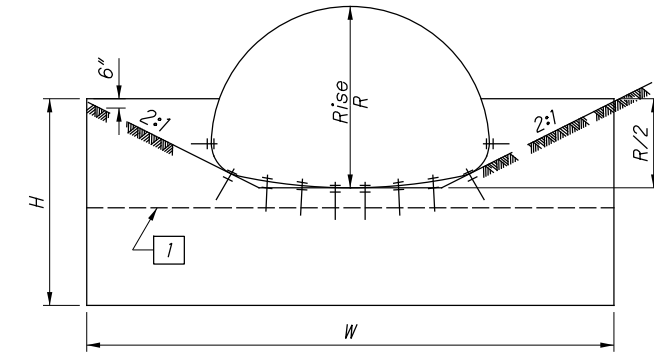
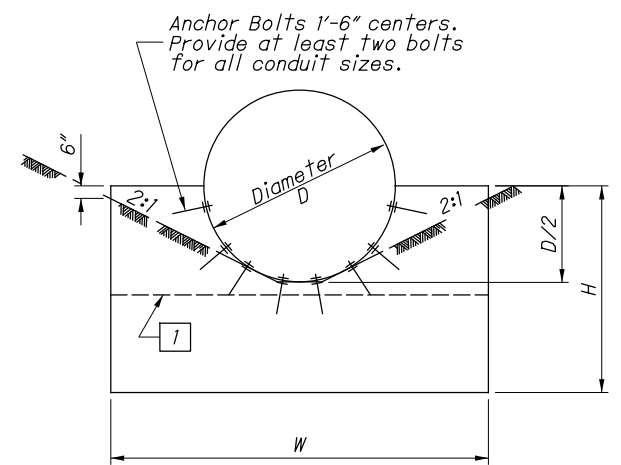


CAST-IN-PLACE HW FOR CORRUGATED METAL PIPE & PLASTIC PIPE (English)

