WELDED WIRE (WWW) and EUREKA REINFORCED SOIL (ERS) M.S.E RETAINING WALLS

Construction Guide

HILFIKER RETAINING WALLS

1902 Hilfiker Lane
Eureka, California 95503-5711
Local 707.443.5093 Toll-Free 800.762.8962

Web: http://www.hilfiker.com *email: info@hilfiker.com*

AMERICAN OWNED & OPERATED

1902-2002 100 YEARS HILFIKER COMPANY

Hilfiker M.S.E. Systems are covered by the following patents:
Patent no. 4,117,686; 4,329,089; 4,505,621 and others

HILFIKER MSE WALL SYSTEMS

Welded Wire Wall and Eureka Reinforced Soil (E.R.S.)

The Hilfiker MSE System is a composite mechanically stabilized earth structure, designed for strength, durability and ease of construction. The welded wire mats reinforce the backfill, providing the tensile strength to make the compacted soil a stable structure. The superior pullout resistance of the wire mesh potentially allows a wide range of backfill soils. Properly installed, the Hilfiker MSE System is exceptionally strong, resilient and economical.

Backfill should preferably be select granular material with a high frictional strength.

ALWAYS FOLLOW YOUR PROJECT SPECIFICATIONS!

Compaction of the backfill is very important to prevent unanticipated settlement of the wall. Ninety to ninety-five percent compaction is recommended for walls supporting paved roadways, railroads, buildings, mining equipment and other significant loads. If the backfill is not compacted as recommended, settlement will occur, and may distort the wall face.

In addition, the moisture content of the backfill prior to and during construction shall be uniformly distributed throughout each lift.

The contractor must provide positive drainage and encapsulation of the backfill to insure that it is not saturated with surface and sub-surface moisture. If rain is expected, protect the backfill from getting wet. If it does get wet, remove the wet portion and replace it with dry backfill.

Under no circumstances should the use of saturated backfill ever be permitted within the M.S.E. structure. This includes the placement of future landscape irrigation.

Hilfiker MSE Systems can be designed as battered, vertical or cantilever structures. The welded wire mats are easily trimmed or bent, adapting to curves, angles and steps. A Welded Wire Wall can be designed to fit nearly any special site application.

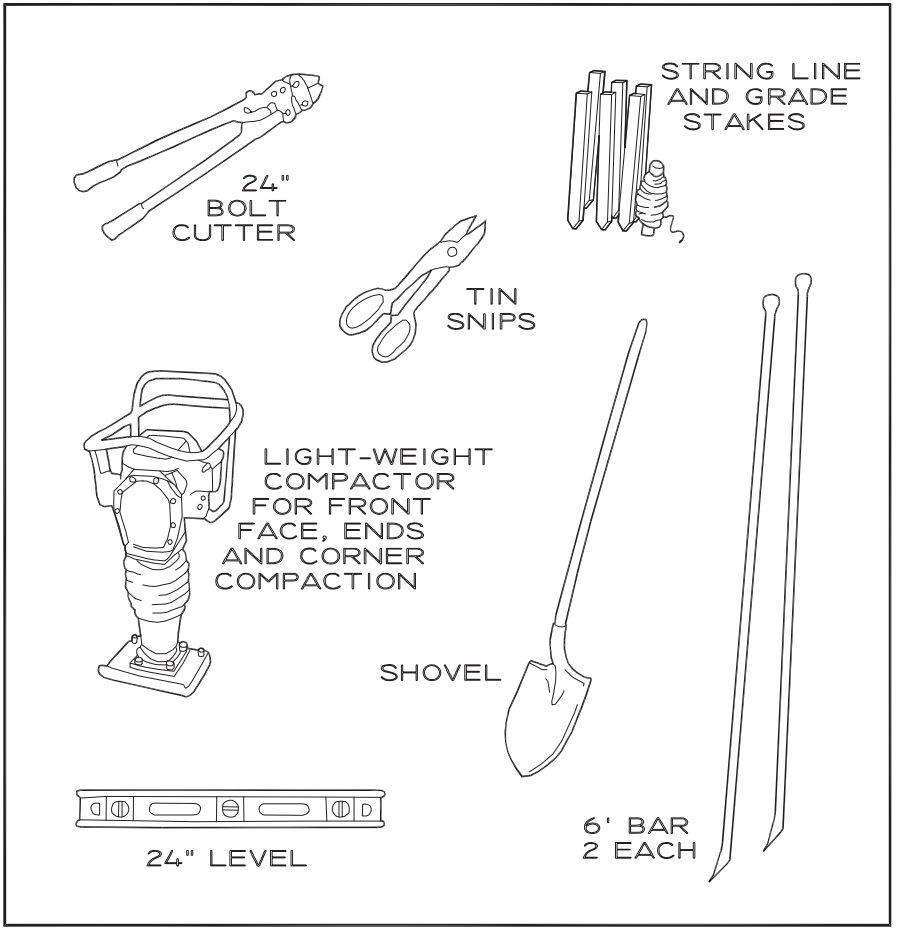
If you have any questions about design, construction or suitability of application, contact Hilfiker Retaining Walls. We will be happy to answer your questions, or design a retaining wall for your project.

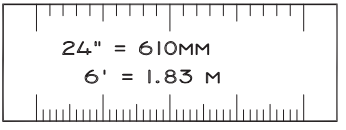
ABOVE ALL, PLEASE REMEMBER, THIS BOOKLET IS A GUIDE ONLY. FIELD CONDITIONS NATURALLY VARY. THE OWNER'S DISCRETION AND EXPERIENCE MAY NECESSITATE MODIFICATIONS WITHIN REASON. HILFIKER ASSUMES NO LIABILITY FOR COMPLIANCE, OR LACK THEREOF.

April 2009
updated 3/14/19

HAND TOOLS NECESSARY

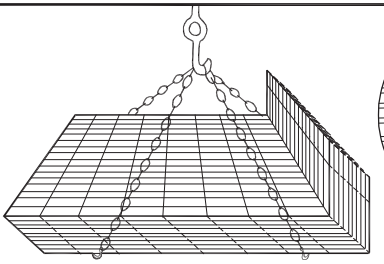
TO BUILD YOUR WALL
(NOT PART OF HILFIKER SUPPLIED COMPONENTS)

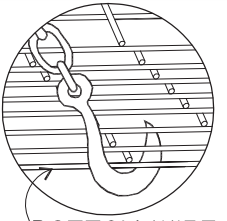




I THINK YOU'LL FIND HILFIKER'S WALL SYSTEMS TO BE THE EASIEST RETAINING WALLS YOU'LL EVER BUILD. THE WIRE MATS ARE DESIGNED TO GIVE THE PROPER STRENGTH. IT'S UP TO YOU TO MAKE THE BACKFILL STRONG. BE SURE IT'S THE RIGHT DENSITY AND COMPACTION. KEEP IT DRY! QUESTIONS? JUST CALL US!

