PART V - DESIGN OF PRINCIPAL SPILLWAY

DESIGN

When a structure such as a retarding dam or pond is installed, hydraulic routing procedures can be used to determine the effect on peak discharges. Exhibit 11-4 provides a short-cut method of hydraulic routing that has been developed for quickly analyzing effects of storage reservoirs on peak discharges. The method is based on average storage and routing effects for many structures. The storage indication method of routing was used. Exhibit 11-4 Table A relates the peak outflow-inflow rates to the storage-runoff volume rates where a single-Stage spillway or weir is used. Exhibit 11-4 Table B relates the volume of runoff to volume of temporary storage for a range of peak release rate. Emergency spillway flow is not considered.

The accuracy of the values in Exhibit 11-4 Tables A & B depends on the relationship between the storage available, the inflow volume, and the shape of the inflow hydrograph. When only a small volume is available for temporary storage, the shape of the outflow hydrograph is very sensitive to the rate of rise of the inflow hydrograph. Conversely, when a large volume is available for storage, the shape of the inflow hydrograph has little effect on the outflow hydrograph which, in this case, is controlled by the hydraulics of the structural system. Therefore, parameters such as runoff curve number and time of concentration, which affect the rate of rise of a hydrograph, become significant parameters in analyzing the effects of structures when the peak outflow rate approaches the peak inflow rate.

Exhibit 11-4 Table A relates the ratio of peaks to volumes. For this case the parameters affecting the shape of the hydrograph are important. In situations where runoff curve numbers are less than 65 in combination with short Tc values, V_s/V_r values read from the table will be up to 25 percent too high. Runoff curve numbers over 85 with long T_c values cause V_s/V_r values to be up to 25 percent too low.

In Exhibit 11-4 Table B, the peak inflow rate is not a factor in determining storage requirements. It can be seen that the ratio of volume of storage (V_s) to volume of runoff (V_r) is relatively high. Therefore, inflow peak is not a significant parameter. Exhibit 11-4 Table B will give satisfactory results for structure drainage areas up to 2,000 acres with a single-stage principal spillway capacity. It is usually accurate within 5 percent for release rates under 0.15 cfs/acre (cubic feet per second per acre) and within 10 percent for release rates over 0.15 cfs/acre up to 0.6 cfs/acre.

Quick return flow (QRF) [1/] can be a factor in sites where the QRF is significant when compared to the capacity of the principal spillway. Where applicable, QRF can be added to the release rate determined from Exhibit 11-4 Table B prior to the selection of a conduit size, or subtracted from the conduit capacity prior to determining required temporary storage from Exhibit 11-4 Table B. Similar corrections can be made for Exhibit 11-4 Table A for release rate.

Design Procedure for Pond or Pipe Structure with Hood Inlet and Detention Storage (Using Method I - Minimum Detention Storage)

NOTES: (1) All structures designed under this procedure must be located in predominantly rural or agricultural areas where failure may only damage farm buildings, agricultural land or township and county roads. The structure must also not require IDNR approval.

(2) This procedure and the data sheet are outlined to do the emergency spillway first, with the top of dam elevation set and the emergency spillway elevation and then the principal spillway pipe elevation (permanent pool) determined.

Steps

1. Determine drainage area from USGS maps, field observations and/or aerial photos.

2. Determine pond surface area from field surveys.

3. Determine ratio drainage area to pond area. Divide Step 1 value by Step 2 value.

4. Set top of dam elevation from field surveys and also record low point elevation on centerline of fill profile.

Emergency Spillway

5. Determine design Q by multiplying DA (Step 1) in acres by 0.5 cfs/ac. Reference: Tech. Guide, Standard and Specification 378, Table 2.

6. Determine maximum permissible velocity (V) in ft/sec. from EFM, Ch 11, Exhibit 11-2, Table 1, based on exit channel slope range, soil erodibility, and grass to be seeded.

7. Determine retardance from EFM, Ch. 11, Exhibit 11-2, Table 2, based on condition of stand and height of vegetation.

8. Determine discharge q in $Ft^3/S/Ft$ (cfs/ft) from Exhibit 11-2, Tables 3A, 3B, 3C, 3D or 3E for maximum permissible velocities.

9. Determine length (L) in feet of level portion of emergency spillway from field surveys, observation or experience.

10. Determine bottom width (b) in feet for stability by dividing Q in cfs (Step 5) by q in cfs/fts (Step 8).

11. Determine Hp from Exhibit 11-2, Table 3A, 3B, 3C, 3D, or 3E for (L) (Step 9) and q (Step 8). Note: Most emergency spillways may have an (L) value less than 25 feet but use Hp value for 25 feet (L) as a minimum.

12. Record actual bottom width (b) used if wider than determined in (Step 10)

13. Recalculate discharge q for selected bottom width by dividing design Q (Step 5) by (b) (Step 12).

14. Determine Hp (used) from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for new q (Step 13).

15. Determine emergency spillway (exit channel) slope. Find minimum and maximum from Exhibit 11-2, Tables 3A, 3B, 3C, 3D or 3E, (for (V) max. from Step 6.) Select exit slope (actual) from field survey, within range of minimum and maximum.

16. Determine freeboard. Minimum freeboard will be 1 foot above the HP value (Step 14). For dams with more than 20 acres drainage area, a minimum of 2 feet must be provided between the crest of the emergency spillway and top of dam.

17. Determine emergency spillway elevation - subtract from top of dam elevation (Step 4), the values of Hp (used) (Step 14) and freeboard value (Step 16).

Principal Spillway

18. Determine detention storage required in Ac. Ft. by selecting principal spillway detention storage (minimum) in inches from Table 2 of Technical Guide Spec. 378 and multiply by drainage area in acres (Step 1) and divide by 12 inches per foot.

19. Determine required stage in feet by dividing storage (Step 18) by pond area (Step 2).

20. Record pipe diameter selected. For Method I, minimum pipe diameter shall be a 4-inch smooth pipe or 6-inch corrugated metal pipe for DA less than 20 acres and 10-inch diameter smooth or corrugated pipe for DA greater than 20 acres. (Table 2, Tech. Guide Spec. 378).

21. Determine stage for hooded inlet to flow full. Minimum stage between inlet invert of pipe to the emergency spillway crest must equal 1.8 times the diameter of principal spillway in ft.

22. Record stage provided - Use stage from Step 21 or Step 19 whichever is greater.

23. Determine storage provided by multiplying stage provided (Step 22) by pond area (Step 2).

24. Determine pipe inlet invert elevation by subtracting stage (Step 22) from emergency spillway elevation (Step 17).

25. Determine pipe outlet invert elevation by adding 1 foot minimum to ground elevation at outlet.

26. Determine pipe length by using planned elevation and cross-section of dam. Select dam top width and side slopes from Tech. Guide Spec. 378.

27. Complete other physical data information from planned elevations.

28. Fill out the sheets for the complete plan.

Example Design - Pond with a Hood Inlet Spillway and Detention Storage - Using Method I Minimum Detention Storage.

(Pond Drainage Area of 20 Ac or less)

STEPS

1. DA = 12 ac - Fayette County

2. Pond area = 0.8 ac.

3. Ratio drainage area to pond area = $\frac{12 \text{ ac}}{0.8 \text{ ac}}$ = 15:1

4. Top of dam elevation = 99.0
   Low point elevation on C_L fill profile = 81.4

Emergency Spillway

5. Design Q = 0.5 $\frac{\text{cfs}}{\text{ac}}$ x 12 ac = 6 cfs

6. Maximum permissible velocity = 5 ft/s for tall fescue on easily erodible soils with slope range 0-5%

7. Retardance = C for fair stand, 10 to 24 inches average length of vegetation

8. q = 3 cfs/ft, Table 3C, p. 11-54h, for V = 5 fps

9. L = 10 ft (Use L = 25 column in Table 3C)

10. b = 6 cfs ÷ 3 cfs/ft = 2 ft (not practical)

11. Hp = 1.3 ft, Table 3C, for L = 25 ft, q = 3 cfs/ft, V = 5 fps

12. Actual b = 8 ft

13. Recalculated q = 6 cfs ÷ 8 ft = 0.75 cfs/ft

14. Hp (used) = 0.9 ft, Table 3C for q = 1 cfs/ft, V = 2 fps

15. Min. slope = 1% max. slope = 6%, actual slope 5%, Table 3C for V = 5 fps (stability)

16. Total difference between emergency spillway and top of dam = 0.9 ft (Hp) + 1.0 ft (freeboard) = 1.9 ft

17. Emergency Spillway elevation = 99.0 - 1.9 = 97.1

Principal Spillway

18. Storage = 0.5 inch x $\frac{12 \text{ ac}}{12 \text{ in/ft}}$ = 0.5 ac. ft.

19. Stage = $\frac{0.5 \text{ ac. ft.}}{0.8 \text{ acres}}$ = .63 ft

20. Pipe diameter = 6- inch H.C.M.P.

21. Stage for full pipe flow = $\frac{1.8 \times 6 \text{ inches}}{12 \text{ in/ft}}$ = 0.9 ft.

22. Stage provided = 0.9 ft

23. Storage provided = 0.9 ft x 0.8 ac = 0.72 ac ft

24. Pipe inlet invert elevation = 97.1 - 0.9 = 96.2

25. Pipe outlet elevation = 80.0 + 1.0 = 81.0

26. Pipe length = Projection U.S. + U.S. Z (TF- WL) + TW + D.S. Z (TF - Toe Elev.) + Extension D.S. + Correction (s)

(a) Horizontal Length -
L_1 = 3 + 2.5(99.8 -96.2) + 10' + 2.5 (99.8 - 80.0) + 3 = 74.5

(b) Pipe through fill @ 90° to C_L therefore no skew correction

(c) Drop in pipe (h) = Inlet Invert Elevation - Outlet Invert Elevation = 96.2 - 81.0 = 15.2 ft.

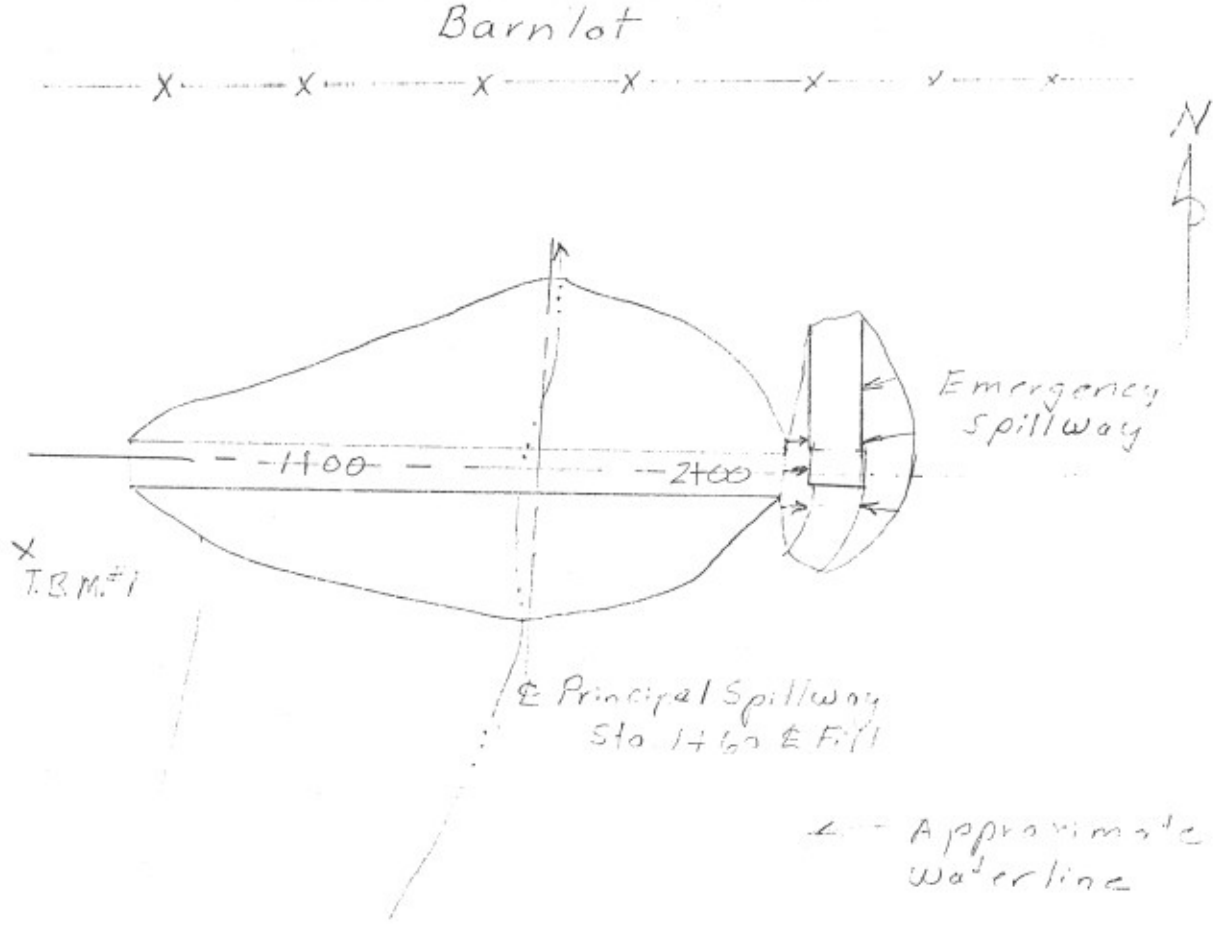
(d) Correction for slope (Table II, EFM p 6-45) = 1.7

(e) Pipe Length = 74.5 + 1.7 = 76.2 Use 76 feet

27. Maximum fill height = 17.6 ft. (TF El. 99.0 - Low Point El. 81.4)
Maximum water depth = 15 ft. (WL Elev. 96.2 - Bottom El. 81.4)

28. Fill out the sheets for the complete plan.

29. Check all your work for omissions and errors.



PLAN MAP

PLAN FOR Farm Pond

COOPERATOR Tom Bass SEC. 5 T. 10N R. 4W

COOPERATING WITH Vigo County SWCD

COUNTY Vigo STATE Indiana

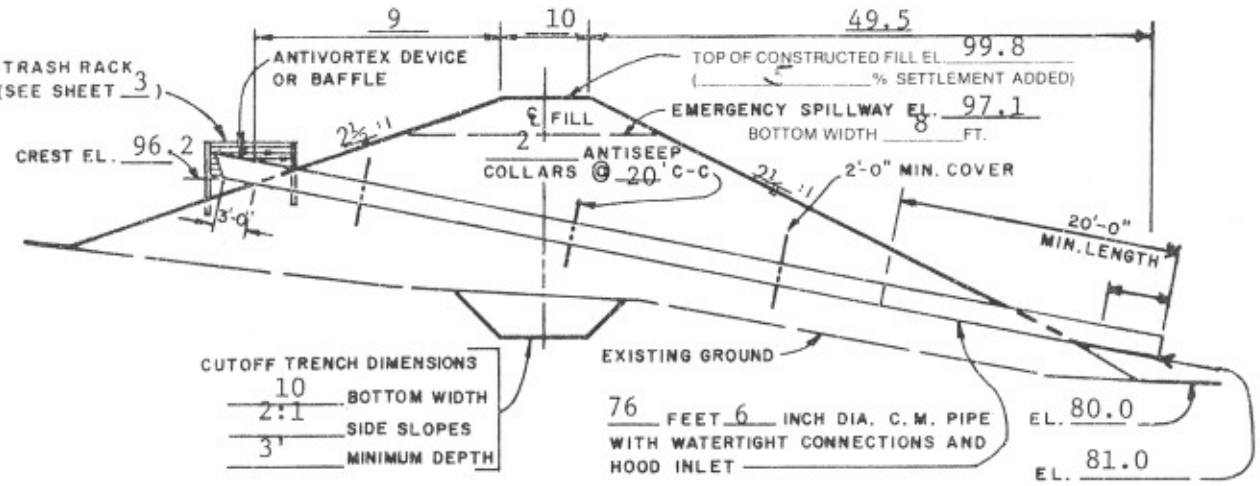
SURVEYED Tom Able DATE 10-81

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed D. Designer	10-81	Approved by Tom Able, DC	11-81
Drawn D. Designer	10-81	Title	
Traced A. Checker	10-81	Title	
Checked A. Checker	10-81	Sheet No. of	Drawing No.

T.B.M.1- Elev. 100.00
16d nail in root of 10" ash on east side of tree.

IN-ENG-42 1 (1) Rev. 6-81



NOTE: MOST PERVIOUS FILL TO BE PLACED IN DOWNSTREAM 1/3 OF DAM.

NOTE: THIS TYPE CONDUIT OUTLET IS LIMITED TO CONDUITS OF 15 INCHES OR LESS WITH THE OUTLET INVERT ONE TO TWO FEET ABOVE A STABLE CHANNEL BOTTOM. FOR CONDUITS OVER 15 INCHES, USE OUTLET PIPE SUPPORT.

NOT TO SCALE

PROFILE ALONG CENTERLINE PRINCIPAL SPILLWAY

ESTIMATE OF MATERIALS

ITEM	QUANTITY	
Clearing	0.2	Acres
Excavation	150	Cu.yd.
Earth fill, compacted	3130	Cu.yd.
Pipe, 6 inch diameter, C.M.P. metal thickness 0.06 in. (-- ga.) with watertight connections and hood inlet	76	Lin.ft.
Antivortex device or baffle	1	Each
Pipe support (See Sheet --)	--	Each
Trash rack and protective fence	1	Each
Antiseep collar	2	Each
Stockwater system (See Sheet 5)	1	Each
Seeding and mulching	1.1	Acres
Fencing	800	Feet

SOILS INVESTIGATION REPORT

LOCATION OF BORINGS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION
#1 -1+00 ℄	0-2	ML
Fill	2-6	CL
#2 -1+40 ℄	0-2.5	ML
Fill	2.5-8	CL
#3 -2+00 ℄	0-3	CL
Fill		

EMBANKMENT POND OR PIPE STRUCTURE WITH HOOD INLET

NAME Tom Boss

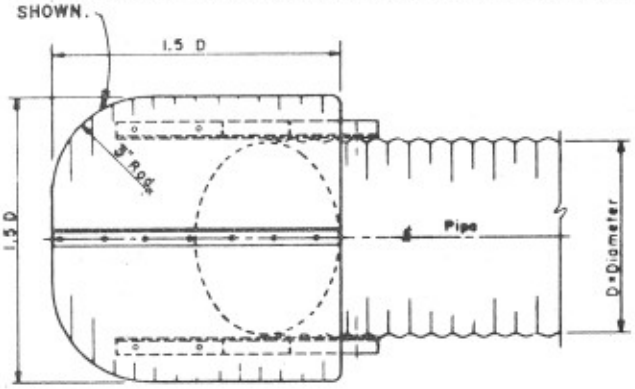
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ____ Date ____ Approved by ____
Drawn ____ Title ____
Checked ____ Title ____
Reviewed ____ Sheet No. 2 of 6 Drawing No. ____

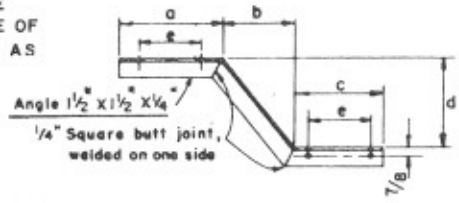
IN-ENG-21 1(2) Rev. 6-81

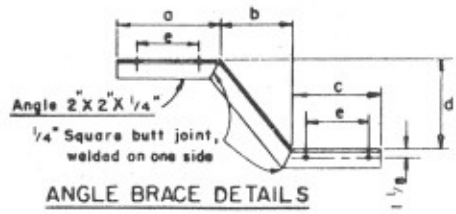
(EFM Notice IN38, August 1981)

METAL BAFFLE SHALL HAVE THE SAME COATING AS THE PIPE TO WHICH IT IS ATTACHED. WHERE METAL BAFFLE IS FABRICATED OF MORE THAN ONE PIECE OF METAL, THE SEPARATE PIECES SHALL BE SECURELY FASTENED TO EACH OTHER. SHARP CORNERS SHALL BE REMOVED. AT CONTRACTOR'S OPTION, METAL BAFFLE MAY BE MADE OF CORRUGATED OR SHEET METAL AND SHAPED CIRCULAR, SQUARE OR AS SHOWN.



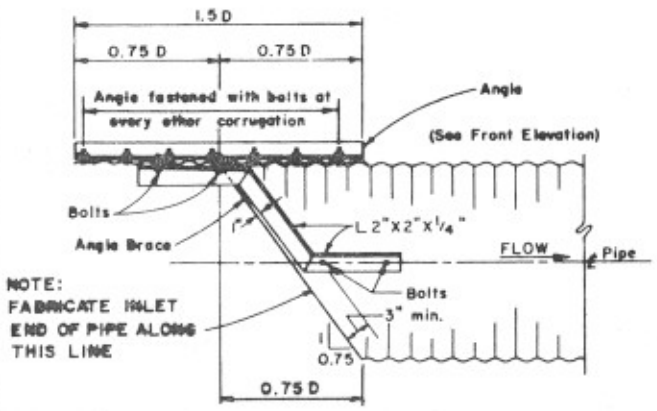
PLAN



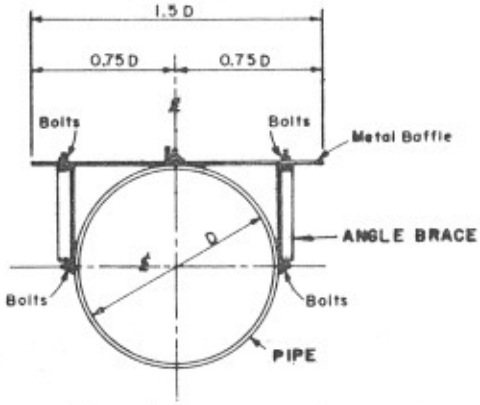


ANGLE BRACE DETAILS

(1 left and 1 right for each baffle)
(for greater tha 15 inches)



SIDE ELEVATION



FRONT ELEVATION

GAGE OF METAL BAFFLE AND DIMENSIONS OF ANGLE BRACE

DIA. OF PIPE, D	GAGE OF BAFFLE		ANGLE BRACE DIMENSIONS IN INCHES				
	STEEL	AL.	a	b	c	d	e
6"	16	0.06					
8"	16	0.06					
10"	16	0.06					
12"	16	0.06					
15"	16	0.06					
18"	16	0.06	10	6	9	8	5 1/3
21"	16	0.06	10	7 1/8	9	9 1/2	5 1/3
24"	14	.075	13	8 1/4	12	11	8
30"	14	.105	13	10 1/2	12	14	8

NOTES:

USE ALUMINUM BAFFLE AND ANGLES WITH ALUMINUM PIPE.

USE STEEL BAFFLE & ANGLES WITH STEEL OR IRON PIPE.

ALL NUTS, BOLTS, AND WASHERS SHALL BE GALVANIZED, CADMIUM PLATED, OR STAINLESS STEEL.

ALL CUTS SHALL BE SAW OR SHEAR CUTS.

HOLES IN THE ANGLE BRACE SHALL BE SPACED AND LOCATED TO MATCH CORRUGATIONS IN PIPE AND BAFFLE.

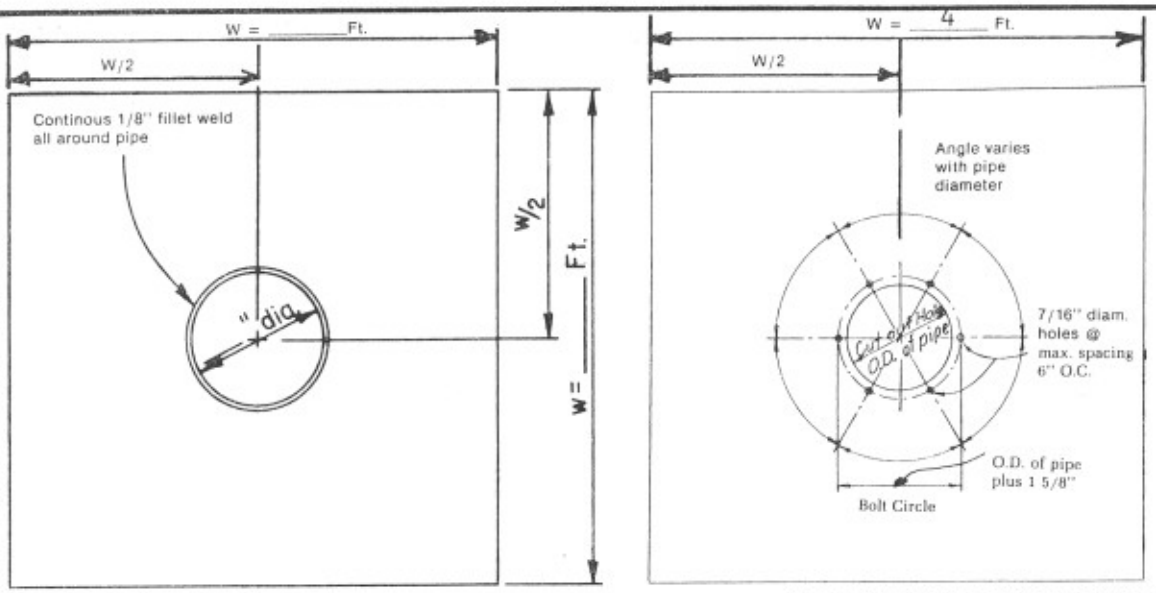
STEEL ANGLES SHALL BE GALVANIZED.

ALL ANGLES SHALL BE 1 1/2" X 1 1/2" X 1/4".

ALL BOLTS SHALL BE 3/8" X 1 1/2" WITH NUT AND SPLIT WASHER.

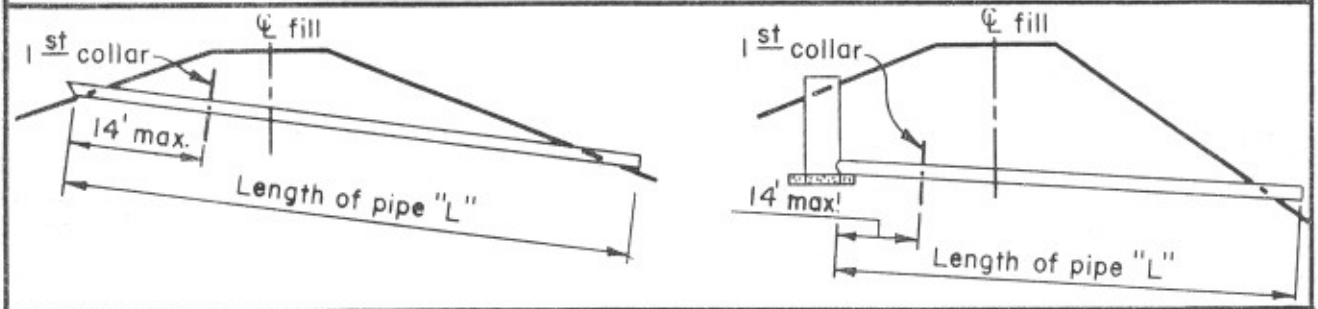
ALL HOLES FOR BOLTS SHALL BE DRILLED 7/16" DIA.

DETAILS OF HOOD INLET FOR CORRUGATED METAL PIPE



Notes: 1. Hot rolled sheet steel 16 ga. or aluminum sheet — min. thickness 0.06".
2. Install C.M. antiseep collar with corrugations vertical.