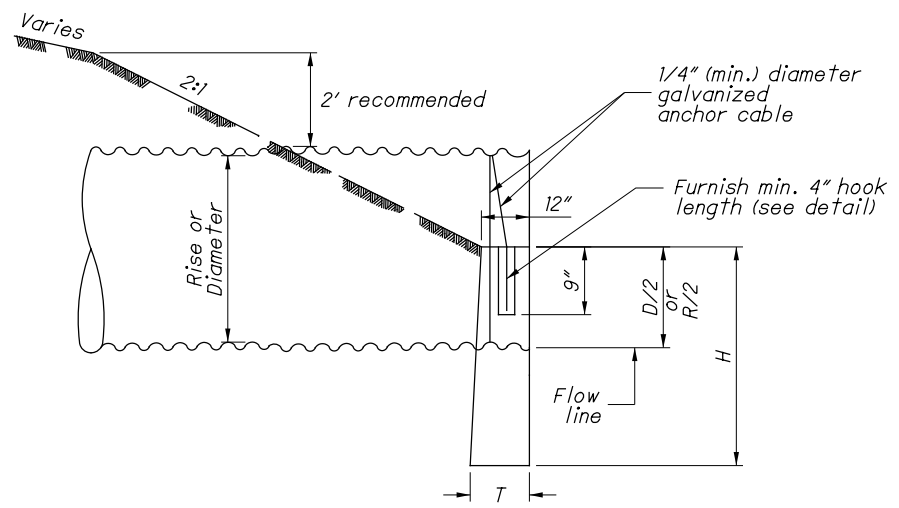
CIRCULAR					PIPE ARCH					PIPE ARCH						
D	W	H	T	CONC. cu. yds.	SPAN	RISE	W	H	T	CONC. cu. yds.	SPAN	RISE	W	H	T	CONC. cu. yds.
12"	2'-0"	3'-0"	12"	0.21	<b>2.67"x1/2" Corrugations</b>					*81"	59"	12'-4"	5'-5"	15"	2.14	
15"	2'-6"	3'-2"	12"	0.27	17"	13"	3'-0"	3'-0"	12"	0.31	87"	63"	13'-0"	5'-7"	17"	2.50
18"	3'-0"	3'-3"	12"	0.33	21"	15"	3'-6"	3'-0"	12"	0.35	95"	67"	14'-0"	5'-9"	20"	3.14
21"	3'-6"	3'-4"	12"	0.39	24"	18"	4'-0"	3'-2"	12"	0.43	103"	71"	15'-0"	5'-11"	22"	3.54
24"	4'-0"	3'-6"	12"	0.46	28"	20"	4'-6"	3'-3"	12"	0.48	112"	75"	16'-0"	6'-1"	24"	3.96
27"	4'-6"	3'-8"	12"	0.53	35"	24"	5'-6"	3'-5"	12"	0.61	117"	79"	17'-9"	6'-3"	25"	4.89
30"	5'-0"	3'-9"	12"	0.60	42"	29"	6'-6"	3'-7"	12"	0.73	128"	83"	18'-0"	6'-5"	26"	5.01
33"	5'-6"	3'-10"	12"	0.68	49"	33"	7'-8"	3'-9"	12"	0.90	137"	87"	19'-0"	6'-7"	27"	5.45
36"	6'-0"	4'-0"	12"	0.76	57"	38"	9'-0"	4'-0"	12"	1.10	142"	91"	20'-9"	6'-9"	27"	6.31
39"	6'-6"	4'-2"	12"	0.84	64"	43"	10'-0"	4'-4"	12"	1.31	<b>6"x2" Corrugations (18" Corner Radius)</b>					
42"	7'-0"	4'-3"	12"	0.92	71"	47"	11'-0"	4'-8"	12"	1.54	*6'-1"	4'-7"	11'-8"	5'-7"	12"	1.89
48"	8'-0"	4'-6"	12"	1.10	*77"	52"	11'-8"	5'-3"	12"	1.84	*6'-4"	4'-9"	12'-0"	5'-8"	14"	2.12
54"	9'-3"	4'-9"	12"	1.33	*83"	57"	12'-4"	5'-5"	15"	2.46	*6'-9"	4'-11"	12'-4"	5'-9"	15"	2.42
60"	10'-6"	5'-6"	12"	1.78	<b>6"x2" Corrugations (31" Corner Radius)</b>					*7'-0"	5'-1"	12'-8"	5'-10"	16"	2.44	
66"	11'-9"	5'-9"	12"	2.06	13'-3"	9'-4"	23'-11"	7'-11"	32"	9.63	7'-3"	5'-3"	12'-11"	5'-11"	17"	2.69
72"	13'-0"	6'-0"	12"	2.37	13'-6"	9'-6"	24'-9"	8'-0"	32"	10.12	7'-8"	5'-5"	13'-2"	6'-0"	18"	2.77
78"	14'-3"	6'-3"	14"	2.94	14'-0"	9'-8"	24'-10"	8'-1"	33"	10.33	7'-11"	5'-7"	14'-0"	6'-1"	20"	3.15
84"	15'-6"	6'-6"	14"	3.30	14'-2"	9'-10"	25'-9"	8'-2"	33"	10.87	8'-2"	5'-9"	14'-8"	6'-2"	21"	3.45
90"	16'-9"	6'-9"	16"	4.00	14'-5"	10'-0"	26'-7"	8'-3"	33"	11.39	8'-7"	5'-11"	15'-0"	6'-3"	22"	3.75
96"	18'-0"	7'-0"	16"	4.40	14'-11"	10'-2"	26'-9"	8'-4"	34"	11.68	8'-10"	6'-1"	15'-10"	6'-4"	23"	4.15
102"	19'-3"	7'-3"	18"	5.28	15'-4"	10'-4"	26'-11"	8'-5"	34"	11.96	9'-4"	6'-3"	16'-0"	6'-5"	24"	4.65
108"	20'-6"	7'-6"	20"	6.21	15'-7"	10'-6"	27'-9"	8'-6"	34"	12.51	9'-6"	6'-5"	16'-10"	6'-6"	26"	4.93
114"	21'-9"	7'-9"	22"	7.25	15'-10"	10'-8"	28'-7"	8'-7"	35"	13.06	9'-9"	6'-7"	17'-9"	6'-7"	27"	5.41