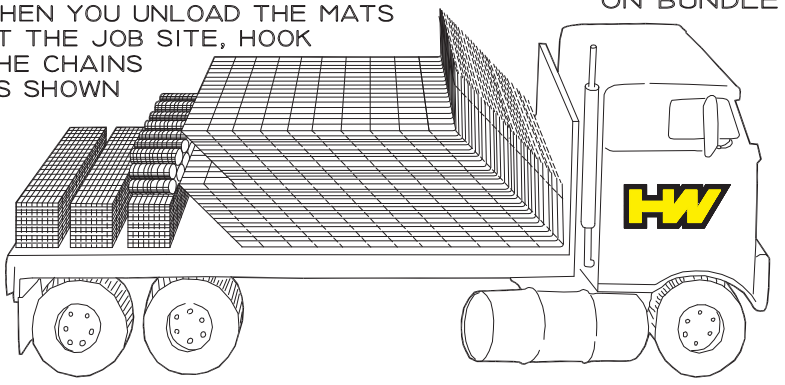
SUGGESTED UNLOADING PROCEDURE





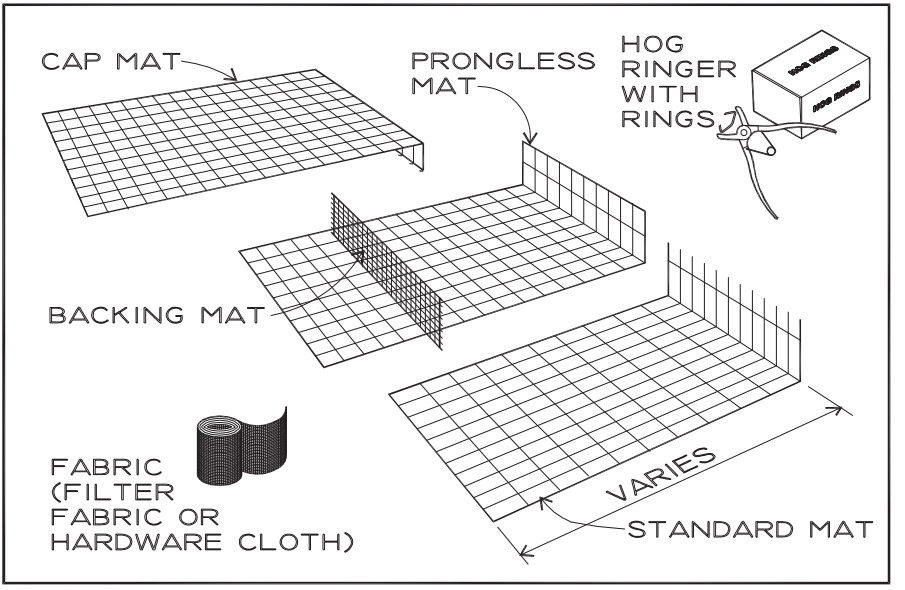
BOTTOM WIRE ON BUNDLE

WHEN YOU UNLOAD THE MATS AT THE JOB SITE, HOOK THE CHAINS AS SHOWN

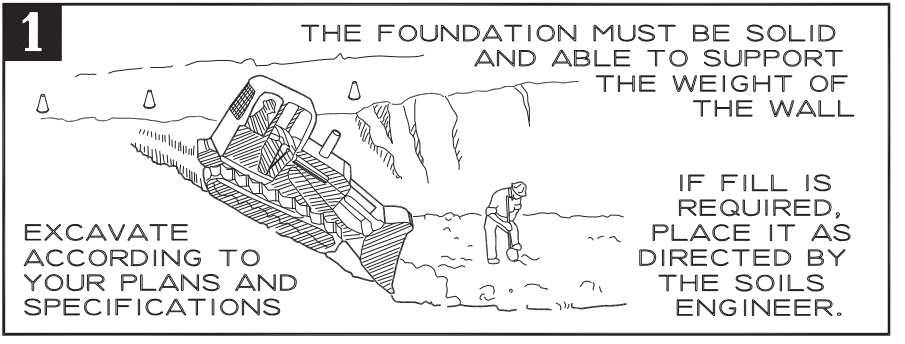


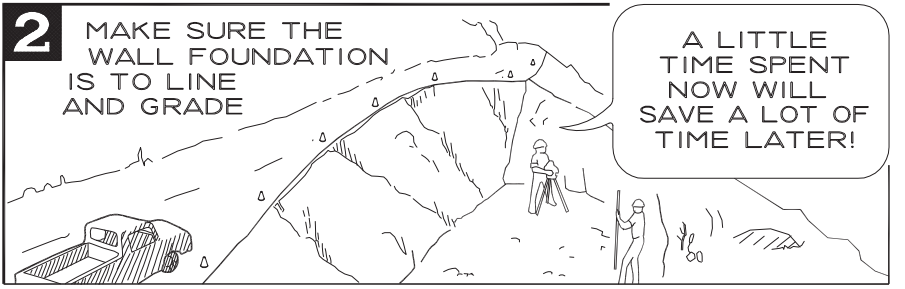
✓ ***IMPORTANT!***
CHECK OFF "WALL PARTS" FROM YOUR BILL OF LADING AS YOU UNLOAD.

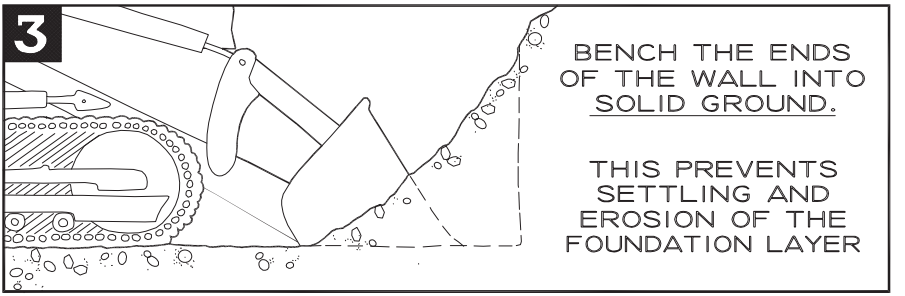
SUPPLIED WALL PARTS



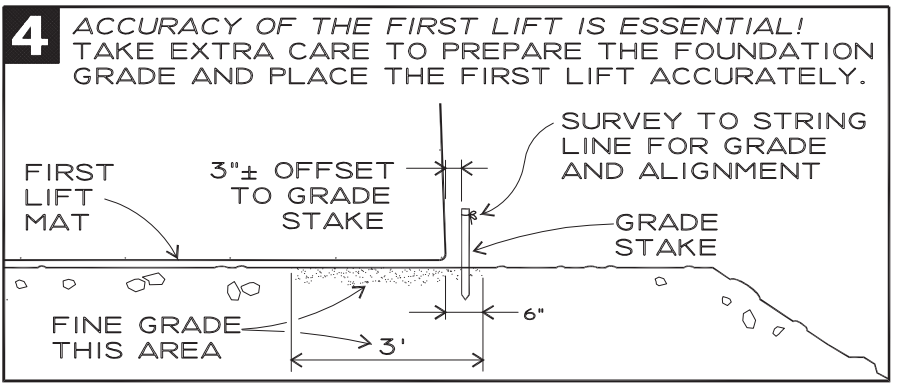
EXCAVATION

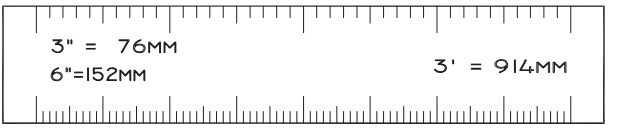


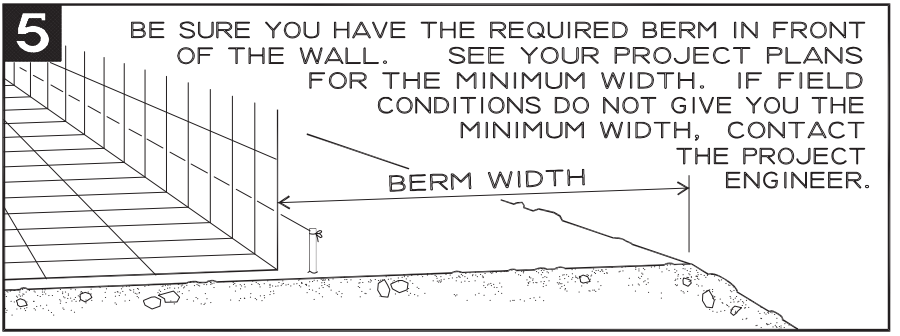


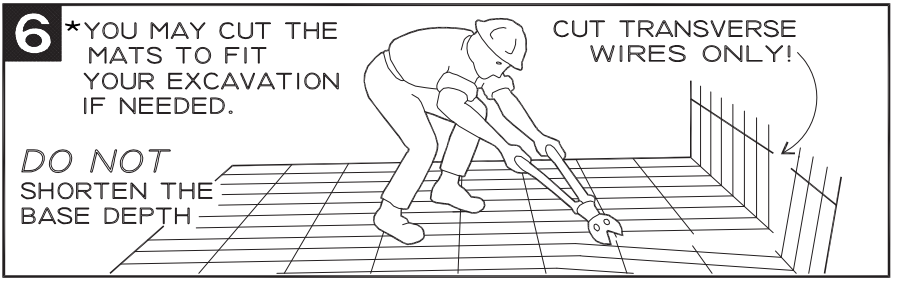


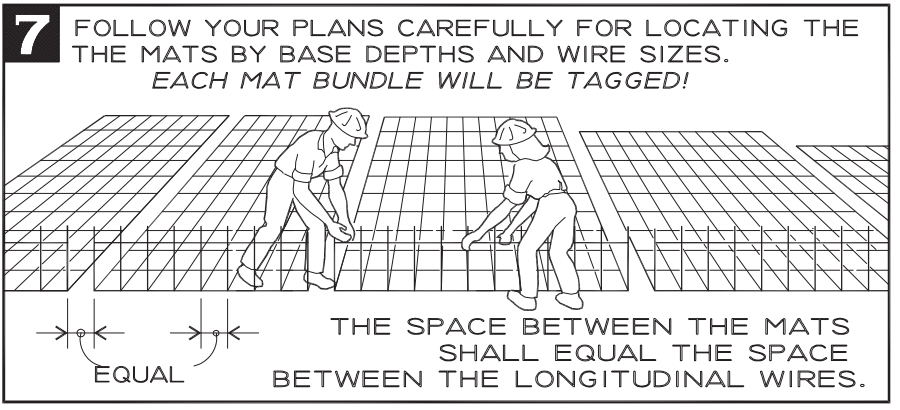
START YOUR WALL!



