FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY

Fabricated Corrugated Aluminum Toewall Drop Spillways are available only in the standard sizes listed in the charts on pages MO-6-2 and MO-6-3.

OVERFALL HEIGHT (F) Select F = 1.9, 3.0 or 4.0 feet as required for channel stability. Flow depth in the downstream channel at structure design capacity should not be less than 3/4 of overfall height to provide backwater condition at the structure outlet. Bank protection must be provided at structure outlet when backwater condition does not exist.

NOTCH DEPTH (H) Select H = 1.8, 1.9 or 2.1 feet as needed. Design depths in the waterway above the structure should not be deeper than notch depth minus freeboard (F).

NOTCH WIDTH (W) The notch width selected should be approximately equal to the bottom width of the downstream channel.

Riprap as shown on the drawings is required.

Complete the drawings by filling in all blanks as applicable. The tables (pages MO-6-2 through MO-6-5) will be used for capacity, structure dimensions and steel schedule. Steel schedules are given for both No. 4 (1/2") and No. 5 (5/8") bars. Select one size.

STRUCTURE DIMENSION CHART FOR FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY

Overfall Height (F) = 1.9 Feet
Notch Depth (H) = 1.8 Feet
Headwall Height (A) = 4.2 Feet
Headwall Length (S) = 8.7 Feet

CAPACITY	FREEBOARD	NOTCH WIDTH	LEG LENGTH	WEIR LENGTH	CONCRETE IN APRON AND TOEWALL
Q	F	W	B	L	Vol.
cfs	ft	ft	ft	ft	cu.yd.
65	0.50	7	1.6	14.2	3.4
75	0.40	8	0.8	14.2	3.6
95	0.25	10	0.0	15.8	4.1
115	0.25	12	0.1	19.0	5.0
135	0.25	14	0.1	22.2	5.9
150	0.25	16	0.1	25.4	7.0
170	0.25	18	0.2	28.6	8.2
190	0.30	20	1.0	33.4	10.0

Overfall Height (F) = 3.0 Feet
Notch Depth (H) = 1.9 Feet
Headwall Height (A) = 5.4 Feet
Headwall Length (S) = 11.3 Feet

CAPACITY	FREEBOARD	NOTCH WIDTH	LEG LENGTH	WEIR LENGTH	CONCRETE IN APRON AND TOEWALL
Q	F	W	B	L	Vol.
cfs	ft	ft	ft	ft	cu.yd.
100	0.20	7	1.6	14.2	3.9
100	0.20	8	0.8	14.2	4.0
105	0.25	7	2.4	15.8	4.0
115	0.15	8	1.6	15.8	4.2
115	0.15	10	0.0	15.8	4.5
120	0.20	8	2.4	17.4	4.4
125	0.15	10	0.8	17.4	4.8

Overfall Height (F) = 3.0 Feet
Notch Depth (H) = 1.9 Feet
Headwall Height (A) = 5.4 Feet
Headwall Length (S) = 11.3 Feet

CAPACITY	FREEBOARD	NOTCH WIDTH	LEG LENGTH	WEIR LENGTH	CONCRETE IN APRON AND TOEWALL
Q	F	W	B	L	Vol.
cfs	ft	ft	ft	ft	cu.yd.
135	0.15	10	1.6	19.0	5.0
135	0.15	12	0.1	19.0	5.4
145	0.15	10	2.4	20.6	5.3
145	0.15	12	0.9	20.6	5.7
150	0.25	10	3.2	22.5	5.5
160	0.15	12	1.7	22.5	6.0
160	0.15	14	0.1	22.5	6.3
170	0.15	12	2.5	23.8	6.3
170	0.15	14	0.9	23.8	6.7
180	0.15	12	3.3	25.4	6.6
180	0.15	14	1.7	25.4	7.0
180	0.15	16	0.1	25.4	7.4
190	0.15	14	2.1	26.2	7.2
190	0.15	16	0.5	26.2	7.6
205	0.15	14	3.3	28.6	7.7
205	0.15	16	1.7	28.6	8.2
205	0.15	18	0.2	28.6	8.6
210	0.20	14	4.5	31.0	8.2
220	0.15	16	2.9	31.0	8.6
220	0.15	18	1.4	31.0	9.3
240	0.15	16	4.1	33.4	9.3
240	0.15	18	2.6	33.4	9.9
240	0.15	20	1.0	33.4	10.4
255	0.15	18	3.8	35.8	10.6
255	0.15	20	2.2	35.8	11.1
270	0.15	18	5.0	38.2	11.2
275	0.15	20	3.4	38.2	11.8
300	0.15	20	5.0	41.5	12.8

STRUCTURE DIMENSION CHART FOR FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY

Overfall Height (F) = 4.0 Feet
Notch Depth (H) = 2.1 Feet
Headwall Height (A) = 6.6 Feet
Headwall Length (S) = 13.4 Feet