120"	23'-0"	8'-0"	24"	8.38	16'-3"	10'-10"	28'-8"	8'-8"	35"	13.34	10'-3"	6'-9"	17'-10"	6'-8"	27"	5.45
*126"	23'-0"	8'-3"	26"	8.64	16'-6"	11'-0"	29'-7"	8'-9"	35"	13.94	10'-8"	6'-11"	17'-11"	6'-9"	27"	5.59
132"	23'-0"	8'-6"	28"	9.23	17'-0"	11'-2"	29'-8"	8'-10"	36"	14.24	10'-11"	7'-1"	18'-10"	6'-10"	28"	5.97
138"	24'-1"	8'-9"	30"	10.50	17'-2"	11'-4"	30'-7"	8'-11"	36"	14.84	11'-5"	7'-3"	18'-11"	6'-11"	28"	6.12
144"	25'-2"	9'-0"	32"	11.89	17'-5"	11'-6"	31'-5"	9'-0"	36"	15.42	11'-7"	7'-5"	19'-9"	7'-0"	28"	6.52
150"	26'-4"	9'-3"	34"	13.38	17'-11"	11'-8"	31'-7"	9'-1"	37"	15.83	11'-10"	7'-7"	20'-9"	7'-1"	29"	6.94
156"	27'-5"	9'-6"	36"	15.01	18'-2"	11'-10"	32'-5"	9'-2"	37"	16.43	12'-4"	7'-9"	20'-10"	7'-2"	29"	7.12
162"	28'-7"	9'-9"	38"	16.75	18'-7"	12'-0"	32'-6"	9'-3"	37"	16.78	12'-6"	7'-11"	21'-8"	7'-3"	29"	7.53
168"	29'-8"	10'-0"	40"	18.61	18'-9"	12'-2"	33'-4"	9'-4"	38"	17.43	12'-8"	8'-1"	22'-7"	7'-4"	30"	7.95
174"	30'-9"	10'-3"	42"	20.28	19'-3"	12'-4"	33'-5"	9'-5"	38"	17.78	12'-10"	8'-4"	23'-7"	7'-5"	30"	8.48
180"	31'-11"	10'-6"	43"	21.87	19'-6"	12'-6"	34'-5"	9'-6"	38"	18.49	13'-5"	8'-5"	23'-7"	7'-6"	30"	8.63
186"	33'-0"	10'-9"	44"	23.54	19'-8"	12'-8"	35'-3"	9'-7"	39"	19.19	13'-11"	8'-7"	23'-7"	7'-7"	31"	8.81
192"	34'-2"	11'-0"	45"	25.30	19'-11"	12'-10"	36'-3"	9'-8"	39"	19.95	14'-1"	8'-9"	25'-1"	7'-8"	31"	9.29
198"	35'-3"	11'-3"	46"	27.12	20'-5"	13'-0"	36'-3"	9'-9"	39"	20.30	14'-3"	8'-11"	25'-6"	7'-9"	31"	9.78
204"	36'-4"	11'-6"	47"	29.15	20'-7"	13'-2"	37'-2"	9'-10"	40"	21.05	14'-10"	9'-1"	25'-6"	7'-10"	32"	10.25
210"	37'-6"	11'-9"	48"	31.03	<b>3"x1" Corrugations</b>					15'-4"	9'-3"	25'-6"	7'-11"	32"	10.25	
216"	38'-7"	12'-0"	49"	33.43	40"	31"	6'-6"	3'-7"	12"	0.70	15'-6"	9'-5"	26'-5"	8'-0"	32"	10.74
222"	39'-9"	12'-3"	50"	36.26	46"	36"	7'-8"	3'-9"	12"	0.85	15'-8"	9'-7"	27'-5"	8'-1"	33"	11.28
228"	40'-10"	12'-6"	51"	37.52	53"	41"	9'-0"	4'-0"	12"	1.06	15'-10"	9'-10"	28'-5"	8'-2"	33"	12.00
234"	42'-0"	12'-9"	52"	39.86	60"	46"	10'-0"	4'-4"	12"	1.27	16'-5"	9'-11"	28'-5"	8'-3"	33"	12.09
240"	43'-1"	13'-0"	53"	42.28	66"	51"	11'-0"	4'-8"	12"	1.54	16'-7"	10'-1"	29'-4"	8'-4"	34"	12.64
246"	44'-2"	13'-3"	54"	44.83	*73"	55"	11'-8"	5'-3"	12"	1.81	--	--	--	--	--	--
252"	45'-4"	13'-6"	55"	47.44												