ALTERNATE DETAILS OF ANTISEEP COLLAR



PIPE SIZE INCHES	MAXIUM SPACING FEET		LENGTH OF PIPE "L" IN FEET															
			50		60		70		80		90		100		110		120	
	SIZE COLLAR "W" FEET		SIZE COLLAR "W" FT.															
	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5
6&8	20	25	2	2	2	2	2	2	3	3	3	3	4	3	4	4	4	4
10&12	20	25	2	2	2	2	3	2	3	3	4	3	4	4	4	4	5	4
15	19	25	2	2	3	2	3	2	4	3	4	3	5	4	5	4	6	4
18	18	25	2	2	3	2	3	2	4	3	4	3	5	4	5	4	6	4
21	15	23	2	2	3	2	4	3	4	3	5	4	5	4	6	4	7	5
24	14	21	3	2	3	2	4	3	5	3	5	4	6	4	7	5	7	5
30		18	—	2	—	3	—	3	—	4	—	4	—	5	—	5	—	6

NUMBER OF REQUIRED ANTISEEP COLLARS & spacing for 6" THRU 30" DIAMETER PIPE

BILL OF MATERIALS

QUANTITY	DESCRIPTION
2	Antiseep collar - 4 ft. or 4 ft. round or square
3	Flange coupling
18	Hex. HD. nuts, 3/8" x 1"
18	Hex. HD. nuts, 3/8"
18	Flat washers - cut steel, 7/16" I.D. x 7/8" O.D.
	Watertight coupling band, w/lug rods

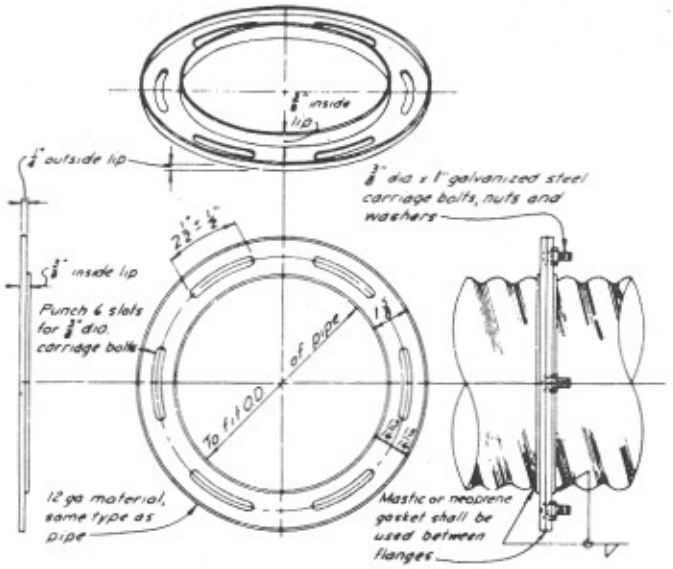
ANTISEEP COLLARS AND COUPLING DEVICES FOR 6" THROU 30" C.M. PIPE

NAME Tom Bass

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date		Approved by	
Designed		Title	
Drawn		Title	
Checked		Sheet No. 3 Of 6	Drawing No.
Reviewed			

IN-ENG-22 1(2) REV. 6-81

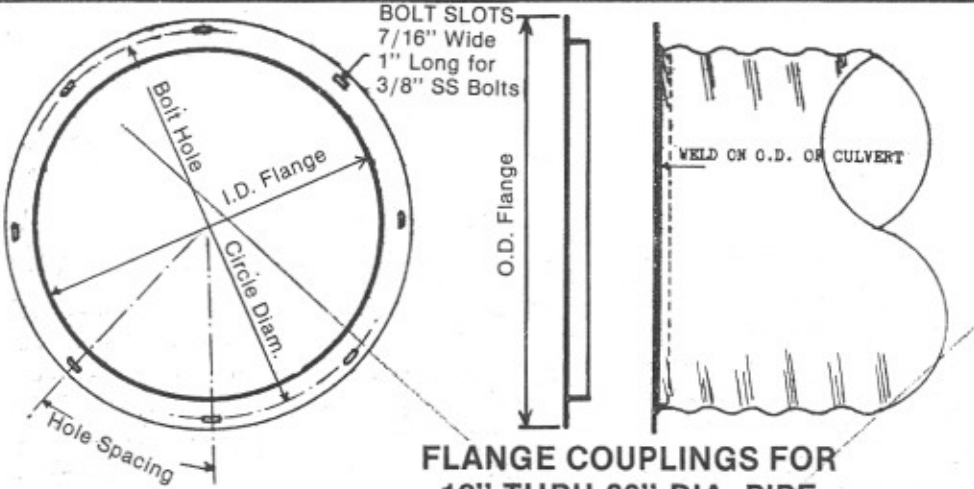


NOTES:
1. THE PIPE MAY BE HELICAL CORRUGATED METAL PIPE OR PIPE MATERIAL OF EQUIVALENT STRENGTH AND DURABILITY.
2. ALL WELDED, MARRED, AND CHECKED SURFACES SHALL BE FIELD COATED WITH A HEAVY APPLICATION OF FIBRATED ASPHALT-CEMENT.
3. COMPLETELY COAT WITH ASPHALT-CEMENT ALL CONTACT SURFACES OF FLANGES AND COLLARS BEFORE FIELD ASSEMBLY.

Use this type coupling.

FLANGE COUPLING FOR 6", 8" & 10" DIA. PIPE

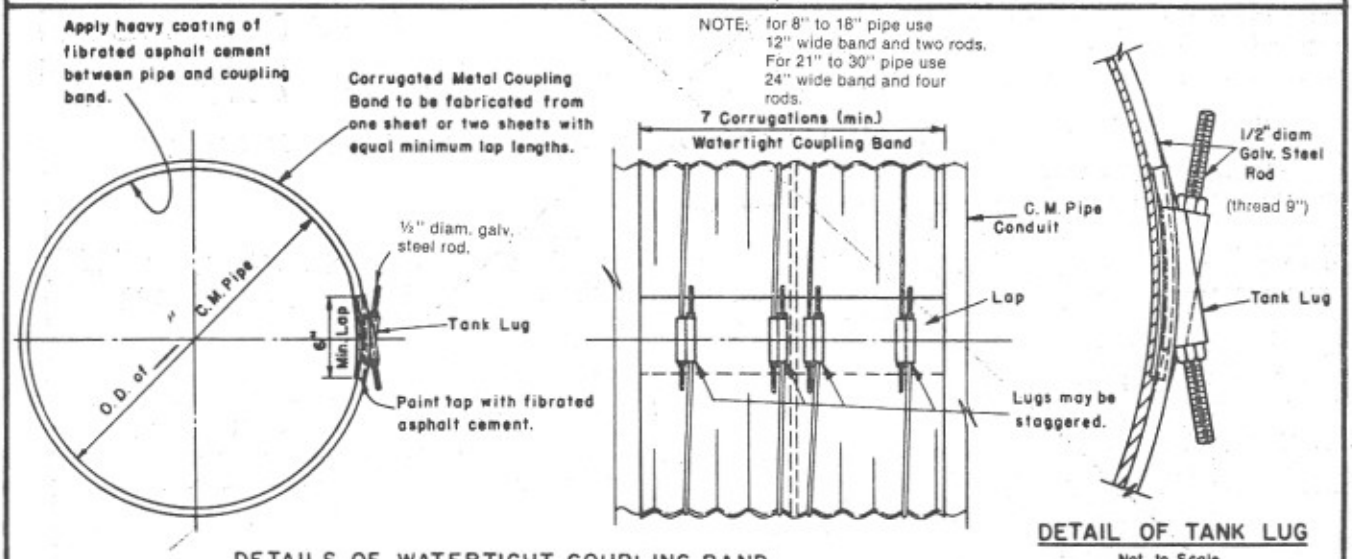
N.T.S.



Pipe Diam. Inches	Min. No. Holes	Min. Spacing Inches
12	10	4.48
15	12	4.52
18	14	4.54
21	16	4.56
24	18	4.58
30	22	4.60

FLANGE COUPLINGS FOR 12" THRU 30" DIA. PIPE

NOTE: Notes for 6", 8" & 10" flange coupling apply for 12" thru 30" flange couplings N.T.S.

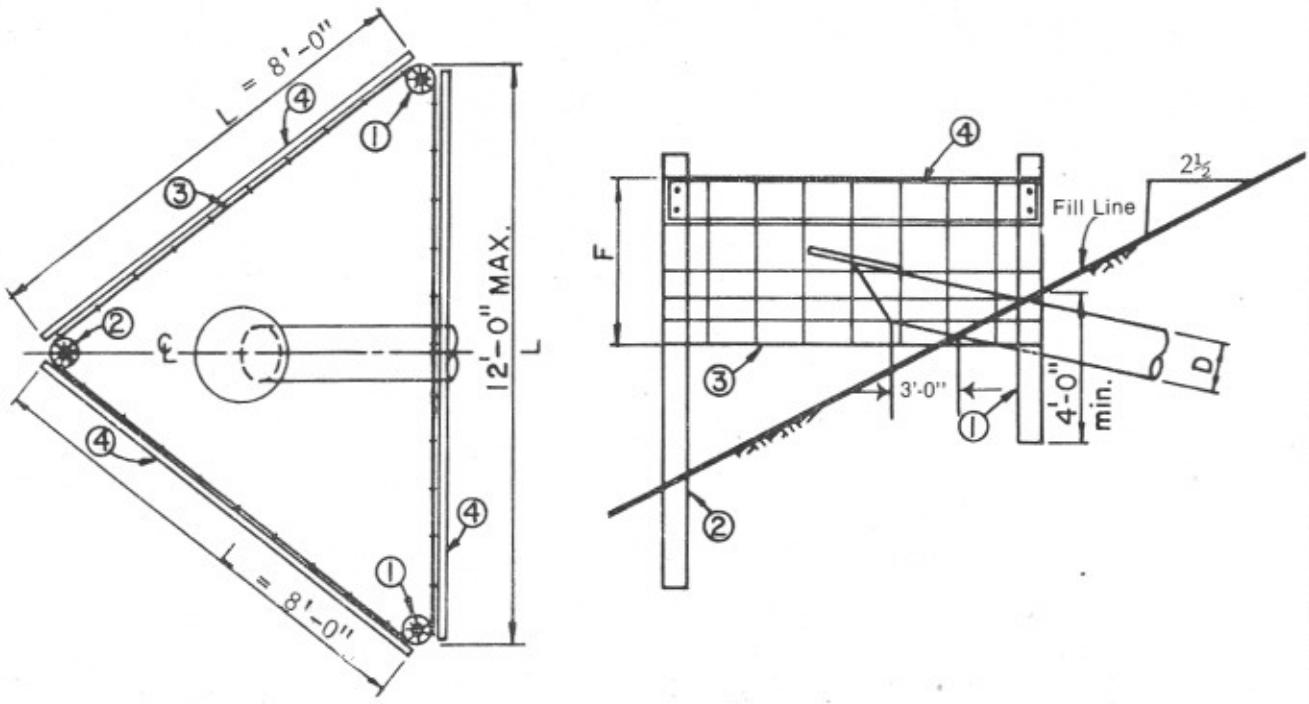


DETAILS OF WATERTIGHT COUPLING BAND

DETAIL OF TANK LUG
Not to Scale

DETAILS OF WATERTIGHT COUPLING BAND 8" THRU 30" DIA. PIPE

(EFM Notice IN38, August 1981)



PLAN SIDE ELEVATION

TRASH RACK FOR HOODED INLETS

BILL OF MATERIALS			
MARK	QUANTITY	DESCRIPTION	LENGTH
1	2	Wood posts, 6" top, black locust, hedge or pressure treated	7'-0"
2	1	Wood posts, 6" top, black locust, hedge or pressure treated	9'-0"
3	1	Fence, woven wire, No. 9 top and bottom, with 12" stays 35 " high	24'-0"
——		Staples - Mark ③ to ① and ②	1 1/4"
4	3	Wood plank 2" thick x 6" wide x L+6", pressure treated	8'-6"
	12	3/8"dia. lag screws with flat washers, mark ④ to ① and ②	4 1/2"

NOTE: Fence and staples to be galvanized and lag screws cadmium plated.

DIMENSIONS					
D	L	F	LIN. FT. OF FENCE	POST LENGTH*	
				①	②
6" - 12"	8-0	35"	24'-0"	7-0	9-0
15" - 18"	10-0	47"		8-0	10-0

* LENGTH OF POST BASED ON 3:1 SLOPE.

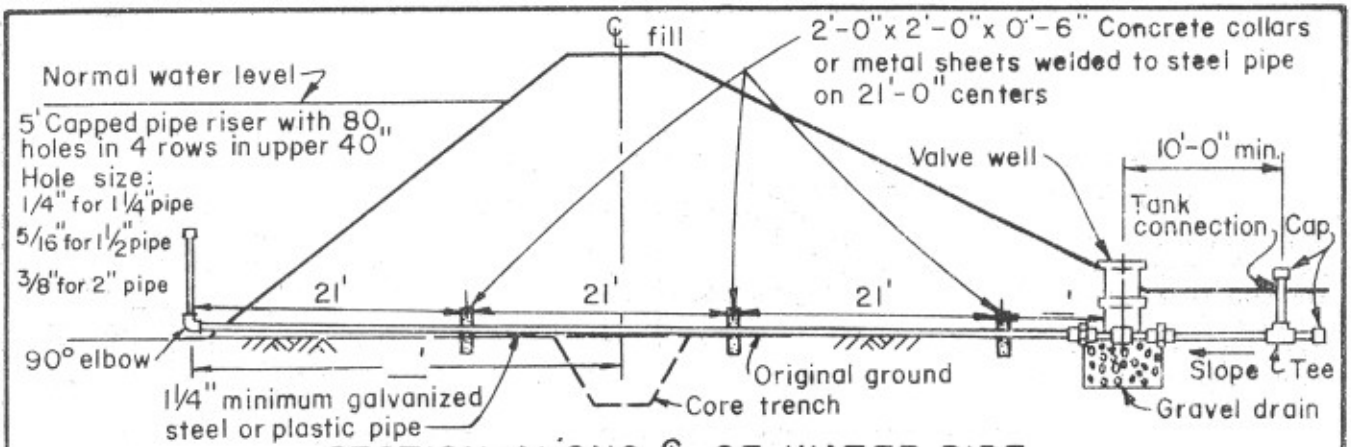
TRASH RACK FOR HOODED INLET OR PIPE DROP INLET

NAME Tom Bass

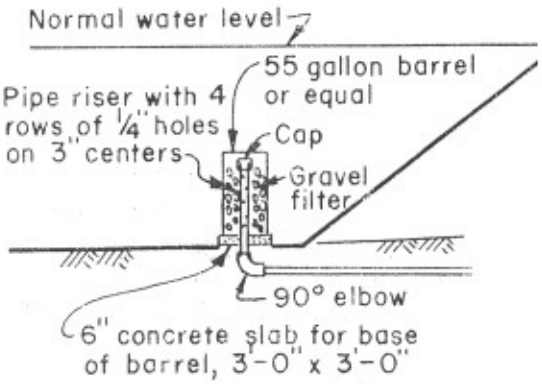
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed Date Approved by
Drawn Title
Checked Title
Reviewed Sheet No. 4 of 6 Drawing No.

IN-ENG-24 1(2) Rev.6-81

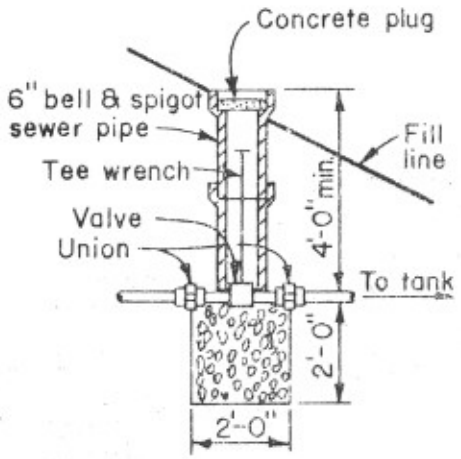


SECTION ALONG ℄ OF WATER PIPE



ALTERNATE INLET

NOT TO SCALE



VALVE WELL DETAIL

QUAN.	BILL OF MATERIALS ITEM	LENGTH
	__" Galv. Iron Pipe or Plastic Pipe (1¼" Min.)	
1	__" Galv. Iron or Plastic Pipe	10'
1	__" Galv. Iron or Plastic Tee	
1	__" Galv. Iron or Plastic Pipe W/80 __" Holes	5'
1	__" Galv. Iron Pipe or Plastic 90° Elbow	
	__" Galv. Iron Pipe or Plastic Cap	
2	1¼" Galv. Iron or Plastic Female Union	
2	1¼" x 2½" Galv. Nipple or Plastic Connectors	
1	__" Gate Valve	
1	Tee Handle	3'-5"
1	6" Bell Joint V.C. Tile	4'-0"
1	Treated Wood Plug to Fit Bell or Concrete Plug	
1	Galv. Sheet Metal Disc 8" Dia.	
1	Brass D Handle With 2-1¼" Screws	
	Pit-Run Sand and Gravel (Drain) - 0.34 Cu. Yd.	
	Coarse Gravel Mix For Barrel	
	Concrete (2 C.F. Per Collar - 5 C.F. Per Base)	

NOTES:

1. Plastic pipe shall be Acrylonitrile-butydiene-styrene (ABS), Polyethylene (PE), or Polyvinyl chloride (PVC).
2. Collars may also be made from butyl rubber.

STOCKWATER SYSTEM

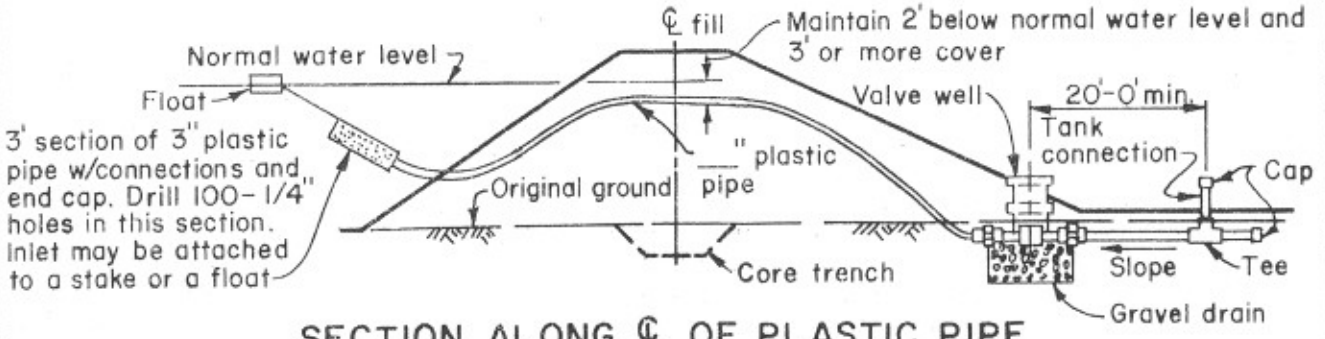
NAME

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
Designed
Drawn
Checked
Approved by
Title
Title
Sheet No. of
Drawing No.

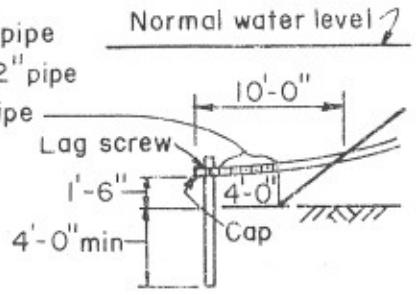
(EFM Notice IN38, August 1981)

IN-ENG-23 2(2) Rev. 6-81



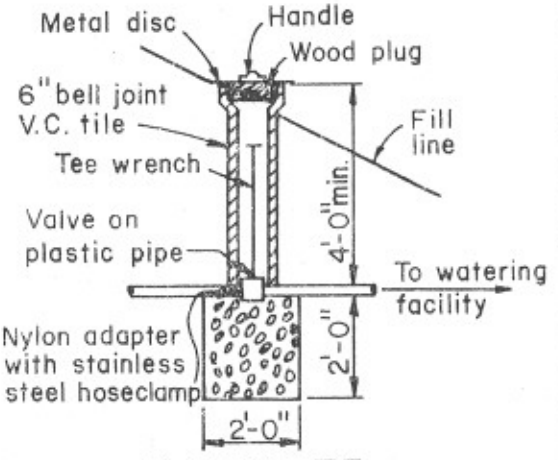
SECTION ALONG ℄ OF PLASTIC PIPE

Perforated section
80 holes in 4 rows
Hole size:
1/4" for 1 1/4" pipe
5/16" for 1 1/2" pipe
3/8" for 2" pipe



ALTERNATE INLET ARRANGEMENT

Use This Type Inlet



ALTERNATE VALVE WELL DETAIL

Use This Type Valve Well

BILL OF MATERIALS

QUAN.	ITEM	LENGTH
	1 1/4" PLASTIC PIPE	100'
2	1 1/4" PLASTIC CAP	
1	1 1/4" PLASTIC TEE	
2	1 1/4" PLASTIC FEMALE UNION	
~~1~~	~~3" PLASTIC PIPE INLET SECTION~~	
1	BRASS - CHECK AND DRAIN VALVE	
1	TEE HANDLE WRENCH	3'-5"
2	6" BELL AND SPIGOT SEWER PIPE	4'-0"
1	Wood Plug Top w/Handle	
1	Wooden Post	6'-0"
1	Lag Screw - 3/8"	4½"

NOT TO SCALE

STOCKWATER SYSTEM

NAME Tom Bass

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Drawing No

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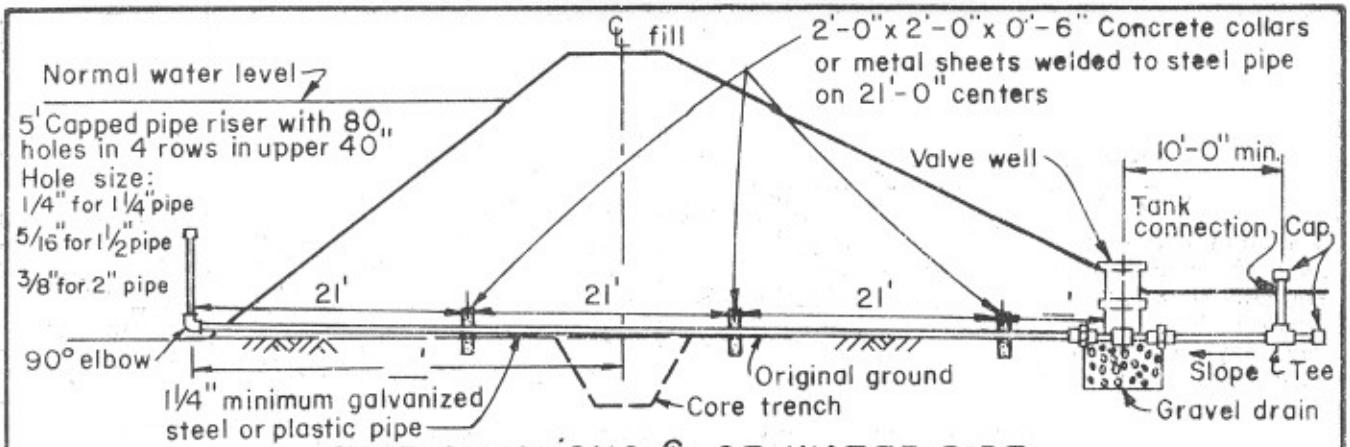
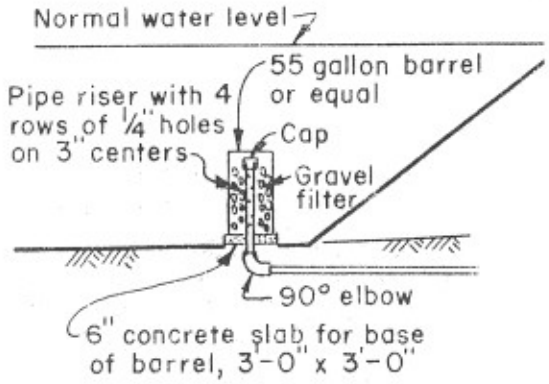
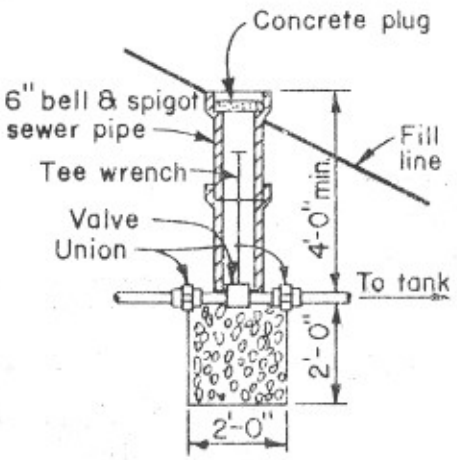


SECTION ALONG ℄ OF WATER PIPE



ALTERNATE INLET



VALVE WELL DETAIL

NOT TO SCALE

QUAN.	BILL OF MATERIALS ITEM	LENGTH
	__" Galv. Iron Pipe or Plastic Pipe (1¼" Min.)	
1	__" Galv. Iron or Plastic Pipe	10'
1	__" Galv. Iron or Plastic Tee	
1	__" Galv. Iron or Plastic Pipe W/80 __" Holes	5'
1	__" Galv. Iron Pipe or Plastic 90° Elbow	
	__" Galv. Iron Pipe or Plastic Cap	
2	1¼" Galv. Iron or Plastic Female Union	
2	1¼" x 2½" Galv. Nipple or Plastic Connectors	
1	__" Gate Valve	
1	Tee Handle	3'-5"
1	6" Bell Joint V.C. Tile	4'-0"
1	Treated Wood Plug to Fit Bell or Concrete Plug	
1	Galv. Sheet Metal Disc 8" Dia.	
1	Brass D Handle With 2-1½" Screws	
	Pit-Run Sand and Gravel (Drain) - 0.34 Cu. Yd.	
	Coarse Gravel Mix For Barrel	
	Concrete (2 C.F. Per Collar - 5 C.F. Per Base)	

NOTES:

1. Plastic pipe shall be Acrylonitrile-butydiene-styrene (ABS), Polyethylene (PE), or Polyvinyl chloride (PVC).
2. Collars may also be made from butyl rubber.

STOCKWATER SYSTEM

NAME

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
Designed
Drawn
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Title
Sheet No
Drawing No.
of

IN-ENG-23 2(2) Rev. 6-81

(EFM Notice IN38, August 1981)

DESIGN DATA

DRAINAGE AREA 12 ACRES, POND AREA 0.8 ACRES, RATIO DRAINAGE AREA TO POND AREA 15:1

RUNOFF CURVE NO. ---, AVE. W.S. SLOPE: FLAT, MODERATE, STEEP (CIRCLE ONE)

TOP OF SETTLED FILL ELEV. 99.0 LOW POINT ON ℄ FILL ELEV. 81.4

EMERGENCY SPILLWAY

DESIGN Q = 12 AC X 0.5 CFS/AC = 6 CFS, MAXIMUM VELOCITY 5 FT/S

RETARDANCE C, DISCHARGE q 3 CFS/FT. L 10 FT

BOTTOM WIDTH b (STABILITY) = $\frac{\text{DESIGN Q}}{\text{DISCHARGE q}}$ = 2 FT, Hp = 1.3 FT.

BOTTOM WIDTH b (USED) 8 FT, DISCHARGE q (USED) = $\frac{\text{DESIGN Q}}{b}$ $\frac{6}{8}$ = 0.75 CFS/FT.

Hp (USED) 0.9 FT. MIN. SLOPE 1 %, MAX. SLOPE 6 %, EXIT SLOPE (ACTUAL) 5

FREEBOARD 1.0 FT. EMERGENCY SPILLWAY CREST ELEV. 97.1

PRINCIPAL SPILLWAY

METHOD I - MINIMUM DETENTION STORAGE

STORAGE = 0.5 IN. X 12 AC./12 0.5 AC. FT., REQUIRED STAGE = $\frac{\text{STORAGE (AC. FT.)}}{\text{POND AREA (AC.)}}$ = 0.63 FT.

