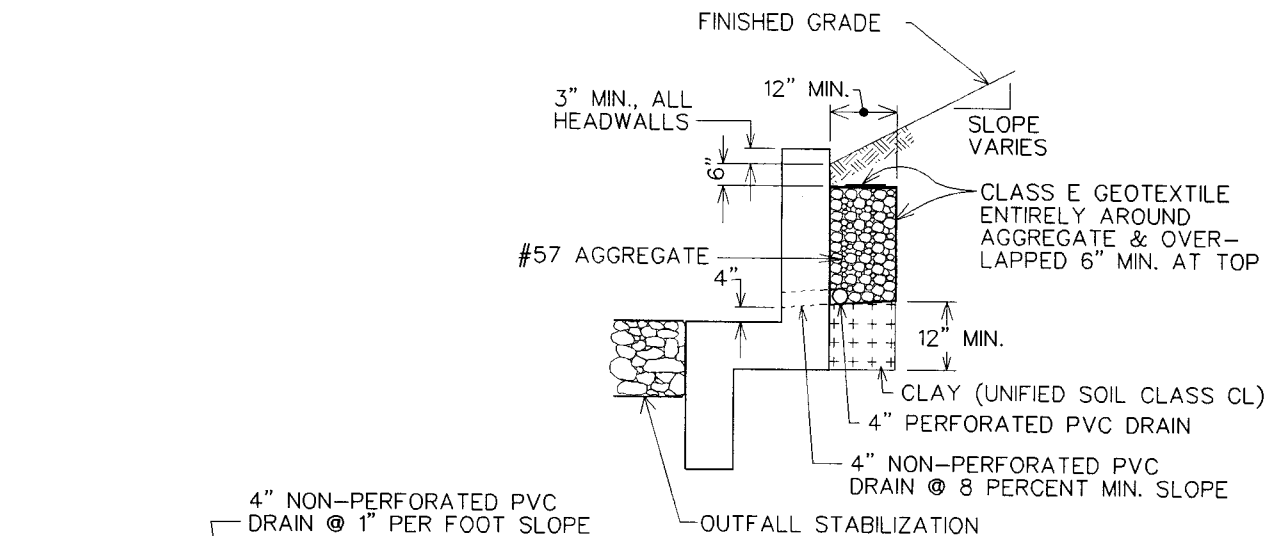


Storm Drain Standard Details

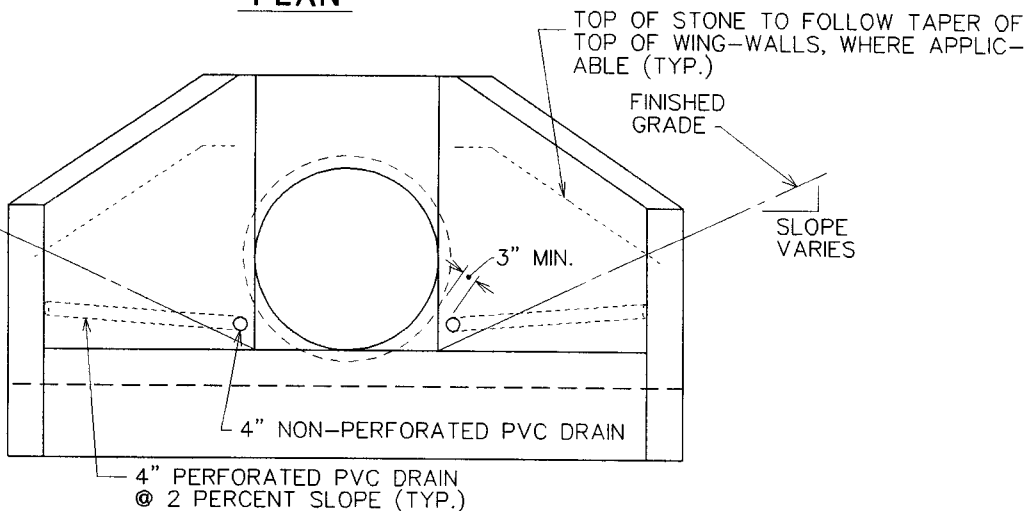
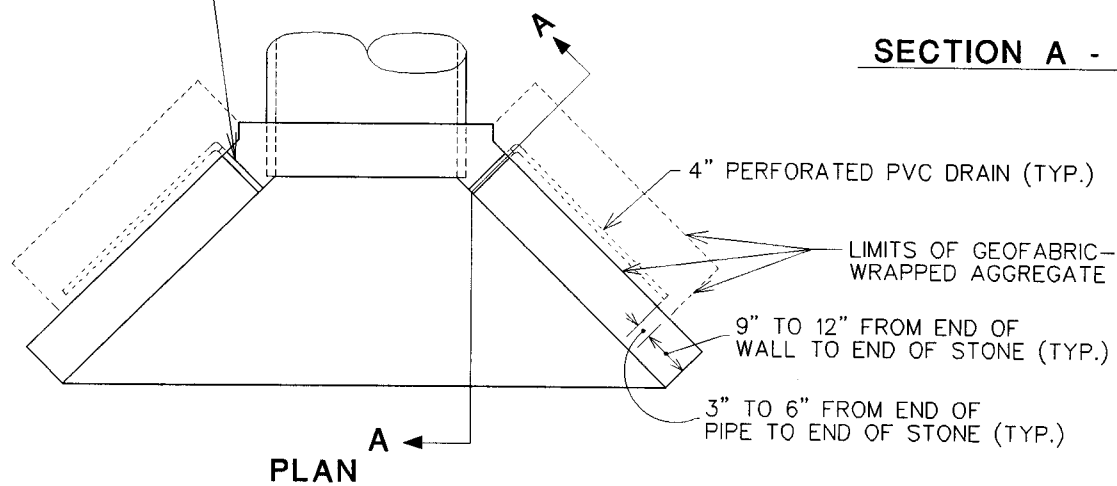
PLATE #	TITLE	SIGNATURE DATE	STD. SPECS. REFERENCE	COMMODITY CODE
D-1.00	Weepholes for Headwalls	3/15/2001	305.04.02	-
D-1.01A	A Headwall-Round Pipe	1/2/2007	305.04.02	349000
D-1.01B	A Headwall-HERCCP	5/15/2002	305.04.02	349100
D-1.01C	A Headwall-CMP Arch	5/15/2002	305.04.02	349200
D-1.02	End Support Wall	10/23/1997	305.04.02	350000-351100
D-1.03	End Support Wall-Tables	10/23/1997	305.04.02	350000-351100
D-1.04	Headwalls: B48,B54,B60	5/15/2002	305.04.02	352000
D-1.05	Headwalls: B66 thru B84	5/15/2002	305.04.02	352000
D-1.06	C Endwall-Round Pipe	3/10/2005	305.04.02	354400
D-1.07A	C Endwall-Arch Pipe	5/15/2002	305.04.02	355500
D-1.07B	C Endwall- Hor.Ellip.Pipe	3/10/2005	305.04.02	355600
D-1.08	E Endwall	5/15/2002	305.04.02	356600, 357700
D-1.09	E Endwall- Tables	10/23/1997	305.04.02	358800
D-1.10	End Section-Round RCCP	1/2/2007	305.04.02	368800
D-1.11	End Section-Round RCCP	1/22/2003	305.04.02	368800
D-1.12	End Section-Round BCCMP	1/22/2003	305.04.02	370000
D-1.13	End Section-Round BCCMP	10/23/1997	305.04.02	370000
D-1.16	Connections-BCCMP E.Sect	10/23/1997	305.04.02	-
D-2.00	Rect. Inlets-Gen'l. Req'm'ts.	3/18/2002	305	-
D-2.01A	A-1 Inlet	3/18/2002	305	372120, 1
D-2.01B	A-2 Inlet	3/18/2002	305	372122, 3
D-2.02A	B-1 Inlet	3/18/2002	305	372132, 3
D-2.02B	B-2 Inlet	3/18/2002	305	372136, 7
D-2.03	Type A, B Inlet Details	3/18/2002	305	-
D-2.05	Type A,B Inlet Top Slabs	3/18/2002	305	380450-380475
D-2.06	E Inlet	3/18/2002	305	375010, 1
D-2.07	E Combination Inlet	3/18/2002	305	376101, 2, 3, 4
D-2.08	Comb.Inlet Curb Piece	11/22/2000	305	380400-380420
D-2.08A	SupportBeam-Dbl.Comb.Inlet	4/25/2002	305	-
D-2.09	E Inlet-Frame & Grate	11/24/1999	305	-
D-2.09A	E Curved Vane Grate & Frame	11/24/1999	305	375020, 2
D-2.09B	Dbl. "E" CV Grate & Frame	11/24/1999	305	375020, 2
D-2.10	Double "E" Comb. Inlet	3/18/2002	305	376110, 1
D-2.12	Precast Std. H Comb. Inlet	7/24/2006	305	
D-2.13	J Inlet Modified Grate	10/23/1997	305	377012-377155
D-2.14	J Inlet Modified Grate	11/24/1999	305	377012-377155
D-2.15	Special "K"- Non-Traffic	3/18/2002	305	378164-378172
D-2.16A	S Inlet-Single Grate	3/18/2002	305	379112, 3
D-2.16B	Single "S" Yard & Median Inlet	3/18/2002	305	379113, 4, 5
D-2.17	S Inlet-Sngl.Fr.& Grate	11/22/2000	305	-
D-2.17A	Single "S" Frame w/CV Grate	5/8/2001	305	379116, 7
D-2.18	S Inlet-Comb.Inlet	3/18/2002	305	380050, 1
D-2.19A	S Inlet-Dbl.Gr.Tand.	3/18/2002	305	379120, 1
D-2.19B	Double "S" Yard & Median Inlet	3/18/2002	305	379123, 4, 5
D-2.20	S Comb.Inlet-Dbl.Gr.Tandem	3/18/2002	305	380110, 1, 2, 3
D-2.21	S Inlet-Frame & Grate	11/24/1999	305	-
D-2.21A	S Inlet-Curved Vane Grate	11/24/1999	305	379116

Storm Drain Standard Details

PLATE #	TITLE	SIGNATURE DATE	STD. SPECS. REFERENCE	COMMODITY CODE
D-2.21B	S Inlet-Mod. Frame & C.V.Gr.	11/24/1999	305	379117
D-2.22A	Type "Y-1" Inlet	3/18/2002	305	380120, 1, 2
D-2.22B	Type "Y-1" Inlet-Details	3/18/2002	305	380120, 1, 2
D-2.22C	Alternate Y-1 Inlet	3/10/2005	305	
D-2.23	Type "Y-2" Inlet	5/15/2002	305	380130, 1
D-2.24A	Y-3 Inlet-Y-1 Base, Beehive	5/15/2002	305	380140, 1
D-2.24B	Y-3 Inlet-Y-2 Base, Beehive	10/23/1997	305	380145, 6
D-2.25A	Y-4 Inlet-Y-1 Base, Stool	5/15/2002	305	380150, 1
D-2.25B	Y-4 Inlet-Y-2 Base, Stool	5/15/2002	305	380155, 6
D-2.25C	Precast Y-5 Yard Inlet	5/15/2002	305	380160, 1
D-2.26	E & S Inlet Gutter, Flare	4/10/2001	-	-
D-2.46	Inlet Capping	3/10/2005	305	
D-3.00	"A" Manhole	3/18/2002	305	380505, 6, 10
D-3.01	Precast "A" & "B" MH	1/2/2007	305	380600, 2, 5, 7
D-3.02A	Precast Alt."C" MH	1/31/2007	305	380610-380645
D-3.02B	Ty."C" MH-Precast Reducers	3/10/2005	305	-
D-3.03	"B" Shallow MH	3/18/2002	305	380515, 16, 20
D-3.04	"C" Manhole	3/18/2002	305	380701-380971
D-3.05	24" Hvy.Traf.MH Fr.& Cvr	10/23/1997	305	381900, 1, 30, 35, 40
D-3.05A	24" Radial Grate	10/23/1997	305	381910
D-3.05B	S.D. Manhole Platen Cover	3/5/2001	305	381900, 1, 30, 35, 40
D-3.06	Sidewalk Frame & Cover	10/23/1997	305	381950
D-3.07	Precast Doghouse Riser	5/15/2002	305	380600-380635
D-3.08	Standard Drop Manhole	3/18/2002	305	380555-380560
D-3.09A	Precast Drop Manhole	5/15/2002	305	380650-380695
D-3.09B	Precast Reducers/Drip Landing	10/23/1997	305	-
D-4.00	Conc.Collar-24"Drain Max	10/23/1997	305	301311
D-4.01	Bend Structure	10/23/1997	305	301312, 5
D-4.02	Bend Structure-Tables & Dim.	10/23/1997	305	301312, 5
D-4.03	Type 1 Junction Chamber	10/23/1997	305	301312, 5
D-4.04	Brick "Y"-Single & Dbl	10/23/1997	305	301312, 5
D-4.06	Field Connection	3/10/2005	305	301312, 5
D-5.02	Gabion Velocity Brkr-Chan.	10/23/1997	312	389412, 36
D-5.03	Std.Curb Opening-C&G	10/23/1997	609.04.02	634350
D-5.04	Std.Ditches-Toe of Slope	10/23/1997	201	201032
D-5.05	Std.Ditches-Top of Slope	10/23/1997	201	201032
D-5.06	Gabion Channel Lining	10/23/1997	312	309412, 18, 36
D-6.03	Pipe Anchors for Steep Pipes	3/10/2005	-	-



SECTION A - A



PLACEMENT AND CONSTRUCTION OF WEEPHOLES FOR TYPES B, C AND E ENDWALLS SHALL BE SIMILAR TO THAT SHOWN HEREON FOR TYPE A HEADWALLS.



