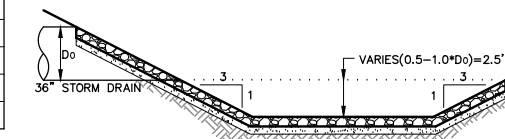
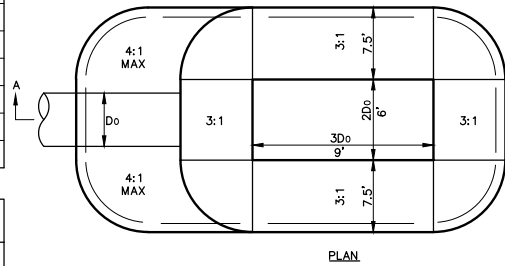


RIP-RAP GRADATIONS	
12" THICKNESS OF RIP-RAP	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
15 INCH	100
12 INCH	70 - 100
8 INCH	45 - 75
6 INCH	30 - 55
3 INCH	10 - 30
1-1/2 INCH	0 - 10

BEDDING GRADATIONS	
6" THICKNESS OF BEDDING	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
3 INCH	100
1-1/2 INCH	55 - 100
3/4 INCH	25 - 60
3/8 INCH	5 - 30
No. 4	0 - 10



**1 SCOUR HOLE DETAIL**  
NOT TO SCALE

**SOLVE EQUATIONS 1 & 2 FOR D<sub>50</sub>**  
**USE THE LARGER OF THE TWO TO DETERMINE GRADATION TABLE**

1)  $D_{50} = \frac{V_w + V_{w2}}{20(\delta_s - \delta_w)C}$   $D_{50} = \frac{62.4 \times 26.11}{64.4 \times 92.6 \times 0.86^2}$   
 $D_{50} = 1629.26$   
 $D_{50} = 4410.56$

$V_w = 5.11$  fps  $Q_{10} = 36.15$  cfs  $D_{50} = 6.82'$   
 $C = 0.86$  (HIGH TURBULENCE), 1.2 (LOW TURBULENCE)  
 $\delta_w = 62.4$  lb/cf  
 $\delta_s = 155$  lb/cf  
 $G = 32.2$  ft/s<sup>2</sup>

**RESULTS**  
 $D_{50} = 7'$

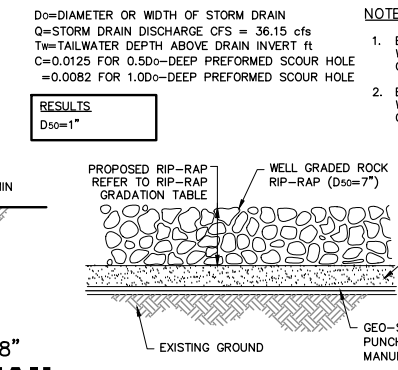
2)  $D_{50} = \frac{C}{T_w} \left( \frac{Q}{D_o} \right)^{1/3}$   $D_{50} = \frac{0.0082}{3} \left( \frac{36.15}{3} \right)^{1/3} = 0.075'$

**DRY STONE RIP-RAP SPECIFICATIONS & GRADING**  
 THE FOLLOWING SPECIFICATIONS AND GRADATIONS ARE MINIMUMS TO BE USED IN CONSTRUCTION.

- USE FILED OR QUARRY DRY STONE RIP-RAP.
- ALL STONES SHALL HAVE A MINIMUM UNIT WEIGHT OF 155 lb/cf. QUARRY DATA SHEETS FOR RIP-RAP TO BE APPROVED PRIOR TO INSTALLATION.
- MINIMUM BED DEPTH OF RIP-RAP SHALL BE 6".
- STONES SHALL BE PLACED IN A SINGLE LAYER WITH CLOSED JOINTS. THE UPRIGHT AXIS OF THE SONTES SHALL BE NEARLY PERPENDICULAR TO THE EMBANKMENT SLOPE. THE COURSES SHALL BE PLACED FROM THE BOTTOM OF THE EMBANKMENT UPWARDLY, WITH LARGER STONES BEING PLACED IN THE LOWER COURSES. OPEN JOINTS SHALL BE FILLED WITH SPALLS. STONES THAT PROJECT MORE THAN THE ALLOWABLE AMOUNT IN THE FINISHED WORK SHALL BE REPLACED, EMBEDDED DEEPER, OR CHIPPED.
- RIP RAP SHALL BE STOCKPILED AND APPROVED PRIOR TO INSTALLATION.