PIPE DIAMETER 6 IN., TYPE H.C.M.P.

IS STAGE SUFFICIENT FOR PIPE FLOW: YES x NO

METHOD II - SHORTCUT FLOOD ROUTING

DESIGN STORM FREQUENCY ___ YEAR 24 HR., RAINFALL ___ IN., RUNOFF Vr ___ IN.

TYPE PIPE ___

STAGE FT.	Vs AC. FT.	Vs IN.	TABLE A				TABLE B		PIPE DATA				RISER DATA	
			Vs Vr	Qo Qi	Qi CFS	Qo CFS	Qo CFS /AC	Qo CFS	DIA. IN.	WILL PIPE FLOW FULL	ACTUAL HEAD FT.	Qo CFS	DIA. IN.	IS STAGE SUFFICIENT FOR Qo

HOOD INLET OR FLARED INLET DATA

PIPE DIA. SELECTED 6 IN., STAGE PROVIDED 0.9 FT., STORAGE PROVIDED 0.72 AC.FT.

PIPE INLET INVERT ELEV. 96.2, PIPE OUTLET INVERT ELEV. 81.0, PIPE LENGTH 74 FT.

DROP INLET DATA

PIPE DIA. ___ IN., RISER DIA. ___ IN., STAGE REQUIRED ___ FT.

STORAGE REQUIRED ___ AC.FT., PIPE LENGTH ___ FT., RISER LENGTH ___ FT.

CREST OF RISER ELEV. ___ FT., OUTLET OF PIPE INVERT ELEV. ___ FT.

PHYSICAL DATA

MAXIMUM FILL HEIGHT 17.6 FT.

MAXIMUM WATER DEPTH 14.8 FT.

HAZARD CLASSIFICATION "a"

DETENTION STRUCTURE DATA

NAME Tom Bass

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date		Approved by	
Designed		Title	
Drawn		Title	
Checked		Sheet No. 6 of 6	Drawing No.
Reviewed			

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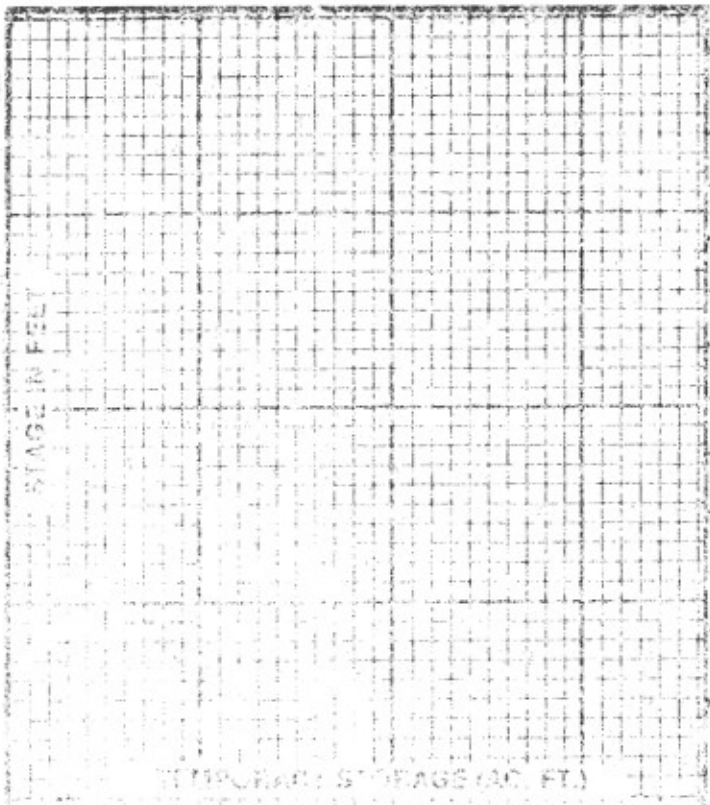

AVAILABLE STORAGE

Elevation	Area sq. in.	Area Flooded Acres	Average Acres	Interval Ac.	Incremental Storage Ac. Ft.	Accum. Storage Ac. Ft.

STAGE - STORAGE CURVE DATA

EARTHWORK COMPUTATIONS

		+5%				
0+50	99.0	0	0			
0+80	94.0	5.3	5.0	2.5	30	75
1+00	88.0	11.6	17.5	11.3	20	226
1+20	84.0	15.8	30.1	23.8	20	476
1+50	83.8	16.0	30.8	30.5	30	915
1+60	82.2	16.6	32.9	31.9	10	319
1+80	84.0	15.8	30.1	31.5	20	630
2+00	92.0	7.4	8.4	19.3	20	386
2+20	99.0	0	0	4.2	20	84
					Total	3111
	Estimated from core			trench		150
					Total	3261

CONSTRUCTION CHECK

Length of fill	230 ft
Top width	12 ft
Side slopes	2½:1 - 2½:1
Max. height dam	6 ft
Stage - emerg.-principal	0.9 ft
Top fill - emerg. spillway	1.9 ft
Veg. spillway width	14 ft
Top fill el.	99.2
Veg. spillway el.	96.3
Principal spillway crest el.	96.1
Pipe outlet invert el.	82.2

Clearing adequate (yes) (no) Core trench adequate (yes) (no) Cut to CL material

Stockwater system adequate (yes) (no) Fencing adequate (yes) (no)

Seeding adequate (yes) (no) Pipe installation adequate (yes) (no)

I certify that this job meets all the requirements of Indiana Standards and Specifications for Pond (Code 378) and the plans as designed.

Checked by: after checker Date: Mar. 12 '82

(EFM Notice IN38, August 1981)

IN-ENG 25 2(2) Rev. 6-81

Example Design - Pond with a Hood Inlet Spillway and Detention Storage - Using Method I Minimum Detention Storage.

(Pond Drainage Area > 20 Acres)

STEPS

1. DA = 28 ac - Vigo County

2. Pond Area = 1.6 ac

3. Ratio drainage area to pond area = $\frac{28 \text{ ac}}{1.6 \text{ ac}}$ = 17.5:1

4. Top of dam elevation = 99.5
   Low point elevation on $\mathcal{L}$ fill profile = 79.8

Emergency Spillway

5. Design Q = 0.5 cfs/ac x 28 ac = 14 cfs

6. Maximum permissible velocity = 5 ft/s for tall fescue on easily erodible soils with slope range 0-5%

7. Retardance = C for fair stand, 10 to 24 inches average length of vegetation

8. q = 3 cfs/ft, Table 3C, p. 11-54h, for V = 5 fps

9. L = 20 ft (Use L = 25 column in Table 3C)

10. b = 14 cfs ÷ 3 cfs/ft = 4.7 ft (not practical)

11. Hp = 1.3 ft, Table 3C, for L = 25 ft, q = 3 cfs/ft, V = 5 fps

12. Actual b = 12 ft

13. Recalculated q = 14 cfs ÷ 12 ft = 1.2 cfs/ft

14. Hp (used) = 0.9 ft, Table 3C for q = 1.25 cfs/ft, V = 3fps

15. Min. slope = 1%, max. slope = 6%, actual slope 5%, Table 3C for V = 5 fps (stability)

16. Total difference between emergency spillway and top of dam = 0.9 ft (Hp) + 1.0 ft (freeboard)=1.9 ft NOTE: DA > 20 acres

    Use 2.0 feet minimum

17. Emergency Spillway elevation 99.5 - 2.0 = 97.5

Principal Spillway

18. Storage = 1.5 inch x $\frac{28 \text{ ac}}{12 \text{ in/ft}}$ = 3.5 ac. ft.

19. Stage = $\frac{3.5 \text{ ac. ft.}}{1.6 \text{ acres}}$ = 2.2 ft.

20. Pipe diameter = 10-inch H.C.M.P.

21. Stage for full pipe flow = $\frac{1.8 \times 10 \text{ inches}}{12 \text{ in/ft}}$ = 1.5 ft.

22. Stage provided = 2.2 ft.

23. Storage provided = 2.2 ft x 1.6 ac = 3.5 ac. ft.

24. Pipe inlet invert elevation = 97. 5 - 2.2 = 95.3

25. Pipe outlet elevation = 79.5 + 1.0 = 80.5

26. Pipe length = Projection U.S. + U.S. Z (TF - WL) + TW + D.S. Z (TF - Toe Elev.) + Extension D.S. + Correction(s)

    (a) Horizontal Length - L_1 = 3 + 2.5(100.5 - 95.3) + 10 + 2.5 (100.5 - 79.5) + 4 = 82.5

    (b) Pipe through fill @ 90° to C_L therefore no skew correction.

    (c) Drop in pipe (h) = Inlet Invert. Elev. - Outlet Invert Elev. = 95.3 - 80.5 = 14.8 ft.

    (d) Correction for slope (Table II, EFM p 6-55) = 1.6 ft.

    (e) Pipe length = 82.5+ 1.6 = 84.1 Use 84 feet

27. Maximum fill height = 19.7 ft. (TF El. 99.5 - Low Point El. 79.8)
    Maximum water depth = 15.5 ft. (WL Elev. 95.3 - Bottom El. 79.8)

28. Fill out the sheets for the complete plan.

29. Check all your work for omissions and errors.

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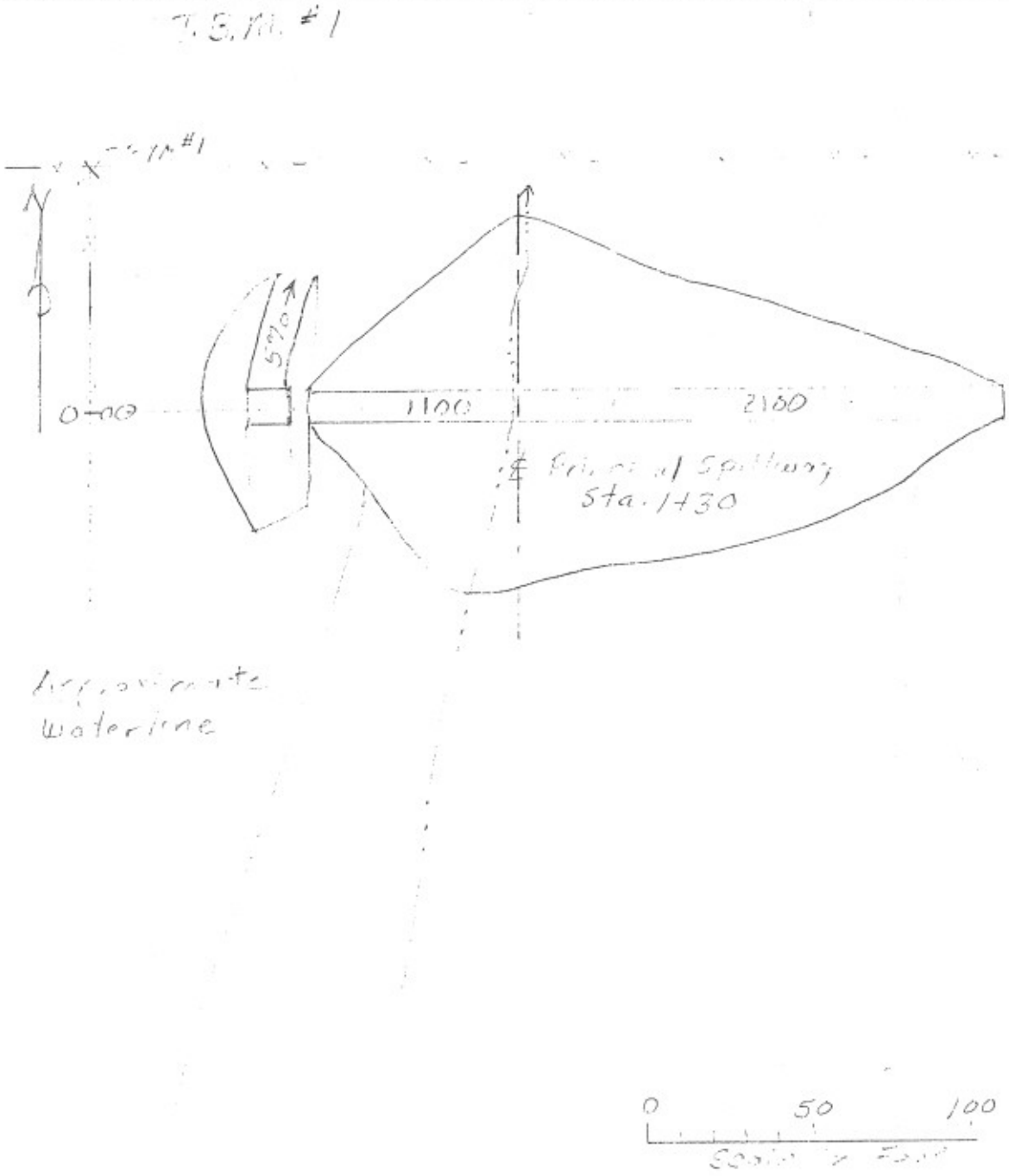

PLAN FOR Farm Pond

COOPERATOR Tim Thomas SEC. 10 T. 11N R. 5W

COOPERATING WITH Vigo County SWCD

COUNTY Vigo STATE IN

SURVEYED A. Checker DATE 12-81

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed D. Designer	Date 12-81	Approved by /s/Tom Able DC, I-82	
Drawn D. Designer		Title	
Traced		Title	
Checked Tom Able	12-81	Sheet No. 1 of 7	Drawing No.

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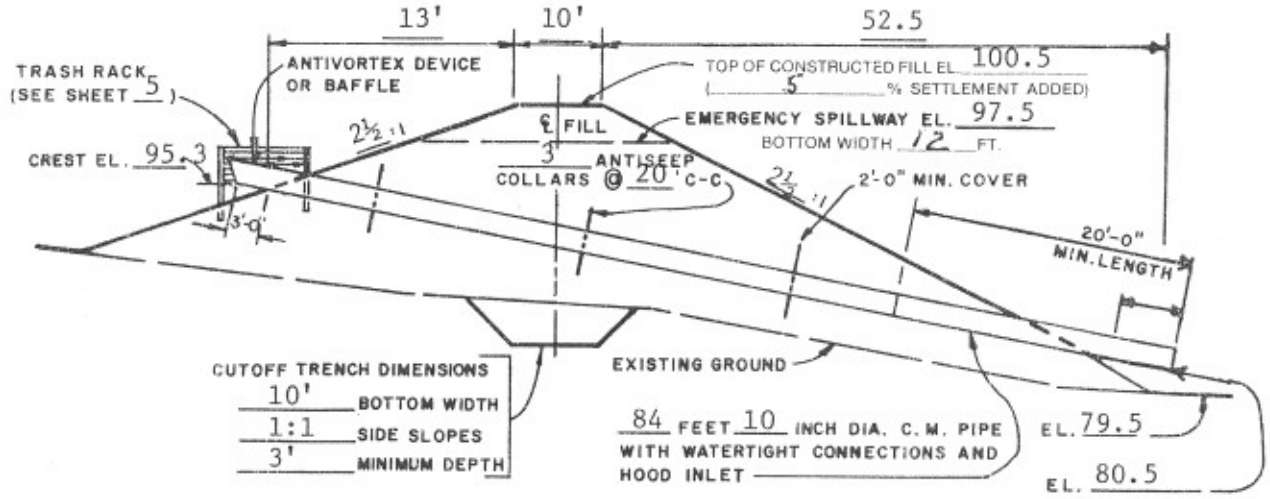
IN-ENG-42 1 (1) Rev. 6-81



NOTE: MOST PERVIOUS FILL TO BE PLACED IN DOWNSTREAM 1/3 OF DAM.

NOTE: THIS TYPE CONDUIT OUTLET IS LIMITED TO CONDUITS OF 15 INCHES OR LESS WITH THE OUTLET INVERT ONE TO TWO FEET ABOVE A STABLE CHANNEL BOTTOM. FOR CONDUITS OVER 15 INCHES, USE OUTLET PIPE SUPPORT.

NOT TO SCALE

PROFILE ALONG CENTERLINE PRINCIPAL SPILLWAY

ESTIMATE OF MATERIALS

ITEM	QUANTITY	
Clearing	0.5	Acres
Excavation	150	Cu.yd.
Earth fill, compacted	4464	Cu.yd.
Pipe, 10 inch diameter, C.M.P. metal thickness 0.06 in. (-- ga.) with watertight connections and hood inlet	84	Lin.ft.
Antivortex device or baffle	1	Each
Pipe support (See Sheet __)	--	Each
Trash rack and protective fence	1	Each
Antiseep collar	3	Each
Stockwater system (See Sheet 4)	1	Each
Seeding and mulching	0.9	Acres
Fencing	400	Feet

SOILS INVESTIGATION REPORT

LOCATION OF BORINGS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION
#1 - 2+30 ℄	0-1	ML
Fill	1-4	CL
#2 - 1+50 ℄	0-1	SM
Fill	1-4	CL

EMBANKMENT POND OR PIPE STRUCTURE WITH HOOD INLET

NAME Tim Thomas

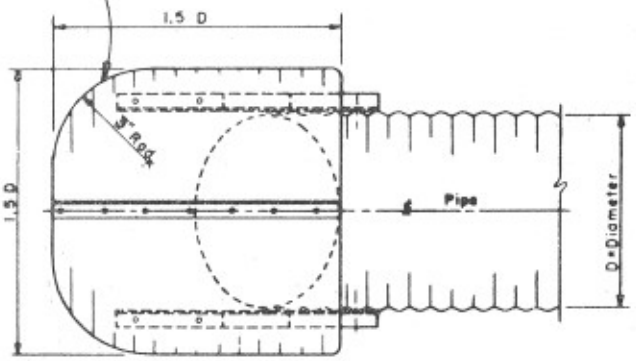
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ____ Date ____ Approved by ____
Drawn ____ Title ____
Checked ____ Title ____
Reviewed ____ Sheet No 2 of ____ Drawing No ____

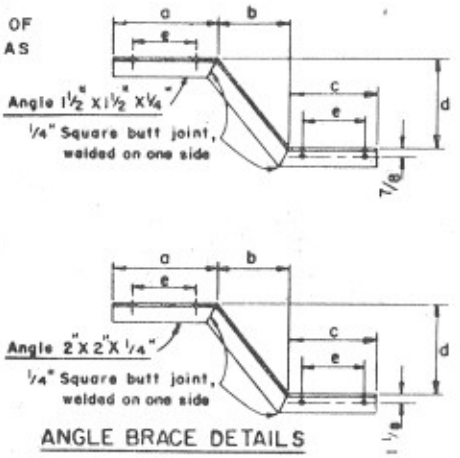
(EFM Notice IN38, August 1981)

IN-ENG-21 1(2) Rev. 6-81

METAL BAFFLE SHALL HAVE THE SAME COATING AS THE PIPE TO WHICH IT IS ATTACHED. WHERE METAL BAFFLE IS FABRICATED OF MORE THAN ONE PIECE OF METAL, THE SEPARATE PIECES SHALL BE SECURELY FASTENED TO EACH OTHER. SHARP CORNERS SHALL BE REMOVED. AT CONTRACTOR'S OPTION, METAL BAFFLE MAY BE MADE OF CORRUGATED OR SHEET METAL AND SHAPED CIRCULAR, SQUARE OR AS SHOWN.

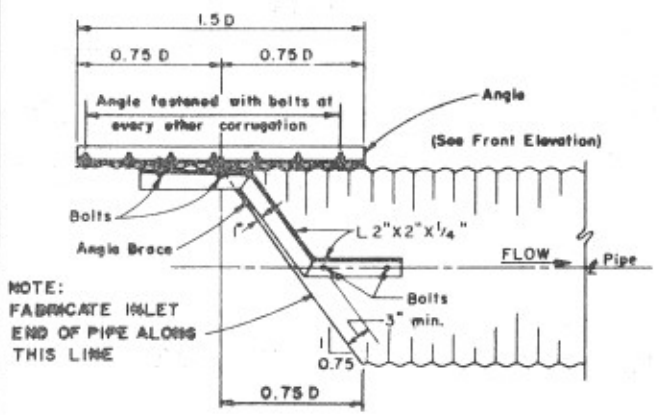


PLAN

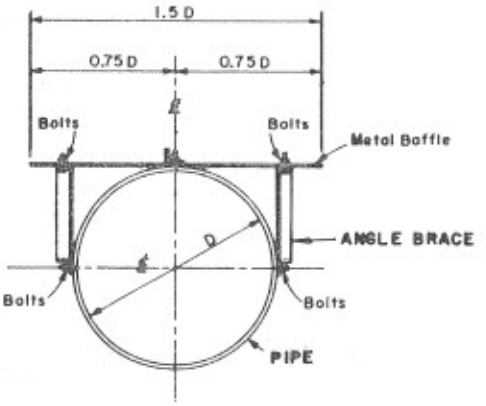


ANGLE BRACE DETAILS

(1 left and 1 right for each baffle) (for greater tha 15 inches)



SIDE ELEVATION



FRONT ELEVATION

GAGE OF METAL BAFFLE AND DIMENSIONS OF ANGLE BRACE

DIA. OF PIPE, D	GAGE OF BAFFLE		ANGLE BRACE DIMENSIONS IN INCHES				
	STEEL	AL.	a	b	c	d	e
6"	16	0.06					
8"	16	0.06					
10"	16	0.06					
12"	16	0.06					
15"	16	0.06					
18"	16	0.06	10	6	9	8	5 1/3
21"	16	0.06	10	7 1/8	9	9 1/2	5 1/3
24"	14	.075	13	8 1/4	12	11	8
30"	14	.105	13	10 1/2	12	14	8

NOTES:

USE ALUMINUM BAFFLE AND ANGLES WITH ALUMINUM PIPE.

USE STEEL BAFFLE & ANGLES WITH STEEL OR IRON PIPE.

ALL NUTS, BOLTS, AND WASHERS SHALL BE GALVANIZED, CADMIUM PLATED, OR STAINLESS STEEL.

ALL CUTS SHALL BE SAW OR SHEAR CUTS.

HOLES IN THE ANGLE BRACE SHALL BE SPACED AND LOCATED TO MATCH CORRUGATIONS IN PIPE AND BAFFLE.

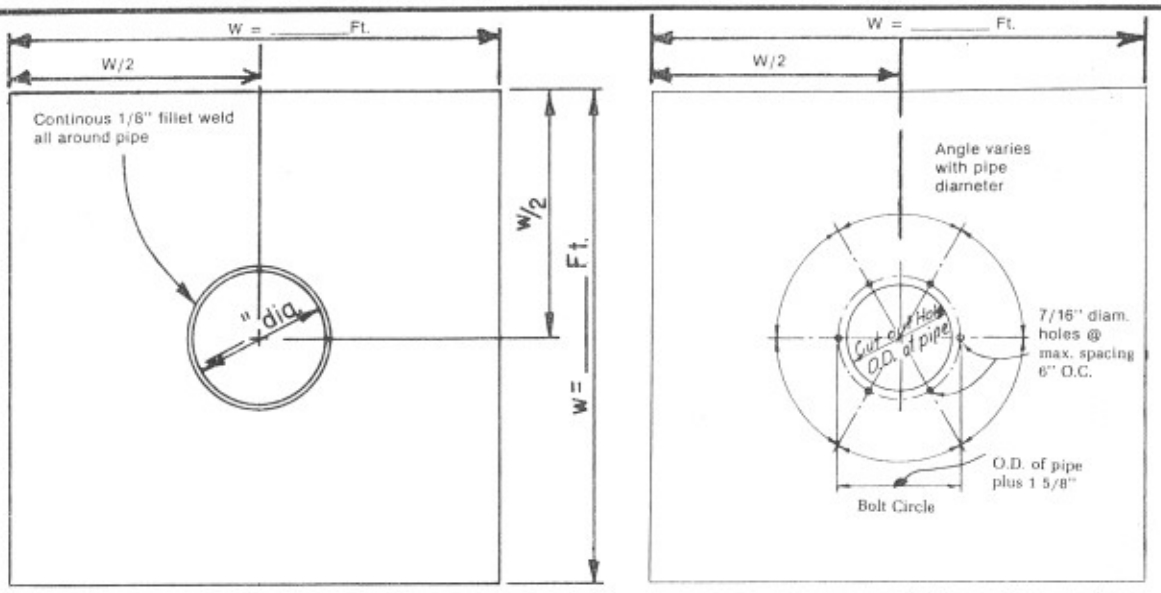
STEEL ANGLES SHALL BE GALVANIZED.

ALL ANGLES SHALL BE 1 1/2" X 1 1/2" X 1/4".

ALL BOLTS SHALL BE 3/8" X 1 1/2" WITH NUT AND SPLIT WASHER.

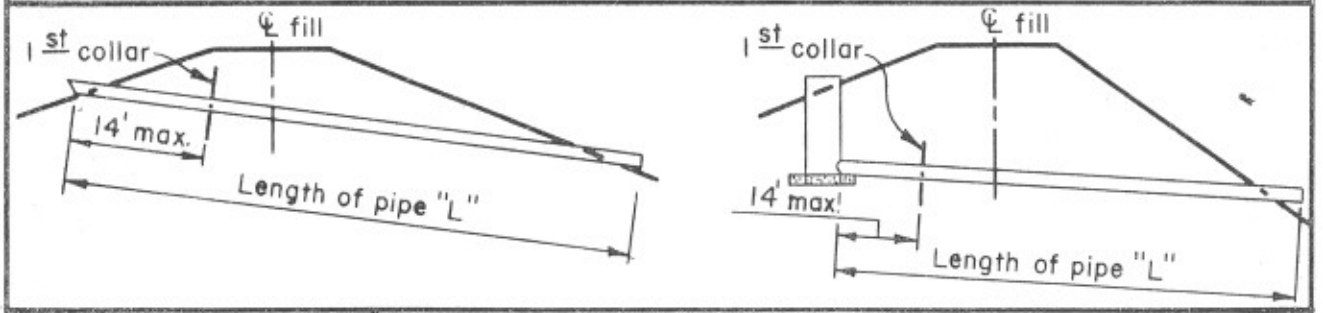
ALL HOLES FOR BOLTS SHALL BE DRILLED 7/16" DIA.

DETAILS OF HOOD INLET FOR CORRUGATED METAL PIPE



Notes: 1. Hot rolled sheet steel 16 ga. or aluminum sheet — min. thickness 0.06".
2. Install C.M. antiseep collar with corrugations vertical.

