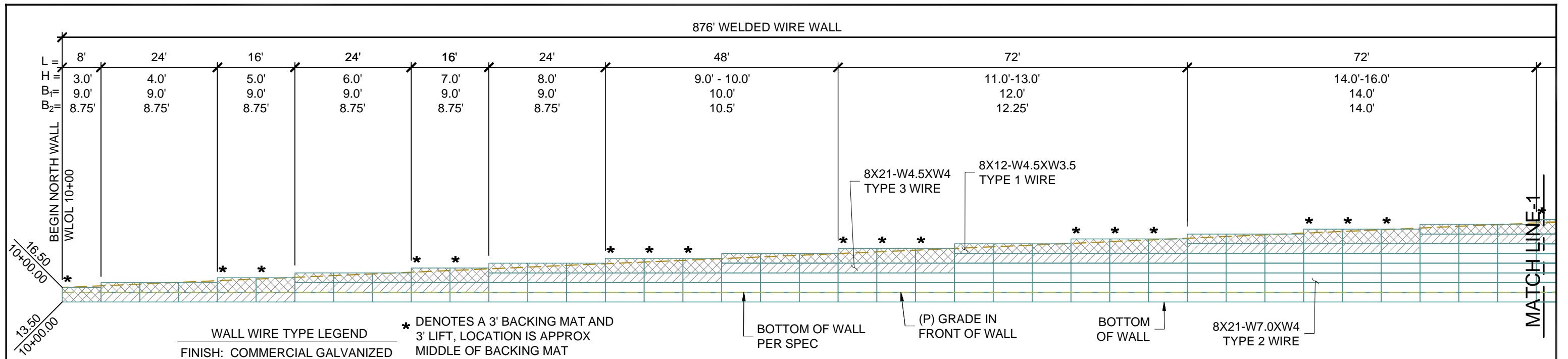
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WELDED WIRE / MSE WALLS
 PLAN VIEW
 & GENERAL NOTES

PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC
SHT	1 OF 9

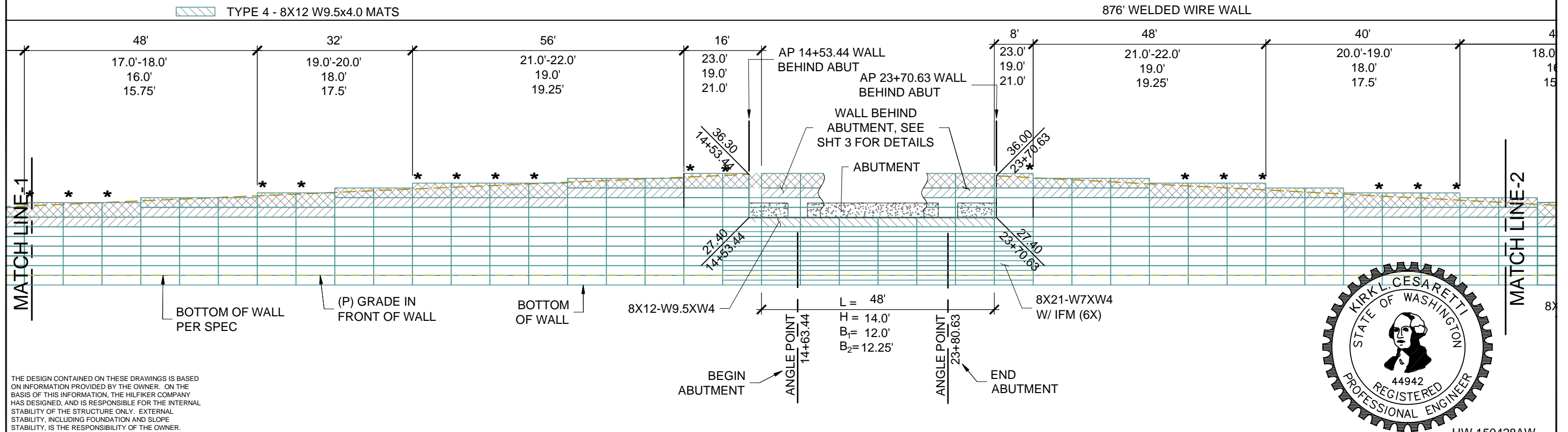


- WALL WIRE TYPE LEGEND**
 FINISH: COMMERCIAL GALVANIZED
 SERVICE LIFE: 75 YEARS
- TYPE 1 - 8X12 W4.5x3.5 MATS
 - TYPE 2 - 8x21 W7.0x4.0 MATS
 - TYPE 2 - 8X21 W7.0x4.0 MATS W/ INTERMEDIATE FLAT MAT (IFM)
 - TYPE 3 - 8X21 W4.5x4.0 MATS
 - TYPE 4 - 8X12 W9.5x4.0 MATS

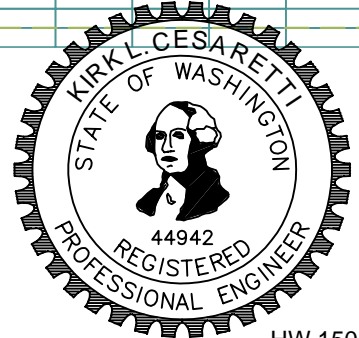
* DENOTES A 3' BACKING MAT AND 3' LIFT, LOCATION IS APPROX MIDDLE OF BACKING MAT

ELEVATION VIEW - NORTH RAMP WALLS 1 & 2 (FRONT VIEW)

SCALE: 1" = 20'



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	5-3-17	KLC	Modified per 2-20-17 Plan Check & New Layout
	5-31-17	KLC	Modified per 4-17-17 Plan Check & New Layout
	6-6-17	KLC	Modified Reinforcing Lengths per Seismic Req't

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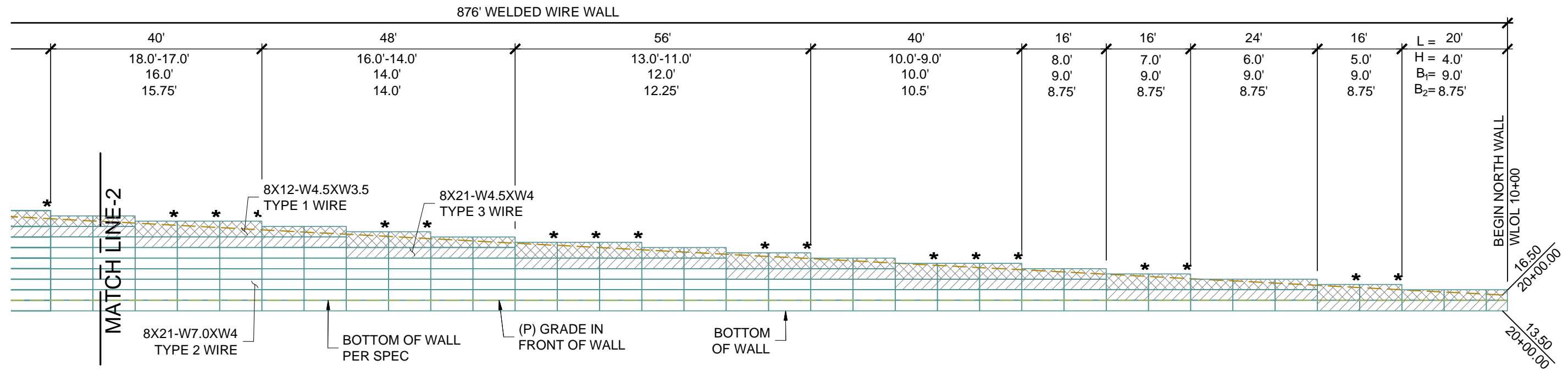
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WELDED WIRE / MSE WALLS
 NORTH RAMP - WALLS 1 & 2
 ELEVATION VIEW

PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC
SHT	2 OF 9



ELEVATION VIEW - NORTH RAMP WALLS 1 & 2 (CONT'D)

SCALE: 1" = 20'

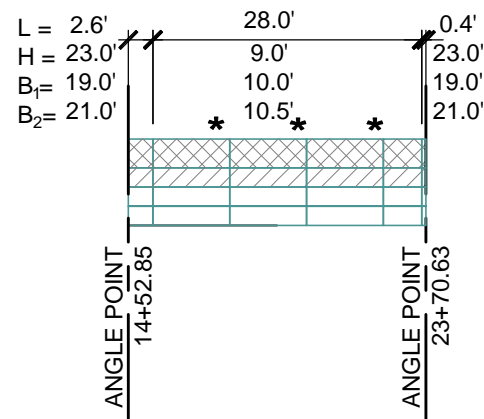
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 - TYPE 2 - 8X21 W7.0x4.0 MATS W/ INTERMEDIATE FLAT MAT (IFM)
 - TYPE 3 - 8X21 W4.5x4.0 MATS
 - TYPE 4 - 8X12 W9.5x4.0 MATS

WELDED WIRE WALL PARAMETERS		
Height of Wall (H) ft	Length of Cap & Prongless Mats (B ₁) ft	Length of Standard Mats (B ₂) ft
≤8'	9.0'	8.75'
9'-10'	10.0'	10.5'
11'-13'	12.0'	12.5'
14'-16'	14.0'	14.0'
17'-18'	16.0'	15.75'
19'-20'	18.0'	17.5'
21'-22'	19.0'	19.25'
23'	19.0'	21.0'

Cap & Prongless Mats are:
 8x12 W4.5x3.5 WWR (Type 1)
 8x12 W9.5x4.0 WWR (Type 4)

Standard Mats are:
 8x21 W4.5x4.0 WWR (Type 3)
 8x21 W7.0x4.0 WWR (Type 2)

Finish: Commercial Galvanized - 75 Year Service Life



NOTE:
 Wall behind abut is continuous from AP to AP

ELEVATION VIEW - NORTH RAMP WALL BEHIND ABUT

SCALE: 1" = 20'

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	5-31-17	KLC	Modified per 4-17-17 Plan Check & New Layout
	6-6-17	KLC	Modified Reinforcing Lengths per Seismic Req't

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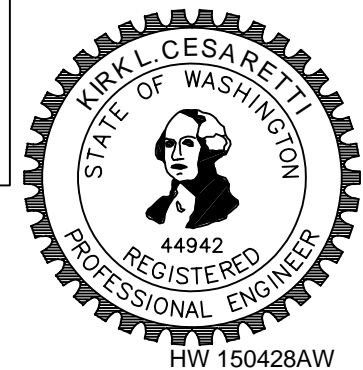
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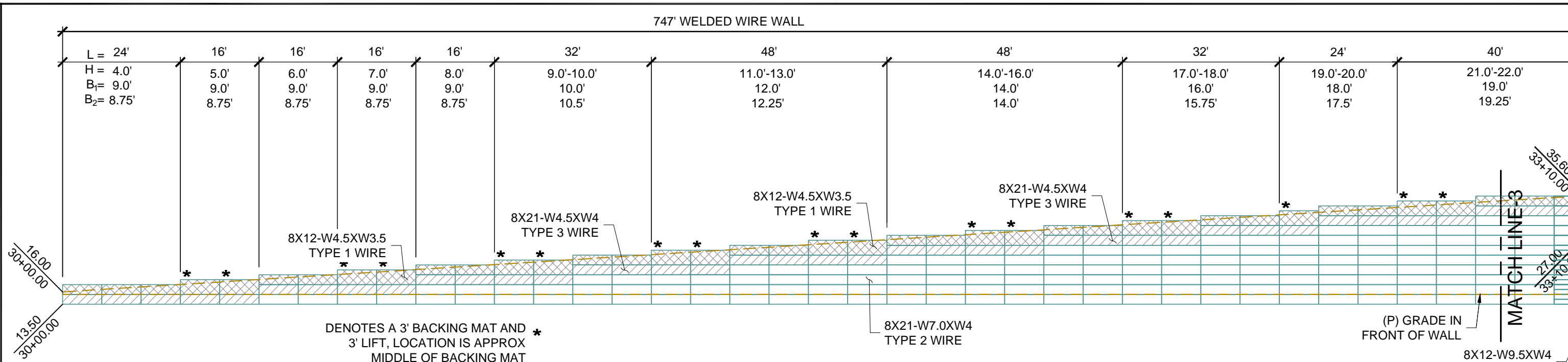
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WELDED WIRE / MSE WALLS
NORTH RAMP WALLS 1 & 2
ELEVATION VIEW (CONT'D)

PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC
SHT	3 OF 9





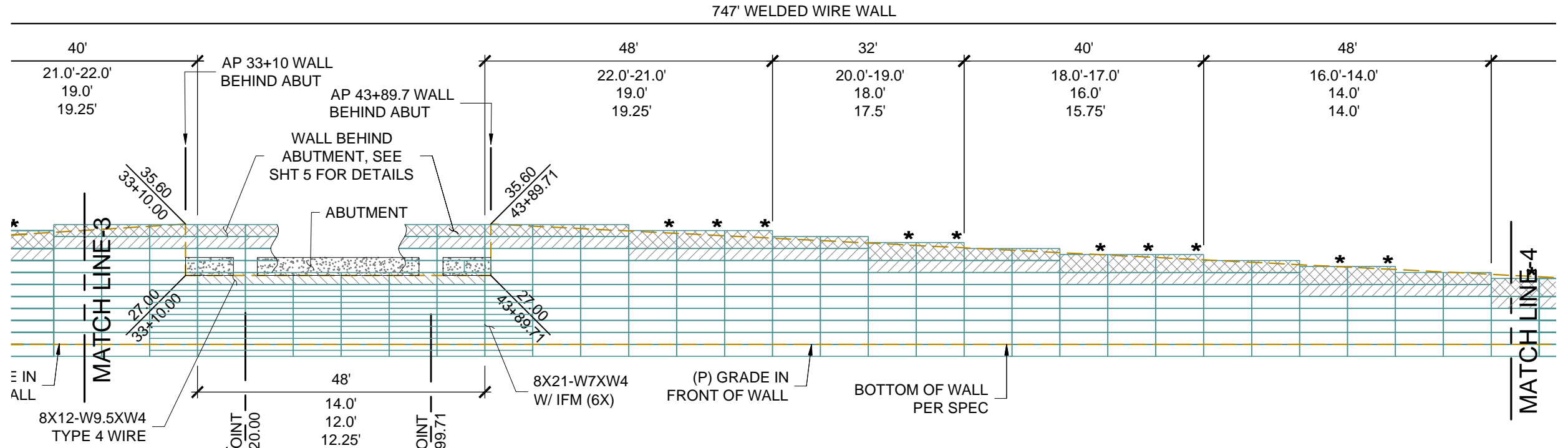
ELEVATION VIEW - SOUTH RAMP WALLS 3 & 4 (FRONT VIEW)

SCALE: 1" = 20'