CAPACITY	FREEBOARD	NOTCH WIDTH	LEG LENGTH	WEIR LENGTH	CONCRETE IN APRON AND TOEWALL
Q	F	W	B	L	Vol.
cfs	ft	ft	ft	ft	cu.yd.
100	0.35	7	1.6	14.2	4.2
120	0.30	7	2.4	15.8	4.4
140	0.20	7	3.2	17.4	4.6
145	0.15	8	2.4	17.4	4.8
160	0.15	8	3.2	19.0	5.0
160	0.15	10	1.6	19.0	5.4
160	0.15	12	0.1	19.0	5.7
170	0.20	10	2.4	20.6	5.6
170	0.20	12	0.9	20.6	6.0
185	0.15	10	3.2	22.2	5.9
185	0.15	12	1.7	22.2	6.3
185	0.15	14	0.1	22.2	6.7
195	0.20	10	4.0	23.8	6.1
195	0.20	12	2.5	23.8	6.6
195	0.20	14	0.9	23.8	7.0
200	0.25	10	4.8	25.4	6.4
210	0.20	12	3.3	25.4	6.9
210	0.20	14	1.7	25.4	7.4
210	0.20	16	0.1	25.4	7.8
220	0.15	12	3.7	26.2	7.1
220	0.15	14	2.1	26.2	7.6
220	0.15	16	0.5	26.2	7.9
235	0.20	12	4.9	28.6	7.5
235	0.20	14	3.3	28.6	8.1
235	0.20	16	1.7	28.6	8.5
235	0.20	18	0.2	28.6	9.0

Overfall Height (F) = 4.0 Feet
Notch Depth (H) = 2.1 Feet
Headwall Height (A) = 6.6 Feet
Headwall Length (S) = 13.4 Feet

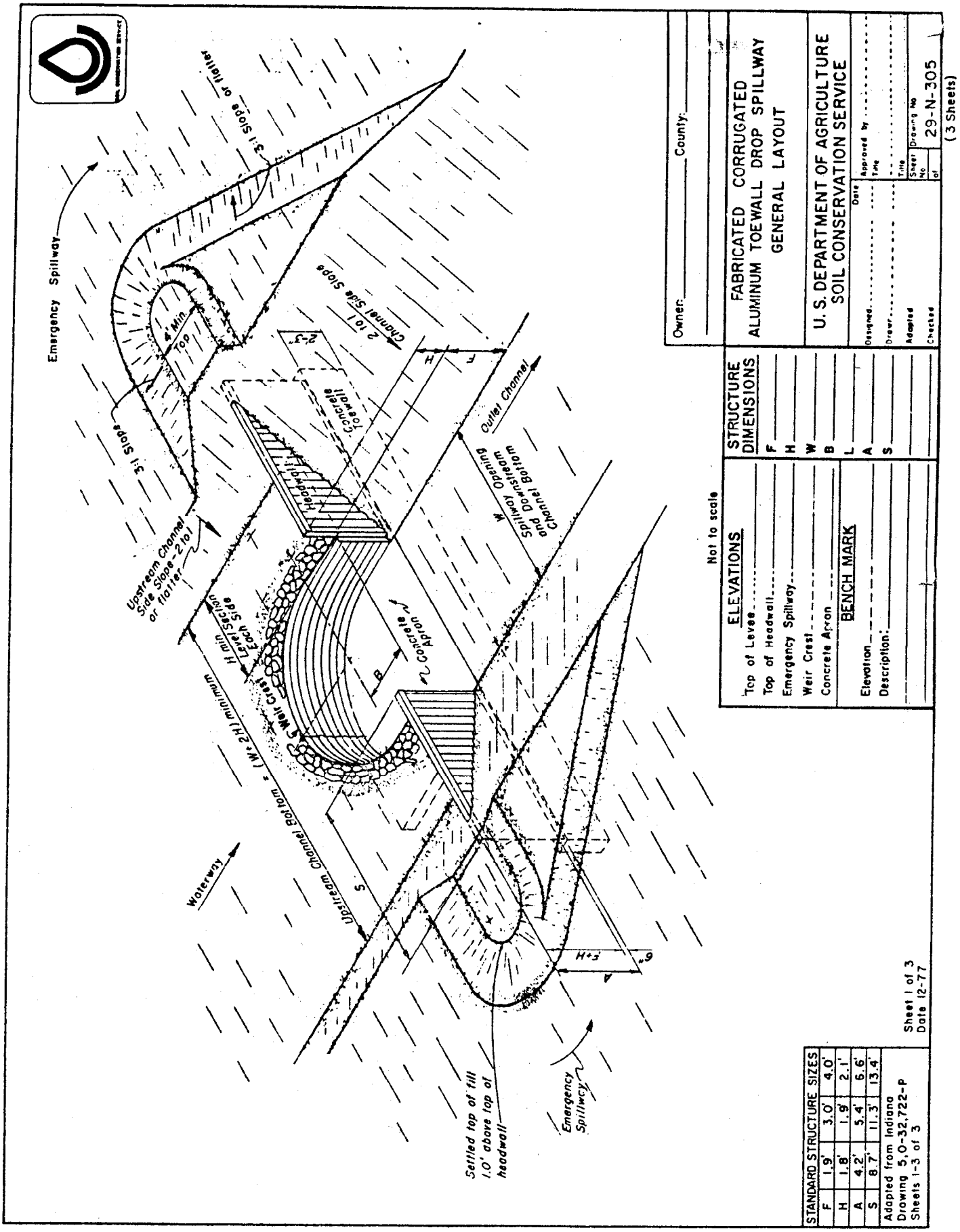
CAPACITY	FREEBOARD	NOTCH WIDTH	LEG LENGTH	WEIR LENGTH	CONCRETE IN APRON AND TOEWALL
Q	F	W	B	L	Vol.
cfs	ft	ft	ft	ft	cu.yd.
255	0.20	14	4.5	31.0	8.6
255	0.20	16	2.9	31.0	9.1
255	0.20	18	1.4	31.0	9.6
275	0.20	14	5.7	33.4	9.1
275	0.20	16	4.1	33.4	9.7
275	0.20	18	2.6	33.4	10.3
275	0.20	20	1.0	33.4	10.8
280	0.25	14	6.9	35.8	9.6
300	0.15	16	5.3	35.8	10.3
300	0.15	18	3.8	35.8	10.9
300	0.15	20	2.2	35.8	11.5
320	0.15	16	6.5	38.2	10.9
320	0.15	18	5.0	38.2	11.6
320	0.15	20	3.4	38.2	12.2
345	0.15	18	6.6	41.5	12.5
345	0.15	20	5.0	41.5	13.1
360	0.20	18	8.2	44.7	13.3
370	0.15	20	6.6	44.7	14.1
400	0.15	20	8.2	47.9	15.1

FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY

NOTCH WIDTH (W)	LEG LENGTH (B)	STEEL SCHEDULE									
		SIZE NO. 4					SIZE NO. 5				
		MARK	QUANTITY	BAR LENGTH	TOTAL LENGTH	WEIGHT	MARK	QUANTITY	BAR LENGTH	TOTAL LENGTH	WEIGHT
7	1.6	1	9	7-9	69-9	46.6	1	7	7-9	54-3	56.6
		2	9	8-0	72-0	48.1	2	8	8-0	64-0	66.8
	2.4	1	9	8-6	76-6	51.1	1	7	8-6	59-6	62.1
		2	10	8-0	80-0	53.4	2	9	8-0	72-0	75.1
	3.2	1	9	9-3	83-3	55.6	1	7	9-3	64-9	67.5
		2	11	8-0	88-0	58-8	2	9	8-0	72-0	75.1
8	0.8	1	10	7-6	75-0	50.1	1	8	7-6	60-0	62.6
		2	9	9-0	81-0	54.1	2	8	9-0	72-0	75.1
	1.6	1	10	8-3	82-6	55.1	1	8	8-3	66-0	68.8
		2	10	9-0	90-0	60.1	2	8	9-0	72-0	75.1
	2.4	1	10	9-0	90-0	60.1	1	8	9-0	72-0	75.1
		2	10	9-0	90-0	60.1	2	9	9-0	81-0	84.5
	3.2	1	10	9-9	97-6	65.1	1	8	9-9	78-0	81.4
		2	11	9-0	99-0	66.1	2	10	9-0	90-0	93.9
10	0	1	12	7-9	93-0	62.1	1	10	7-9	77-6	80.8
		2	9	11-0	99-0	66.1	2	8	11-0	88-0	91.8
	0.8	1	12	8-6	102-0	68.1	1	10	8-6	85-0	88.7
		2	10	11-0	110-0	73.5	2	9	11-0	99-0	103.3
	1.6	1	12	9-3	111-0	74.2	1	10	9-3	92-6	96.5
		2	11	11-0	121-0	80.8	2	9	11-0	99-0	103.3
	2.4	1	12	10-0	120-0	80.2	1	10	10-0	100-0	104.3
		2	11	11-0	121-0	80.8	2	10	11-0	110-0	114.7
	3.2	1	12	10-9	129-0	86.2	1	10	10-9	107-6	112.1
		2	12	11-0	132-0	88.2	2	10	11-0	110-0	114.7
	4.0	1	12	11-9	141-0	94.2	1	10	11-9	117-6	122.6
		2	13	11-0	143-0	95.5	2	11	11-0	121-0	126.2
	4.8	1	12	12-6	150-0	100.2	1	10	12-6	125-0	130.4
		2	14	11-0	154-0	102.9	2	12	11-0	132-0	137.7
12	0.1	1	14	8-9	122-6	81.8	1	11	8-9	96-3	100.4
		2	10	13-0	130-0	86.8	2	9	13-0	117-0	122.0
	0.9	1	14	9-6	133-0	88.8	1	11	9-6	104-6	109.0
		2	11	13-0	143-0	95.5	2	9	13-0	117-0	122.0
	1.7	1	14	10-3	143-6	95.9	1	11	10-3	112-9	117.6
		2	12	13-0	156-0	104.2	2	10	13-0	130-0	135.6
	2.5	1	14	11-3	157-6	105.2	1	11	11-3	123-9	129.1
		2	13	13-0	169-0	112.9	2	11	13-0	143-0	149.2
	3.3	1	14	12-0	168-0	112.2	1	11	12-0	132-0	137.7
		2	13	13-0	169-0	112.9	2	11	13-0	143-0	149.2
	3.7	1	14	12-3	171-6	114.6	1	11	12-3	134-9	140.5
		2	14	13-0	182-0	121.6	2	12	13-0	156-0	162.7
	4.9	1	14	13-6	189-0	126.3	1	11	13-6	148-6	154.9
		2	15	13-0	195-0	130.3	2	13	13-0	169-0	176.3
14	0.1	1	16	9-9	156-0	104.2	1	13	9-9	126-9	132.2
		2	11	15-0	165-0	110.2	2	10	15-0	150-0	156.5
	0.9	1	16	10-6	168-0	112.2	1	13	10-6	136-6	142.4
		2	12	15-0	180-0	120.2	2	10	15-0	150-0	156.5
	1.7	1	16	11-3	180-0	120.2	1	13	11-3	146-3	152.5
		2	13	15-0	195-0	130.3	2	11	15-0	165-0	172.1

FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY

NOTCH WIDTH (W)	LEG LENGTH (B)	STEEL SCHEDULE									
		SIZE NO. 4					SIZE NO. 5				
		MARK	QUANTITY	BAR LENGTH	TOTAL LENGTH	WEIGHT	MARK	QUANTITY	BAR LENGTH	TOTAL LENGTH	WEIGHT
14	2.1	1	16	11-9	188-0	125.6	1	13	11-9	152-9	159.3
		2	13	15-0	195-0	130.3	2	11	15-0	165-0	172.1
	3.3	1	16	13-0	208-0	138.9	1	13	13-0	169-0	176.3
		2	14	15-0	210-0	140.3	2	12	15-0	180-0	187.7
	4.5	1	16	14-3	228-0	152.3	1	13	14-3	185-3	193.2
		2	16	15-0	240-0	160.3	2	13	15-0	195-0	203.4
	5.7	1	16	15-3	244-0	163.0	1	13	15-3	198-3	206.8
		2	17	15-0	255-0	170.3	2	14	15-0	210-0	219.0
	6.9	1	16	16-6	264-0	176.4	1	13	16-6	214-6	223.7
		2	18	15-0	270-0	180.4	2	15	15-0	225-0	234.7
16	0.1	1	18	10-9	193-6	129.3	1	14	10-9	150-6	157.0
		2	12	17-0	204-0	136.3	2	10	17-0	170-0	177.3
	0.5	1	18	11-3	202-6	135.3	1	14	11-3	157-6	164.3
		2	13	17-0	221-0	147.6	2	11	17-0	187-0	195.0
	1.7	1	18	12-3	220-6	147.3	1	14	12-3	171-6	178.9
		2	14	17-0	238-0	159.0	2	12	17-0	204-0	212.8
	2.9	1	18	13-6	243-0	162.3	1	14	13-6	189-0	197.1
		2	15	17-0	255-0	170.3	2	13	17-0	221-0	230.5
	4.1	1	18	14-9	265-6	177.4	1	14	14-9	206-6	215.4
		2	16	17-0	272-0	181.7	2	14	17-0	238-0	248.2
	5.3	1	18	16-0	288-0	192.4	1	14	16-0	224-0	233.6
		2	17	17-0	289-0	193.1	2	15	17-0	255-0	266.0
	6.5	1	18	17-3	310-6	207.4	1	14	17-3	241-6	251.9
		2	19	17-0	323-0	215.8	2	16	17-0	272-0	283.7
18	0.2	1	20	11-9	235-0	157.0	1	16	11-9	188-0	196.1
		2	13	19-0	247-0	165.0	2	11	19-0	209-0	218.0
	1.4	1	20	13-0	260-0	173.7	1	16	13-0	208-0	216.9
		2	14	19-0	266-0	177.7	2	12	19-0	228-0	237.8
	2.6	1	20	14-3	285-0	190.4	1	16	14-3	228-0	237.8
		2	16	19-0	304-0	203.1	2	13	19-0	247-0	257.6
	3.8	1	20	15-6	310-0	207.1	1	16	15-6	248-0	258.7
		2	17	19-0	323-0	215.8	2	14	19-0	266-0	277.4
	5.0	1	20	16-9	335-0	223.8	1	16	16-9	268-0	279.5
		2	18	19-0	342-0	228.5	2	15	19-0	285-0	297.3
	6.6	1	20	18-3	365-0	243.8	1	16	18-3	292-0	304.6
		2	20	19-0	380-0	253.8	2	16	19-0	304-0	317.1
	8.2	1	20	19-9	395-0	263.9	1	16	19-9	316-0	329.6
		2	21	19-0	399-0	266.5	2	18	19-0	342-0	356.7
20	1.0	1	22	13-9	302-6	202.1	1	18	13-9	247-6	258.1
		2	15	21-0	315-0	210.4	2	13	21-0	273-0	284.7
	2.2	1	22	14-9	324-6	216.8	1	18	14-9	265-6	276.9
		2	16	21-0	336-0	224.5	2	14	21-0	294-0	306.6
	3.4	1	22	16-0	352-0	235.2	1	18	16-0	288-0	300.4
		2	17	21-0	357-0	238.5	2	15	21-0	315-0	328.5
	5.0	1	22	17-9	390-6	260.9	1	18	17-9	319-6	333.2
		2	19	21-0	399-0	266.5	2	16	21-0	336-0	350.5
	6.6	1	22	19-3	423-6	282.9	1	18	19-3	346-6	361.4
		2	21	21-0	441-0	294.6	2	17	21-0	357-0	372.4
	8.2	1	22	20-9	456-6	304.9	1	18	20-9	373-6	389.6
		2	22	21-0	462-0	308.6	2	18	21-0	378-0	394.3