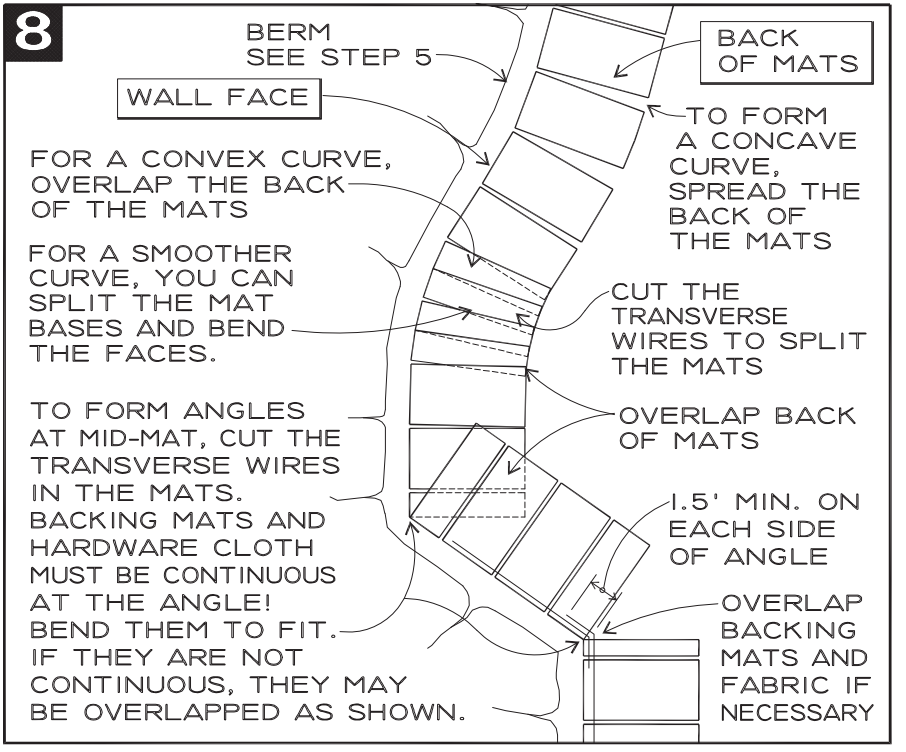


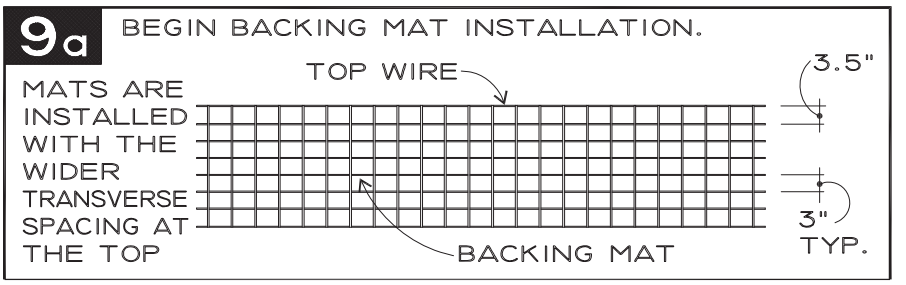


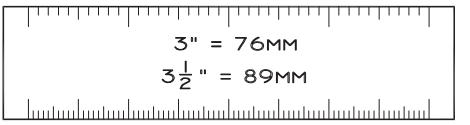




*DO NOT SCRAP THE TRIMMED PORTION UNTIL THE WALL IS COMPLETE. SAVE REMAINING TRIMMMED PORTION, IN CASE IT CAN BE USED ELSEWHERE IN THE MSE WALL.

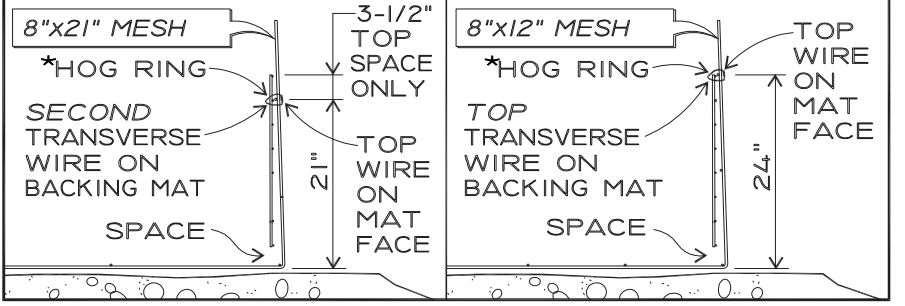

8
BERM
SEE STEP 5
BACK
OF MATS
WALL FACE
TO FORM
A CONCAVE
CURVE,
SPREAD THE
BACK OF
THE MATS
FOR A CONVEX CURVE,
OVERLAP THE BACK
OF THE MATS
FOR A SMOOTHER
CURVE, YOU CAN
SPLIT THE MAT
BASES AND BEND
THE FACES.
CUT THE
TRANSVERSE
WIRES TO SPLIT
THE MATS
TO FORM ANGLES
AT MID-MAT, CUT THE
TRANSVERSE WIRES
IN THE MATS.
BACKING MATS AND
HARDWARE CLOTH
MUST BE CONTINUOUS
AT THE ANGLE!
BEND THEM TO FIT.
IF THEY ARE NOT
CONTINUOUS, THEY MAY
BE OVERLAPPED AS SHOWN.
OVERLAP BACK
OF MATS
1.5' MIN. ON
EACH SIDE
OF ANGLE
OVERLAP
BACKING
MATS AND
FABRIC IF
NECESSARY


9a
BEGIN BACKING MAT INSTALLATION.
TOP WIRE
3.5"
MATS ARE
INSTALLED
WITH THE
WIDER
TRANSVERSE
SPACING AT
THE TOP
3"
TYP.
BACKING MAT

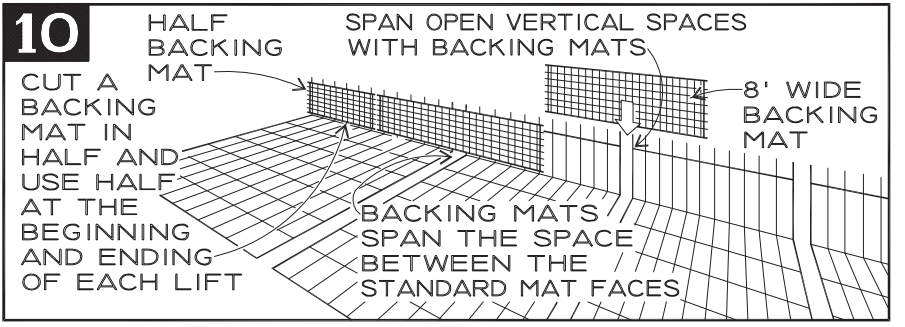

3" = 76MM
3½" = 89MM

9 INSTALL THE BACKING MATS INSIDE THE FIRST LIFT

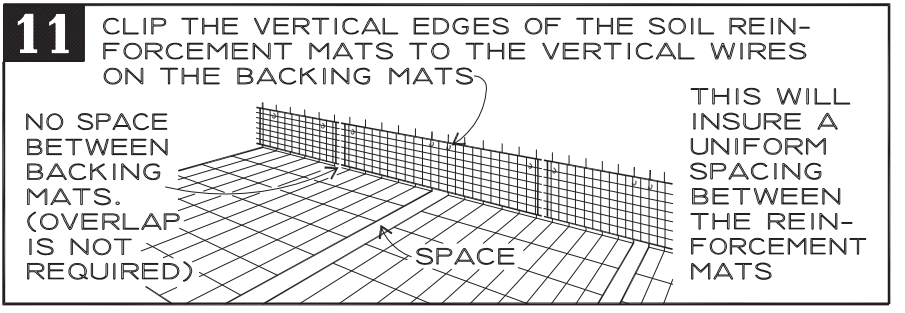
IMPORTANT! CHECK STANDARD MAT MESH SIZE!

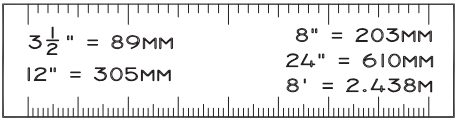


10

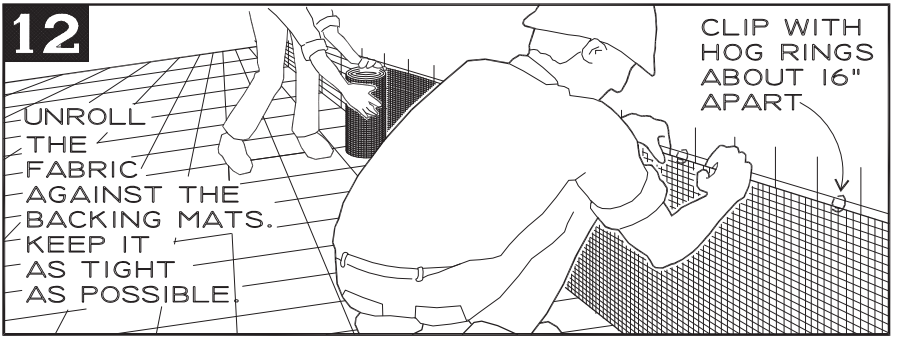


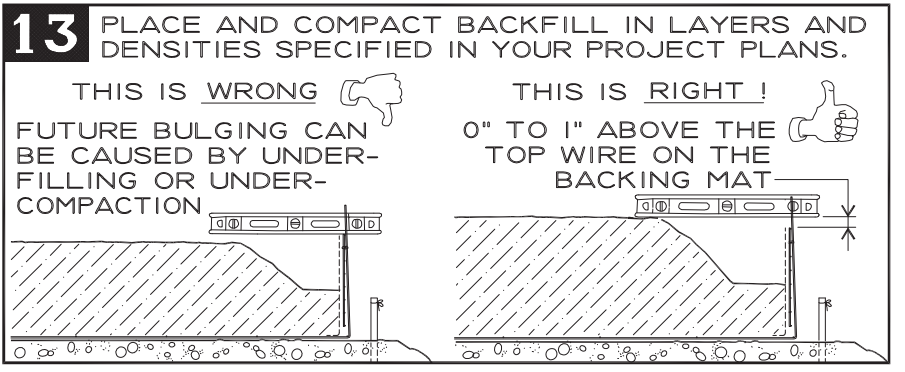
11 CLIP THE VERTICAL EDGES OF THE SOIL REINFORCEMENT MATS TO THE VERTICAL WIRES ON THE BACKING MATS

