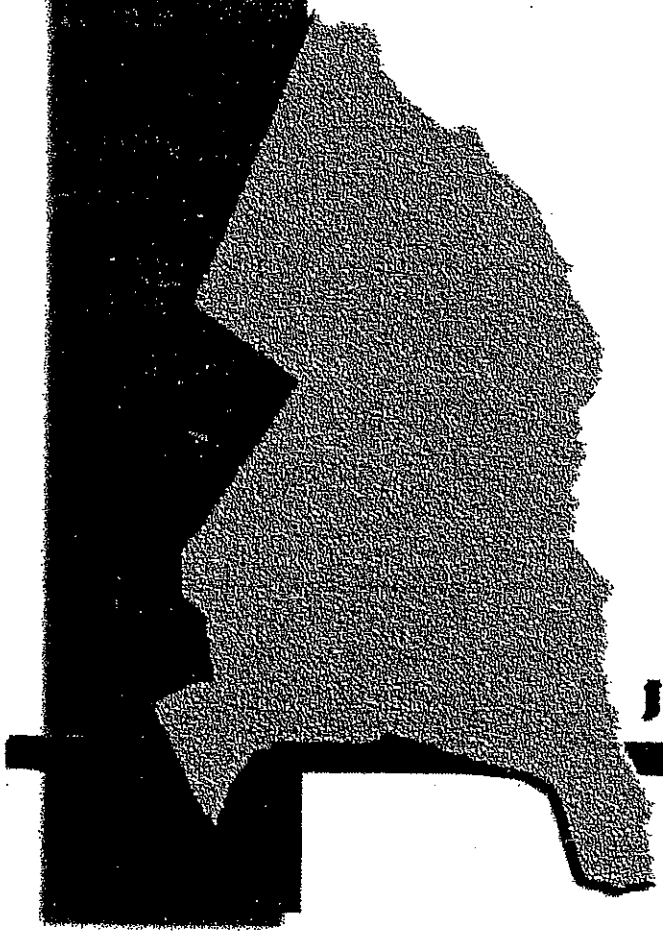
Prince George's County
Department of Environmental Resources

Standard Details for Stormwater Mangement Construction



January 2001

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ELLIPTICAL REINFORCED CONCRETE PIPE	ERCP
EXCAVATION	EXC.
FIRST FLOOR	FF
FOOTING	FT
POLYVINYL CHLORIDE PIPE	PVC
REINFORCED CONCRETE PIPE (ALL CLASSES)	RCP
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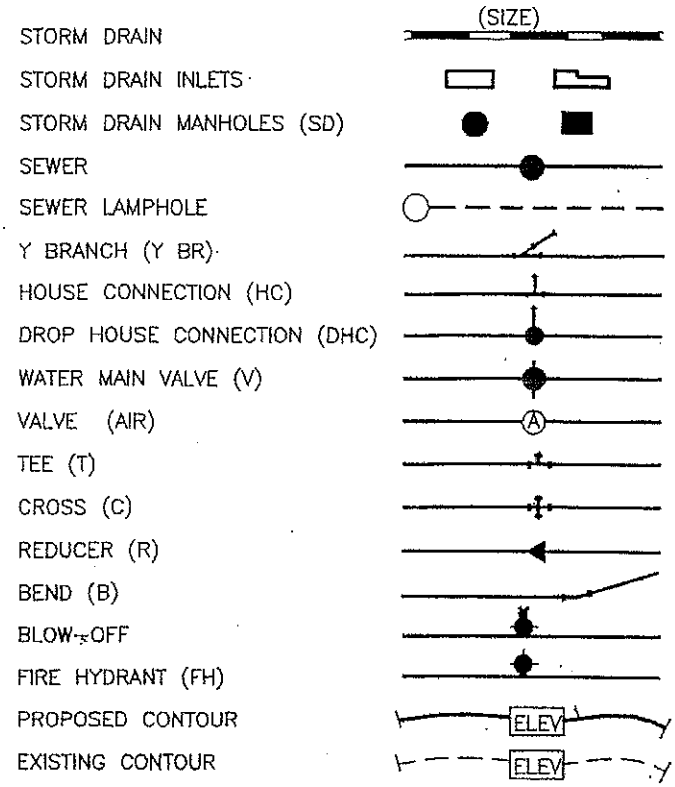
DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

REVISION
JAN. 2001

STORM DRAIN CONVENTIONAL SYMBOLS

SD 1.0

PROPOSED WORK



DEPARTMENT OF ENVIRONMENTAL RESOURCES

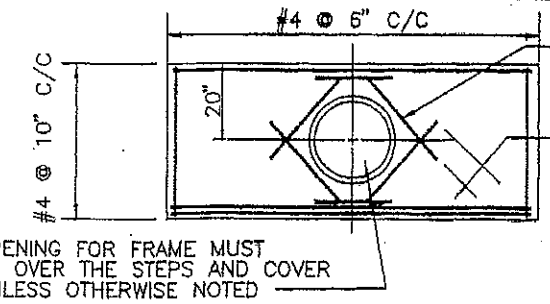
APPROVED BY: _____ DATE: 3/16/01

Stan E. Wildesen, P.E.
Assoc. Director

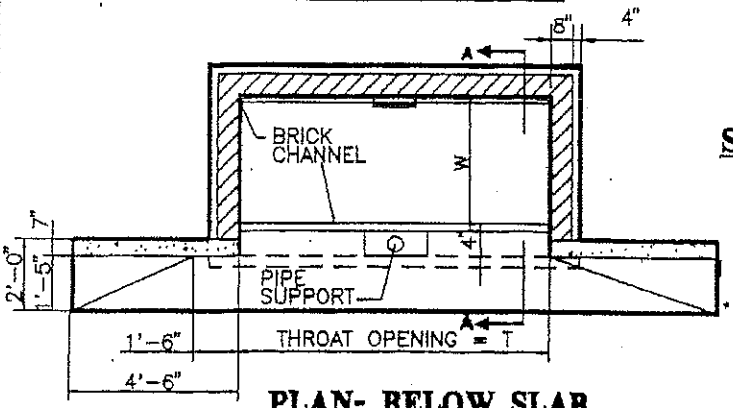
REVISION
JAN. 2001

STORM DRAIN CONVENTIONAL SYMBOLS

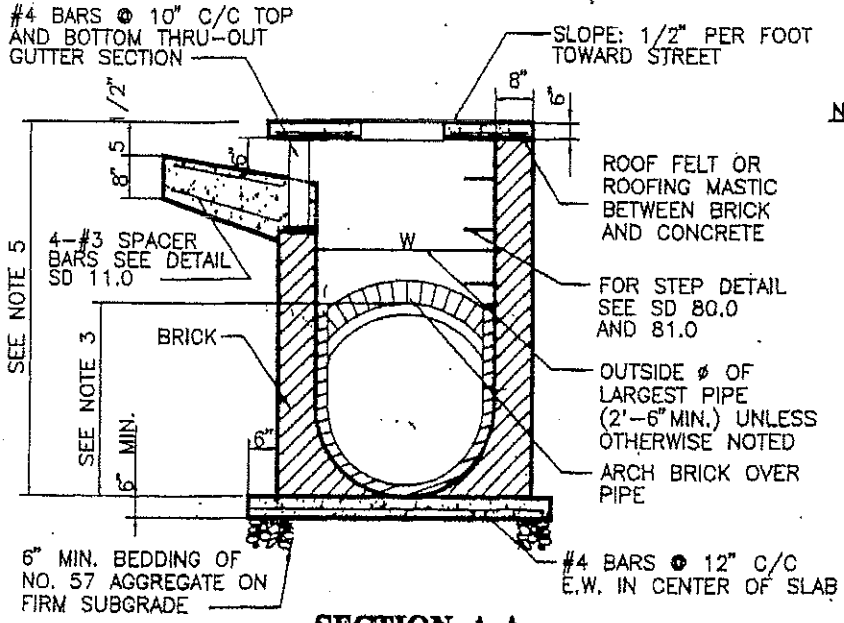
SD 1.1



PLAN- TOP SLAB



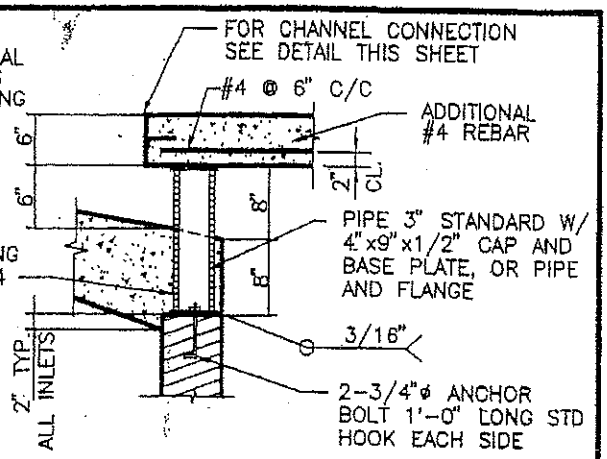
PLAN- BELOW SLAB



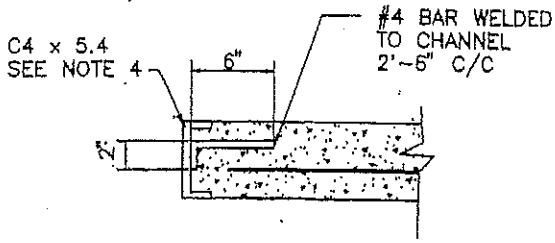
SECTION A-A

DESIGNATION	BOTTOM SLAB THICKNESS	T-THROAT OPENING	NUMBER * OF PIPE SUPPORTS	MAXIMUM WIDTH (W)	MINIMUM WIDTH (W)
A – 5	6"	5'-0"	0	5'	2'-6"
A – 10	6"	10'-0"	1	10'	2'-6"
A – 15	8"	15'-0"	2	15'	2'-6"
A – 20	8"	20'-0"	3	20'	2'-6"

* PIPE SUPPORTS TO BE SPACED 5'-0" ON CENTER.



SECTION THRU PIPE SUPPORT



CHANNEL DETAIL

NOTES:

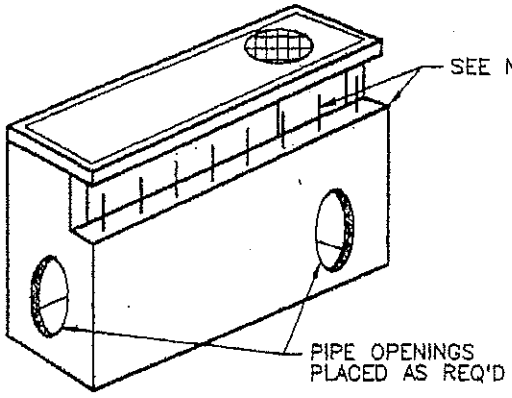
1. fc' = 4,000 psi @ 28 DAYS WITH AIR ENTRAINED.
2. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
3. CHANNEL TO BE BUILT TO CROWN OF PIPE.
4. APPLY ONE SHOP COAT AND ONE FIELD COAT OF APPROVED BATTLESHIP GRAY PAINT IN ACCORDANCE WITH PRINCE GEORGE'S COUNTY STANDARD SPECIFICATIONS.
5. SPECIAL DESIGN IS REQUIRED FOR STRUCTURES DEEPER THAN 8' AND SPECIAL DESIGN IS REQUIRED FOR TOP SLAB THAT EXCEEDS MAXIMUM WIDTH REQUIREMENTS.
6. PROVIDE "CHESAPEAKE BAY DRAINAGE DON'T DUMP" ON FRONT FACE OF TOP SLAB. (SD. 82.0)
7. PIPES CAN NOT BE USED AS STEPS.
8. FOR PIPES 30" OR LARGER PROVIDE STEPS IN CHANNELS OF STRUCTURES, SEE SD 110.0.
9. ON TERMINAL INLETS, THE BOTTOM SHALL BE SLOPED TO OUTLET PIPE WITH 9" MINIMUM FALL.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: St. E. Wild
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

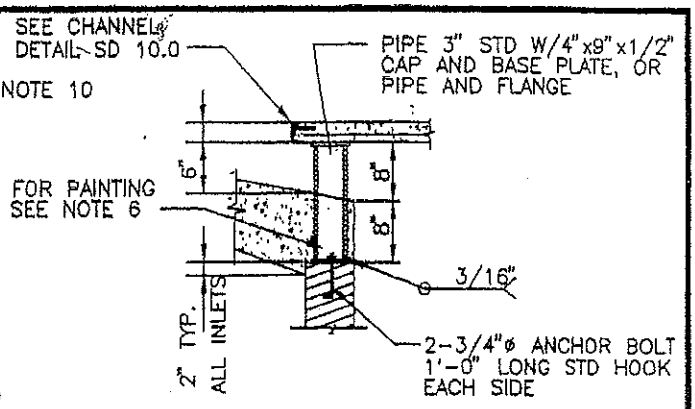
REVISION
JAN. 2001

STORM DRAIN TYPE "A" INLET

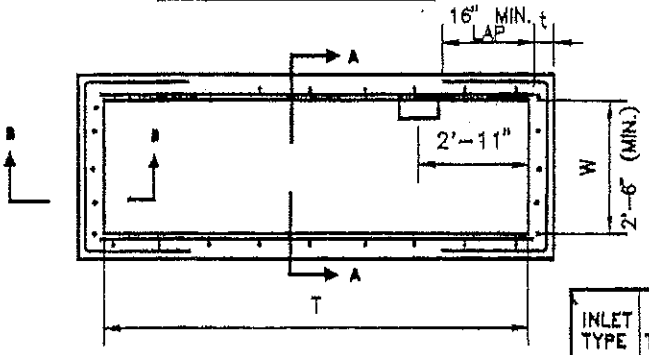
SD 10.0



ISOMETRIC VIEW



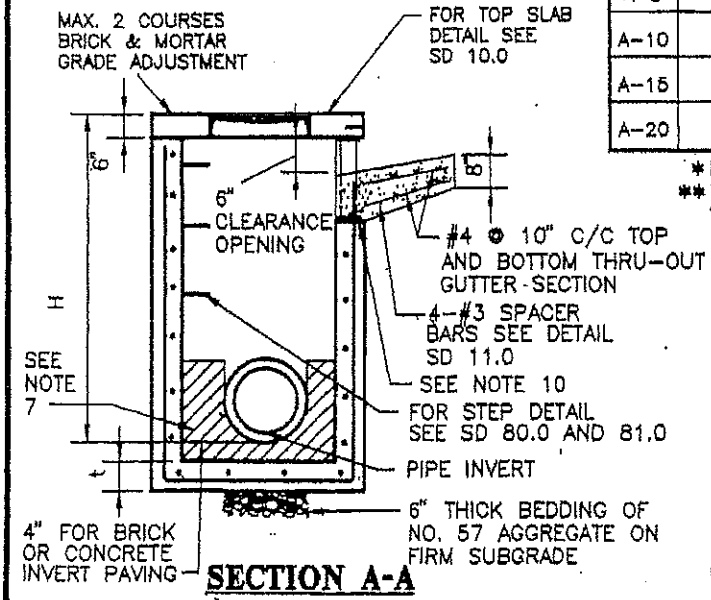
SECTION THRU PIPE SUPPORT



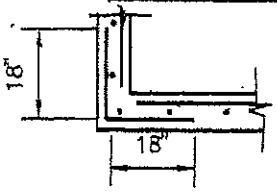
PLAN WITH SLAB REMOVED

INLET TYPE	WALL (t) THICKNESS	MAXIMUM WIDTH (W)**	T	H	REINFORCEMENT	NUMBER * OF PIPE SUPPORTS
A-5	6"	5'	5'	8'	#4 @ 12" E.W.	0
A-10	6"	5'	10'	8'	#4 @ 6" E.W.	1
A-15	8"	7.5'	15'	12'	#4 @ 6" E.W.	2
A-20	8"	10'	20'	12'	#5 @ 6" E.W. (2 LAYERS)	3

* PIPE SUPPORTS TO BE SPACED 5'-0' ON CENTER
** RATIO MORE THAN 2:1 SHOULD BE DESIGNED AS A T-BEAM OR AS A TWO WAY SLAB.



SECTION A-A



SECTION B-B

NOTES:

1. CONCRETE STRENGTH SHALL BE fc' = 5,000 psi @ 28 DAYS WITH AIR ENTRAINED. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
2. MINIMUM PIPE OPENING SHOULD BE PIPE OUTSIDE DIAMETER + 6".
3. 2" MINIMUM CONCRETE COVER REQUIRED.
4. PROVIDE "CHESAPEAKE BAY DRAINAGE DON'T DUMP" ON FRONT FACE OF TOP SLAB. (SD 82.0)
5. SHOP DRAWING APPROVAL IS REQUIRED IF DIFFERENT FROM THE STANDARD DETAIL.
6. PROVIDE BATTLESHIP GRAY PAINT FOR SUPPORT PIPES.
7. PROVIDE CONCRETE OR BRICK BENCH TO CROWN OF PIPE.
8. ACCESS OPENING MUST BE ABOVE STEPS.
9. PIPE CAN NOT BE USED AS STEPS.
10. PRECAST MANUFACTURER MAY PROVIDE PRODUCT UP TO TOE OF GUTTER SECTION. VERTICAL REBAR ON THE FRONT FACE SHOULD EXTEND 12".

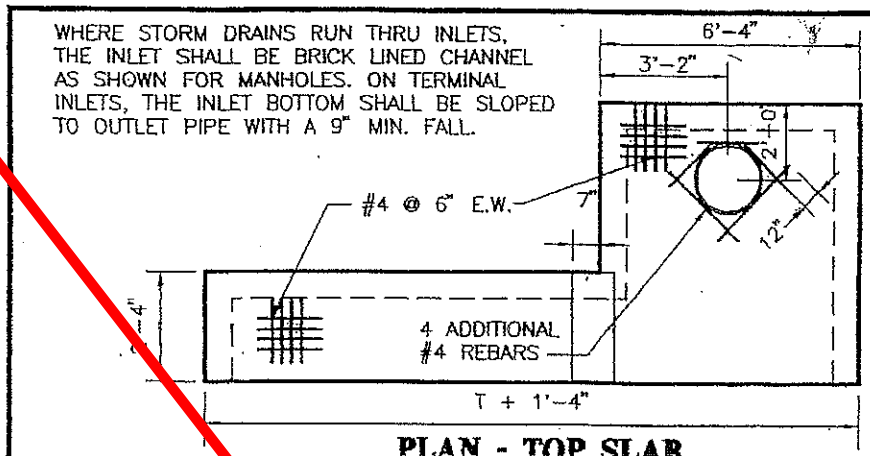
DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director
DATE: 3/14/01

REVISION
JAN. 2001

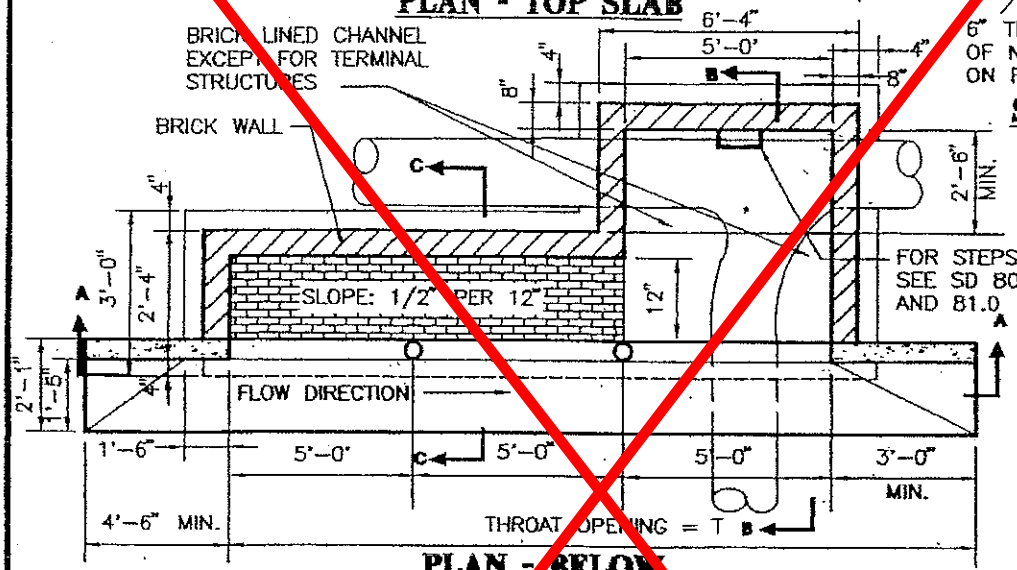
STORM DRAIN TYPE "A" PRECAST INLET

SD 10.1

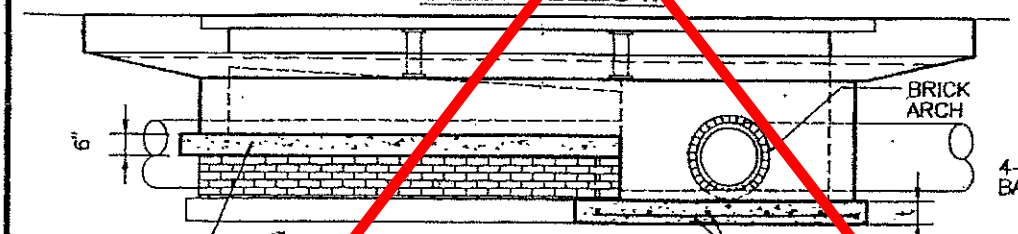
WHERE STORM DRAINS RUN THRU INLETS, THE INLET SHALL BE BRICK LINED CHANNEL AS SHOWN FOR MANHOLES. ON TERMINAL INLETS, THE INLET BOTTOM SHALL BE SLOPED TO OUTLET PIPE WITH A 9" MIN. FALL.



PLAN - TOP SLAB



PLAN - BELOW



FOOTING WHERE PIPE IS NOT ADJACENT

8" BRICK WALL AND FOOTING IS REQUIRED UNDER INLET EXTENSION WHERE PIPE IS ADJACENT

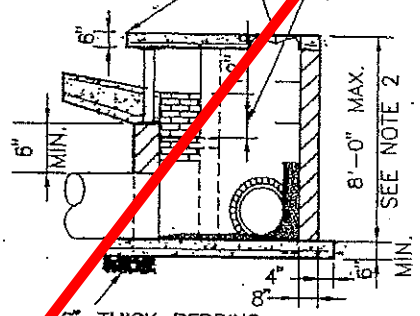
SECTION A-A

N.T.S

SEE FRAME AND COVER SD 90.0 SLOPE:1/2" = 12"

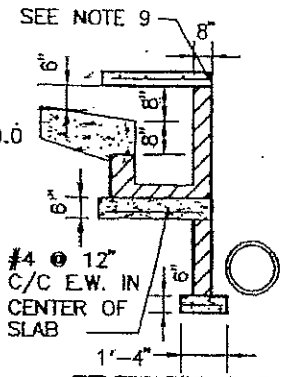
SEE CHANNEL DETAIL SD 10.0

VARIES SEE NOTE 8

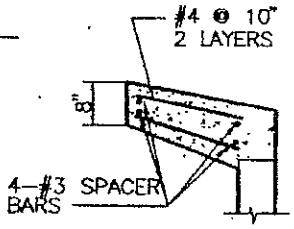


6" THICK BEDDING OF NO. 57 AGGREGATE ON FIRM SUBGRADE

SECTION B-B



SECTION C-C



DETAIL

DESIGNATION	BOTTOM SLAB THICKNESS (t)	T-THROAT OPENING	NUMBER * OF PIPE SUPPORTS
B - 10	6"	10'-0"	1
B - 15	8"	15'-0"	2
B - 20	8"	20'-0"	3

* PIPE SUPPORTS TO BE SPACED 5'-0" ON CENTER.

NOTES: #4 @ 9" C/C E.W.

1. SEE PIPE SUPPORT DETAIL SD 10.0.
2. SPECIAL DESIGN IS REQUIRED FOR STRUCTURES DEEPER THAN 8'.
3. FOR 30" AND LARGER PIPE PROVIDE STEPS IN CHANNEL. SEE SD 11.0.
4. 8" THICK BRICK WALL.
5. fc' = 4,000 psi @ 28 DAYS WITH AIR ENTRAINED.
6. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
7. PROVIDE "CHESAPEAKE BAY DRAINAGE DON'T DUMP" ON FRONT FACE OF TOP SLAB. (SD 82.0)
8. 12" MIN., 3'-0" MAX. AT UPSTREAM END OF CHANNEL.
9. PROVIDE ROOFING FELT OR ROOFING MASTIC BETWEEN BRICK AND CONCRETE.
10. PROVIDE BENCH UP TO CROWN OF PIPE.
11. ACCESS OPENING MUST BE ABOVE STEPS.
12. PIPE CAN NOT BE USED AS STEPS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES

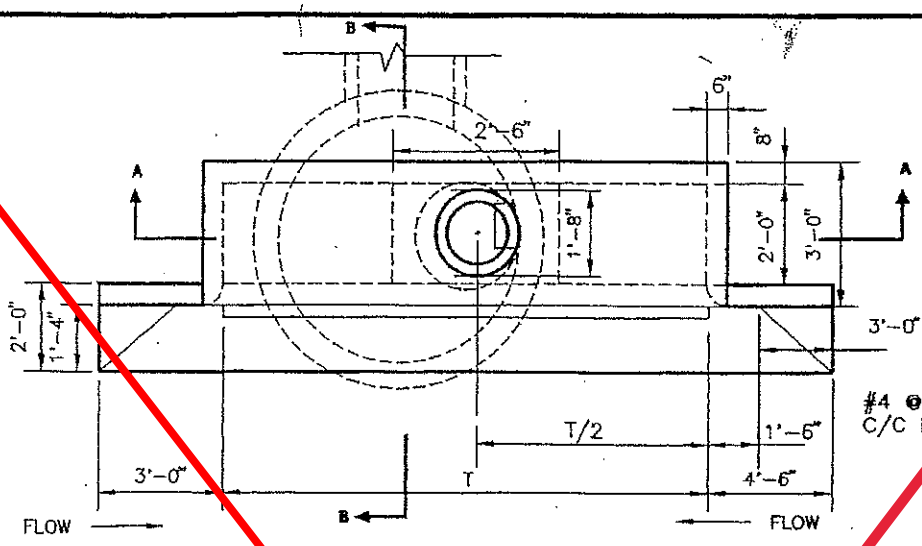
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director

DATE: 3/16/01

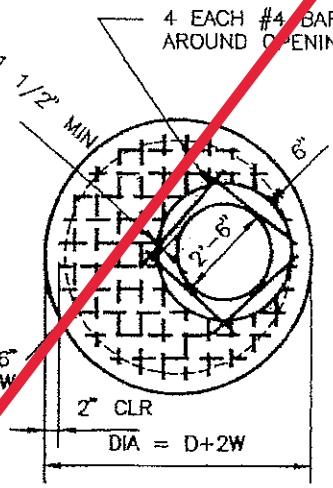
REVISION
JAN. 2001

STORM DRAIN TYPE "B" INLET

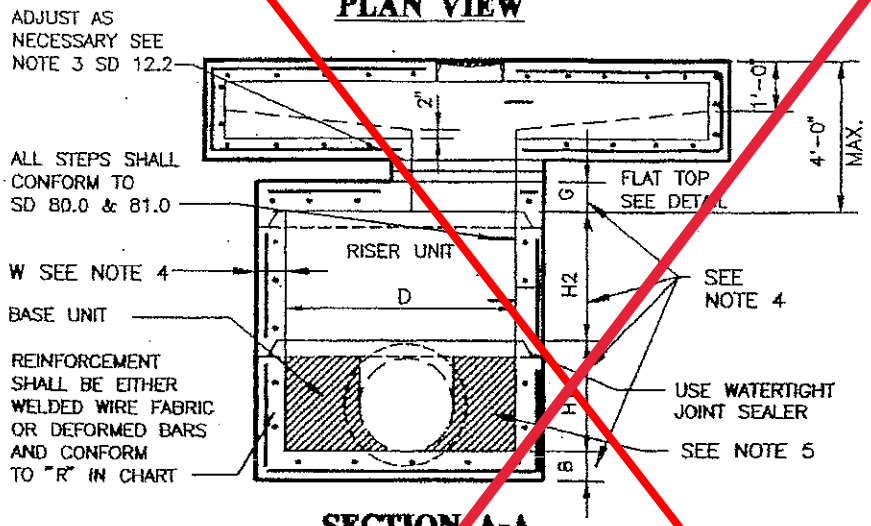
SD 11.0



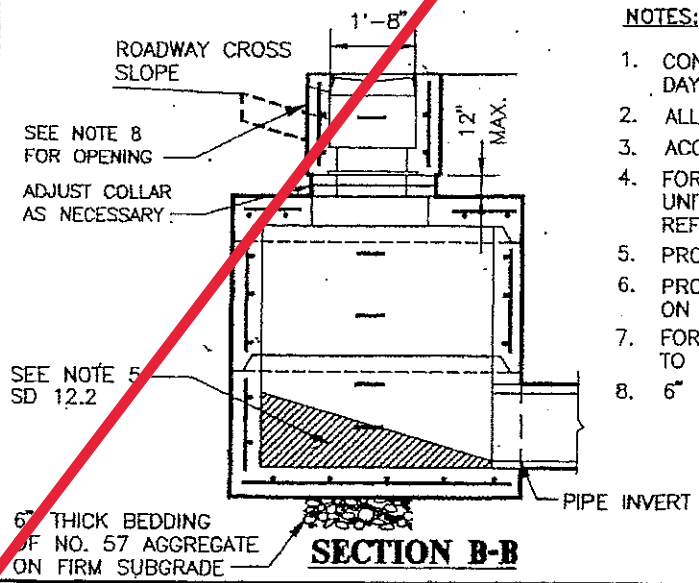
PLAN VIEW



FLATOP DETAIL



SECTION A-A



SECTION B-B

NOTES:

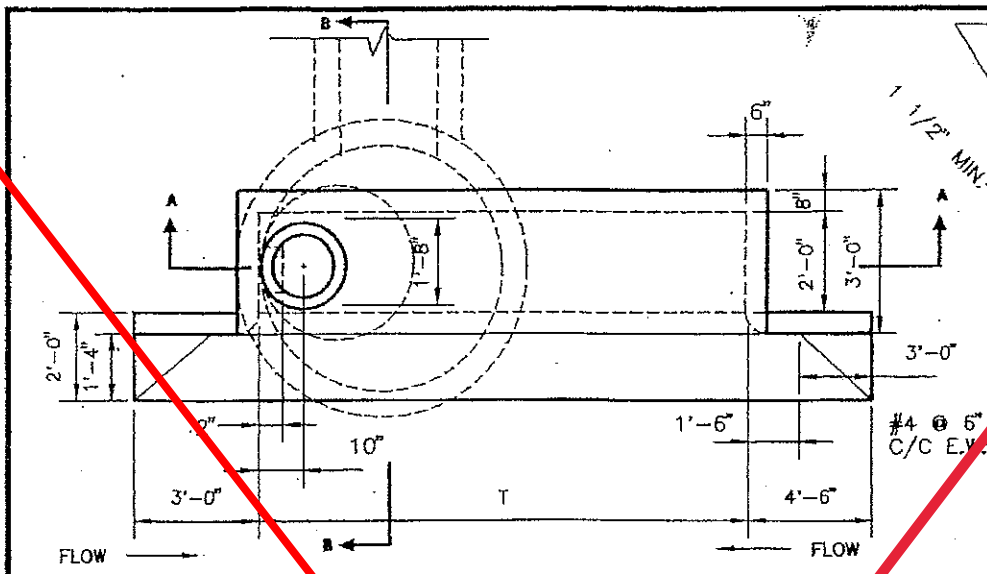
1. CONCRETE STRENGTH SHALL BE fc'= 5,000 psi @ 28 DAYS WITH AIR ENTRAINED.
2. ALL REINFORCEMENT STEEL TO BE ASTM A615, GRADE 60.
3. ACCESS OPENING TO BE OVER STEP.
4. FOR H1, H2, B, G, W RELATED TO BASE HEIGHT, RISER UNIT HEIGHT, BASE SLAB THICKNESS, WALL THICKNESS, REFER TO A TABLE ON SD 12.2.
5. PROVIDE BENCH UP TO CROWN OF PIPE.
6. PROVIDE "CHESAPEAKE BAY DRAINAGE, DON'T DUMP" ON FRONT OF TOP SLAB.
7. FOR REINFORCEMENT OF TROUGH AND WALLS, REFER TO A TABLE ON SD 12.2.
8. 6" THROAT OPENING AT FRONT FACE OF THE TOP SLAB.

DEPARTMENT OF
ENVIRONMENTAL RESOURCES
APPROVED BY: E. E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

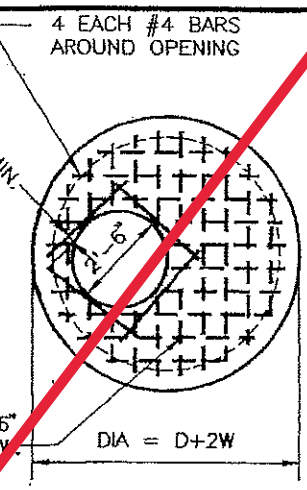
REVISION
JAN. 2001

STORM DRAIN
TYPE "B"
PRECAST INLET

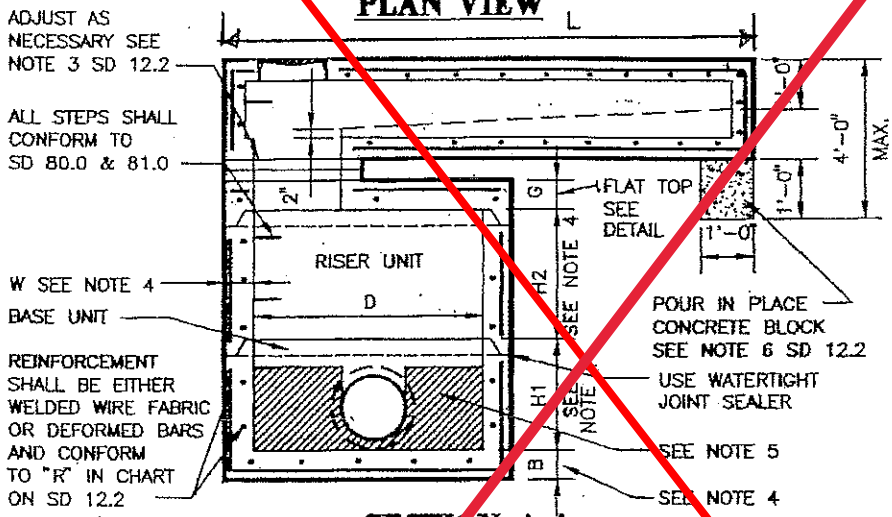
SD 12.0



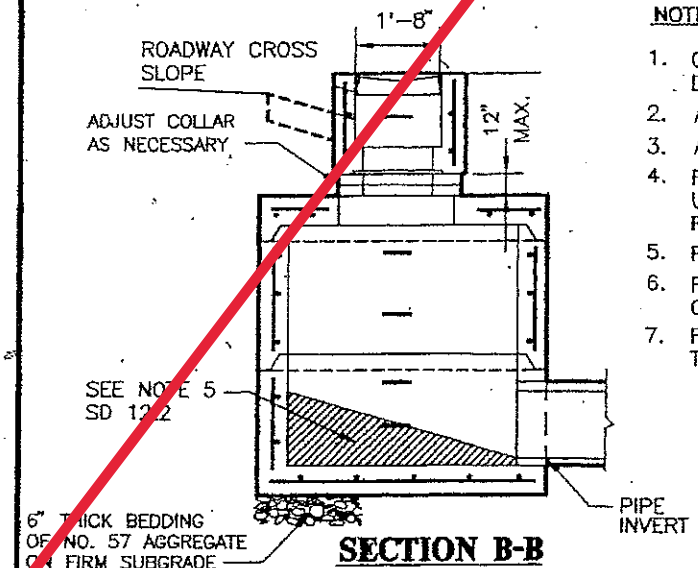
PLAN VIEW



FLATOP DETAIL



SECTION A-A



SECTION B-B

NOTES:

1. CONCRETE STRENGTH SHALL BE fc'= 5,000 psi @ 28 DAYS WITH AIR ENTRAINED.
2. ALL REINFORCEMENT STEEL TO BE ASTM A615, GRADE 60.
3. ACCESS OPENING TO BE OVER STEP.
4. FOR H1, H2, B, G, W RELATED TO BASE HEIGHT, RISER UNIT HEIGHT, BASE SLAB THICKNESS, WALL THICKNESS, REFER TO A TABLE ON SD 12.2.
5. PROVIDE BENCH UP TO CROWN OF PIPE.
6. PROVIDE "CHESAPEAKE BAY DRAINAGE, DON'T DUMP" ON FRONT OF TOP SLAB.
7. FOR REINFORCEMENT OF TROUGH AND WALLS, REFER TO A TABLE ON SD 12.2.