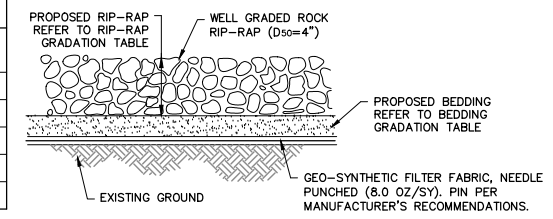
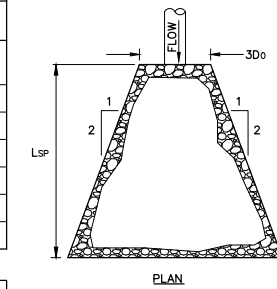
**NOTE:**

- EQUATION 1 CAME FROM THE US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION, CE, HYDRAULIC DESIGN CRITERIA, SHEET 712-1, 1970
- EQUATION 2 CAME FROM THE US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION, CE, HYDRAULIC DESIGN CRITERIA, SHEET 722-7, 1970



RIP-RAP GRADATIONS	
12" THICKNESS OF RIP-RAP	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
15 INCH	100
12 INCH	70 - 100
8 INCH	45 - 75
6 INCH	30 - 55
3 INCH	10 - 30
1-1/2 INCH	0 - 10

BEDDING GRADATIONS	
6" THICKNESS OF BEDDING	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
3 INCH	100
1-1/2 INCH	55 - 100
3/4 INCH	25 - 60
3/8 INCH	5 - 30
No. 4	0 - 10



**3 RIP-RAP DETAIL**  
NOT TO SCALE

**SOLVE EQUATIONS 1 & 2 FOR D<sub>50</sub>**  
**USE THE LARGER OF THE TWO TO DETERMINE GRADATION TABLE**

1)  $D_{50} = \frac{V_w + V_{w2}}{20(\delta_s - \delta_w)C}$   $D_{50} = \frac{62.4 \times 43.82}{64.4 \times 92.6 \times 0.86^2}$   $D_{50} = 2734.37$   
 $D_{50} = 4410.56 = 0.62'$

$V_w = 6.62$  fps  
 $C = 0.86$  (HIGH TURBULENCE), 1.2 (LOW TURBULENCE)  
 $\delta_w = 62.4$  lb/cf  
 $\delta_s = 155$  lb/cf  
 $G = 32.2$  ft/s<sup>2</sup>

**RESULTS**  
 $D_{50} = 7.4" < 8"$

2)  $D_{50} = \frac{C}{T_w} \left( \frac{Q}{D_o} \right)^{1/3}$   $D_{50} = \frac{0.0082}{2} \left( \frac{20.81}{2} \right)^{1/3} = 0.09'$

**DRY STONE RIP-RAP SPECIFICATIONS & GRADING**  
 THE FOLLOWING SPECIFICATIONS AND GRADATIONS ARE MINIMUMS TO BE USED IN CONSTRUCTION.

- USE FILED OR QUARRY DRY STONE RIP-RAP.
- ALL STONES SHALL HAVE A MINIMUM UNIT WEIGHT OF 155 lb/cf. QUARRY DATA SHEETS FOR RIP-RAP TO BE APPROVED PRIOR TO INSTALLATION.
- MINIMUM BED DEPTH OF RIP-RAP SHALL BE 6".
- STONES SHALL BE PLACED IN A SINGLE LAYER WITH CLOSED JOINTS. THE UPRIGHT AXIS OF THE SONTES SHALL BE NEARLY PERPENDICULAR TO THE EMBANKMENT SLOPE. THE COURSES SHALL BE PLACED FROM THE BOTTOM OF THE EMBANKMENT UPWARDLY, WITH LARGER STONES BEING PLACED IN THE LOWER COURSES. OPEN JOINTS SHALL BE FILLED WITH SPALLS. STONES THAT PROJECT MORE THAN THE ALLOWABLE AMOUNT IN THE FINISHED WORK SHALL BE REPLACED, EMBEDDED DEEPER, OR CHIPPED.
- RIP RAP SHALL BE STOCKPILED AND APPROVED PRIOR TO INSTALLATION.