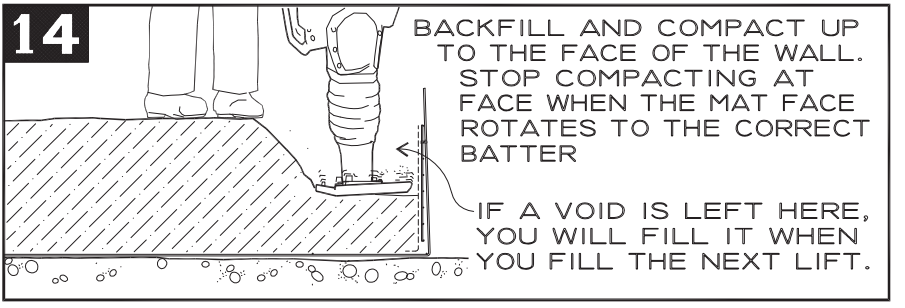


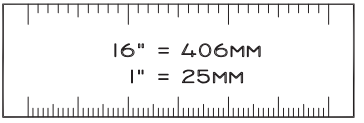


*THE USE OF PNEUMATIC HOG RINGS (OR C-RINGS) ARE NOT RECOMMENDED FOR THE BACKING MAT INSTALLATION

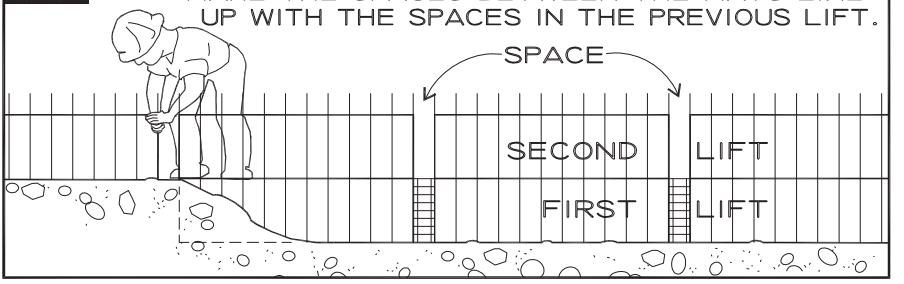

12
UNROLL THE FABRIC AGAINST THE BACKING MATS. KEEP IT AS TIGHT AS POSSIBLE.
CLIP WITH HOG RINGS ABOUT 16" APART


13
PLACE AND COMPACT BACKFILL IN LAYERS AND DENSITIES SPECIFIED IN YOUR PROJECT PLANS.
THIS IS WRONG
FUTURE BULGING CAN BE CAUSED BY UNDER-FILLING OR UNDER-COMPACTION
THIS IS RIGHT !
0" TO 1" ABOVE THE TOP WIRE ON THE BACKING MAT

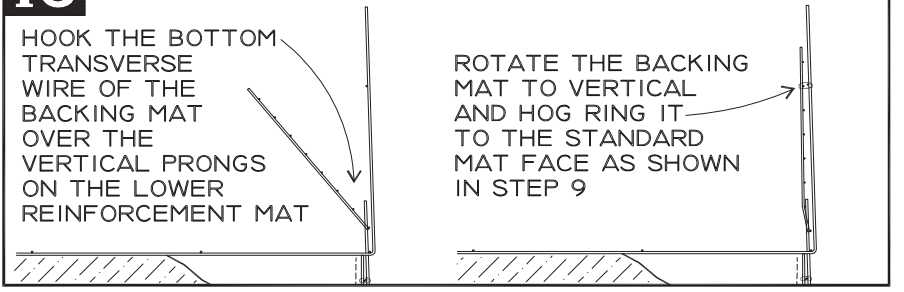

14
BACKFILL AND COMPACT UP TO THE FACE OF THE WALL. STOP COMPACTING AT FACE WHEN THE MAT FACE ROTATES TO THE CORRECT BATTER
IF A VOID IS LEFT HERE, YOU WILL FILL IT WHEN YOU FILL THE NEXT LIFT.


16" = 406MM
1" = 25MM

15 BEGIN THE NEXT LIFT OF REINFORCEMENT MATS. MAKE THE SPACES BETWEEN THE MATS LINE UP WITH THE SPACES IN THE PREVIOUS LIFT.



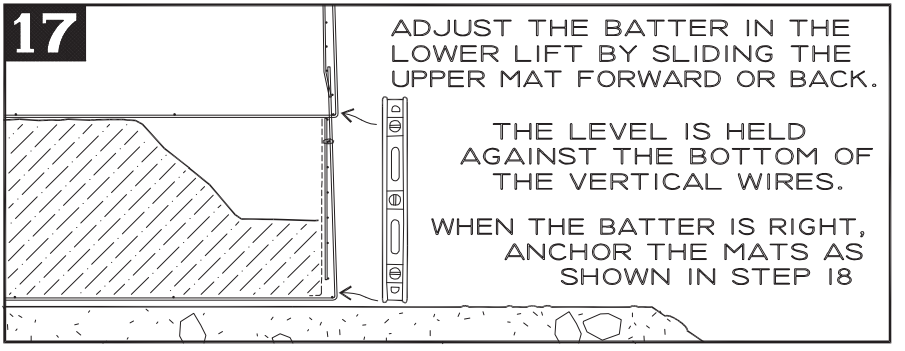
16 INSTALL THE NEXT LEVEL OF BACKING MATS.



17 ADJUST THE BATTER IN THE LOWER LIFT BY SLIDING THE UPPER MAT FORWARD OR BACK.

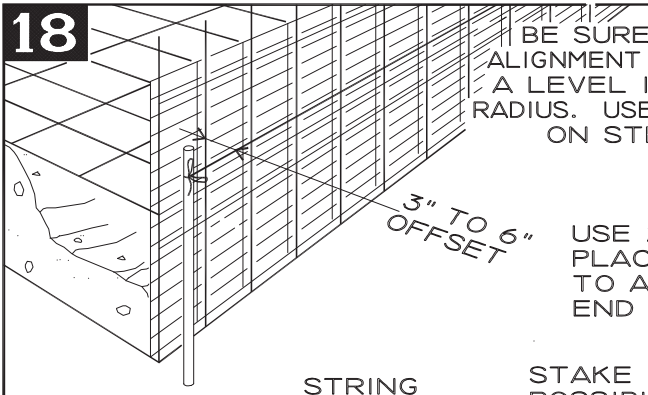
THE LEVEL IS HELD AGAINST THE BOTTOM OF THE VERTICAL WIRES.

WHEN THE BATTER IS RIGHT, ANCHOR THE MATS AS SHOWN IN STEP 18



1:48 = 1/4 INCH PER VERTICAL FOOT
1:10 = 1.2 INCH PER VERTICAL FOOT
1:6 = 2 INCHES PER VERTICAL FOOT

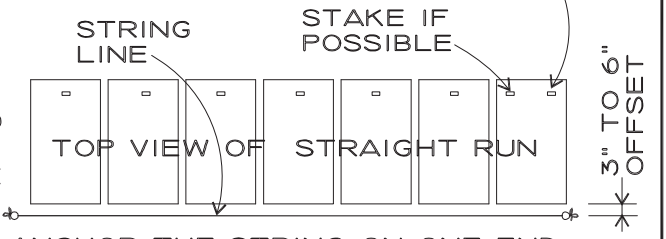
18



BE SURE TO CONTROL ALIGNMENT ON EVERY LIFT. A LEVEL IS USED ON A RADIUS. USE A STRINGLINE ON STRAIGHT RUNS

USE 2 STAKES OR PLACE BACKFILL TO ANCHOR THE END MATS.

STRINGLINE MAY BE PLACED BEHIND THE WALL FACE ABOVE THE FIRST LIFT.

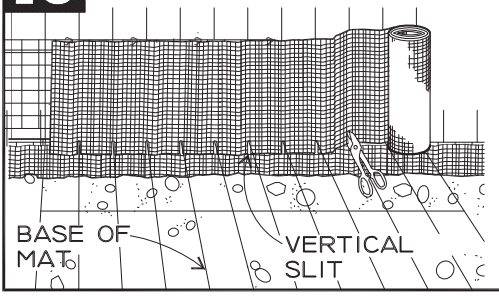


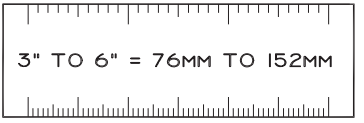
ANCHOR THE STRING ON ONE END, SET THE DESIRED OFFSET, MOVE TO THE OTHER END AND DO THE SAME.