APPROVAL
William J. Hyslop
 DIRECTOR
 BUR. OF ENGINEERING/CONSTRUCTION
 3/15/01
 DATE

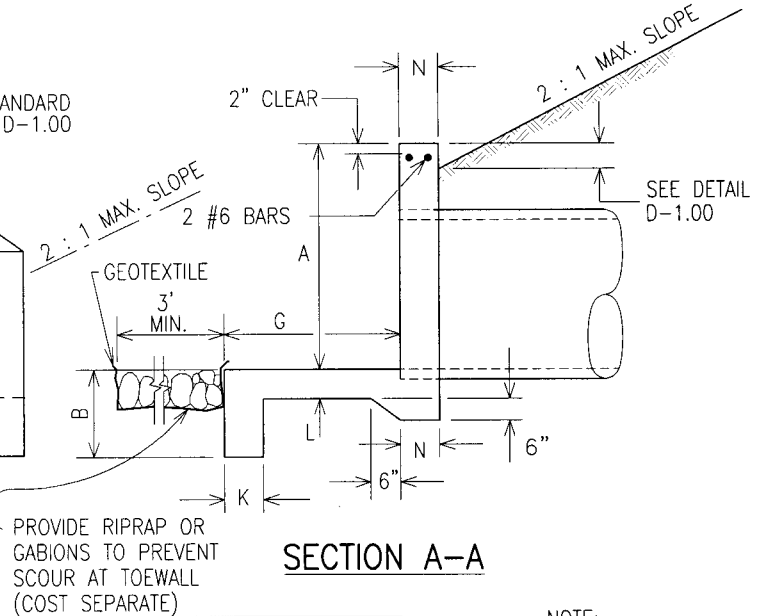
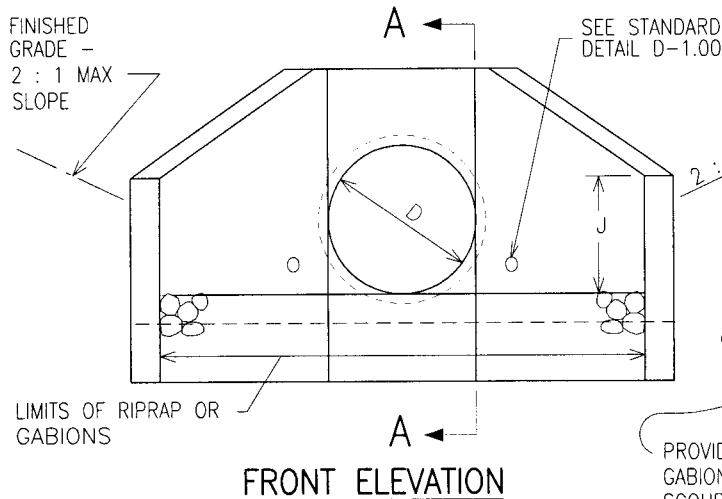
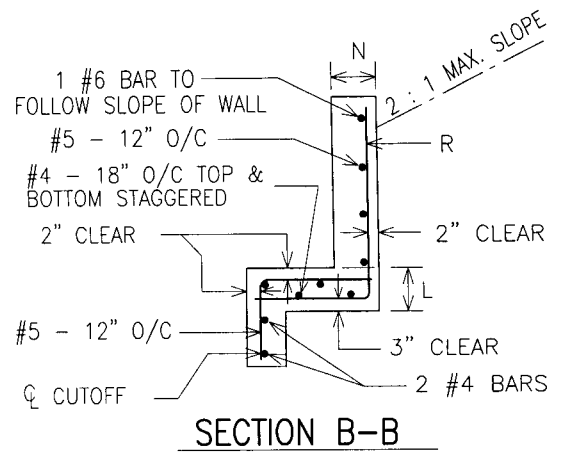
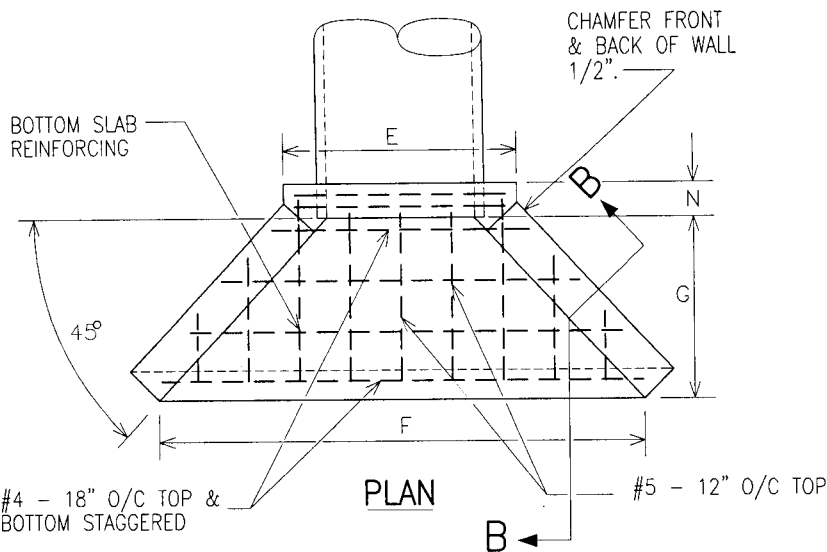
DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS

HEADWALL WEEPHOLES FOR HEADWALLS

ISSUED: AUGUST, 1997
 REVISED: FEBRUARY 2001
 REVISED:

PLATE

D-1.00



D	A	B	E	F	G	J	K	L	N	R	ΔVOL.C.Y.
15",18"	3'-0"	2'-0"	3'-0"	7'-6"	3'-0"	2'-0"	8"	10"	8"	#5-12" O/C	1.70
21"	3'-3"	2'-0"	3'-4"	7'-9"	3'-0"	2'-0"	8"	10"	8"	#5-12" O/C	1.80
24"	3'-6"	2'-0"	3'-8"	8'-0"	3'-0"	2'-0"	8"	10"	8"	#5-12" O/C	1.90
27"	3'-9"	2'-6"	3'-11"	8'-3"	3'-0"	2'-0"	8"	10"	8"	#5-12" O/C	2.1
30"	4'-0"	2'-6"	4'-2"	8'-6"	3'-0"	2'-0"	8"	10"	10"	#5-12" O/C	3.15
36"	4'-6"	3'-0"	4'-8"	10'-0"	3'-6"	2'-3"	9"	10"	10"	#5-12" O/C	3.43
42"	5'-0"	3'-0"	5'-3"	11'-6"	4'-0"	2'-9"	9"	10"	10"	#5-12" O/C	4.19
48"	5'-6"	3'-0"	5'-10"	13'-0"	4'-6"	3'-0"	9"	10"	12"	#5-12" O/C	5.44
54"	6'-0"	3'-0"	6'-5"	14'-6"	5'-0"	3'-3"	9"	12"	12"	#5-12" O/C	6.90
60"	6'-6"	3'-0"	7'-0"	16'-0"	5'-6"	3'-6"	9"	12"	12"	#5-12" O/C	8.42
66"	7'-0"	3'-0"	7'-7"	17'-6"	6'-0"	3'-9"	9"	12"	14"	#5-12" O/C	9.58
72"	7'-6"	3'-0"	8'-2"	19'-0"	6'-6"	4'-3"	9"	12"	14"	#5-12" O/C	11.63

Δ BASED ON 2:1 CHANNEL SIDE SLOPES.

NOTE:
 EXPOSED EDGES TO BE CHAMFERED 1" x 1".
 HEADWALL TO BE PARALLEL TO ϕ OF ROADWAY UNLESS OTHERWISE NOTED IN THE CONTRACT DRAWINGS.
 CONCRETE VOLUME BASED ON 2:1 SIDE SLOPES. TO BE USED FOR ESTIMATING ONLY.
 CONCRETE: MIX #3
 USE OF METAL PIPE SHALL BE RESTRICTED TO REPAIR AND REPLACEMENT ONLY, EXCEPT WITH APPROVAL OF THE DEPARTMENT OF PUBLIC WORKS. ADJACENT METAL PIPE SHALL BE INSPECTED FOR REPLACEMENT PRIOR TO REPLACING HEADWALL.
 PRECASTING THIS ENDWALL: SEE NOTE 5, DETAIL D-1.01B.

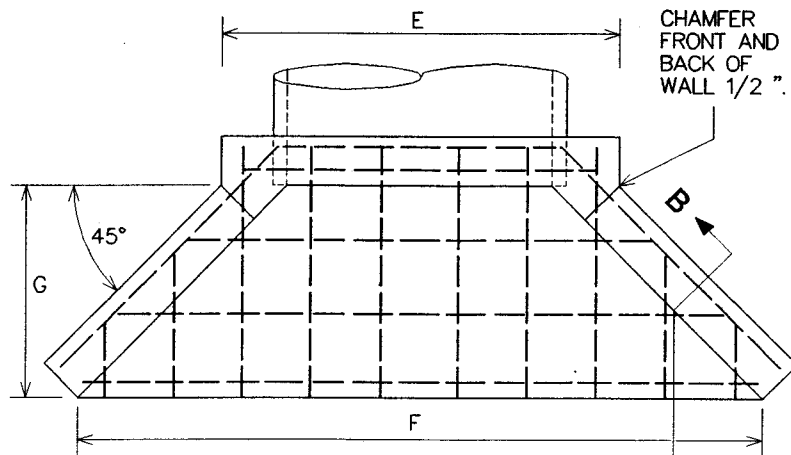


APPROVAL
[Signature]
 DIRECTOR
[Signature]
 BUR. OF ENGINEERING / CONSTRUCTION
 1-2-07
 DATE

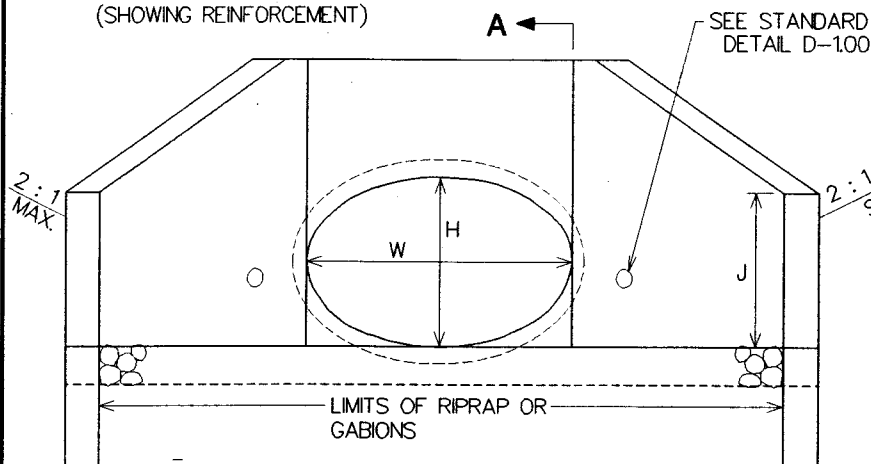
DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS
 TYPE "A" HEADWALL
 CIRCULAR PIPE

ISSUED: OCTOBER, 1977
 REVISED: FEBRUARY, 1981
 REVISED: NOVEMBER, 2006

PLATE
 D-1.01A



PLAN
(SHOWING REINFORCEMENT)



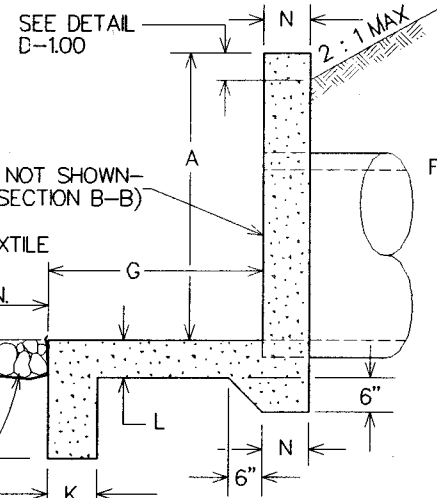
ELEVATION

- NOTES:
1. CHAMFER EXPOSED EDGES 1" x 1".
 2. MIX NO. 3 CONCRETE
 3. CONCRETE QUANTITIES TO BE USED FOR ESTIMATING ONLY.
 4. HEADWALL TO BE PARALLEL TO C. OF ROADWAY UNLESS OTHERWISE NOTED IN THE CONTRACT DRAWINGS.

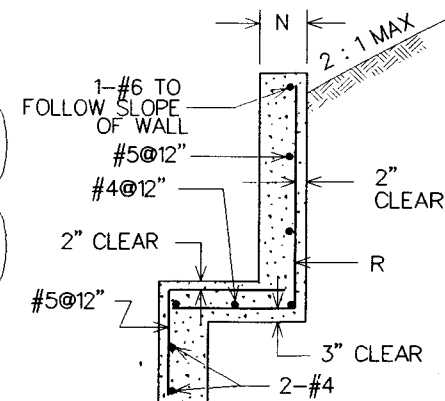
PROVIDE RIPRAP OR GABIONS TO PREVENT SCOUR AT TOEWALL (COST SEPARATE)

EQ. RD.	W	H	A	B	E	F	G	J	K	L	N	R	Δ VOL. C. Y.
36"	45"	29"	3'-9"	3'-0"	5'-6"	9'-9"	3'-0"	2'-0"	8"	10"	8"	#5@12"	2.17
42"	53"	34"	4'-3"	3'-0"	6'-3"	11'-5"	3'-6"	2'-3"	8"	10"	10"	#5@12"	2.99
48"	60"	38"	4'-8"	3'-0"	7'-0"	12'-4"	3'-8"	2'-6"	8"	10"	10"	#5@12"	3.38
54"	68"	43"	5'-3"	3'-0"	7'-8"	13'-8"	4'-0"	2'-9"	9"	12"	10"	#5@12"	4.53
60"	76"	48"	5'-6"	3'-0"	8'-5"	15'-4"	4'-6"	3'-0"	9"	12"	10"	#5@12"	5.32
66"	83"	53"	6'-0"	3'-0"	9'-1"	17'-0"	5'-0"	3'-3"	9"	12"	12"	#5@12"	7.07
72"	91"	58"	6'-6"	3'-0"	9'-10"	18'-3"	5'-4"	3'-6"	9"	12"	12"	#5@12"	7.88

Δ SEE NOTE 3



SECTION A-A



SECTION B-B

5. PRECAST WALL WITH DIMENSIONS AND REINFORCEMENT EQUIVALENT TO CAST IN PLACE WALL SHOWN WILL BE CONSIDERED. PROVIDE SHOP DRAWING SHOWING REINFORCEMENT AND MEANS OF WALL-TO-TOE CONNECTION. PLACE ON UNDISTURBED EARTH OR POUR CONCRETE FOOTING TO SAME. PRECAST WALLS THAT ARE CUT OR BROKEN FOR ANY REASON WILL BE REJECTED. PRECAST CONCRETE: 4500 psi MIN.
6. USE OF METAL PIPE SHALL BE RESTRICTED TO REPAIR AND REPLACEMENT ONLY, EXCEPT WITH APPROVAL OF THE DEPARTMENT OF PUBLIC WORKS. ADJACENT METAL PIPE SHALL BE INSPECTED FOR REPLACEMENT PRIOR TO REPLACING HEADWALL.