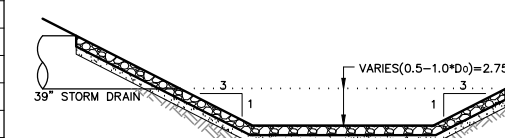
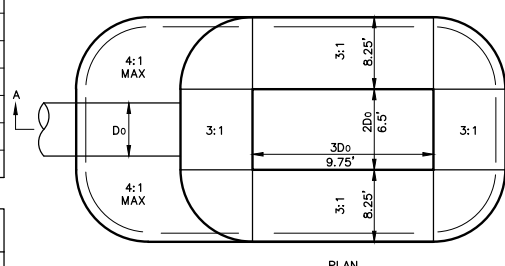
**NOTE:**

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- EQUATION 2 CAME FROM THE US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION, CE, HYDRAULIC DESIGN CRITERIA, SHEET 722-7, 1970



RIP-RAP GRADATIONS	
12" THICKNESS OF RIP-RAP	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
15 INCH	100
12 INCH	70 - 100
8 INCH	45 - 75
6 INCH	30 - 55
3 INCH	10 - 30
1-1/2 INCH	0 - 10

BEDDING GRADATIONS	
6" THICKNESS OF BEDDING	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
3 INCH	100
1-1/2 INCH	55 - 100
3/4 INCH	25 - 60
3/8 INCH	5 - 30
No. 4	0 - 10



**2 SCOUR HOLE DETAIL**  
NOT TO SCALE

**SOLVE EQUATIONS 1 & 2 FOR D<sub>50</sub>**  
**USE THE LARGER OF THE TWO TO DETERMINE GRADATION TABLE**

1)  $D_{50} = \frac{V_w + V_{w2}}{20(\delta_s - \delta_w)C}$   $D_{50} = \frac{62.4 \times 23.91}{64.4 \times 92.6 \times 0.86^2}$   
 $D_{50} = 1492.12$   
 $D_{50} = 4410.56 = 0.34'$

$V_w = 4.89$  fps  $Q_{10} = 34.55$  cfs  $D_{50} = 4.08'$   
 $C = 0.86$  (HIGH TURBULENCE), 1.2 (LOW TURBULENCE)  
 $\delta_w = 62.4$  lb/cf  
 $\delta_s = 155$  lb/cf  
 $G = 32.2$  ft/s<sup>2</sup>

**RESULTS**  
 $D_{50} = 5'$

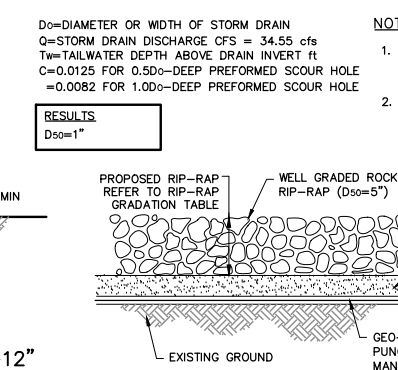
2)  $D_{50} = \frac{C}{T_w} \left( \frac{Q}{D_o} \right)^{1/3}$   $D_{50} = \frac{0.0082}{3.25} \left( \frac{34.55}{3.25} \right)^{1/3} = 0.03'$

**DRY STONE RIP-RAP SPECIFICATIONS & GRADING**  
 THE FOLLOWING SPECIFICATIONS AND GRADATIONS ARE MINIMUMS TO BE USED IN CONSTRUCTION.

- USE FILED OR QUARRY DRY STONE RIP-RAP.
- ALL STONES SHALL HAVE A MINIMUM UNIT WEIGHT OF 155 lb/cf. QUARRY DATA SHEETS FOR RIP-RAP TO BE APPROVED PRIOR TO INSTALLATION.
- MINIMUM BED DEPTH OF RIP-RAP SHALL BE 6".
- STONES SHALL BE PLACED IN A SINGLE LAYER WITH CLOSED JOINTS. THE UPRIGHT AXIS OF THE SONTES SHALL BE NEARLY PERPENDICULAR TO THE EMBANKMENT SLOPE. THE COURSES SHALL BE PLACED FROM THE BOTTOM OF THE EMBANKMENT UPWARDLY, WITH LARGER STONES BEING PLACED IN THE LOWER COURSES. OPEN JOINTS SHALL BE FILLED WITH SPALLS. STONES THAT PROJECT MORE THAN THE ALLOWABLE AMOUNT IN THE FINISHED WORK SHALL BE REPLACED, EMBEDDED DEEPER, OR CHIPPED.
- RIP RAP SHALL BE STOCKPILED AND APPROVED PRIOR TO INSTALLATION.