19

BEGIN INSTALLING THE FABRIC. CLIP IT WITH HOG RINGS TO THE TOP WIRE ON THE BACKING MAT. CUT A VERTICAL SLIT IN THE BOTTOM OF THE FABRIC AT EACH LONGITUDINAL WIRE AS SHOWN.

PUSH THE FABRIC DOWN AROUND THE LONGITUDINAL WIRES, CREATING AN OVERLAP INTO THE PREVIOUS LIFT.



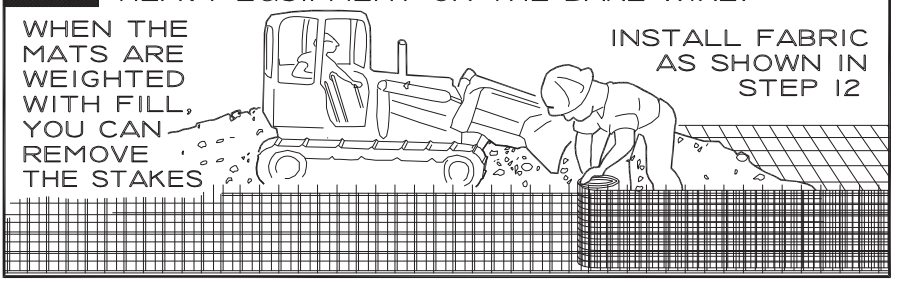


20

BEGIN BACKFILLING AGAIN. *DO NOT* OPERATE HEAVY EQUIPMENT ON THE BARE WIRE!

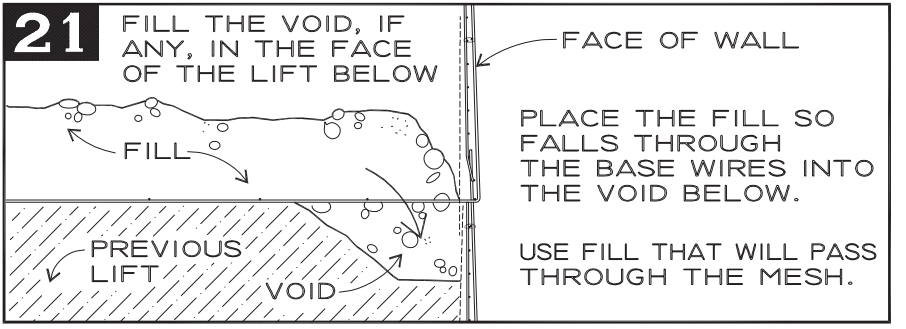
WHEN THE MATS ARE WEIGHTED WITH FILL, YOU CAN REMOVE THE STAKES

INSTALL FABRIC AS SHOWN IN STEP 12



21

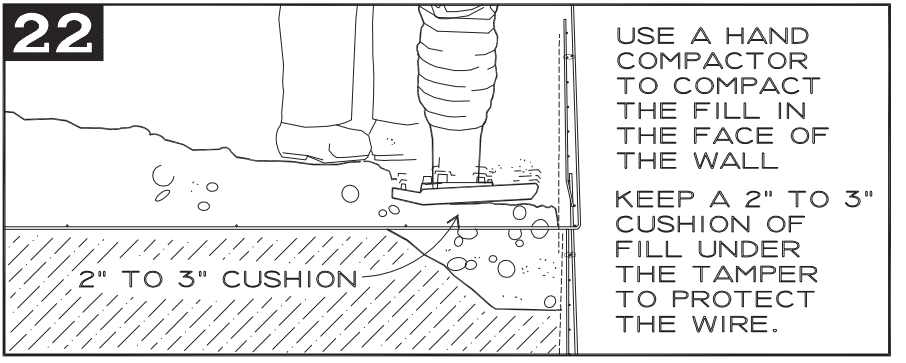
FILL THE VOID, IF ANY, IN THE FACE OF THE LIFT BELOW



PLACE THE FILL SO FALLS THROUGH THE BASE WIRES INTO THE VOID BELOW.

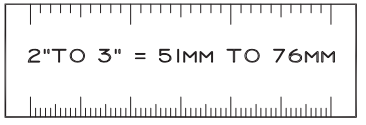
USE FILL THAT WILL PASS THROUGH THE MESH.

22

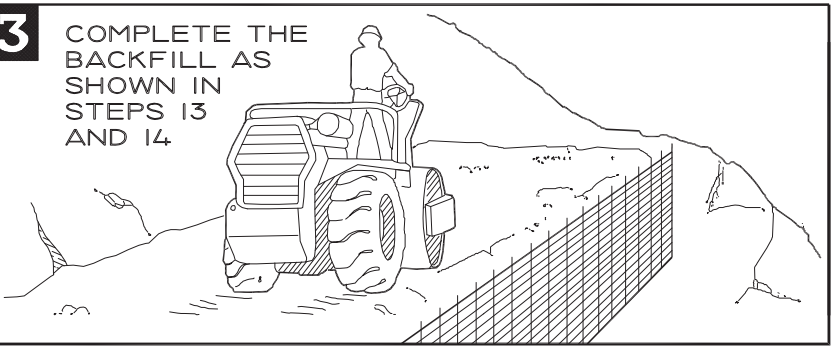


USE A HAND COMPACTOR TO COMPACT THE FILL IN THE FACE OF THE WALL

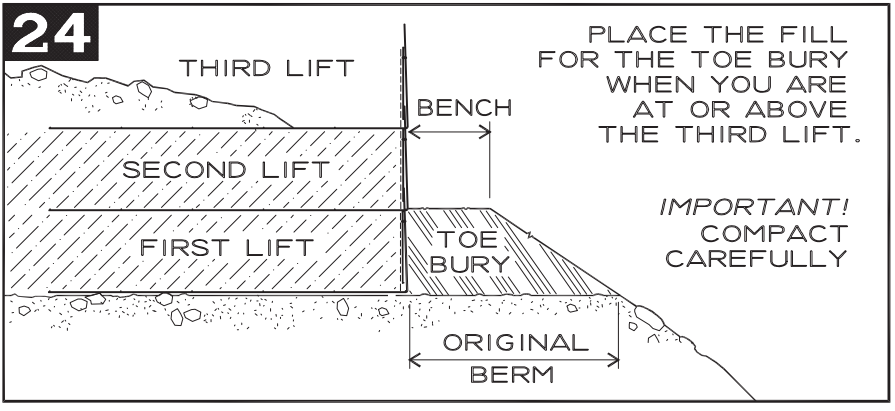
KEEP A 2" TO 3" CUSHION OF FILL UNDER THE TAMPER TO PROTECT THE WIRE.



23 COMPLETE THE BACKFILL AS SHOWN IN STEPS 13 AND 14

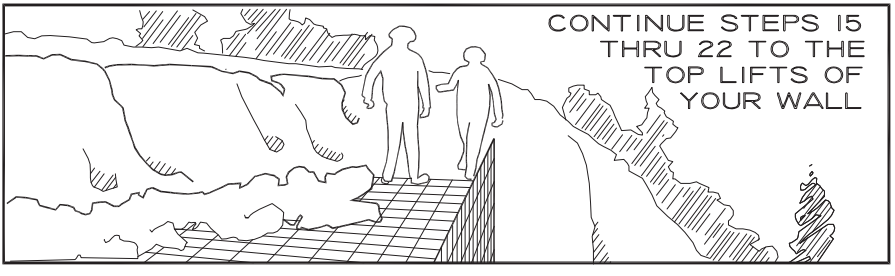


24



PLACE THE FILL FOR THE TOE BURY WHEN YOU ARE AT OR ABOVE THE THIRD LIFT.