ALTERNATE DETAILS OF ANTISEEP COLLAR



PIPE SIZE INCHES	MAXIUM SPACING FEET		LENGTH OF PIPE "L" IN FEET															
			50		60		70		80		90		100		110		120	
	SIZE COLLAR "W" FEET		SIZE COLLAR "W" FT.															
	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5
6&8	20	25	2	2	2	2	2	2	3	3	3	3	4	3	4	4	4	4
10&12	20	25	2	2	2	2	3	2	3	3	4	3	4	4	4	4	5	4
15	19	25	2	2	3	2	3	2	4	3	4	3	5	4	5	4	6	4
18	18	25	2	2	3	2	3	2	4	3	4	3	5	4	5	4	6	4
21	15	23	2	2	3	2	4	3	4	3	5	4	5	4	6	4	7	5
24	14	21	3	2	3	2	4	3	5	3	5	4	6	4	7	5	7	5
30		18	—	2	—	3	—	3	—	4	—	4	—	5	—	5	—	6

NUMBER OF REQUIRED ANTISEEP COLLARS & spacing for 6" THRU 30" DIAMETER PIPE

BILL OF MATERIALS

QUANTITY	DESCRIPTION
3	Antiseep collar - 4 ft. or 4 ft. round or square
4	Flange coupling
24	Hex. HD. nuts, 3/8" x 1"
24	Hex. HD. nuts, 3/8"
24	Flat washers - cut steel, 7/16" I.D. x 7/8" O.D.
	Watertight coupling band, w/lug rods

ANTISEEP COLLARS AND COUPLING DEVICES FOR 6" THROU 30" C.M. PIPE

NAME Tim Thomas

U.S. DEPARTMENT OF AGRICULTURE
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Date
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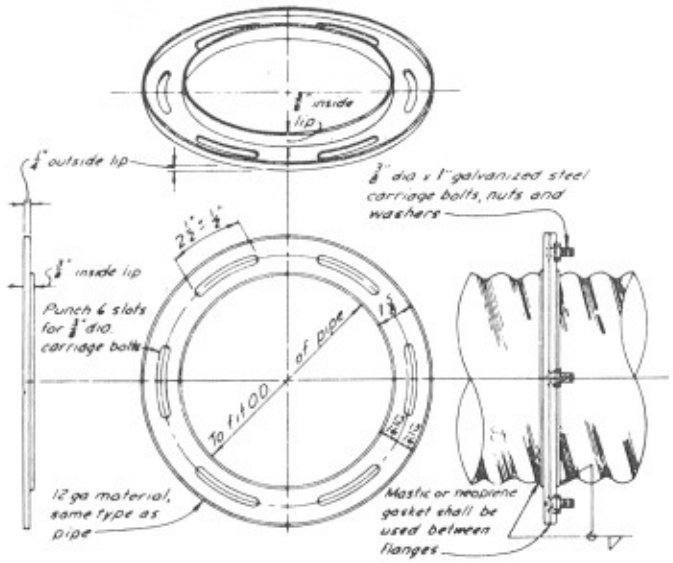
Title
Sheet No. 3 Of. 7
Drawing No.

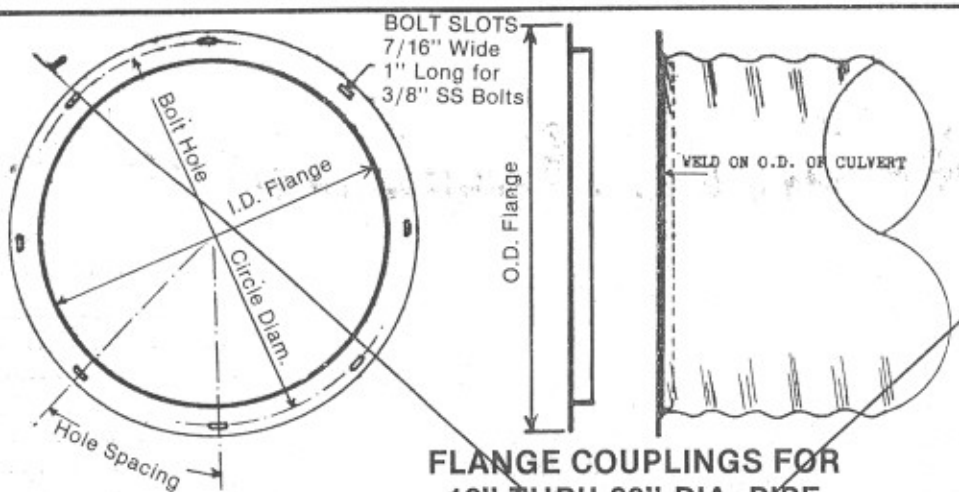


NOTES:
1. THE PIPE MAY BE HELICAL CORRUGATED METAL PIPE OR PIPE MATERIAL OF EQUIVALENT STRENGTH AND DURABILITY.
2. ALL WELDED, MARRED, AND CHECKED SURFACES SHALL BE FIELD COATED WITH A HEAVY APPLICATION OF FIBRATED ASPHALT-CEMENT.
3. COMPLETELY COAT WITH ASPHALT-CEMENT ALL CONTACT SURFACES OF FLANGES AND COLLARS BEFORE FIELD ASSEMBLY.

Use This Type Coupling

FLANGE COUPLING FOR 6", 8" & 10" DIA. PIPE

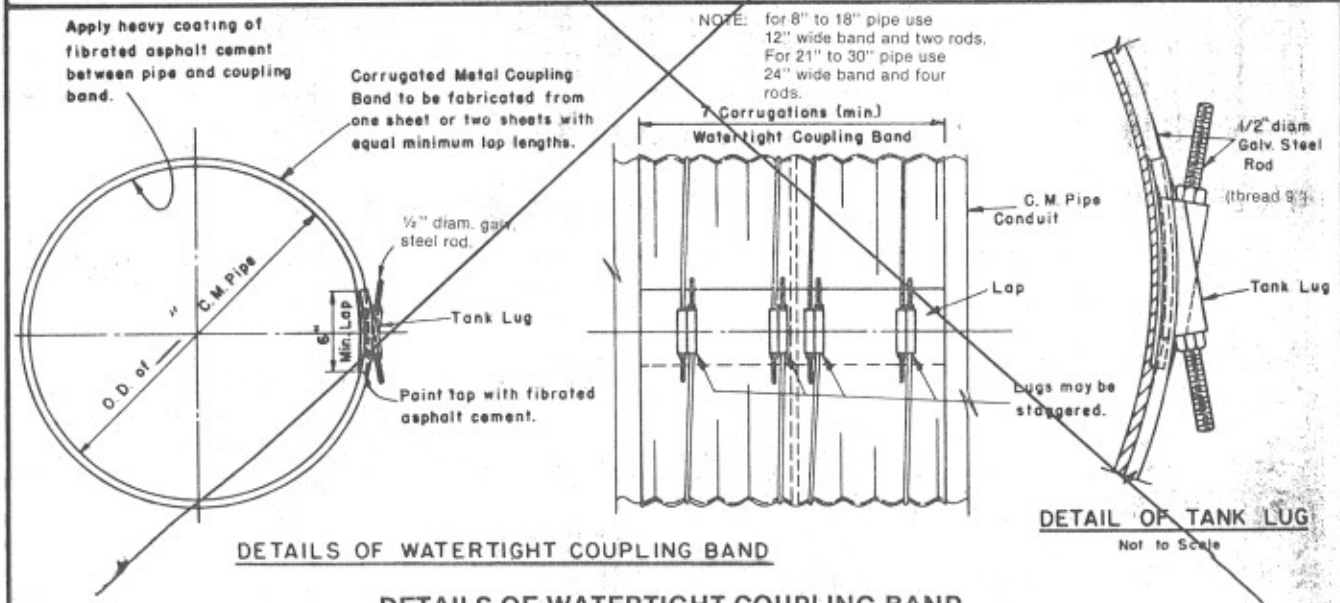
N.T.S.



Pipe Diam. Inches	Min. No. Holes	Min. Spacing Inches
12	10	4.48
15	12	4.52
18	14	4.54
21	16	4.56
24	18	4.58
30	22	4.60

FLANGE COUPLINGS FOR 12" THRU 30" DIA. PIPE

NOTE: Notes for 6", 8" & 10" flange coupling apply for 12" thru 30" flange couplings N.T.S.



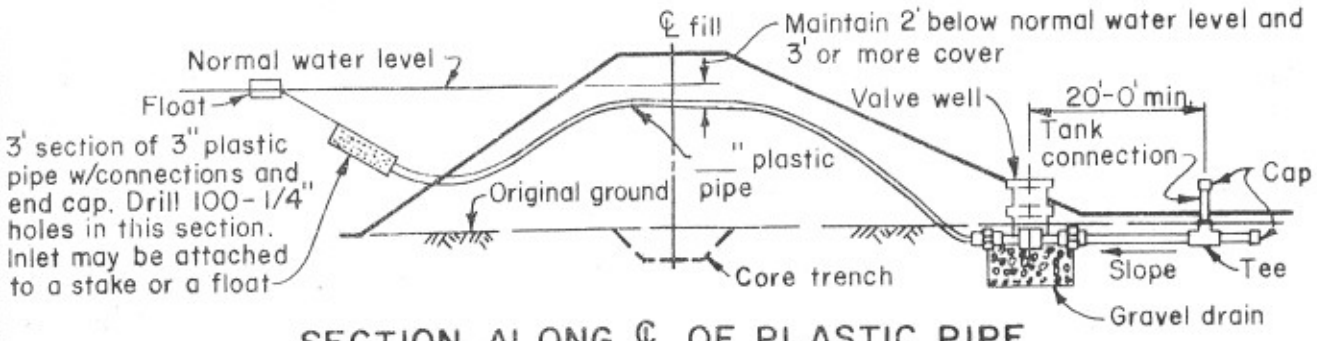
DETAILS OF WATERTIGHT COUPLING BAND

DETAIL OF TANK LUG
Not to Scale

DETAILS OF WATERTIGHT COUPLING BAND 8" THRU 30" DIA. PIPE

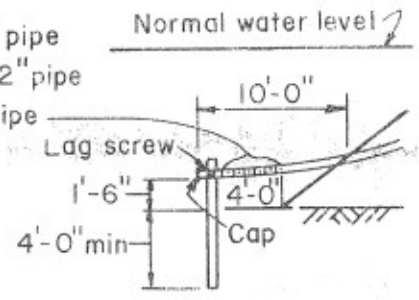
IN-ENG-22 2(2) REV. 6-81

(EFM Notice IN38, August 1981)



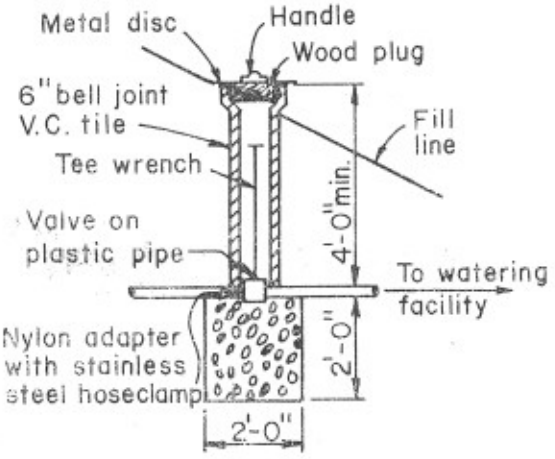
SECTION ALONG ℄ OF PLASTIC PIPE

Perforated section
80 holes in 4 rows
Hole size:
1/4" for 1 1/4" pipe
5/16" for 1 1/2" pipe
3/8" for 2" pipe



ALTERNATE INLET ARRANGEMENT

Use This Type Inlet



ALTERNATE VALVE WELL DETAIL

Use This Type Valve Well

BILL OF MATERIALS

QUAN.	ITEM	LENGTH
	1 1/4" PLASTIC PIPE	125'
2	1 1/4" PLASTIC CAP	
1	1 1/4" PLASTIC TEE	
2	1 1/4" PLASTIC FEMALE UNION	
~~1~~	~~3" PLASTIC PIPE INLET SECTION~~	
1	BRASS - CHECK AND DRAIN VALVE	
1	TEE HANDLE WRENCH	3'-5"
2	6" BELL AND SPIGOT SEWER PIPE	4'-0"
1	Wood Plug Top w/Handle	
1	Wooden Post	6'-0"
1	Lag Screw - 3/8"	4½"

NOT TO SCALE

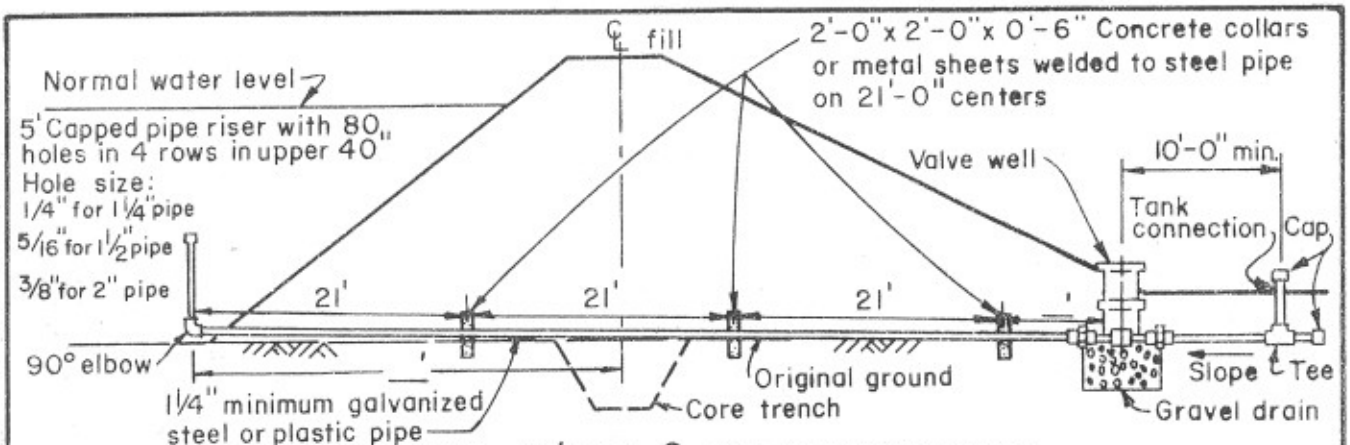
STOCKWATER SYSTEM

NAME Tim Thomas

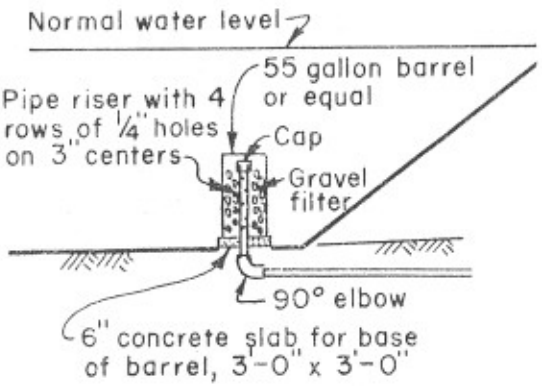
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ..... Date .....
Drawn .....
Checked .....
Reviewed .....
Approved by .....
Title .....
Title .....
Sheet No. 4 of 7
Drawing No.

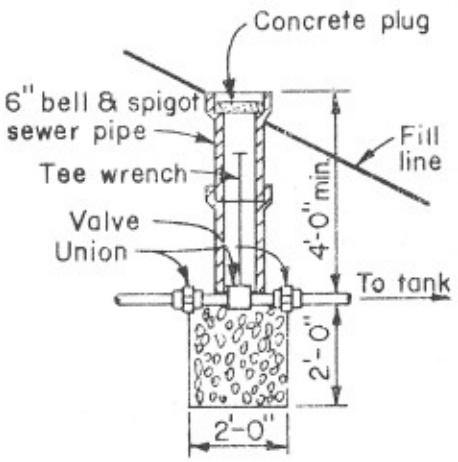
IN-ENG-23 1(2) Rev. 6-81



SECTION ALONG ℄ OF WATER PIPE



ALTERNATE INLET



VALVE WELL DETAIL

NOT TO SCALE

QUAN.	BILL OF MATERIALS ITEM	LENGTH
	__" Galv. Iron Pipe or Plastic Pipe (1¼" Min.)	
1	__" Galv. Iron or Plastic Pipe	10'
1	__" Galv. Iron or Plastic Tee	
1	__" Galv. Iron or Plastic Pipe W/80 __" Holes	5'
1	__" Galv. Iron Pipe or Plastic 90° Elbow	
	__" Galv. Iron Pipe or Plastic Cap	
2	1¼" Galv. Iron or Plastic Female Union	
2	1¼" x 2½" Galv. Nipple or Plastic Connectors	
1	__" Gate Valve	
1	Tee Handle	3'-5"
1	6" Bell Joint V.C. Tile	4'-0"
1	Treated Wood Plug to Fit Bell or Concrete Plug	
1	Galv. Sheet Metal Disc 8" Dia.	
1	Brass D Handle With 2-1¼" Screws	
	Pit-Run Sand and Gravel (Drain) - 0.34 Cu. Yd.	
	Coarse Gravel Mix For Barrel	
	Concrete (2 C.F. Per Collar - 5 C.F. Per Base)	

NOTES:

1. Plastic pipe shall be Acrylonitrile-butydiene-styrene (ABS), Polyethylene (PE), or Polyvinyl chloride (PVC).
2. Collars may also be made from butyl rubber.

STOCKWATER SYSTEM

NAME

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
Designed
Drawn
Checked
Approved by
Title
Title
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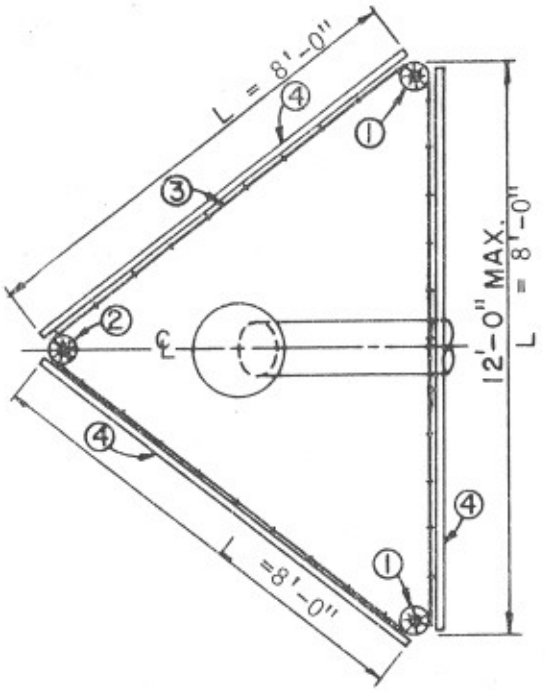
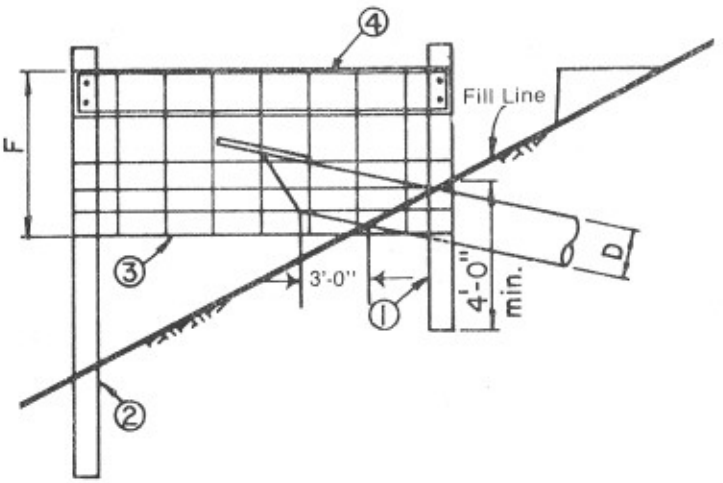
File
of
Drawing No.

IN-ENG-23 2(2) Rev. 6-81

(EFM Notice IN38, August 1981)



PLAN



SIDE ELEVATION

TRASH RACK FOR HOODED INLETS

BILL OF MATERIALS			
MARK	QUANTITY	DESCRIPTION	LENGTH
1	2	Wood posts, 6" top, black locust, hedge or pressure treated	7'-0"
2	1	Wood posts, 6" top, black locust, hedge or pressure treated	9'-0"
3	1	Fence, woven wire, No. 9 top and bottom, with 12" stays 35" high	24'-0"
———		Staples - Mark ③ to ① and ②	1 1/4"
4	3	Wood plank 2" thick x 6" wide x L+6", pressure treated	8'-6"
	12	3/8"dia. lag screws with flat washers, mark ④ to ① and ②	4 1/2"

NOTE: Fence and staples to be galvanized and lag screws cadmium plated.

DIMENSIONS					
D	L	F	LIN. FT. OF FENCE	POST LENGTH*	
				①	②
6" - 12"	8-0	35"	24'-0"	7-0	9-0
15" - 18"	10-0	47"		8-0	10-0

* LENGTH OF POST BASED ON 3:1 SLOPE.

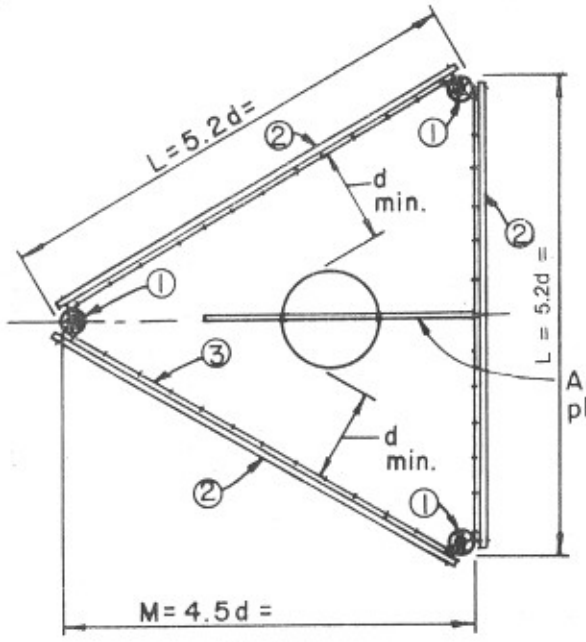
TRASH RACK FOR HOODED INLET OR PIPE DROP INLET

NAME Tim Thomas

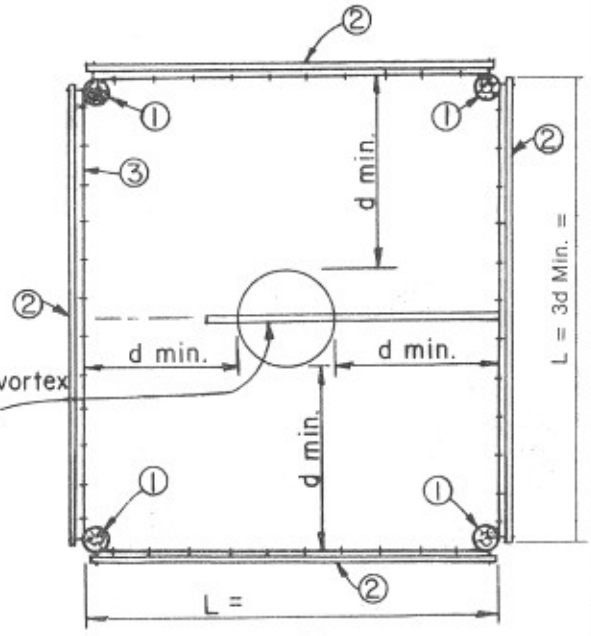
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ____ Date ____ Approved by ____
Drawn ____ Title ____
Checked ____ Title ____
Reviewed ____ Sheet No. 5 of 7 Drawing No. ____

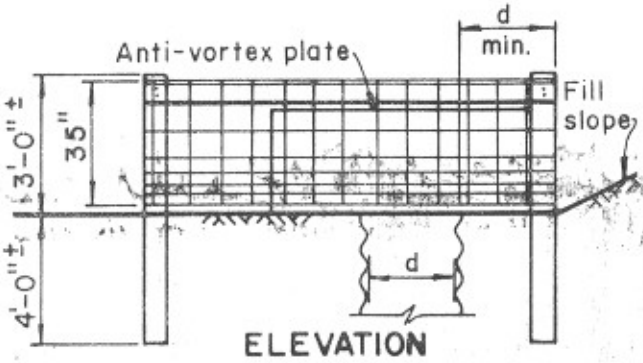
IN-ENG-24 1(2) Rev.6-81



PLAN

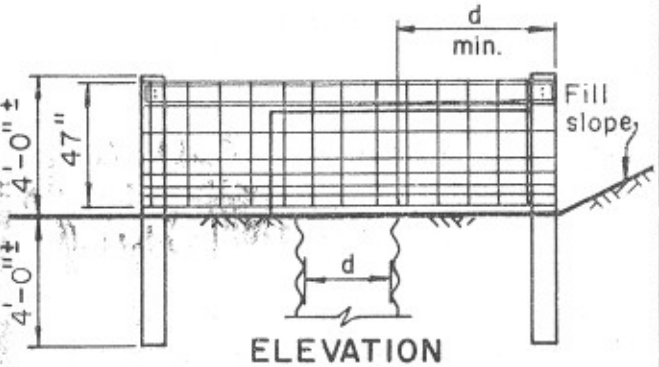


PLAN



ELEVATION

Note: Triangle use limited to:
1. Stage of 2'-6" maximum
2. Riser dia. of 2'-0" maximum



ELEVATION

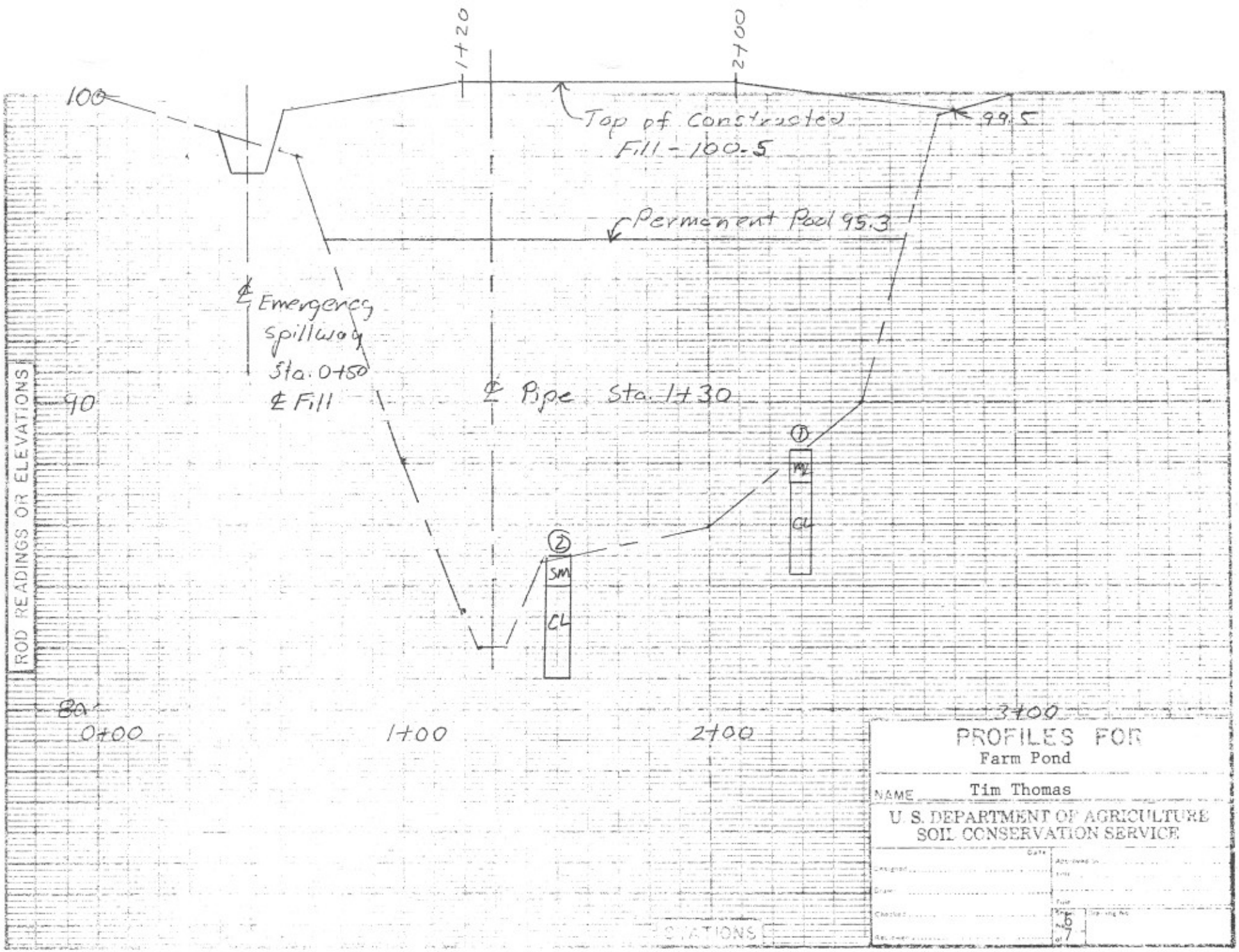
Note: Square use limited to:
1. Stage of 3'-6" max. with 47" fence
2. Riser dia. of 4'-0" maximum