DEPARTMENT OF
ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

REVISION
JAN. 2001

STORM DRAIN
TYPE "B"
PRECAST INLET

SD 12.1

INLET TYPE	T	L	NUM. OF PIPE SUPPORTS *
B-5	5'-0"	6'-0"	0
B-10	10'-0"	11'-0"	1
B-15	15'-0"	16'-0"	2
B-20	20'-0"	21'-0"	3

*PIPE SUPPORT SHALL BE PLACED AT 5' INTERVALS

PIPE SIZE RANGE	CIRCULAR BASE AND RISER UNIT DIMENSIONS				FLAT TOP	AREA OF REINFORCEMENT (SQ. IN. PER FT. FOR WALL)	BOTTOM SLAB	
	H1*	H2 *	W	D	G	R	THICKNESS B	AREA OF REINFORCEMENT (SQ. IN. PER FT.)
15" TO 24"	3' TO 5'	1' TO 5'	5"	48"	8"	0.12	8"	0.14
27" TO 36"	4' TO 6'	1' TO 6'	6"	60"	8"	0.15	8"	0.17
42" TO 48"	5' TO 7'	1' TO 7'	7"	72"	8"	0.18	8"	0.27
54" TO 66"	6' TO 8'	1' TO 8'	8"	8[illegible]	8"	0.21	8"	0.27
68" TO 72"	7' TO 8'	1' TO 8'	[illegible]"	96"	8"	0.24	8"	0.28
78" TO 84"	8' TO 9'	1' TO 8'	[illegible]0"	108"	8"	0.27	8"	0.30

* IF THERE IS AN INCOMING PIPE IN A RISER UNIT, REFER TO H1 FOR HEIGHT LIMITATION

NOTES:

1. CURB OPENING SHALL NOT ENCROACH UPON CROSSWALK AREAS.
2. ANGLES AND ANCHOR BOLTS TO BE GALVANIZED AFTER WELDING IN ACCORDANCE WITH ASTM A 123.
3. GRADE AND SLOPE ADJUSTMENT SHALL BE PROVIDED IN THE FIELD USING PRECAST ADJUSTMENT COLLAR RINGS WITH KEY. THE HEIGHT OF ADJUSTMENT IS 12" MAX.
4. A CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD SLOPED AT 2" PER FOOT TOWARD OUTLET AND BERM SHALL BE CONSTRUCTED UP TO HALF HEIGHT OF OUTGOING PIPE.
5. SLOPED TROUGH FLOOR TO BE CONSTRUCTED IN FIELD USING BRICK OR CONCRETE AND USED WHEN ROAD GRADE IS 1.5% OR LESS.
6. PROVIDE CONCRETE BLOCK WHEN CONCRETE INLET IS INSTALLED AT THE END OF THE TROUGH FOR 10', 15', AND 20' OPENINGS ONLY.
7. TROUGH FRONT CAN BE CAST IN PLACE MONOLITHICALLY WITH ROAD GUTTER.
8. CONCRETE STRENGTH SHALL BE fc'=5000 psi @ 28 DAYS WITH AIR ENTRAINED. REINFORCEMENT STEEL TO BE ASTM A615 GRADE 60.
9. PROVIDE KEY ON EACH UNIT.
10. PROVIDE "CHESAPEAKE BAY DRAINAGE--DON'T DUMP" NOTE ON FRONT OF TOP SLAB. (SD 82.0)

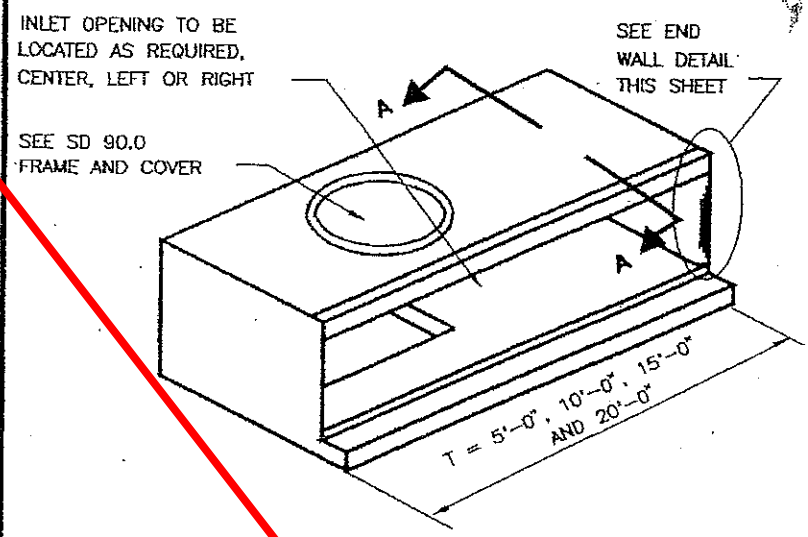
DEPARTMENT OF ENVIRONMENTAL RESOURCES

APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01

REVISION
JAN. 2001

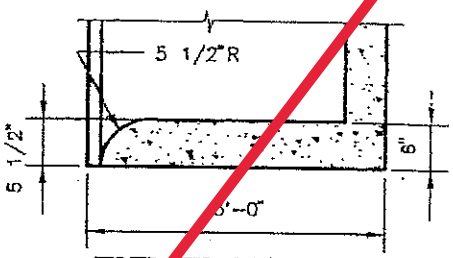
STORM DRAIN TYPE "B" PRECAST INLET

SD 12.2



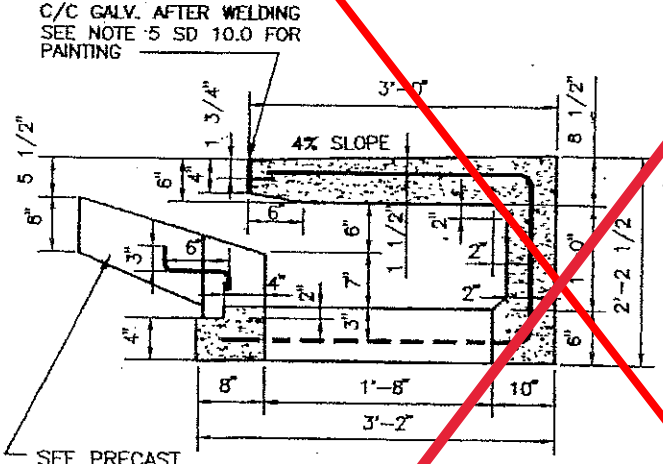
ISOMETRIC VIEW

N.T.S.



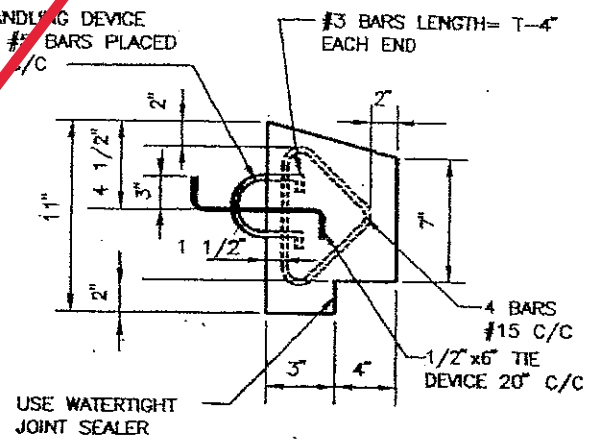
END WALL DETAIL

N.T.S.



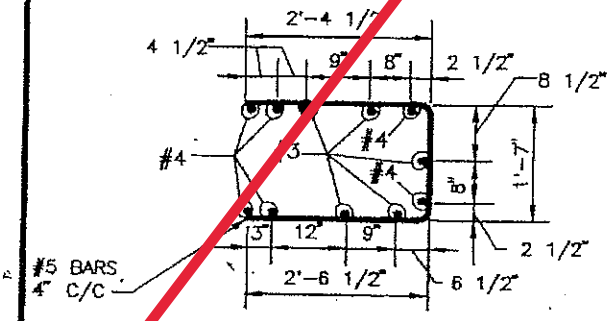
SECTION A-A

N.T.S.



PRECAST TROUGH FRONT

N.T.S.



USE 4 ADDL. #3 BARS AROUND FRAME AND COVER

REINFORCEMENT DETAIL

N.T.S.

NOTES:

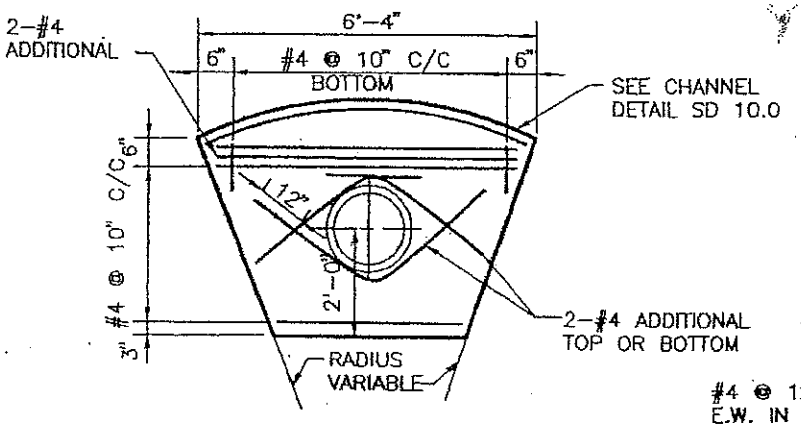
1. fc' = 5,000 psi @ 28 DAYS WITH AIR ENTRAINED.
2. ALL REINFORCING STEEL TO BE ASTM A 615 GRADE 60.
3. 2" CLEARANCE BETWEEN CONCRETE AND REBARS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

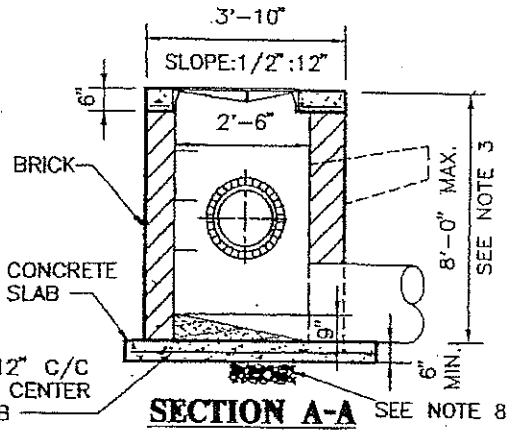
REVISION
JAN. 2001

STORM DRAIN TYPE "B" PRECAST INLET TROUGH

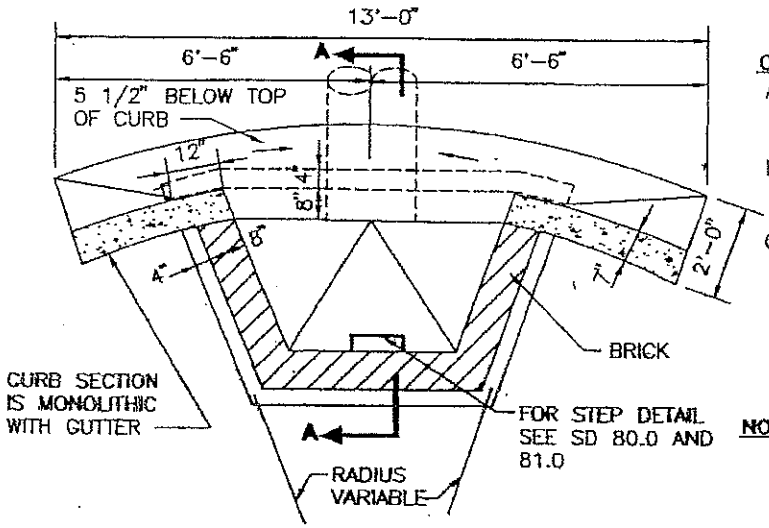
SD 12.3



PLAN - TOP SLAB



SECTION A-A



PLAN - BELOW

TYPE "C-I-P" INLET

C–I–P NOTES:

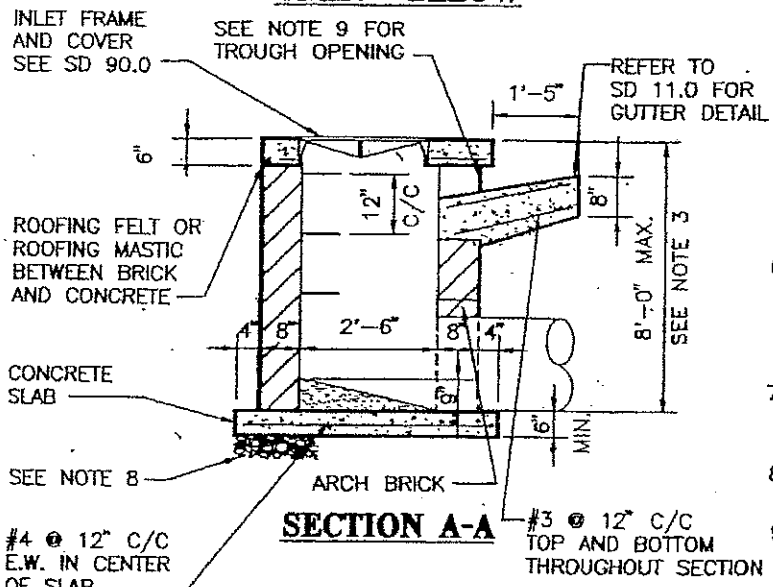
A. C–I–P SAME AS C–I INLET, WITH CURB AND GUTTER ELIMINATED AND INLET PIPE ADDED.

B. PARGING IS REQUIRED FOR BRICK CONSTRUCTION IN ACCORDANCE WITH PRINCE GEORGE'S COUNTY STANDARD SPECIFICATIONS.

C. GRADES GIVEN FOR TOPS OF INLETS REFER TO FRONT EDGE OF SLAB AT CENTER OF INLET. SLABS SHALL BE SET TO CONFORM TO SHAPE OF STREET OR CURB. TYPICAL FOR C–I AND C–I–P INLETS.

NOTES:

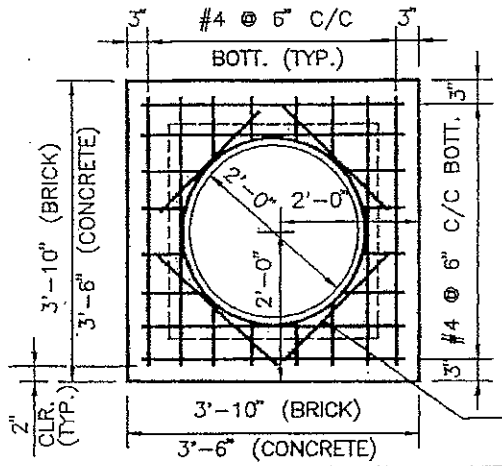
1. fc' = 4,000 psi @ 28 DAYS WITH AIR ENTRAINED.
2. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
3. 8" BRICK WALLS ARE STRUCTURALLY SATISFACTORY TO A DEPTH OF 8'–0".
4. FOR PIPES 30" AND LARGER, PROVIDE STEPS IN CHANNELS OF STRUCTURES, SEE SD 110.0.
5. WHERE STORM DRAINS RUN THRU INLETS, THE INLET SHALL BE FORMED WITH BRICK LINED CHANNEL AS SHOWN FOR MANHOLES. ("A" MANHOLE)
6. SPECIAL DESIGN IS REQUIRED FOR STRUCTURES DEEPER THAN 8' AND SPECIAL DESIGN IS REQUIRED FOR TOP SLAB WITH WIDTH GREATER THAN 3'.
7. PROVIDE "CHESAPEAKE BAY DRAINAGE DON'T DUMP" ON FRONT FACE OF TOP SLAB. (SD 82.0)
8. PROVIDE 6" THICK BEDDING OF NO. 57 AGGREGATE ON FIRM SUBGRADE.
9. 6" THROAT OPENING AT THE FRONT FACE OF THE TOP SLAB.



SECTION A-A

TYPE "C-I" INLET

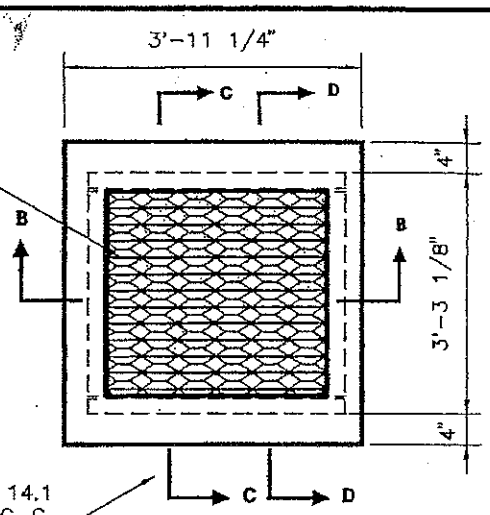
DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	STORM DRAIN TYPE "CI" AND "C-I-P" INLETS	SD 13.0



STANDARD WR SINGLE FRAME AND GRATE SEE DETAIL SD 14.1

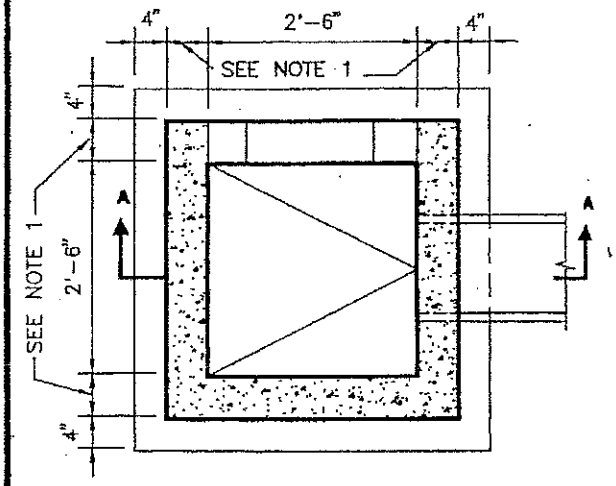
4 ADDITIONAL #4 BARS AROUND OPENING

PLAN OF TOP SLAB "D1" INLET

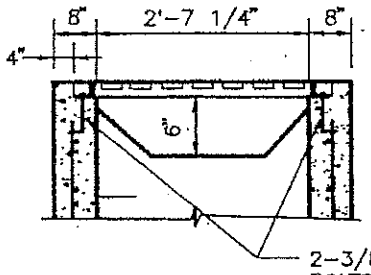


SEE DETAIL SD 14.1 FOR SECTIONS C-C AND D-D

PLAN OF TOP SLAB "D2" INLET



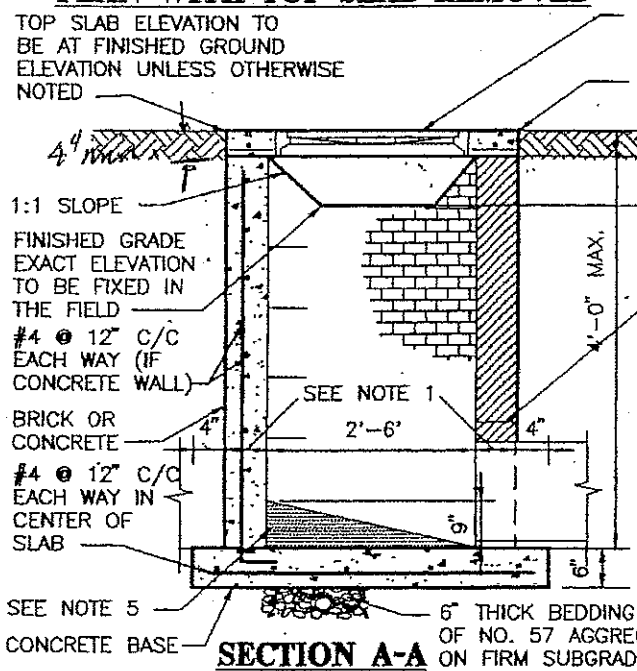
PLAN WITH TOP SLAB REMOVED



2-3/8"ø ANCHOR BOLTS 1'-0" LONG STANDARD HOOK EACH SIDE

SECTION B-B - "D2" INLET

FOR BASE DETAIL SEE "D1" INLET

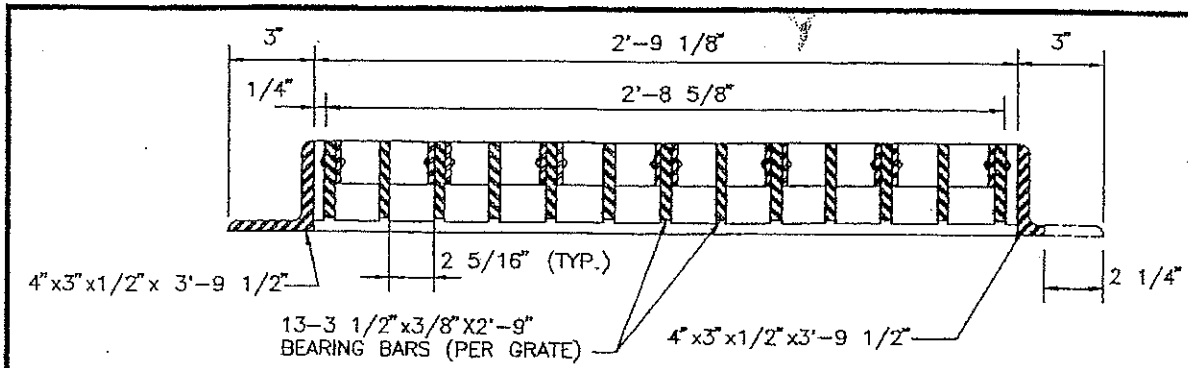


SECTION A-A

NOTES:

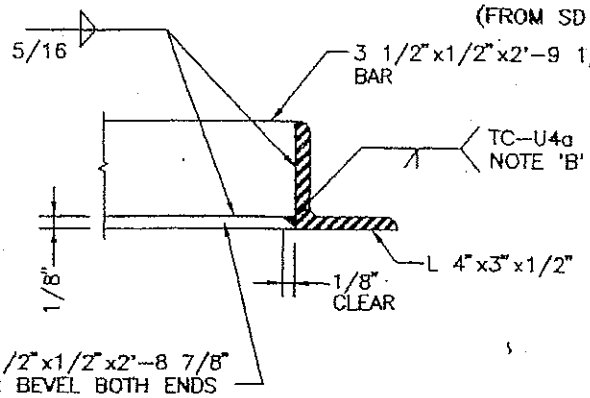
1. IF WALL IS BRICK, MIN. WALL THICKNESS IS 8". IF WALL IS CONCRETE MIN. IS 6".
2. STEEL GRATING BARS SHALL BE COATED IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENTAL RESOURCES SWM STANDARDS AND SPECIFICATIONS.
3. fc' = 4,000 psi @ 28 DAYS WITH AIR ENTRAINED.
4. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
5. PROVIDE SLOPES (2" PER FOOT) AS SHOWN IF USED AS TERMINAL.
6. STEP MUST BE LOCATED UNDER ACCESS OPENING. REFER TO SD 80.0 AND 81.0 FOR STEP DETAILS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN TYPE "D1" AND "D2" INLETS**	**SD 14.0**



SECTION C-C

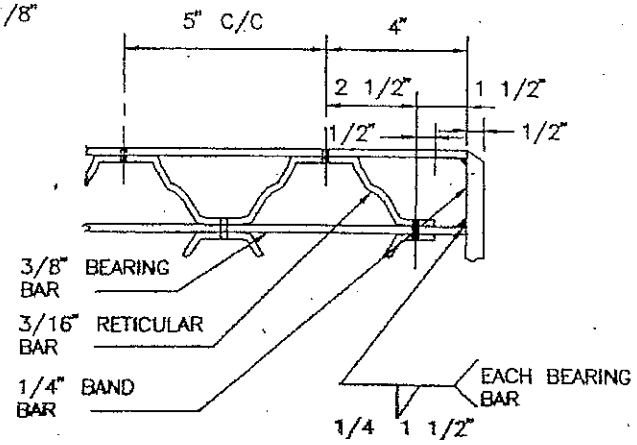
(FROM SD 14.0)



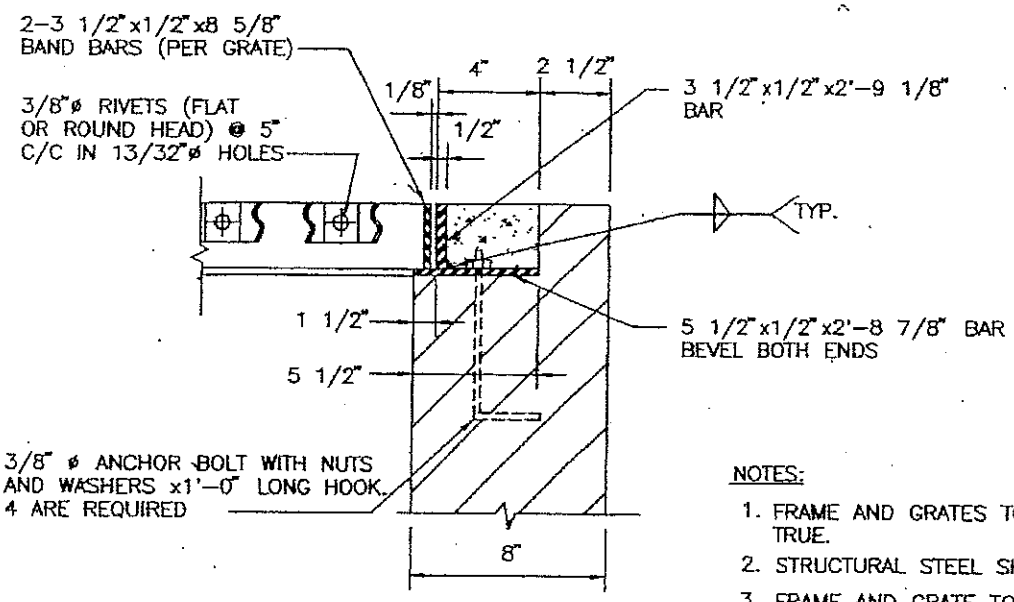
NOTE 'B'

WELD 3 1/2"X1/2"x2'-8 7/8" BAR TO 4"x1/2" L BEFORE WELDING 3 1/2"x1/2"x2'-9 1/8" BAR.

WELD DETAIL



GRATING DETAIL



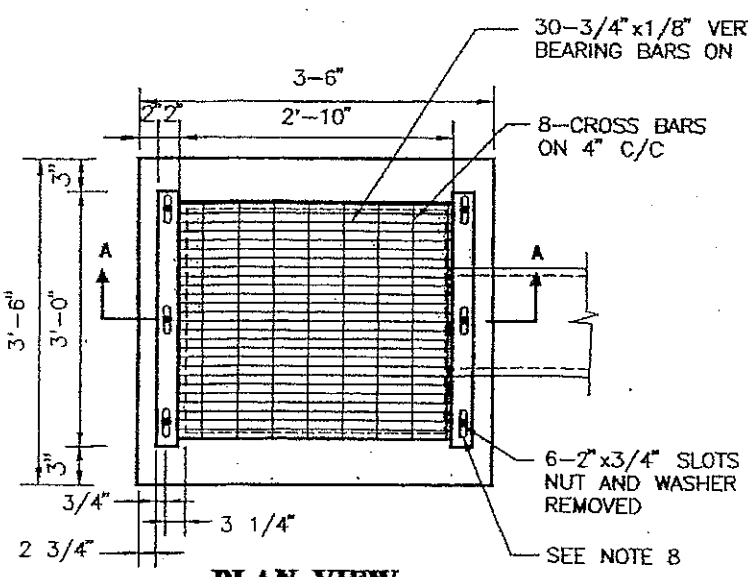
SECTION D-D

(FROM SD 14.0)

NOTES:

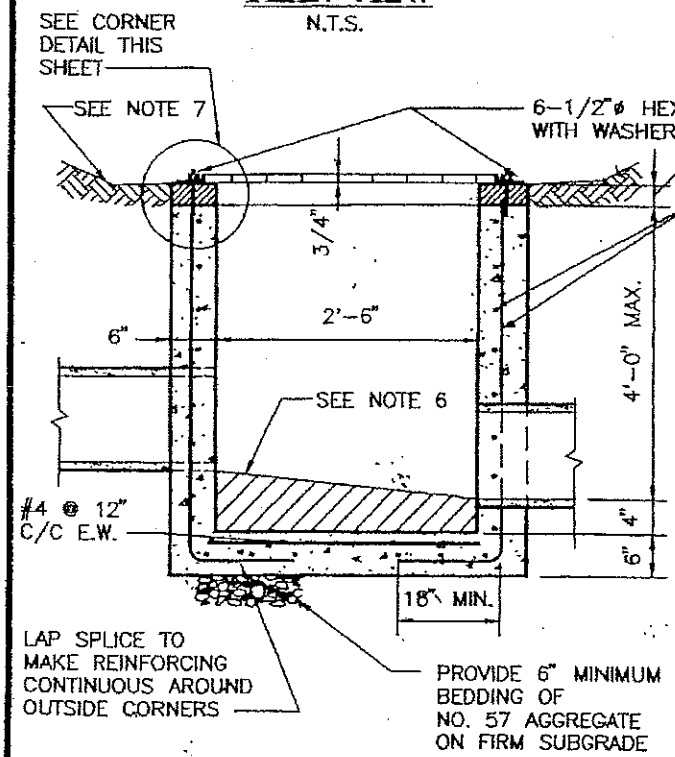
1. FRAME AND GRATES TO BE SQUARE, FLAT AND TRUE.
2. STRUCTURAL STEEL SHALL BE ASTM A-36.
3. FRAME AND GRATE TO BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A-123 EXCEPT FOR ADHERENCE WHICH SHALL BE IN ACCORDANCE WITH ASTM A-153.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: S. E. Wildesen Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	STORM DRAIN TYPE "D" INLET GRATE	SD 14.1

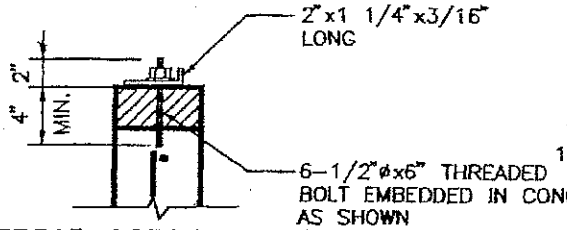


PLAN VIEW

N.T.S.



SECTION A-A

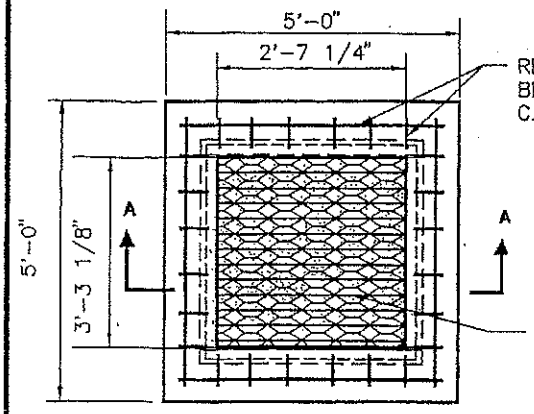


TYPICAL CORNER DETAIL

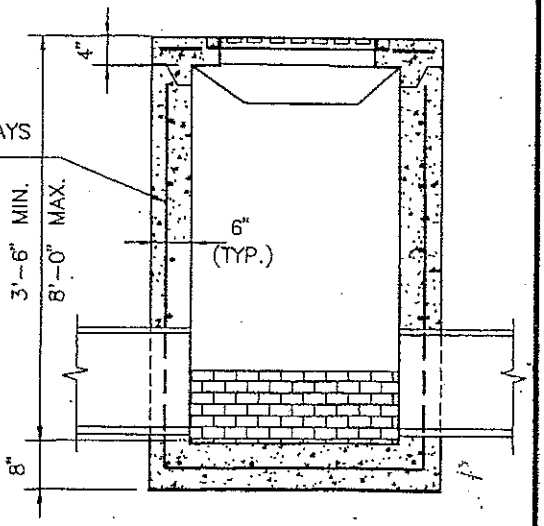
NOTES:

1. CONCRETE TO BE fc' = 5,000 psi @ 28 DAYS WITH AIR ENTRAINED.
2. THREADED PLASTIC INSERTS TO BE PROVIDED FOR HANDLING.
3. GRATING SHALL BE STEEL "IRVING X–BAR TYPE AA" OR APPROVED EQUIVALENT. ALL MATERIAL TO BE HOT DIPPED GALVANIZED.
4. GRADE AND SLOPE ADJUSTMENTS TO BE COMPLETED IN THE FIELD USING CONCRETE OR BRICK AND MORTAR WITH MIN. ONE COURSE OF BRICK OR UP TO MAX. 6" OF CONCRETE.
5. PIPE OPENINGS TO BE PROVIDED AS REQUIRED FOR SIZE, LOCATION AND INVERT ELEVATION.
6. FOR TERMINAL INLET INVERT TO BE CONCRETE OR BRICK AND SHALL SLOPE 2" PER FOOT TOWARD OUTLET AND SHALL BE PROVIDED IN THE FIELD.
7. SLOPE GROUND TOWARD INLET TO PROVIDE POSITIVE DRAINAGE.
8. 2–2"x1 1/4"x3/16"x3' LONG (CENTERED ON GRATE) THEN TRIM VERTICAL LEG OF ANGLE TO 3/4". WELD SECURELY TO GRATING AT EVERY FOURTH BAR. TOUCH UP WELDED AREAS WITH ZINC–RICH PAINT AFTER WELDING.
9. MIN. 12" EARTH COVER OVER PIPE.
10. INSTALL STEPS IN ACCORDANCE WITH SD 81.0 AND 82.0.