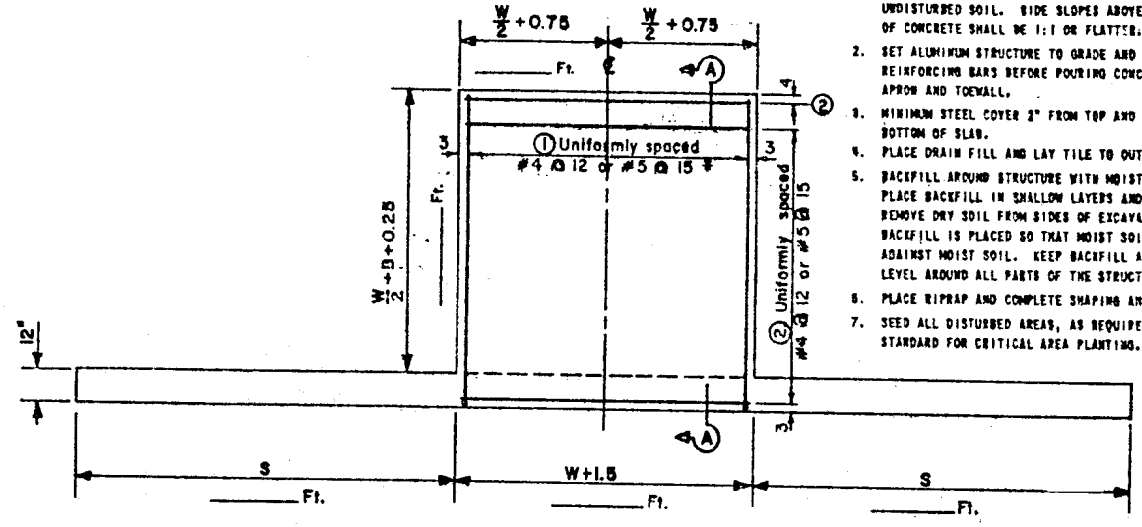

Emergency Spillway
3:1 Slope or flatter
3:1 Slope
4' Min. Top
2 to 1 Channel Side Slope
2'-3"
Concrete Toewall
Headwall
Outlet Channel
Spillway Opening and Downstream Channel Bottom
Upstream Channel Side Slope-2 to 1 or flatter
H min Level Section Each Side
Weir Crest
Concrete Apron
Upstream Channel Bottom = (W+2H) minimum
Waterway
Settled top of fill 1.0' above top of headwall
Emergency Spillway
Not to scale
Owner: County:
FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY
GENERAL LAYOUT
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Drawn
Adapted
Checked
Date
Approved by
Title
Sheet No
of
Drawing No
29-N-305
(3 Sheets)
ELEVATIONS
Top of Levee
Top of Headwall
Emergency Spillway
Weir Crest
Concrete Apron
BENCH MARK
Elevation
Description:
STRUCTURE DIMENSIONS
F
H
W
B
L
A
S
Sheet 1 of 3
Date 12-77
STANDARD STRUCTURE SIZES
F 1.9' 3.0' 4.0'
H 1.8' 1.9' 2.1'
A 4.2' 5.4' 6.6'
S 8.7' 11.3' 13.4'
Adapted from Indiana Drawing 5,0-32,722-P Sheets 1-3 of 3

QUANTITIES

Structure	1	each
Concrete (CT + CA)		cu.yds.
Reinforcing Bars #4		lin.ft.
#5		lin.ft.
Drain Fill (0.04 x L)		cu.yds.
Riprap (0.03 x L cu.yds.)		
Site Preparation		
Excavation and Backfill		
Drain Tile Outlet		each

NOTES:

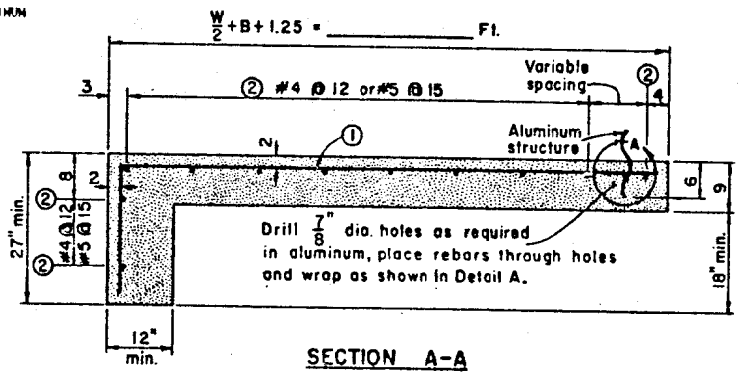
1. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS EQUAL TO 3000 PSI. (6 BAG MIX).
2. ALUMINUM SHEETS SHALL BE STRUCTURAL PLATE (2.5" X 9.0" CORRUGATIONS) 0.100" THICKNESS.
3. APPLY ASPHALTIC MASTIC BETWEEN ALUMINUM SHEETS BEFORE BOLTING TOGETHER.
4. DRAIN FILL SHALL CONSIST OF SAND, GRAVEL, OR CONCRETE AGGREGATE MIXTURE WITH 50 TO 80% PASSING A NO. 4 SIEVE, MAXIMUM SIZE OF 3" AND NOT MORE THAN 5% PASSING A NO. 200 SIEVE.
5. RIPRAP MAY CONSIST OF WELL-GRADED ROCK, MAXIMUM SIZE 6", OR 8" CONCRETE BLOCK SET WITH CORE OPENINGS UP AND FILLED WITH SOIL.