\* Determine channel configuration for pipe sizes between end treatment "A" and end treatment "B" by 2:1 slopes passing through a point 6" below the top and at each side of the headwall. For end treatment "B", 2:1 slopes are tangent to pipe.

1 Top surface of 6" inlet headwall extension

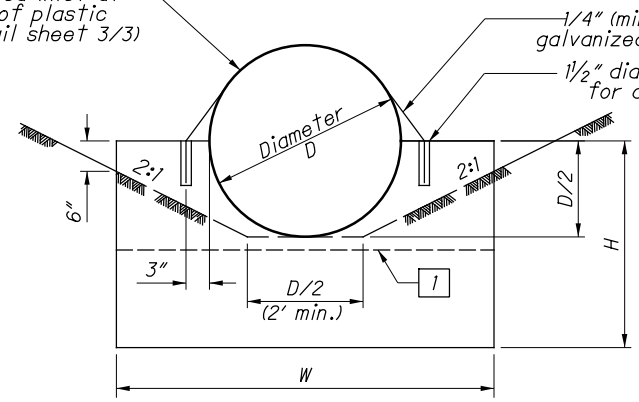


METAL PIPE END TREATMENT "B" W/ ANCHOR BOLT OPTION

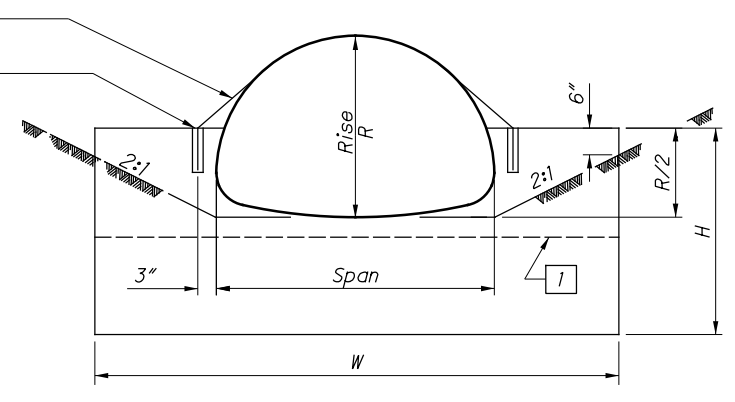


PLASTIC & METAL PIPE PROFILE  
W/ ANCHOR CABLE OPTION

Provide improved inlet at upstream end of plastic pipe (see detail sheet 3/3)



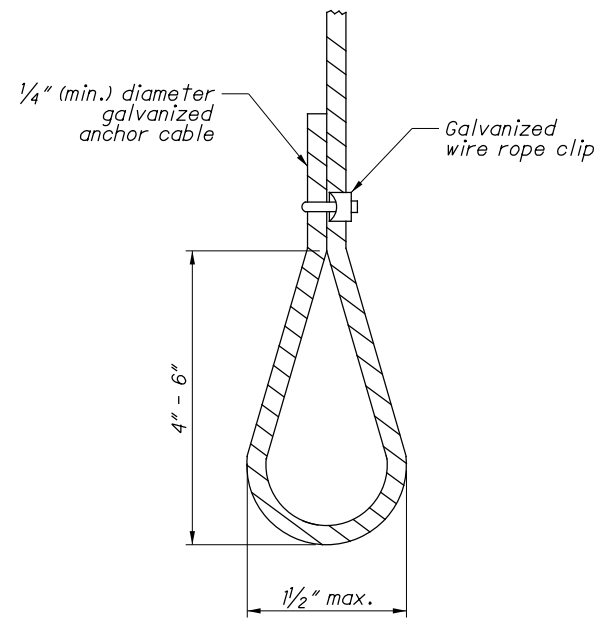
CIRCULAR



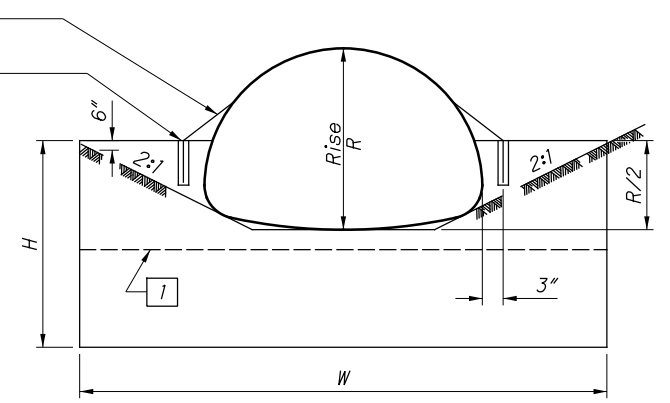
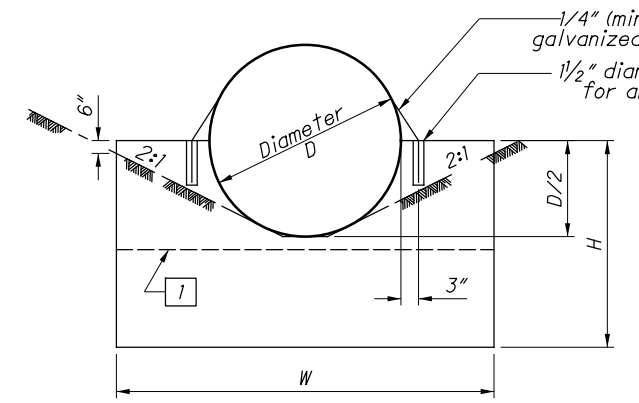
METAL PIPE-ARCH