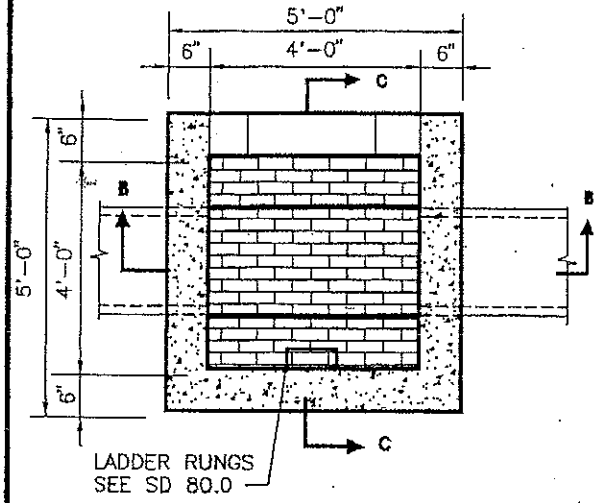
DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Ston E. Widesen Ston E. Widesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN PRECAST YARD INLET**	**SD 15.0**



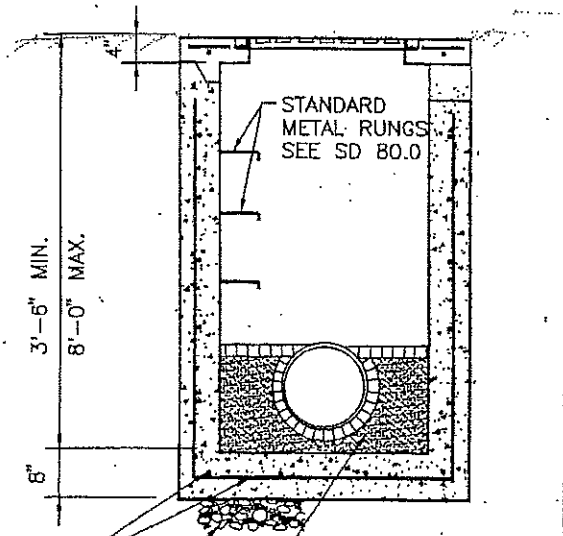
PLAN OF TOP SLAB



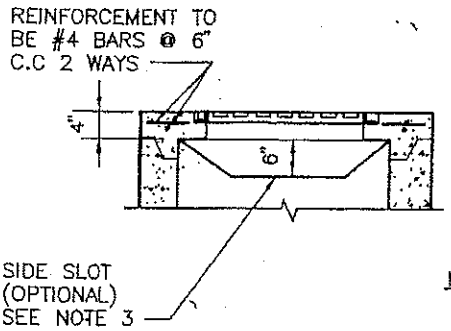
SECTION B-B



PLAN BELOW



SECTION C-C

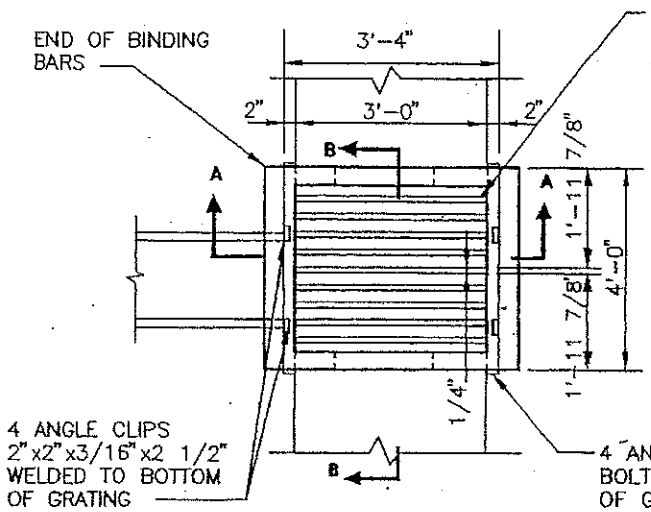


SECTION A-A

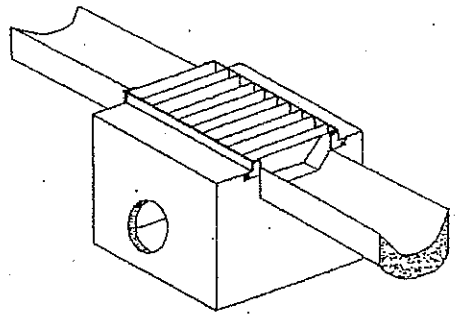
NOTES:

1. THE CONSTRUCTION OF THE STRUCTURE MUST BE IN ACCORDANCE WITH PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES, STORMWATER STANDARDS AND SPECIFICATIONS.
2. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
3. PROVIDE 8 ADDITIONAL #4 BARS REINFORCEMENT FOR PIPE OPENINGS AND SLOTS.
4. fc' = 5,000 psi FOR PRECAST @ 28 DAYS WITH AIR ENTRAINED.
5. FOR TRAFFIC AREA, TOP SLAB AND FRAME AND COVER MUST BEAR HS20 LOADING.

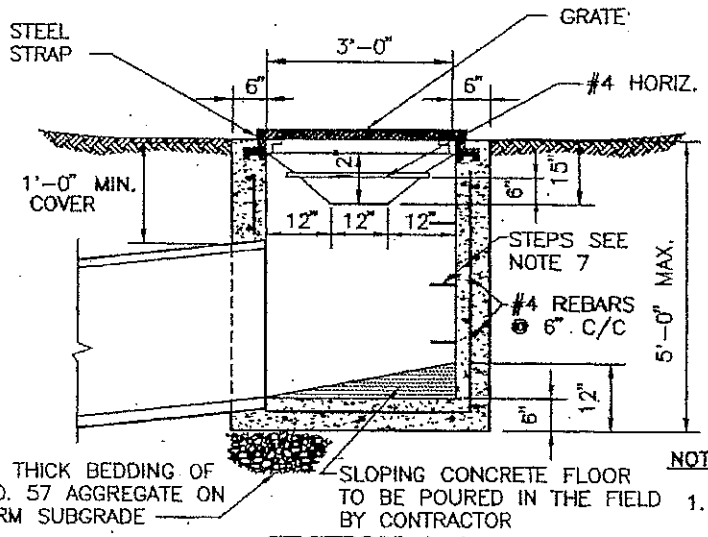
DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISION		
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director — DATE: 3/16/01	JAN. 2001	STORM DRAIN TYPE "E" INLET	SD 16.0



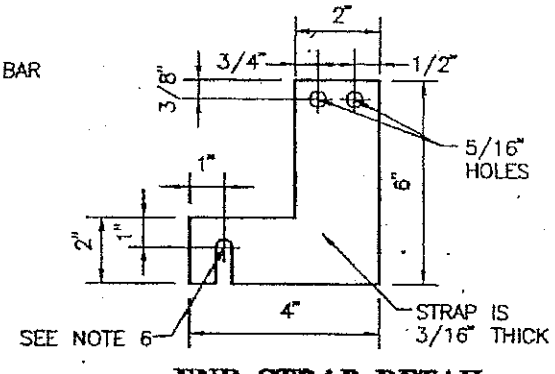
PLAN VIEW
N.T.S.



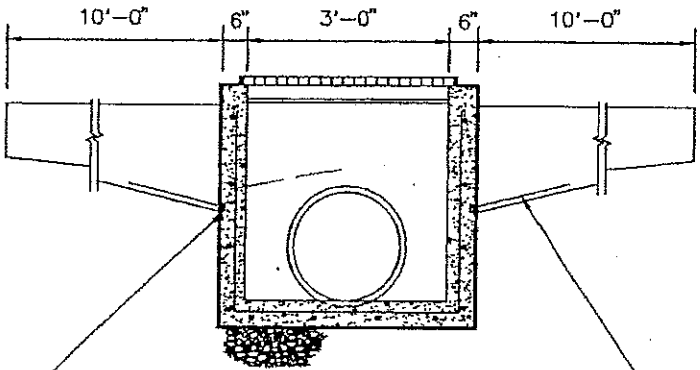
ISOMETRIC VIEW



SECTION A-A



END STRAP DETAIL
N.T.S.



SECTION B-B

NOTES:

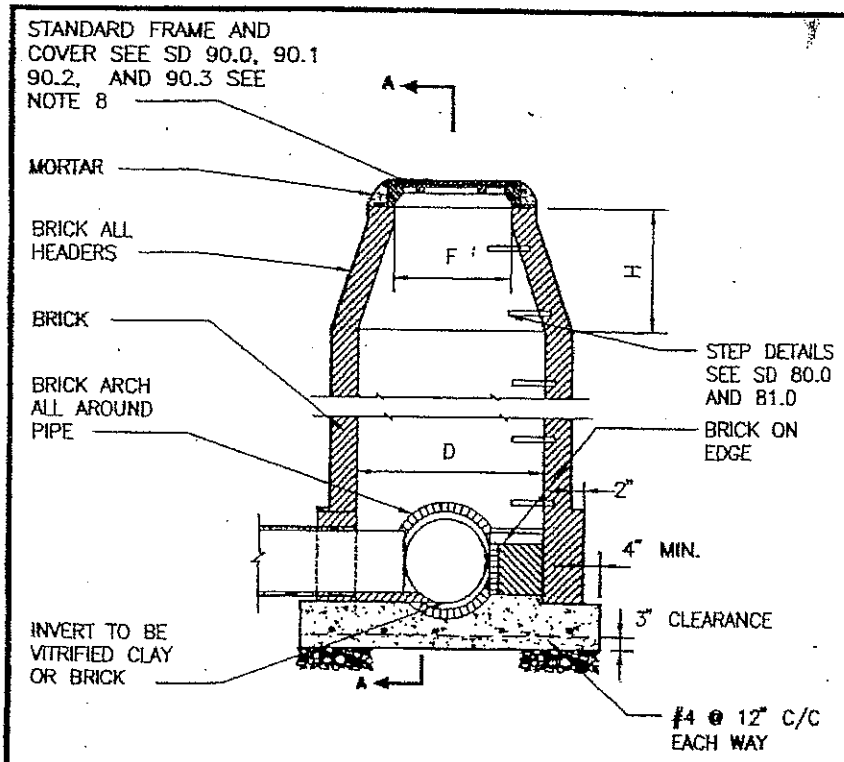
1. THE CONCRETE VALLEY GUTTER TO BE USED IN THE CONNECTION WITH THIS INLET SHALL BE TRANSITIONED TO MEET EXISTING DITCH OR PAVEMENT. THIS TRANSITION WILL TAKE PLACE WITHIN 10' OF THIS INLET. THE CONCRETE VALLEY IS TO BE 6" THICK WITH 6"x6"-W2.1XW2.1 WIRE MESH PLACED AT CENTER OF CONCRETE.
2. PIPE OUTLETS AND GUTTER APPROACHES CAN BE REVISED TO MEET EXISTING CONDITIONS.
3. CONCRETE CONSTRUCTION TO BE fc' = 5,000 psi @ 28 DAYS WITH AIR ENTRAINED. REINFORCEMENT #4 BARS AT 12" C/C 2" COVER.
4. GRATING SHALL BE HOT DIPPED GALVANIZED AND SHALL WITHSTAND A LIVE LOAD OF 150 PSF.
5. INSIDE WALLS MAY BE TAPERED 1/2".
6. 9/16" SLOTTED HOLE TO RECEIVE 1/2"x4" GALVANIZED MACHINE BOLT IMBEDDED 3" INTO CONCRETE WALL. NUT AND WASHER TO BE PLACED ON END OF BOLT AFTER GRATE IS INSTALLED.
7. PROVIDE STEP AT 1'-4" C/C BELOW TOP OPENING REFER TO SD 80.0 AND 81.0 FOR STEP DETAIL.
8. ALL REINFORCEMENT STEEL TO BE ASTM A615 GRADE 60.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

REVISION
JAN. 2001

STORM DRAIN
TYPE "K" PRECAST INLET
NON-TRAFFIC AREAS

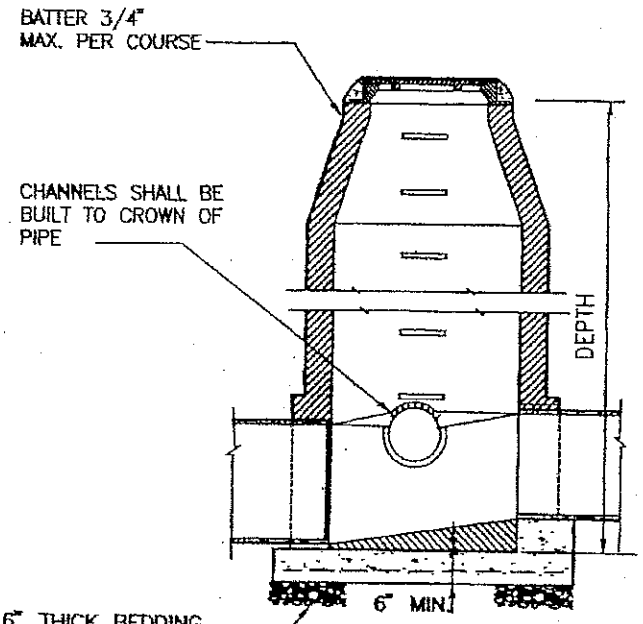
SD 17.0



MANHOLE DIMENSIONS			
PIPE DIA.	D	F (MIN.)	H (MIN.)
15" – 24"	4'–0"	24"	48"
27" – 36"	5'–0"	24"	52"
42" – 48"	6'–0"	24"	63"
54" – 60"	7'–0"	24"	84"

WALL & BASE SLAB SCHEDULE	
DEPTH	THICKNESS
TO 12'–0"	8"
12'–16'	12"

MANHOLE SECTION

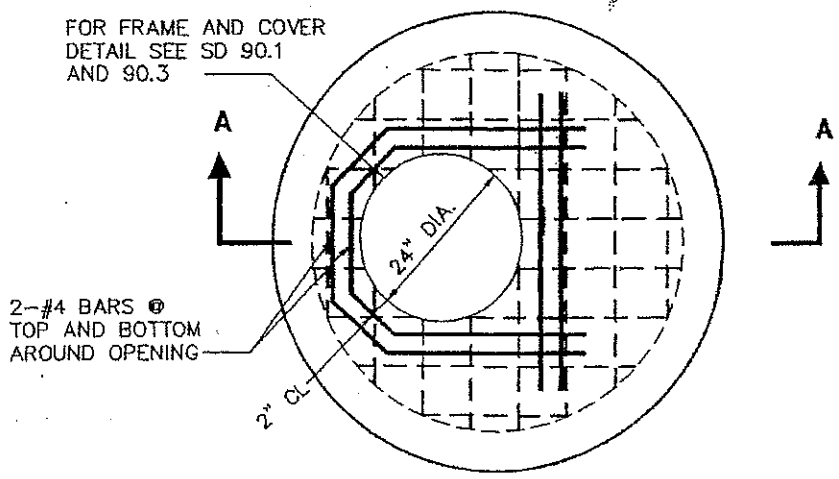


SECTION A-A

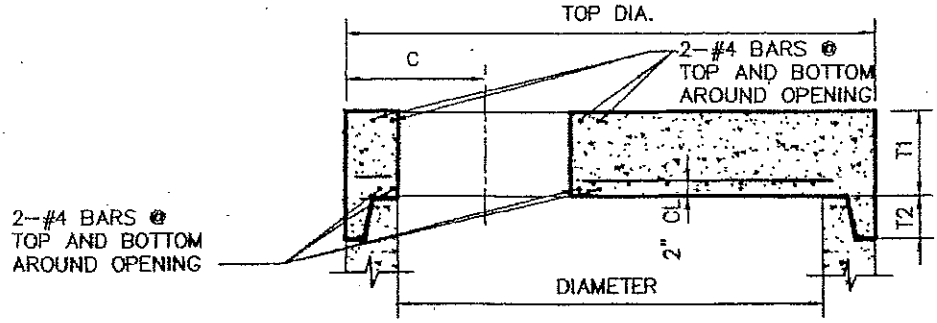
NOTES:

1. FOR PIPES LARGER THAN 27", PROVIDE STEPS IN CHANNELS OF STRUCTURES – SEE SD110.0.
2. PARGING IS REQUIRED FOR BRICK CONSTRUCTION IN ACCORDANCE WITH PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES STORMWATER STANDARDS AND SPECIFICATIONS.
3. ALL MORTAR JOINTS ON OUTSIDE TO BE COMPLETELY FILLED WITH MORTAR.
4. PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVAL IS REQUIRED FOR ALL SPECIAL DESIGN STRUCTURES
5. CONCRETE COMPRESSION STRENGTH TO BE 4,000 psi AT 28 DAYS.
6. FOR DEPTH GREATER THAN 16' A SPECIAL DESIGN IS REQUIRED.
7. ALL REINFORCEMENT STEEL TO BE ASTM A615, GRADE 60.
8. USE TRAFFIC BEARING FRAME AND COVER IN TRAFFIC AREA.
9. ANY INCOMING PIPE SHALL NOT ENTER A MANHOLE AT ANY ANGLE LESS THAN 90° TO THE OUTFLOW PIPE, EXCEPT WHEN THE DIFFERENCE IN INVERT ELEVATION BETWEEN THE INFLOW AND OUTFLOW PIPES ARE GREATER THAN 2'.
10. THE MINIMUM SPACING BETWEEN CONNECTIONS SHALL BE 2' IF INCOMING PIPES ARE AT THE SAME INVERT.

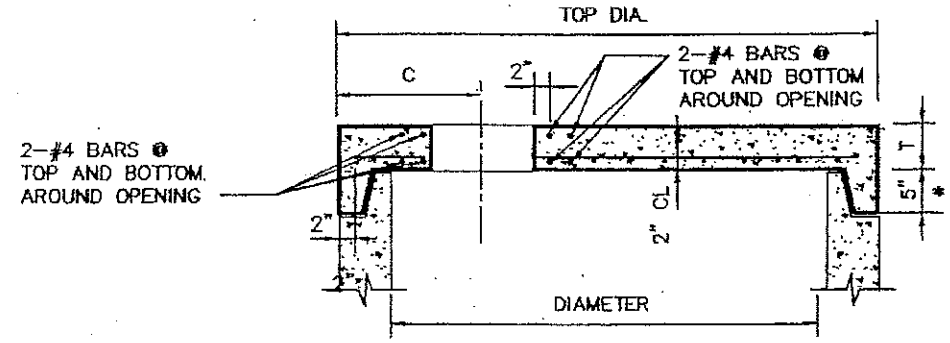
DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISION		
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	JAN. 2001	STORM DRAIN TYPE "A" MASONRY MANHOLE	SD 20.0



PLAN VIEW



48", 60", AND 72" MANHOLES SECTION



84" AND 96" MANHOLES SECTION

DIMENSIONS						
MH DIA.	C	TOP DIA.	REINFORCEMENT	T1	T2*	T
48"	20"	56"	#5 @ 6" C/C E.W.	6"	4"	–
60"	21"	72"	#5 @ 6" C/C E.W.	8"	4"	–
72"	22"	86"	#6 @ 6" C/C E.W.	8"	5"	–
84"	20"	100"	#6 @ 6" C/C E.W.	–	–	8"
96"	21"	114"	#6 @ 6" C/C E.W.	–	–	8"

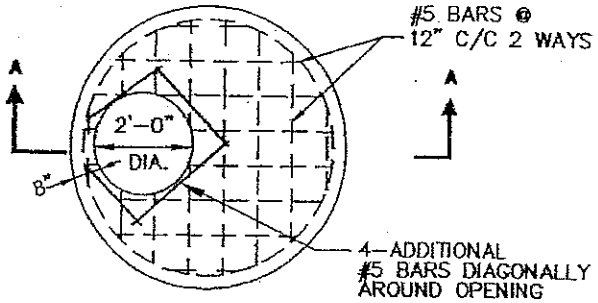
*PER MANUFACTURER'S DESIGN

DEPARTMENT OF
ENVIRONMENTAL RESOURCES
APPROVED BY:
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

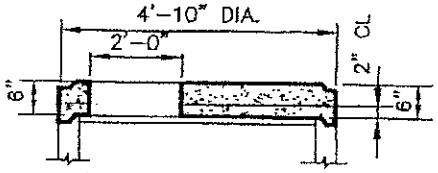
REVISION
JAN. 2001

STORM DRAIN
TOP SLAB FOR TYPE "A" PRECAST MANHOLE

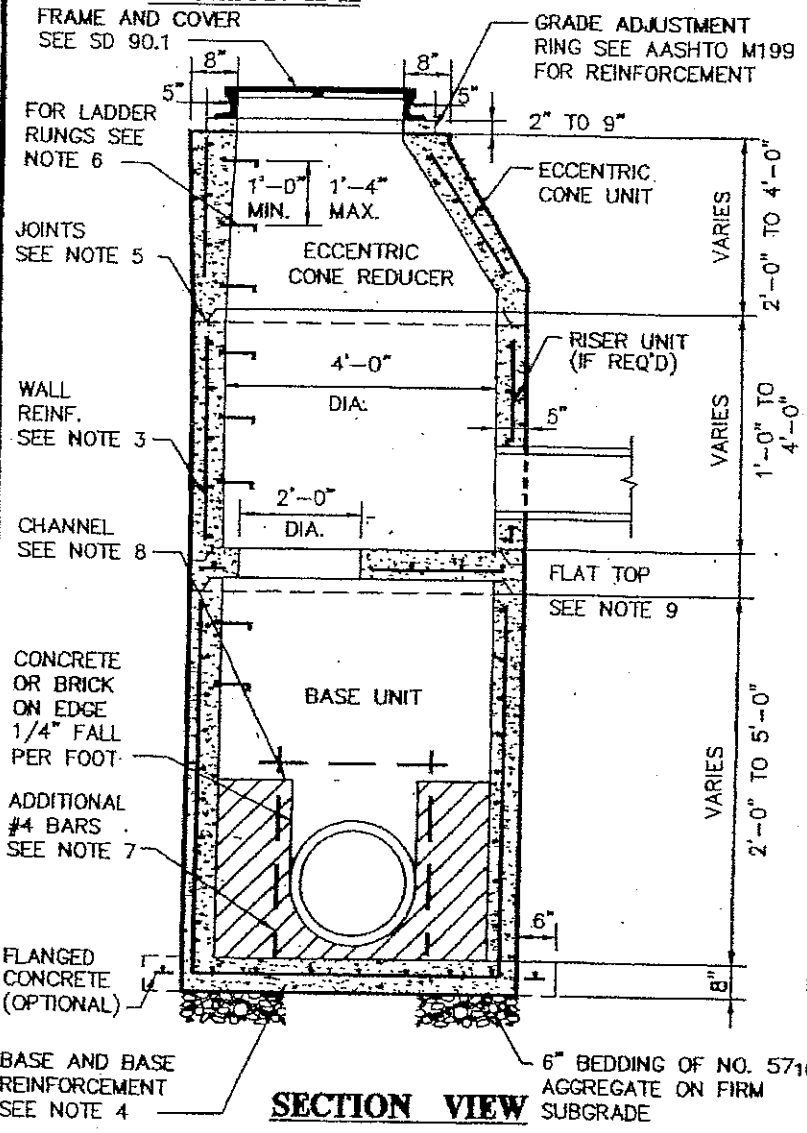
SD 21.0



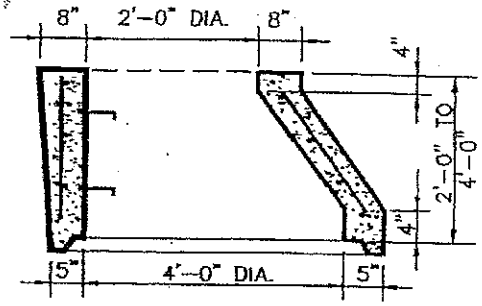
FLAT SLAB - TOP



SECTION A-A



SECTION VIEW



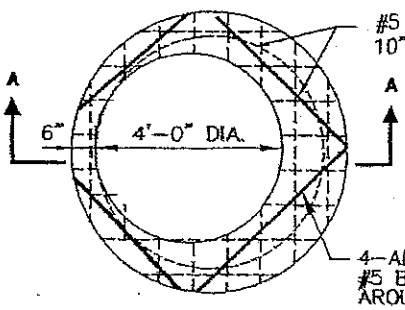
ECCENTRIC CONE REDUCER

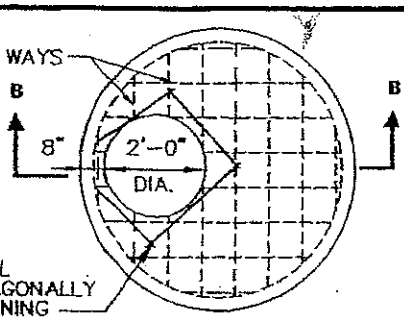
(ALTERNATE FOR FLATTOP REDUCER)

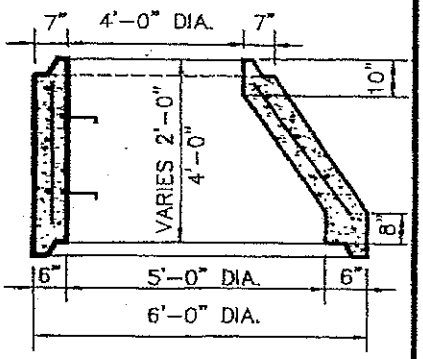
NOTES:

1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 AND ASTM C478.
2. CONCRETE TO BE fc'=5000 @ 28 DAYS WITH AIR ENTRAINED.
3. WALL REINFORCEMENT FOR BASE UNITS, RISER UNITS AND ECCENTRIC CONE REDUCERS SHALL BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.12 SQ. IN./FT. FOR 48" DIAMETER MANHOLES. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 AND A82. DEFORMED REINFORCEMENT SHALL CONFORM TO ASTM A615 GRADE 60.
4. BASE REINFORCEMENT TO BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.14 SQ. IN./FT. THE BASE MAY BE CAST MONOLITHIC WITH THE BASE UNIT OR JOINTED PER MANUFACTURER'S DESIGN. APPROVAL BY PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES, IS REQUIRED.
5. THE MANUFACTURER SHALL FORM MALE AND FEMALE ENDS OF JOINTS USING OWN DESIGN. THE JOINTS SHALL BE SEALED BY THE CONTRACTOR USING MORTAR AND MADE WATERTIGHT USING RUBBER O-RING GASKETS CONFORMING TO ASTM C361 AND C443 OR FLEXIBLE PLASTIC GASKETS CONFORMING TO AASHTO M198 (TYPE B).
6. LADDER RUNGS SHALL BE INSTALLED IN VERTICAL ALIGNMENT AT 1'-4" MAX. C/C RUNG TYPES SHALL BE IN ACCORDANCE WITH SD 80.0 (METAL LADDER RUNGS) OR SD 81.0 (COPOLYMER POLYPROPYLENE STEEL ENCAPSULATED LADDER RUNGS). PIPE CANNOT BE USED AS STEPS.
7. ADDITIONAL #4 BARS ARE TO BE USED AROUND ALL OPENINGS IN THE STRUCTURE.
8. fc' = 3000 psi CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD AND BE CONSTRUCTED UP TO CROWN OF PIPES.
9. THE FLAT TOP SLAB LANDING SHALL BE USED ONLY EVERY 12' INTERVAL. REFER TO MDSHA 384.13 FOR REINFORCEMENT DETAIL.
10. A SHOP DRAWING HAS TO BE APPROVED BY DER IF THE STRUCTURE IS MORE THAN 15' IN DEPTH.

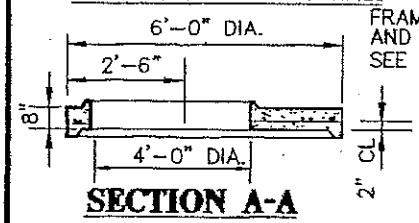
PRINCE GEORGE'S COUNTY MARYLAND	DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Stan E. Wildeesen Stan E. Wildeesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	STORM DRAIN TYPE "A" 48" DIA. PRECAST MANHOLE FOR 12"-24" PIPES	SD 21.1



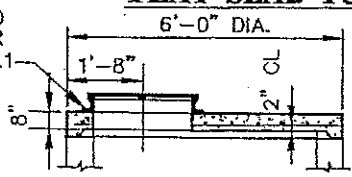




FLATTOP REDUCER



FLAT SLAB TOP

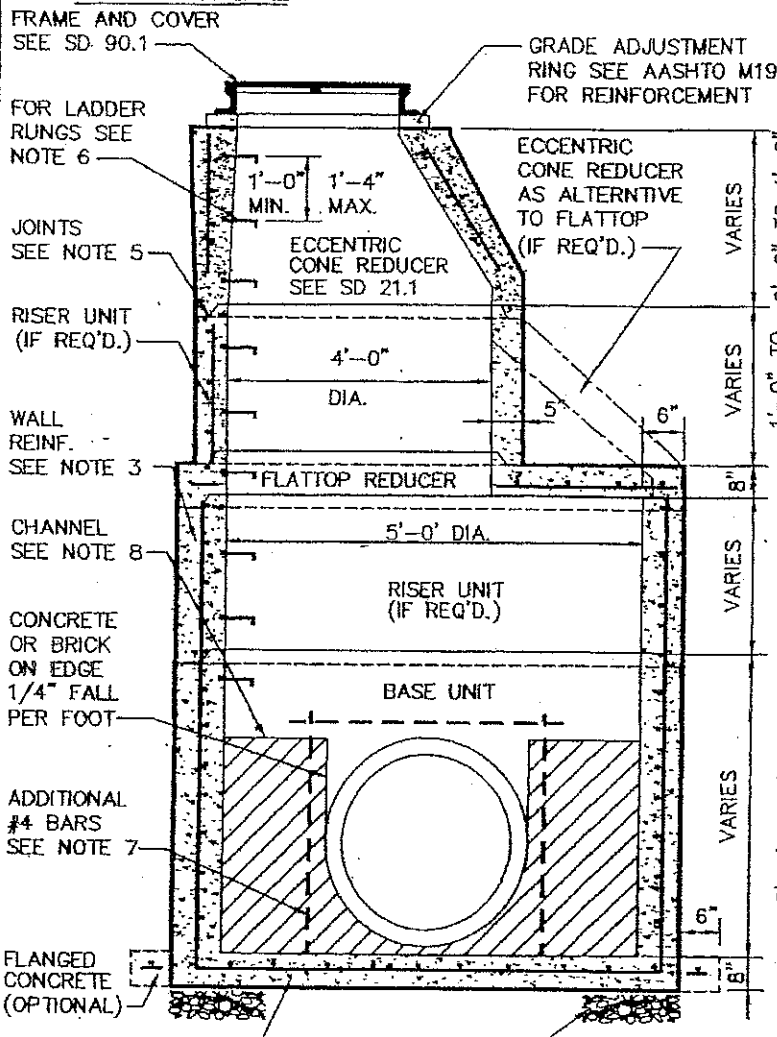


ECCENTRIC CONE REDUCER

(ALTERNATE FOR FLATTOP REDUCER)

SECTION A-A

SECTION B-B



SECTION VIEW

NOTES:

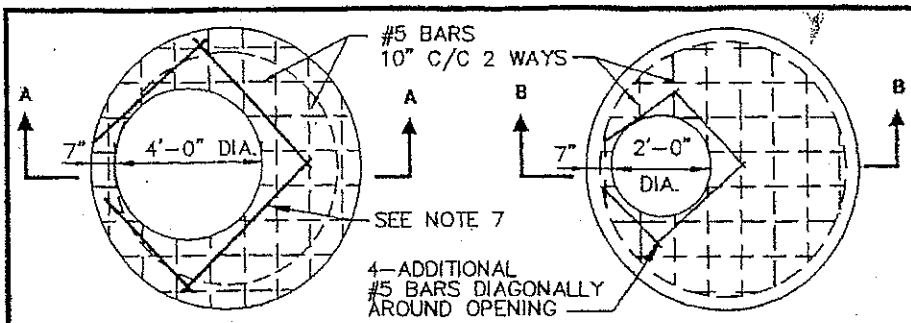
1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 AND ASTM C478.
2. CONCRETE TO BE fc'=5000 @ 28 DAYS WITH AIR ENTRAINED.
3. WALL REINFORCEMENT FOR BASE UNITS, RISER UNITS AND ECCENTRIC CONE REDUCERS SHALL BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.15 SQ. IN./FT. FOR 60" DIAMETER MANHOLES. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 AND A82. DEFORMED REINFORCEMENT SHALL CONFORM TO ASTM A615 GRADE 60.
4. BASE REINFORCEMENT TO BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.17 SQ. IN./FT. THE BASE MAY BE CAST MONOLITHIC WITH THE BASE UNIT OR JOINTED PER MANUFACTURER'S DESIGN. APPROVAL BY PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES, IS REQUIRED.
5. THE MANUFACTURER SHALL FORM MALE AND FEMALE ENDS OF JOINTS USING OWN DESIGN. THE JOINTS SHALL BE SEALED BY THE CONTRACTOR USING MORTAR AND MADE WATERTIGHT USING RUBBER O-RING GASKETS CONFORMING TO ASTM C361 AND C443 OR FLEXIBLE PLASTIC GASKETS CONFORMING TO AASHTO M198 (TYPE B).
6. LADDER RUNGS SHALL BE INSTALLED IN VERTICAL ALIGNMENT AT 1'-4" MAX. C/C RUNG TYPES SHALL BE IN ACCORDANCE WITH SD 80.0 (METAL LADDER RUNGS) OR SD 81.0 (COPOLYMER POLYPROPYLENE STEEL ENCAPSULATED LADDER RUNGS). PIPE CANNOT BE USED AS STEP.
7. ADDITIONAL #4 BARS ARE TO BE USED AROUND ALL OPENINGS IN THE STRUCTURE.
8. fc' = 3000 psi CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD AND BE CONSTRUCTED UP TO THE CROWN OF PIPES.
9. A SHOP DRAWING HAS TO BE APPROVED BY DER IF THE STRUCTURE IS MORE THAN 20' IN DEPTH.
10. THE FLAT TOP REDUCER SHALL BE USED ONLY AT EVERY 12' INTERVALS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: S. E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