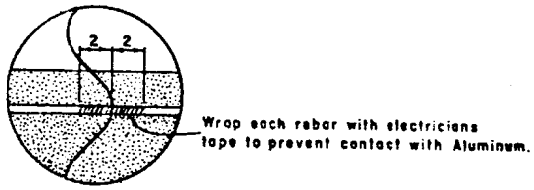
TOP VIEW - CONCRETE SLAB ONLY

CONSTRUCTION NOTES:

1. EXCAVATE FOR CONCRETE APRON AND TOEWALL IN UNDISTURBED SOIL. SIDE SLOPES ABOVE THE TOP OF CONCRETE SHALL BE 1:1 OR FLATTER.
2. SET ALUMINUM STRUCTURE TO GRADE AND PLACE REINFORCING BARS BEFORE POURING CONCRETE FOR APRON AND TOEWALL.
3. MINIMUM STEEL COVER 2" FROM TOP AND 3" FROM BOTTOM OF SLAB.
4. PLACE DRAIN FILL AND LAY TILE TO OUTLET STUB.
5. BACKFILL AROUND STRUCTURE WITH MOIST SOIL. PLACE BACKFILL IN SHALLOW LAYERS AND TAMP WELL. REMOVE DRY SOIL FROM SIDES OF EXCAVATIONS AS BACKFILL IS PLACED SO THAT MOIST SOIL IS TAMPED AGAINST MOIST SOIL. KEEP BACKFILL APPROXIMATELY LEVEL AROUND ALL PARTS OF THE STRUCTURE.
6. PLACE RIPRAP AND COMPLETE SHAPING AND GRADING.
7. SEED ALL DISTURBED AREAS, AS REQUIRED IN STANDARD FOR CRITICAL AREA PLANTING.



SECTION A-A



DETAIL A

Owner: _____

REINFORCING STEEL SCHEDULE					
MARK	QUANTITY	SIZE	BAR LENGTH	TYPE	TOTAL
①				1'-10"	
②				Straight	

* The use of #5 ①, will require some of the 15" spacings to be adjusted up to 1" plus or minus to achieve uniform spacing of rebars.

Not to scale

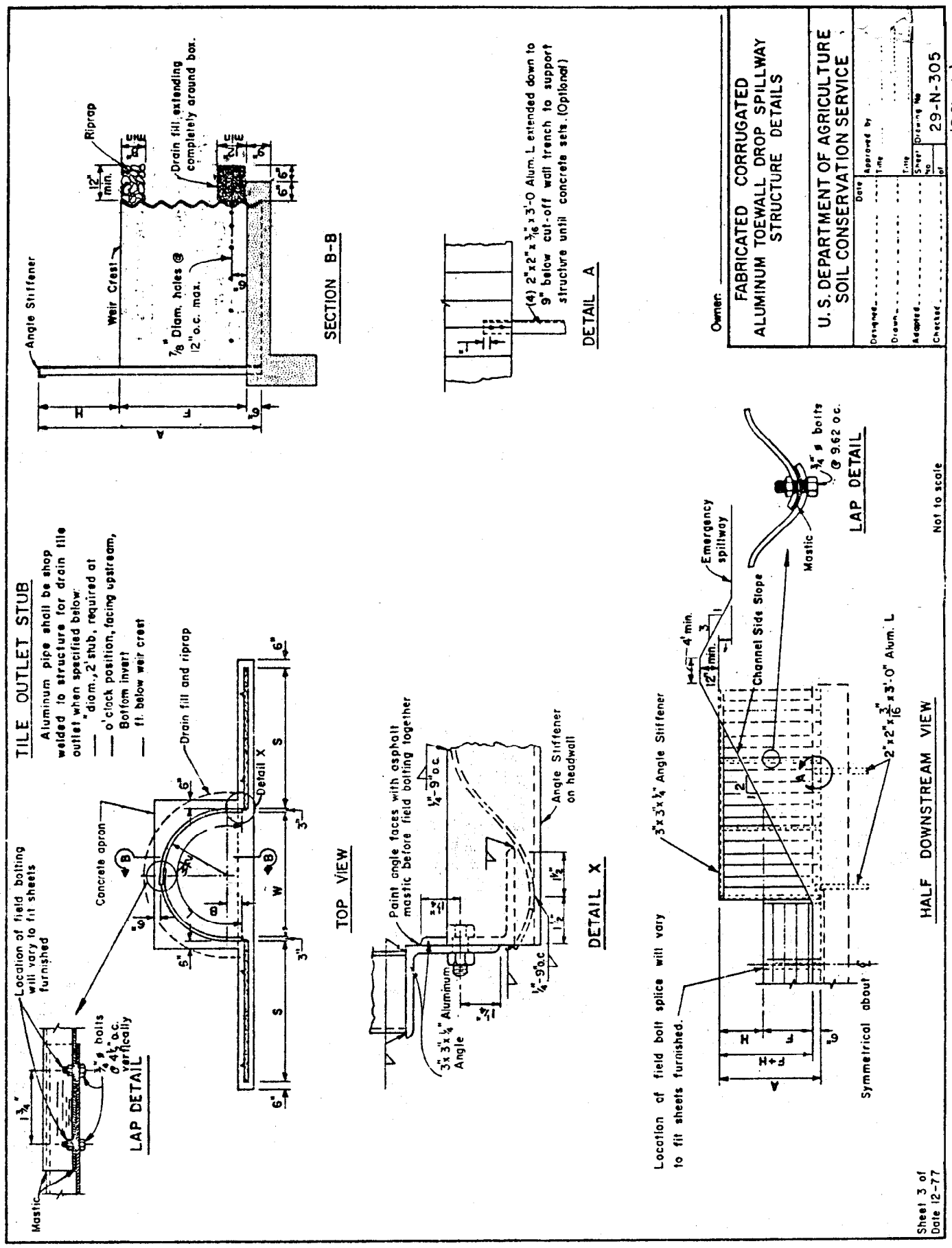
FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY CONCRETE AND STEEL DETAILS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed | Date | Approved by
Drawn | Title
Adapted | Title
Checked | Sheet No of | Drawing No 29-N-305