PLASTIC & METAL PIPE END TREATMENT "A"  
W/ ANCHOR CABLE OPTION

1 Top surface of 6" inlet headwall extension



ANCHOR CABLE DETAIL



METAL PIPE END TREATMENT "B"  
W/ ANCHOR CABLE OPTION

NOTES

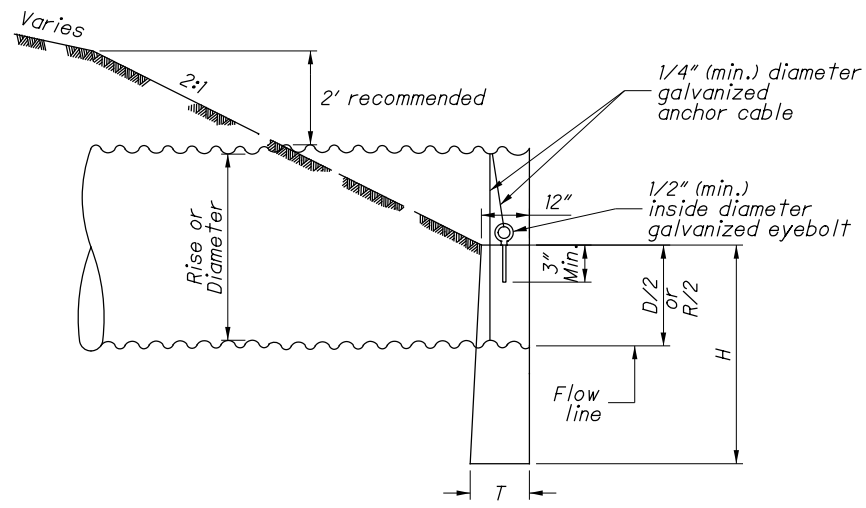
Tightly wrap galvanized anchor cable one time completely around the circumference of the conduit. Furnish hook at least 4" long at the ends of the anchor cable as shown above.

Cut galvanized anchor cable to length required.

Form or drill 1/2" diameter openings for anchor cable at locations shown. Alternatively, place anchor cable in wet concrete at the dimensions shown above to secure conduit to headwall.

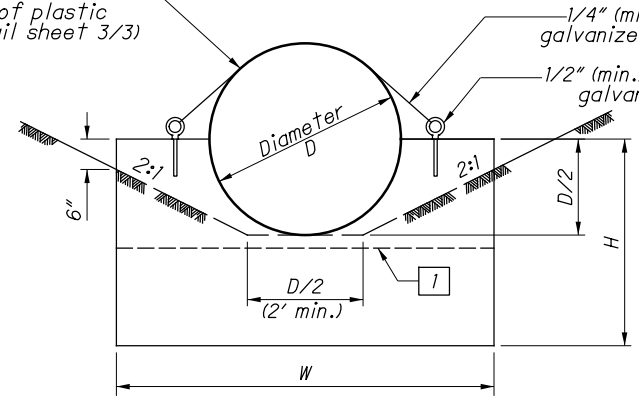
Fill any openings made for anchor cables with grout after the cables are placed to a taut fit.

Secure cables such that they are taut after the grout or concrete has cured.