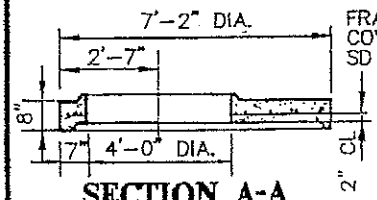
REVISION
JAN. 2001

STORM DRAIN
TYPE "A"
60" DIA. PRECAST MANHOLE
FOR 27"-36" PIPES

SD 21.2

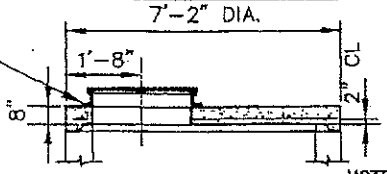


FLATTOP REDUCER

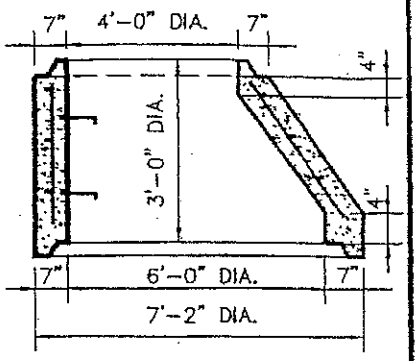


SECTION A-A

FLAT SLAB TOP

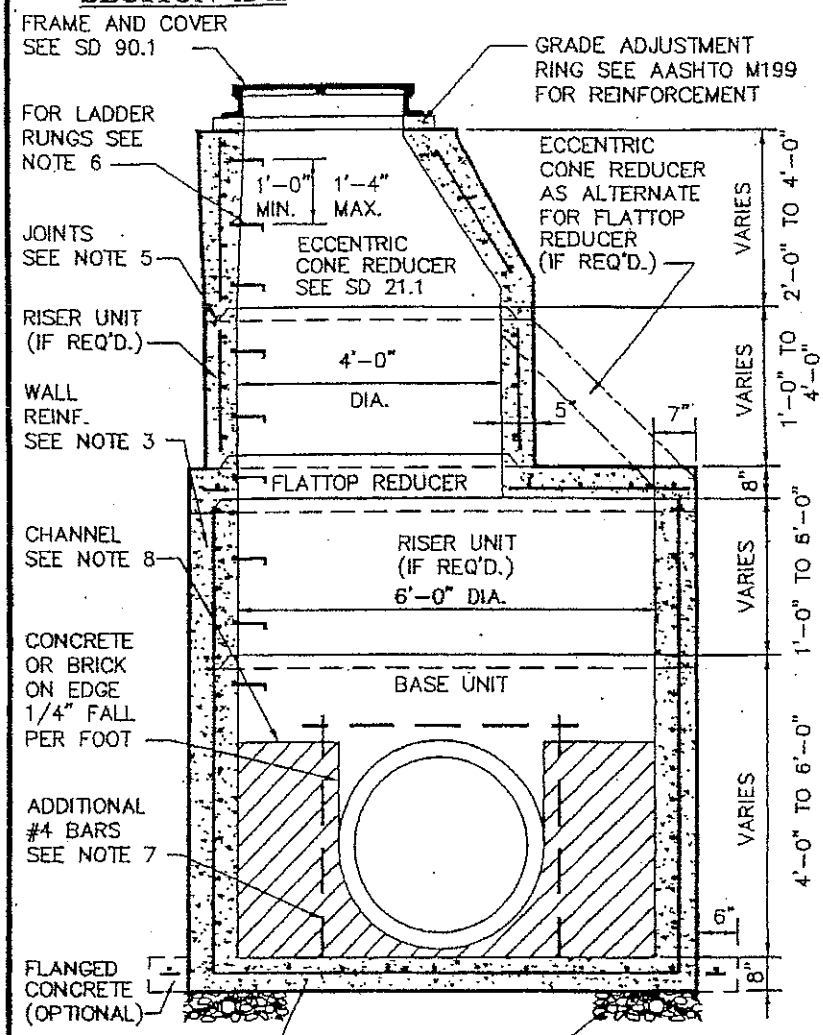


SECTION B-B



ECCENTRIC CONE REDUCER

(ALTERNATE FOR FLATTOP REDUCER)



SECTION VIEW

NOTES:

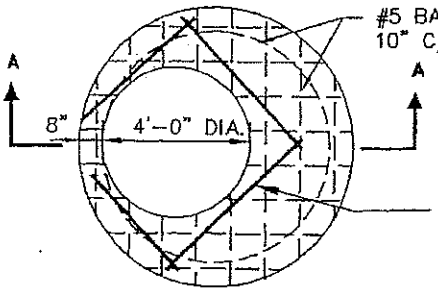
1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 AND ASTM C478.
2. CONCRETE TO BE fc'=5000 psi @ 28 DAYS WITH AIR ENTRAINED.
3. WALL REINFORCEMENT FOR BASE UNITS, RISER UNITS AND ECCENTRIC CONE REDUCERS SHALL BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.18 SQ. IN./FT. FOR 72" DIAMETER MANHOLES. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 AND A82. DEFORMED REINFORCEMENT SHALL CONFORM TO ASTM A615 GRADE 60.
4. BASE REINFORCEMENT TO BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.27 SQ. IN./FT. THE BASE MAY BE CAST MONOLITHIC WITH THE BASE UNIT OR JOINTED PER MANUFACTURER'S DESIGN. APPROVAL BY PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES, IS REQUIRED.
5. THE MANUFACTURER SHALL FORM MALE AND FEMALE ENDS OF JOINTS USING OWN DESIGN. THE JOINTS SHALL BE SEALED BY THE CONTRACTOR USING MORTAR AND MADE WATERTIGHT USING RUBBER O-RING GASKETS CONFORMING TO ASTM C361 AND C443 OR FLEXIBLE PLASTIC GASKETS CONFORMING TO AASHTO M198 (TYPE B).
6. LADDER RUNGS SHALL BE INSTALLED IN VERTICAL ALIGNMENT AT 1'-4" MAX. C/C RUNG TYPES SHALL BE IN ACCORDANCE WITH SD 80.0 (METAL LADDER RUNGS) OR SD 81.0 (COPOLYMER POLYPROPYLENE STEEL ENCAPSULATED LADDER RUNGS). PIPE CANNOT BE USED AS STEPS.
7. ADDITIONAL #4 BARS ARE TO BE USED AROUND ALL OPENINGS IN THE STRUCTURE.
8. fc' = 3000 psi CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD AND BE CONSTRUCTED UP TO CROWN OF PIPES.
9. A SHOP DRAWING HAS TO BE APPROVED BY DER IF THE STRUCTURE IS MORE THAN 22' IN DEPTH.
10. FLAT TOP REDUCER SHALL BE USED ONLY AT EVERY 12' INTERVAL.

DEPARTMENT OF
ENVIRONMENTAL RESOURCES
APPROVED BY:
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

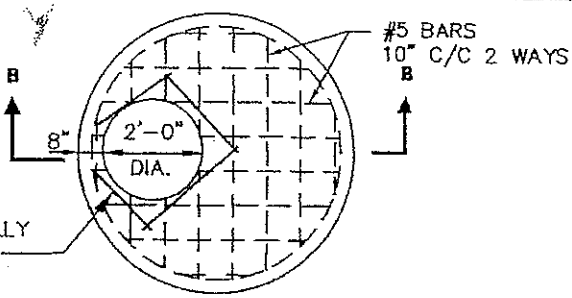
REVISION
JAN. 2001

STORM DRAIN
TYPE "A"
72" DIA. PRECAST MANHOLE
FOR 42"-48" PIPES

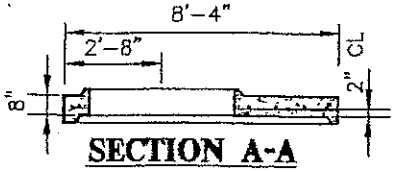
SD 21.3



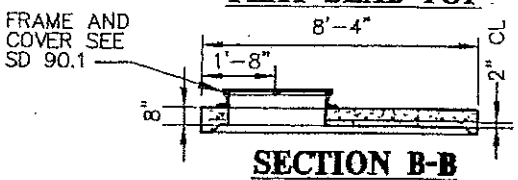
FLATTOP REDUCER



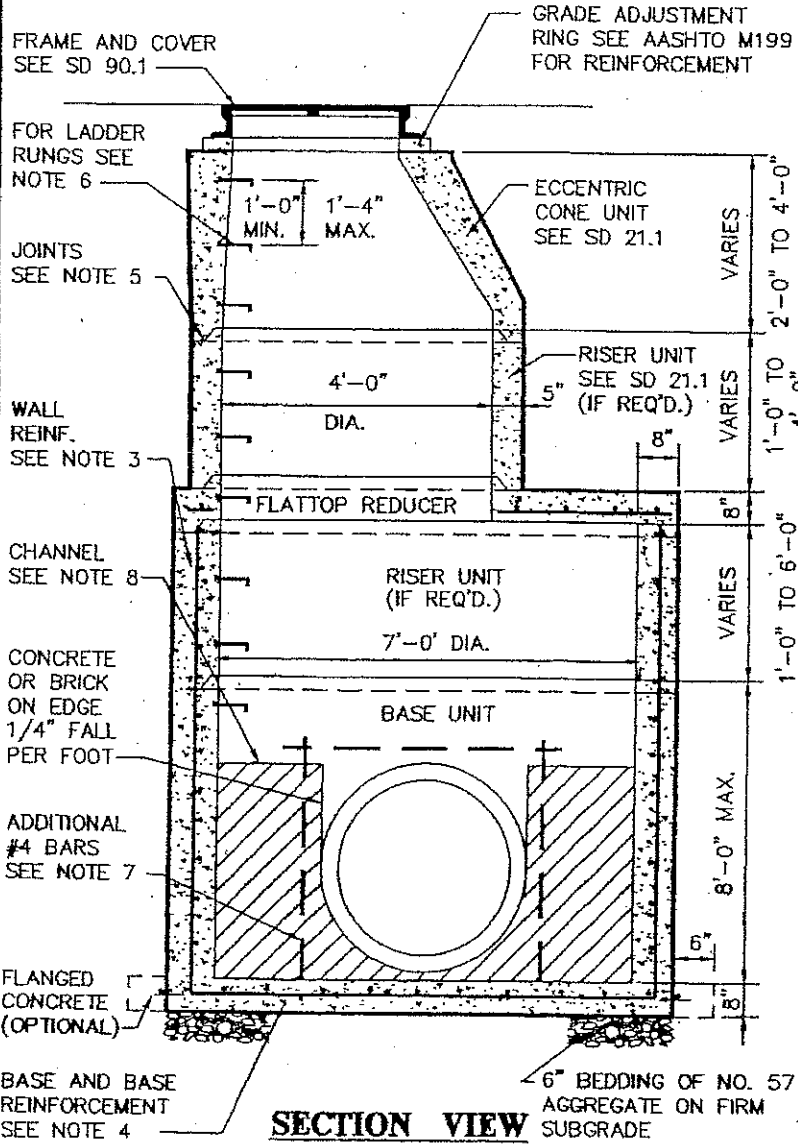
FLAT SLAB TOP



SECTION A-A



SECTION B-B



SECTION VIEW

NOTES:

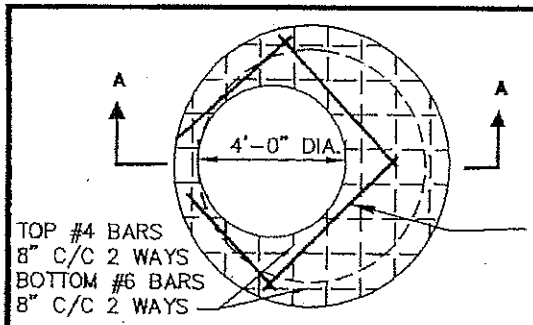
1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 AND ASTM C478.
2. CONCRETE TO BE fc'=5000 @ 28 DAYS WITH AIR ENTRAINED.
3. WALL REINFORCEMENT FOR BASE UNITS, RISER UNITS AND ECCENTRIC CONE REDUCERS SHALL BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.21 SQ. IN./FT. FOR 84" DIAMETER MANHOLES. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 AND A82. DEFORMED REINFORCEMENT SHALL CONFORM TO ASTM A615 GRADE 60.
4. BASE REINFORCEMENT TO BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.27 SQ. IN./FT. THE BASE MAY BE CAST MONOLITHIC WITH THE BASE UNIT OR JOINTED PER MANUFACTURER'S DESIGN. APPROVAL BY PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES IS REQUIRED.
5. THE MANUFACTURER SHALL FORM MALE AND FEMALE ENDS OF JOINTS USING OWN DESIGN. THE JOINTS SHALL BE SEALED BY THE CONTRACTOR USING MORTAR AND MADE WATERTIGHT USING RUBBER O-RING GASKETS CONFORMING TO ASTM C361 AND C443 OR FLEXIBLE PLASTIC GASKETS CONFORMING TO AASHTO M198 (TYPE B).
6. LADDER RUNGS SHALL BE INSTALLED IN VERTICAL ALIGNMENT AT 1'-4" MAX. C/C RUNG TYPES SHALL BE IN ACCORDANCE WITH SD 81.0 (METAL LADDER RUNGS) OR SD 81.0 (COPOLYMER POLYPROPYLENE STEEL ENCAPSULATED LADDER RUNGS). PIPE CAN NOT BE USED AS STEPS.
7. ADDITIONAL #4 BARS ARE TO BE USED AROUND ALL OPENINGS IN THE STRUCTURE.
8. fc' = 3000 psi CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD AND BE CONSTRUCTED UP TO CROWN OF PIPE.
9. A SHOP DRAWING HAS TO BE APPROVED BY DER IF THE STRUCTURE IS MORE THAN 24' IN DEPTH.
10. THE FLAT TOP REDUCER SHALL BE ONLY USED AT EVERY 12' INTERVAL.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

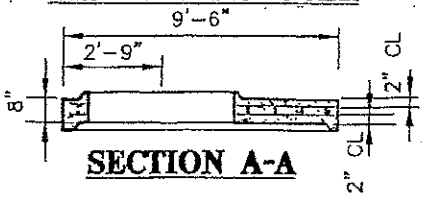
REVISION
JAN. 2001

STORM DRAIN
TYPE "A"
84" DIA. PRECAST MANHOLE
FOR 54"-66" PIPES

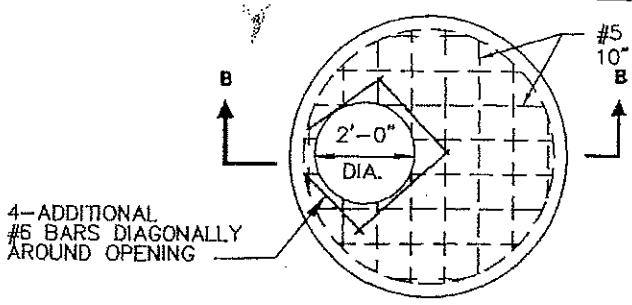
SD 21.4



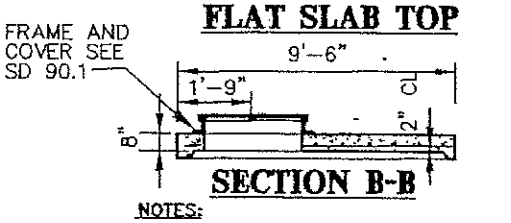
FLATTOP REDUCER



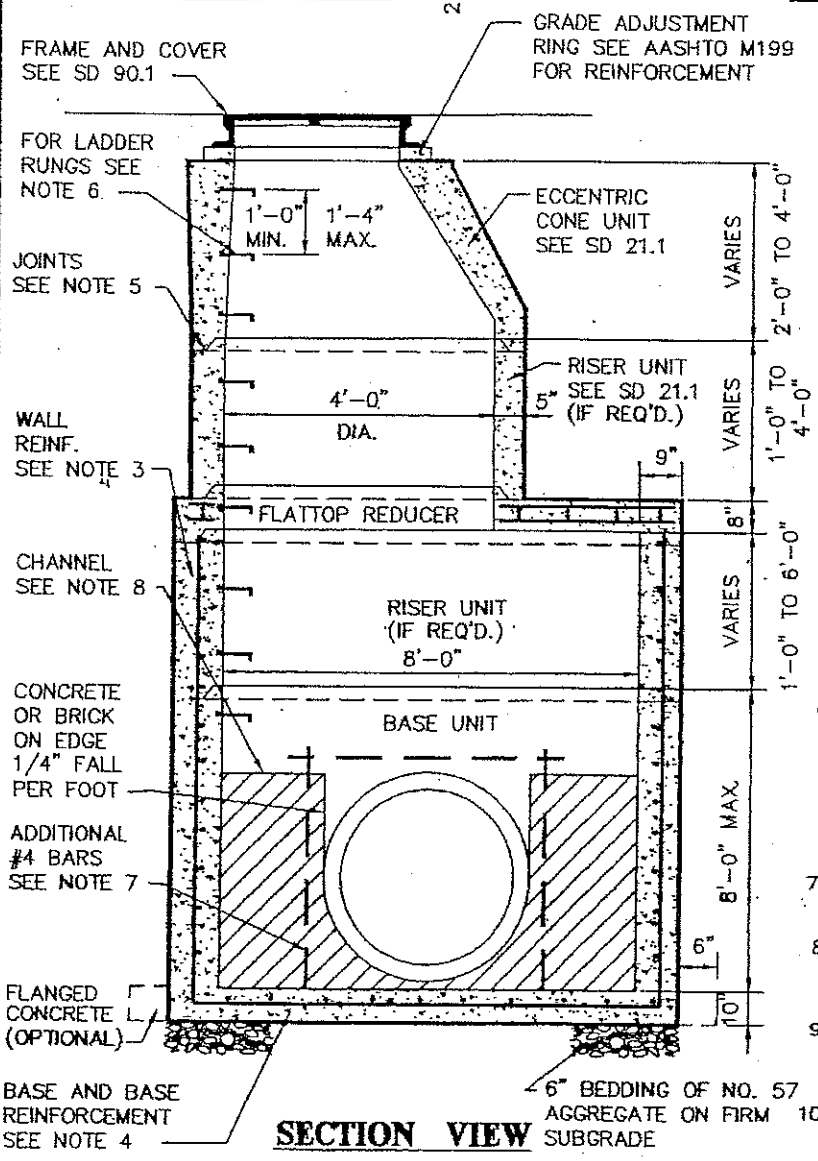
SECTION A-A



FLAT SLAB TOP



SECTION B-B

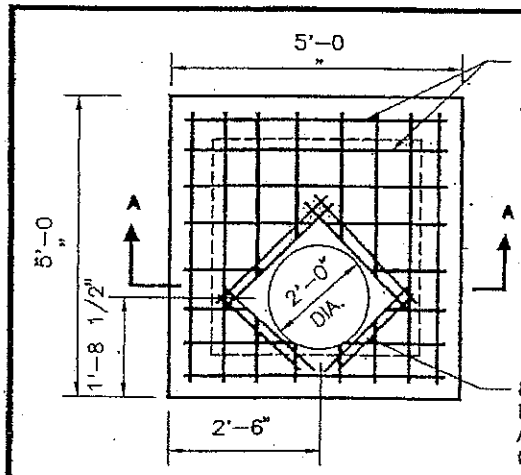


SECTION VIEW

NOTES:

1. MANHOLES SHALL BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M199 AND ASTM C478.
2. CONCRETE TO BE fc'=5000 @ 28 DAYS WITH AIR ENTRAINED.
3. WALL REINFORCEMENT FOR BASE UNITS, RISER UNITS AND ECCENTRIC CONE REDUCERS SHALL BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.24 SQ. IN./FT. FOR 84" DIAMETER MANHOLES. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 AND A82. DEFORMED REINFORCEMENT SHALL CONFORM TO ASTM A615 GRADE 60.
4. BASE REINFORCEMENT TO BE DEFORMED BARS OR WELDED WIRE FABRIC WITH A MINIMUM AREA OF 0.28 SQ. IN./FT. THE BASE MAY BE CAST MONOLITHIC WITH THE BASE UNIT OR JOINTED PER MANUFACTURER'S DESIGN. APPROVAL BY PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES IS REQUIRED.
5. THE MANUFACTURER SHALL FORM MALE AND FEMALE ENDS OF JOINTS USING OWN DESIGN. THE JOINTS SHALL BE SEALED BY THE CONTRACTOR USING MORTAR AND MADE WATERTIGHT USING RUBBER O-RING GASKETS CONFORMING TO ASTM C361 AND C443 OR FLEXIBLE PLASTIC GASKETS CONFORMING TO AASHTO M198 (TYPE B).
6. LADDER RUNGS SHALL BE INSTALLED IN VERTICAL ALIGNMENT AT 1'-4" MAX. RUNG C/C TYPES SHALL BE IN ACCORDANCE WITH SD 80.0 (METAL LADDER RUNGS) OR SD 81.0 (COPOLYMER POLYPROPYLENE STEEL ENCAPSULATED LADDER RUNGS). PIPE CAN NOT BE USED AS STEPS.
7. ADDITIONAL #4 BARS ARE TO BE USED AROUND ALL OPENINGS IN THE STRUCTURE.
8. fc' = 3000 psi CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD AND BE CONSTRUCTED UP TO CROWN OF PIPES.
9. A SHOP DRAWING HAS TO BE APPROVED BY DER IF THE STRUCTURE IS MORE THAN 24' IN DEPTH.
10. THE FLAT TOP REDUCER SHALL BE USED AT ONLY EVERY 12' INTERVALS.

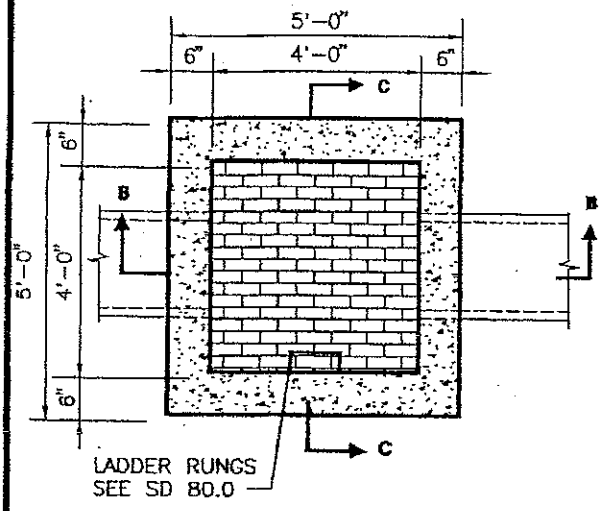
DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: S. E. Wild DATE: 3/16/01 Ston E. Wildesen, P.E. Assoc. Director	REVISION JAN. 2001	**STORM DRAIN** **TYPE "A"** **96" DIA. PRECAST MANHOLE** **FOR A 72" PIPE**	**SD 21.5**



REINFORCEMENT TO BE #4 BARS @ 6" C.C 2 WAYS

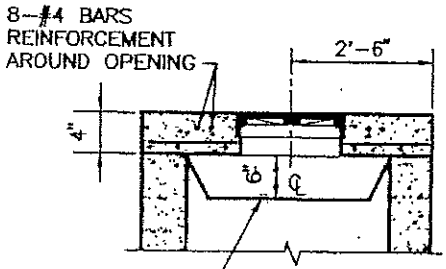
8-#4 BARS REINFORCEMENT AS SHOWN AROUND OPENING

PLAN OF TOP SLAB



LADDER RUNGS SEE SD 80.0

PLAN BELOW



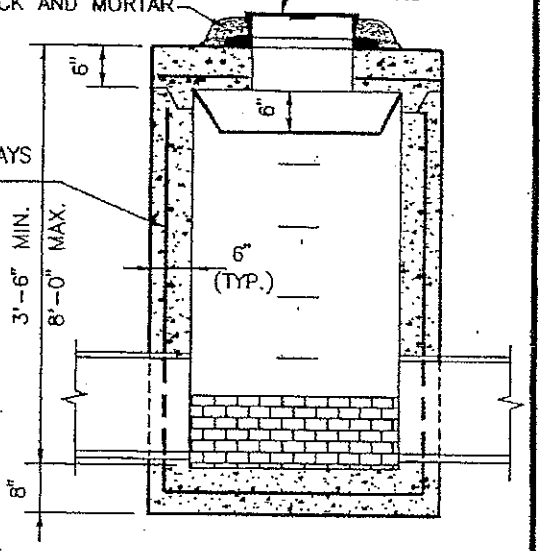
SIDE SLOT (OPTIONAL) SEE NOTE 3

SECTION A-A

GRADE ADJUSTMENT TO BE CONCRETE MIX NO. 2 OR BRICK AND MORTAR

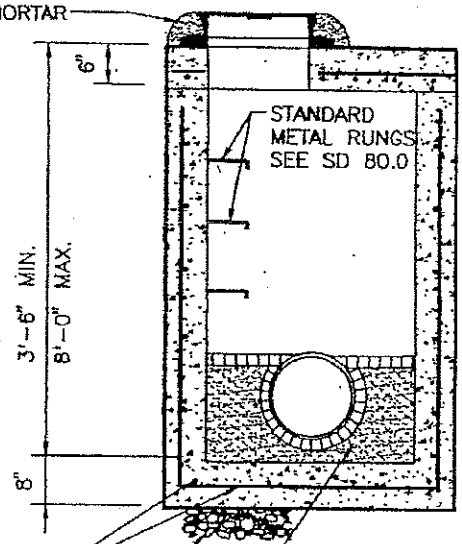
FRAME AND COVER SEE SD 90.1, 90.2 AND 90.3

#4 DEFORMED BARS @ 6" C/C 2 WAYS 2" COVER



SECTION B-B

GRADE ADJUSTMENT TO BE CONCRETE MIX NO. 2 OR BRICK AND MORTAR



#4 @ 6" C/C EACH WAY

6" BEDDING OF NO. 57 AGGREGATE ON FIRM SUBGRADE

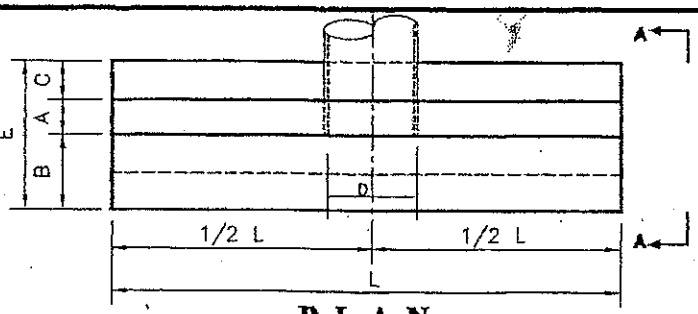
CONCRETE OR BRICK CHANNEL SHALL BE PROVIDED IN THE FIELD

SECTION C-C

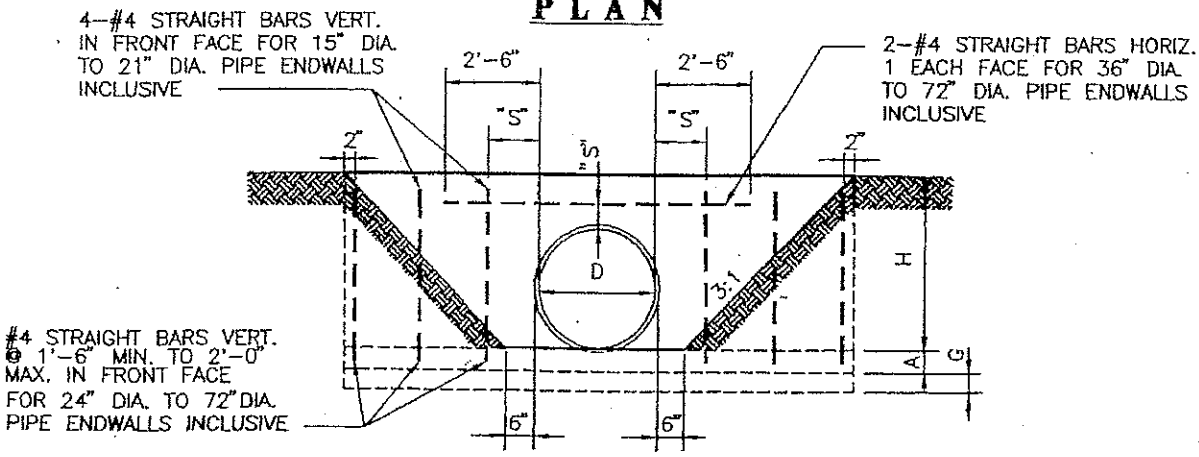
NOTES:

1. THE CONSTRUCTION OF THE STRUCTURE MUST BE IN ACCORDANCE WITH PRINCE GEORGE'S COUNTY, DEPARTMENT OF ENVIRONMENTAL RESOURCES, STORMWATER STANDARDS AND SPECIFICATIONS.
2. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
3. PROVIDE 8 ADDITIONAL #4 BARS REINFORCEMENT FOR PIPE OPENINGS AND SLOTS.
4. fc' = 5,000 psi FOR PRECAST @ 28 DAYS WITH AIR ENTRAINED.
5. FOR TRAFFIC AREA, TOP SLAB AND FRAME AND COVER MUST BEAR HS20 LOADING.

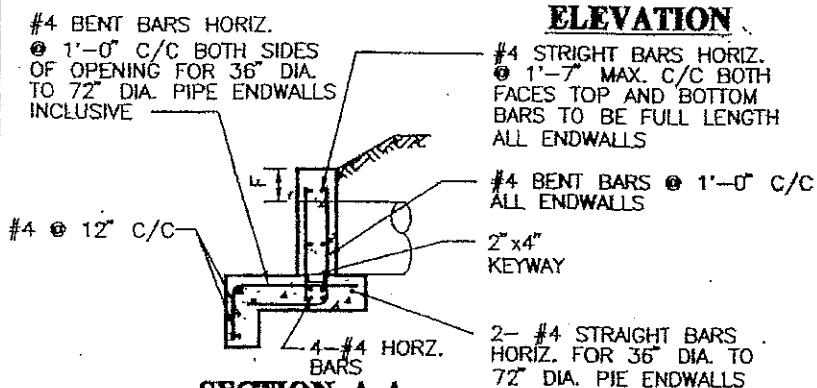
DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISION		
APPROVED BY: Stan E. Wadesen, P.E. Assoc. Director DATE: 3/16/01	JAN. 2001	STORM DRAIN TYPE "B" PRECAST SHALLOW MANHOLE	SD 22.0



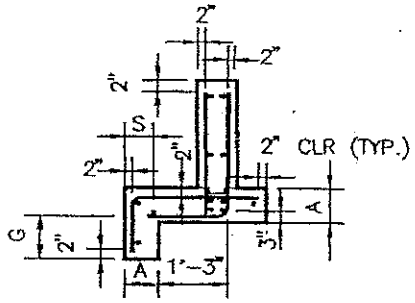
PLAN



ELEVATION



SECTION A-A



DISPOSITION OF BARS

OPENING		DIMENSIONS									
D INCHES	AREA SQ. FT.	A	B	C	E	F	G	H	3:1 SLOPE L	2:1 SLOPE L	S
15	1.23	9"	10"	6"	2'–1"	12"	2'–0"	2'–3"	15'–9"	11'–3"	4"
18	1.77	9"	10"	6"	2'–1"	12"	2'–0"	2'–6"	17'–6"	12'–6"	4"
21	2.40	9"	10"	6"	2'–1"	12"	2'–0"	2'–9"	19'–3"	13'–9"	4"
24	3.14	9"	14"	6"	2'–5"	12"	2'–0"	3'–0"	21'–0"	15'–0"	6"
27	3.98	9"	14"	6"	2'–5"	12"	2'–0"	3'–3"	22'–9"	16'–3"	6"
30	4.91	9"	14"	6"	2'–5"	12"	2'–0"	3'–6"	24'–6"	17'–6"	6"
33	5.94	9"	14"	6"	2'–5"	12"	3'–0"	3'–9"	26–3"	18'–9"	6"
36	7.07	12"	16"	10"	3'–2"	12"	3'–0"	4'–0"	28'–0"	20'–0"	6"
42	9.62	12"	16"	10"	3'–2"	12"	3'–0"	4'–6"	31'–6"	22'–6"	8"
48	12.57	12"	16"	10"	3'–2"	12"	3'–0"	5'–0"	35'–0"	25'–0"	8"
54	15.90	12"	20"	12"	3'–8"	12"	3'–0"	5'–6"	38'–6"	27–6"	8"
60	19.64	12"	20"	12"	3'–8"	12"	3'–0"	6'–0"	42'–0"	30'–0"	8"
72	28.27	12"	20"	12"	3'–8"	12"	3'–0"	7'–0"	49'–0"	35'–0"	8"

QUANTITIES IN THIS TABLE TO BE USED FOR ESTIMATING ONLY

NOTES:

1. UNLESS OTHERWISE SPECIFIED, THE SIDE SLOPE 2:1 MAXIMUM TO BOTTOM OF THE OUTFALL CHANNEL. KEEP 6" AWAY FROM STORM DRAIN PIPE.
2. fc' = 5,000 psi @ 28 DAYS WITH AIR ENTRAINED FOR PRECAST CONCRETE. fc' = 4,000 psi WITH AIR ENTRAINED FOR CAST IN PLACE.
3. PROVIDE 6" THICK OF NO. 57 AGGREGATE BEDDING ON FIRM SUBGRADE.
4. 2" MINIMUM CONCRETE CLEARANCE.

DEPARTMENT OF ENVIRONMENTAL RESOURCES

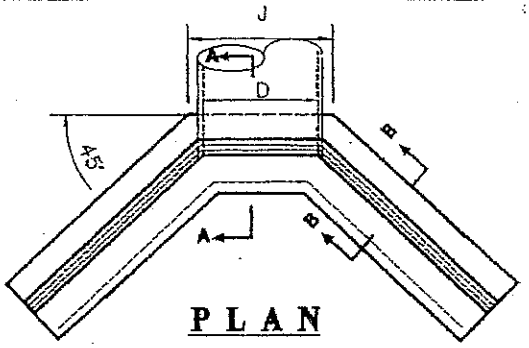
APPROVED BY: DATE: 3/16/01

Stan E. Wildesen, P.E.
Assoc. Director

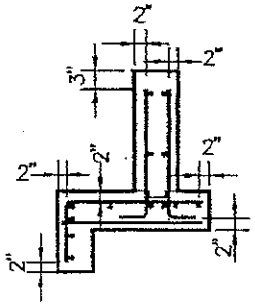
REVISION
JAN. 2001

STORM DRAIN ENDWALL

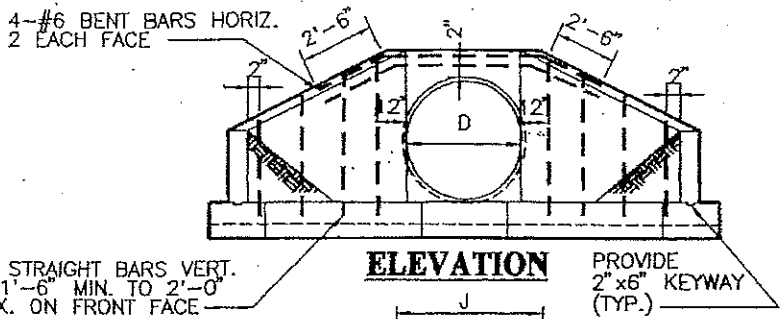
SD 30.0



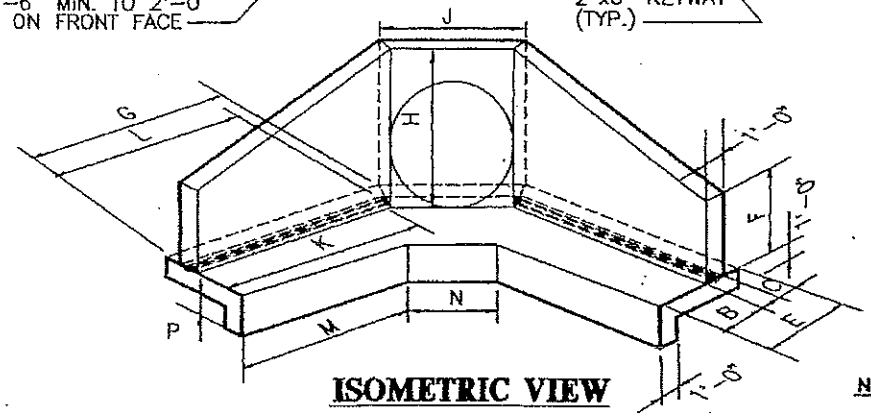
PLAN



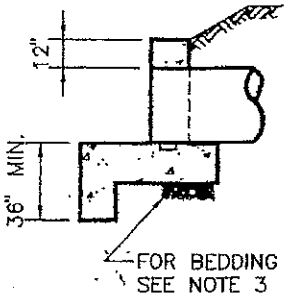
DISPOSITION OF BARS



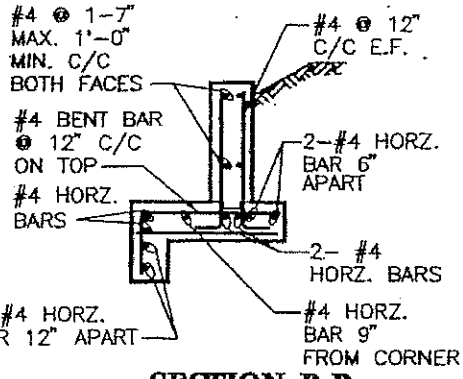
ELEVATION



ISOMETRIC VIEW



SECTION A-A



SECTION B-B

NOTES:

1. FOR MORE DETAILS AND NOTES SEE SD 30.0
2. UNLESS OTHERWISE SPECIFIED THE MAX. SIDE SLOPE IS 2:1 TO THE BOTTOM OF THE OUTFALL CHANNEL.
3. PROVIDE 6" THICK OF NO. 57 AGGREGATE BEDDING ON FIRM SUBGRADE.
4. fc' = 5,000 psi @ 28 DAYS WITH AIR ENTRAINED.
5. 2" MINIMUM CONCRETE CLEARANCE.