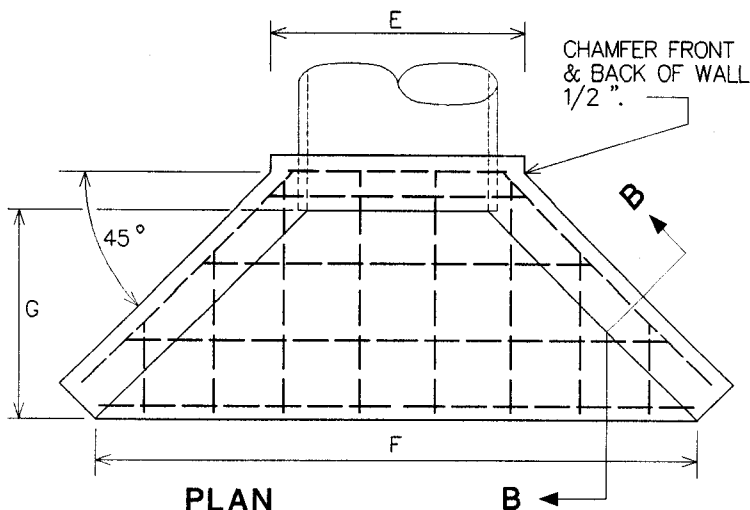
APPROVAL
DIRECTOR
William K. Ryan
BUR. OF ENGINEERING/CONSTRUCTION
5/15/02
DATE

DEPARTMENT OF PUBLIC WORKS
STANDARD STORM DRAINAGE DETAILS
TYPE "A" HEADWALL
HORIZONTAL ELLIPTICAL CONCRETE PIPE

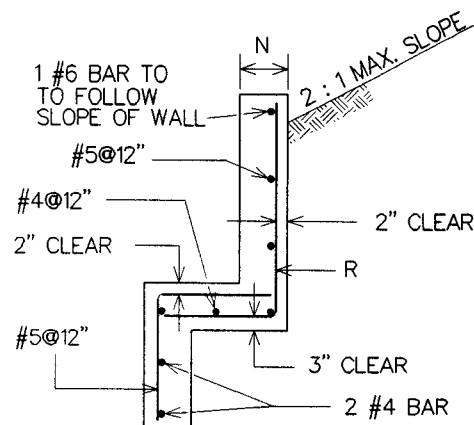
ISSUED: SEPTEMBER, 1979
REVISED: FEBRUARY, 1981
REVISED: MAY, 2002

PLATE

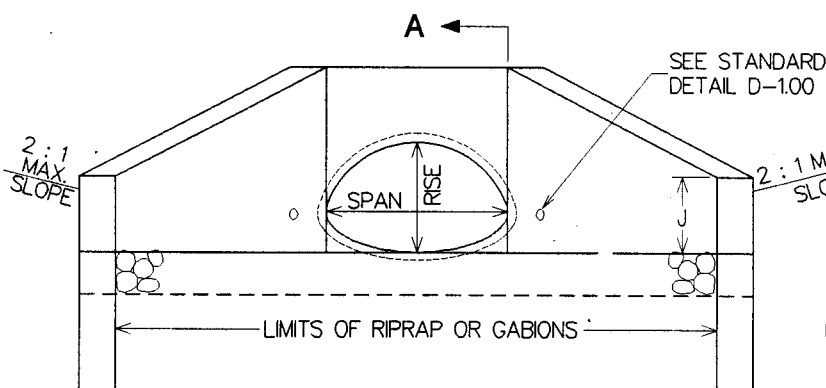
D-1.01B



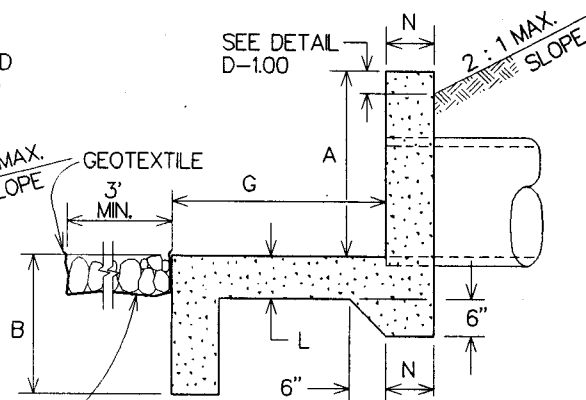
PLAN
(SHOWING REINFORCEMENT)



SECTION B-B



ELEVATION



SECTION A-A

PROVIDE RIPRAP OR GABIONS TO PREVENT SCOUR AT TOEWALL (COST SEPARATE)

Δ BASED ON 2:1 CHANNEL SIDE SLOPES. SEE NOTE 2

EQ.RD.	SPAN	RISE	A	B	E	F	G	J	K	L	N	R	Δ CONC. CY
18"	21"	15"	2'-3"	2'-0"	2'-9"	7'-9"	3'-0"	1'-0"	8"	8"	8"	#5@12"	1.12
24"	28"	20"	2'-8"	2'-0"	3'-4"	8'-4"	3'-0"	1'-4"	8"	8"	8"	#5@12"	1.29
30"	35"	24"	3'-0"	2'-0"	3'-11"	8'-11"	3'-0"	1'-4"	8"	8"	8"	#5@12"	1.45
36"	42"	29"	3'-5"	2'-6"	4'-5"	9'-6"	3'-0"	1'-11"	8"	10"	8"	#5@12"	1.86
42"	49"	33"	3'-9"	3'-0"	5'-1"	10'-1"	3'-0"	2'-3"	9"	10"	8"	#5@12"	2.18
48"	57"	38"	4'-2"	3'-0"	5'-9"	11'-9"	3'-6"	2'-5"	9"	10"	8"	#5@12"	2.75
54"	64"	43"	4'-7"	3'-0"	6'-4"	13'-0"	3'-10"	2'-8"	9"	12"	10"	#5@12"	3.83
60"	71"	47"	4'-11"	3'-0"	6'-11"	14'-3"	4'-2"	2'-10"	9"	12"	10"	#5@12"	4.41

NOTES:

1. CHAMFER EXPOSED EDGES 1" x 1".
2. CONCRETE QUANTITIES TO BE USED FOR ESTIMATING ONLY.
3. HEADWALL TO BE PARALLEL TO C OF ROADWAY UNLESS OTHERWISE NOTED ON CONTRACT DRAWINGS.
4. MIX NO. 3 CONCRETE
5. PRECASTING THIS ENDWALL: SEE NOTE 5, DETAIL D-101B.
6. FOR REPAIR/REPLACEMENT ONLY. INSPECT METAL PIPE FOR REPLACEMENT PRIOR TO REPLACING HEADWALL.



APPROVED
William K. Korman
 DIRECTOR
 BUR. OF ENGINEERING/CONSTRUCTION
 5/15/02
 DATE

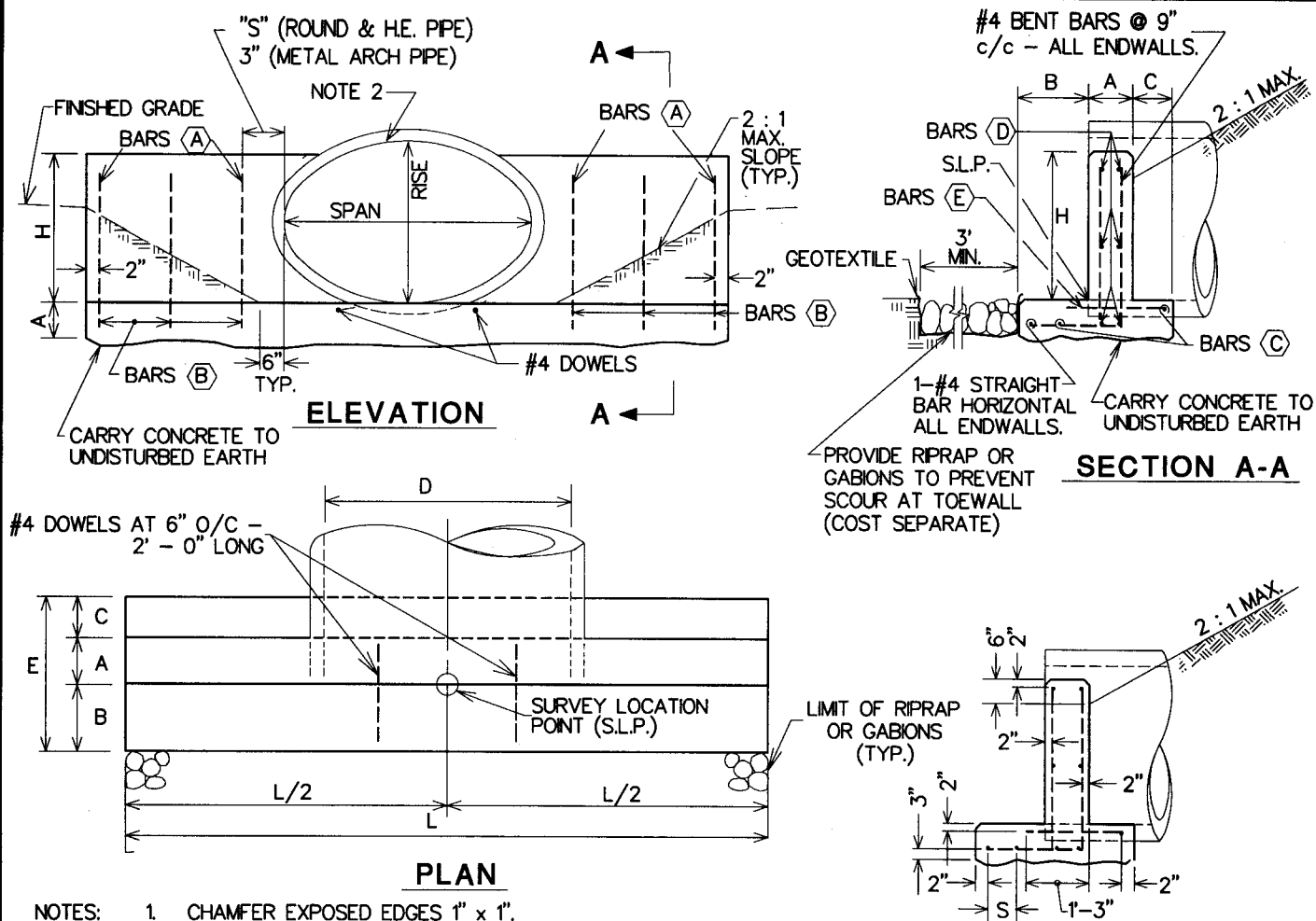
DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS

TYPE "A" HEADWALL
 METAL PIPE ARCH

ISSUED: OCTOBER, 1977
 REVISED: FEBRUARY, 1981
 REVISED: MAY, 2002

PLATE

D-1.01C



- NOTES:
1. CHAMFER EXPOSED EDGES 1" x 1".
 2. HORIZONTAL ELLIPTICAL PIPE SHOWN. SPAN & RISE SIMILAR FOR B.C.C.M. PIPE ARCH. FOR CIRCULAR PIPE, D = SPAN = RISE.
 3. HEADWALL TO BE PARALLEL TO $\frac{1}{2}$ OF ROADWAY UNLESS OTHERWISE NOTED IN THE CONTRACT DRAWINGS.
 4. MX NO. 3 CONCRETE
 5. SEE STANDARD DETAIL PLATE D-103 FOR DIMENSIONS & REINFORCING.
 6. USE OF CORRUGATED METAL PIPE SHALL BE RESTRICTED TO REPAIR & REPLACEMENT ONLY, EXCEPT WITH APPROVAL OF THE DEPARTMENT OF PUBLIC WORKS. ADJACENT METAL PIPE SHALL BE INSPECTED FOR REPLACEMENT PRIOR TO REPLACING HEADWALL.
 7. SUBGRADE DRAINAGE PER PLANS OR AS DIRECTED BY ENGINEER.

BAR	SIZE & SHAPE	NO. BARS	ORIENTATION	LOCATION	SPACING
(A)	#4 STRAIGHT	4	VERTICAL	FRONT FACE	AS SHOWN
(B)	#4 STRAIGHT	VAR.	VERTICAL	FRONT FACE	2'-0" MAX.
(C)	#4 STRAIGHT	2	HORIZONTAL	AS SHOWN	-
(D)	#4 STRAIGHT	VAR.	HORIZONTAL	BOTH FACES	1'-7" c/c MAX.
(E)	#4 STRAIGHT	VAR.	HORIZONTAL	BOTH SIDES OF OPENING	1'-0" c/c MAX.