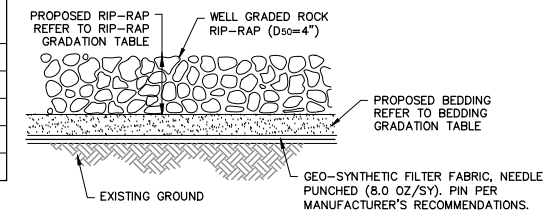
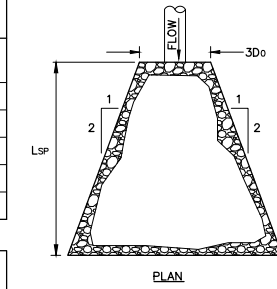
**NOTE:**

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- EQUATION 2 CAME FROM THE US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION, CE, HYDRAULIC DESIGN CRITERIA, SHEET 722-7, 1970



RIP-RAP GRADATIONS	
8" THICKNESS OF RIP-RAP	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
10 INCH	100
8 INCH	70 - 100
6 INCH	50 - 75
3 INCH	20 - 40
1-1/2 INCH	0 - 15

BEDDING GRADATIONS	
6" THICKNESS OF BEDDING	
SIEVE SIZE SQUARE MESH	PERCENT PASSING
3 INCH	100
1-1/2 INCH	55 - 100
3/4 INCH	25 - 60
3/8 INCH	5 - 30
No. 4	0 - 10



**4 RIP-RAP DETAIL**  
NOT TO SCALE

**SOLVE EQUATIONS 1 & 2 FOR D<sub>50</sub>**  
**USE THE LARGER OF THE TWO TO DETERMINE GRADATION TABLE**

1)  $D_{50} = \frac{V_w + V_{w2}}{20(\delta_s - \delta_w)C}$   $D_{50} = \frac{62.4 \times 23.04}{64.4 \times 92.6 \times 0.86^2}$   $D_{50} = 1437.70$   
 $D_{50} = 4410.56 = 0.33'$

$V_w = 4.80$  fps  
 $C = 0.86$  (HIGH TURBULENCE), 1.2 (LOW TURBULENCE)  
 $\delta_w = 62.4$  lb/cf  
 $\delta_s = 155$  lb/cf  
 $G = 32.2$  ft/s<sup>2</sup>

**RESULTS**  
 $D_{50} = 3.9" < 4"$

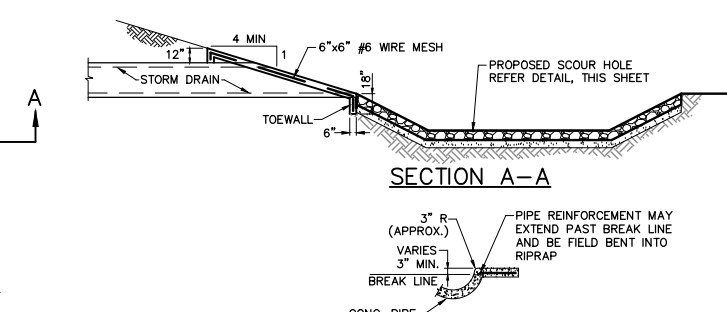
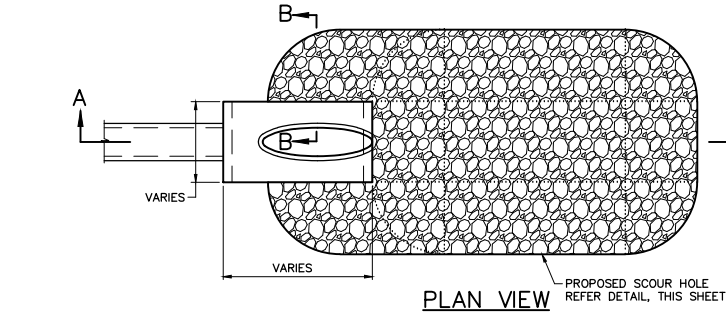
2)  $D_{50} = \frac{C}{T_w} \left( \frac{Q}{D_o} \right)^{1/3}$   $D_{50} = \frac{0.0082}{3} \left( \frac{15.06}{3} \right)^{1/3} = 0.02'$

**DRY STONE RIP-RAP SPECIFICATIONS & GRADING**  
 THE FOLLOWING SPECIFICATIONS AND GRADATIONS ARE MINIMUMS TO BE USED IN CONSTRUCTION.