TRASH RACKS FOR PIPE DROP INLET

BILL OF MATERIALS

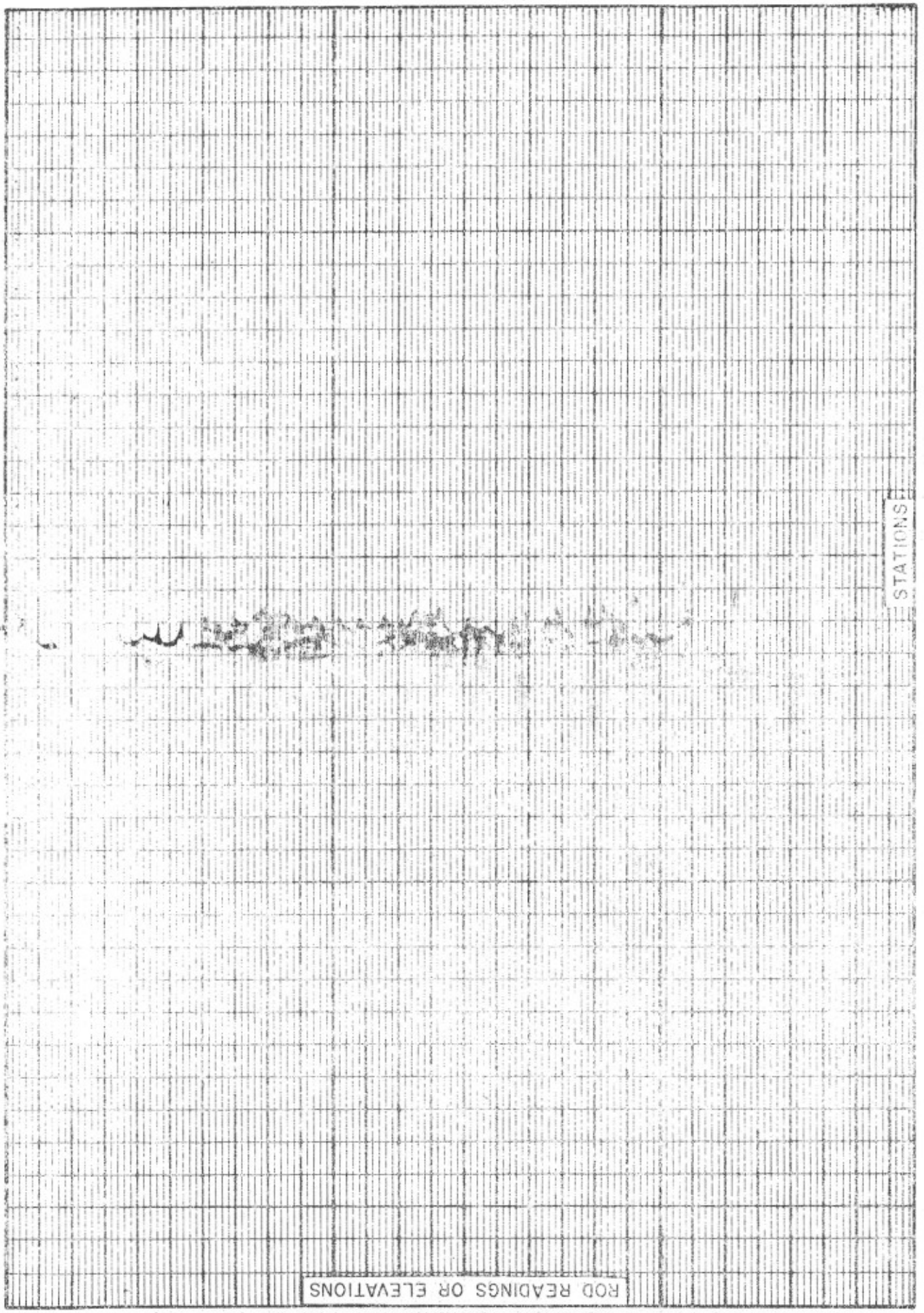
MARK	QUANTITY	DESCRIPTION	LENGTH
1		Wood posts, 6" tip, black locust, hedge or pressure treated	
2		Wood plank 2" thick x 6" wide x L, pressure treated	
3	1	Fence, woven wire, No. 9 top and bottom, with 12" stays ____" high	
——	As req'd	Staples - Mark ③ to ① and ②	1 1/4"
——		3/8" dia. lag screws with flat washers, mark ② to ①	4 1/2"

NOTE: Fence and staples to be galvanized and lag screws cadmium plated.



(EFM Notice IN38, August 1981)

IN-ENG-19 (2) Rev. 6-81



IN-ENG-19 2(2) Rev. 6-81

(EFM Notice IN38, August 1981)

DESIGN DATA

DRAINAGE AREA 28 ACRES, POND AREA 1.6 ACRES, RATIO DRAINAGE AREA TO POND AREA 17½:1

RUNOFF CURVE NO. _____, AVE. W.S. SLOPE: FLAT, MODERATE, STEEP (CIRCLE ONE)

TOP OF SETTLED FILL ELEV. 99.5 LOW POINT ON ℄ FILL ELEV. 79.8

EMERGENCY SPILLWAY

DESIGN Q = 28 AC X 0.5 CFS/AC = 14 CFS, MAXIMUM VELOCITY 5 FT/S

RETARDANCE C, DISCHARGE q 3 CFS/FT. L 20 FT

BOTTOM WIDTH b (STABILITY) = $\frac{\text{DESIGN Q } 14}{\text{DISCHARGE q } 3}$ = 4.7 FT, Hp = 1.3 FT.

BOTTOM WIDTH b (USED) 12 FT, DISCHARGE q (USED) = $\frac{\text{DESIGN Q } 14}{b\ 12}$ = 1.2 CFS/FT.

Hp (USED) 0.9 FT. MIN. SLOPE 1 %, MAX. SLOPE 6 %, EXIT SLOPE (ACTUAL) 5%

FREEBOARD 1.0 FT., EMERGENCY SPILLWAY CREST ELEV. 97.5

PRINCIPAL SPILLWAY

EFM-47

METHOD I - MINIMUM DETENTION STORAGE

STORAGE = 1.5 IN. X 28 AC./12 ~~283.5~~ AC. FT., REQUIRED STAGE = $\frac{\text{STORAGE (AC. FT.)}}{\text{POND AREA (AC.)}}$ = 2.2 FT.

PIPE DIAMETER 10 IN., TYPE H.C.M.P.

IS STAGE SUFFICIENT FOR PIPE FLOW: YES x NO _____

METHOD II - SHORTCUT FLOOD ROUTING

DESIGN STORM FREQUENCY _____ YEAR 24 HR., RAINFALL _____ IN., RUNOFF Vr _____ IN.

TYPE PIPE _____

STAGE FT.	Vs AC. FT.	Vs IN.	TABLE A Vs Vr	Qo Qi	Qi CFS	Qo CFS	TABLE B Qo CFS /AC	Qo CFS	PIPE DATA DIA. IN.	WILL PIPE FLOW FULL	ACTUAL HEAD FT.	Qo CFS	RISER DATA DIA. IN.	IS STAGE SUFFICIENT FOR Qo

HOOD INLET OR FLARED INLET DATA

PIPE DIA. SELECTED 10 IN., STAGE PROVIDED 2.2 FT., STORAGE PROVIDED 3.5 AC.FT.

PIPE INLET INVERT ELEV. 95.3, PIPE OUTLET INVERT ELEV. 80.5, PIPE LENGTH 84 FT.

DROP INLET DATA

PIPE DIA. _____ IN., RISER DIA. _____ IN., STAGE REQUIRED _____ FT.

STORAGE REQUIRED _____ AC.FT., PIPE LENGTH _____ FT., RISER LENGTH _____ FT.

CREST OF RISER ELEV. _____ FT., OUTLET OF PIPE INVERT ELEV. _____ FT.

PHYSICAL DATA

MAXIMUM FILL HEIGHT 19.7 FT.

MAXIMUM WATER DEPTH 15.5 FT.

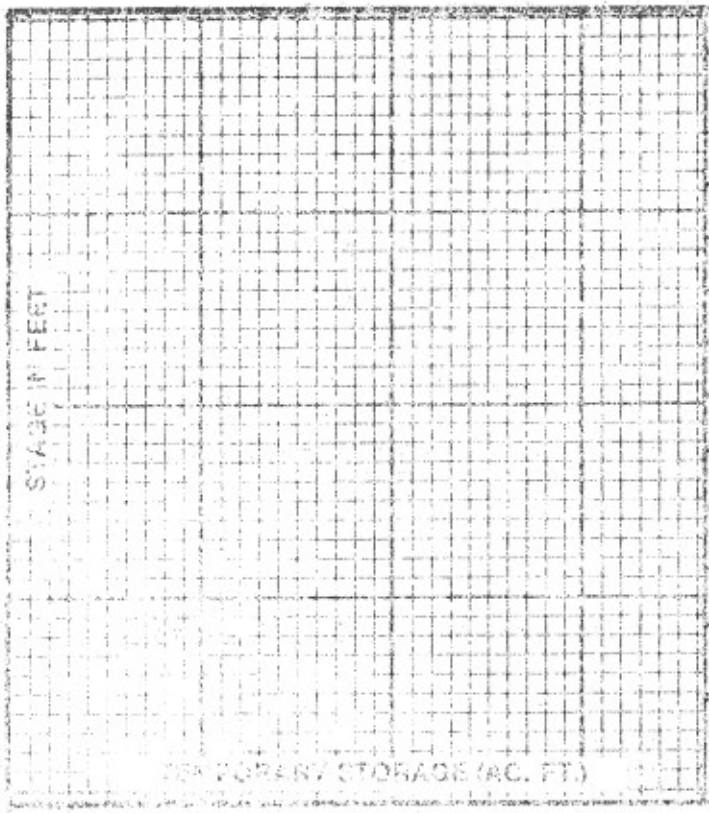
HAZARD CLASSIFICATION "a"

DETENTION STRUCTURE DATA

NAME Tim Thomas

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date		Approved by	
Designed		Title	
Drawn		Title	
Checked		Sheet No 7 Of 7	Drawing No.
Reviewed			



AVAILABLE STORAGE

Elevation	Area		Average Acres	Interval Ft.	Interval Storage Ac. Ft.	Accum. Storage Ac. Ft.
	Sq. In.	Planted Area				

STAGE - STORAGE CURVE DATA

EARTHWORK COMPUTATIONS

Sta.	Fill	Cu. yd. per 100 ft.	Average fill cu. yd.	Distance ft.	Fill cu. yd.
	+Settlement				
0+60	98.2	1.4	0.7		
0+65	98.0	1.6	0.8	0.8	5	4
1+00	88.0	12.2	18.3	9.6	35	336
1+20	83.2	17.4	24.4	21.4	20	428
1+25	82.0	18.6	41.9	33.2	5	166
1+32	82.0	18.6	41.9	41.9	7	293
1+45	84.8	15.8	29.0	36.0	13	468
2+00	86.0	14.6	25.2	27.1	55	1490
2+50	90.0	10.0	13.0	19.1	50	955
2+75	99.3	0.3	0.1	6.5	25	163
2+80	99.5	0.0	0	0.1	5	1
					Total	4314
Estimated in Core Trench Excavation						150
					Total	4464

CONSTRUCTION CHECK

Length of fill	220 ft.
Top width	10 (min.) ft.
Side slopes	2½:1 (min.)
Pipe diameter	10 in.
Spwy. (emerg. prin.)	2.2 ft.
Top fill — emerg. el.	2.2 ft.
Vol. spwy. earth	12 ft.
Top of fill el.	99.8 Low Spot
Veg. spwy. el.	97.6
Perm. spwy. inlet crest el.	95.4
Perm. spwy. outlet invert el.	79.7

Clearing adequate (yes) (no) Core trench adequate (yes) (no) Min. 3' good clay

Stockwater system adequate (yes) (no) Fencing adequate (yes) (no)

Seeding adequate (yes) (no) Seeded & mulched Pipe installation adequate (yes) (no)

I certify that this job meets all the requirements of Indiana Standards and Specifications for Pond (Code 378) and the plans as designed.

Checked by: Date:

NOTE: (3) The following procedure is an alternate method of design starting with a determined water level for the pond and then determining the emergency spillway and top of dam elevations.

STEPS

1. Determine drainage area from USGS maps, field observations and/or aerial photos.

2. Determine pond surface area from field surveys.

3. Determine ratio drainage area to pond area. Divide Step 1 value by Step 2 value.

4. Record crest elevation of pipe inlet invert from field surveys.

Principal Spillway

5. Determine detention storage required in Ac. Ft. by selecting principal spillway detention storage (minimum) in inches from Table 2 of Technical Guide Spec. 378 and multiply by drainage area in acres (Step 1) and divide by 12 inches per foot.

6. Determine required stage in feet by dividing storage (Step 5) by pond area (Step 2).

7. Record pipe diameter selected. For Method I, minimum pipe diameter shall be a 4-inch smooth pipe or 6-inch corrugated metal pipe for DA less than 20 acres and 10-inch diameter smooth or corrugated pipe for DA greater than 20 acres. (Table 2, Tech. Guide Spec. 378)

8. Determine stage for hooded inlet to flow full. Minimum stage between inlet invert of pipe to the emergency spillway crest must equal 1.8 times the diameter of principal spillway in ft.

9. Record stage provided - Use stage from (Step 6) or (Step 8) whichever is greater.

10. Determine storage provided by multiplying stage provided (Step 9) by pond area (Step 2)

11. Determine emergency spillway crest elevation - add to pipe inlet invert elevation (Step 4) the stage provided (Step 9)

Emergency Spillway

12. Determine design Q by multiplying DA (Step 1) in acres by 0.5 cfs/ac. Reference: Tech. Guide, Standard and Specification 378, Table 2.

13. Determine maximum permissible velocity (V) in fps from EFM, Ch. 11, Exhibit 11-2, Table 1, based on exit channel slope range, soil erodibility, and grass to be seeded.

14. Determine retardance from EFM, Ch. 11, Exhibit 11-2, Table 2, based on condition of stand and height of vegetation.

15. Determine discharge q in $Ft^3/S/Ft$ (cfs/ft) from Exhibit 11-2, Tables 3A, 3B, 3C, 3D, or 3E for maximum permissible velocities.

16. Determine length (L) in feet of level portion of emergency spillway from field survey, observation or experience.

17. Determine bottom width (b) in feet for stability by dividing Q in cfs (Step 12) by q in cfs/fts (Step 15).

18. Determine Hp from Exhibit 11-2, Table 3A, 3B, 3C, 3D, or 3E for (L) (Step 16) and q(Step 15). Note: Most emergency spillways may have an (L) value less than 25 feet but use Hp value for 25 feet (L) as a minimum.

19. Record actual bottom width (b) used if wider than determined in Step 17

20. Recalculate discharge q for selected bottom width by dividing design Q (Step 12) by (b) (Step 19)

21. Determine Hp (used) from Exhibit 11-2, Table 3A, 3B, 3C, 3D, or 3E for new q (Step 23).

22. Determine emergency spillway (exit channel) slope. Find minimum and maximum from Exhibit 11-2, Tables 3A, 3B, 3C, 3D, or 3E. (For (V) max from step 13) Select exit slope (actual) from field survey, with range of minimum and maximum.

23. Determine freeboard. Minimum freeboard will be 1 foot above the HP value (Step 14). For dams with more than 20 acres drainage area, a minimum of 2 feet must be provided between the crest of the emergency spillway and top of dam.

24. Determine top of dam elevation - add to emergency spillway elevation (step 11) the value from step 23 and also record low point on center-line of fill profile elevation.

25. Determine pipe outlet invert elevation by adding 1 foot minimum to ground elevation at outlet.

26. Determine pipe length by using planned elevations and cross-section of dam. Select dam top width and side slopes from Tech. Guide Spec. 378.

27. Complete other physical data information from planned elevations.

28. Fill out the sheets for the complete plan.

29. Check all your work for omissions and errors

(EFM Notice IN38, August 1981)

Example Design - Pond with a hood inlet spillway and detention storage- Using Method I minimum detention storage.

(Pond Drainage Area over 20 Acres)

STEPS

1. D.A. = 40 Acres - Jefferson County

2. Pond Area = 2.0 Acres

3. Ratio = $\frac{40 \text{ Ac.}}{2.0 \text{ Ac.}}$ = 20:1

4. Pipe Inlet Invert Elev. = 96.3

Principal Spillway

5. Storage = $\frac{1.5 \text{ inch} \times 40 \text{ acres}}{12 \text{ inch/foot}}$ = 5.0 Ac. Ft.

6. Stage = $\frac{5.0 \text{ Ac. Ft.}}{2.0 \text{ Acres}}$ = 2.5 feet

7. Pipe Diameter = 10- inch smooth steel pipe

8. Stage for full pipe flow = $\frac{1.8 \times 10 \text{ inch}}{12 \text{ in/ft}}$ = 1.5 feet

9. Stage provided = 2.5 feet

10. Storage provided = 2.5 ft. x 20 acres = 5.0 Ac. Ft.

11. Emergency Crest Elev. = 96.3 + 2.5 = 98.8

Emergency Spillway

12. Design Q = 0.5 cfs/Acres x 40 Acres = 20 cfs

13. Maximum permissible velocity (V) = 6 fps for tall fescue on erosion resistance soil with slope range 5-10%

14. Retardance = B for good stand, 11 to 24 inches average length of vegetation.

15. q = 5 cfs/ft, Table 3B, p. 11-54g, for V = 6 fps

16. L = 20 ft (Use L = 25 column in Table 3B)

17. b = 20 cfs ÷ 5 cfs/ft = 4 feet (too narrow for dozer)

18. Hp = 1.9 feet, Table 3B, for L = 25 ft., q = 5 cfs/ft, V = 6fps

19. Actual bottom = 10 feet

20. Recalculated q = 20 cfs ÷ 10 ft = 2 cfs/ft

21. Hp (used) = 1.4 ft., Table 3B for q = 2 cfs/ft, V = 3fps

22. Min. slope = 1%; max. slope = 10%; actual slope = 7%; Table 3B for V = 6 fps (stability)

23. Difference = 1.0 (freeboard) + 1.4 (Hp) = 2.4 feet

24. Top of fill elev. = 98.8 + 2.4 = 101.2
Low point elev. = 83.8

25. Pipe outlet invert elev. = 83.3 + 1.0 = 84.3

26. Pipe Length = Projection U.S. + U.S. Z (TF - WL) + TW + D.S. Z (TF - Toe Elev.) + Extension D.S. + Corrections.

(a) Horizontal Length-
L_1 = 3 + 2.5(102.1 - 96.3) + 10 + 2.5(102.1 - 83.3) + 4 = 78.5

(b) Pipe through fill @ 90 to C_L, therfore, no skew correction.

(c) Drop in pipe (h) = 96.3 - 83.3 = 13 feet

(d) Correction for slope (Table II, EFM p. 6-45) = 1.1

(e) Pipe Length = 78.5 + 1.1 = 79.6 Use 80 Feet

27. Maximum fill height = 17.4 (TF El. 101.2 - low point El.
Maximum water depth = 12.5 (WL El. 96.3 - Bottom El. 83.3)

28. Fill out the sheet for the completed plan.

29. Check all work for omissions and errors.

DESIGN PROCEDURE FOR POND OR PIPE STRUCTURE WITH HOOD, DROP OR FLARED INLET AND WATER DETENTION (USING SHORT CUT FLOOD ROUTING METHOD II)

NOTES: (1) All structures designed under this procedure must be located in predominantly rural or agricultural areas where failure may only damage farm buildings, agricultural land,or township and county roads. The structure must also not require IDNR approval

(2) This method of design would be to start with a determined waterline for the pond and then determine the emergency spillway and top of dam elevation.

Steps

1. Determine drainage area from USGS maps, field observations, and/or aerial photos.

2. Determine pond surface area from field surveys. Maybe option to develop elevation - available storage information from field surveys, which may require a complete topographic survey of the area particularly for "dry pool" where storage starts at bottom for practices other than ponds.

3. Determine ratio drainage area to pond area. Divide step 1 value by step 2 value.

4. Determine CN from EFM, Ch. 2 based on soils, cover, etc., as determined by soil survey and field observations. Use form IN-ENG-10.

5. Determine average watershed slope from survey data, soil survey, field observations, and/or USGS maps. For definition of average watershed slope, see EFM, Ch. 2, p. 2-7

Principal Spillway - Method II - Shortcut Flood Routing

6. Principal spillway elevation from step 2.

7. Determine design storm frequency from Table 2 of Technical Guide Spec. 378.

8. Determine rainfall amount from EFM, Ch.2, Exhibit IN-2-4

9. Determine runoff amount Vr from EFM, Ch. 2, Exhibit IN-2-7A for curve number (step 4)and rainfall step 8.

10. Record type pipe and diameter to be used.

11. Estimate a stage in feet to provide adequate detention storage and full pipe flow.

12. Determine volume of storage Vs in ac. ft. from multiplication of stage (step 11) and surface area (step 2) or from elevation - available storage table.

13. Calculate Vs in watershed inches by multiplying value in Step 12 by 12 in/ft and dividing by drainage area (Step 1).

14. Determine Qo from EFM, Ch. 11, Exhibit 11-4 A or B Table B. Enter Fig. 1, p 11-55a EFM with Vr (Step 9) and Vs (Step 13) to determine Table to use (A or B).

Table A only

(a) Calculate Vs/Vr ratio by dividing Vs value (Step 13) by Vr value (Step 9).

(b) Determine Qo/Qi ratio from center area of Table A.

(c) Determine Qi cfs from EFM, Ch 2, Exhibit 2-10 using CN (Step 4) Slope factor (Step 5), Drainage Area (Step 1) and rainfall (Step 8). Correction can be made for exact slope by using EFM, Fig. 2.1B "Interpolating Factors for Various Slopes and Drainage Areas." Adjustment for ponding and swampy areas occurring in the watershed can be made from EFM, p 2-10.3 or 2-10.4.

(d) Determine Qo cfs by multiplying Qi (Step 14(c)) by Qo/Qi ratio (Step 14(b)).

Table B only

(a) Determine Qo $ft^3/s/ac$ or cfs/ac from Table B for value of Vs (Step 13) and Vr (Step 9).

15. Convert outflow required Qo to cfs by multiplying Qo (Step 14) by drainage area (Step 1).

Pipe Data

16. Determine pipe diameter needed to provide Qo or greater from Step 15 using the approximate head and pipe length. Head on pipe is difference between the emergency spillway elevation and the elevation at 0.6 D above the outlet invert or the tailwater elevation at the outlet of the pipe. Use whichever is smaller (D is diameter of pipe conduit). Use EFM, Ch 6, Figure 6-25, 6-26, 6-26.1 6-33 or 6-34.

17. Check for full pipe flow if a drop inlet is used. For a full pipe flow, one of the following conditions must be met:

(a) Outlet of pipe completely submerged by tailwater in outlet channel.

(b) Riser depth five times the diameter of the barrel.

(c) Pipe barrel slope is flatter than critical slope. Exhibit 3-5 can be used to determine friction slope, which is same as critical slope. Use correct "n" value. Use pipe diameter (Step 10) and Q = (Step 14).

18. Record actual head in feet.

19. Record actual Qo in cfs for actual head and pipe length.

Riser Data

20. Determine riser diameter, if using a drop inlet from EFM, Ch 6, p 6-43 or IN-ENG-26.

21. Determine if stage is sufficient at inlet.

(a) Drop inlet, EFM, Ch 6, p 6-43

(b) Hooded inlet - 1.8D minimum

(c) Flared inlet - 2.0D minimum

Emergency Spillway

22. Determine emergency spillway elevation by adding to principal spillway elevation (Step 6) the actual stage (Step 11).

23. Determine design Q by multiplying D.A. (Step 1) in acres by 0.5 cfs/ac. Reference: Tech. Guide, Standard and Specification 378, Table 2

24. Determine maximum permissible velocity (V) in ft/sec from EFM, Ch 11, Exhibit 11-2, Table 1, based on exit channel slope range, soil erodibility, and grass to be seeded.

25. Determine retardance from EFM, Ch 11, Exhibit 11-2, Table 2, based on condition of stand and height of vegetation.

26. Determine discharge q in ft^3/ s/ft or cfs/ft from Exhibit 11-2 Tables 3A, 3B, 3C, 3D or 3E, for maximum permissible velocities.

27. Determine length (L) of level portion of emergency spillway from field surveys, observation or experience

28. Determine bottom width (b) for stability by dividing Q (Step 23) by q in (Step 26).

29. Determine Hp from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for (L) (Step 27) and q (Step 26).

Note: Most emergency spillways may have an (L) value less than 25 feet but use Hp value for 25 feet (L) as a minimum

30. Record actual bottom width (b) used if wider than determined in (Step 28)

31. Recalculate discharge q for selected bottom width by dividing design Q (Step 23) by b (Step 30).

32. Determine Hp (used) from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for new Q (Step 31).

33. Determine emergency spillway (exit channel) slopes - find minimum and maximum from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E. For (V) max. from (Step 24) select Exit slope actual from field surveys,

within range of minimum and maximum.

34. Determine freeboard - minimum freeboard will be 1 foot above the Hp value (Step 32). For dams with more than 20 acres drainage area, a minimum 2 feet will be provided between the crest of the emergency spillway and top of dam including the Hp value.

35. Determine top of settled dam elevation by adding to emergency spillway elevation (Step 22) the value of Hp (used) (Step 32) and freeboard (Step 34).

36. Fill out the sheets for the complete plan.

    (a) Baffle dimensions from IN-ENG-26.

    (b) Pipe angle and degrees - angle is obtained by computing the slope of barrel in ft/ft. Use this answer in Mathematical Table, p. 11, Tab. 2 to find the angle for this slope and add 90 degrees.