* BOTTOM BARS TO BE FULL LENGTH

PRECAST WALL WITH DIMENSIONS AND REINFORCING EQUIVALENT TO CAST IN PLACE WALL SHOWN WILL BE CONSIDERED. PROVIDE SHOP DRAWING SHOWING REINFORCEMENT AND MEANS OF WALL-TO-TOE CONNECTION. PLACE ON UNDISTURBED EARTH OR POUR CONCRETE FOOTING TO SAME. PRECAST WALLS THAT ARE CUT OR BROKEN FOR ANY REASON WILL BE REJECTED. PRECAST CONCRETE: 4500 psi MIN.



APPROVAL
William J. [Signature]
 DIRECTOR
 BUR. OF ENGINEERING/CONSTRUCTION
 10/23/97
 DATE

DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS

END SUPPORT WALL

ISSUED: SEPTEMBER, 1980
 REVISED: FEBRUARY, 1981
 REVISED: AUGUST, 1997

PLATE

D-1.02

△ CONCRETE VOLUME & LBS. STEEL
FOR ESTIMATING ONLY

CIRCULAR PIPE:

OPENING		DIMENSIONS							△ VOLUME CONCRETE CY.	STEEL LBS. △	REINFORCING BARS APPLICATIONS				
DIAM.	AREA SQ.FT	A	B	C	E	H	L	S			BAR (A)	BAR (B)	BAR (C)	BAR (D)	BAR (E)
12"	.79	9"	6"	6"	1'-9"	0'-10"	4'-0"	4"	.27	24	●			●	●
15"	1.23	9"	6"	6"	1'-9"	1'-0 1/2"	4'-9"	4"	.34	26	●			●	●
18"	1.79	9"	6"	6"	1'-9"	1'-3"	5'-6"	4"	.42	29	●			●	●
21"	2.40	9"	6"	6"	1'-9"	1'-5"	6'-3"	4"	.49	33		●		●	●
24"	3.14	9"	14"	6"	2'-5"	1'-6"	7'-0"	6"	.69	38		●		●	●
30"	4.91	9"	14"	6"	2'-5"	1'-9"	8'-6"	6"	.88	53		●		●	●
36"	7.07	12"	16"	10"	3'-2"	2'-0"	10'-0"	6"	1.73	85		●	●	●	●
42"	9.62	12"	16"	10"	3'-2"	2'-3"	11'-6"	8"	2.07	96		●	●	●	●
48"	12.57	12"	16"	10"	3'-2"	2'-6"	13'-0"	8"	2.44	106		●	●	●	●
54"	15.90	12"	20"	12"	3'-8"	2'-9"	14'-6"	8"	3.08	121		●	●	●	●
60"	19.64	12"	20"	12"	3'-8"	3'-0"	16'-0"	8"	3.50	143		●	●	●	●

BITUMINOUS COATED CORRUGATED METAL PIPE ARCH:

OPENING			DIMENSIONS							△ VOLUME CONCRETE CY.	STEEL LBS △	REINFORCING BARS APPLICATIONS				
EQ.DIA	SIZE	AREA SQ.FT	A	B	C	E	H	L	S			BAR (A)	BAR (B)	BAR (C)	BAR (D)	BAR (E)
24"	28" x 20"	2.2	9"	14"	6"	2'-5"	1'-2"	5'-11"	6"	0.56	33		●		●	●
30"	35" x 24"	4.4	9"	14"	6"	2'-5"	1'-5"	7'-5"	6"	0.69	37		●		●	●
36"	42" x 29"	6.4	12"	16"	10"	3'-2"	1'-8"	8'-10"	6"	1.40	54		●		●	●
42"	49" x 33"	8.7	12"	16"	10"	3'-2"	1'-11"	10'-4"	8"	1.70	77		●	●	●	●
48"	57" x 38"	11.4	12"	16"	10"	3'-2"	2'-2"	12'-1"	8"	2.07	90		●	●	●	●
54"	64" x 43"	14.3	12"	20"	12"	3'-8"	2'-6"	13'-7"	8"	2.70	102		●	●	●	●
60"	71" x 47"	17.6	12"	20"	12"	3'-8"	2'-9"	15'-1"	8"	3.08	112		●	●	●	●

HORIZONTAL ELLIPTICAL REINFORCED CONCRETE PIPE:

OPENING			DIMENSIONS							△ VOLUME CONCRETE CY.	STEEL LBS △	REINFORCING BARS APPLICATIONS				
EQ.DIA	SIZE	AREA SQ.FT	A	B	C	E	H	L	S			BAR (A)	BAR (B)	BAR (C)	BAR (D)	BAR (E)
18"	23" x 14"	1.8	9"	14"	6"	2'-5"	1'-2"	5'-11"	6"	0.54	33	●			●	●
24"	30" x 19"	3.3	9"	14"	6"	2'-5"	1'-5"	7'-5"	6"	0.70	47		●		●	●
27"	34" x 22"	4.1	12"	16"	10"	3'-2"	1'-7"	8'-2"	6"	1.30	57		●		●	●
30"	38" x 24"	5.1	12"	16"	10"	3'-2"	1'-8"	8'-10"	6"	1.42	64		●		●	●
33"	42" x 27"	6.3	12"	16"	10"	3'-2"	1'-10"	9'-7"	6"	1.57	72		●	●	●	●
36"	45" x 29"	7.4	12"	16"	10"	3'-2"	1'-11"	10'-4"	8"	1.72	77		●	●	●	●
39"	49" x 32"	8.8	12"	16"	10"	3'-2"	2'-1"	11'-3"	8"	1.92	85		●	●	●	●
42"	53" x 34"	10.2	12"	20"	12"	3'-8"	2'-2"	12'-1"	8"	2.31	90		●	●	●	●
48"	60" x 38"	12.9	12"	20"	12"	3'-8"	2'-6"	13'-7"	8"	2.70	102		●	●	●	●
54"	68" x 43"	16.6	12"	20"	12"	3'-8"	2'-8"	14'-6"	8"	2.91	118		●	●	●	●



APPROVAL
William H. Hays
DIRECTOR
BUR. OF ENGINEERING/CONSTRUCTION
10/23/97
DATE

DEPARTMENT OF PUBLIC WORKS
STORM DRAINAGE DETAILS

END SUPPORT WALL
TABLES

ISSUED: OCTOBER 1977
REVISED: FEBRUARY 1981
REVISED: AUGUST, 1997

PLATE
D-1.03

4-#6 BENT BARS HORIZONTAL
2 EACH FACE.

#4 STRAIGHT BARS
VERTICAL @ 1'-6" MIN.
TO 2'-0" MAX. IN
FRONT FACE.

SUBGRADE DRAIN (TYP.)
SEE STD. DETAIL D-100

ELEVATION

CARRY CONCRETE TO
UNDISTURBED EARTH

2:1 MAX. SLOPE

SEE DETAIL D-100

S.L.P.

#4 BENT BARS
@ 1'-0" C/C BELOW
OPENING.

GEOTEXTILE

SEE PLAN

CARRY CONCRETE TO
UNDISTURBED EARTH

SECTION A-A

PROVIDE RIPRAP OR
GABIONS TO PREVENT
SCOUR AT TOEWALL
(COST SEPARATE)

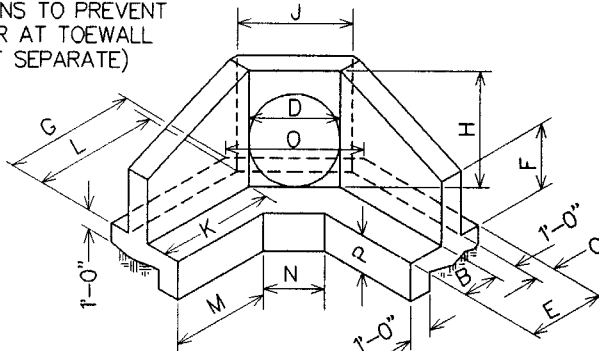
SURVEY LOCATION
POINT (S.L.P.)

45°

45°

PLAN

LIMITS OF RIPRAP (OR
GABION) SCOUR PRO-
TECTION FOR TOE OF
HEADWALL



ISOMETRIC VIEW

#5 BARS HORIZONTAL @ 1'-7"
MAX. C/C BOTH FACES BOTTOM
BARS BENT ALONG ENDWALL
OTHERS STRAIGHT.

1-#4 BENT BAR
HORIZONTAL

2-#4 BENT BARS
HORIZONTAL

#5 BENT BARS
BOTH WINGWALLS
ALL ENDWALLS.

#5 BENT BARS @
1'-0" c/c BOTH
SIDES OF OPENING.

#4 STRAIGHT
BARS HORIZONTAL.
1 EACH WINGWALL.

SECTION B-B

GENERAL NOTES :

CONCRETE: MIX #3

CHAMFER: ALL EXPOSED EDGES

1" x 1" OR AS DIRECTED.

SUBGRADE DRAINAGE: PER STD. PLATE

D-100 OR AS DIRECTED.

PRECAST WALL WITH DIMENSIONS AND
REINFORCING EQUIVALENT TO CAST IN
PLACE WALL SHOWN WILL BE CONSIDERED.
PROVIDE SHOP DRAWING SHOWING REIN-
FORCEMENT & MEANS OF WALL-TO-TOE

CONNECTION. PLACE ON UNDISTURBED EARTH
OR POUR CONCRETE FOOTING TO SAME.
PRECAST WALLS THAT ARE CUT OR BROKEN
FOR ANY REASON WILL BE REJECTED.
PRECAST CONCRETE: 4500 psi MIN.

CORRUGATED METAL PIPE USE IS
RESTRICTED TO REPAIR & REPLACEMENT
ONLY, EXCEPT WITH D.P.W. APPROVAL.
INSPECT ADJACENT METAL PIPE FOR RE-
PLACEMENT BEFORE REPLACING HEADWALL.

DISPOSITION OF BARS DETAIL

OPENING		DIMENSIONS													VOL. CONC. C. Y.	STEEL LBS.
D INCHES	AREA SQ. FT.	B	C	E	F	G	H	J	K	L	M	N	O	P		
48	12.57	1'-4"	10"	3'-2"	2'-9"	7'-0 ³ / ₄ "	5'-0"	4'-10"	6'-3 ¹ / ₂ "	6'-8 ¹ / ₂ "	5'-9"	2'-10 ³ / ₄ "	5'-6"	3'-0"	5.3	292
54	15.9	1'-8"	1'-0"	3'-8"	3'-0"	7'-8 ¹ / ₂ "	5'-6"	5'-4"	6'-10 ¹ / ₂ "	7'-3 ¹ / ₂ "	6'-2 ¹ / ₄ "	3'-1 ¹ / ₂ "	6'-2"	3'-0"	6.4	332
60	19.64	1'-8"	1'-0"	3'-8"	3'-3"	8'-5"	6'-0"	5'-10"	7'-7 ¹ / ₄ "	8'-0 ¹ / ₄ "	6'-11"	3'-7 ¹ / ₂ "	6'-8"	3'-0"	7.3	397

QUANTITIES IN TABLE TO BE USED FOR ESTIMATING ONLY.



APPROVAL
William H. Hargrave
DIRECTOR
BUR. OF ENGINEERING/CONSTRUCTION
5/15/02
DATE

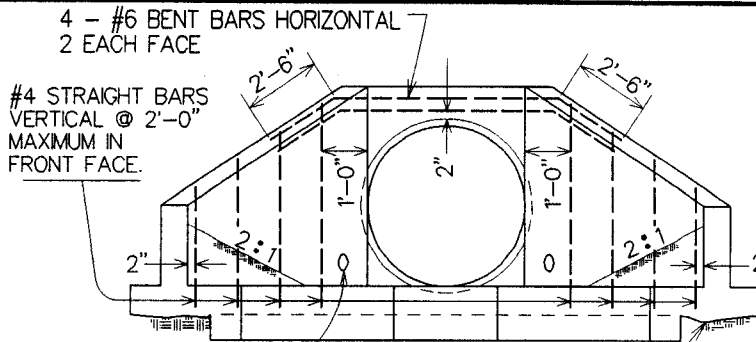
DEPARTMENT OF PUBLIC WORKS
STORM DRAINAGE DETAILS

HEADWALLS
B-48, B-54 & B-60

ISSUED: OCTOBER, 1977
REVISED: FEBRUARY, 1981
REVISED: MAY, 2002

PLATE

D-1.04



SUBGRADE DRAIN (TYP.)
SEE STD. DETAIL D-100

3/4" Ø HOOK BOLTS
@ 1'-6" C/C AROUND
PIPE ARCH WHEN
METAL PIPE IS USED.

#4 BENT BARS
@ 1'-0" C/C BELOW
OPENING.

GEOTEXTILE

S.L.P.

2:1
MAXIMUM
SLOPE

SEE DETAIL
D-100

ELEVATION

CARRY CONCRETE TO
UNDISTURBED EARTH

SECTION A-A

CARRY CONCRETE TO
UNDISTURBED EARTH

PROVIDE RIPRAP OR
GABIONS TO PREVENT
SCOUR AT TOEWALL
(COST SEPARATE)

SURVEY LOCATION
POINT (S.L.P.)

45°

45°

PLAN

LIMITS OF RIPRAP (OR
GABION) SCOUR PRO-
TECTION FOR TOE OF
HEADWALL

- B-66 #4 LONG BENT BARS HOR.
B-72 #4 SHORT BENT BARS HOR.
ALT. 1 WITH 1 @ 6" C/C.
- B-78 #4 LONG BENT BARS HOR.
B-84 #4 SHORT BENT BARS HOR.
ALT. 1 WITH 2 RESP. @ 4" C/C.

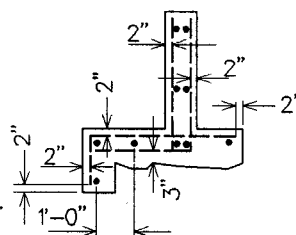
GENERAL NOTES :

CONCRETE: MIX #3

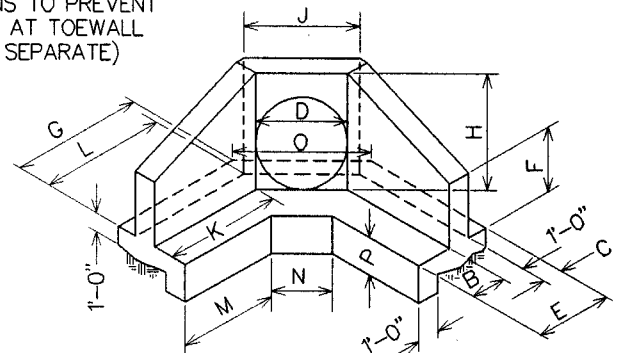
CHAMFER: ALL EXPOSED EDGES
1" x 1" OR AS DIRECTED.