WALL WIRE TYPE LEGEND

FINISH: COMMERCIAL GALVANIZED
SERVICE LIFE: 75 YEARS

- TYPE 1 - 8X12 W4.5x3.5 MATS
- TYPE 2 - 8x21 W7.0x4.0 MATS
- TYPE 2- 8X21 W7.0x4.0 MATS W/ INTERMEDIATE FLAT MAT (IFM)
- TYPE 3 - 8X21 W4.5x4.0 MATS
- TYPE 4 - 8X12 W9.5x4.0 MATS



ELEVATION VIEW - SOUTH RAMP (CONT'D)

SCALE: 1" = 20'



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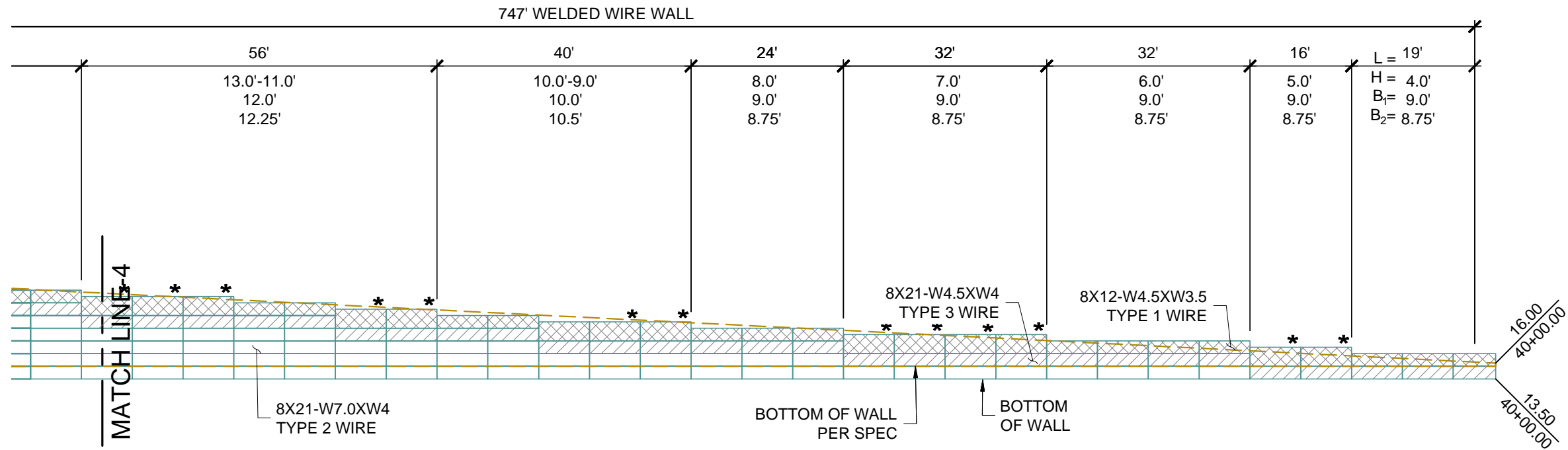
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WELDED WIRE / MSE WALLS
SOUTH RAMP WALLS 3 & 4 -
ELEVATION VIEW

HW 150428AW

PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC

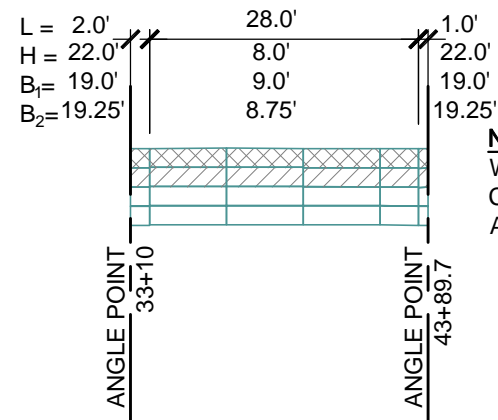
SHT **4** OF 9



ELEVATION VIEW - SOUTH RAMP (CONT'D)

SCALE: 1" = 20'

- WALL WIRE TYPE LEGEND**
- FINISH: COMMERCIAL GALVANIZED
SERVICE LIFE: 75 YEARS
- TYPE 1 - 8X12 W4.5x3.5 MATS
 - TYPE 2 - 8x21 W7.0x4.0 MATS
 - TYPE 2 - 8X21 W7.0x4.0 MATS W/ INTERMEDIATE FLAT MAT (IFM)
 - TYPE 3 - 8X21 W4.5x4.0 MATS
 - TYPE 4 - 8X12 W9.5x4.0 MATS



NOTE:
WALL BEHIND ABUT IS CONTINUOUS FROM AP TO AP

ELEVATION VIEW - SOUTH RAMP WALL BEHIND ABUT

SCALE: 1" = 20'

WELDED WIRE WALL PARAMETERS		
Height of Wall (H) ft	Length of Cap & Prongless Mats (B ₁) ft	Length of Standard Mats (B ₂) ft
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Standard Mats are:
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8x21 W7.0x4.0 WWR (Type 2)

Finish: Commercial Galvanized - 75 Year Service Life



HW 150428AW

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	5-31-17	KLC	Modified per 4-17-17 Plan Check & New Layout
	6-1-17	KLC	Added Elevation View of Wall behind Abut
	6-6-17	KLC	Modified Reinforcing Lengths per Seismic Req't