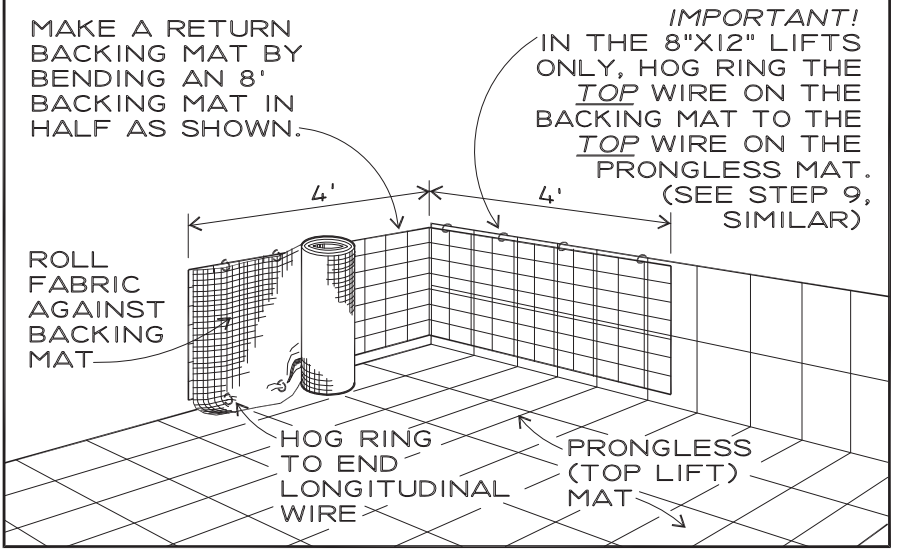
IMPORTANT! COMPACT CAREFULLY



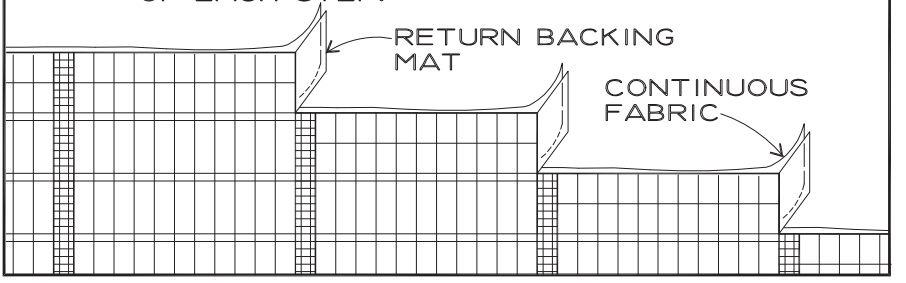
CONTINUE STEPS 15 THRU 22 TO THE TOP LIFTS OF YOUR WALL

TOP OF WALL DETAILS

25 THE ENDS OF THE TOP LIFTS NEED RETURN BACKING MATS TO CONTAIN THE FILL.



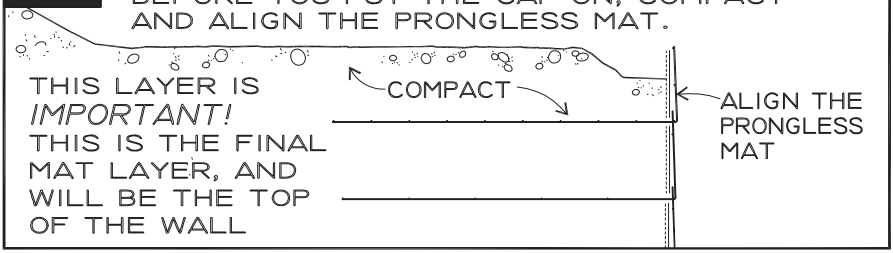
26 IF YOUR WALL STEPS AT THE TOP, USE A RETURN BACKING MAT TO CLOSE THE END OF EACH STEP.



8" = 203MM 4' = 1.22M
12" = 305MM 8' = 2.44M

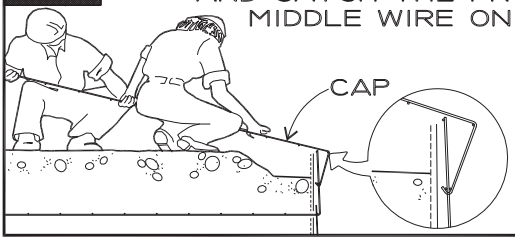
2

BACKFILL TO THE TOP OF THE TOP LIFT. BEFORE YOU PUT THE CAP ON, COMPACT AND ALIGN THE PRONGLESS MAT.



28

COMPLETE THE FINAL LIFT. TILT THE CAP AND CATCH THE FRONT HOOK UNDER THE MIDDLE WIRE ON THE PRONGLESS MAT

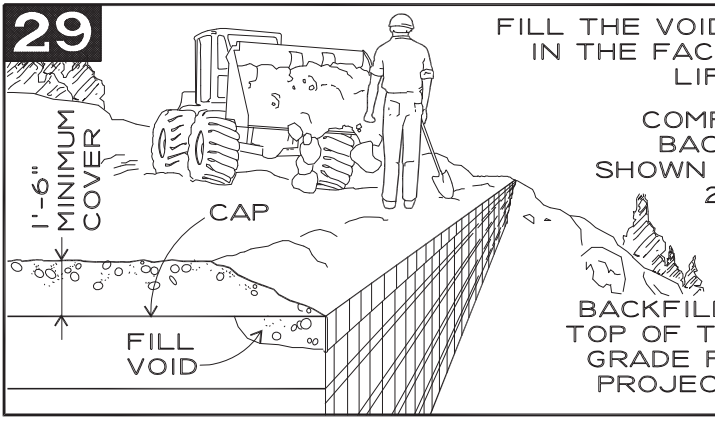


LAY THE CAP ONTO THE FILL. CHECK THE ALIGNMENT, SET THE BATTER, AND ANCHOR. BEGIN THE COVER BACKFILL

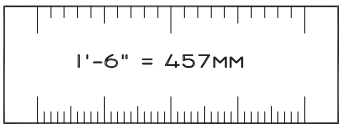
29

FILL THE VOID, IF ANY, IN THE FACE OF THE LIFT BELOW

COMPACT THE BACKFILL AS SHOWN IN STEPS 21 AND 22.



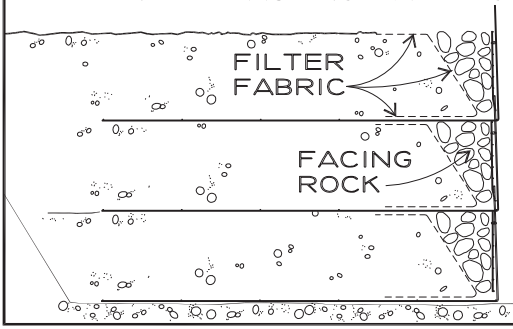
BACKFILL TO THE TOP OF THE FINAL GRADE PER YOUR PROJECT PLANS.



PROJECT-SPECIFIC DETAILS

ROCK FACING INSIDE THE WALL FACE

30 SOME PROJECTS CALL FOR ROCK FACING. IN THESE APPLICATIONS, THE HARDWARE CLOTH IS OMITTED. ROCK LARGER THAN THE OPENINGS IN THE BACKING MAT MESH IS PLACED AT THE FACE OF THE WALL

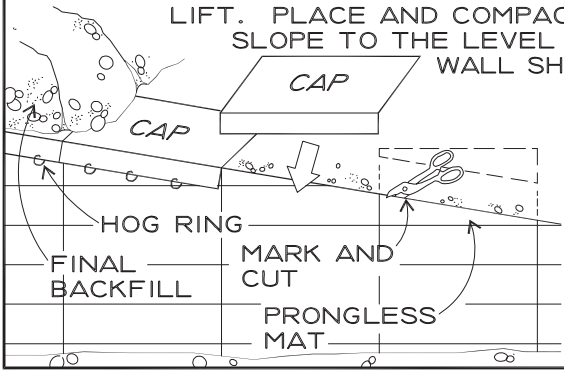


FILTER FABRIC MAY BE INSTALLED DIRECTLY BEHIND THE ROCK.

THIS ENCAPSULATES THE BACKFILL AND PREVENTS ANY FINES FROM MIGRATING INTO THE ROCK ZONE.

SLOPED CAP ON TOP OF WALL

31 SOME WALLS REQUIRE A SLOPED CAP TO MAINTAIN A MINIMUM SHOULDER WIDTH ABOVE THE WALL. INSTALL THE BACKING MAT AND FABRIC IN THE TOP LIFT. PLACE AND COMPACT THE BACKFILL ON SLOPE TO THE LEVEL OF THE TOP OF THE WALL SHOWN IN YOUR PLANS.

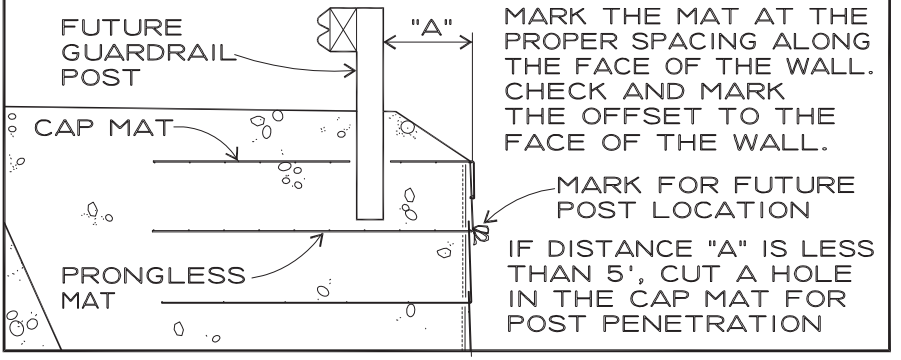


MARK THE PRONGLESS MATS AND BACKING MATS, AND CUT THEM TO FOLLOW THE SLOPE. INSTALL THE CAP MATS AND HOG RING TO THE FACE.

PLACE AND COMPACT THE FINAL LAYER OF FILL.