37. Check all your work for omissions and errors.

Example Design - Pond with Water Detention and Drop Inlet

Principal Spillway

Steps

1. Drainage area: 60 ac., Fayette County

2. Develop available storage information from survey data. Permanent pool elevation at 96.0 - area 2.5 ac.

(1) Elev. Ft.	(2) Area Ac.	(3) Ave. Area Ac.	(4) Interval Ft.	(5) Interval Storage-Ac Ft	(6) Accumulated Storage-Ac Ft
96.0	2.5				0
		2.7	2	5.4	
98.0	2.9				5.4
		3.2	2	6.4	
100.0	3.4				11.8
		3.7	2	7.4	
102.0	4.0				19.2

3. Drainage area to pond area ratio = $\frac{60 \text{ ac}}{2.5 \text{ ac}}$ = 24:1

4. CN - See IN-ENG-10 on p. 11-106.

   Soils of watershed: Cincinnati - 40 ac., poor woods
   20 ac., good pasture

   CN = 75

5. Average watershed slope: 10%; Slope factor: Steep

Principal Spillway

6. Principal spillway elevation = 96.0

7. Minimum design storm frequency Q5-24 hour storm AMC II

8. Rainfall amount = 3.65 inches

9. Runoff amount = 1.40 inches

10. Use helical corrugated metal pipe - HCMP

11. Estimated stage = 1.5 ft.

31. Recalculated discharge q = 30 cfs/12 ft = 2.5 cfs/ft

32. Hp (used) = 1.2 ft

33. Min. slope = 1%, max. slope = 7%, actual slope = 5%

34. Total difference between emergency spillway and top of dam = 1.2 ft (Hp) + 1.0 ft (freeboard) = 2.2 ft

35. Top of settled dam = 97.5 + 2.2 ft. = 99.7

36. Fill out sheets for the complete plans.

37. Check all your work for omissions and errors.

12. Vs = 4.0 ac ft from Stage - Storage Curve

13. Vs in watershed inches = $\frac{4.0 \text{ ac ft} \times 12 \text{ in/ft}}{60 \text{ ac}}$ = 0.8 in

14. Table B

    (a) Qo = 0.07 cfs/ac

15. Qo = 0.07 cfs/ac X 60 ac = 4.2 cfs

16. Pipe diameter - 10 inches using Figure 6-26.1 with estimated head of 18 feet and pipe length 80 ft. - pipe capacity = 6.3 X 0.95 = 6.0 cfs

17. Pipe will flow full - yes. Riser height will be five times the diameter of the barrel.

18. Actual head 17.4 ft

19. Actual Qo = 5.9 cfs

    Riser Data

20. Riser diameter = 18 in

21. Stage needed over weir = 0.55 ft

    Emergency Spillway

22. Emergency spillway elevation = 96.0 + 1.5 ft. = 97.5

23. Design Q = 0.5 cfs/ac X 60 ac = 30 cfs

24. Maximum permissible velocity = 6 fps for tall fescue, erosion resistant soils and exit slope 5-10%.

25. Retardance = C for fair stand and 11 to 24 inch length of vegetation.

26. Discharge q = 4 cfs/ft

27. Length (L) = 25 ft

28. Bottom width (b) = 30 cfs/4 cfs/ft = 7.5 ft

29. Hp = 1.5 ft

30. Actual bottom width (b) = 12 ft

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

IN-ENG-10
Rev. 3/81
File Code 210-J1

PEAK RUNOFF COMPUTATION SHEET

Cooperator Charles Fish Project Pond

By D. Designer Date 4-3-75 Checked by A. Checker Date 4-4-75

HYDROLOGIC CURVE NUMBER (CN)

WATERSHED DESCRIPTION	MAJOR SOIL TYPES — Hydrologic Soil Group (Exhibit 2-1 EFM)				ACRES	PRODUCT
			Cinn.			
	A	B	C	D		
Cultivated - without conservation treatment	72	81	88	91		
Cultivated - with conservation treatment	62	71	78	81		
Pasture or range - poor condition	68	79	86	89		
Pasture or range - good condition	39	61	(74)	80	20	1480
Meadow	30	58	71	78		
Woods or Forest - thin stand, poor cover, no mulch	45	66	(77)	83	40	3080
Woods or Forest - good cover	25	55	70	77		
Farmsteads	59	74	82	86		
Roads	74	84	90	92		
Other (Specify)						
			TOTALS			4560

Weighted CN = $\frac{\text{Product Total}}{\text{Total Acres}} = \frac{4560}{60} =$ 76

CN Rounded to nearest Exhibit 2-10 Value (65, 70, 75, etc.) = 75
(Do not use less than CN 60 without approval of area engineer)

Average Watershed Slope: 10% (Flat = 0-3%; Moderate = 3-8%; (Steep) = >8%)

Adjustment Factors: Slope -- Ponding --

From Technical Guide Section IV and EFM (Ex. IN 2-4)	Storm 1	Storm 2
Design Frequency - Years	5 yr.	
Rainfall - inches	3.65	
Storm Duration - hours	24	
From EFM, Exhibit 2-10, sheet 18 of 21		
Peak Discharge - cfs	80 c.f.s.	

Sheet 1 of 1

(EFM Notice IN38, August 1981)

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

IN-ENG-10
Rev. 3/81
File Code 210-J1

PEAK RUNOFF COMPUTATION SHEET

Cooperator Charles Fish Project Pond

By D. Designer Date 4-3-75 Checked by A. Checker Date 4-4-75

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From EFM, Exhibit 2-10, sheet 18 of 21		
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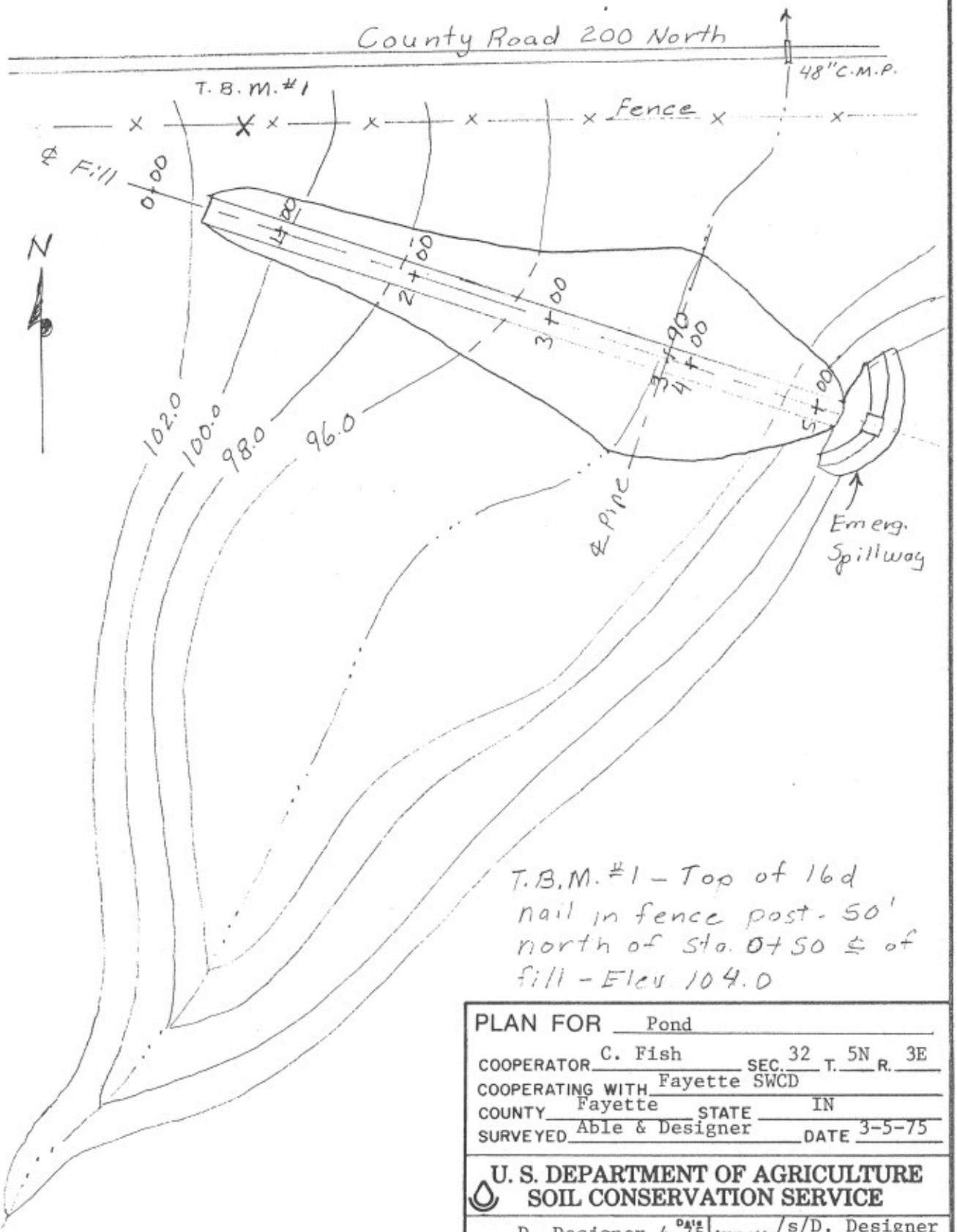
Sheet 1 of 1

(EFM Notice IN38, August 1981)



PLAN FOR Pond

COOPERATOR C. Fish SEC. 32 T. 5N R. 3E

COOPERATING WITH Fayette SWCD

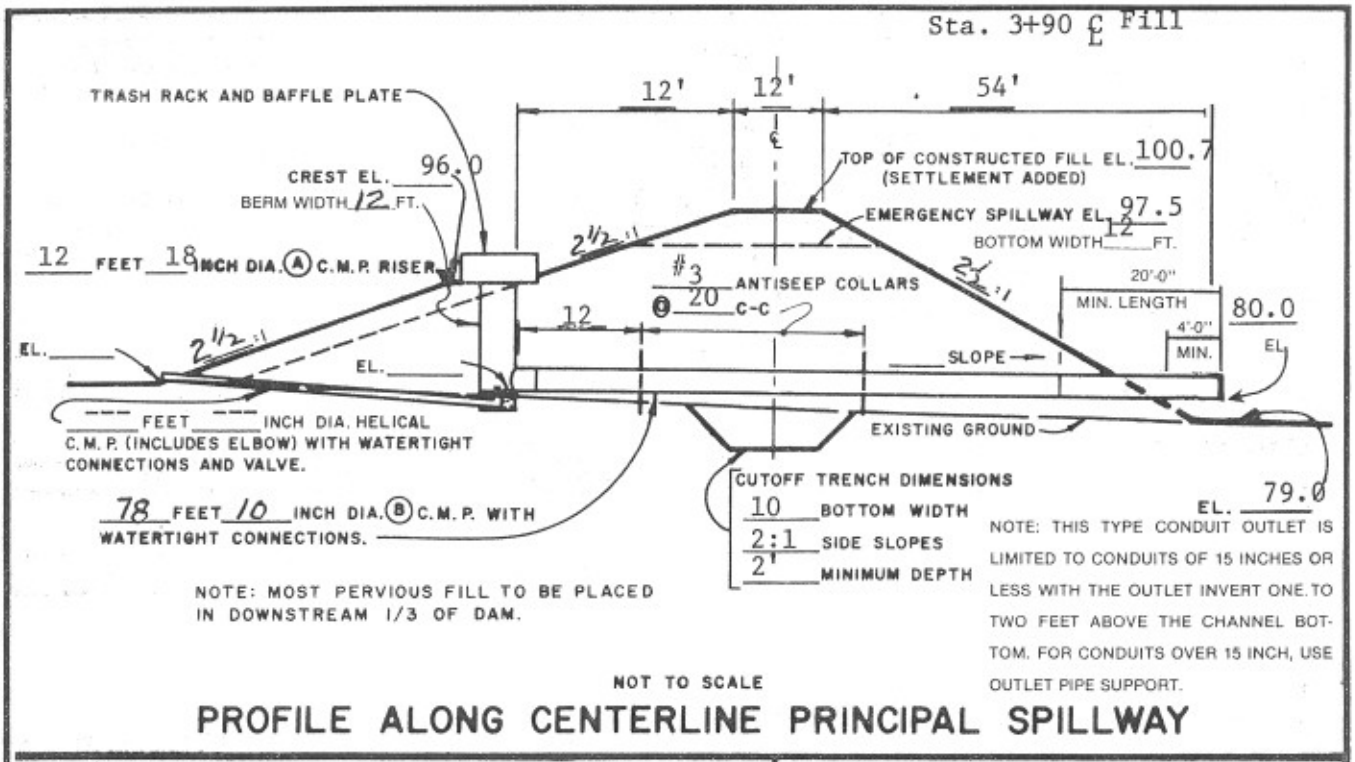
COUNTY Fayette STATE IN

SURVEYED Able & Designer DATE 3-5-75

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	D. Designer 4-75 (Date)	Approved by	/s/D. Designer
Drawn	D. Designer	Title	SCT
Traced	A. Checker 4-75	Title	
Checked	Tom Able, DC4-75	Sheet No. 1 of 1	Drawing No.

IN-ENG-42 1 (1) Rev. 6-81



NOT TO SCALE

PROFILE ALONG CENTERLINE PRINCIPAL SPILLWAY

ESTIMATE OF MATERIALS

ITEM	QUANTITY	
Clearing	2.0	Acres
Excavation	250	Cu. yd.
Earth Fill, compacted	11,700	Cu. yd.
Drawdown pipe, ____ inch diameter, H.C.M.P., metal thickness ____" (____ga.) with watertight connections	--	Lin. ft.
Pipe, 10 inch diameter B, C.M.P., metal thickness .06" (____ga.) with watertight connections	78	Lin.ft.
Riser, 18 inch diameter A, C.M.P., metal thickness .06" (____ga)	12	Lin. ft.
Valve, ____ inch diameter, with type ____ frame	--	Each
Baffle plate	1	Each
Trash rack (see sheet 4)	1	Each
Antiseep collar	3	Each
Stockwater System (see sheet 5)	1	Each
Pipe support (see sheet ____)	--	Each
Concrete	0.68	Cu.yd.
Seeding and mulching	1.5	Acres
Fencing	600	Feet

SOIL INVESTIGATION REPORT

LOCATION OF BORINGS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION
#1 - 1+00 ℄	0-1	ML
FILL	1-3	SM
	3-6	CL
#2 - 2+00 ℄	0-2	SM
Fill	2-5	CL
#3 - 3+6 ℄	0-2	SM
Fill	2-5	CL
#4 - 4+50 ℄	0-2	ML
	2-5	CL

EMBANKMENT POND OR PIPE STRUCTURE WITH PIPE DROP INLET

NAME Charles Fish

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn		Title	
Checked		Title	
Reviewed		Sheet No. 2 of 4	Drawing No.

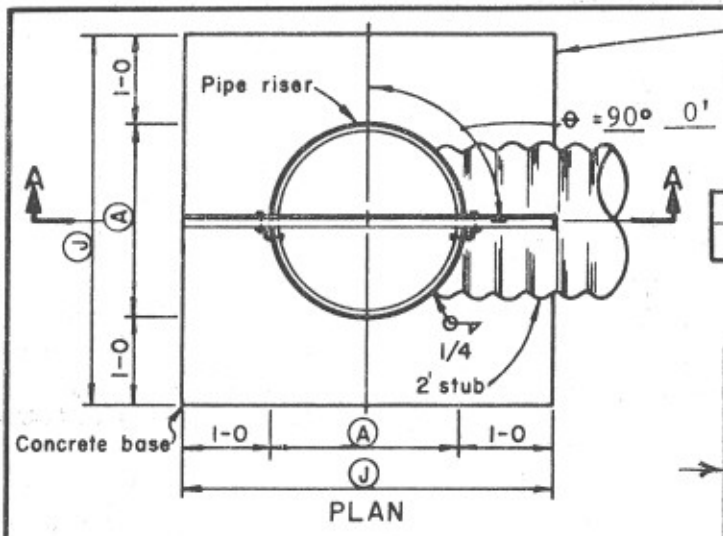
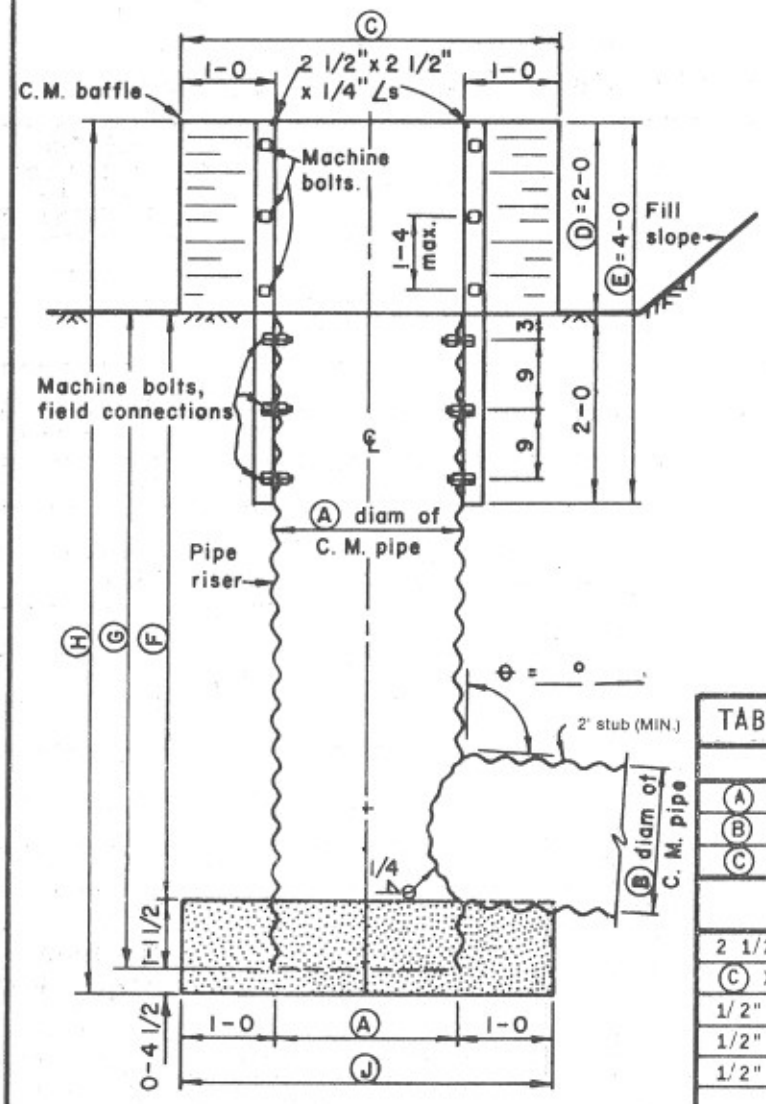


TABLE OF QUANTITIES FOR CONCRETE RISER BASE

DIA. OF RISER IN INCHES	18"	21"	24"	30"
CONCRETE, CU.YD.	0.68	0.78	0.89	1.12

INLET PROPORTIONS (MIN.)		ANTIVORTEX BAFFLE
PIPE DIA. CONDUIT (B)	RISER DIA. (A)	LENGTH FEET (C)
8 TO 12	18	3-6
15	21	3-9
18	24	4-0
21 AND 24	30	4-6



SECTION ON CENTERLINE
SECTION A-A

DETAILS OF INLET

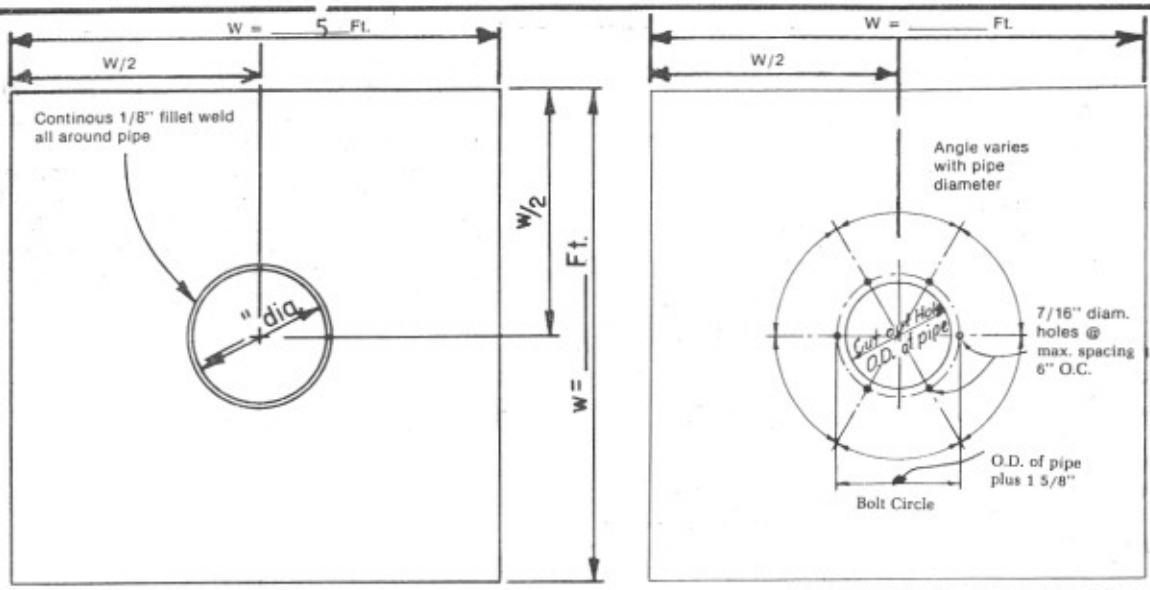
NOTES:

1. CORRUGATED METAL PIPE MAY BE MADE OF ALUMINUM OR ZINC-COATED IRON OR STEEL AND MEET FEDERAL SPECIFICATIONS, WW-P-302C OR WW-P-405A AND SHALL BE CLASS I OR II, SHAPE 1. USE 16 GAGE (THICKNESS = 0.06").
2. ALL ACCESSORIES AND FASTENERS SHALL BE OF COMPATIBLE METALS THROUGHOUT STRUCTURE. GALVANIZED OR CADMIUM PLATED BOLTS, NUTS, AND WASHERS MAY BE USED.
3. ALL HOLES FOR BOLTS SHALL BE 1/16" LARGER THAN DIAMETER OF BOLTS.
4. DROP INLET SHALL BE SHOP FABRICATED.
5. ZINC-COATED METALS, AFTER WELDING OR CUTTING, SHALL BE REPAIRED AS FOLLOWS:
   (A) THOROUGHLY CLEAN THE DAMAGED AREAS ON BOTH SIDES OF THE PIPE WITH WIRE BRUSH.
   (B) PAINT THE CLEANED AREAS WITH TWO COATS OF ZINC OXIDE - ZINC DUST PAINT.
   (C) APPLY A HEAVY COAT OF ASPHALT OVER THE PAINTED AREAS.

TABLE SHOWING DIMENSIONS AND MATERIALS

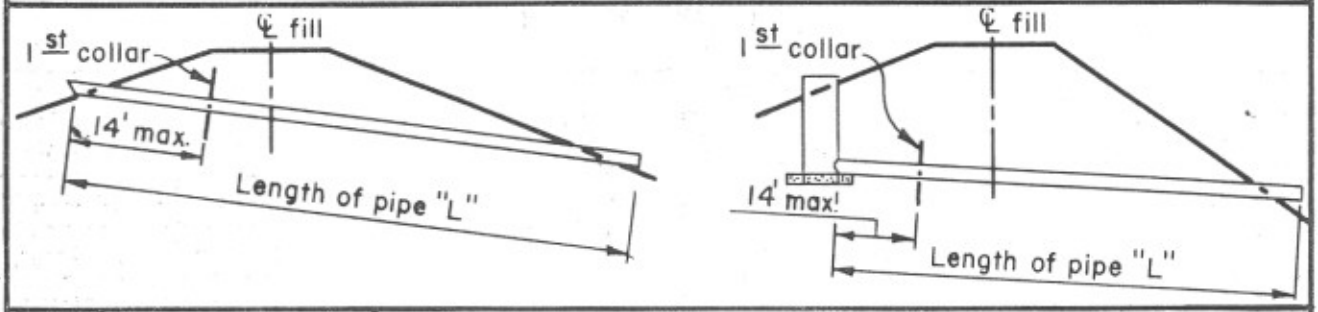
DIMENSIONS			
(A) 18"	(D) 2-0	(G) 12'-1½"	
(B) 10"	(E) 4-0	(H) 14'-6"	
(C) 3'-6"	(F) 11'-0"	(J) 3'-6"	

MATERIAL ITEMS	QUANTITY REQUIRED
2 1/2" X 2 1/2" X 1/4" ANGLES X (E) 4-0	2
(C) X (D) C.M. SHEET	1
1/2" X 1 1/4" MACHINE BOLTS	12
1/2" STEEL SPLIT LOCKWASHERS	12
1/2" NUTS	12



Notes: 1. Hot rolled sheet steel 16 ga. or aluminum sheet — min. thickness 0.06".
2. Install C.M. antiseep collar with corrugations vertical.

ALTERNATE DETAILS OF ANTISEEP COLLAR



PIPE SIZE INCHES	MAXIUM SPACING FEET		LENGTH OF PIPE "L" IN FEET															
			50		60		70		80		90		100		110		120	
	SIZE COLLAR "W" FEET		SIZE COLLAR "W" FT.															
	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5	4X4	5X5
6&8	20	25	2	2	2	2	2	2	3	3	3	3	4	3	4	4	4	4
10&12	20	25	2	2	2	2	3	2	3	3	4	3	4	4	4	4	5	4
15	19	25	2	2	3	2	3	2	4	3	4	3	5	4	5	4	6	4
18	18	25	2	2	3	2	3	2	4	3	4	3	5	4	5	4	6	4
21	15	23	2	2	3	2	4	3	4	3	5	4	5	4	6	4	7	5
24	14	21	3	2	3	2	4	3	5	3	5	4	6	4	7	5	7	5
30		18	—	2	—	3	—	3	—	4	—	4	—	5	—	5	—	6

NUMBER OF REQUIRED ANTISEEP COLLARS & spacing for 6" THRU 30" DIAMETER PIPE

BILL OF MATERIALS

QUANTITY	DESCRIPTION
3	Antiseep collar - 5 ft. or 5 ft. round or square
4	Flange coupling
	Hex. HD. nuts, 3/8" x 1"
	Hex. HD. nuts, 3/8"
	Flat washers - cut steel, 7/16" I.D. x 7/8" O.D.
	Watertight coupling band, w/lug rods

ANTISEEP COLLARS AND COUPLING DEVICES FOR 6" THROU 30" C.M. PIPE

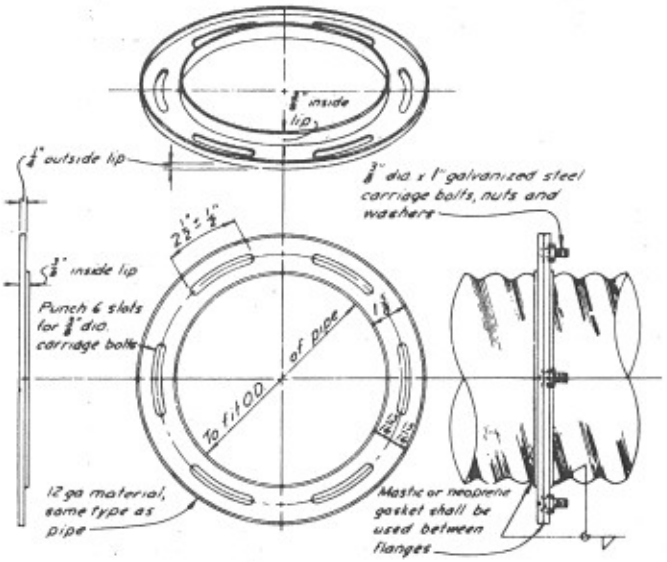
NAME Charles Fish

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
Designed
Drawn
Checked
Reviewed
Approved by
Title
Title
Sheet No. 3 Of 7
Drawing No.

(EFM Notice IN38, August 1981)

IN-ENG-22 1(2) REV. 6-81

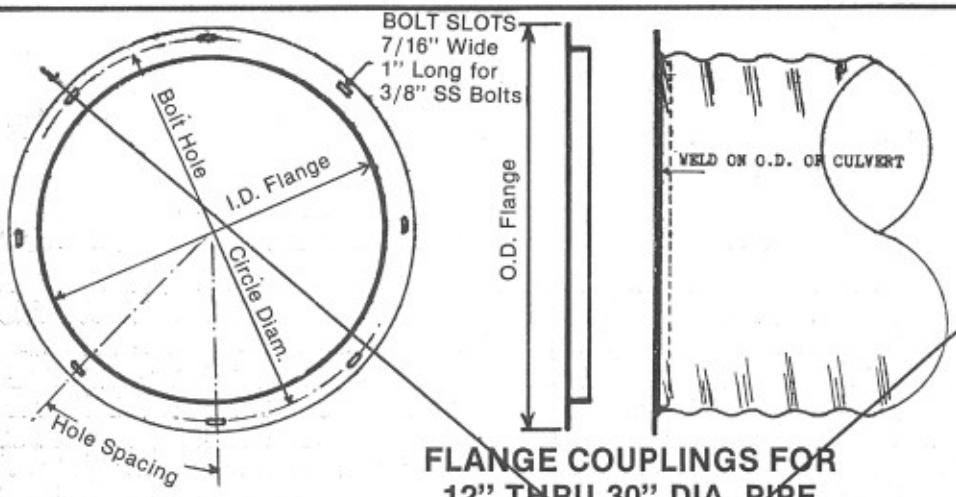


NOTES:
1. THE PIPE MAY BE HELICAL CORRUGATED METAL PIPE OR PIPE MATERIAL OF EQUIVALENT STRENGTH AND DURABILITY.
2. ALL WELDED, MARRED, AND CHECKED SURFACES SHALL BE FIELD COATED WITH A HEAVY APPLICATION OF FIBRATED ASPHALT-CEMENT.
3. COMPLETELY COAT WITH ASPHALT-CEMENT ALL CONTACT SURFACES OF FLANGES AND COLLARS BEFORE FIELD ASSEMBLY.