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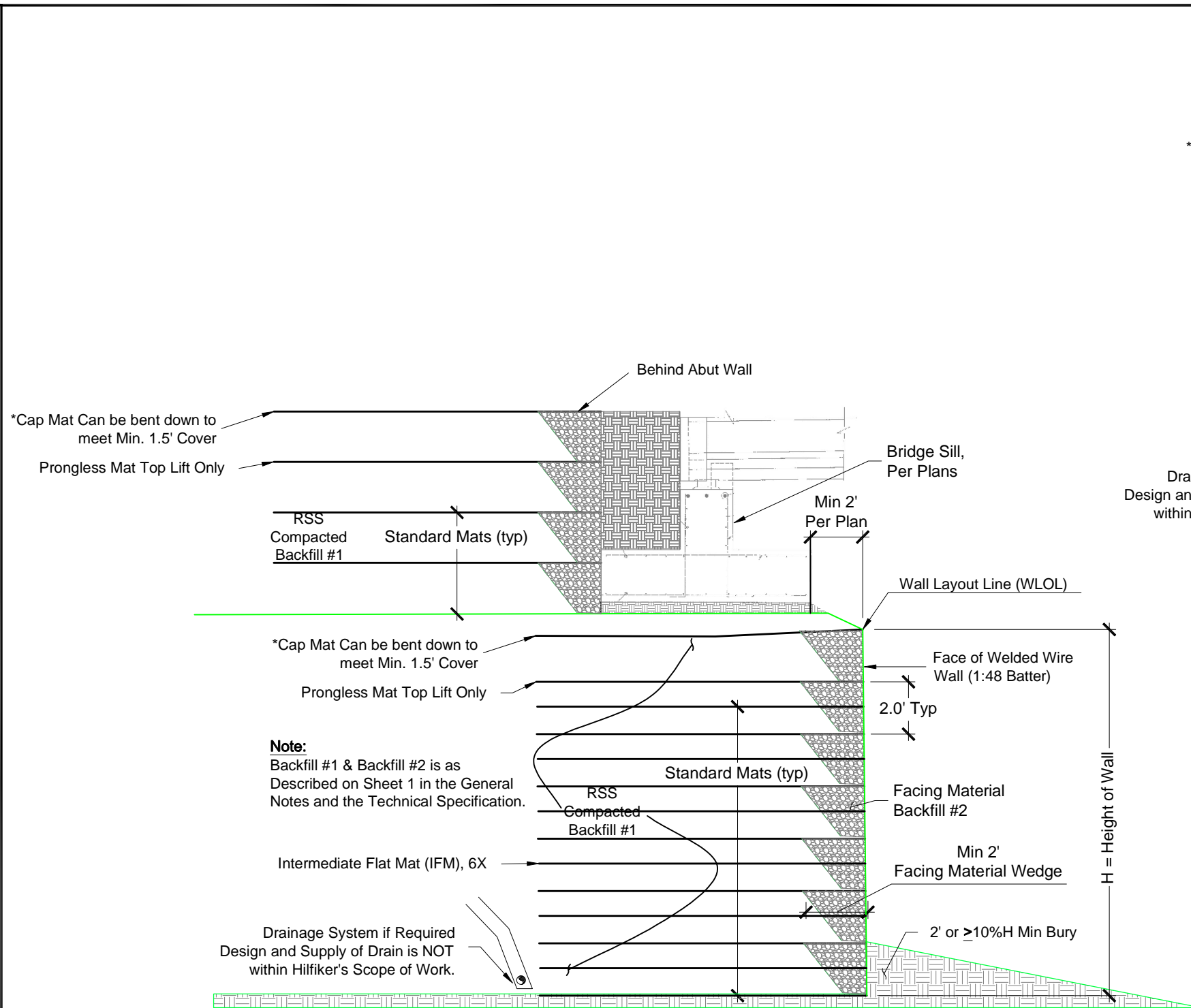
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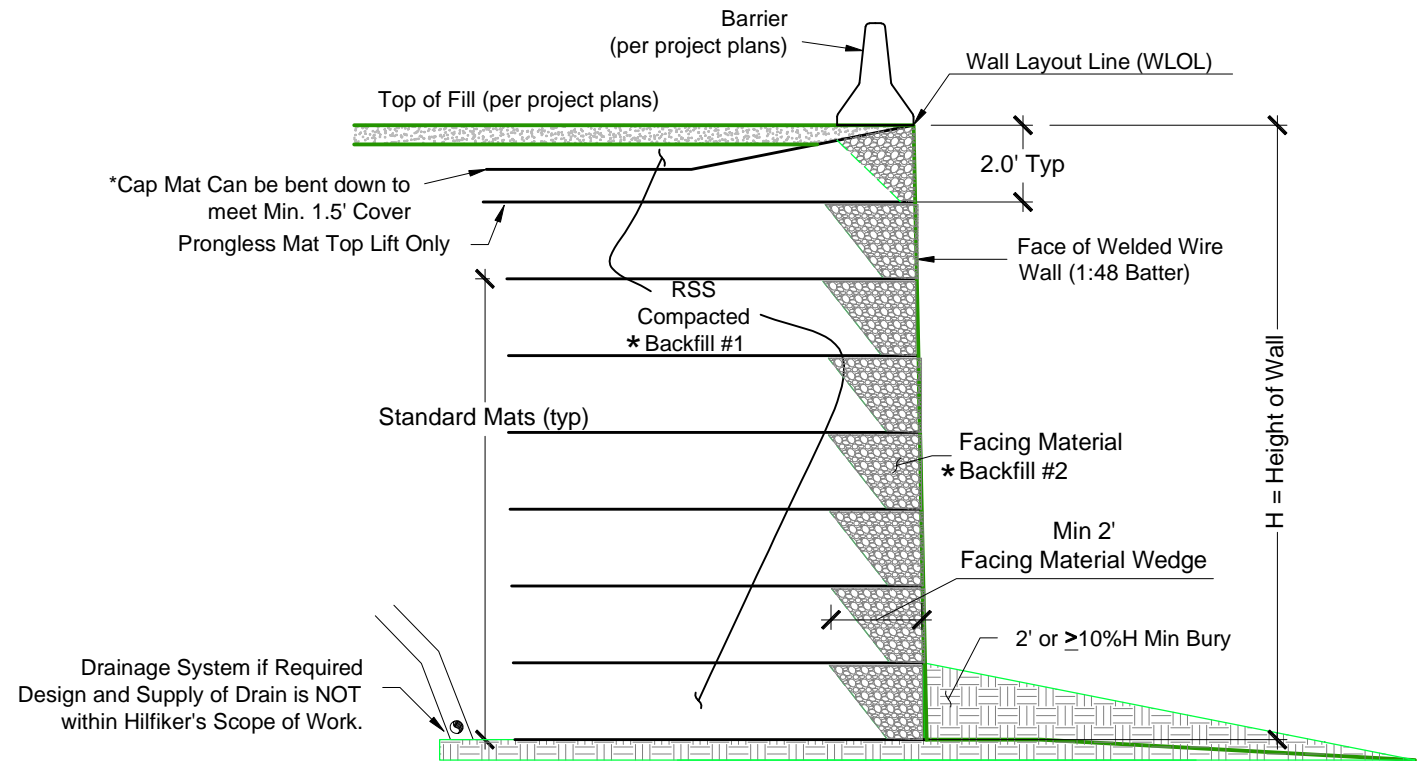
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WELDED WIRE / MSE WALLS
SOUTH RAMP ELEVATION VIEW
(CONT'D)

PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC

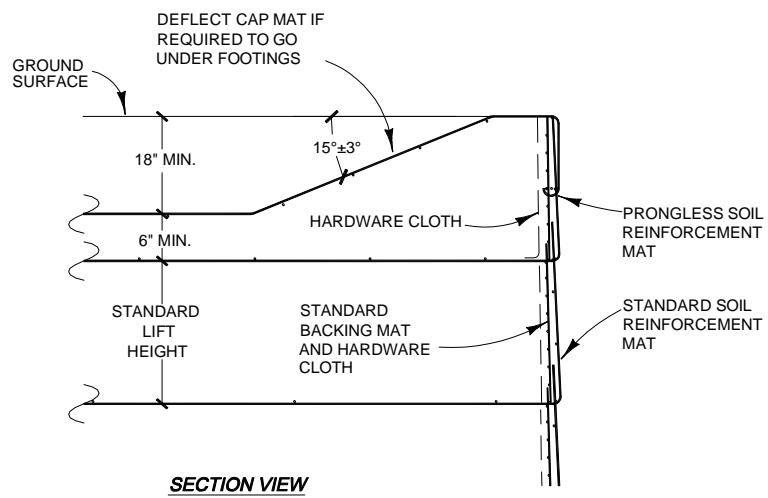
SHT 5 OF 9



CROSS SECTION AT ABUTMENT
SCALE: 1" = 5'



TYPICAL CROSS SECTION
SCALE: 1" = 5'