OPENING		DIMENSIONS											
D INCHES	AREA SQ. FT.	B	C	E	F	G	H	J	K	L	M	N	P
48	12.57	1'-4"	10"	3'-2"	2'-9"	7'-3/4"	5'-0"	4'-10"	6'-3 1/2"	6'-8 1/2"	5'-9"	2'-10 3/4"	2'-0"
54	15.90	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"	2'-0"
60	19.64	1'-8"	1'-0"	3'-8"	3'-3"	8'-5"	6'-0"	5'-10"	7'-7 1/4"	8'-1/4"	6'-11"	3'-7 1/2"	2'-0"

QUANTITIES IN THIS TABLE TO BE USED FOR ESTIMATING ONLY

DEPARTMENT OF ENVIRONMENTAL RESOURCES

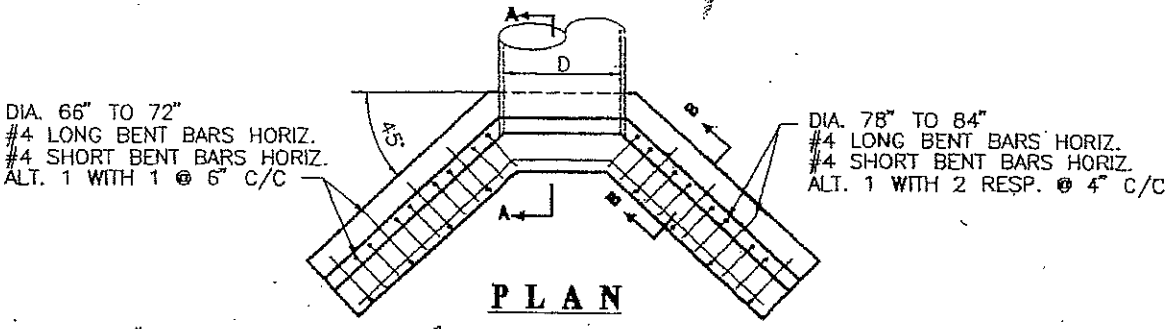
APPROVED BY: _____ DATE: 3/16/01

Stan E. Wildesen, P.E.
Assoc. Director

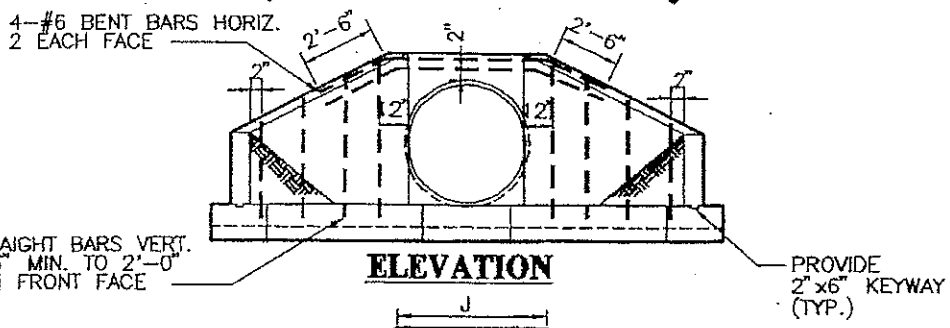
REVISION
JAN. 2001

STORM DRAIN
TYPE "A" HEADWALL FOR 48", 54", AND 60" PIPE

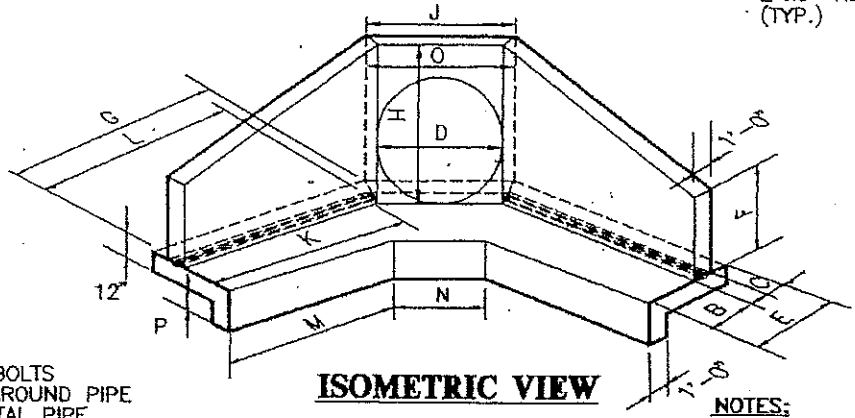
SD 31.0



PLAN



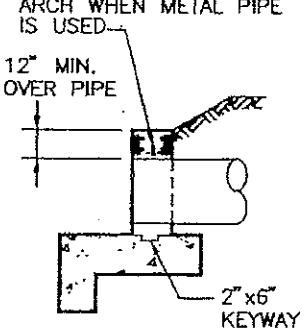
ELEVATION



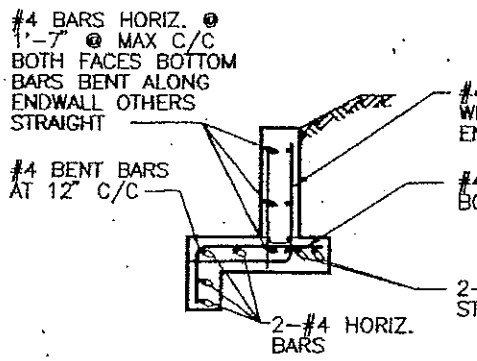
ISOMETRIC VIEW

NOTES:

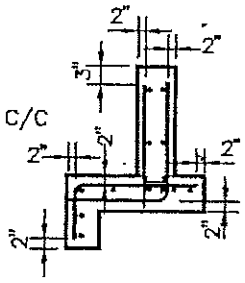
1. REFER TO SD 30.0 FOR NOTES.



SECTION A-A



SECTION B-B



DISPOSITION OF BARS

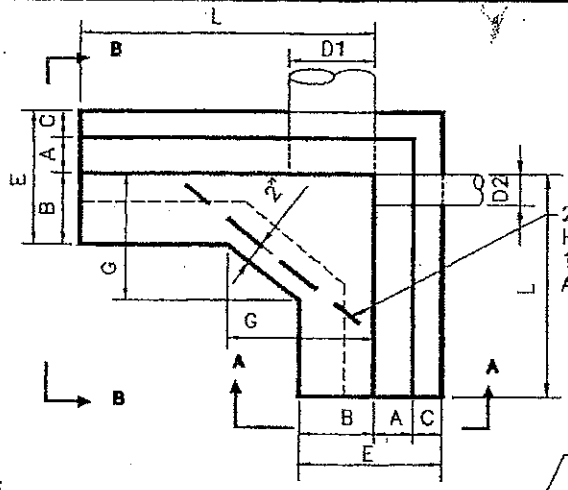
OPENING		DIMENSIONS												
D INCHES	AREA SQ. FT.	B	C	E	F	G	H	J	K	L	M	N	O	P
66	23.80	2'-6"	1'-3"	4'-9"	3'-0"	11'-2 1/2"	6'-8 1/2"	6'-4"	10'-3 1/4"	10'-8 1/2"	9'-3"	3'-5"	7'-4 1/2"	2'-0"
72	28.27	2'-6"	1'-3"	4'-9"	3'-3"	12'-1"	7'-3"	6'-10"	11'-1 3/4"	11'-6 3/4"	10'-1 1/4"	3'-11"	7'-10 1/2"	2'-0"
78	33.20	3'-0"	1'-6"	5'-6"	3'-6"	13'-1/2"	7'-9 1/2"	7'-4"	12'-0"	12'-5"	10'-9"	4'-0"	8'-6 3/4"	2'-6"
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"	2'-6"

DEPARTMENT OF
ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

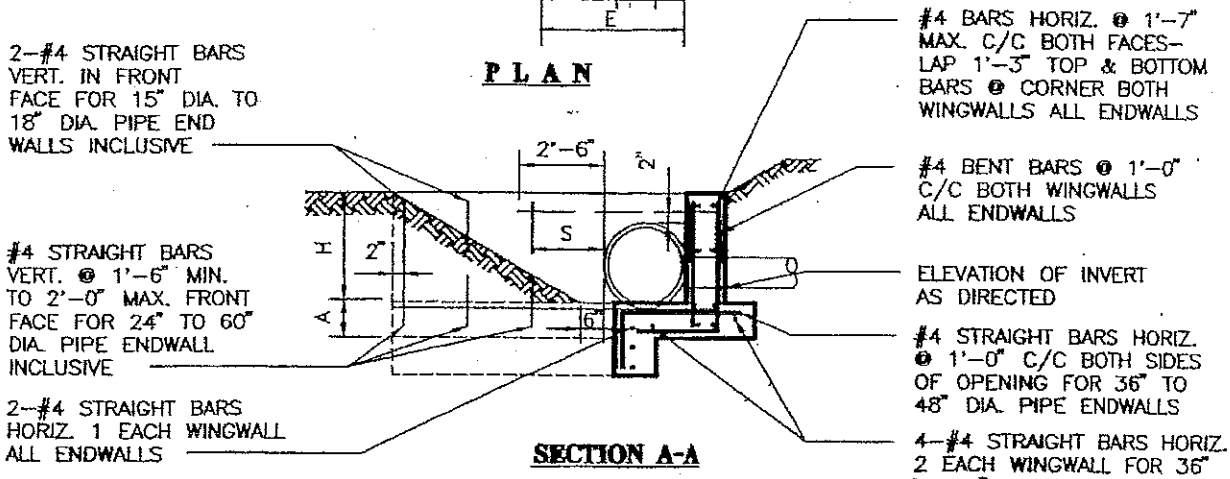
REVISION
JAN. 2001

STORM DRAIN
TYPE "B" HEADWALL FOR 66", 72", 78", 84" DIA. PIPES

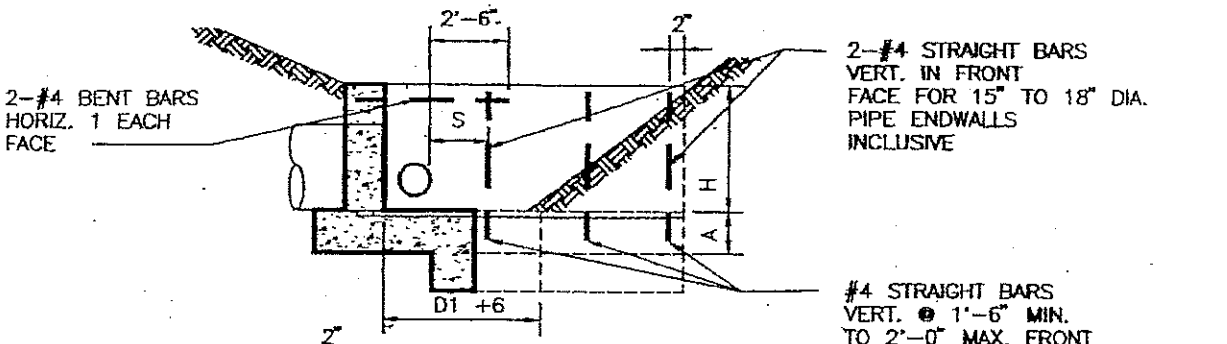
SD 32.0



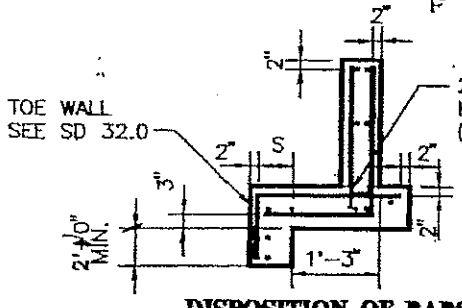
PLAN



SECTION A-A



SECTION B-B



DISPOSITION OF BARS

NOTES:

1. REFER TO SD 30.0 FOR OTHER NOTES.
2. "S" DISTANCE FROM INSIDE SURFACE TO PIPE TO VERTICAL BARS IN FRONT AND REAR FACE
   4" FOR 15" DIA. TO 18" DIA. PIPES INCLUSIVE
   6" FOR 24" DIA. TO 36" DIA. PIPES INCLUSIVE
   8" FOR 42" DIA. TO 48" DIA. PIPES INCLUSIVE
3. FOR DIMENSION TABLE SEE SD 33A.0

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: H E Wild DATE: Stan E. Wildesen, P.E. Assoc. Director 3/16/01	REVISION JAN. 2001	**STORM DRAIN TYPE "H" ENDWALL**	**SD 33.0**

QUANTITY TABLE									
D1	D2	A	B	C	E	H	3:1 SLOPE L	2:1 SLOPE L	G
15"	15"	9"	6"	6"	1'-9"	2'-0"	7'-9"	5'-9"	2'-0"
18"	15"	9"	6"	6"	1'-9"	2'-3"	8'-9"	6'-6"	2'-3"
18"	18"	9"	6"	6"	1'-9"	2'-3"	8'-9"	6'-6"	2'-3"
24"	15"	9"	14"	6"	2'-5"	2'-9"	10'-9"	8'-0"	3'-0"
24"	18"	9"	14"	6"	2'-5"	2'-9"	10'-9"	8'-0"	3'-0"
24"	24"	9"	14"	6"	2'-5"	2'-9"	10'-9"	8'-0"	3'-0"
30"	15"	9"	14"	6"	2'-5"	3'-6"	13'-6"	10'-0"	3'-9"
30"	18"	9"	14"	6"	2'-5"	3'-6"	13'-6"	10'-0"	3'-9"
30"	24"	9"	14"	6"	2'-5"	3'-6"	13'-6"	10'-0"	3'-9"
30"	30"	9"	14"	6"	2'-5"	3'-6"	13'-6"	10'-0"	3'-9"
36"	15"	12"	16"	10"	3'-2"	4'-0"	15'-6"	11'-6"	4'-6"
36"	18"	12"	16"	10"	3'-2"	4'-0"	15'-6"	11'-6"	4'-6"
36"	24"	12"	16"	10"	3'-2"	4'-0"	15'-6"	11'-6"	4'-6"
36"	30"	12"	16"	10"	3'-2"	4'-0"	15'-6"	11'-6"	4'-6"
36"	36"	12"	16"	10"	3'-2"	4'-0"	15'-6"	11'-6"	4'-6"
42"	15"	12"	16"	10"	3'-2"	4'-6"	17'-6"	13'-0"	5'-3"
42"	18"	12"	16"	10"	3'-2"	4'-6"	17'-6"	13'-0"	5'-3"
42"	24"	12"	16"	10"	3'-2"	4'-6"	17'-6"	13'-0"	5'-3"
42"	30"	12"	16"	10"	3'-2"	4'-6"	17'-6"	13'-0"	5'-3"
42"	36"	12"	16"	10"	3'-2"	4'-6"	17'-6"	13'-0"	5'-3"
42"	42"	12"	16"	10"	3'-2"	4'-6"	17'-6"	13'-0"	5'-3"
48"	15"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"
48"	18"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"
48"	24"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"
48"	30"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"
48"	36"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"
48"	42"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"
48"	48"	12"	16"	10"	3'-2"	5'-0"	19'-6"	14'-6"	6'-0"

DEPARTMENT OF ENVIRONMENTAL RESOURCES

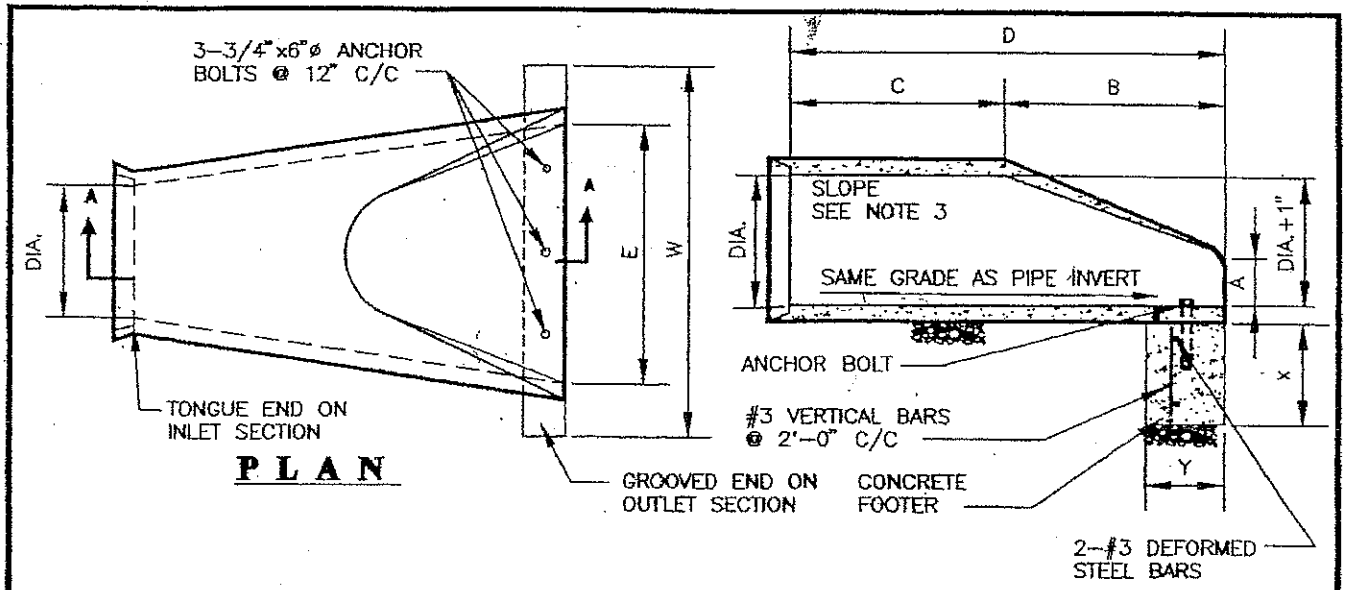
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director

DATE: 3/16/01

REVISION
JAN. 2001

STORM DRAIN TYPE "H" ENDWALL QUANTITY TABLE

SD 33A.0



PLAN

SECTION A-A

TABLE OF DIMENSIONS									
CONCRETE END SECTION							CONCRETE FOOTER		
PIPE DIA.	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"	2' MIN.	9"
18"	3:1	10 1/4"	2'-2"	4'-0"	6'-2"	3'-0"	4'-0"	2' MIN.	9"
21"	3:1	9"	3'-0"	3'-1 1/2"	6'-1 1/2"	3'-6"	4'-6"	2' MIN.	9"
24"	3:1	11"	3'-7"	2'-8"	6'-3"	4'-0"	5'-0"	2' MIN.	9"
27"	3:1	10 1/2"	4'-1 1/2"	2'-0"	6'-1 1/2"	4'-6"	5'-6"	2' MIN.	9"
30"	3:1	1'-1"	4'-5"	1'-10"	6'-3"	5'-0"	6'-0"	2' MIN.	9"
33"	3:1	1'-2"	4'-7"	2'-2"	6'-9"	5'-6"	6'-6"	2' MIN.	9"
36"	3:1	1'-3 1/2"	5'-3"	3'-1"	8'-1 1/2"	6'-0"	7'-3"	2' MIN.	9"
42"	3:1	1'-9 1/4"	5'-5"	2'-10"	8'-3"	6'-6"	7'-9"	2' MIN.	9"
48"	3:1	2'-1"	6'-0"	2'-2"	8'-2"	7'-0"	8'-6"	2' MIN.	12"
54"	2.4:1	2'-5"	5'-2"	2'-10"	8'-0"	7'-6"	9'-0"	2' MIN.	12"
60"	2:1	2'-7"	4'-11"	3'-8 1/2"	8'-7 1/2"	8'-0"	9'-6"	2' MIN.	12"
66"	2:1	2'-4"	6'-6"	1'-9"	8'-3"	8'-6"	10'-0"	2' MIN.	12"
72"	2:1	2'-10"	6'-6"	1'-9"	8'-3"	9'-0"	10'-9"	2' MIN.	12"

NOTES:

1. END SECTION MUST BE REINFORCED TO CONFORM WITH ASTM C-76 CLASS IV PIPE.
2. DEFORMED STEEL BARS TO BE ASTM A615 GRADE 60. CONCRETE fc' = 4,000 psi @ 28 DAYS.
3. INVERT ELEVATION TO BE AT THE PIPE END OF THE STANDARD END SECTION ELEVATIONS TO BE NOTED ON CONSTRUCTION PLANS.
4. CONCRETE FOOTER SHALL ALWAYS BE USED WHEN SD 34.0 IS SPECIFIED ON THE PLAN. COST OF CONCRETE FOOTER TO BE INCLUDED IN THE PRICE OF END SECTION.
5. USE EPOXY BONDING AGENT TO FILL A VOID OF ANCHOR BOLTS.
6. 6" THICK BEDDING OF NO. 57 AGGREGATE ON FIRM SUBGRADE
7. PROVIDE RAILING FENCE WHEN PIPE SIZE IS 42" OR GREATER.

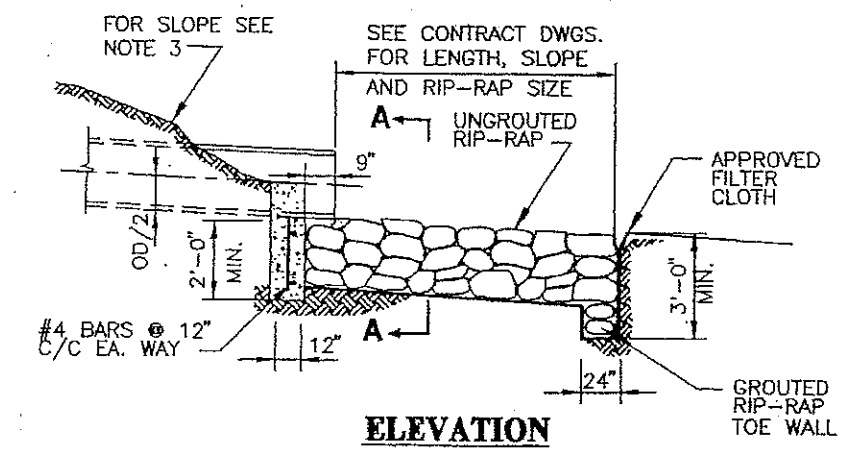
DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: Stan E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

REVISION
JAN. 2001

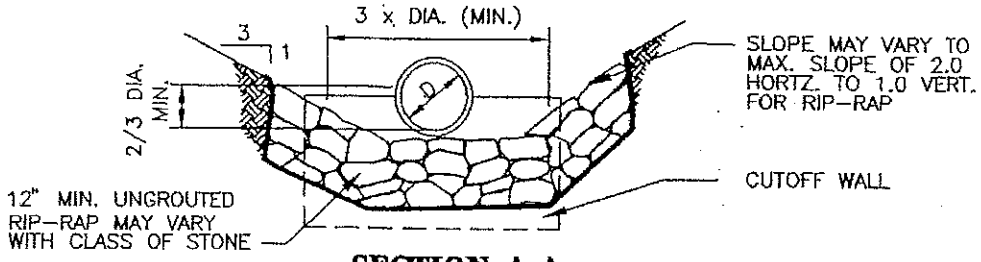
STORM DRAIN
PRECAST CONCRETE END SECTION ROUND PIPE

SD 34.0

RIP RAP CHANNEL

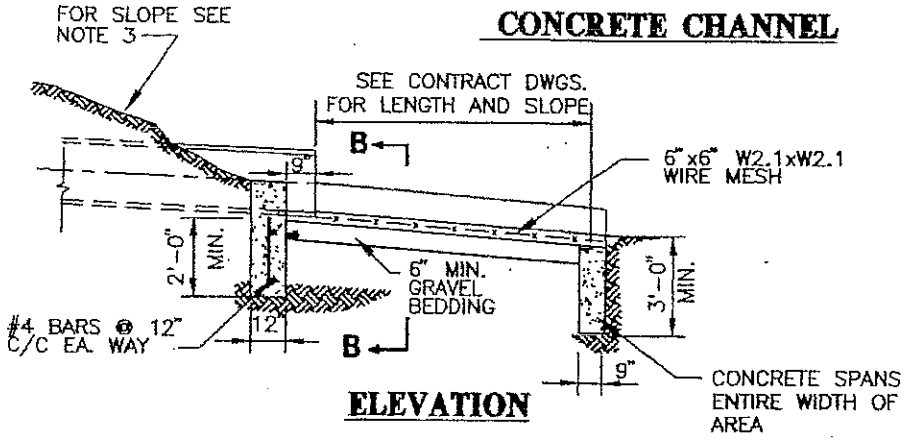


ELEVATION

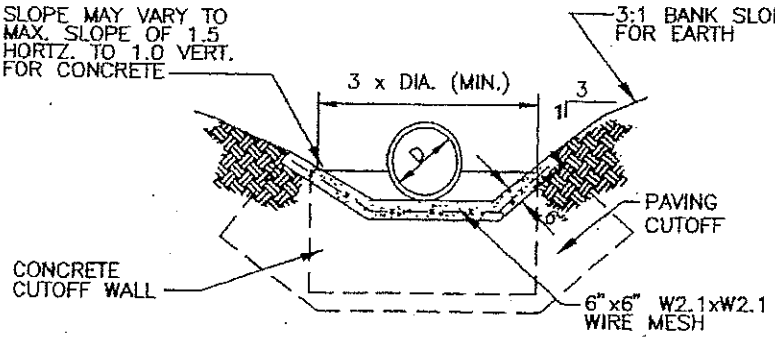


SECTION A-A

CONCRETE CHANNEL



ELEVATION

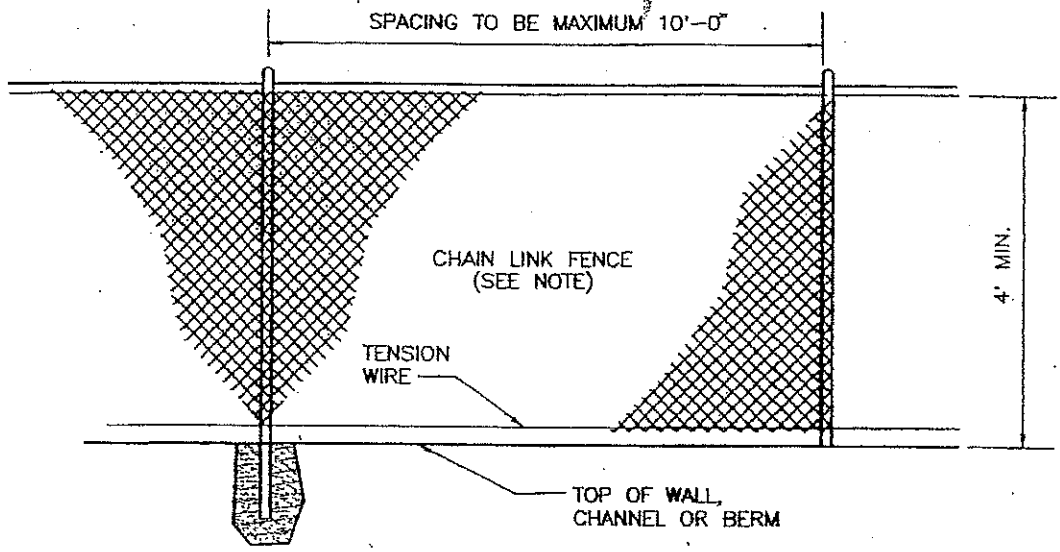


SECTION B-B

NOTES:

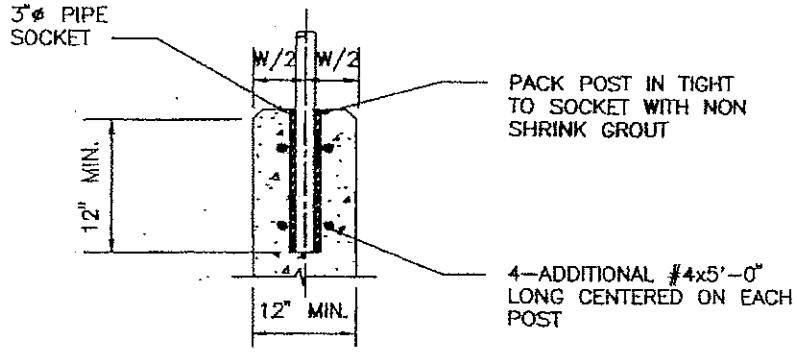
1. PAVING TO BE USED ONLY WHERE DIRECTED OR SHOWN. WHEN CONCRETE PAVING IS USED WIRE MESH SHALL BE EXTENDED DOWN INTO CUTOFF WALL AT LOWER END OF PAVEMENT.
2. CONCRTE STRENGTH fc' = 4,000 psi @ 28 DAYS AND SHALL BE AIR ENTRAINED. ALL DEFORMED BARS SHALL BE ASTM A 615 GRADE 60.
3. THE SLOPE BEHIND THE OUTFALL SHALL BE AS PER APPROVED PLAN AND NO GREATER THAN 3:1.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: H. E. Wild Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN CUTOFF WALL AND OUTFALL DETAIL**	**SD 35.0**

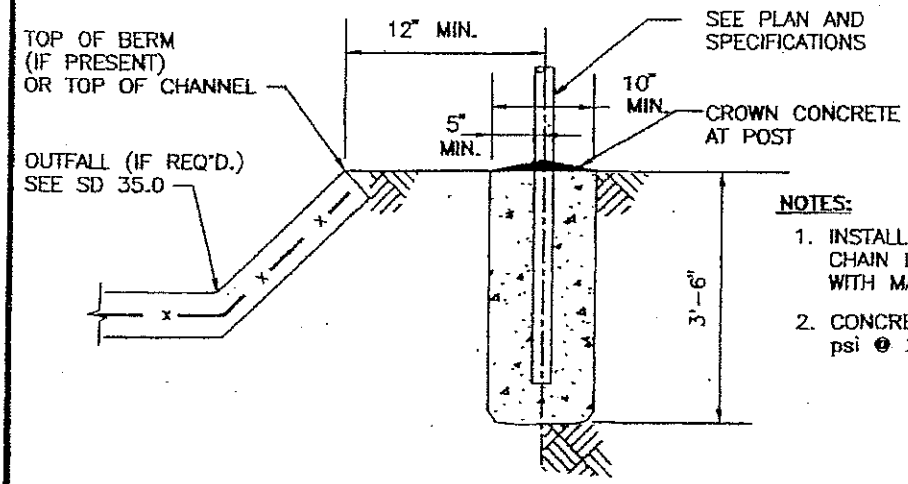


CHAIN LINK FENCE DETAIL

NOTE: REFER TO PLANS AND SPECIFICATIONS FOR GATE INFORMATION



POST INSTALLATION WALL

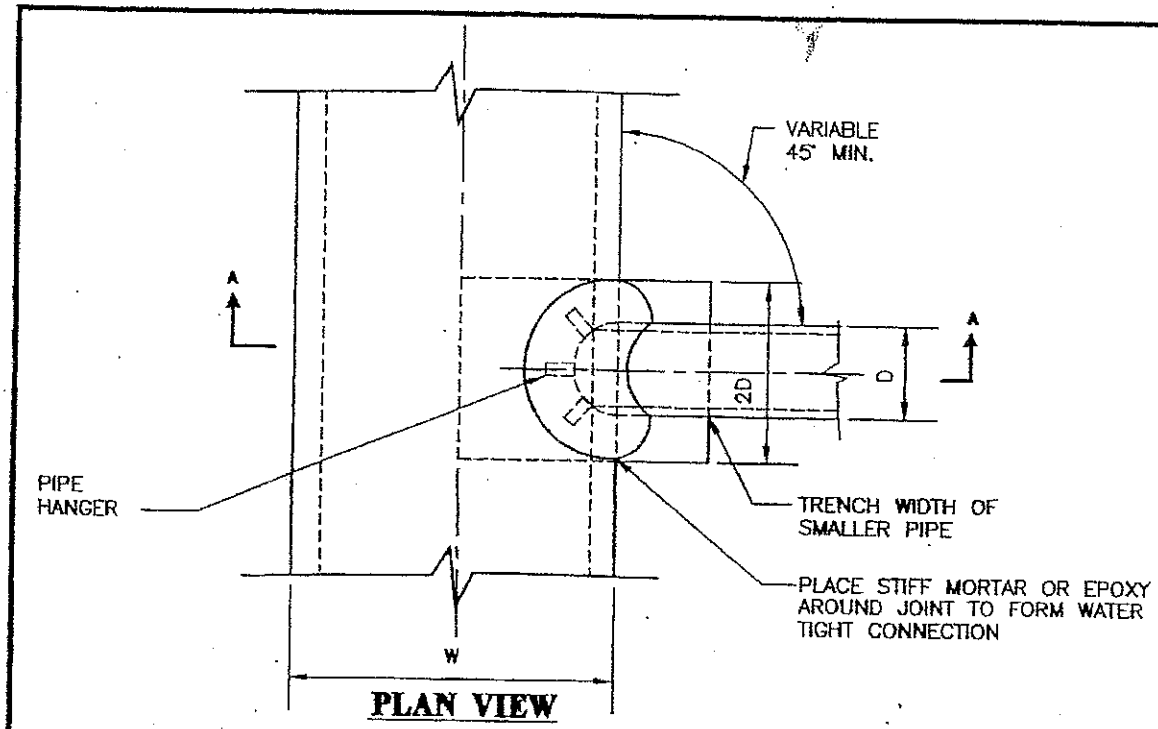


NOTES:

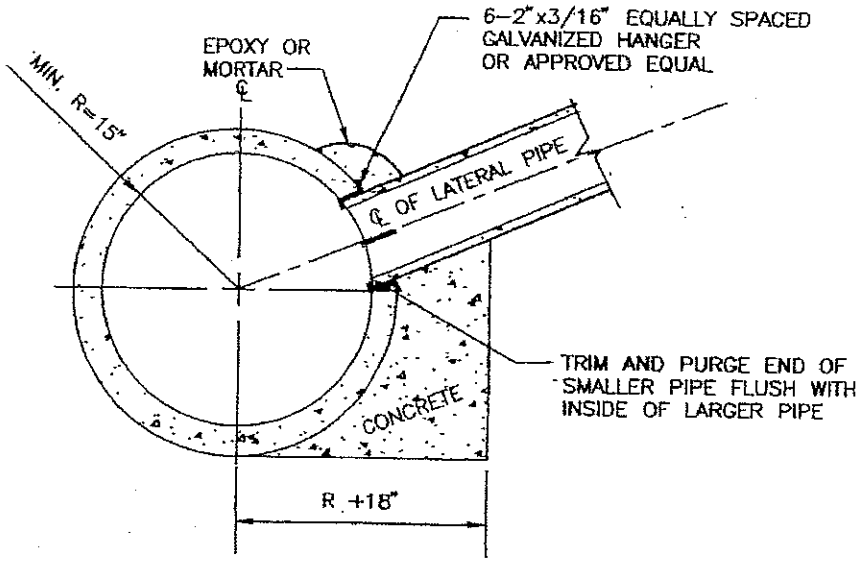
1. INSTALLATION AND SPECIFICATION OF CHAIN LINK FENCE SHALL BE IN COMPLIANCE WITH MANUFACTURER'S MANUAL.
2. CONCRETE STRENGTH SHALL BE fc' = 4,000 psi @ 28 DAYS WITH AIR ENTRAINED.