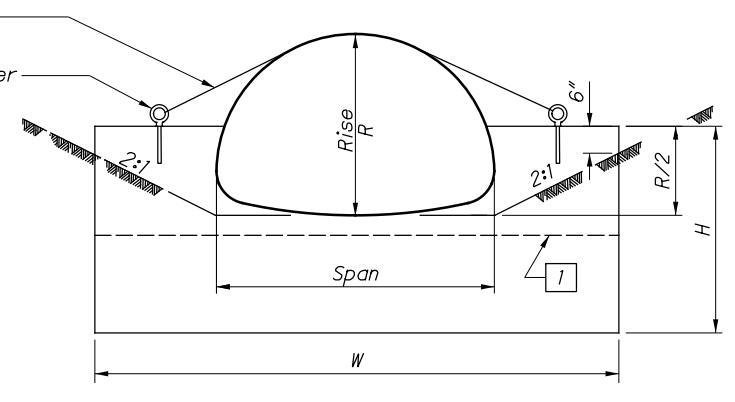


PLASTIC & METAL PIPE PROFILE  
W/ ANCHOR CABLE EYE BOLT OPTION

Provide improved inlet at upstream end of plastic pipe (see detail sheet 3/3)



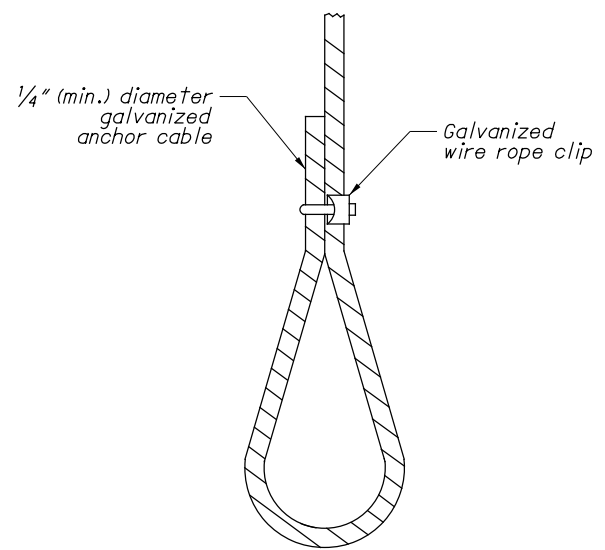
CIRCULAR



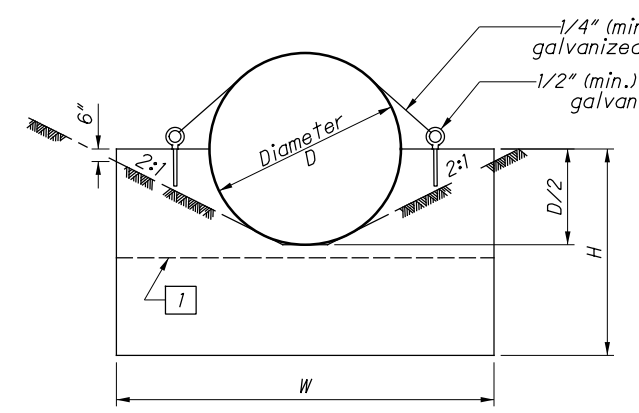
METAL PIPE-ARCH

PLASTIC & METAL PIPE END TREATMENT "A"  
W/ ANCHOR CABLE EYE BOLT OPTION

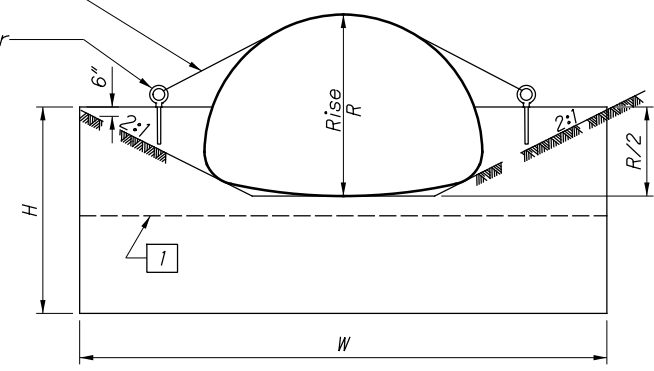
1 Top surface of 6" inlet headwall extension



ANCHOR CABLE DETAIL FOR EYEBOLT OPTION



METAL PIPE END TREATMENT "B"  
W/ ANCHOR CABLE EYE BOLT OPTION



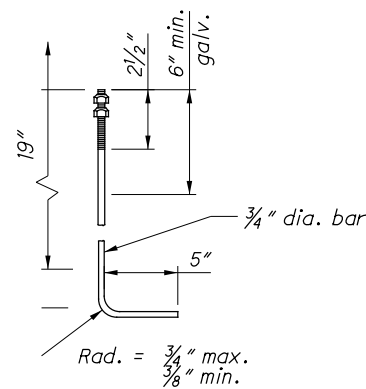
NOTES

Drill openings a min. of 3" deep for eyebolts at the locations shown. Insert entire length of bolt shank into opening. Fill openings with grout and allow to harden before securing anchor cable. Alternatively, place eyebolts in wet concrete at the locations shown above.