SECTION VIEW
DEFLECTED CAP MAT DETAIL

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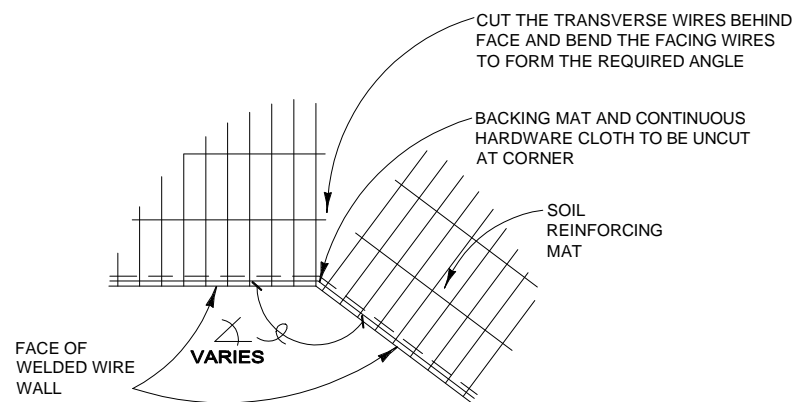
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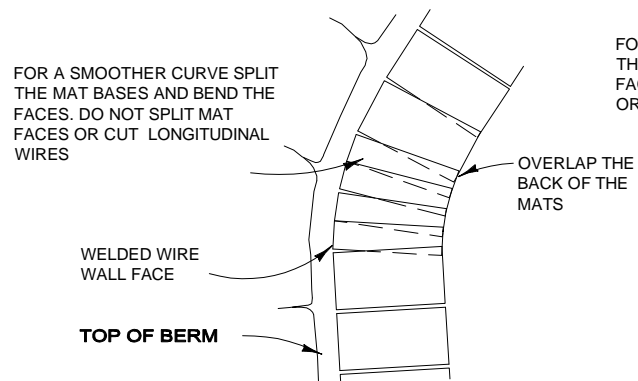
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WELDED WIRE / MSE WALLS
CROSS SECTION @ ABUTMENT &
DETAILS

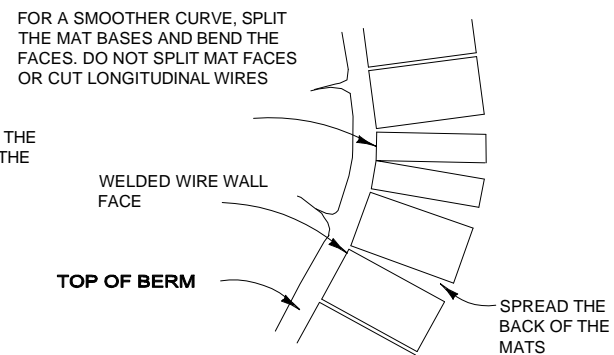
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DESIGN	KLC
DRAWN	KLC
SHT	6 OF 9



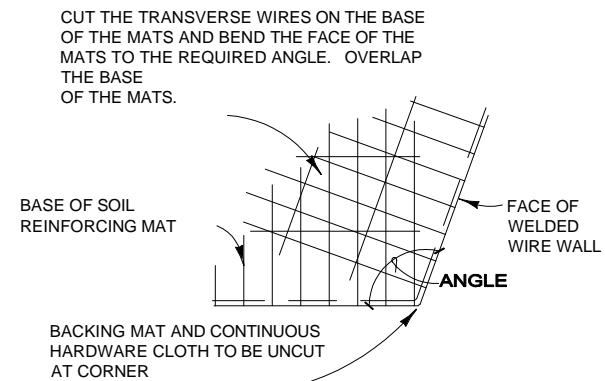
**PLAN VIEW
CONCAVE ANGLE DETAIL**
NOT TO SCALE



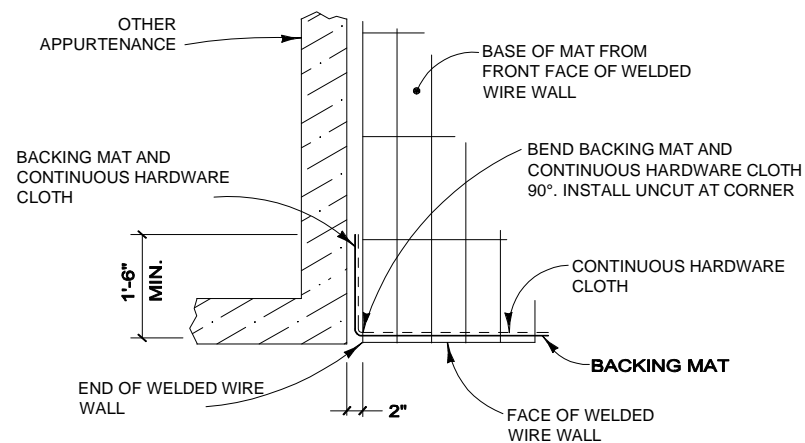
**PLAN VIEW
CONVEX CURVE**
NOT TO SCALE



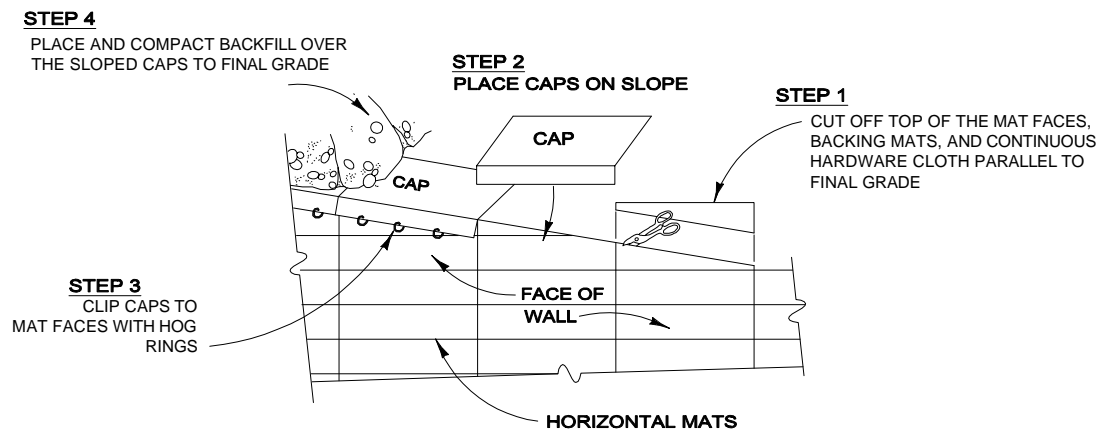
**PLAN VIEW
CONCAVE CURVE**
NOT TO SCALE



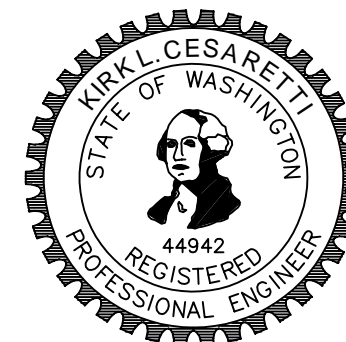
**PLAN VIEW
OBTUSE CONVEX ANGLE**
NOT TO SCALE



**PLAN VIEW
WELDED WIRE WALL END
AT OTHER APPURTENANCE**
NOT TO SCALE



**PICTORIAL ELEVATION
SLOPED CAP MAT DETAIL**
NOT TO SCALE



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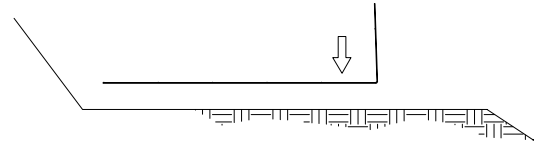
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**WELDED WIRE / MSE WALLS
DETAILS**

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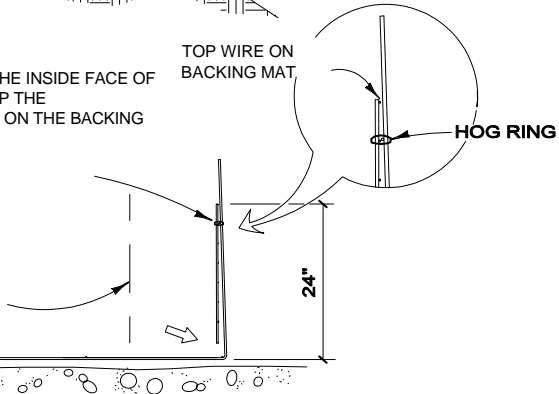
PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC
SHT	7 OF 9