SUBGRADE DRAINAGE: PER STD. PLATE

PRECAST WALL WITH DIMENSIONS AND
REINFORCING EQUIVALENT TO CAST IN
PLACE WALL SHOWN WILL BE CONSIDERED.
PROVIDE SHOP DRAWING SHOWING RE-
INFORCEMENT AND MEANS OF WALL-TO-
TOE CONNECTION. PLACE ON UNDISTURBED
EARTH OR POUR CONCRETE FOOTING
TO SAME. PRECAST WALLS THAT ARE
CUT OR BROKEN FOR ANY REASON WILL BE
REJECTED. PRECAST CONCRETE: 4500 psi MIN.



DISPOSITION OF BARS DETAIL



ISOMETRIC VIEW

#5 BARS HORIZONTAL @ 1'-7"
MAX. C/C BOTH FACES BOTTOM
BARS BENT ALONG ENDWALL
OTHERS STRAIGHT.

1-#4 BENT BAR
HORIZONTAL
2-#4 BENT BARS
HORIZONTAL

#5 BENT BARS
BOTH WINGWALLS
ALL ENDWALLS.

#5 BENT BARS @
1'-0" c/c BOTH
SIDES OF OPENING.

#4 STRAIGHT
BARS HORIZONTAL.
1 EACH WINGWALL.

SECTION B-B

CORRUGATED METAL PIPE USE IS
RESTRICTED TO REPAIR & REPLACEMENT
EXCEPT WITH D.P.W. APPROVAL. INSPECT
ADJACENT METAL PIPE FOR REPLACEMENT
BEFORE REPLACING HEADWALL.

OPENING		DIMENSIONS													VOL. CONC. C. Y.	STEEL LBS.
D INCHES	AREA SQ. FT.	B	C	E	F	G	H	J	K	L	M	N	O	P		
66	23.80	2'-6"	1'-3"	4'-9"	3'-0"	11'-2 1/2"	6'-8 1/2"	6'-4"	10'-3 1/4"	10'-8 1/2"	9'-3"	3'-5"	7'-4 1/2"	3'-0"	10.5	585
72	28.27	2'-6"	1'-3"	4'-9"	3'-3"	12'-1"	7'-3"	6'-10"	11'-1 3/4"	11'-6 3/4"	10'-1 1/4"	3'-11"	7'-10 1/2"	3'-0"	11.8	645
78	33.20	3'-0"	1'-6"	5'-6"	3'-6"	13'-0 1/2"	7'-9 1/2"	7'-4"	12'-0"	12'-5"	10'-9"	4'-0"	8'-6 3/4"	3'-0"	13.8	865
84	38.48	3'-0"	1'-6"	5'-6"	3'-9"	13'-10"	8'-4"	7'-10"	12'-9 1/2"	13'-2 1/2"	11'-6 1/2"	4'-6"	9'-0 3/4"	3'-0"	15.2	984

QUANTITIES IN TABLE TO BE USED FOR ESTIMATING ONLY.



APPROVED
William Hopman
DIRECTOR
BUREAU OF ENGINEERING/CONSTRUCTION
5/15/02
DATE

DEPARTMENT OF PUBLIC WORKS
STORM DRAINAGE DETAILS

HEADWALLS

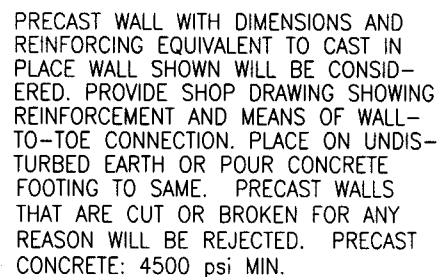
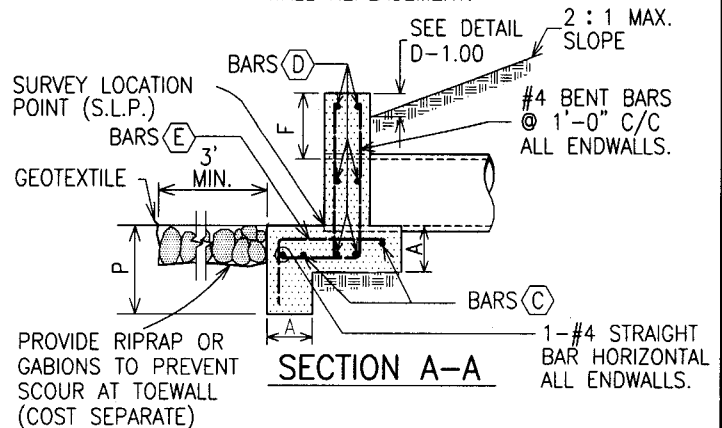
B-66, B-72, B-78 & B-84

ISSUED: OCTOBER, 1977
REVISED: FEBRUARY, 1981
REVISED: MAY, 2002

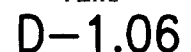
PLATE

D-1.05

CORRUGATED METAL PIPE: USE FOR REPAIR, REPLACEMENT ONLY, EXCEPT WITH D.P.W. APPROVAL. ADJACENT METAL PIPE TO BE INSPECTED FOR REPLACEMENT PRIOR TO HEAD-WALL REPLACEMENT.



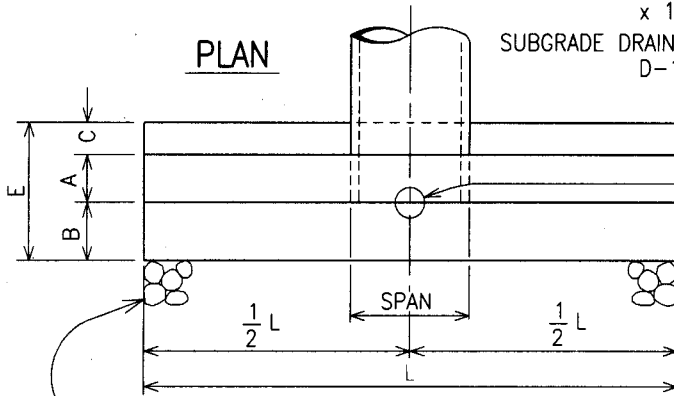
* TOP & BOTTOM BARS TO BE FULL LENGTH

† FOR ESTIMATING PURPOSES ONLY

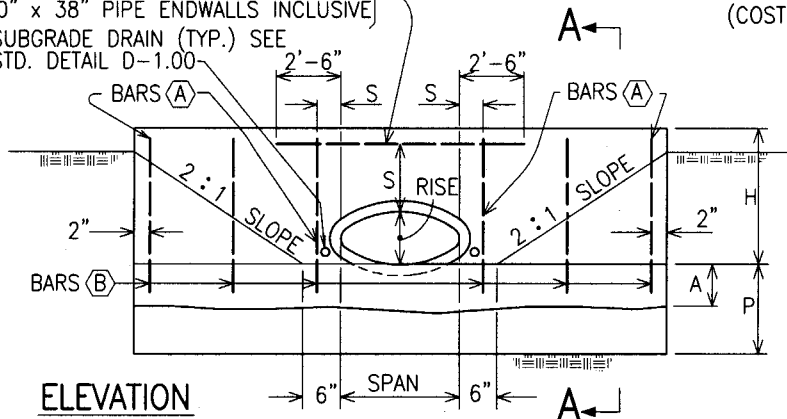
D-1.07A

CONCRETE : MIX # 3
 CHAMFER : ALL EXPOSED EDGES 1" x 1" OR AS DIRECTED.
 SUBGRADE DRAINAGE: PER STD. PLATE D-1.00 OR AS DIRECTED.

CORRUGATED METAL PIPE: USE FOR REPAIR, REPLACEMENT ONLY, EXCEPT WITH D.P.W. APPROVAL. ADJACENT METAL PIPE TO BE INSPECTED FOR REPLACEMENT PRIOR TO HEADWALL REPLACEMENT.



2-#4 STRAIGHT BARS HORIZONTAL
 1 EACH FACE FOR 42" x 27" TO 60" x 38" PIPE ENDWALLS INCLUSIVE
 SUBGRADE DRAIN (TYP.) SEE STD. DETAIL D-1.00



SURVEY LOCATION POINT (S.L.P.)

GEOTEXTILE

PROVIDE RIPRAP OR GABIONS TO PREVENT SCOUR AT TOEWALL (COST SEPARATE)

2 : 1 MAX. SLOPE

SEE DETAIL D-1.00

#4 BENT BARS @ 1'-0" C/C ALL ENDWALLS.

BARS (D)

BARS (E)

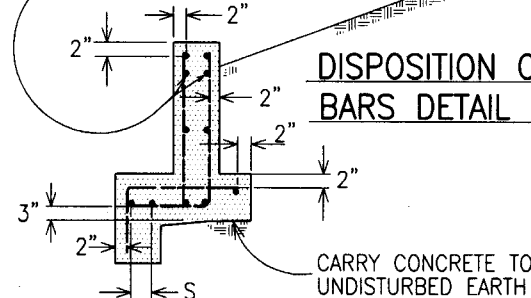
3' MIN.

P

SECTION A-A

1-#4 STRAIGHT BAR HORIZONTAL ALL ENDWALLS.

ADD'L. BARS REQUIRED FOR 42" x 27" TO 60" x 38" PIPE



DISPOSITION OF BARS DETAIL

CARRY CONCRETE TO UNDISTURBED EARTH

BAR	SIZE & SHAPE	NO. BARS	ORIENTATION	LOCATION	SPACING
(A)	#4 STRAIGHT	4	VERTICAL	FRONT FACE	AS SHOWN
(B)	#4 STRAIGHT	VAR.	VERTICAL	FRONT FACE	2'-0" MAX.
(C)	#4 STRAIGHT	2	HORIZONTAL	AS SHOWN	-
(D)*	#4 STRAIGHT	VAR.	HORIZONTAL	BOTH FACES	1'-7" c/c MAX.
(E)	#4 BENT	VAR.	HORIZONTAL	BOTH SIDES OF OPENING	1'-0" c/c MAX.

* TOP & BOTTOM BARS TO BE FULL LENGTH

PRECAST WALL WITH DIMENSIONS AND REINFORCING EQUIVALENT TO CAST IN PLACE WALL SHOWN WILL BE CONSIDERED. PROVIDE SHOP DRAWING SHOWING REINFORCEMENT AND MEANS OF WALL-TO-TOE CONNECTION. PLACE ON UNDISTURBED EARTH OR POUR CONCRETE FOOTING TO SAME. PRECAST WALLS THAT ARE CUT OR BROKEN FOR ANY REASON WILL BE REJECTED. PRECAST CONCRETE: 4500 psi MIN.

OPENING		DIMENSIONS									QUANTITIES†		REINFORCING BARS APPLICATIONS				
D	AREA	A	B	C	E	F	H	L	P	S	CONC. C. Y.	STEEL LBS.	BAR (A)	BAR (B)	BAR (C)	BAR (D)	BAR (E)
INCHES S x R	SQ. FT.																
23 x 14	1.8	9"	6"	6"	1'-9"	9"	2'-3"	9'-6"	2'-0"	6"	1.4	87	●			●	●
30 x 19	3.3	9"	14"	6"	2'-5"	14"	3'-2"	13'-8"	2'-0"	6"	2.5	145		●		●	●
34 x 22	4.1	9"	14"	6"	2'-5"	12"	3'-2"	13'-8"	2'-0"	6"	2.5	145		●		●	●
38 x 24	5.1	12"	14"	6"	2'-5"	9"	3'-2"	13'-8"	2'-6"	6"	3.4	144		●		●	●
42 x 27	6.3	12"	16"	10"	3'-2"	10"	3'-6"	17'-11"	2'-6"	6"	5.2	212		●	●	●	●
45 x 29	7.4	12"	16"	10"	3'-2"	14"	3'-11"	17'-11"	2'-6"	8"	5.4	217		●	●	●	●
49 x 32	8.8	12"	16"	10"	3'-2"	10"	4'-0"	17'-11"	2'-6"	8"	5.4	217		●	●	●	●
53 x 34	10.2	12"	20"	12"	3'-8"	14"	4'-9"	21'-9"	3'-0"	8"	8.0	284		●	●	●	●
60 x 38	12.9	12"	20"	12"	3'-8"	10"	4'-9"	21'-9"	3'-0"	8"	7.9	284		●	●	●	●

† FOR ESTIMATING PURPOSES ONLY



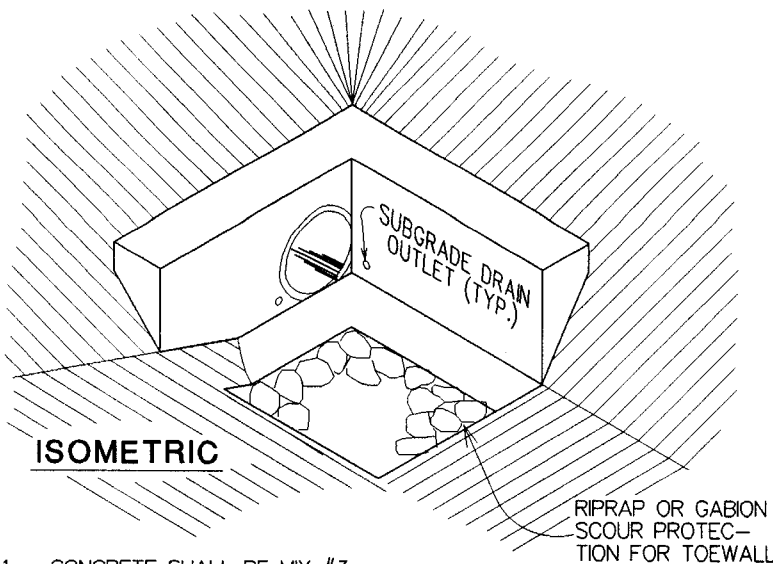
APPROVED
 [Signature]
 DIRECTOR
 [Signature]
 BUR. OF ENGINEERING/CONSTRUCTION
 3/12/05
 DATE

DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS

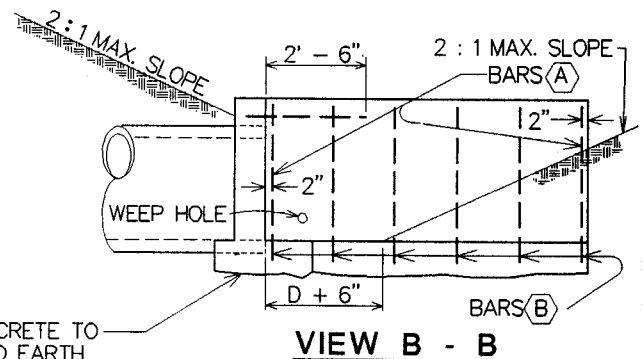
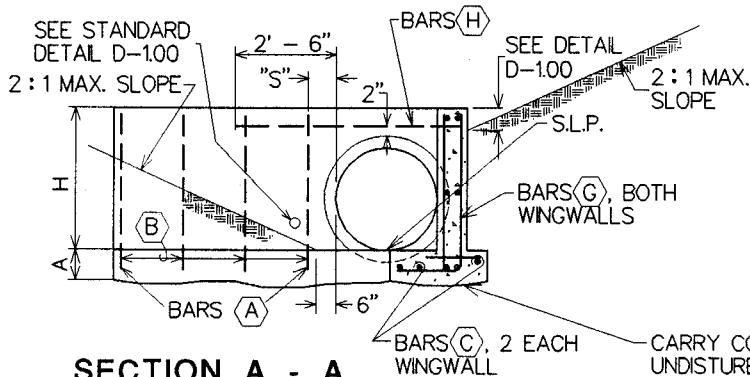
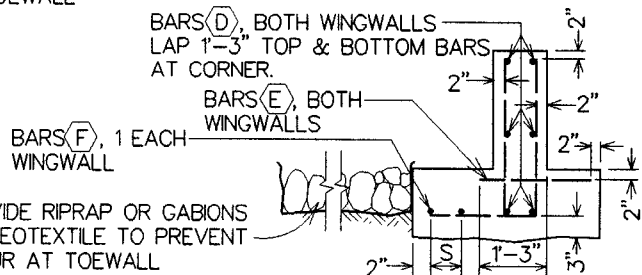
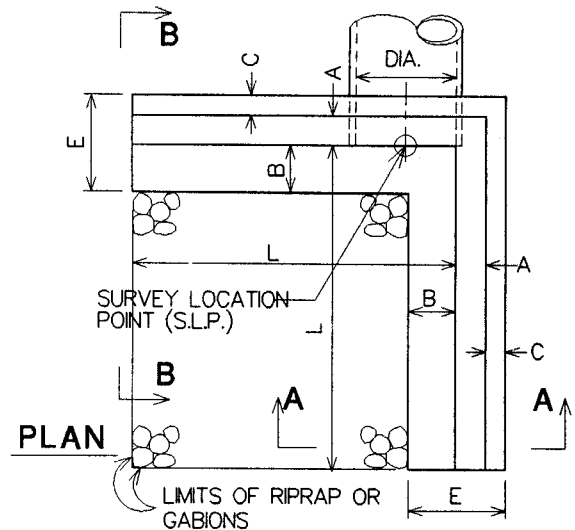
TYPE C ENDWALL
 HOR. ELLIPTICAL PIPE

ISSUED: AUGUST, 1997
 REVISED: MAY, 2002
 REVISED: FEBRUARY, 2005

PLATE
 D-1.07B



1. CONCRETE SHALL BE MIX #3.
2. CHAMFER ALL EXPOSED EDGES 1" x 1" OR AS DIRECTED.
3. SUBGRADE DRAINAGE PER DETAIL D-1.00 OR AS DIRECTED.
4. CIRCULAR PIPE SHOWN. DETAIL ALSO APPLICABLE TO HORIZONTAL ELLIPTICAL & CORRUGATED METAL ARCH PIPE. CORRUGATED METAL PIPE SHALL NOT BE USED WITHOUT DPW APPROVAL, EXCEPT FOR REPLACEMENT.
5. SEE DETAIL D-1.09 FOR DIMENSIONS & REINFORCEMENT.
6. ONE WINGWALL SHALL BE PARALLEL TO ϕ OF ROAD, UNLESS OTHERWISE NOTED ON CONTRACT DRAWINGS.



BAR	SIZE & SHAPE	NO. BARS	ORIENTATION	LOCATION	SPACING
(A)	#4 STRAIGHT	4	VERTICAL	FRONT FACE	AS SHOWN
(B)	#4 STRAIGHT	VAR.	VERTICAL	FRONT FACE	2'-0" MAX
(C)	#4 STRAIGHT	4	HORIZONTAL	AS SHOWN	-
(D)*	#4 STRAIGHT	VAR.	HORIZONTAL	BOTH FACES	1'-7" c/c MAX.
(E)	#4 STRAIGHT	VAR.	HORIZONTAL	BOTH SIDES OF OPENING	1'-0" c/c
(F)	#4 STRAIGHT	2	HORIZONTAL	AS SHOWN	AS SHOWN
(G)	#4 BENT	VAR.	VERTICAL	AS SHOWN	1'-0" c/c
(H)	#4 BENT	2	HORIZONTAL	1 EACH FACE	1'-0" c/c

PRECAST WALL WITH DIMENSIONS AND REINFORCING EQUIVALENT TO CAST IN PLACE WALL SHOWN WILL BE CONSIDERED. PROVIDE SHOP DRAWING SHOWING REINFORCEMENT AND MEANS OF WALL-TO-TOE CONNECTION. PLACE ON UNDISTURBED EARTH OR POUR CONCRETE FOOTING TO SAME. PRECAST WALLS THAT ARE CUT OR BROKEN FOR ANY REASON WILL BE REJECTED. PRECAST CONCRETE: 4500 psi MIN.

* TOP & BOTTOM BARS TO BE FULL LENGTH



APPROVAL
William J. [Signature]
 DIRECTOR
 BUR. OF ENGINEERING/CONSTRUCTION
 5/15/02
 DATE

DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS
TYPE E ENDWALL

ISSUED: OCTOBER, 1977
 REVISED: AUGUST, 1997
 REVISED: MAY, 2002
 PLATE

D-1.08

CIRCULAR PIPE

OPENING		DIMENSIONS							QUANTITIES †		REINFORCING BARS APPLICATIONS							
DIA.	AREA	A	B	C	E	H	L	S	CONC. C. Y.	STEEL LBS.	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
INCHES	SQ. FT.																	
12	0.79	9"	6"	6"	1'-9"	1'-9"	3'-6"	4"	0.7	55	●			●	●	●	●	
15	1.23	9"	6"	6"	1'-9"	2'-0"	4'-3"	4"	0.9	61	●			●	●	●	●	
18	1.77	9"	6"	6"	1'-9"	2'-3"	5'-0"	4"	1.1	68	●			●	●	●	●	
21	2.40	9"	6"	6"	1'-9"	2'-6"	5'-9"	4"	1.4	77	●			●	●	●	●	
24	3.14	9"	14"	6"	2'-5"	2'-9"	6'-6"	6"	1.8	106		●		●	●	●	●	
30	4.91	9"	14"	6"	2'-5"	3'-6"	8'-0"	6"	2.6	140		●		●	●	●	●	
36	7.07	12"	16"	10"	3'-2"	4'-0"	9'-6"	6"	5.0	235		●	●	●	●	●	●	●
42	9.62	12"	16"	10"	3'-2"	4'-6"	11'-0"	8"	6.1	303		●	●	●	●	●	●	●
48	12.57	12"	16"	10"	3'-2"	5'-0"	12'-6"	8"	7.3	341		●	●	●	●	●	●	●
54	15.90	12"	20"	12"	3'-8"	5'-6"	14'-0"	8"	9.2	438		●	●	●	●	●	●	●
60	19.64	12"	20"	12"	3'-8"	6'-0"	15'-6"	8"	10.6	496		●	●	●	●	●	●	●
72	28.27	12"	20"	12"	3'-8"	7'-0"	17'-0"	8"	12.7	597		●	●	●	●	●	●	●

METAL PIPE ARCH

OPENING		DIMENSIONS							QUANTITIES †		REINFORCING BARS APPLICATIONS							
D	AREA	A	B	C	E	H	L	S	CONC. C. Y.	STEEL LBS.	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
INCHES S x R	SQ. FT.																	
17 x 13	1.1	9"	6"	6"	1'-9"	1'-7"	3'-9"	4"	0.7	53	●			●	●	●	●	
21 x 15	1.6	9"	6"	6"	1'-9"	2'-2"	5'-10"	4"	1.3	75	●			●	●	●	●	
24 x 18	2.2	9"	6"	6"	1'-9"	2'-2"	5'-10"	4"	1.3	75	●			●	●	●	●	
28 x 20	2.8	9"	6"	6"	1'-9"	2'-2"	5'-10"	6"	1.3	74	●			●	●	●	●	
35 x 24	4.4	9"	14"	10"	2'-9"	3'-2"	8'-6"	6"	2.8	118		●		●	●	●	●	
42 x 29	6.4	9"	14"	10"	2'-9"	3'-2"	8'-6"	6"	2.7	117		●		●	●	●	●	
49 x 33	8.7	12"	16"	10"	3'-2"	3'-11"	11'-3"	8"	5.8	271		●	●	●	●	●	●	●
57 x 38	11.4	12"	16"	10"	3'-2"	3'-11"	11'-3"	8"	5.7	261		●	●	●	●	●	●	●
64 x 43	14.3	12"	20"	12"	3'-8"	4'-8"	13'-9"	8"	8.2	366		●	●	●	●	●	●	●
71 x 47	17.6	12"	20"	12"	3'-8"	4'-8"	13'-9"	8"	8.1	355		●	●	●	●	●	●	●

HORIZONTAL ELLIPTICAL R. C. PIPE

OPENING		DIMENSIONS							QUANTITIES †		REINFORCING BARS APPLICATIONS							
D	AREA	A	B	C	E	H	L	S	CONC. C. Y.	STEEL LBS.	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
INCHES S x R	SQ. FT.																	
23 x 14	1.8	9"	6"	6"	1'-9"	2'-2"	5'-10"	6"	1.3	75	●			●	●	●	●	
30 x 19	3.3	9"	14"	6"	2'-5"	3'-2"	8'-6"	6"	2.6	118		●		●	●	●	●	
34 x 22	4.1	9"	14"	6"	2'-5"	3'-2"	8'-6"	6"	2.6	118		●		●	●	●	●	
38 x 24	5.1	12"	14"	6"	2'-8"	3'-2"	8'-6"	6"	3.7	118		●		●	●	●	●	
42 x 27	6.3	12"	16"	10"	3'-2"	3'-6"	11'-3"	6"	5.5	265		●	●	●	●	●	●	●
45 x 29	7.4	12"	16"	10"	3'-2"	3'-11"	11'-3"	8"	5.9	271		●	●	●	●	●	●	●
49 x 32	8.8	12"	16"	10"	3'-2"	4'-0"	11'-3"	8"	5.9	273		●	●	●	●	●	●	●
53 x 34	10.2	12"	20"	12"	3'-8"	4'-8"	13'-9"	8"	8.4	366		●	●	●	●	●	●	●
60 x 38	12.9	12"	20"	12"	3'-8"	4'-8"	13'-9"	8"	8.3	366		●	●	●	●	●	●	●

†QUANTITIES FOR
ESTIMATING ONLY.

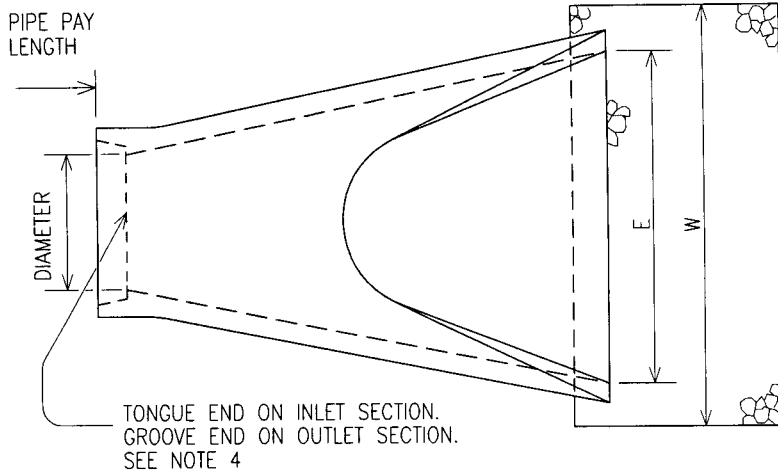


APPROVAL
William R. [Signature]
DIRECTOR
BUREAU OF ENGINEERING / CONSTRUCTION
DATE 10/23/97

DEPARTMENT OF PUBLIC WORKS STORM DRAINAGE DETAILS TYPE E ENDWALL TABLES

ISSUED: OCTOBER, 1977
REVISED: AUGUST, 1997
REVISED:

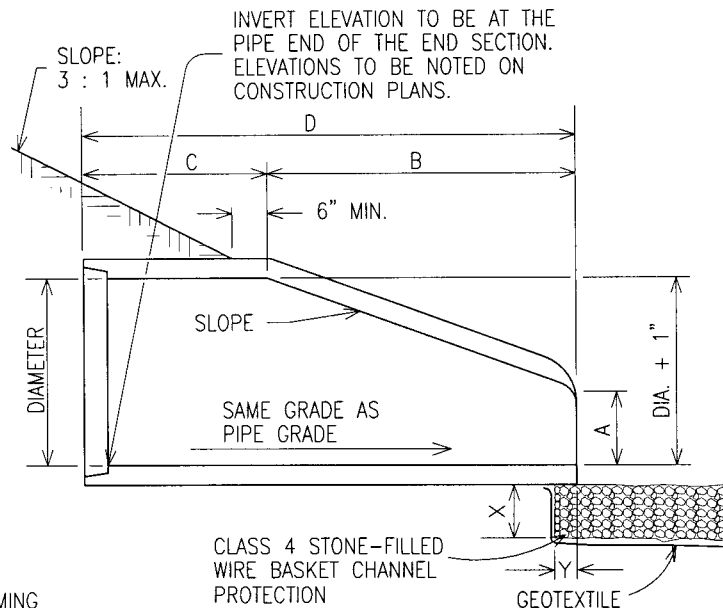
PLATE
D-1.09



PLAN

NOTES

1. END SECTIONS MUST BE REINFORCED TO CONFORM WITH CLASS IV PIPE.
2. PREFERRED USE: OUTFALLS ONLY. EXTRA CARE MUST BE TAKEN TO PROTECT ADJACENT SLOPES FROM EROSION WHEN USED IN LIEU OF A HEADWALL AT THE INLET END OF A PIPE.
3. CONCRETE FOOTER SHALL BE AS SHOWN ON STD. DETAIL PLATE D-1.11. SEE NOTE 2 ON THAT PLATE.
4. CONTRACTOR HAS OPTION OF FURNISHING END SECTIONS CONFORMING TO THIS STANDARD DETAIL PLATE OR TO STANDARD DETAIL PLATE D-1.11.