(3 Sheets)

Sheet 2 of 3
Date 12-77 (Rev. 4-79)


TILE OUTLET STUB
Aluminum pipe shall be shop welded to structure for drain tile outlet when specified below:
___ "diam., 2' stub, required at
___ o'clock position, facing upstream,
Bottom invert
___ ft. below weir crest
Location of field bolting will vary to fit sheets furnished
Mastic
¾" ø bolts @ 4½" o.c. vertically
LAP DETAIL
Concrete apron
Drain fill and riprap
Detail X
TOP VIEW
Angle Stiffener
Weir Crest
7/8" Diam. holes @ 12" o.c. max.
Riprap
12" min.
Drain fill extending completely around box.
SECTION B-B
(4) 2"x2"x3/16"x3'-0 Alum. L extended down to 9" below cut-off wall trench to support structure until concrete sets. (Optional)
DETAIL A
Paint angle faces with asphalt mastic before field bolting together
¼"-9" o.c.
3"x3"x¼" Aluminum Angle
Angle Stiffener on headwall
DETAIL X
Emergency spillway
Channel Side Slope
Mastic
¾" ø bolts @ 9.62 o.c.
LAP DETAIL
3"x3"x¼" Angle Stiffener
2"x2"x3/16"x3'-0" Alum. L
Location of field bolt splice will vary to fit sheets furnished.
Symmetrical about
HALF DOWNSTREAM VIEW
Not to scale
Owner:
FABRICATED CORRUGATED ALUMINUM TOEWALL DROP SPILLWAY STRUCTURE DETAILS
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE
Designed
Drawn
Approved
Checked
Date
Approved by
Title
Sheet No.
of
Drawing No.
29-N-305
(3 Sheets)
Sheet 3 of
Date 12-77

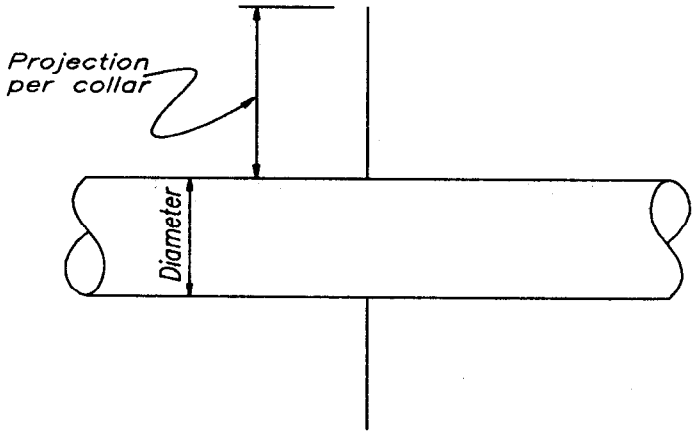
MINIMUM TOTAL ANTI-SEEP COLLAR PROJECTION 1/ 2/ -- FEET

TOTAL PIPE LENGTH 3/	HOODED OR CANOPY INLET PIPE SPILLWAY	DROP INLET PIPE SPILLWAY
	Projection	Projection
50	1.5	2.3
60	2.0	3.0
70	2.5	3.8
80	3.0	4.5
90	3.5	5.2
100	4.0	6.0
110	4.5	6.8
120	5.0	7.5
130	5.5	8.3
140	6.0	9.0
150	6.5	9.8

1/ Applies to pipe principal spillways designed under the Pond Standard (378) or the Grade Stabilization Structure Standard (410).

2/ Less anti-seep collars are needed if any drainage improvements that enclose pipe (i.e. foundation or embankment drains) are included. Use length of pipe upstream from drain location.

3/ For minimum anti-seep collar projection determination the pipe length for dry dams may be 2 times the length from pipe inlet to centerline of dam.



Minimum projection may be computed with the following formula:

$$P = \frac{C(L - 20)}{2}$$

where P = total anti-seep collar projection

L = total pipe length[1/]

C = 0.10 for canopy or hooded inlet

<u>or</u> C = 0.15 for drop inlet

1/ For dry dams use "L" equal to 2 times the length from pipe inlet to centerline of dam.

Anti-seep collars should not project from the conduit more than 3 feet or less than 1 foot.

Minimum anti-seep collar dimension = (2 x projection per collar) + D

where D = conduit outside dimension in feet

Maximum collar spacing is 14 times projection per collar <u>but not to exceed 25 feet</u>.

EXAMPLE: Overall height of dam is 25 feet and combined sideslopes of 6:1 with a 18 inch diameter conduit with canopy inlet, pipe length -- 110 feet.