STEP 1
PLACE THE FIRST COURSE OF SOIL REINFORCEMENT MATS ON PREPARED FOUNDATION



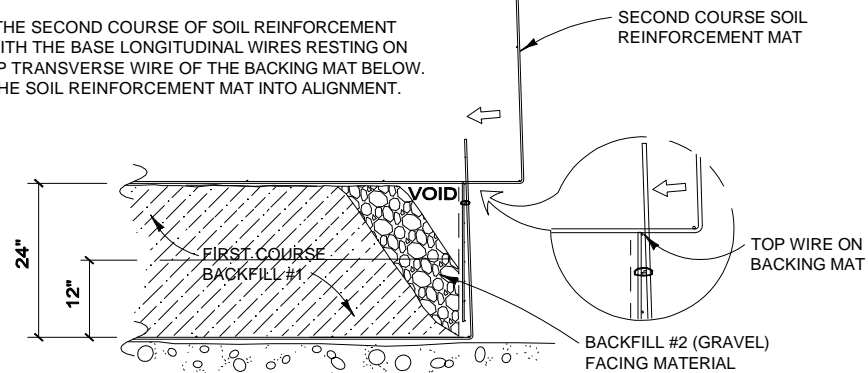
STEP 2
PLACE THE BACKING MAT AGAINST THE INSIDE FACE OF THE SOIL REINFORCEMENT MAT. CLIP THE SECOND-TO-TOP TRANSVERSE WIRE ON THE BACKING MAT TO THE TOP TRANSVERSE WIRE ON THE SOIL REINFORCEMENT MAT.

INSTALL CONTINUOUS HARDWARE CLOTH AND HOG-RING TO THE TOP WIRE ON THE BACKING MAT.



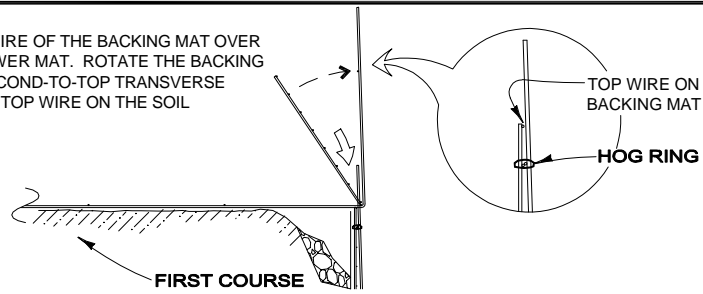
STEP 3
PLACE AND COMPACT THE BACKFILL IN LAYERS AND DENSITIES AS SPECIFIED IN THE PROJECT PLANS. LEAVE A VOID AT THE FACE AS SHOWN.

PLACE THE SECOND COURSE OF SOIL REINFORCEMENT MATS WITH THE BASE LONGITUDINAL WIRES RESTING ON THE TOP TRANSVERSE WIRE OF THE BACKING MAT BELOW. SLIDE THE SOIL REINFORCEMENT MAT INTO ALIGNMENT.

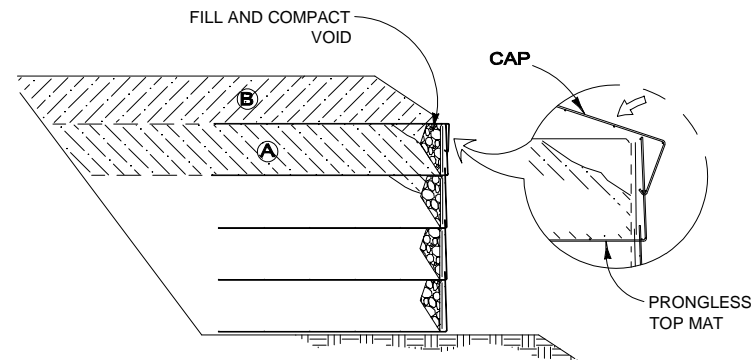
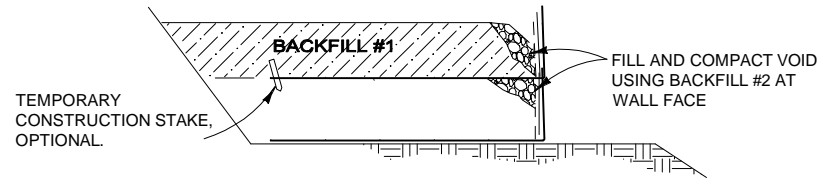


CONSTRUCTION SEQUENCE
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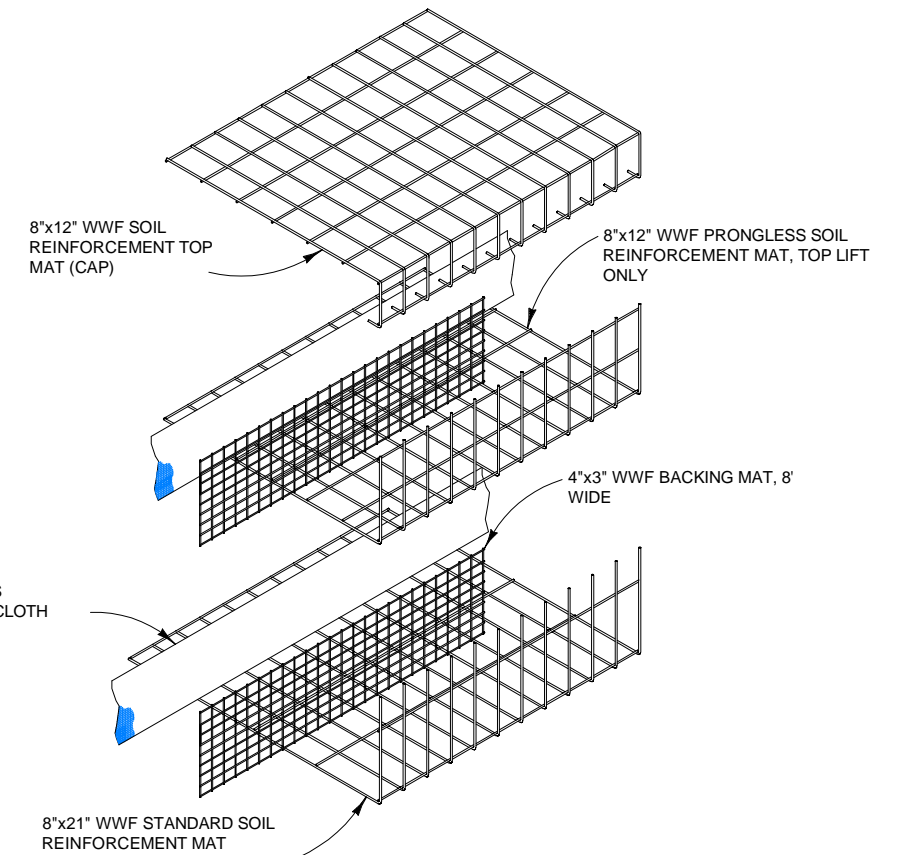
STEP 4
HOOK THE BOTTOM TRANSVERSE WIRE OF THE BACKING MAT OVER THE VERTICAL PRONGS ON THE LOWER MAT. ROTATE THE BACKING MAT TO VERTICAL AND CLIP THE SECOND-TO-TOP TRANSVERSE WIRE ON THE BACKING MAT TO THE TOP WIRE ON THE SOIL REINFORCEMENT MAT.