- USE FILED OR QUARRY DRY STONE RIP-RAP.
- ALL STONES SHALL HAVE A MINIMUM UNIT WEIGHT OF 155 lb/cf. QUARRY DATA SHEETS FOR RIP-RAP TO BE APPROVED PRIOR TO INSTALLATION.
- MINIMUM BED DEPTH OF RIP-RAP SHALL BE 6".
- STONES SHALL BE PLACED IN A SINGLE LAYER WITH CLOSED JOINTS. THE UPRIGHT AXIS OF THE SONTES SHALL BE NEARLY PERPENDICULAR TO THE EMBANKMENT SLOPE. THE COURSES SHALL BE PLACED FROM THE BOTTOM OF THE EMBANKMENT UPWARDLY, WITH LARGER STONES BEING PLACED IN THE LOWER COURSES. OPEN JOINTS SHALL BE FILLED WITH SPALLS. STONES THAT PROJECT MORE THAN THE ALLOWABLE AMOUNT IN THE FINISHED WORK SHALL BE REPLACED, EMBEDDED DEEPER, OR CHIPPED.
- RIP RAP SHALL BE STOCKPILED AND APPROVED PRIOR TO INSTALLATION.

**NOTE:**

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- EQUATION 2 CAME FROM THE US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION, CE, HYDRAULIC DESIGN CRITERIA, SHEET 722-7, 1970



**2 REINFORCED CONCRETE SLOPING HEADWALL**  
NOT TO SCALE

**RECORD DRAWING**

THE SIGNED AND SEALED CONSTRUCTION DOCUMENT HAS BEEN REVISED TO REFLECT CONSTRUCTION RECORDS MAINTAINED AND PROVIDED BY THE CONTRACTOR FOR THIS PROJECT. THE INFORMATION SHOWN ON THIS RECORD DRAWING, WHICH WAS PROVIDED BY THE CONTRACTOR, OR OTHERS NOT ASSOCIATED WITH THE DESIGN ENGINEER, CANNOT BE VERIFIED FOR ACCURACY OR COMPLETENESS. PACHECO KOCH SHALL ASSUME NO LIABILITY FOR ANY CHANGES MADE DURING CONSTRUCTION THAT WERE NOT SPECIFICALLY APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION. THE SEALED CONSTRUCTION DRAWINGS ARE ON FILE AT THE OFFICES OF PACHECO KOCH.

ATTESTED BY: *[Signature]*  
 ENGINEER OF RECORD: CHET LEUGERS, P.E.  
 CONTRACTOR: MILLER-VALENTE CONSTRUCTION  
 DATE REVISED: 06/08/2017

NO.	DATE	REVISION
06/09/2017	RECORD DRAWINGS	
09/19/2016	REVISED DETAIL	

**Pacheco Koch**  
 7557 RAMBLER ROAD, SUITE 1400  
 DALLAS, TX 75231 972.235.3031  
 TX REG. ENGINEERING FIRM F-14439  
 TX REG. SURVEYING FIRM LS-10193005

**RIP-RAP DETAILS**

**ROCKWALL MANUFACTURING FACILITY**  
**LOT 1, BLOCK A, ROCKWALL**  
**TECHNOLOGY PARK, PHASE IV**  
**CITY OF ROCKWALL, ROCKWALL COUNTY, TEXAS**

DESIGN	DRAWN	DATE	SCALE	NOTES	FILE	NO.
CTL	RHB	JULY 2016	N.T.S.			<b>C4.8</b>

NELSON 6/14/2017 11:56 AM M:\CNC-37\3762-16.05-A\DWG\CIVIL C-3D 2015\3762-16.05-4STRM.DWG

Rockwall Manufacturing Facility