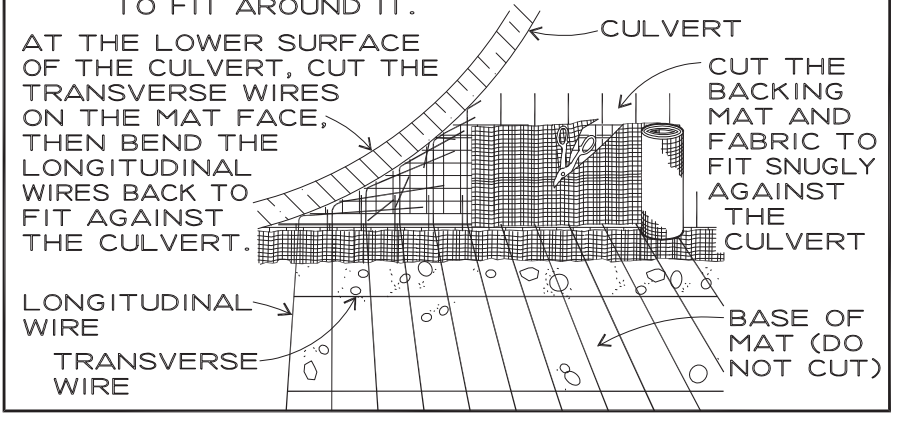
WOOD GUARDRAIL PENETRATION

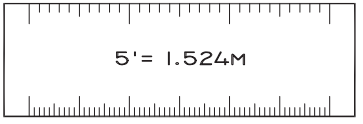
32 IF THE PLANS CALL FOR GUARDRAIL POSTS NEAR THE FACE OF THE WALL, IT MAY BE NECESSARY TO CUT HOLES IN THE CAP MATS.



CULVERT THROUGH WALL

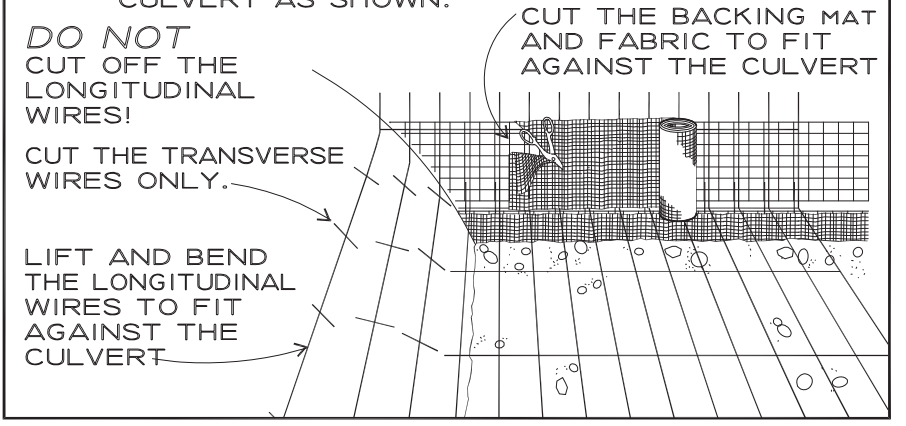
33 IF A CULVERT OR LARGE PIPE PASSES THROUGH THE FACE OF THE WALL, THE MATS ARE CUT TO FIT AROUND IT.



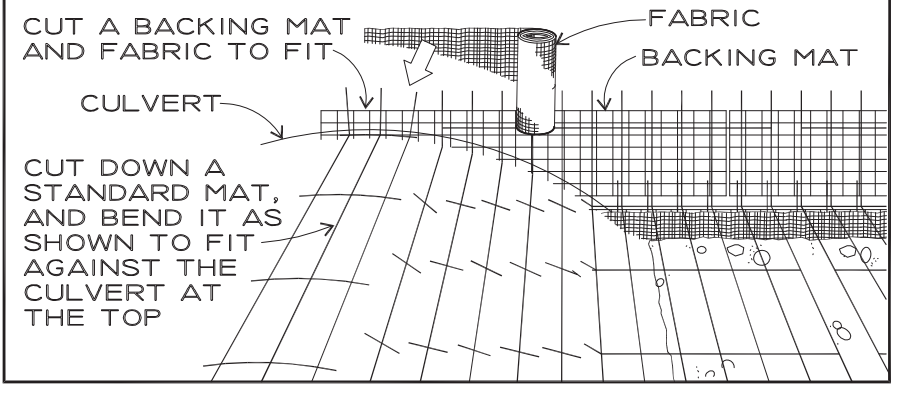


CULVERT THROUGH WALL (CONTINUED)

34 AT THE UPPER SURFACE OF THE CULVERT, THE TRANSVERSE WIRES IN THE BASE OF THE MATS ARE CUT AND BENT AGAINST THE CULVERT AS SHOWN.

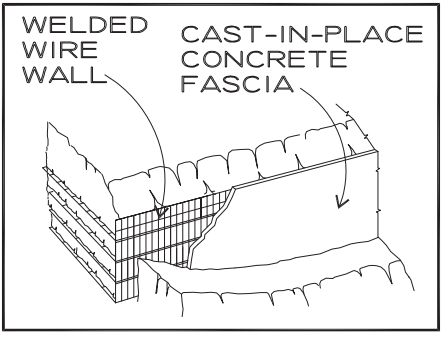


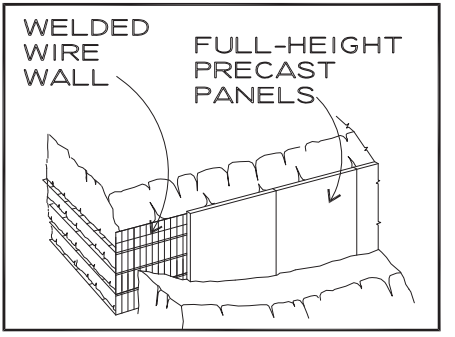
35 THERE MAY BE A LARGE GAP IN THE FACE OF THE WALL AT THE TOP OF THE CULVERT.



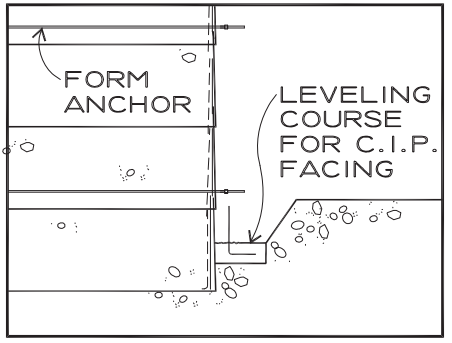
EUREKA REINFORCED SOIL M.S.E. WALL DETAILS

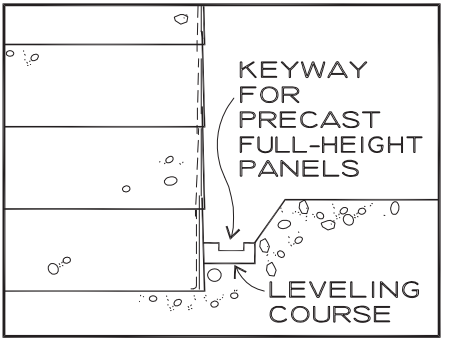
THE HILFIKER E.R.S. WALL BEGINS AS A WELDED WIRE WALL. AFTER COMPLETION AND ANY POTENTIAL SETTLEMENT, PERMANENT FACING IS INSTALLED. THIS MAY CONSIST OF CAST-IN-PLACE CONCRETE, OR FULL-HEIGHT PRECAST CONCRETE PANELS. THE PROJECT CONSTRUCTION PLANS WILL GIVE MORE SPECIFIC DETAILS.





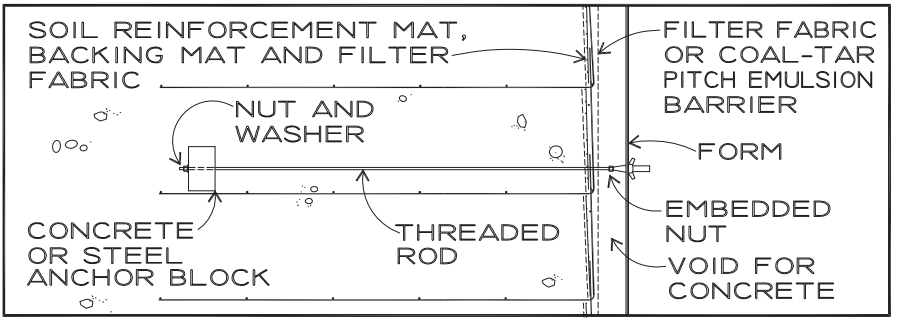
A LEVELING COURSE IS CAST AGAINST THE TOE OF THE WELDED WIRE WALL. THIS WILL SERVE TO SUPPORT AND ALIGN THE FORMS FOR THE C.I.P. FACING, OR WILL HAVE A KEYWAY FOR ALIGNMENT AND CONTROL OF THE TOE OF THE PRECAST FULL-HEIGHT PANELS.