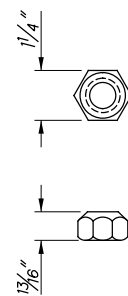
Tightly wrap galvanized anchor cable one time completely around the circumference of the conduit.

Cut galvanized anchor cable to length required.

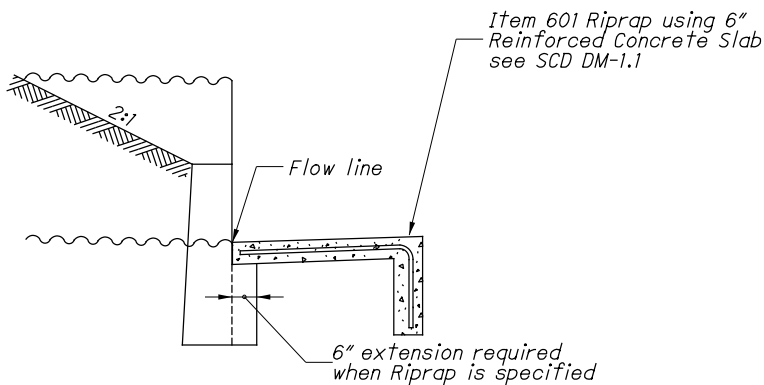
Place cable through eyebolt and form a loop as shown in the above detail. Ensure the cable is pulled to a tight fit and secured with a galvanized wire rope clip.



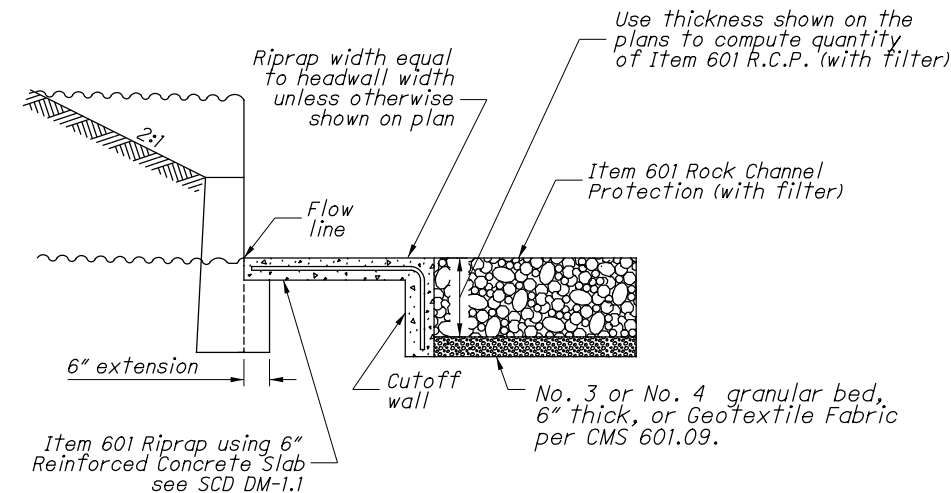
**ANCHOR BOLT**



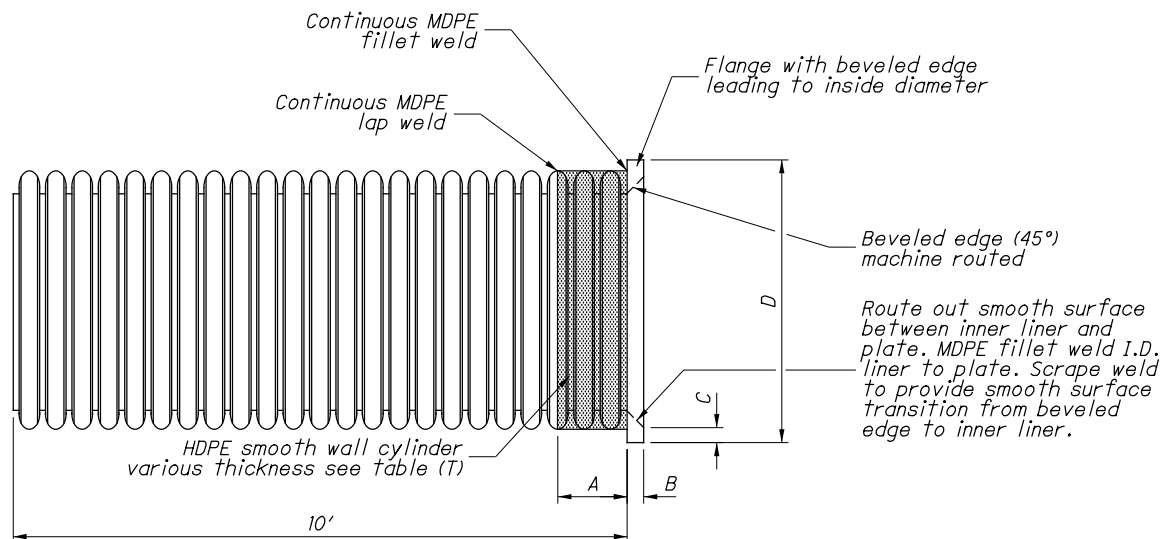
**NUT**  
(ASTM A 325 and A 153)