Use this type coupling.

FLANGE COUPLING FOR 6", 8" & 10" DIA. PIPE

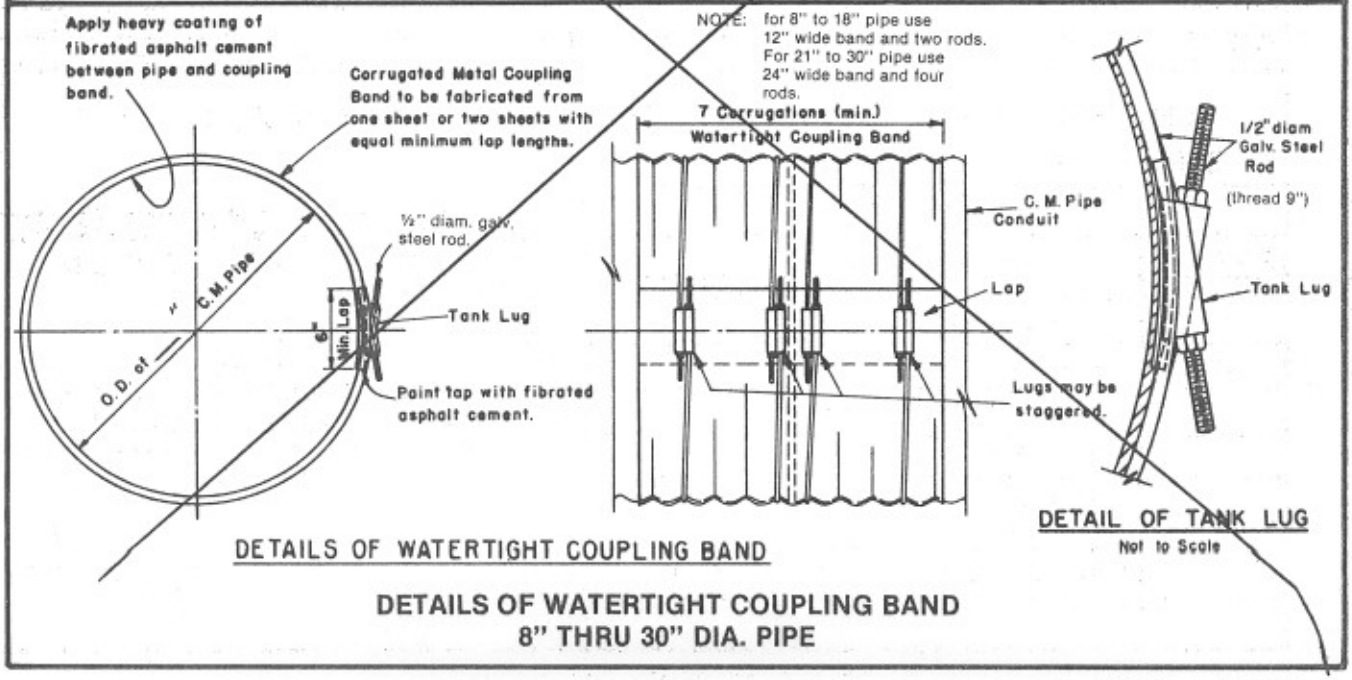
N.T.S.



Pipe Diam. Inches	Min. No. Holes	Min. Spacing Inches
12	10	4.48
15	12	4.52
18	14	4.54
21	16	4.56
24	18	4.58
30	22	4.60

FLANGE COUPLINGS FOR 12" THRU 30" DIA, PIPE

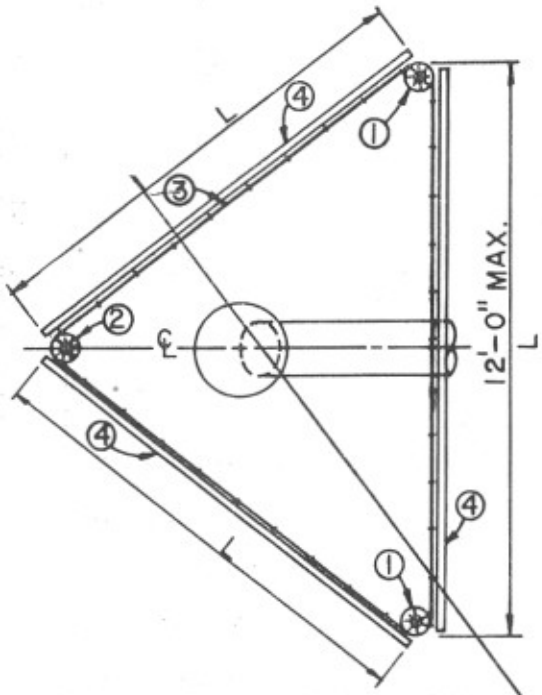
NOTE: Notes for 6", 8" & 10" flange coupling apply for 12" thru 30" flange couplings N.T.S.



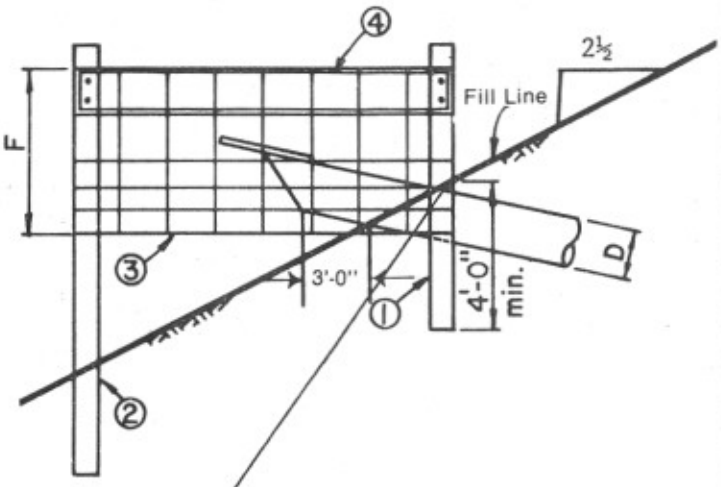
DETAILS OF WATERTIGHT COUPLING BAND

DETAIL OF TANK LUG
Not to Scale

DETAILS OF WATERTIGHT COUPLING BAND 8" THRU 30" DIA. PIPE



PLAN



SIDE ELEVATION

TRASH RACK FOR HOODED INLETS

BILL OF MATERIALS			
MARK	QUANTITY	DESCRIPTION	LENGTH
1	2	Wood posts, 6" tip, black locust, hedge or pressure treated	
2	1	Wood posts, 6" tip, black locust, hedge or pressure treated	
3	1	Fence, woven wire, No. 9 top and bottom, with 12" stays ___" high	
———		Staples - Mark ③ to ① and ②	1 1/4"
4	3	Wood plank 2" thick x 6" wide x L+6", pressure treated	
	12	3/8"dia. lag screws with flat washers, mark ④ to ① and ②	4 1/2"

NOTE: Fence and staples to be galvanized and lag screws cadmium plated.

DIMENSIONS					
D	L	F	LIN.FT. OF FENCE	POST LENGTH*	
				①	②
6" - 12"	8-0	35"		7-0	9-0
15" - 18"	10-0	47"		8-0	10-0

* LENGTH OF POST BASED ON 3:1 SLOPE.

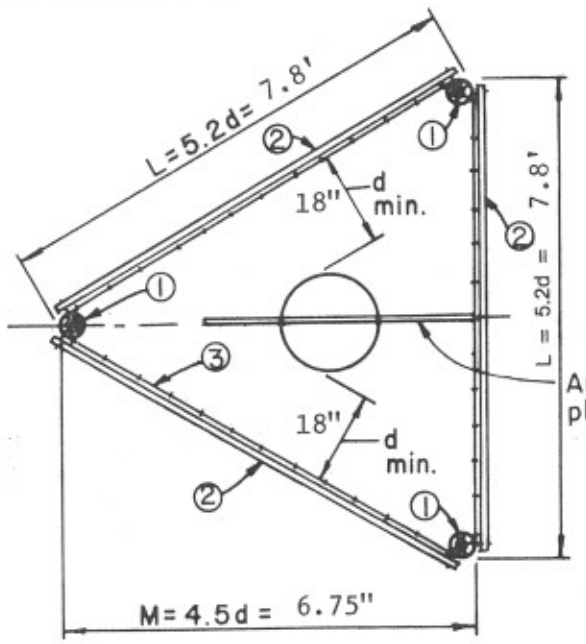
TRASH RACK FOR HOODED INLET OR PIPE DROP INLET

NAME Charles Fish

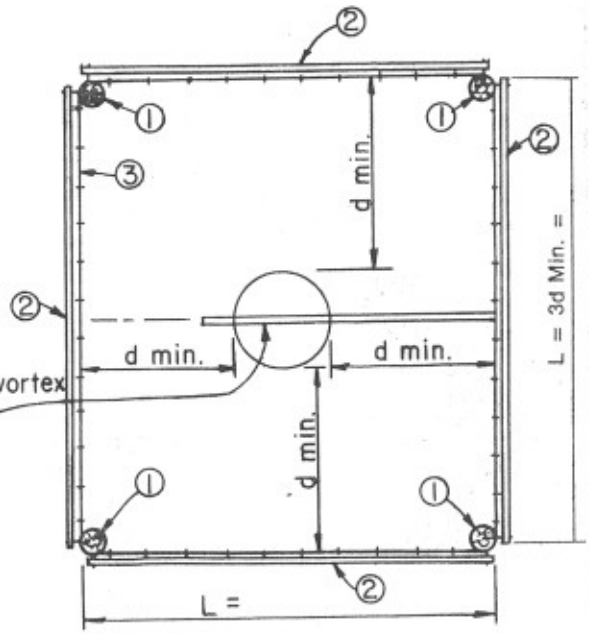
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed ____ Date ____ Approved by ____
Drawn ____ Title ____
Checked ____ Title ____
Reviewed ____ Sheet No. 4 of 7 Drawing No. ____

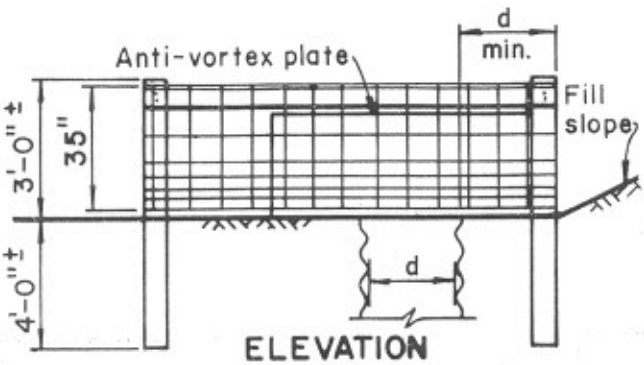
IN-ENG-24 1(2) Rev.6-81



PLAN

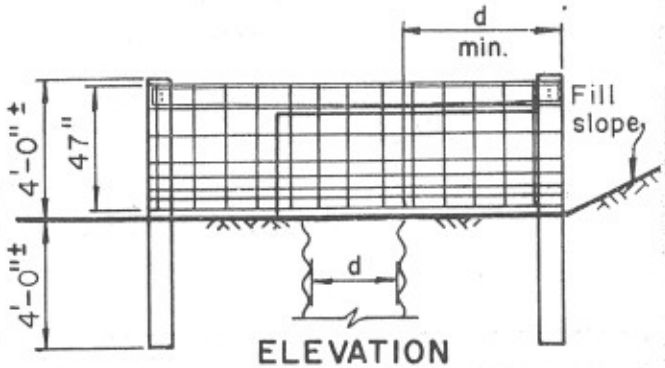


PLAN



ELEVATION

Note: Triangle use limited to:
1. Stage of 2'-6" maximum
2. Riser dia. of 2'-0" maximum



ELEVATION

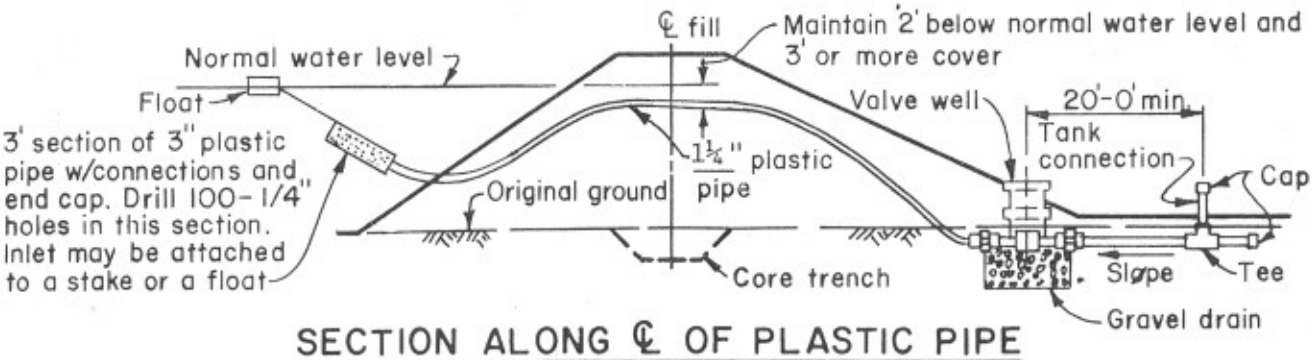
Note: Square use limited to:
1. Stage of 3'-6" max. with 47" fence
2. Riser dia. of 4'-0" maximum

TRASH RACKS FOR PIPE DROP INLET

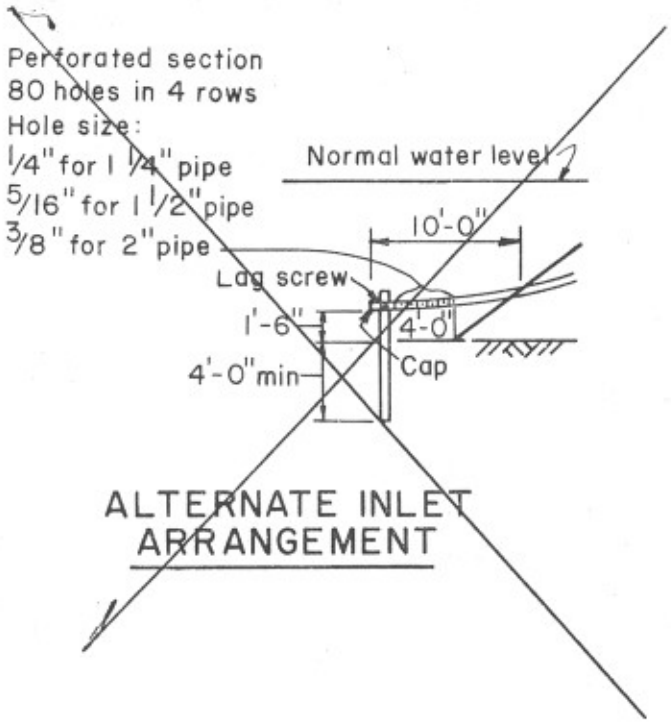
BILL OF MATERIALS

MARK	QUANTITY	DESCRIPTION	LENGTH
1	3	Wood posts, 6" tφp, black locust, hedge or pressure treated	7'-0"
2	3	Wood plank 2" thick x 6" wide x L, pressure treated	7'-8"
3	1	Fence, woven wire, No. 9 top and bottom, with 12" stays 35" high	24'-0"
——	As req'd	Staples - Mark ③ to ① and ②	1 1/4"
——	12	3/8" dia. lag screws with flat washers, mark ② to ①	4 1/2"

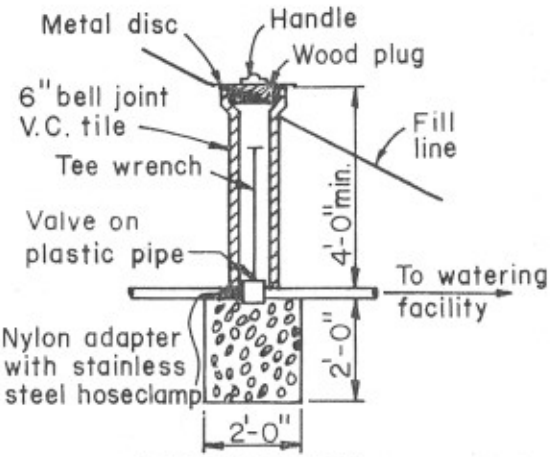
NOTE: Fence and staples to be galvanized and lag screws cadmium plated.



SECTION ALONG ℄ OF PLASTIC PIPE



ALTERNATE INLET ARRANGEMENT



ALTERNATE VALVE WELL DETAIL

BILL OF MATERIALS		
QUAN.	ITEM	LENGTH
	1 1/4" PLASTIC PIPE	150'
2	1 1/4" PLASTIC CAP	
1	1 1/4" PLASTIC TEE	
2	1 1/4" PLASTIC FEMALE UNION	
1	3" PLASTIC PIPE INLET SECTION	3'
1	BRASS - CHECK AND DRAIN VALVE	
1	TEE HANDLE WRENCH	3'-5"
2	6" BELL AND SPIGOT SEWER PIPE	4'-0"

NOT TO SCALE

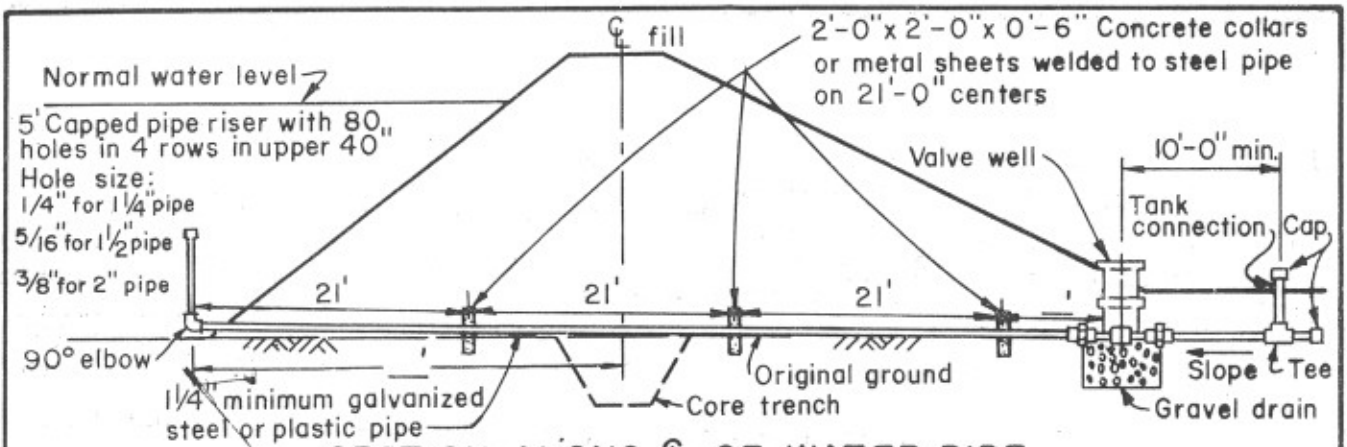
STOCKWATER SYSTEM

NAME Charles Fish

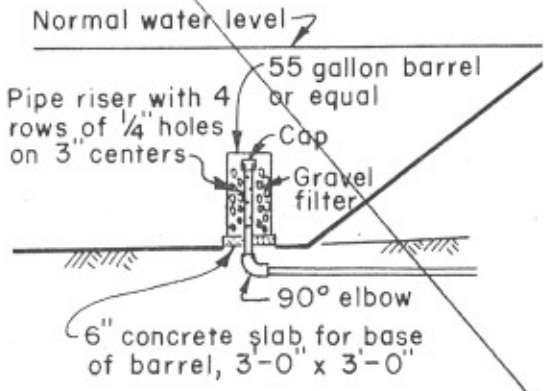
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date	Approved by
Designed	Title
Drawn	Title
Checked	Sheet No. 3 of 7
Reviewed	Drawing No.

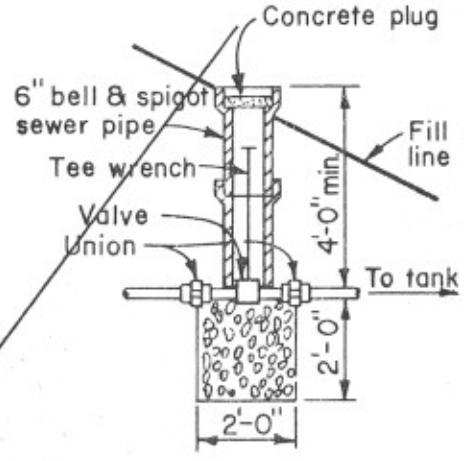
IN-ENG-23 1(2) Rev. 6-81



SECTION ALONG ℄ OF WATER PIPE



ALTERNATE INLET



VALVE WELL DETAIL

NOT TO SCALE

QUAN.	BILL OF MATERIALS ITEM	LENGTH
	__" Galv. Iron Pipe or Plastic Pipe (1¼" Min.)	
1	__" Galv. Iron or Plastic Pipe	10'
1	__" Galv. Iron or Plastic Tee	
1	__" Galv. Iron or Plastic Pipe W/80 __" Holes	5'
1	__" Galv. Iron Pipe or Plastic 90° Elbow	
	__" Galv. Iron Pipe or Plastic Cap	
2	1¼" Galv. Iron or Plastic Female Union	
2	1¼" x 2½" Galv. Nipple or Plastic Connectors	
1	__" Gate Valve	
1	Tee Handle	3'-5"
1	6" Bell Joint V.C. Tile	4'-0"
1	Treated Wood Plug to Fit Bell or Concrete Plug	
1	Galv. Sheet Metal Disc 8" Dia.	
1	Brass D Handle With 2-1¼" Screws	
	Pit-Run Sand and Gravel (Drain) - 0.34 Cu. Yd.	
	Coarse Gravel Mix For Barrel	
	Concrete (2 C.F. Per Collar - 5 C.F. Per Base)	

NOTES:

1. Plastic pipe shall be Acrylonitrile-butydiene-styrene (ABS), Polyethylene (PE), or Polyvinyl chloride (PVC).
2. Collars may also be made from butyl rubber.

STOCKWATER SYSTEM

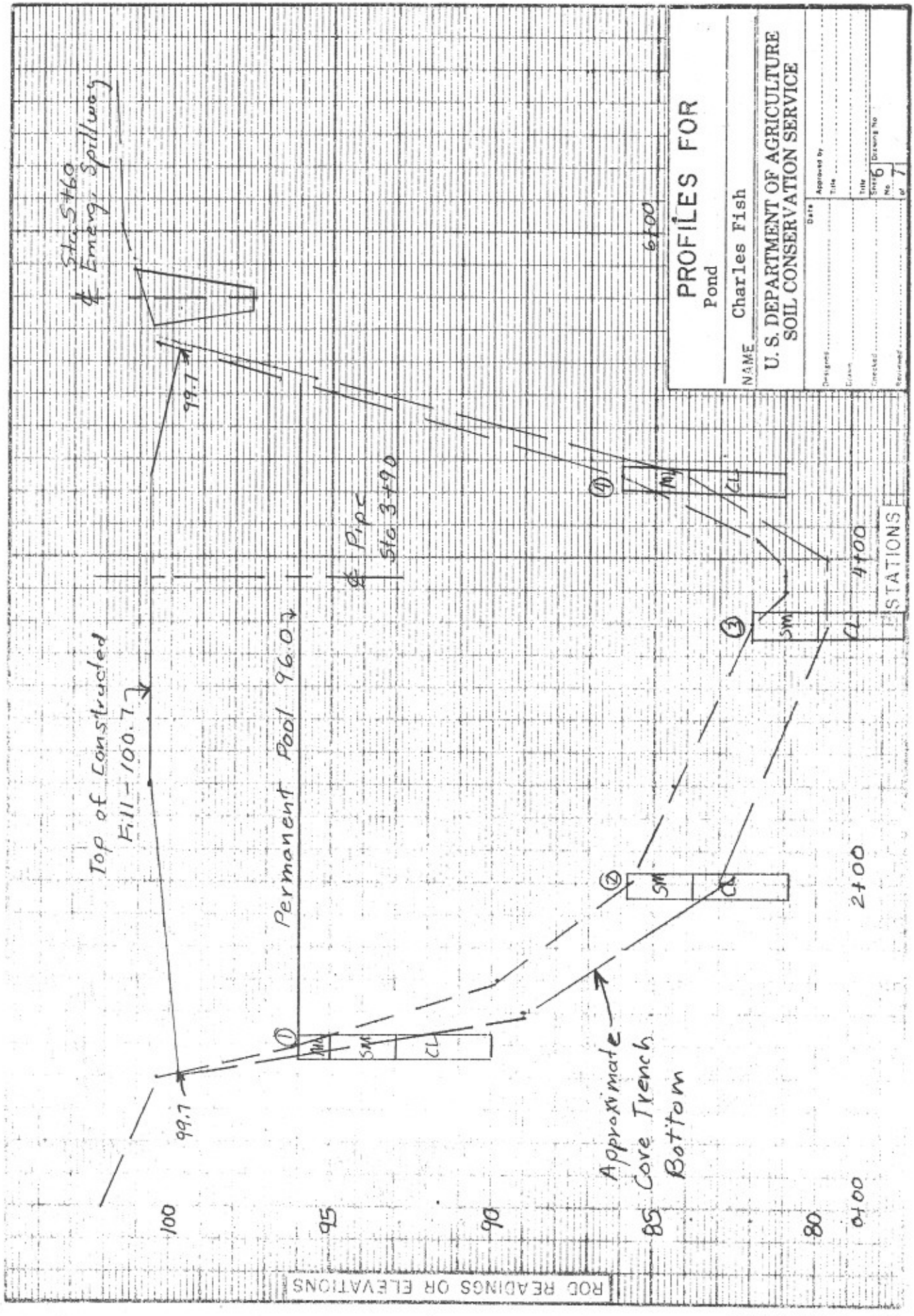
NAME

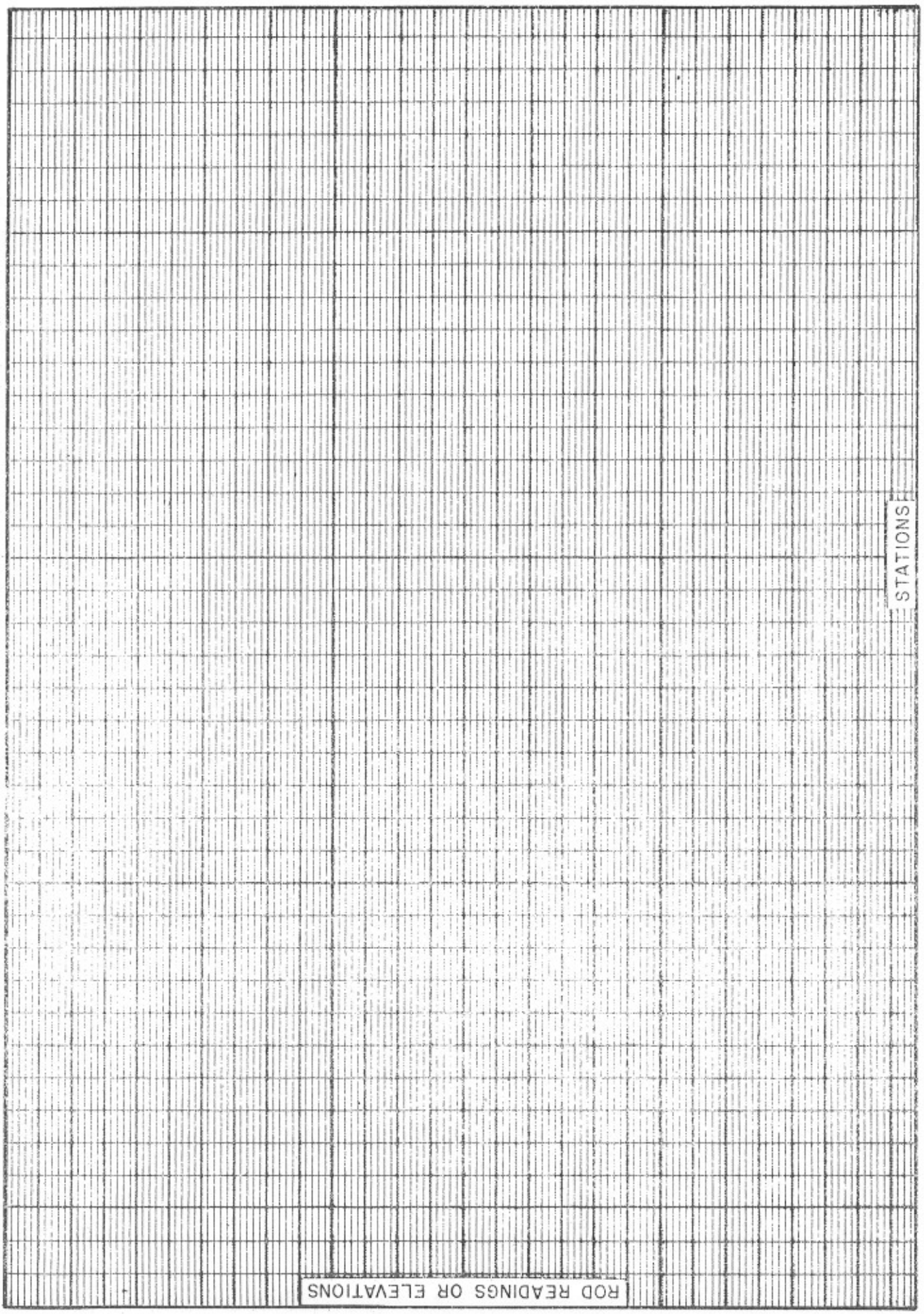
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed — Date — Approved by
Drawn — Title
Checked — Sheet No. — Drawing No.
Reviewed — of

IN-ENG-23 2(2) Rev. 6-81

(EFM Notice IN38, August 1981)


PROFILES FOR
Pond
NAME Charles Fish
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Sta 5+60
℄ Emerg. Spillway
99.7
℄ Pipe
Sta 3+90
Top of Constructed
Fill - 100.7
Permanent Pool 96.0
99.7
Approximate
Cove Trench
Bottom
SM
CL
STATIONS
6+00
4+00
2+00
0+00
100
95
90
85
80
ROC READINGS OR ELEVATIONS



(EFM Notice IN38, August 1981)

DESIGN DATA

DRAINAGE AREA 60 ACRES, POND AREA 2.5 ACRES, RATIO DRAINAGE AREA TO POND AREA 24.1

RUNOFF CURVE NO. 75, AVE. W.S. SLOPE: FLAT, MODERATE, (STEEP) (CIRCLE ONE)

TOP OF SETTLED FILL ELEV. 99.7 LOW POINT ON ℄ FILL ELEV. 79.8

EMERGENCY SPILLWAY

DESIGN Q = 60 AC X 0.5 CFS/AC = 30 CFS, MAXIMUM VELOCITY 6 FT/S

RETARDANCE C, DISCHARGE q 4 CFS/FT. L 25 FT

BOTTOM WIDTH b (STABILITY) = $\frac{\text{DESIGN Q}}{\text{DISCHARGE q}} = \frac{30}{4} =$ 7.5 FT, Hp = 1.5 FT.