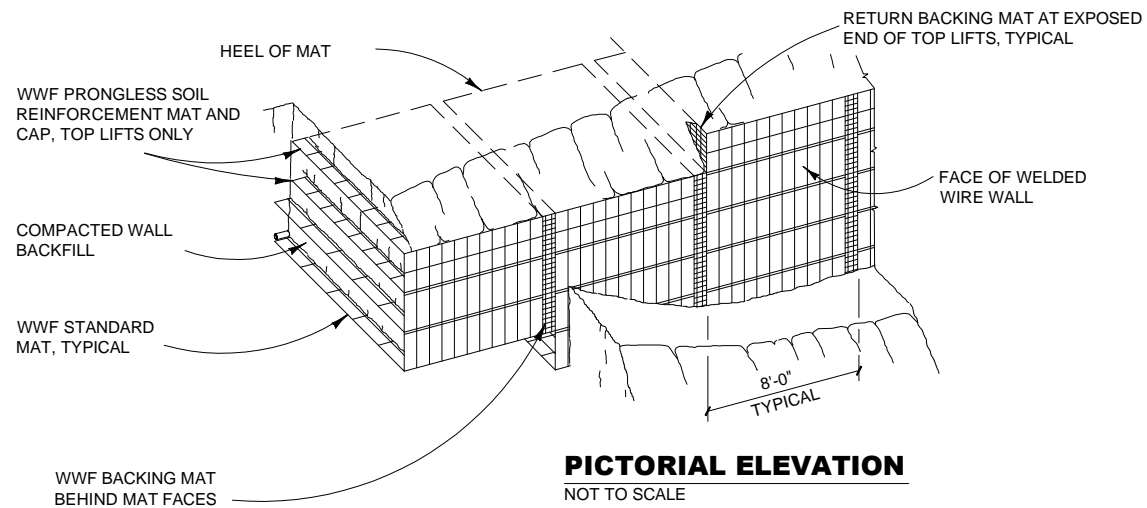
STEP 5
INSTALL THE HARDWARE CLOTH. PLACE AND COMPACT THE BACKFILL AND FACE GRAVEL TO THE BASE ELEVATION OF THE NEXT MAT. REPEAT STEPS 3 THROUGH 5 TO THE TOP LIFT.



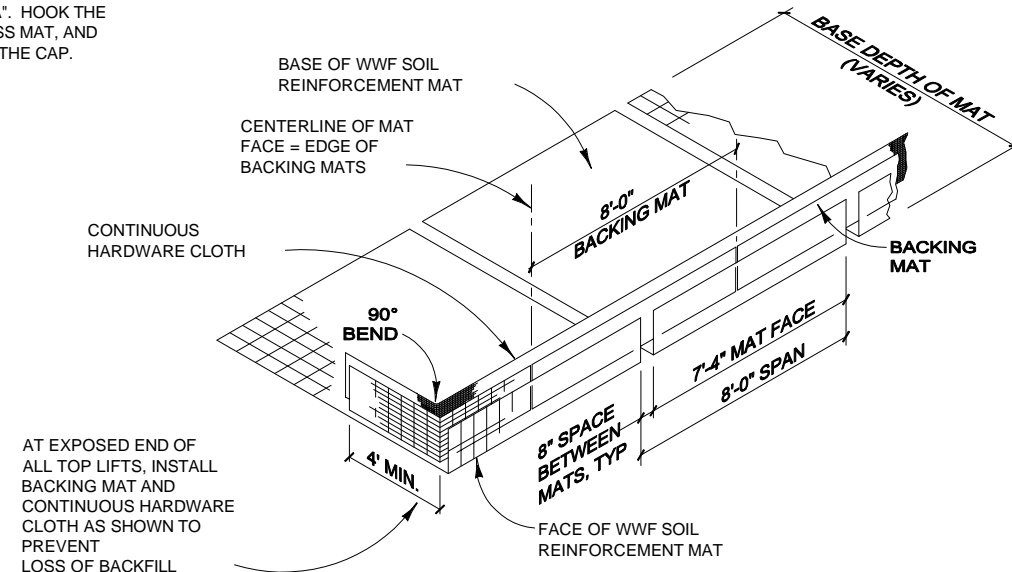
STEP 6: TOP LIFT
PLACE THE TOP LIFT PRONGLESS MAT, BACKING MAT AND HARDWARE CLOTH. PLACE AND COMPACT BACKFILL AND FACE GRAVEL IN AREA 'A'. HOOK THE CAP OVER THE MIDDLE TRANSVERSE WIRE ON THE PRONGLESS MAT, AND ROTATE INTO PLACE. BACKFILL 'B' TO 1'-6" MIN. COVER OVER THE CAP.



WALL COMPONENTS
NOT TO SCALE



PICTORIAL ELEVATION
NOT TO SCALE



WELDED WIRE WALL COMPONENTS WITH RETURN MAT
NOT TO SCALE

THE DESIGN CONTAINED ON THESE DRAWINGS IS BASED ON INFORMATION PROVIDED BY THE OWNER. ON THE BASIS OF THIS INFORMATION, THE HILFIKER COMPANY HAS DESIGNED, AND IS RESPONSIBLE FOR THE INTERNAL STABILITY OF THE STRUCTURE ONLY. EXTERNAL STABILITY, INCLUDING FOUNDATION AND SLOPE STABILITY, IS THE RESPONSIBILITY OF THE OWNER.



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	5-3-17	KLC	Modified per 2-20-17 Plan Check & New Layout
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Georgetown Crossroads Development

WELDED WIRE / MSE WALLS
CONSTRUCTION SEQUENCE & DETAILS

HW 150428AW

PROJECT	16-078
DATE	2-16-17
DESIGN	KLC
DRAWN	KLC

SHT **8** OF 9

**TECHNICAL SPECIFICATIONS
FOR HILFIKER M. S. E. SYSTEM
Welded Wire Wall
(Brite Basic: Non-Galvanized Wire)**

1.0 DESCRIPTION

This work shall consist of a **Welded Wire Retaining Wall (WWW)**, Mechanically Stabilized Earth Retaining Wall [MSE] constructed in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans or established by the Owner's Engineer.

2.0 MATERIALS

The Contractor shall make his own arrangements to purchase all **WWW** M.S.E. materials, including wire mesh reinforcement mats, backing materials, and all necessary incidentals from Hilfiker Retaining Walls, 1902 Hilfiker Lane, Eureka, CA 95503-5711, ph. 707/443-5093; www.hilfiker.com; info@hilfiker.com.

2.1 Wire Reinforcement and Cap Mesh

Welded wire fabric for facing shall be formed by a 90-degree bend of the soil wire reinforcement mesh and a prong to interlock with the soil reinforcing mesh above. The reinforcing mesh shall be shop fabricated of cold drawn steel wire and shall be welded into the finished mesh fabric conforming to the minimum requirements of ASTM A-1064, with a yield strength minimum of 450 MPa [65 ksi]. Welded Wire Mesh for the **WWW** shall be as per project specifications, and will be brite-basic [non-galvanized].

2.2 Backing Materials

2.2.1 Backing Mats

Where required, as shown on the plans, steel backing mat shall be W5 vertical x W2.5 horizontal minimum (.2582" [6.6 mm] x .178" [4.5 mm] nom. dia.) welded wire fabric meeting ASTM A-1064.

2.2.3 Filter Fabric

Where required, as shown on the plans, geotextile filter fabric shall be utilized to retain the soil.