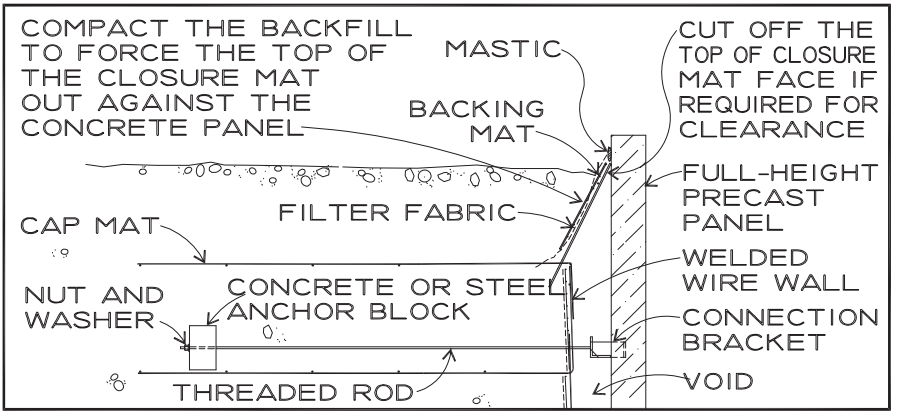
ANCHORS FOR C.I.P. FORMS

ANCHORAGE BOLTS ARE INSTALLED AS THE WELDED WIRE WALL IS BUILT. THE DESIGN MAY VARY FROM THAT SHOWN HERE. SPACING, SIZE AND PROJECT-SPECIFIC DETAILS OF THE ANCHORS WILL BE SHOWN IN THE CONSTRUCTION PLANS.

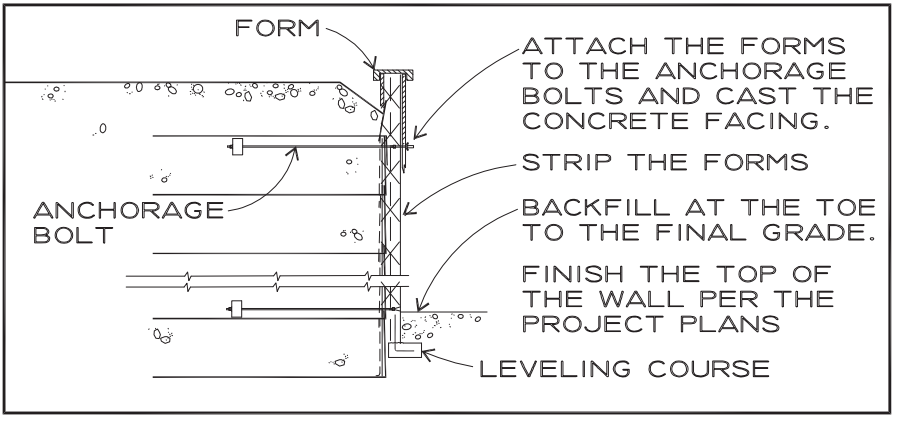


ANCHORS FOR FULL-HEIGHT PRECAST PANELS

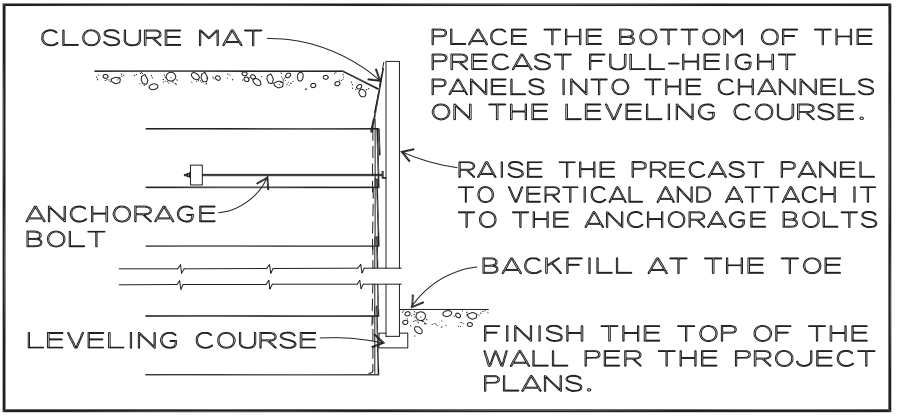
ANCHORAGE BOLTS ARE INSTALLED ONLY NEAR THE TOP OF THE WALL. THE DESIGN MAY VARY FROM THAT SHOWN HERE. SPACING, SIZE AND PROJECT-SPECIFIC DETAILS OF THE ANCHORS WILL BE SHOWN IN THE CONSTRUCTION PLANS.



FINISHING THE E.R.S. C.I.P. FACING



FINISHING THE E.R.S. PRECAST FACING



STAND BACK AND ADMIRE YOUR WORK OF ART! SEND PHOTOGRAPHS TO HILFIKER RETAINING WALLS FOR POTENTIAL PUBLICATION (WITH YOUR APPROVAL, OF COURSE!)

WIRE SIZE COMPARISON TABLE

"W" SIZE NUMBER	NOMINAL DIAMETER (INCHES)	NOMINAL DIAMETER (MM)
W12.0	.391	9.9
W9.5	.348	8.8
W7.0	.299	7.6
W4.5	.239	6.1
W4.0	.226	5.7
W3.5	.211	5.4

WIRE SPECIFICATIONS

ASTM SPECIFICATION	AASHTO STANDARD	TITLE
A 82	M 32	COLD-DRAWN STEEL WIRE FOR CONCRETE REINFORCEMENT
A 185	M 55	WELDED STEEL WIRE FABRIC FOR CONCRETE REINFORCEMENT
A 123	M 111	ZINC (HOT DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS

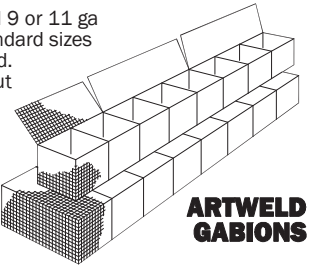
WELDED SMOOTH WIRE FABRIC ASTM A 185

WIRE SIZE	TENSILE STRENGTH PSI	YIELD STRENGTH PSI	WELD SHEAR STRENGTH
W1.2 & OVER	75,000 (520 MPA)	65,000 (450 MPA)	35,000 (240 MPA)

FOR MORE INFORMATION ON WELDED WIRE REINFORCEMENT (WWR) CHECK THE WEBSITE FOR THE WIRE REINFORCEMENT INSTITUTE:
HTTP://WWW.WIREREINFORCEMENTINSTITUTE.ORG/

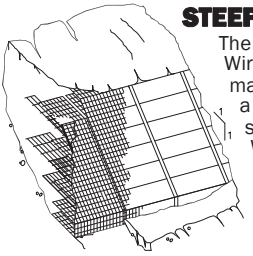
OTHER HILFIKER PRODUCTS

ArtWeld Gabions are factory-assembled of galvanized 9 or 11 ga Welded Wire Mesh, and are shipped folded flat. Standard sizes are available, and non-standard sizes can be supplied. The mesh can be field-cut to any size or shape without losing structural strength. In comparison to conventional gabions, the larger wire diameter and welded grid gives greater strength, longer life and easier installation. "Spiral" binders, used in field assembly of the gabion edges, and preformed stiffeners, are fast and simple to install.



ARTWELD GABIONS

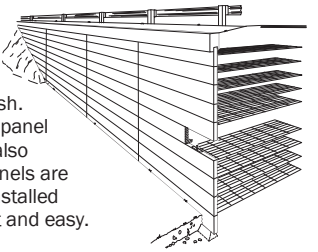
STEEPENED SLOPE



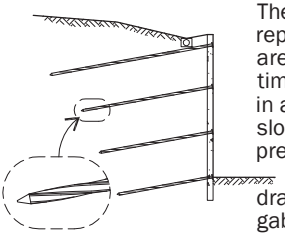
The Hilfiker Steepened slope system is composed of Welded Wire Fabric components. The flat primary soil reinforcement mats are interlocked with bent facing mats, prefabricated to a 1:1 slope. The slope may be flattened, if desired, by stepping each layer back. Behind the facing mats are Welded Wire Fabric backing mats incorporated with erosion mat or sod. Virtually any type of sod or vegetation that will best suit the environment may be used with this system. Low-growth, maintenance-free vegetation is typically specified.

REINFORCED SOIL EMBANKMENT (SMOOTH FACE)

The R.S.E. Smooth Face Retaining Wall retains most of the advantages of the Welded Wire Wall, while providing the additional durability of precast face panels. Panels can be cast to match a variety of architectural treatments, as well as a smooth finish. In most structures, the simple 12.5' x 2.5' standard panel is used, making all the panels interchangable. We also manufacture special panel sizes when required. Panels are cast with a cantilever footing at the back, and pre-installed reinforcement mat anchors, making installation fast and easy.



SPIRALNAIL WALL SYSTEM



The Spiralnail system was originally designed to replace conventional soil nailing systems. Spiralnails are driven directly into the soil, eliminating time-consuming "drill and grout". They can be used in a variety of projects, including retaining walls, slope stabilization, tie-backs for cast-in-place or precast concrete panels, repair of existing retaining structures, and can be designed to act as soil drains. They can also be faced with welded wire, gabions, and "spider" slope reinforcing.