POST INSTALLATION ALONG CHANNEL

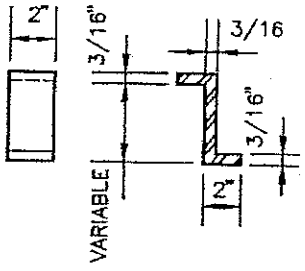
DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: _____ DATE: 3/16/01 Stan E. Wideman, P.E. Assoc. Director	REVISION JAN. 2001	STORM DRAIN CHAIN LINK FENCE DETAIL	SD 40.0



PLAN VIEW



SECTION A-A

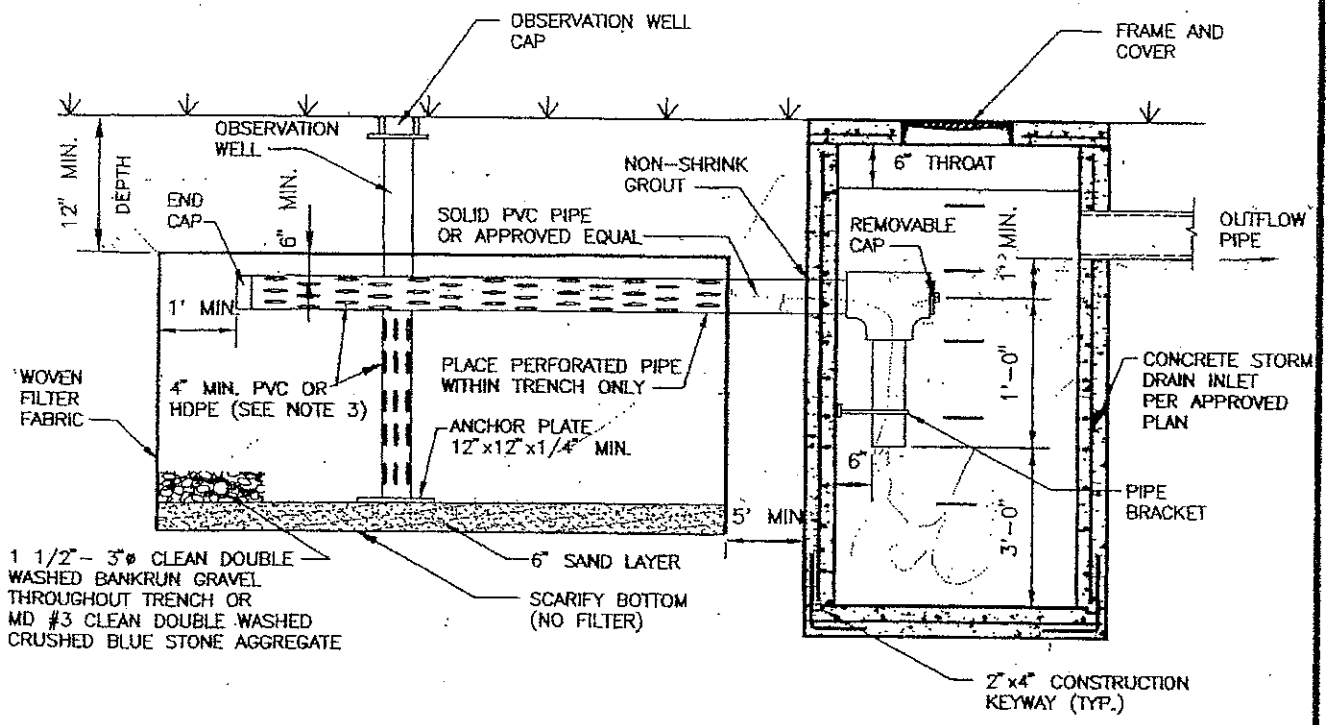


PIPE HANGER

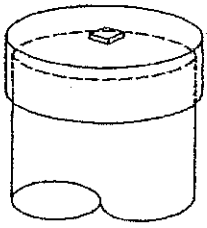
NOTES

1. OPENING MUST BE MADE WITH APPROPRIATE EQUIPMENT. ANY CRACKING OR DAMAGE OF PIPE WILL REQUIRE DETERMINATION OF ACCEPTANCE BY THE INSPECTOR.
2. CONCRETE FILLING TO BE fc'=3,500 psi OR HIGHER IN STRENGTH.

DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISION		
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	JAN. 2001	STORM DRAIN FIELD CONNECTION FOR RCP	SD 50.0



ELEVATION

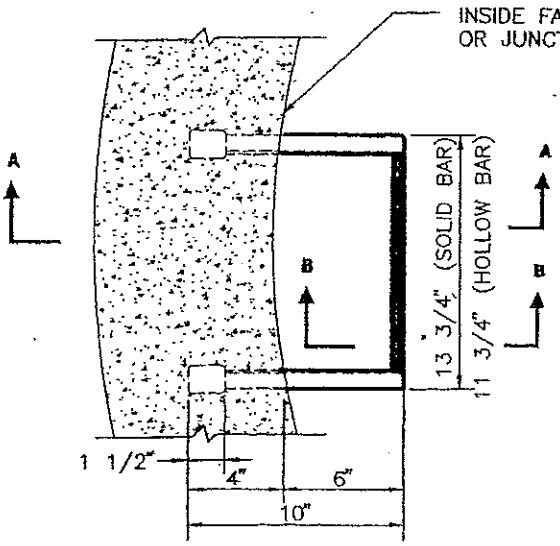


THREADED WELL CAP (CLOSED)

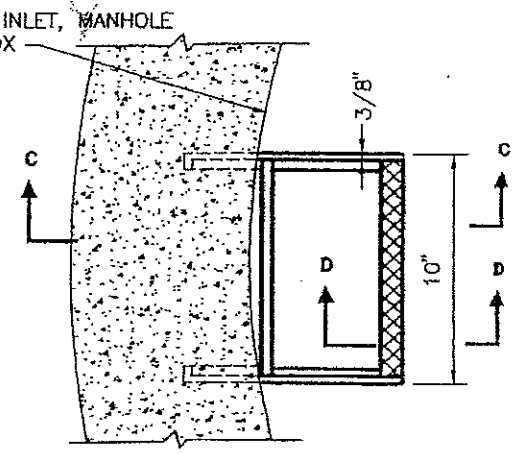
NOTES:

1. FILTER CLOTH TO BE PLACED AT ALL SIDES, EXCEPT THE BOTTOM.
2. SET WELL CAP ABOVE GRADE IN UNIMPROVED AREAS.
3. PIPE SIZES SHALL BE IN ACCORDANCE WITH THE APPROVED PLAN.

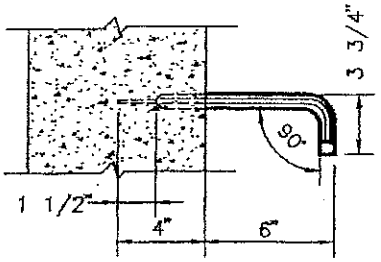
DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: L. E. Widesen Stan E. Widesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN INFILTRATION SYSTEM DETAIL**	**SD 70.0**



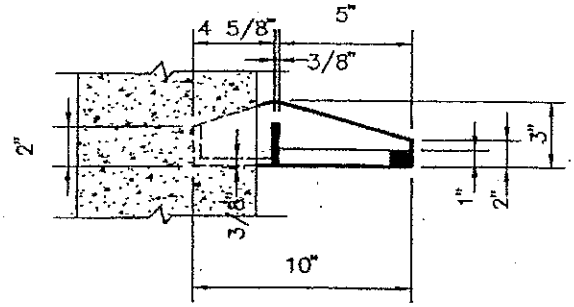
PLAN - 1



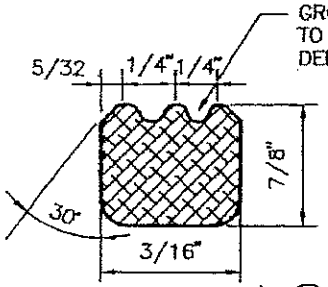
PLAN - 2



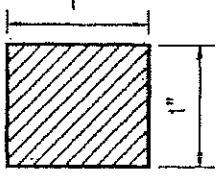
SECTION A-A



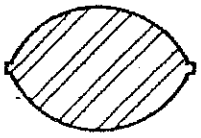
SECTION C-C



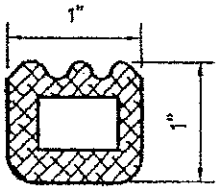
SECTION B-B (1)
ALUMINUM ALLOY (SOLID BAR)



SECTION D-D (2)
CAST IRON



ALTERNATE
SECTION B-B (3)
STEEL

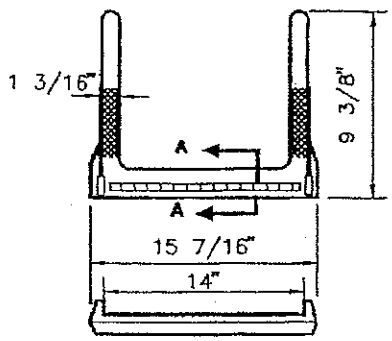


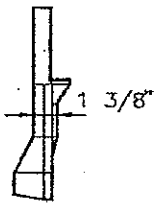
ALTERNATE
SECTION B-B (4)
ALUMINUM ALLOY (HOLLOW BAR)

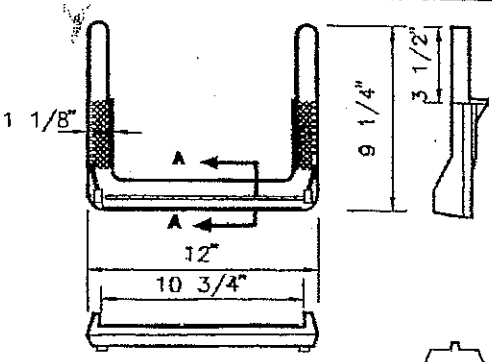
NOTES:

1. METAL LADDER RUNGS ARE TO BE USED IN INLETS, MANHOLES AND JUNCTION BOXES OVER 3' IN DEPTH OR AS DIRECTED BY THE ENGINEER, USED EITHER WITH BRICK OR CONCRETE CONSTRUCTION. (WHERE BRICK CONSTRUCTION IS EMPLOYED, THE MORTAR JOINTS SHALL BE ADJUSTED TO ACCOMMODATE LADDER RUNGS) METAL LADDER RUNGS MAY BE COMPRISED OF ONE OF THE FOLLOWING:
   - (1) ALUMINUM ALLOY–SHALL CONFORM TO ASTM DESIGNATION B221 ALLOY 6061–T6. THAT PORTION EMBEDDED IN THE STRUCTURE SHALL BE COATED WITH ZINC CHROMATE OR APPROVED EQUIVALENT.
   - (2) CAST IRON SHALL CONFORM TO ASTM A48 CLASS 308.
   - (3) STEEL SHALL CONFORM TO ASTM A615 GRADE 48, GALVANIZED AFTER FABRICATION AS PER ASTM A153.
   - (4) ALUMINUM ALLOY–SHALL CONFORM TO ASTM DESIGNATION B221 ALLOY 6061–T6. THAT PORTION EMBEDDED IN THE STRUCTURE SHALL BE COATED WITH ZINC CHROMATE OR APPROVED EQUIVALENT.
2. ALL STEPS TO BE 12" ±1" CENTER TO CENTER.
3. BOTTOM STEP TO BE 5" MIN. AND 16 1/2" MAX. ABOVE WORKING LEVEL.
4. STEPS SHALL BE SET SUCH THAT THEY ARE IN VERTICAL ALIGNMENT WITH MANHOLE ACCESS OPENING AND ALIGN WITH BENCH.

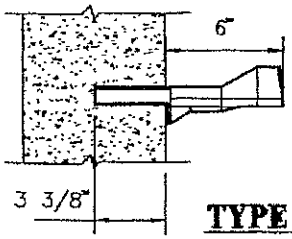
DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISION		
APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director — DATE: 3/16/01	JAN. 2001	STORM DRAIN MANHOLE AND INLET STEPS IN CHANNELS	SD 80.0





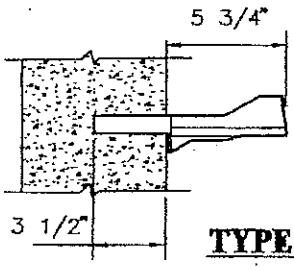


SETION A-A

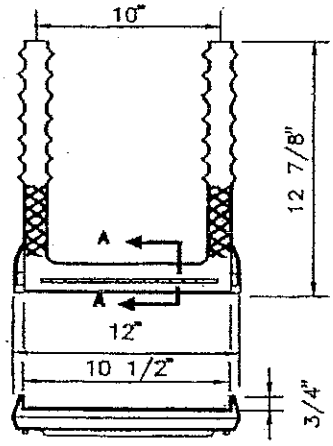


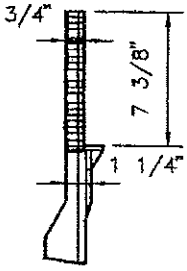
TYPE "A"

SETION A-A

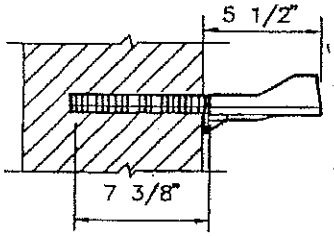


TYPE "B"

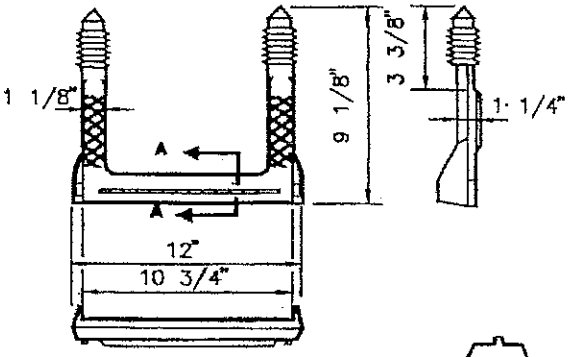




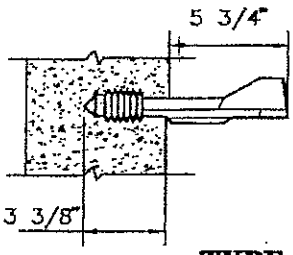
SETION A-A



TYPE "C"



SETION A-A

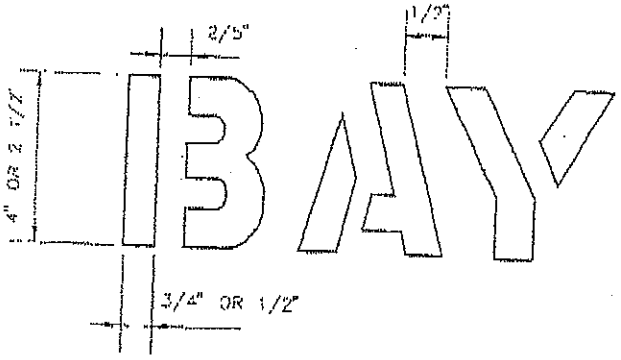


TYPE "D"

NOTES:

1. TYPES "A" AND "B" ARE TO BE DRIVEN INTO RECEPTACLES THAT ARE CAST INTO WALL.
2. TYPE "C" IS FOR BRICK OR BLOCK INSTALLATIONS.
3. TYPE "D" IS PRESS FITTED INTO PREFORMED CONCRETE HOLES.
4. LADDER RUNGS ARE TO BE USED IN INLETS. MANHOLES AND JUNCTION BOXES OVER 3 FEET IN DEPTH OR AS DIRECTED BY ENGINEER, USED EITHER WITH BRICK OR CONCRETE CONSTRUCTION. (WHERE BRICK CONSTRUCTION IS EMPLOYED, MORTAR JOINTS SHALL BE ADJUSTED.
5. COPOLYMER POLYPROPYLENE ENCAPSULATED 1/2"ø STEEL REINFORCEMENT BAR STEEL SHALL CONFORM TO ASTM A615 GRADE 60 AND SHALL BE CERTIFIED BY MANUFACTURER TO CONFORM TO ASTM 4101 AND HAVE A MINIMUM EXPOSED THICKNESS OF 1/8".
6. SECTION A–A SHOWS 1/2"ø STEEL REINFORCEMENT BAR.
7. INSTALLATION SHALL CONFORM TO MANUFACTURER'S RECOMMENDATIONS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	STORM DRAIN COPOLYMER POLYPROPYLENE STEEL ENCAPSULATED LADDER RUNG	SD 81.0

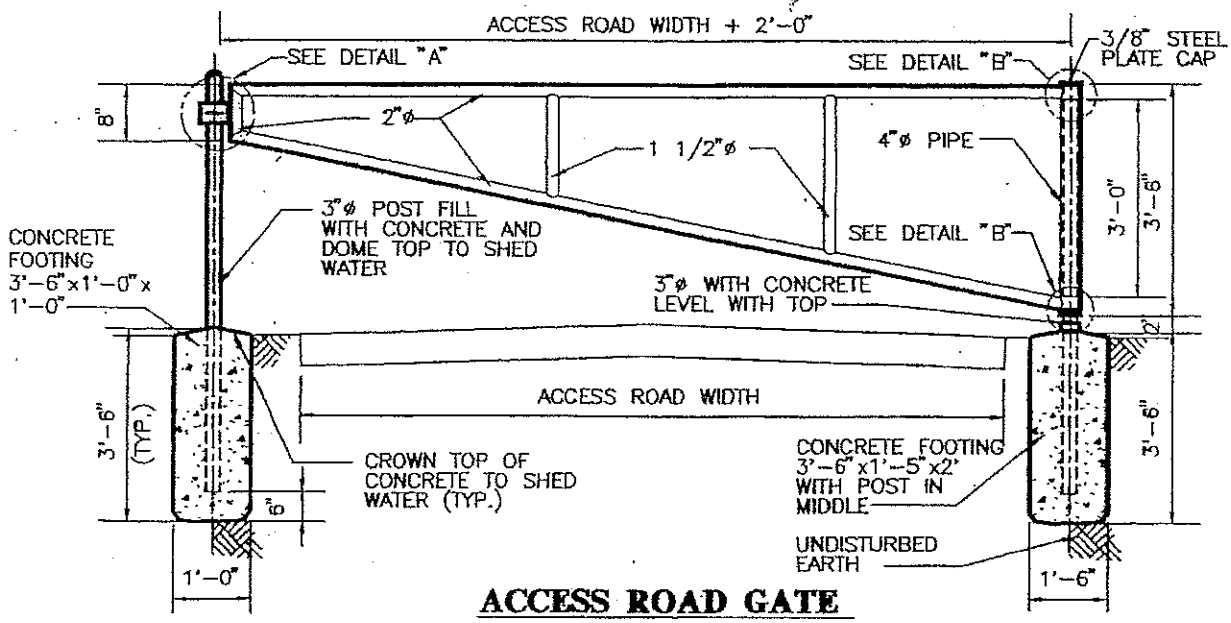


SAMPLE
NOT TO SCALE

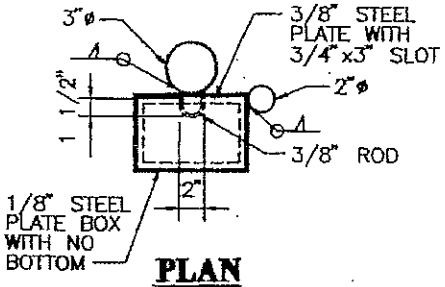
NOTE

1. THE WORDS "CHESAPEAKE BAY DRAINAGE" AND "DON'T DUMP" MUST BE PLACED ON THE ARMOR CHANNEL OF THE COUNTY'S PUBLIC AND PRIVATE STORM DRAIN INLETS.
2. GRAY RUST-PROOFING NONTOXIC PAINT FOR THE BACKGROUND.
3. BLUE ENAMEL SPRAY NONTOXIC PAINT FOR LETTERS.
4. FOR OTHER SPECIFICATIONS, REFER TO MANUFACTURER'S INSTRUCTIONS.

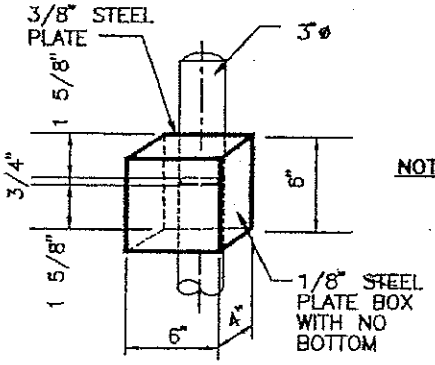
DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Stan C. Widerman, P.E. Assoc. Director DATE:	REVISION JAN. 2001	STORM DRAIN SIGN STENCIL	SD 82.0



ACCESS ROAD GATE

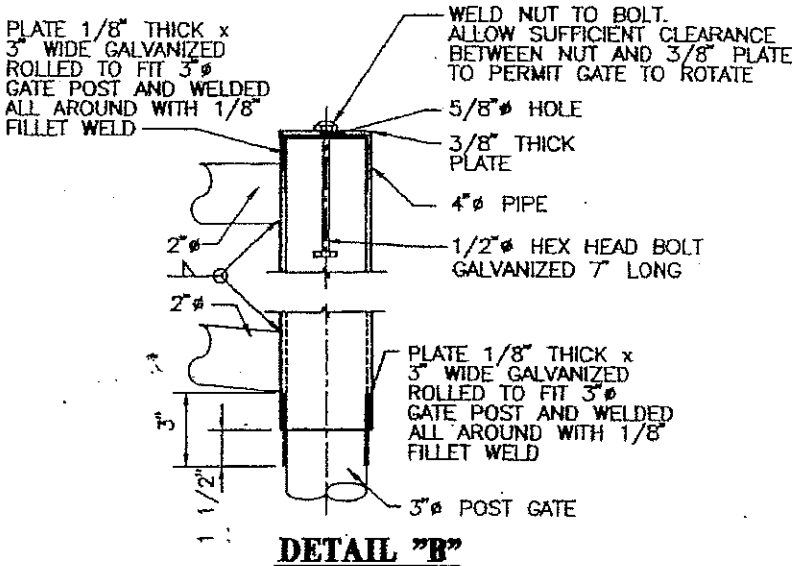


PLAN



ELEVATION

DETAIL "A"

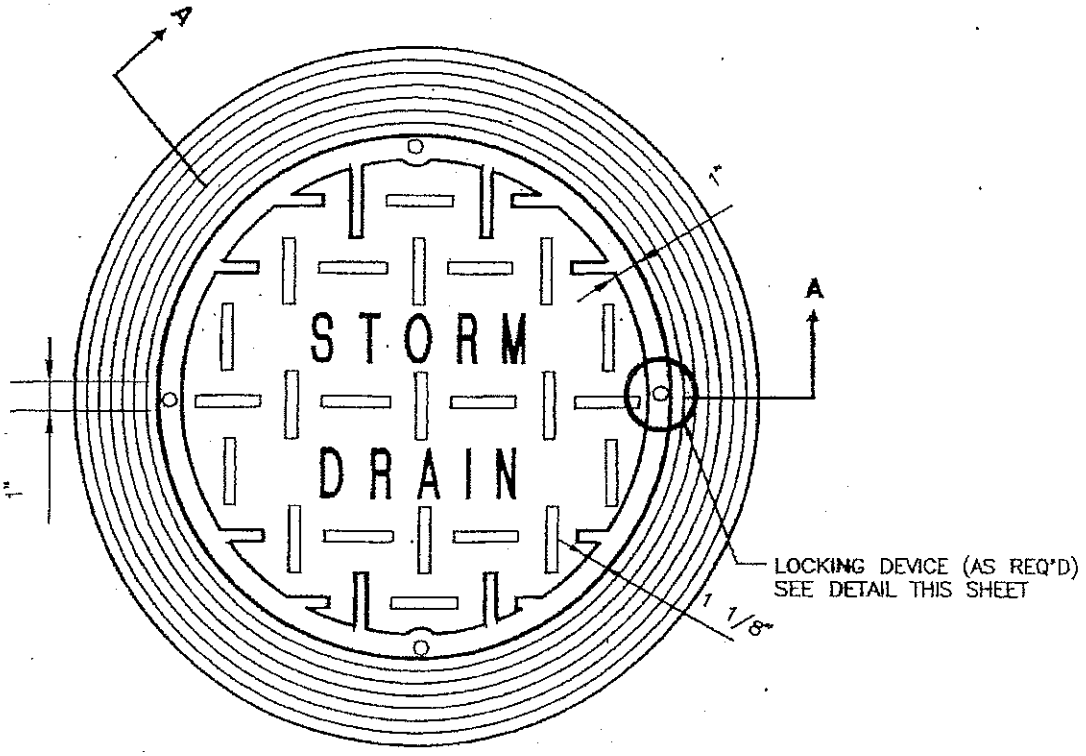


DETAIL "B"

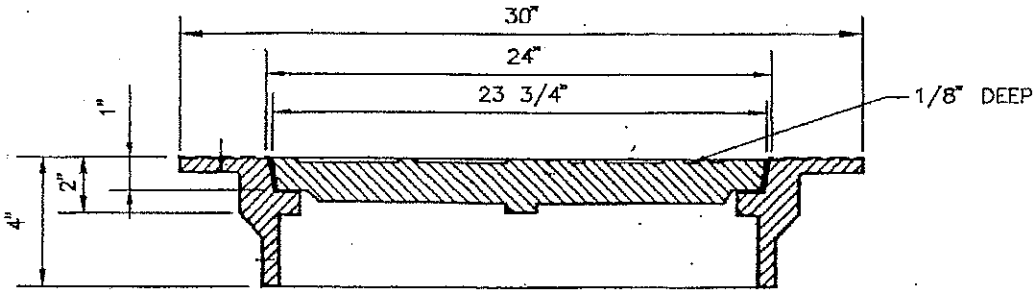
NOTES:

1. ALL METAL USED IN THE MANUFACTURE OF THE ACCESS ROAD GATE TO BE HOT DIP GALVANIZED. ALL WELDS AND PIPE TO BE PAINTED AND TOUCHED UP IN ACCORDANCE WITH MANUFACTURES RECOMMENDATIONS.
2. ALL JOINTS TO BE WELDED ALL AROUND WITH 3/16" WELDS.
3. ALL PIPE TO BE SCHEDULE 40 STEEL. DIAMETERS SHOWN ARE NOMINAL PIPE SIZE.
4. PADLOCK WILL BE FURNISHED BY PRINCE GEORGE'S COUNTY IF IT IS IN PUBLIC PROPERTY.
5. CONTRACTOR SHALL PROVIDE AN ADDITIONAL 3"ø POST WITH 3/8" ROD. LOCATE TO HOLD GATE IN AN OPEN POSITION 90° FROM THAT SHOWN BELOW.
6. GATE TO SWING IN TOWARDS PRINCE GEORGE'S COUNTY PROPERTY OR EASEMENT.
7. WIDTH OF GATE NOT TO EXCEED 16 FT.
8. CONCRETE STRENGTH fc' = 4,000 psi @ 28 DAYS WITH AIR ENTRAINED.

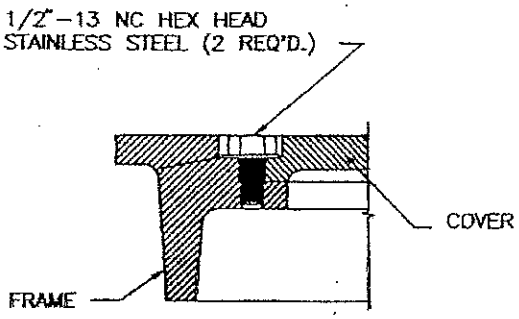
DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISION	STORMWATER MANAGEMENT ACCESS ROAD GATE	SD 83.0
APPROVED BY: [signature] DATE: 3/16/01 Stan E. Wildesen, P.E. Assoc. Director	JAN. 2001		



PLAN



SECTION A-A

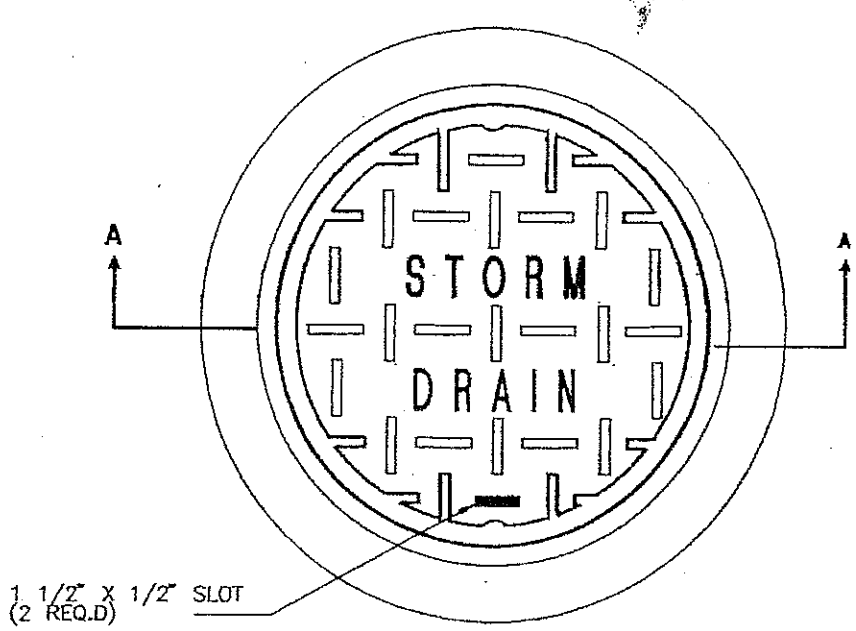


LOCKING DEVICE DETAIL
(AS REQUIRED)

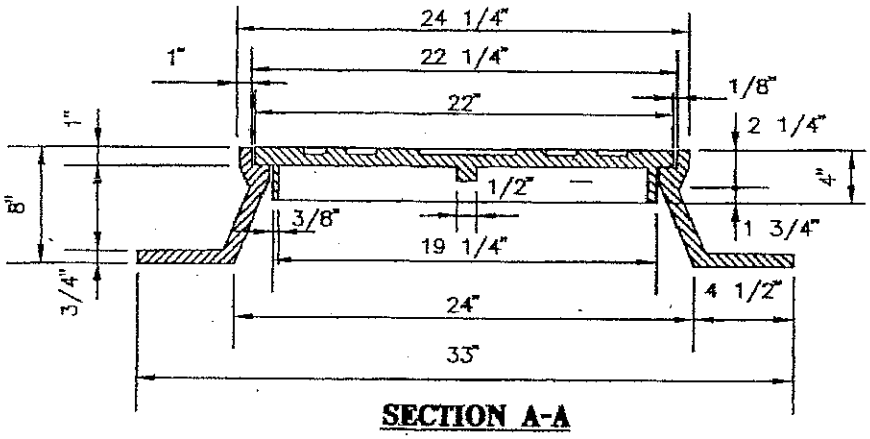
NOTE:

1. THE WORDS "STORM DRAIN" SHALL BE CAST INTO THE TOP CENTER OF ALL STORM DRAIN COVERS.
2. MATERIAL OF FRAME AND COVER SHALL BE CAST IRON OR DUCTILE IRON CASTING.
3. CAST IRON SHALL CONFORM TO ASTM A48 CLASS 30 OR AASHTO M105 CLASS 30.
4. DUCTILE IRON COATING SHALL CONFORM TO ASTM A536 GRADE 65-45-12.
5. MINIMUM PROOF LOAD TEST OF 4,000 LBS. SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF FEDERAL SPECIFICATIONS RR-F-621.
6. PROVIDE NON-SLIP TREAD ON COVER.
7. LOCKING DEVICE AS REQUIRED AS SHOWN ON DRAWING OR APPROVED EQUAL.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Ston E. Wildesen Ston E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN MANHOLE FRAME & COVER (NON-TRAFFIC AREA)**	**SD 90.0**



PLAN

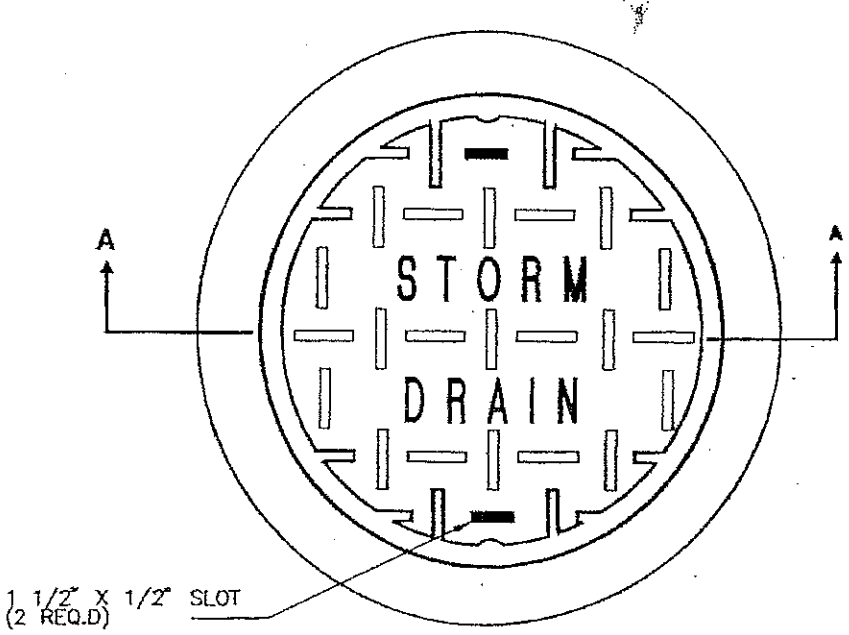


SECTION A-A

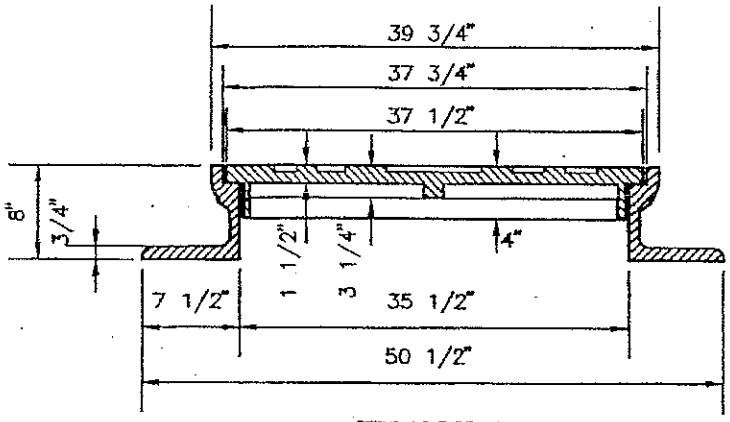
NOTE:

1. THE WORDS "STORM DRAIN" SHALL BE CAST INTO THE TOP CENTER OF ALL STORM DRAIN COVERS.
2. MATERIAL OF FRAME AND COVER SHALL BE CAST IRON OR DUCTILE IRON CASTING.
3. CAST IRON SHALL CONFORM TO ASTM A48 CLASS 30 OR AASHTO M105 CLASS 30.
4. DUCTILE IRON COATING SHALL CONFORM TO ASTM A536 GRADE 65–45–12.
5. FRAME AND COVER SHALL BE HEAVY DUTY TO CONFORM WITH AASHTO H20/HS20 LOADING CONDITIONS (16,000 LBS. WHEEL LOADS).
6. MINIMUM PROOF LOAD TEST OF 25,000 LBS. SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF FEDERAL SPECIFICATIONS RR–F–621.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Ston E. Wildesen Ston E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN MANHOLE RING AND COVER (TRAFFIC AREA)**	**SD 90.1**



PLAN

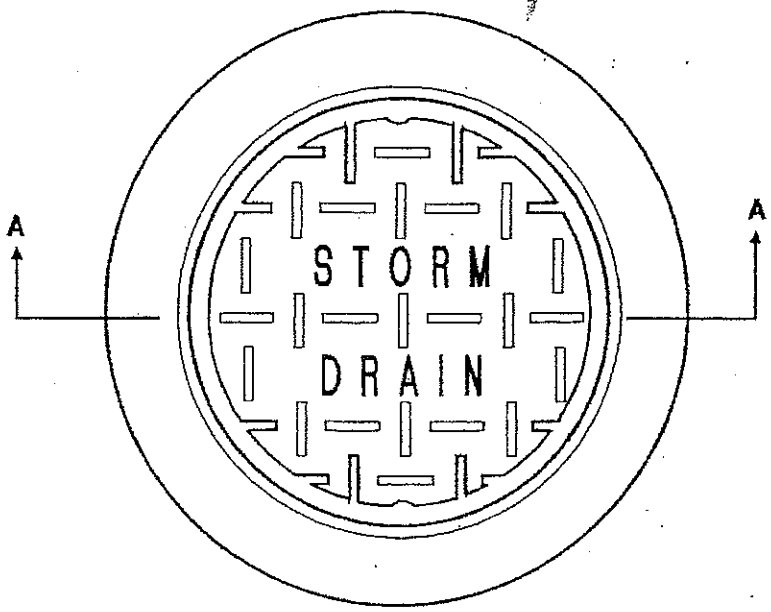


SECTION A-A

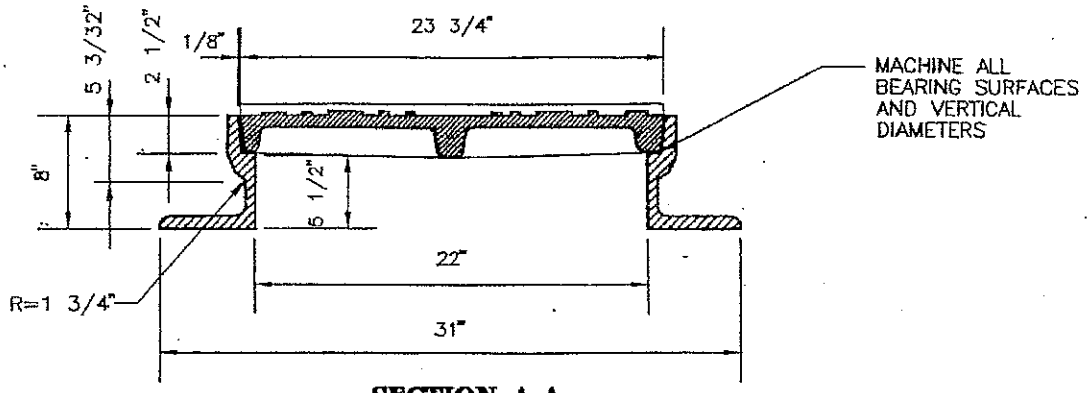
NOTE:

1. THE WORDS "STORM DRAIN" SHALL BE CAST INTO THE TOP CENTER OF ALL STORM DRAIN COVERS.
2. MATERIAL OF FRAME AND COVER SHALL BE CAST IRON OR DUCTILE IRON CASTING.
3. CAST IRON SHALL CONFORM TO ASTM A48 CLASS 30 OR AASHTO M105 CLASS 30.
4. DUCTILE IRON COATING SHALL CONFORM TO ASTM A536 GRADE 65-45-12.
5. FRAME AND COVER SHALL BE HEAVY DUTY TO CONFORM WITH AASHTO H20/HS20 LOADING CONDITIONS (16,000 LBS. WHEEL LOADS).
6. MINIMUM PROOF LOAD TEST OF 25,000 LBS. SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF FEDERAL SPECIFICATIONS RR-F-621.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: _____ DATE: Stan E. Wildesen, P.E. Assoc. Director 3/16/01	REVISION JAN. 2001	**STORM DRAIN FRAME AND COVER FOR 6' AND 7' DIA. MANHOLES (TRAFFIC AREA)**	**SD 90.2**



PLAN

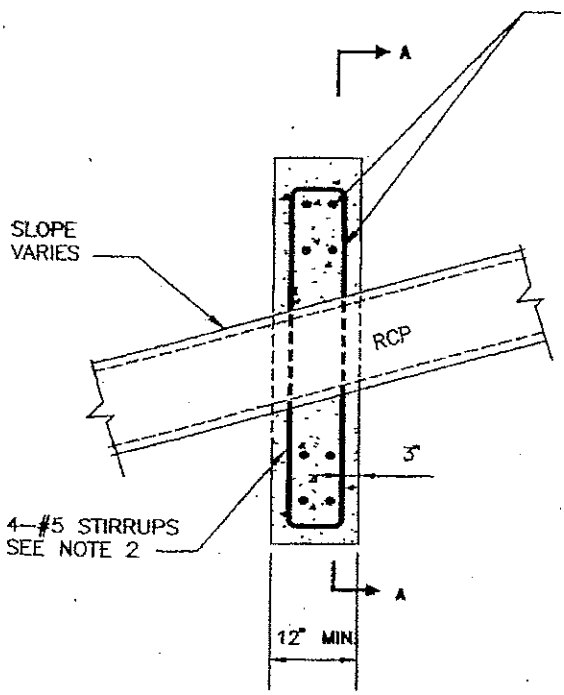


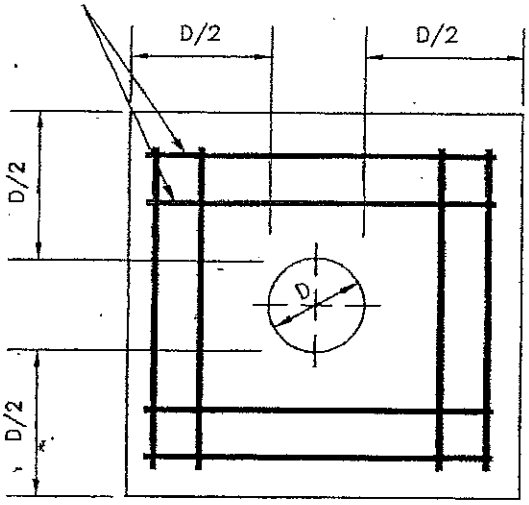
SECTION A-A

NOTE:

1. THE WORDS "STORM DRAIN" SHALL BE CAST INTO THE TOP CENTER OF ALL STORM DRAIN COVERS.
2. MATERIAL OF FRAME AND COVER SHALL BE CAST IRON OR DUCTILE IRON CASTING.
3. CAST IRON SHALL CONFORM TO ASTM A48 CLASS 30 OR AASHTO M105 CLASS 30.
4. DUCTILE IRON COATING SHALL CONFORM TO ASTM A536 GRADE 65–45–12.
5. FRAME AND COVER SHALL BE HEAVY DUTY TO CONFORM WITH AASHTO H20/HS20 LOADING CONDITIONS (16,000 LBS. WHEEL LOADS).
6. MINIMUM PROOF LOAD TEST OF 25,000 LBS. SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST VERSION OF FEDERAL SPECIFICATIONS RR–F–621.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: S. E. Wildesen Stan E. Wildesen, P.E. Assoc. Director DATE: 3/16/01	REVISION JAN. 2001	**STORM DRAIN MANHOLE FRAME AND COVER (TRAFFIC AREA)**	**SD 90.3**





ELEVATION

SECTION A-A

NOTES:

1. fc'= 4000psi @ 28 DAYS.
2. ALL REINFORCING STEEL TO BE ASTM A615 GRADE 60.
3. CARRY ALL BEARING SURFACES TO FIRM SUBGRADE. PLACE CONCRETE ANCHOR AGAINST DOWNGRADE SIDE OF BELL.
4.

PIPE SLOPE	MAX. DISTANCE OF ANCHOR C.C.
20%–34%	36'
35%–50%	24'
50% OR MORE	16'

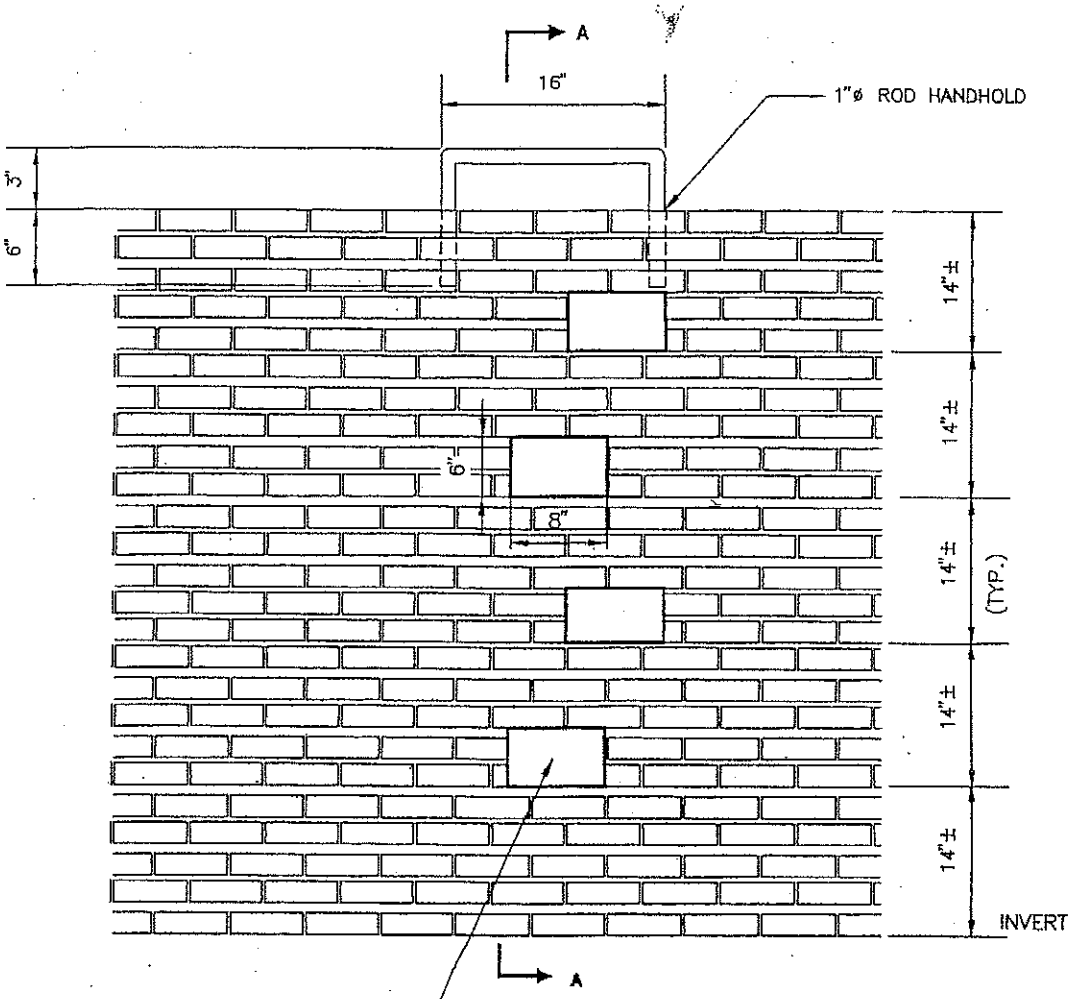
5. USE EPOXY ADHESIVE TO FILL AREA BETWEEN PIPE AND ANCHOR.
6. 2" MINIMUM CONCRETE CLEARANCE.
7. 1/2" REINFORCEMENT BAR CLEARANCE.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: _____ DATE: 3/16/01
Stan E. Widesen, P.E.
Assoc. Director

REVISION
JAN. 2001

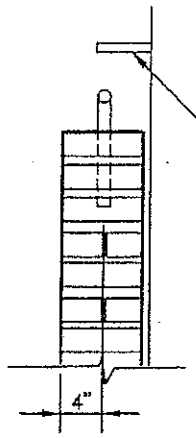
STORM DRAIN CONCRETE ANCHOR FOR 15" TO 30" PIPES

SD 100.0



PROVIDE STEP BY LEAVING BRICKS OUT OF CHANNEL AS SHOWN. STEPS TO BE 4" MINIMUM DEPTH AND PARGE 4" THICKNESS TO SEAL STEP USING NON-SHRINK CONCRETE OR MORTAR

ELEVATION

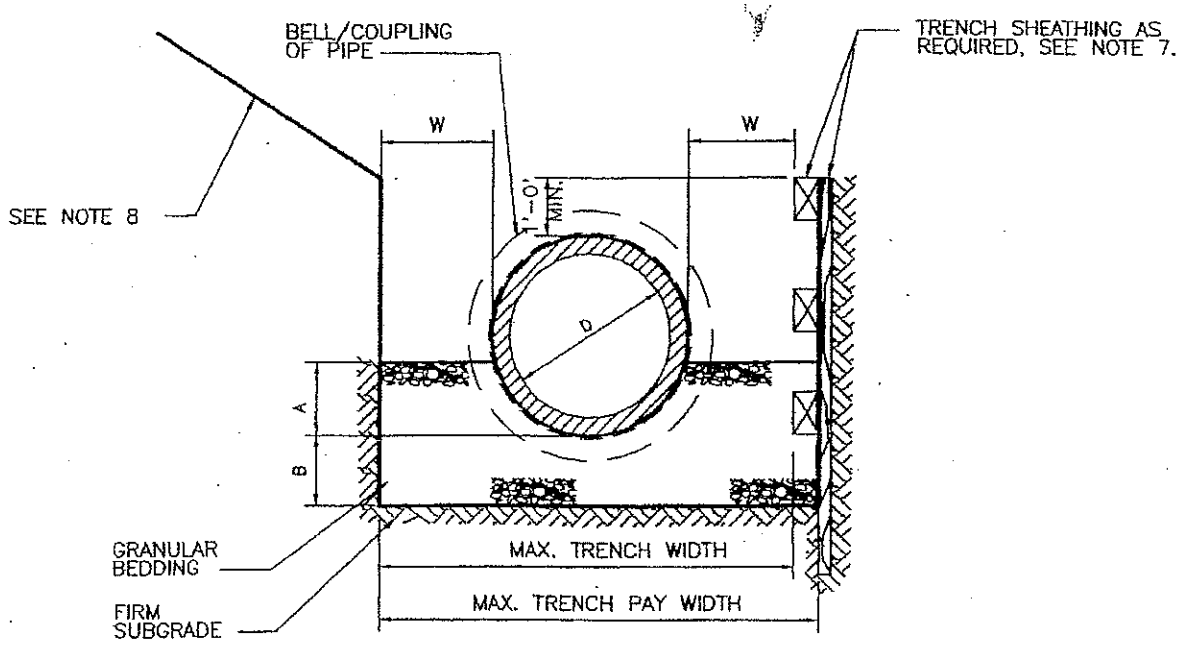


NOTE:

FOR CHANNELS LESS THAN 8" THICK PROVIDE STANDARD MANHOLE STEP 6" MAXIMUM ABOVE TOP OF CHANNEL

SECTION A-A

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: _____ DATE: Ston E. Wildesen, P.E. Assoc. Director 3/16/01	REVISION JAN. 2001	**STORM DRAIN MANHOLE AND INLET STEPS IN CHANNELS**	**SD 110.0**



ELEVATION

DIMENSIONS			
D	A	W	B
15"	5"	8"	6"
16" &18"	6"	8"	6"
20" &21"	7"	8"	6"
24"	8"	12"	6"
27"	8"	12"	6"
30"	9"	12"	6"
33"	10"	15"	6"
36"	10"	15"	6"
42"	13"	15"	6"
48"	15"	18"	6"
54"	16"	18"	6"
60"	18"	18"	6"
66"	21"	18"	6"
72"	21"	18"	6"
78"	23"	18"	6"
84"	25"	18"	6"
90"	26"	18"	6"
96"	28"	18"	12"
102"	30"	18"	12"
108"	32"	18"	12"
114"	34"	24"	12"
120"	36"	24"	12"

NOTES:

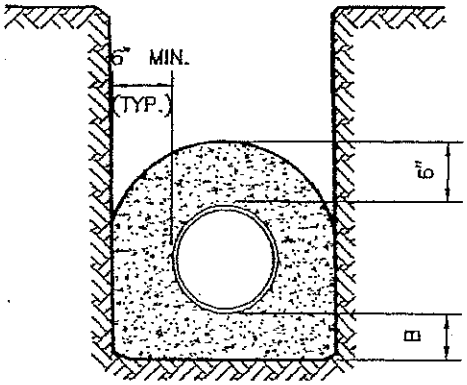
1. THIS DETAIL APPLIES TO RCP STORM DRAIN PIPE ONLY.
2. WHERE SPECIFICALLY REQUIRED, fc' = 3,000 psi @ 28 DAYS CONCRETE AND SADDLE BLOCKS SHALL BE USED IN LIEU OF THE GRAVEL CRADLE.
3. BEDDING MATERIAL FOR CIRCULAR AND ELLIPTICAL PIPES SHALL BE IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENTAL RESOURCES STORMWATER MANAGEMENT STANDARDS AND SPECIFICATIONS.
4. MAXIMUM CLEAR TRENCH WIDTH SHALL BE 2W PLUS THE OUTSIDE DIAMETER OF THE PIPE.
5. THIS PIPE BEDDING DETAIL IS NOT FOR PIPES AND STRUCTURES WITHIN AN STORM MANAGEMENT POND EMBANKMENT.
6. UNLESS OTHERWISE NOTED ON DRAWING, ALL CONSTRUCTION METHODS, PROCEDURES MUST BE IN COMPLIANCE WITH DEPARTMENT OF ENVIRONMENTAL RESOURCES, STORMWATER MANAGEMENT STANDARDS AND SPECIFICATIONS.
7. SHEETING, SHORING AND BRACING SHALL MEET REQUIREMENTS OF MOSHA AND DESIGNED BY THE ENGINEER PRIOR TO APPROVAL.
8. PROVIDE MAXIMUM 4' DEEP VERTICAL SLOPE FOR TRENCH AND USE 1:1 SLOPE ABOVE THE MAXIMUM DEPTH.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: S. E. Wild DATE: 3/16/01
Ston E. Wildesen, P.E.
Assoc. Director

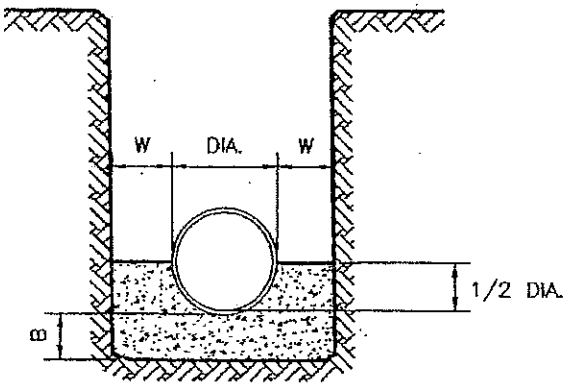
REVISION
JAN. 2001

STORM DRAIN BEDDING AND TRENCH WIDTHS FOR PIPE

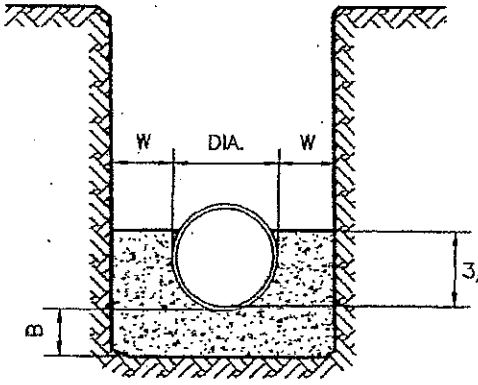
SD 130.0



ENCASEMENT DETAIL



LOW CRADLE DETAIL



HIGH CRADLE DETAIL

DIMENSIONS		
D	W	B
15"	8"	SEE NOTE 1
16" &18"	8"	
20" &21"	8"	
24"	12"	
27"	12"	6"
30"	12"	6"
33"	15"	6"
36"	15"	6"
42"	15"	6"
48"	18"	6"
54"	18"	6"
60"	18"	6"
66"	18"	6"
72"	18"	6"
78"	18"	6"
84"	18"	6"
90"	18"	6"
96"	18"	12"
102"	18"	12"
108"	18"	12"
114"	24"	12"
120"	24"	12"

NOTES:

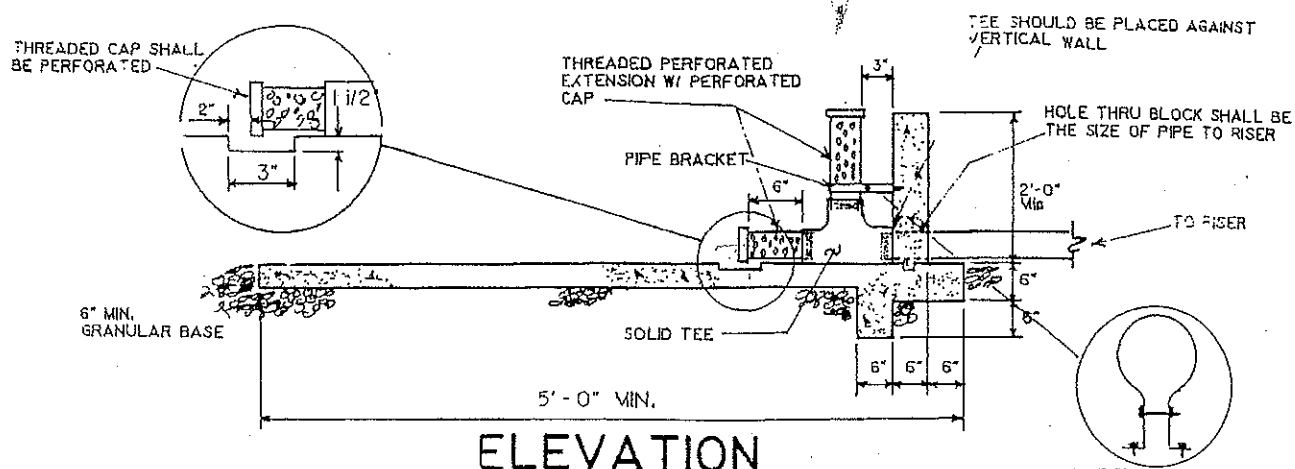
1. 3" MIN. FOR PIPES 24" DIAMETER AND SMALLER SEE TABLE FOR PIPES LARGER THAN 24" DIAMETER
2. PLACE TRENCH SHORING AS REQUIRED.
3. POUR CONCRETE AGAINST UNDISTURBED EARTH. REMOVE SHEETING BEFORE POURING OR LEAVE LOWER PORTION OF SHEETING IN PLACE. ALL CONCRETE SHALL HAVE fc' =3,500 psi @ 28 DAYS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES
APPROVED BY: S. E. Wildesen
Stan E. Wildesen, P.E.
Assoc. Director
DATE: 3/16/01

REVISION
JAN. 2001

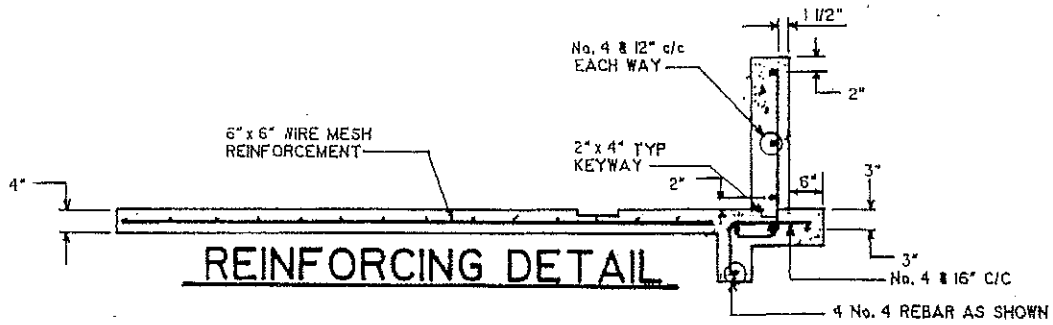
STORM DRAIN CONCRETE & ENCASEMENT CRADLE DETAILS

SD 150.0



ELEVATION

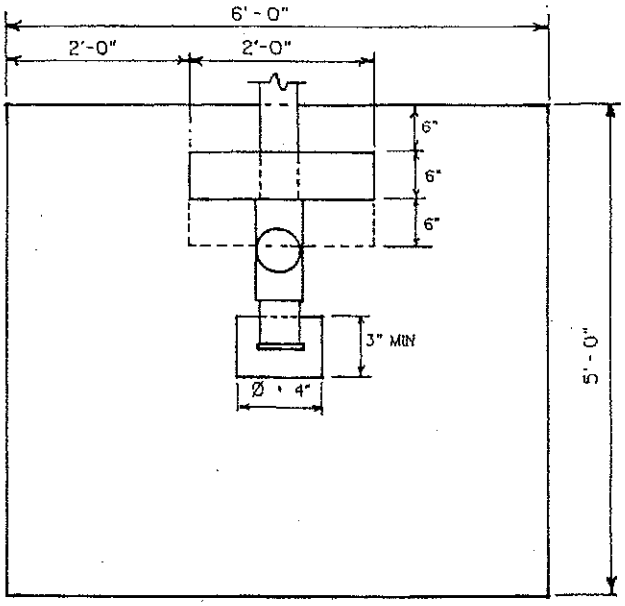
PIPE BRACKET DETAIL



REINFORCING DETAIL

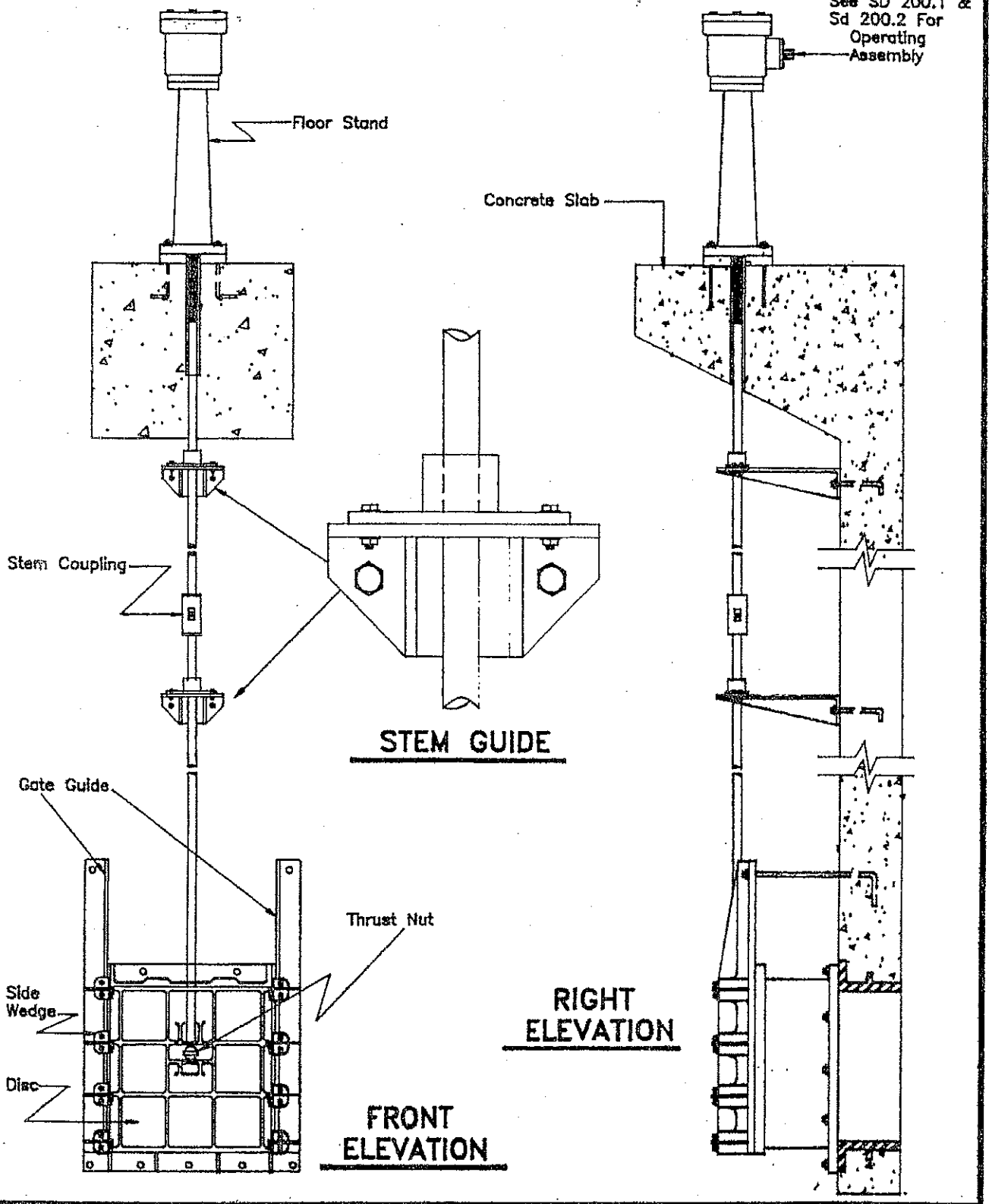
NOTES:

1. TOTAL AREA OF PERFORATIONS = TWICE (2x) THE CROSS SECTIONAL AREA OF PIPE
2. f'_c = 4000 PSI FOR CONC @ 28 DAYS
3. ALL STEEL TO BE ASTM A 615 GRADE 60.
4. PIPE BRACKET SHALL BE GALVANIZED AND COATED WITH BATTLESHIP GREY PAINT (SEE NOTE 5 SD 10.0)
5. ALL EXPOSED EDGES TO HAVE 3/4" x 3/4" CHAMFER OR AS DIRECTED
6. OTHER OPTIONS SHOULD BE APPROVED BY Prince George's County Department Of Environmental Resources, Watershed Protection Branch.