**INLET CHANNEL PROTECTION  
DETAIL**



**OUTLET CHANNEL PROTECTION  
DETAIL**



**HDPE IMPROVED INLET - TYPE A CONDUITS**

PIPE SIZE	A	B	C	D	T
12 in.	6.00 in.	0.50 in.	1.00 in.	15.15 in.	0.13 in.
15 in.	6.00 in.	0.63 in.	1.26 in.	18.73 in.	0.19 in.
18 in.	6.00 in.	0.75 in.	1.50 in.	22.57 in.	0.25 in.
24 in.	8.00 in.	1.00 in.	2.00 in.	30.08 in.	0.25 in.
30 in.	8.00 in.	1.25 in.	2.50 in.	37.50 in.	0.38 in.
36 in.	10.00 in.	1.50 in.	3.00 in.	45.00 in.	0.38 in.
42 in.	10.00 in.	1.75 in.	3.50 in.	51.90 in.	0.38 in.
48 in.	10.00 in.	2.00 in.	4.00 in.	59.60 in.	0.38 in.
60 in.	12.00 in.	2.50 in.	5.00 in.	74.50 in.	0.38 in.

**NOTES**

**GENERAL:** Provide a riprap reinforced concrete slab according to SCD DM-1.1 if the pipe is depressed or it is specified in the plan. Payment for the slab is made per square yard of **Item 601 Riprap Using 6" Reinforced Concrete Slab** and includes the cost of the cutoff wall.

This drawing is for cast-in-place half-height concrete headwalls. Precast half-height headwalls are only approved for round conduits with a maximum conduit diameter of 78". When precast headwalls are furnished, provide openings for the anchor cable as shown and fill with grout after placement of the anchor cable. If anchor bolts are to be used with a precast headwall, fill the anchor cable openings with grout.

**CONCRETE:** Use 4000 psi compressive strength concrete for headwall. Concrete quantities are based on headwalls without the 6" extension under the channel protection.

**ANCHOR BOLTS:** Furnish bolts (see detail sheet 2/3) that meet ASTM A 307 for anchoring both ends of metal pipe. The top 6" min. of the bolt must be galvanized according to ASTM A 153. Cost of anchors is included in the price bid per foot of Item 611.

Headwall dimensions are based on end treatment "A" for pipe sizes up to and including 120", 71"x47", and 66"x51", and on end treatment "B" for sizes over and including 132", 13'-3"x9'-4", and 7'-3"x5'-3".

**PLASTIC PIPE:** Plastic pipe may not be available in all the sizes specified on this drawing.

**ANCHOR CABLE:** Furnish galvanized anchor cable (see detail sheet 2/4 & 3/4) that meets ASTM A 1023 for anchoring both ends of plastic or metal pipe. Wire rope clip must be galvanized according to ASTM A 153. Cost of anchor cable and wire rope clip is included in the unit price bid per foot of Item 611.

**EYEBOLTS:** Furnish eyebolts (see detail sheet 3/4) that meet ASTM A 489 for anchoring both ends of metal or plastic pipe. The eyebolts must be galvanized according to ASTM A 153. Furnish eyebolts with a min. I.D. eye of 1/2" and a min. shank length of 3". Cost of eyebolts is included in the price bid per foot of Item 611.

**IMPROVED INLET FOR HDPE PIPE:** Furnish improved inlet at upstream end of culverts and open-ended storm sewers using plastic pipe when specified in the plans.

Use HDPE smooth cap and flange materials according to ASTM D 3350 345464C.