3.0 SELECT GRANULAR BACKFILL (#1) MATERIALS

As shown on the plans, select granular backfill materials for the **WWW** wall structure shall be reasonably free from organic and otherwise deleterious materials and shall conform to the following gradation limits as determined by ASTM D-422:

Sieve Designation	Percent by Weight Passing Standard Sieves (AASHTO T 27 & T 11)
6 inches (152.4 mm)	100
3 inches (76.2 mm)	100 - 75
No. 200 (75 µm)	0 - 15

The backfill shall conform to all of the following additional requirements:

- A. The Plasticity Index (P.I.), as determined by ASTM D-4318 (AASHTO T 90), shall not exceed 10.
- B. The fraction finer than 15 microns (0.015 mm), as determined by ASTM D-422 (AASHTO T-88) shall not exceed 25 percent.
- C. The material shall exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard direct shear test ASTM D-3080-72 (AASHTO T-236), utilizing a sample of the material compacted to 90% percent of ASTM D-1557-92. No testing is required for backfill where 80 percent of the material is greater than ¾ inch (19 mm). Before construction begins, the borrow selected shall be subject to show conformance with this frictional requirement.

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In addition, backfill materials shall also meet the following corrosion requirements:

Resistivity	≥ 3000 OHM-cm (min)	AASHTO T 288
pH	5.0 to 10.0, inclusive	AASHTO T 289
Chlorides	≤ 100 mg/kg (ppm)	AASHTO T 291
Sulfates	≤ 200 mg/kg (ppm)	AASHTO T 290
Organic Content	<1%	AASHTO

T267-86

If the resistivity is greater than or equal to 5,000 ohm-cm, the chlorides and sulfates requirements may be waived.

3.1 Acceptance of Material

The Contractor shall furnish to the Owner's Engineer a Certificate of Compliance certifying that the select granular backfill material complies with this section of the specifications. A copy of all test results performed by the Contractor, which are necessary to assure compliance with the specifications, shall also be furnished to the Owner's Engineer and the MSE supplier.

The frequency of sampling of Select Granular Backfill necessary to assure the above-mentioned requirements shall be directed by the Owner's Engineer.

Backfill not conforming to this specification shall not be used without written consent of the Engineer.

4.0 CONSTRUCTION REQUIREMENTS

4.1 Wall Excavation

Wall excavation shall be in accordance with the requirements of the Project specifications and in reasonably close conformity with the limits and construction stages shown on the plans. All excavation cuts and slopes shall be in accordance with governing safety regulations.

4.2 Foundation Preparation

The foundation for the structure shall be graded level for a width equal to or exceeding the length of the reinforcement mat or as shown on the plans. Prior to wall construction, the foundation, if not in rock, shall be compacted, as directed by the Owner's Engineer. Refer the Geotechnical Report provided by Geopier Improvement Design.

Any unsuitable foundation material below the reinforced soil volume, as determined by the Owner's Engineer, shall be excavated for the full length of mat reinforcements, and to a depth as directed by the Owner's Engineer. Excavated unsuitable material shall be replaced as directed by the Owner's Engineer.

The maximum calculated applied bearing pressure at the foundation level is as shown on the elevation view for each wall. It is the responsibility of the engineer to determine that this calculated applied bearing pressure is allowable for that location.

4.3 M.S.E. Wall Erection

Standard wire mesh reinforcement mats, and applicable facing materials, shall be placed in 24" successive horizontal lifts in the sequence shown on the plans as backfill placement proceeds. Each standard lift must have the ability to compress a minimum of 2" without creating any outward bulge of the facing elements. Vertical tolerance (plumbness) and horizontal alignment tolerance shall not exceed two (2) inches (51mm) when measured at the junction of the wire facing and soil reinforcement along a 10-foot (3 m) straight edge.

The Proprietary Hilfiker WWW system is specifically design to allow for settlement without face of wall bulging. The compressible face of the Hilfiker WWW system allows for as much as 2-3" per each 24" lift or 10% per wall height settlement due to the internal backfill of the wall. Table 8 on page 16 of the Geotechnical Report by Parikh Consultants, Inc identifies an estimated settlement of +/-9" due to the wall foundation material being made of 'predominately fine-grained materials'. This amount of settlement presents no anticipated problems for the wall system. Notation on the Plan Set identifies the potential settlement zone post the 30 day anticipated settlement period.

The overall vertical tolerance of the wall (top and bottom) after construction shall not exceed one (1) inch (25 mm) per ten (10) feet (3 m) of wall height, unless the wall design requires a battered facing. For battered facing structures, the overall tolerance from the theoretical battered locations shall not exceed one-half (1/2) inch (13 mm) per ten (10) feet (3 m) of battered wall height.

4.4 Backfill (#1) Placement

Backfill placement shall closely follow erection of each course of reinforcement mats. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing. Any wall materials, which become damaged or disturbed during backfill placement, shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Owner's Engineer. The Contractor, at their expense, shall correct any misalignment or distortion of the wall facing due to placement of backfill outside the limits of this specification.

Backfill shall be compacted to 95 percent of AASHTO T 99 method C or D, with oversize correction, at optimum moisture content (±2%).

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill material shall have a placement moisture content equal to or within two percentage points of optimum moisture content (Wopt ±2%). Backfill material with placement moisture content in excess or less than Wopt ±2% shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift. The Contractor shall decrease the percentage of deviation from optimum moisture, if necessary, to obtain the specified density. The optimum moisture content shall be determined in accordance with AASHTO T 99 Standard Proctor Method A, with coarse particle correction according to AASHTO T 224.

Backfill shall be placed in complete horizontal lifts. The maximum lift thickness after compaction shall not exceed twelve (12) inches (305 mm). The Contractor shall decrease this lift thickness, if necessary, to obtain the desired density.

Backfill(#2) within two (2) feet of the backface of the wall facing is required to be a higher quality more granular material. Rock facing material shall consist of sound, durable, angular or sub-angular rock, reasonably free from organic and other deleterious matter and shall conform to the following gradation as determined by ASTM D-422:

This material shall have the same characteristics as detailed in paragraph 3.0 with the following exceptions:

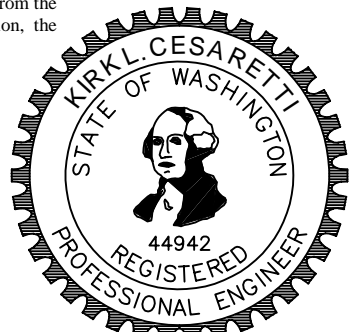
Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1½ inch	100
¾ inch	0 - 15

The backfill shall conform to all of the following additional requirements:

- A. The Plasticity Index (P.I.), as determined by ASTM D-4318 (AASHTO T 90), shall not exceed 6.
- B. The fraction finer than 15 microns (0.015 mm), as determined by ASTM D-422 (AASHTO T-88) shall not exceed 15 percent.
- C. The material shall exhibit an angle of internal friction of not less than 34 degrees, as determined by the standard direct shear test ASTM D-3080-72 (AASHTO T-236), utilizing a sample of the material compacted to 90% percent of ASTM D-1557-92. No testing is required for backfill where 80 percent of the material is greater than ¾ inch (19 mm). Before construction begins, the borrow selected shall be subject to show conformance with this frictional requirement

Compaction in this front face area shall be achieved by a minimum of three (3) passes of a lightweight mechanical tamper, roller or vibratory system. Soil density tests are not generally required within this area.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to rapidly direct run-off of rainwater away from the wall face. In addition, the Contractor shall not allow surface run-off from adjacent areas to enter the wall construction.



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