LONGITUDINAL SECTION

TABLE OF DIMENSIONS									
CONCRETE END SECTION							CONCRETE FOOTER (SEE NOTE 3)		
DIAMETER	SLOPE	A	B	C	D	E	W	X	Y
15"	3:1	6 1/2"	2'-4"	3'-10"	6'-2"	2'-6"	3'-6"	12"	9"
18"	3:1	10 1/4"	2'-2"	4'-0"	6'-2"	3'-0"	4'-0"	12"	9"
24"	3:1	11"	3'-7"	2'-8"	6'-3"	4'-0"	5'-0"	15"	9"
30"	3:1	1'-1"	4'-5"	1'-10"	6'-3"	5'-0"	6'-0"	15"	9"
36"	3:1	1'-3 1/2"	5'-3"	3'-1"	8'-1 1/2"	6'-0"	7'-3"	15"	9"
42"	3:1	1'-9 1/4"	5'-5"	2'-10"	8'-3"	6'-6"	7'-9"	15"	9"
48"	3:1	2'-1"	6'-0"	2'-2"	8'-2"	7'-0"	8'-6"	18"	12"
54"	2.4:1	2'-5"	5'-2"	2'-10"	8'-0"	7'-6"	9'-0"	18"	12"
60"	2:1	2'-7"	4'-11"	3'-8 1/2"	8'-7 1/2"	8'-0"	9'-6"	18"	12"
66"	2:1	2'-4"	6'-6"	1'-9"	8'-3"	8'-6"	10'-0"	18"	12"
72"	2:1	2'-10"	6'-6"	1'-9"	8'-3"	9'-0"	10'-9"	18"	12"

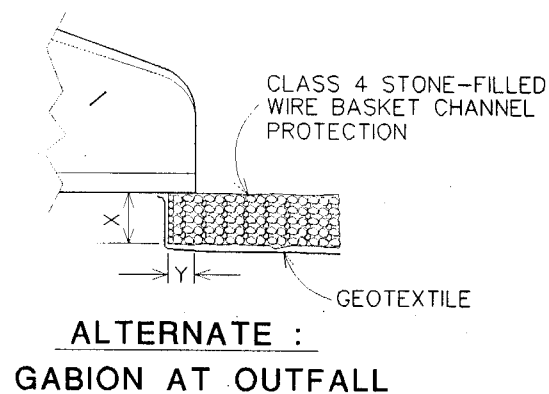
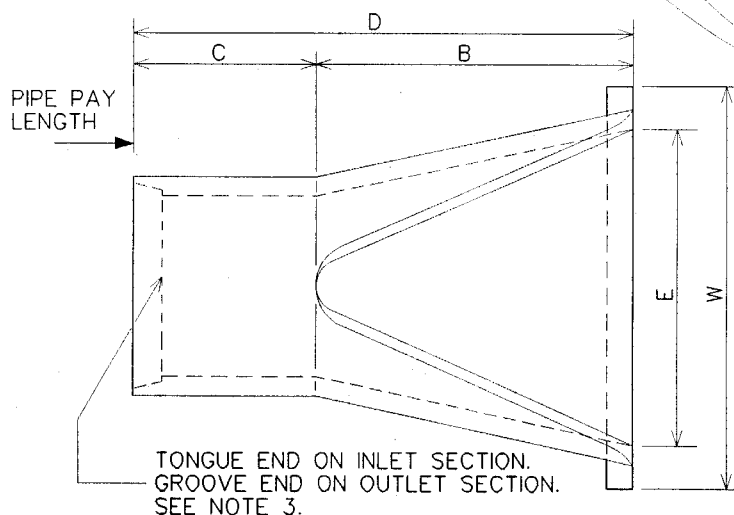
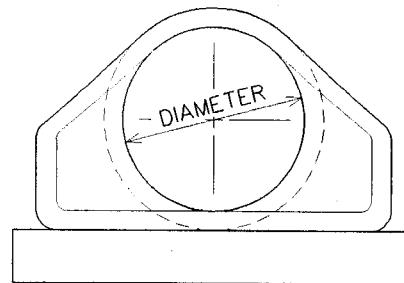
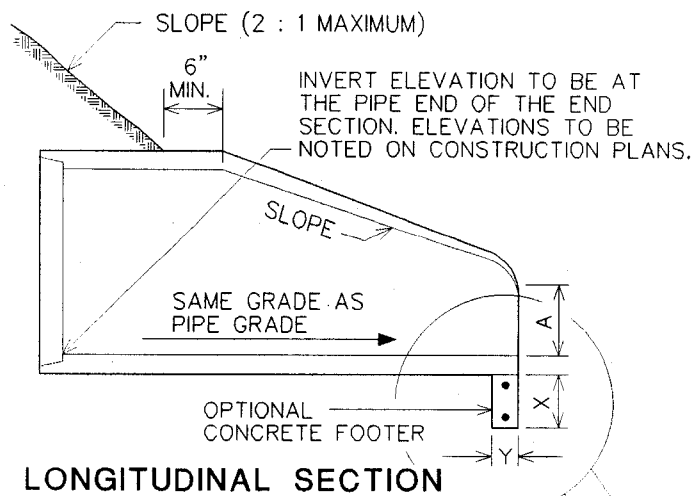


APPROVAL
[Signature]
 DIRECTOR
[Signature]
 BUR. OF ENGINEERING/CONSTRUCTION
 1-2-07
 DATE

DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS
CONCRETE END SECTION
 ROUND CONCRETE PIPE

ISSUED: OCTOBER, 1977
 REVISED: OCTOBER, 2006
 REVISED:

PLATE
D-1.10



NOTES

1. END SECTIONS MUST BE REINFORCED TO CONFORM WITH CLASS IV PIPE.
2. CONCRETE FOOTER SHALL BE USED WHEN SPECIFIED ON THE PLANS. COST OF CONCRETE FOOTER TO BE PAID PER CUBIC YARD OF MIX NO. 2 CONCRETE FOR MISCELLANEOUS STRUCTURES. REINFORCEMENT TO BE #4 BARS.
3. PREFERRED USE: OUTFALLS ONLY. EXTRA CARE MUST BE TAKEN TO PROTECT ADJACENT SLOPES FROM EROSION WHEN USED IN LIEU OF A HEADWALL AT THE INLET END OF A PIPE.

TABLE OF DIMENSIONS									
CONCRETE END SECTION							CONCRETE FOOTER		
DIAMETER	SLOPE	A	B	C	D	E	W	X	Y
12"	3:1	4"	2'-0"	4'-0 ⁷ / ₈ "	6'-0 ⁷ / ₈ "	2'-0"	3'-0"	12"	9"
15"	3:1	6"	2'-3"	3'-10"	6'-1"	2'-6"	3'-6"	12"	9"
18"	3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"	4'-0"	12"	9"
21"	3:1	9"	3'-0"	3'-1 ¹ / ₂ "	6'-1 ¹ / ₂ "	3'-6"	4'-6"	12"	9"
24"	3:1	9 ¹ / ₂ "	3'-7 ¹ / ₂ "	2'-6"	6'-1 ¹ / ₂ "	4'-0"	5'-0"	15"	9"
27"	3:1	10 ¹ / ₂ "	4'-1 ¹ / ₂ "	2'-0"	6'-1 ¹ / ₂ "	4'-6"	5'-6"	15"	9"
30"	3:1	1'-0"	4'-6"	1'-7 ³ / ₄ "	6'-1 ³ / ₄ "	5'-0"	6'-0"	15"	9"
36"	3:1	1'-3"	5'-3"	2'-10 ³ / ₄ "	8'-1 ³ / ₄ "	6'-0"	7'-3"	15"	9"
42"	3:1	1'-6" OR 1'-9"	5'-3"	2'-11"	8'-2"	6'-6"	7'-9"	15"	9"
48"	3:1	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	8'-6"	18"	12"
54"	2.4:1	2'-3"	5'-5"	2'-9 ¹ / ₄ "	8'-2 ¹ / ₄ "	7'-6"	9'-0"	18"	12"

NOTE: CONTRACTOR HAS OPTION OF FURNISHING END SECTIONS CONFORMING TO DETAILS ON THIS SHEET OR END SECTIONS CONFORMING TO DETAILS ON PLATE D-1.10



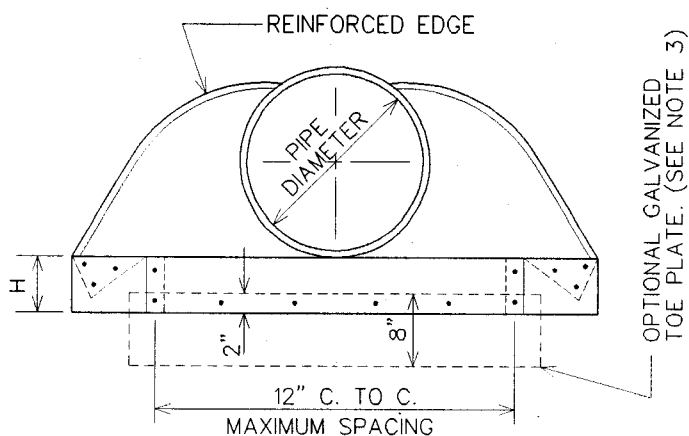
APPROVED
William J. Hagan
 DIRECTOR
 BUR. OF ENGINEERING/CONSTRUCTION
 1/22/03
 DATE

DEPARTMENT OF PUBLIC WORKS STORM DRAINAGE DETAILS CONCRETE END SECTION ROUND CONCRETE PIPE

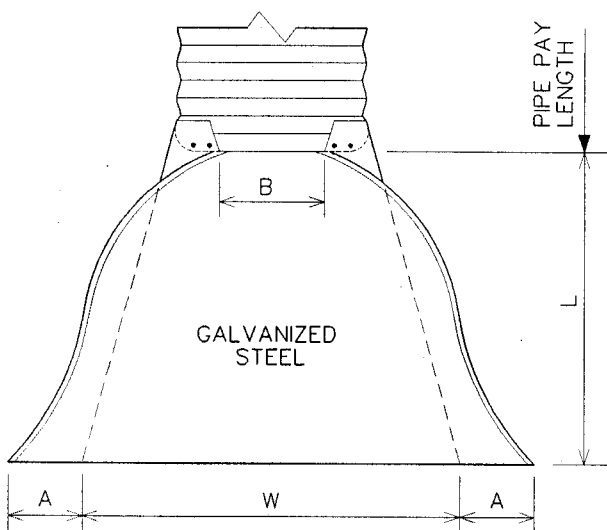
ISSUED: OCTOBER, 1977
 REVISED: JANUARY, 2003
 REVISED:

PLATE

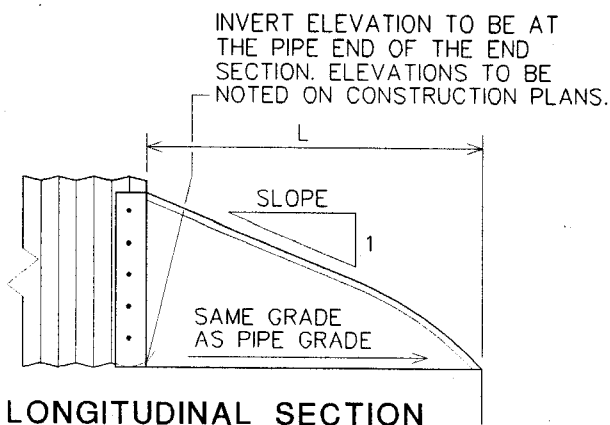
D-1.11



END VIEW



PLAN



LONGITUDINAL SECTION

- NOTES:
1. ALL 3 PIECE BODIES TO HAVE 12 GA. SIDES AND 10 GA. CENTER PANELS. WIDTH OF CENTER PANELS TO BE GREATER THAN 20 % OF THE PIPE PERIPHERY. MULTIPLE PANEL BODIES TO HAVE LAP SEAMS WHICH ARE TO BE TIGHTLY JOINED BY 3/8" DIAMETER GALVANIZED RIVETS OR BOLTS.
 2. FOR 60" THRU 84" SIZES, REINFORCED EDGES TO BE SUPPLEMENTED WITH GALVANIZED STIFFENER ANGLES. THE ANGLES WILL BE 2" x 2" x 1/4" - 60" THRU 72" DIAMETER AND 2 1/2" x 2 1/2" x 1/4" FOR 78" AND 84" DIAMETER. THE ANGLES TO BE ATTACHED BY 3/8" DIA. GALVANIZED NUTS AND BOLTS.
 3. TOE PLATE SHALL BE USED WHEN SPECIFIED ON THE PLANS. COST OF TOE PLATE TO BE INCLUDED IN BID PRICE PER EACH OF METAL END SECTION.
 4. TYPE 3 CONNECTION INCLUDES ONE FOOT OF PIPE LENGTH FOR 42" THRU 84" DIAMETER AS A CONNECTOR SECTION. THE CONNECTOR SECTION WILL BE ATTACHED TO THE END SECTION BY GALVANIZED RIVETS OR BOLTS.
 5. FOR REPLACEMENT USE ONLY. APPROVAL OF DEPARTMENT OF PUBLIC WORKS REQUIRED. ALSO SEE NOTE 4, STD. DETAIL PLATE D-110.
 6. SEE ALSO STANDARD DETAIL PLATE D-113.