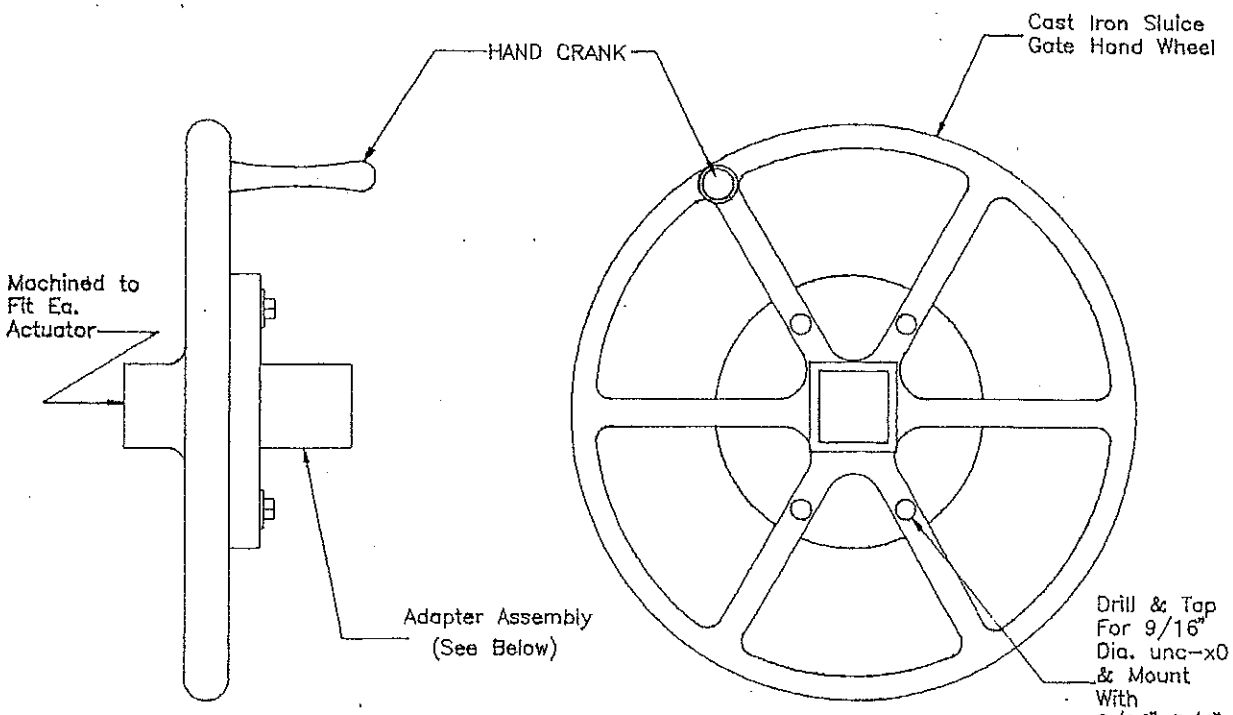


PLAN VIEW

PRINCE GEORGES COUNTY MARYLAND DEPARTMENT OF ENVIRONMENTAL RESOURCES Approved By: [signature] Date: 11-21-90	REVISIONS	STORM DRAIN LOW FLOW STRUCTURE FOR EXTENDED DETENTION POND TYP.	SD 160.0

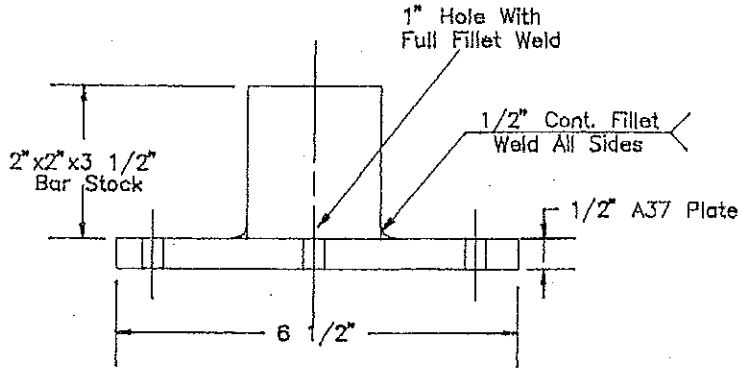


DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISIONS	STORM DRAIN SLUICE GATE FOR DEWATERING SYSTEM	SD 200.0
Approved By: _____ Date: _____			

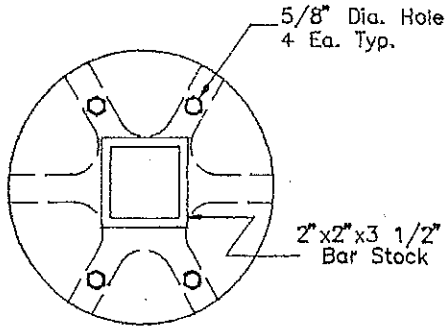


SIDE VIEW

PLAN VIEW

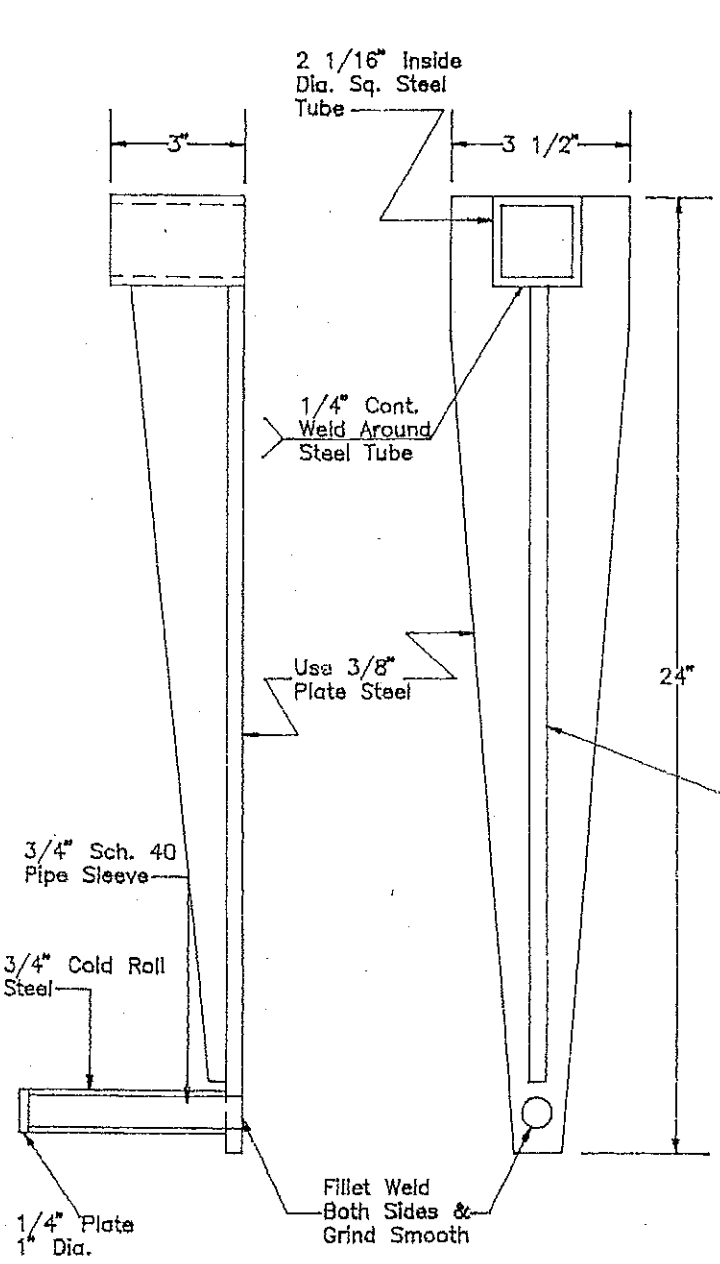


ADAPTER SIDE VIEW

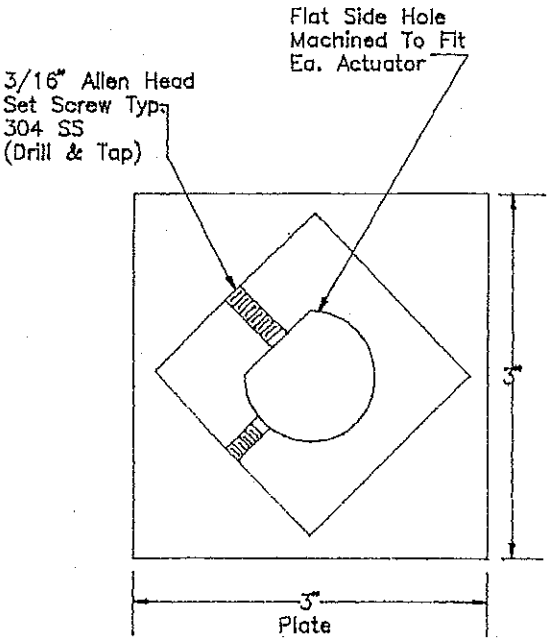


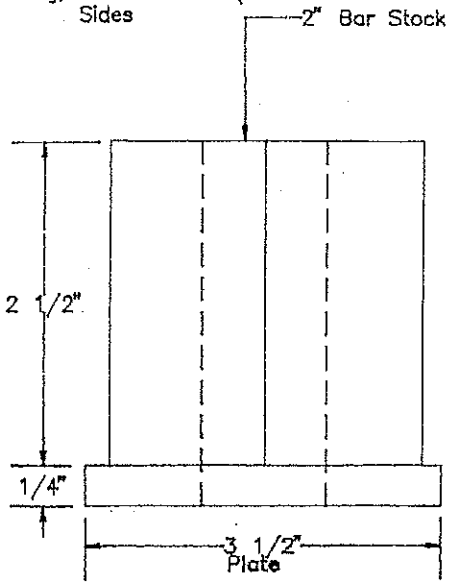
ADAPTER BOTTOM VIEW

DEPARTMENT OF ENVIRONMENTAL RESOURCES Approved By: _____ Date: _____	REVISIONS	STORM DRAIN **SLUICE GATE WHEEL ASSEMBLY**	**SD 200.1**



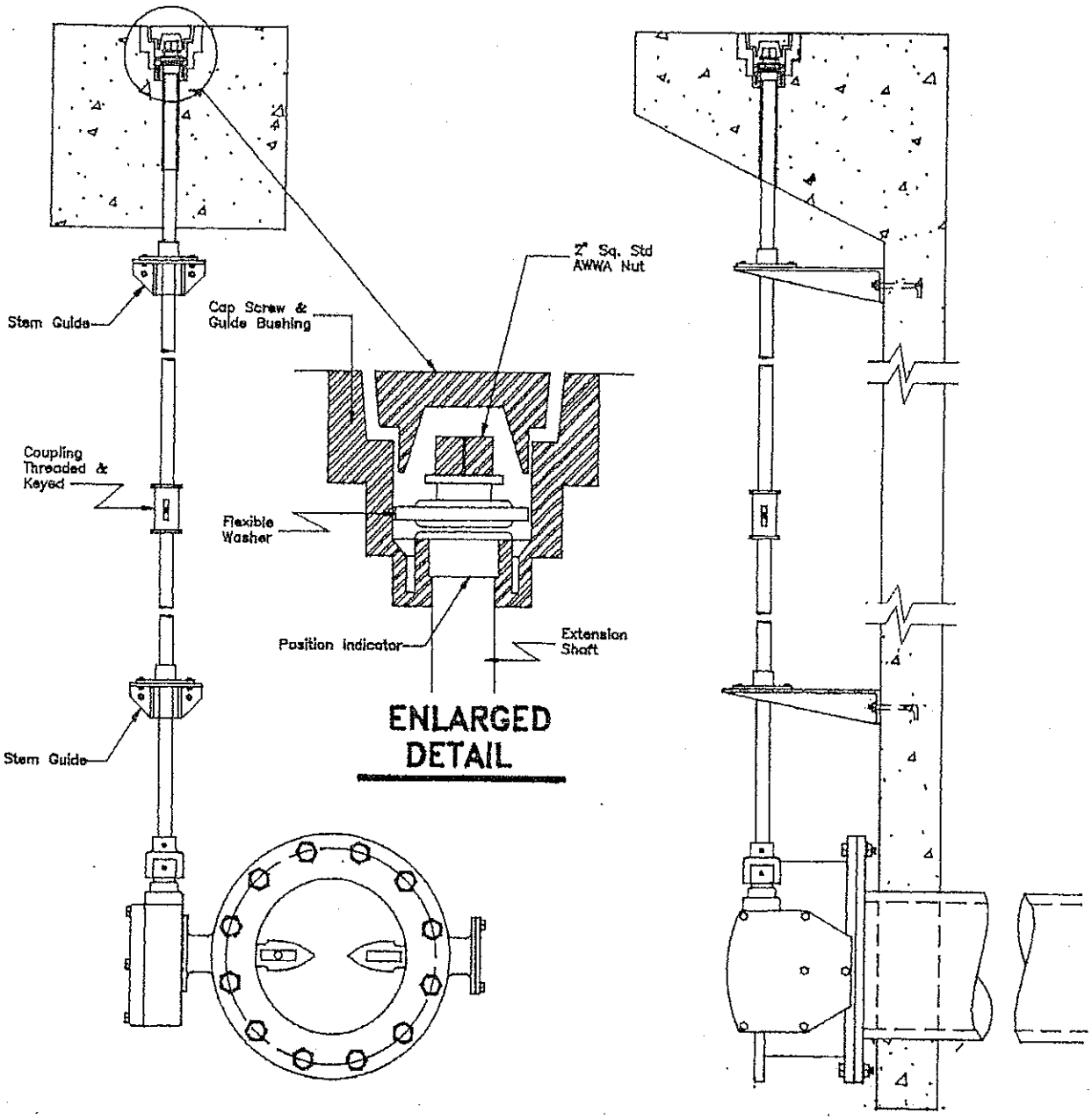
OPERATING WRENCH DETAIL





OPERATING NUT DETAIL

DEPARTMENT OF ENVIRONMENTAL RESOURCES Approved By: _____ Date: _____	REVISIONS	STORM DRAIN OPERATING WRENCH & NUT ASSEMBLY FOR SLUICE GATE	SD 200.2

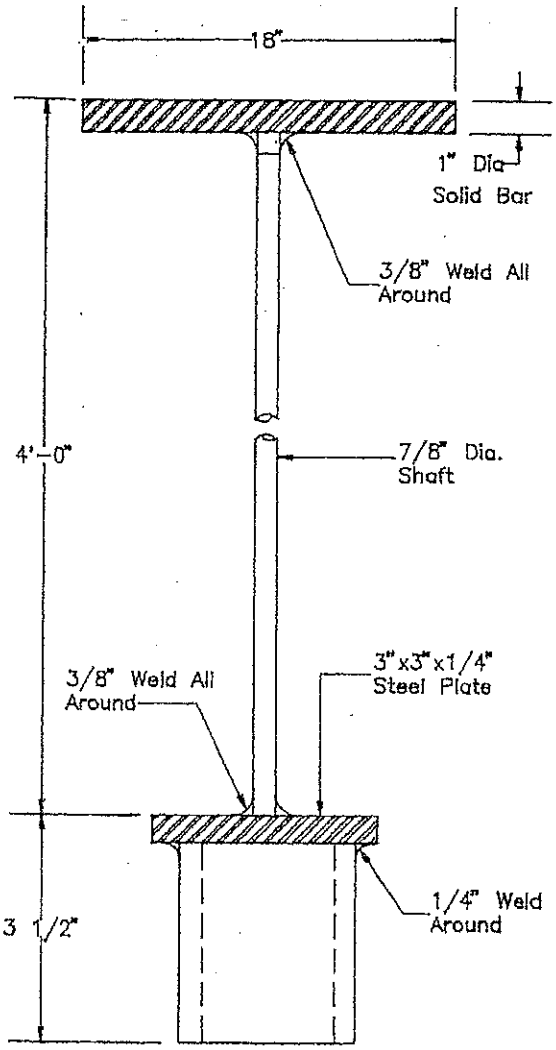


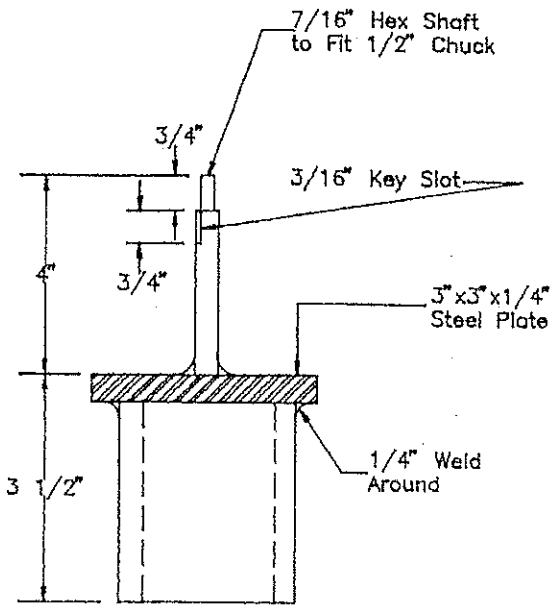
ENLARGED DETAIL

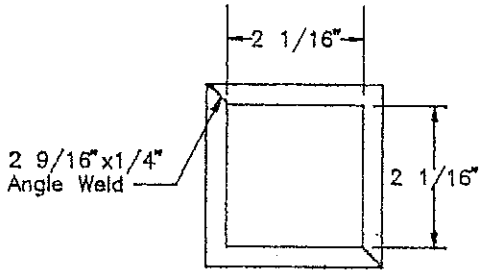
FRONT ELEVATION

LEFT ELEVATION

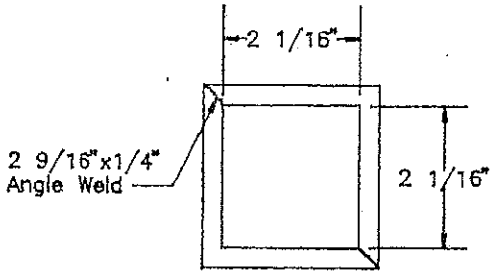
DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISIONS	STORM DRAIN	SD
Approved By: _____		**CONTROL VALVE FOR DEWATERING SYSTEM**	**210.0**
Date: _____			





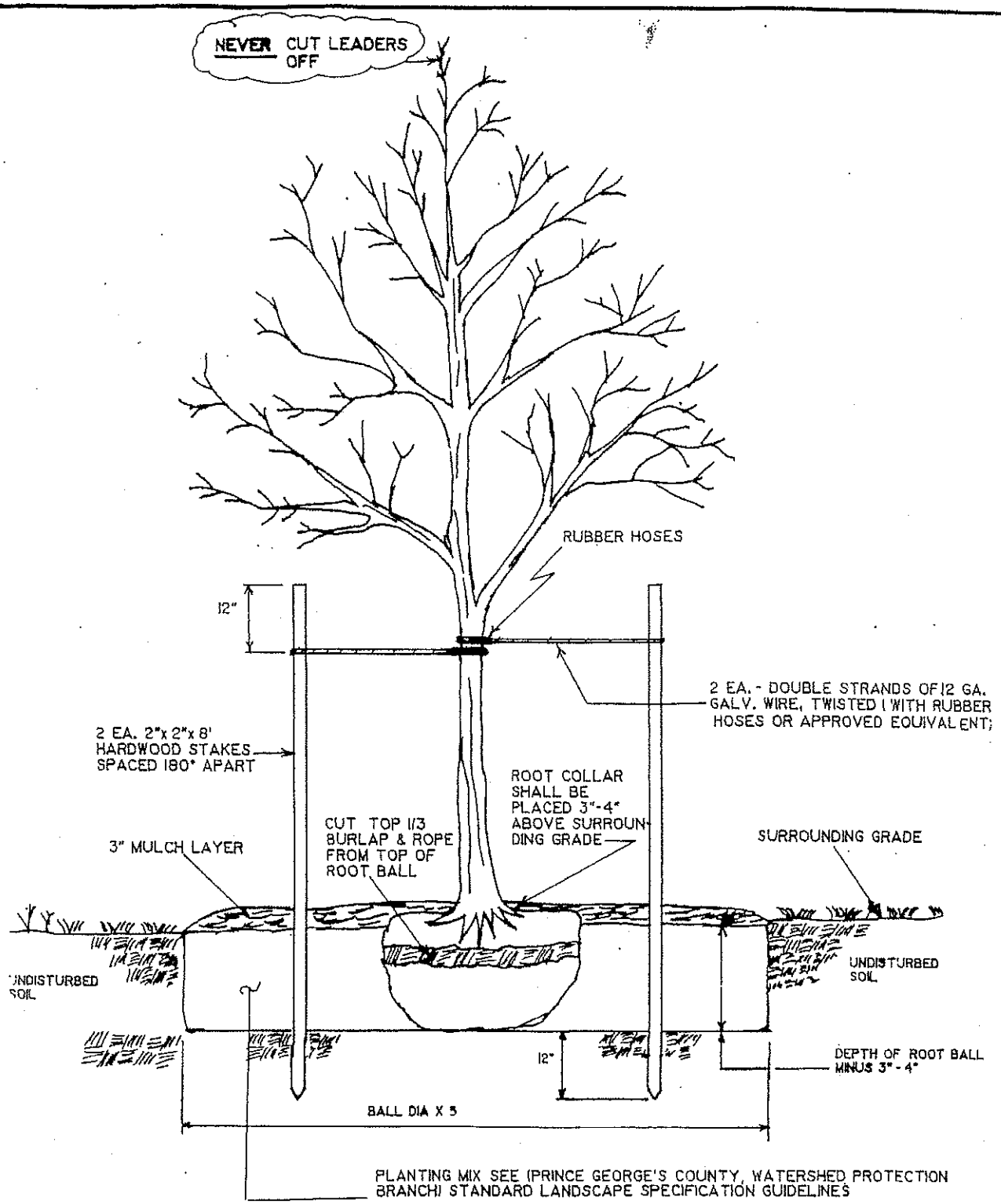


SOCKET ADAPTER FOR ELECTRIC DRILL



VALVE KEY DETAIL

DEPARTMENT OF ENVIRONMENTAL RESOURCES	REVISIONS	STORM DRAIN	SD
Approved By: _____		VALVE KEYS	210.1
Date: _____			

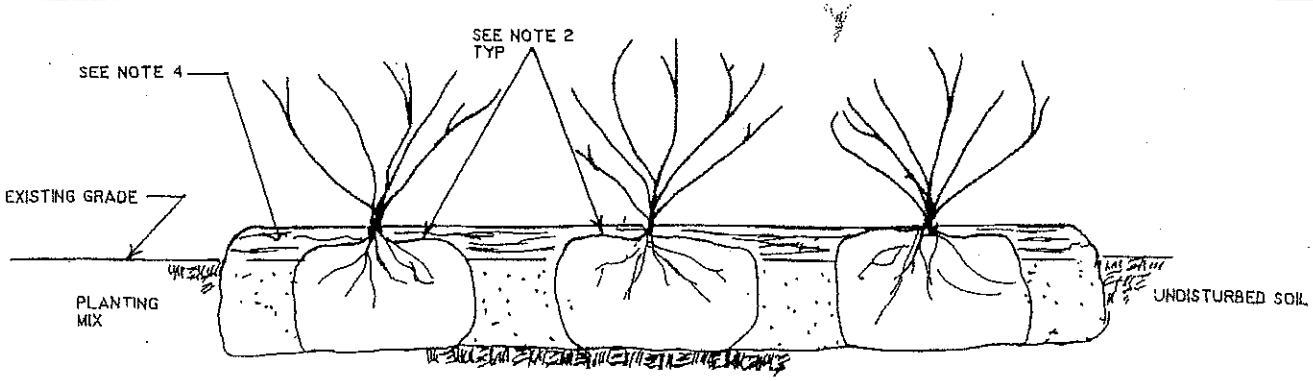


DEPARTMENT OF ENVIRONMENTAL RESOURCES
Approved By: [signature]
Date: 11-21-90

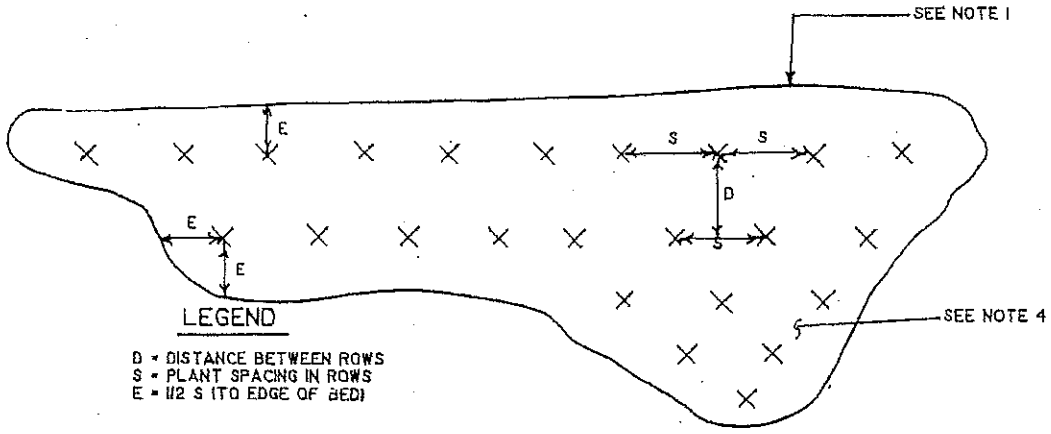
REVISIONS

LANDSCAPING
DECIDUOUS AND EVERGREEN TREE PLANTING

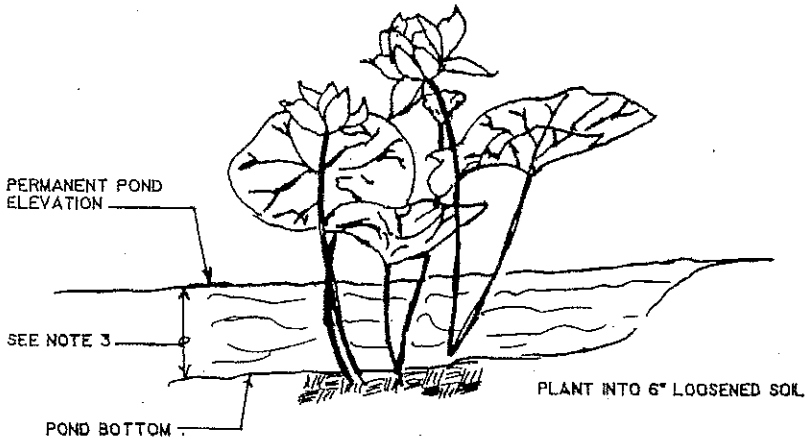
LS 10.0



SHRUB BED PLANTING DETAIL



SHRUB & PERENNIAL BED DETAIL



NOTES:

1. SPADE EDGE PERIMETER OF BED
2. TOP OF ROOT BALL SHALL BE 2" ABOVE THE EXISTING GRADE.
3. PLANT DEPTH WILL VARY ACCORDING TO PLANT TYPE (SEE LS 30.0)
4. THE ENTIRE BED SHALL BE COVERED TO A DEPTH OF 3" WITH MULCH.

AQUATIC PLANTING DETAIL

PRINCE GEORGES COUNTY MARYLAND

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Approved By:
Date: 11-21-90

REVISIONS

LANDSCAPING

SHRUB PLANTING

LS 20.0

PLANT SCHEDULE

SYMBOL	BOTANICAL / COMMON NAME	QUANT.	SIZE	ROOT	SPACING	REMARKS
AR	Acer rubrum / RED MAPLE	10	2 1/2 CAL	B & B	AS	
PS	Pinus strobus WHITE PINE	6	6' - 8' HGT	B & B	AS	
IO	Ilex opaca / AMERICAN HOLLY	3	6' - 8' HGT	B & B	AS	2 Female, 1 Male
MV	Magnolia virgiana / SWAMP MAGNOLIA	5	6' - 8' HGT	B & B	AS	
EL	Elaeagnus umbellata AUTUM OLIVE	4	18" - 24" SPR	CG	AS	
CO	Cephalanthus occidentalis / BUTTONBUSH	10	18" - 24" SPR	CG	6' O.C.	WET CULTIVATED PLANT BETWEEN 125.0 - 128.0 EL.
AC	Acorus calamus / SWEET FLAG	150		BR	2' O.C.	WET CULTIVATED PLANT BETWEEN 127.5 - 128.0 EL.
SL	Sagittaria latifolia DUCK POTATO	300	QUART	CG	2' O.C.	WET CULTIVATED PLANT BETWEEN 126.5 - 128.0 EL.

SAMPLE

LEGEND

CAL = CALIPER
HGT = HEIGHT
SPR = SPREAD
B&B = BALLED & BURLAPPED
CG = CONTAINER GROWN
BR = BAREROOT
AS = AS SHOWN

PRINCE GEORGES COUNTY MARYLAND

DEPARTMENT OF ENVIRONMENTAL RESOURCES
Approved By: [signature]
Date: 11-21-90

REVISIONS

LANDSCAPING. TYPICAL PLANT SCHEDULE

LS 30.0

n=.013

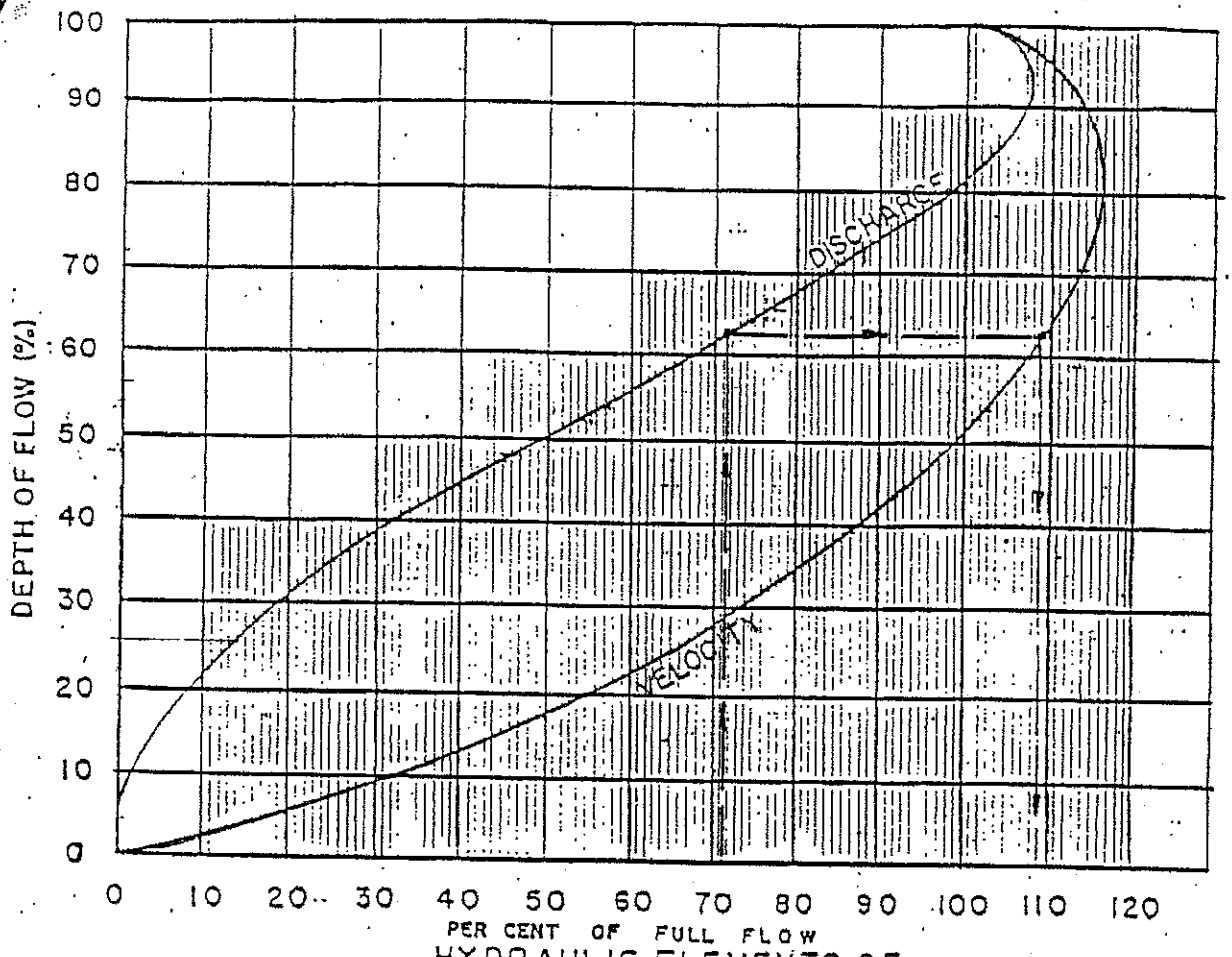
Pipe Size (in)	Pipe Size (ft)	Area (sf)	K	Capacities (cfs) at Various Slopes 0.50	1.0	2.0	3.0	4.0	5.0	7.5	10.0
12	1.00	0.79	35.7	3	4	5	6	7	8	10	11
15	1.25	1.23	64.7	5	6	9	11	13	14	18	20
18	1.50	1.77	105.3	7	11	15	18	21	24	29	33
21	1.75	2.41	158.8	11	16	22	28	32	36	43	50
24	2.00	3.14	226.8	16	23	32	39	45	51	62	72
27	2.25	3.98	310.5	22	31	44	54	62	69	85	98
30	2.50	4.91	411.2	29	41	58	71	82	92	113	130
33	2.75	5.94	530.2	37	53	75	92	106	119	145	168
36	3.00	7.07	668.7	47	67	95	116	134	150	183	211
42	3.50	9.62	1009	71	101	143	175	202	226	276	319
48	4.00	12.57	1440	102	144	204	249	288	322	394	455
54	4.50	15.90	1972	139	197	279	342	394	441	540	624
60	5.00	19.63	2612	185	261	369	452	522	584	715	826
66	5.50	23.76	3367	238	337	476	583	673	753	922	1065
72	6.00	28.27	4247	300	425	601	736	849	950	1163	1343
84	7.00	38.48	6407	453	641	906	1110	1281	1433	1755	2026
96	8.00	50.27	9147	647	915	1294	1584	1829	2045	2505	2893

$$\text{Capacity} = K\sqrt{S}$$

$$S_{min} = \left(\frac{Q}{K}\right)^2$$

$$K = \frac{1.49}{.013} A R^{2/3}$$

$$T_t = \frac{L}{V}$$



HYDRAULIC ELEMENTS OF CIRCULAR SECTION APPROX.

To get partial flow depth and partial flow velocity:

1. Start with actual Q (Q_a), pipe diameter, pipe area (A), n value and actual slope (S)
2. Look up conveyance (K) for pipe size and n value.
3. Calculate capacity (Q_c) of pipe using K & S. $Q_c = K\sqrt{S}$
4. Calculate velocity at capacity using full pipe area. $V_c = Q_c / A$
5. Go into graph on horizontal axis with Q_a / Q_c
6. Read vertically until discharge curve is intersected.
7. Read horizontally to left axis to get Depth %
   Partial Flow Depth = Depth % x pipe diameter
8. Read horizontally to right until velocity curve is intersected.
9. Read down to horizontal axis to get Velocity %
10. Partial Flow Velocity (V_p) = Velocity % x V_c

Example:

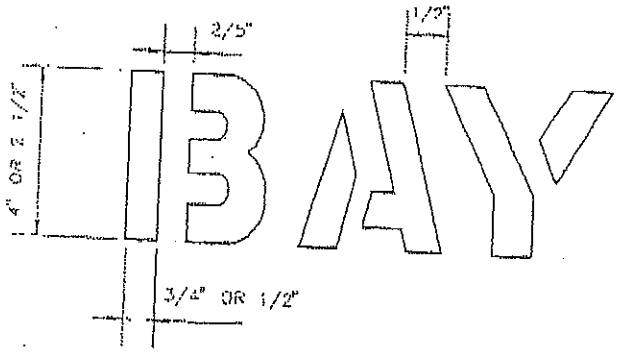
1. Actual Q = 15 cfs
   18" RCP @ 4%
   n = 0.013 A = 1.77 sf
2. K = 105.3
3. $Q_c = 105.3\sqrt{.04} = 21.1$ cfs
4. $V_c = 21.1/1.77 = 11.9$ fps
5. $Q_a / Q_c = 15.0/21.1 = .71$
6/7. Depth % = 63
   Depth = .63 x 18" = 11.3"
8/9. Velocity % = 109
10. $V_p = 1.09 \times 11.9 = 13.0$ fps

$$R = \frac{D + 2\,\text{thickness}}{\frac{x}{L}} + D/2$$

PIPE SIZE (inches)	LENGTH OF JOINT (inches)	$x = 1/3$ JOINT (feet)	2 × WALL THICKNESS (feet)	PIPE LENGTH (feet) 4′	5′	6′	8′
27	3 1/8	.0868	.54	130	161	194	256
30	3 3/8	.0938	.58	132	165	199	265
33	3 5/8	.1007	.62	135	169	203	269
36	3 3/4	.1042	.66	142	177	212	283
42	4	.1111	.76	155	194	232	308
48	4 1/4	.1180	.84	166	207	248	329
54	4 1/2	.1250	.92	179	219	263	349
60	5	.1389	1.00	177	218	261	340
66	5 1/4	.1458	1.08	184	228	272	364
72	5 1/2	.1528	1.16	189	238	284	378
78	6	.1667	1.24	189	235	281	376
84	6 1/4	.1736	1.34	196	246	292	388
90	6 3/4	.1875	1.42	194	241	288	384
96	7 1/4	.2014	1.50	192	238	289	378
102	7 5/8	.2118	1.58	193	241	288	382
108	7 7/8	.2187	1.66	200	249	297	395
120	8 1/4	.2292	1.84	212	264	314	419

MINIMUM RADIUS OF CURVATURE ON CENTERLINE OF PIPE

D. M. G. 1967



SAMPLE
NOT TO SCALE

NOTE:

1. THE WORDS "CHESAPEAKE BAY DRAINAGE" AND "DON'T DUMP" MUST BE PLACED ON THE ARMOR CHANNEL OF THE COUNTY'S PUBLIC AND PRIVATE STORM DRAIN INLETS.
2. GRAY RUST-PROOFING NONTOXIC PAINT FOR THE BACKGROUND.
3. BLUE ENAMEL SPRAY NONTOXIC PAINT FOR LETTERS.
4. FOR OTHER SPECIFICATIONS, REFER TO MANUFACTURER'S INSTRUCTIONS.

DEPARTMENT OF ENVIRONMENTAL RESOURCES APPROVED BY: Glen E. Wilderson, P.E. Assoc. Director DATE:	REVISION JAN. 2001	STORM DRAIN SIGN STENCIL	SD 82.0