Read minimum total projection from table: 4.5 feet

Assume use of 2 collars. Normally a dam up to 35 feet in height would need 1, 2, or 3 collars.

$$\text{Minimum Projection per collar} = \frac{\text{Minimum Total Projection}}{\text{Number of collars}} = \frac{4.5}{2} = 2.25 \text{ ft}$$

2.25 ft (between 1 ft and 3 ft) okay

Minimum anti-seep collar dimension = (2 x 2.25) + 1.5 = <u>6.0 feet</u>

Maximum collar spacing = 14 x 2.25 ft = 31.5 feet

Collar spacing used = <u>25 feet</u>

SCREW ANCHORS

In lieu of larger, heavier base plates, screw anchors may be used on Box Inlets, Pipe Outlets, and other installations to resist buoyancy forces. For computations of existing buoyancy forces, see page MO-3-11b. The existing safety factor may be increased to 1.5 or higher by addition of more weight or screw anchors.

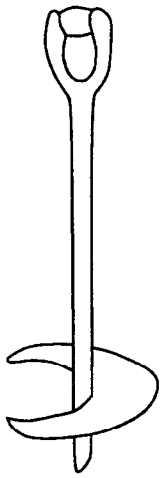
They may also be used where fences crossing depressions are subject to uplift forces or in lieu of dead man type anchors where they are specified.

The following data applies to screw anchors that may be installed by hand or machine. On some soils they may be difficult to install by hand. Hand installed anchors will be primarily the 4-inch size. The anchors are installed so a foot or less is protruding above ground surface. For very soft soils, an extension may be added to rod so that screw anchor can be installed to a greater depth to reach firm soil.

TYPICAL DATA

Anchor Size Dia.	Rod Dia. & Length	Typical Working Torque Ft-lbs	Anchor Holding Strengths - (lbs.) vs. Soil Class		
			Class 5	Class 6	Class 7
4"	¾" x 54"	400	4500	3000	1500
6"	¾" x 66"	400	6500	5000	2500
8"	1" x 66"	1000	11000	9000	6000
10"	1¼" x 66"	2300	13000	10000	7000
10"	1¼" x 96"	2300	13000	10000	7000
14"	1¼" x 96"	2300	16000	15000	12000

Note:
(1) If hand installed, holding strength may be reduced by as much as 10% to 20%. Strength ratings apply to properly installed anchors only.
(2) If unsure of soil class, use soil class 7 unless the soil is very soft; then see soil type 8.
(3) As close as practical, the anchor should be installed at an angle that lines up with the direction of resisting force needed. Anchors subject to pull at an angle may be installed vertically if 18" deep by 10" diameter concrete collars or 12" deep by 11" wide by 0.170–inch thick metal plates are used to prevent anchor rod deflection.



Reference data indicates that steel wire, cables, or chains will withstand the following minimum tensile force:

Chain, Cable, or Wire Size	Tensile Strength
12 gage (0.1046 inch)	250 lbs
9 gage (0.1495 inch)	510 lbs
1/8 inch	360 lbs
3/16 inch	800 lbs
1/4 inch	1,300 lbs
5/16 inch	1,900 lbs
3/8 inch	2,700 lbs
1/2 inch	4,500 lbs

This table is a conservative guide based on low grade steel. If available, the manufacturer's rated tensile strength may be used. Quite often the rated tensile strength is higher because higher grade steel is used.

Mobile homes often use 1¼ inch wide by 0.035 inch thick, high strength steel straps rated at approximately 4,725 pounds minimum tensile strength to attach anchor to mobile homes.

SOIL CLASSIFICATION DATA

Class	Common Soil-Type Description	Geological Soil Classification	Probe Values in.–lbs. (Nm)	Typical Blow Count "N" per ASTM-D1586
2/ 0	Sound hard rock, unweathered	Granite, Massive Limestone, Dolomite	N.A.	N.A. 1/
2/ 1	Very dense and/or cemented sands; coarse gravel and cobbles	Limestone and Sandstone	750-1600 (90-208)	60-100+
2/ 2	Dense fine sand; very hard silts and clays (may be preloaded)	Basal till; boulder clay; weathered laminated rock	600-750 (78-98)	45-60
2/ 3	Dense clays, sands and gravel; hard silts and clays	Glacial till; weathered shales, weathered siltstone	500-600 (65-78)	35-50
2/ 4	Medium dense sandy gravel; very stiff to hard silts and clays	Glacial till; hardpan	400-500 (52-65)	24-40
5	Medium dense coarse sand and sandy gravels; stiff to very stiff silts and clays; roller compacted earthfill	Residual soils; glacial till; earthfill	300-400 (39-52)	14-25
6	Loose to medium dense fine to coarse sand; firm to stiff clays and silts; dozer compacted earthfill	Dense hydraulic fill; residual soils; earthfill	200-300 (26-39)	7-14
7	Loose fine sand; Alluvium; loess; soft-firm clays; varied clays; semi-compacted earthfill; wet soils; topsoil	Floodplain soils; lake clays; gumbo; earthfill	100-200 (13-26)	4-8
3/ 8	Peat, organic silts; inundated silts, fly ash	Swamp, marsh	Less than 100 (0-13)	0-5

1/ Class 1 soils are difficult to probe consistently and the ASTM blow count may be of questionable value.
2/ It would be difficult to impossible to install anchors in Class 4 through 0 soils.
3/ It is advisable to install anchors deep enough, by the use of extensions, to penetrate a firm soil, if soil on surface is Class 8.