TABLE OF DIMENSIONS

PIPE DIA.	GAUGE	A (1" ±)	B MAX.	H (1" ±)	L (1 1/2" ±)	W (2" ±)	SLOPE (APPROX.)	BODY
12"	14	6"	6"	6"	21"	24"	2 1/2 : 1	1 PC.
15"	14	7"	8"	6"	26"	30"	2 1/2 : 1	1 PC.
18"	14	8"	10"	6"	31"	36"	2 1/2 : 1	1 PC.
21"	14	9"	12"	6"	36"	42"	2 1/2 : 1	1 PC.
24"	14	10"	13"	6"	41"	48"	2 1/2 : 1	1 PC.
30"	14	12"	16"	8"	51"	60"	2 1/2 : 1	1 PC.
36"	14	14"	19"	9"	60"	72"	2 1/2 : 1	2 PC.
42"	12	16"	22"	11"	69"	84"	2 1/2 : 1	2 PC.
48"	12	18"	27"	12"	78"	90"	2 1/4 : 1	2 PC.
54"	12	18"	30"	12"	84"	102"	2 : 1	2 PC.
60"	12	18"	33"	12"	87"	114"	1 3/4 : 1	3 PC.
66"	12	18"	36"	12"	87"	120"	1 1/2 : 1	3 PC.
72"	12	18"	39"	12"	87"	126"	1 1/3 : 1	3 PC.
78"	12	18"	42"	12"	87"	132"	1 1/4 : 1	3 PC.
84"	12	18"	45"	12"	87"	138"	1 1/6 : 1	3 PC.



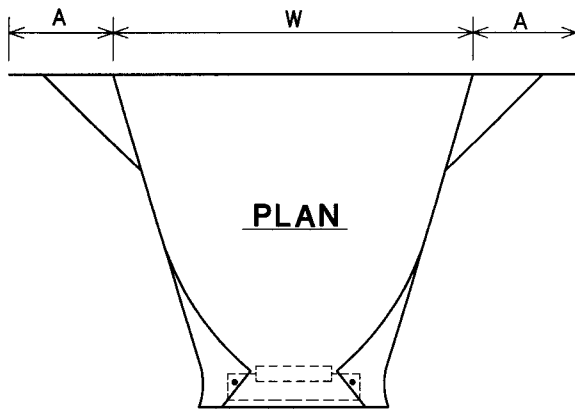
APPROVAL
William J. Koppman
 DIRECTOR
 BUR. OF ENGINEERING CONSTRUCTION
 1/22/03
 DATE

DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS
**METAL END SECTION
 ROUND METAL PIPE**

ISSUED: OCTOBER, 1977
 REVISED: JANUARY, 2003
 REVISED:

PLATE

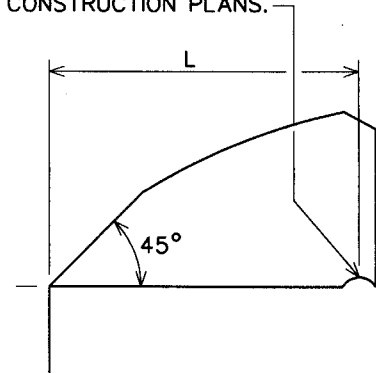
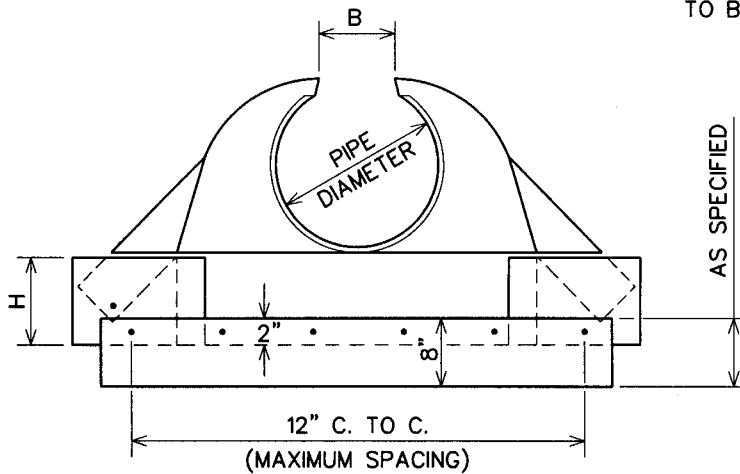
D-1.12



NOTES :

1. ALL RODS, BOLTS, NUTS, ETC. TO BE HOT DIP GALVANIZED, ELECTROGALVANIZED OR CADMIUM PLATED.
2. SPECIFICATION: A.A.S.H.T.O. DESIGNATION M 36-57.
3. END SECTIONS TO BE SHIPPED WITH TOP FINISHING PIECE BOLTED IN PLACE AND CONNECTION PIECE ASSEMBLED IN PLACE.
4. FOR REPLACEMENT USE ONLY. APPROVAL OF DEPARTMENT OF PUBLIC WORKS REQUIRED. PREFERRED USE: OUTFALLS ONLY. EXTRA CARE MUST BE TAKEN TO PROTECT ADJACENT SLOPES FROM EROSION WHEN USED IN LIEU OF A HEAD-WALL AT THE INLET END OF A PIPE
5. SEE ALSO STANDARD DETAIL PLATE D-1.12 .

INVERT ELEVATION TO BE AT THE PIPE END OF THE END SECTION. ELEVATIONS TO BE NOTED ON CONSTRUCTION PLANS.



PIPE DIAMETER	GAUGE	DIMENSION					BODY
		A (1" ±)	B	H	L (1 1/2" ±)	W (2" ±)	
12"	14	7 1/2"	6"	6"	21"	24"	1 PC.
15"	14	8 5/8"	8"	6"	26"	30"	1 PC.
18"	14	9 1/4"	9"	6"	31"	36"	1 PC.
21"	14	9 7/8"	11"	6 1/4"	36"	42"	1 PC.
24"	14	11 1/4"	12"	6"	42"	48"	1 PC.
30"	14	13"	15"	7 1/2"	52 1/2"	60"	2 PC.
36"	12	14"	18"	8"	63"	72"	2 PC.
42"	12	16 3/4"	21"	10 1/2"	73 1/2"	84"	2 PC.
48"	12	18 1/4"	27"	12"	84"	90"	2 PC.



APPROVAL
Charles Allen
 DIRECTOR
William Kopman
 BUR. OF ENGINEERING/CONSTRUCTION
 -- 10/23/97 --
 DATE

DEPARTMENT OF PUBLIC WORKS
 STORM DRAINAGE DETAILS

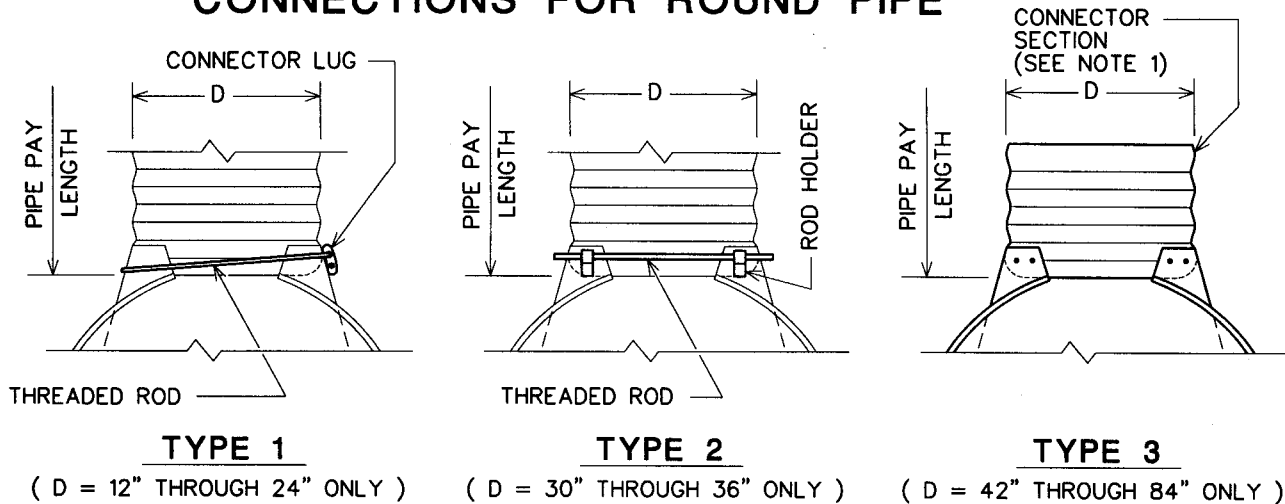
METAL END SECTION
 ROUND METAL PIPE

ISSUED: OCTOBER, 1977
 REVISED: AUGUST, 1997
 REVISED:

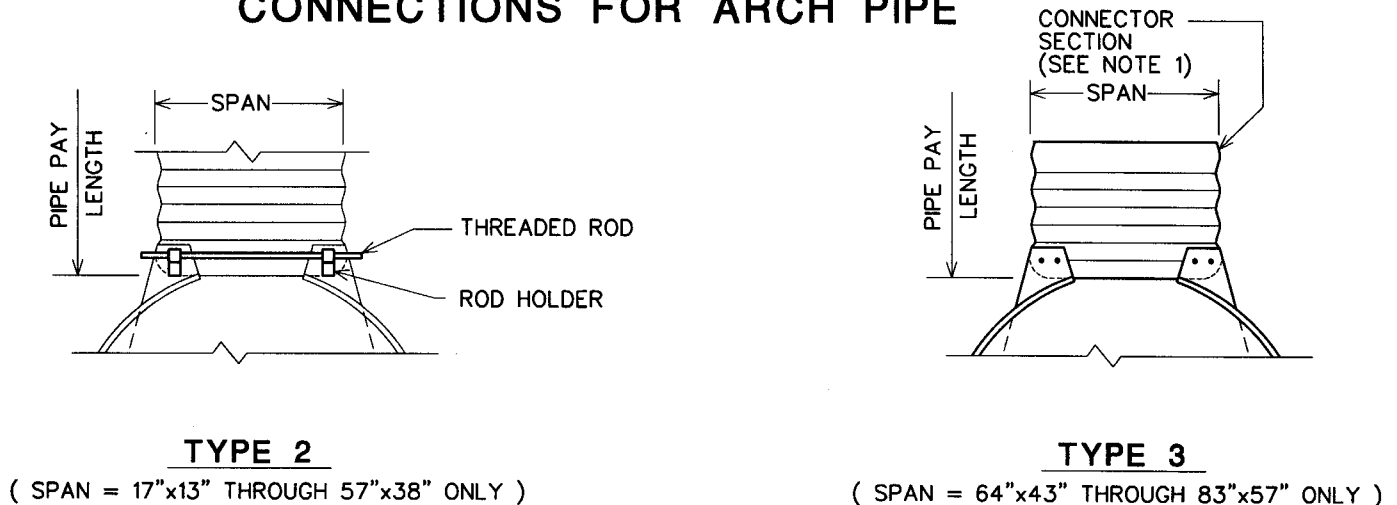
PLATE

D-1.13

CONNECTIONS FOR ROUND PIPE



CONNECTIONS FOR ARCH PIPE



NOTES :

1. TYPE 3 CONNECTION INCLUDES ONE FOOT OF THE PIPE LENGTH FOR 64" x 43" THROUGH 83" x 57" ARCH SIZES AND 42" THROUGH 84" ROUND SIZES AS A CONNECTOR SECTION. THE CONNECTOR SECTION WILL BE ATTACHED TO THE END SECTION BY GALVANIZED RIVETS OR BOLTS.
2. WHERE END SECTION IS TO BE APPLIED TO A STRUCTURAL PLATE PIPE OR STRUCTURAL PLATE ARCH PIPE THE END SECTION SHALL BE ORDERED WITHOUT THE ONE FOOT OF PIPE LENGTH. INSTEAD, DRILL HOLES AND FIELD BOLT THE END SECTION DIRECTLY TO THE STRUCTURAL PLATE PIPE OR STRUCTURAL PLATE ARCH PIPE.
3. CORRUGATED METAL PIPE, ARCH PIPE, METAL END SECTIONS, STRUCTURAL PLATE PIPE & STRUCTURAL PLATE ARCH PIPE SHALL BE USED FOR REPLACEMENT IN KIND ONLY, SUBJECT TO APPROVAL BY THE BUREAU OF ENGINEERING & CONSTRUCTION.



APPROVAL
William F. Haysman
DIRECTOR
BUR. OF ENGINEERING / CONSTRUCTION
10/23/97
DATE

DEPARTMENT OF PUBLIC WORKS
STORM DRAINAGE DETAILS

**CONNECTIONS
METAL END SECTIONS**

ISSUED: OCTOBER 1977
REVISED: AUGUST 1997
REVISED:

PLATE

D-1.16