BOTTOM WIDTH b (USED) 12 FT, DISCHARGE q (USED) = $\frac{\text{DESIGN Q } 30}{b \quad 12} =$ 2.5 CFS/FT.

Hp (USED) 1.2 FT. MIN. SLOPE 1 %, MAX. SLOPE ____ %, EXIT SLOPE (ACTUAL) 5%

FREEBOARD 1.0 FT., EMERGENCY SPILLWAY CREST ELEV. 97.5

PRINCIPAL SPILLWAY

METHOD I - MINIMUM DETENTION STORAGE

STORAGE = ____ IN. X ____ AC./12 ____ AC. FT., REQUIRED STAGE = $\frac{\text{STORAGE (AC. FT.)}}{\text{POND AREA (AC.)}} =$ ____ FT.

PIPE DIAMETER ____ IN., TYPE ____

IS STAGE SUFFICIENT FOR PIPE FLOW: YES ____ NO ____

METHOD II - SHORTCUT FLOOD ROUTING

DESIGN STORM FREQUENCY 5 YEAR 24 HR., RAINFALL 3.65 IN., RUNOFF Vr 1.40 IN.

TYPE PIPE H.C.M.P.

STAGE FT.	Vs AC. FT.	Vs IN.	TABLE A				TABLE B		PIPE DATA				RISER DATA	
			Vs Vr	Qo Qi	Qi CFS	Qo CFS	Qo CFS /AC	Qo CFS	DIA. IN.	WILL PIPE FLOW FULL	ACTUAL HEAD FT.	Qo CFS	DIA. IN.	IS STAGE SUFFICIENT FOR Qo
1.5	4.0	0.8					0.07	4.2	10"	Yes	17.4	5.9	18	0.55

HOOD INLET OR FLARED INLET DATA

PIPE DIA. SELECTED ____ IN., STAGE PROVIDED ____ FT., STORAGE PROVIDED ____ AC.FT.

PIPE INLET INVERT ELEV. ____, PIPE OUTLET INVERT ELEV. ____, PIPE LENGTH ____ FT.

DROP INLET DATA

PIPE DIA. 10 IN., RISER DIA. 18 IN., STAGE REQUIRED 1.5 FT.

STORAGE REQUIRED 4.0 AC.FT., PIPE LENGTH 78 FT., RISER LENGTH 12 FT.

CREST OF RISER ELEV. 96.0 FT., OUTLET OF PIPE INVERT ELEV. 80.0 FT.

PHYSICAL DATA

MAXIMUM FILL HEIGHT 19.9 FT.

MAXIMUM WATER DEPTH 15 FT.

HAZARD CLASSIFICATION "a"

DETENTION STRUCTURE DATA

NAME Charles Fish

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date		Approved by	
Designed		Title	
Drawn		Title	
Checked		Sheet No. 7 Of 7	Drawing No.
Reviewed			

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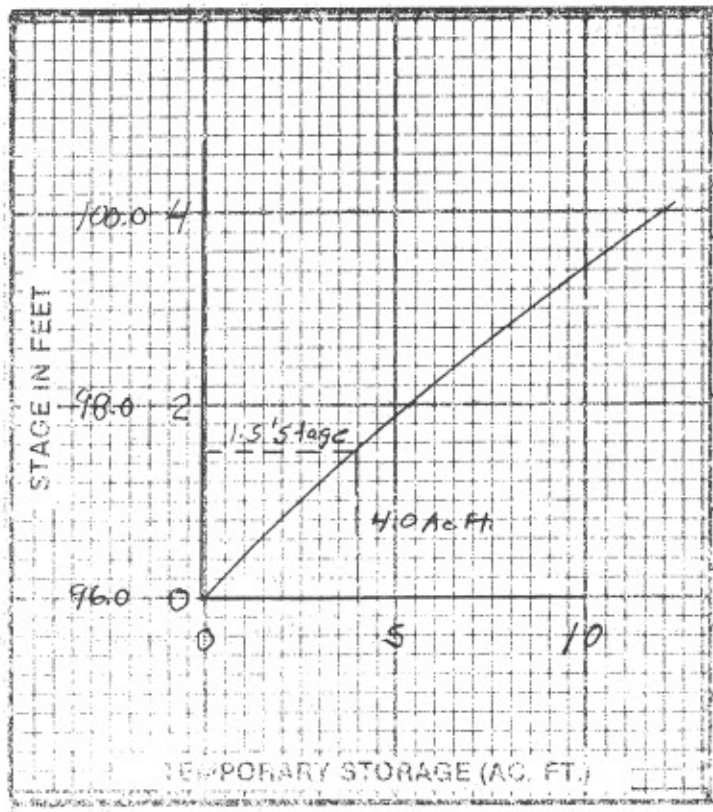


AVAILABLE STORAGE

Elevation	Area Sq.in.	Area Flooded Acres	Average Acres	Interval Ft.	Interval Storage Ac. Ft.	Accum. Storage Ac. Ft.
96.0	11.0	2.5				0
			2.7	2	5.4	
98.0	12.8	2.9				5.4
			3.2	2	6.4	
100.0	14.8	3.4				11.8
			3.7	2	7.4	
102.0	17.6	4.0				19.2

STAGE - STORAGE CURVE DATA

EARTHWORK COMPUTATIONS

Station	Fill Height Ft. +5%	Cu.yd. per Ft.	Average fill cu.yd.	Distance ft.	Fill cu.yd.
0+80	0	0			
1+00	3.9	3.2	1.6	20	32
1+40	10.4	14.6	8.9	40	356
2+00	14.6	26.3	20.5	60	1227
2+60	16.1	31.2	28.8	60	1725
3+60	18.6	40.3	35.8	100	3575
3+80	19.6	44.3	42.3	20	846
3+94	19.6	44.3	44.3	14	620
4+10	18.8	41.1	42.7	16	683
4+50	14.4	25.6	33.4	40	1334
5+30	0	0	12.8	80	1024
				Total	11422
Core Trench Excavation					250
				Total Yardage	11672

CONSTRUCTION CHECK

Length of fill 455 ft
Top width 12 (min.) ft
Side slopes 2½:1 - 2½:1
Pipe diameter 10 in
Stage (emerg-prin.) 1.7 ft
Top fill - emerg. elev 2.2 ft
Veg. spwy. width 18 ft
Top fill el. 99.8 (min.)
Veg. spwy. el 97.6
Prin. spwy. crest el 95.9
Prin. spwy. outlet invert el 80.3

Clearing adequate (yes) (no)
Core trench adequate (yes) (no) 3' into blue fill
Stockwater system adequate (yes) (no)
Fencing adequate (yes) (no)
Seeding adequate (yes) (no) Good Stand Started
Pipe installation adequate (yes) (no)

I certify that this job meets all the requirements of Indiana Standards and Specifications for Pond (Code 378) and the plans as designed.

Checked by: /s/Allen Checker Date: 4-25-75

DESIGN PROCEDURE FOR POND OR PIPE STRUCTURE
WITH HOOD, DROP OR FLARED INLET AND WATER DETENTION
(USING METHOD II - SHORT CUT FLOOD ROUTING

NOTES: 1) All structures designed under this procedure must be located in predominantly rural or agricultural areas where failure may only damage farm buildings, agricultural land or township and county roads. The structure must also not require IDNR approval.

2) This method of design would be to start with a determined emergency spillway crest for the pond and then determine the permanent pool (principal spillway) and top of dam elevations.

Steps

1. Determine drainage area from USGS maps, field observations, and/or aerial photos.

2. Determine pond surface area from field surveys. May option to develop elevation - available storage information from field surveys, which may require a complete topographic survey of the area, particularly for "dry pool" type practices where storage starts at bottom of valley.

3. Determine ratio drainage area to pond area. Divide step 1 value by step 2 value.

4. Determine CN from EFM, Ch. 2 based on soils, cover, etc ., as determined by soil survey and field observations. Use form IN-ENG-10.

5. Determine average watershed slope from survey data, soil survey, field observations, and/or USGS maps. For definition of average watershed slope, see EFM, Ch. 2, p. 2-7.

Principal Spillway - Method II - Shortcut Flood Routing

6. Set emergency spillway elevation from field surveys. Also record low point elevation on centerline of fill profile.

7. Determine design storm frequency from Table 2 of Technical Guide Spec. 378.

8. Determine rainfall amount from EFM, Ch. 2, Exhibit IN-2-4.

9. Determine runoff amount Vr from EFM, Ch. 2, Exhibit IN-2-7A for curve number step 2 and rainfall step

10. Select pipe diameter and type pipe to be used.

STEPS

11. Determine pipe capacity (Qo) in cfs.

(a) Calculate head. Head on the pipe is difference between the emergency spillway elevation and the greater elevation of (1) the elevation at 0.6 diameter above the pipe outlet invert, or (2) the tailwater elevation at the outlet of the pipe.

(b) Estimate pipe length. Assume approximate top of dam and principal spillway elevation. Select top width and side slopes from Tech. Guide Spec 378.

(c) Determine Qo in cfs for head, pipe length, pipe diameter and type (Step 10). Use EFM, Ch 6, Figure 6-25, 6-26, 6-26.1, 6-33 or 6-34.

12. Convert outflow required Qo to cfs/acre by dividing Qo (Step 11c) by drainage area (Step 1)

13. Determine Table to use (A or B). If Qo valve (Step 12) is greater than 0.47 cfs/acre, use Table A, EFM, Chap. 11, p. 11-55b. If less than 0.47 cfs/acres, use Table B, EFM, Chap. 11, p 11-55c.

14. Determine required detention storage (Vs) in inches. (Table A only)

(a) Determine Qi cfs from EFM, Ch 2, Exhibit 2-10 using CN (Step 4), Slope Factor (Step 5), Drainage Area (Step 1) and rainfall (Step 8). (Correction can be made for exact slope by using EFM, Fig. 2.1B, "Interpolating Factors for Various Slopes and Drainage Areas").

(b) Calculate Qo/Qi ratio by dividing Qo value (Step 11c) by Qi value (Step 14a).

(c) Determine Vs/Vr ratio by entering center area of Table A with Qo/Qi value (Step 14b) and reading Vs/Vr value from vertical (tenths) and horizontal (hundredths) columns.

(d) Calculate Vs in watershed inches by multiplying Vr value (Step 9) by Vs/Vr value (Step 14c)

(Table B only)

(a) Determine Vs in watershed inches from Table B using Vr value (Step 9) and Qo (cfs/acre) value (Step 12).

15. Calculate Vs in acre-feet by multiplying Vs value (Step 14) by drainage area (Step 1) and dividinga by 12 in/ft.

Steps

16. Determine stage to provide required storage (Vs)

    a. By dividing Vs value (Step 15) by pond surface area (Step 2)

    b. From elevation - available storage curve (Step 2)

17. Determine minimum stage at pipe inlet to provide full pipe flow Qo (Step 11c).

    a. Drop Inlet: EFM, Ch 6, Fig. 6-27, p. 6-43

    b. Hood Inlet: 1.8 X pipe diameter

    c. Flared Inlet: Culvert inlet control tables, EFM, Ch 3.

18. Use stage from Step 16 or 17, whichever is greater.

NOTES:

1. If Step 17 value is much greater than Step 16 value, repeat Steps 10 - 17 with smaller pipe diameter.

2. If Step 16 value is much greater than Step 17 value, and Step 16 value is more than desired, repeat Steps 10 -17 with larger pipe diameter.

19. Determine permanent pool elevation by subtracting stage used (Step 18) from emergency spillway elevation (Step 6).

Pipe Data (If a drop inlet is used)

20. Check for full pipe flow. For a full pipe flow, one of the following conditions must be met:

    a. Outlet of pipe completely submerged by tailwater in outlet channel.

    b. Riser depth five times the diameter of the barrel.

    c. Pipe barrel slope is flatter than critical slope. Exhibit 3-5, EFM, can be used to determine friction slope, which is same as critical slope. Use correct "n" value. Use pipe diamter (Step 10) and Qo (Step 11)

21. Pipe angle in degrees for stub fabrication - Angle is obtained by computing the slope of barrel in ft/ft. Divide the actual difference in elevation between each end of the barrel by the length of barrel. Use this answer in Mathematical Table, p. 11, Tab. 2 to find the angle for th slope and add 90 degrees.

22. Baffle dimensions from IN-ENG-26.

Emergency Spillway

23. Determine design Q by multiplying DA (Step 1) in acres by 0.5 cfs/ac. Reference: Tech. Guide, Standard and Specification 378, Table 2.

Steps

24. Determine maximum permissible velocity (V) in ft/sec. from EFM, Ch. 11, Exhibit 11-2, Table 1, based on exit channel slope range, soil erodibility, and grass to be seeded.

25. Determine retardance from EFM, Ch. 11, Exhibit 11-2, Table 2, based on condition of stand and height of vegetation.

26. Determine discharge q in $Ft^3/S/Ft$ (cfs/ft) from Exhibit 11-2, Tables 3A, 3B, 3C, 3D or 3E for maximum permissible velocities.

27. Determine bottom width (b) in feet for stability by dividing Q in cfs (Step 23) by q in cfs/ft (Step 26).

28. Determine length (L) in feet of level portion of emergency spillway from field surveys, observation or experience.

29. Determine Hp from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for (L) (Step 28) and q (Step 26). Note: Most emergency spillways may have an (L) value less than 25 feet but use Hp value for 25 feet (L) as a minimum.

30. Record actual bottom width (b) used if wider than determined in Step 27.

31. Recalculate discharge q for selected bottom width by dividing design Q (Step 23) by (b) (Step 30).

32. Determine Hp (used) from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for new q (Step 31)

33. Determine emergency spillway (exit channel) slope. Find minimum and maximum from Exhibit 11-2, Tables 3A, 3B, 3C, 3D or 3E, (for (V) max. from Step 24). Select exit slope (actual) from field survey, within range of minimum and maximum.

34. Determine freeboard. Minimum freeboard will be 1 foot above the Hp value (Step 32). For dams with more than 20 acres drainage area, a minimum of 2 feet must be provided between the crest of the emergency spillway and top of dam.

35. Determine top of settled dam elevation by adding to emergency spillway elevation (Step 6) the value of Hp (used) (Step 32) and freeboard (Step 34).

36. Complete other physical data from planned elevations.

37. Fill out the sheets for the complete plans.

DESIGN PROCEDURE FOR PONDS WITH NO PRINCIPAL SPILLWAY WITH D.A. 10 ACRES OR LESS

NOTE: All structures designed under this procedure must be located in predominantly rural or agricultural areas where failure may only damage farm buildings, agricultural land or township and county roads. The structure must also not require IDNR approval.

STEPS

1. Determine drainage area from USGS maps, aerial photos, and/or field observation.

2. Determine pond surface area from field survey data.

3. Determine volume of storage from field survey data, or estimate by taking 40 percent of the product of the pond surface area times the maximum water depth to the vegetated spillway crest.

4. Check drainage area to pond surface area ratio with guidelines in Tech. Guide Spec. 378. Determine ratio by dividing drainage area Step 1 by pond surface area Step 2.

5. Set elevation of permanent pool waterline from field survey.

6. Design trickle tube, if none, go to Step 6. (Note: Trickle tubes should be seriously considered for ponds with steep vegetated spillway sites, very erodible soils, wet weather seeps, and/or high drainage area to pond surface area ratios.)

   (a) Provide stage between permanent pool and vegetated spillway crest. The following equation may be used to determine the stage required to store ½ inch of runoff (assumes vertical projection of pond area).

   $$\text{Stage} = \frac{\text{Ratio}}{24}$$

   Use 0.5 ft minimum and 1.0 ft maximum.

   (b) Determine elevation of vegetated spillway crest by adding stage to permanent pool elevation.

Vegetated Spillway

7. Determine design Q by multiplying DA Step 1 in acres by 1.0 cfs/ac. Reference: Tech. Guide, Standard and Specification 378, Table 2.

8. Determine maximum permissible velocity from EFM, Ch 11, Exhibit 11-2, Table 1, based on exit channel slope range and soil erodibility and grass to be seeded.

9. Determine retardance from EFM, Ch 11, Exhibit 11-2, Table 2, based on condition of stand and height of vegetation.

10. Determine discharge q in $Ft^3/S/Ft$ (cfs/ft) from Exhibit 11-2, Tables 3A, 3B, 3C, 3D or 3E for maximum permissible velocities.

11. Determine length (L) in feet of level portion of vegetated spillway from field surveys, observation or experience.

12. Determine bottom width (b) in feet for stability by dividing Q in cfs (Step 7) by q in cfs/fts (Step 10).

13. Determine Hp from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for (L) (Step 11) and q (Step 10.) Note: Most vegetated spillways may have an (L) value less than 25 feet but use Hp value for 25 feet (L) as a minimum.

14. Record actual bottom width (b) used if wider than determined in Step 12.

15. Recalculate discharge q for selected bottom width by dividing design Q (Step 7) by (b) (Step 14).

16. Determine Hp (used) from Exhibit 11-2, Table 3A, 3B, 3C, 3D or 3E for new q (Step 15).

17. Determine vegetated spillway (exit channel) slope. Find minimum and maximum from Exhibit 11-2, Tables 3A, 3B, 3C, 3D or 3E for V (max) from Step 8. Select exit slope actual from field survey, within range of minimum and maximum.

18. Determine freeboard. Minimum freeboard will be 1 foot above the the HP value (Step 15).

19. Determine settled fill elevation by adding the freeboard value Step 18 and the Hp value Step 15 to the vegetated spillway crest elevation (Step 5 or 6b).

20. Determine earth fill top width and side slopes from Tech. Guide Spec 378 based on maximum fill height from field survey.

21. Complete data sheets for plan. Use IN-ENG-40 for pond layout, etc.; IN-ENG-23 for Stockwater System, IN-CONS-13 for Fence, and other sheets as may be needed for tickle tube, etc.

22. Prepare written specifications to indicate how work is to be done

23. Check all work for omissions and errors.

Example Design - Pond with no Principal Spillway and with DA or 10 Acres or Less

STEPS

1. DA = 8 ac - Jennings County

2. Pond Surface Area = 0.5 ac

3. Volume of Storage (estimated) = 40% x 0.5 ac x 16 ft = 3.2 ac ft

4. Ratio = $\frac{8.0 \text{ ac}}{0.5 \text{ ac}}$ = 16 (Within Tech. Guide 378 Range)

5. Waterline elevation = 98.5

6. (a) Stage = $\frac{16}{24}$ = 0.67 ft; use 0.7 ft

   (b) Crest of Vegetated Spillway = 98.5 + 0.7 = 99.2

Vegetated Spillway

7. Design Q = $\frac{1 \text{ cfs}}{\text{ac}}$ x 8 ac = 8 cfs

8. Maximum permissible velocity = 4 ft/s for tall fescue on easily erodible soils with slope range 5 -10%

9. Retardance = C for fair stand, 10 to 24 inches average length of vegatation.

10. q = 1.5 cfs/ft, Table 3C, p 11-54h, for V = 4 fps

11. L = 10 ft (Use L = 25 column in Table 3C)

12. b = 8 cfs ÷ 1.5 cfs/ft = 5.3 ft (not practical)

13. Hp = 1.0 ft, Table 3C, for L = 25 ft, q = 1.5 cfs/ft, V = 4 fps

14. Actual b = 8 ft

15. Recalculated q = 8 cfs ÷ 8 ft = 1.0 cfs/ft

16. Hp (used) = 0.9 ft, Table 3C for q = 1 cfs/ft, V = 2 fps

17. Min. slope = 1%; max. slope = 6% actual slope 4%, Table 3C for V = 4 fps (Stability)

18. Freeboard = 1.0 ft

STEPS

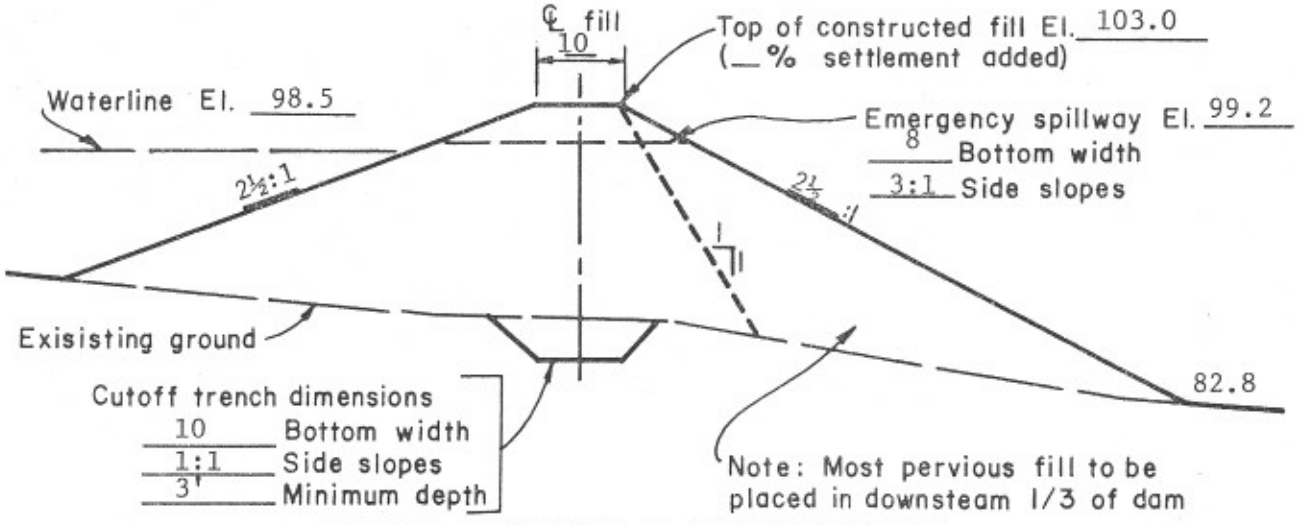
19. Settled fill elevation = 99.2 + 1.0 + 0.9 = 101.1

20. Top width = 10 ft. side slopes = 2½:1, 2½:1

21. Fill out sheets for the complete plans

22. Prepare written specification

23. Check all your work for omissions and errors



CROSS SECTION OF EMBANKMENT Not to Scale

DESIGN DATA

Drainage Area = 8 Acres
Pond Area = 0.5 Acres
Drainage Area to Pond Area Ratio = 16 :1
Emergency Spillway Elev. 99.2
Maximum Water Depth = 15.3 Feet
Total Volume of Storage Below Emergency Splwy. = 3.2 Ac.Ft.

EMERGENCY SPILLWAY

Design Q = 8 Ac. x 1 CFS/Ac. = 8 CFS
Veg. & Stand Fescue Good Retardance "C"
Bottom Width (b) (Used) = 8 Ft. L = 25 Ft.
Discharge q (Used) = $\frac{Q}{b}$ = 1.0 CFS/Ft
Hp (Used) 0.9 Ft.
Exit Slope = 4.0 % Min. = 1.0 % Max. = 6.0 %
Freeboard = 1.0 Ft.
Settled Fill Elevation = Em. Spwy. El. 99.2 + Hp 0.9 Ft. + Freeboard 1.0 Ft. = 101.1

ESTIMATE OF QUANTITIES

Item	Quantity
Clearing	0.3 Acres
Excavation	373 Cu.yd.
Stock Water System (See Sheet 3)	1 Job
Earth Fill, Compacted	3726 Cu.yd.
Trickle Tube (See Sheet 2)	1 Job
Seeding	0.5 Acres
Fencing	1200 Feet

AVAILABLE STORAGE

EL.	AREA SQ. IN.	AREA FLOODED ACRES	AVER. ACRES	INTERVAL FT.	INTERVAL STORAGE AC.FT.	ACCUM. STORAGE AC.FT.
83.2	0.0	0.0				0
			0.4x0.5x16		3.2	
99.2	2.18	0.5				3.2

SOIL INVESTIGATION REPORT

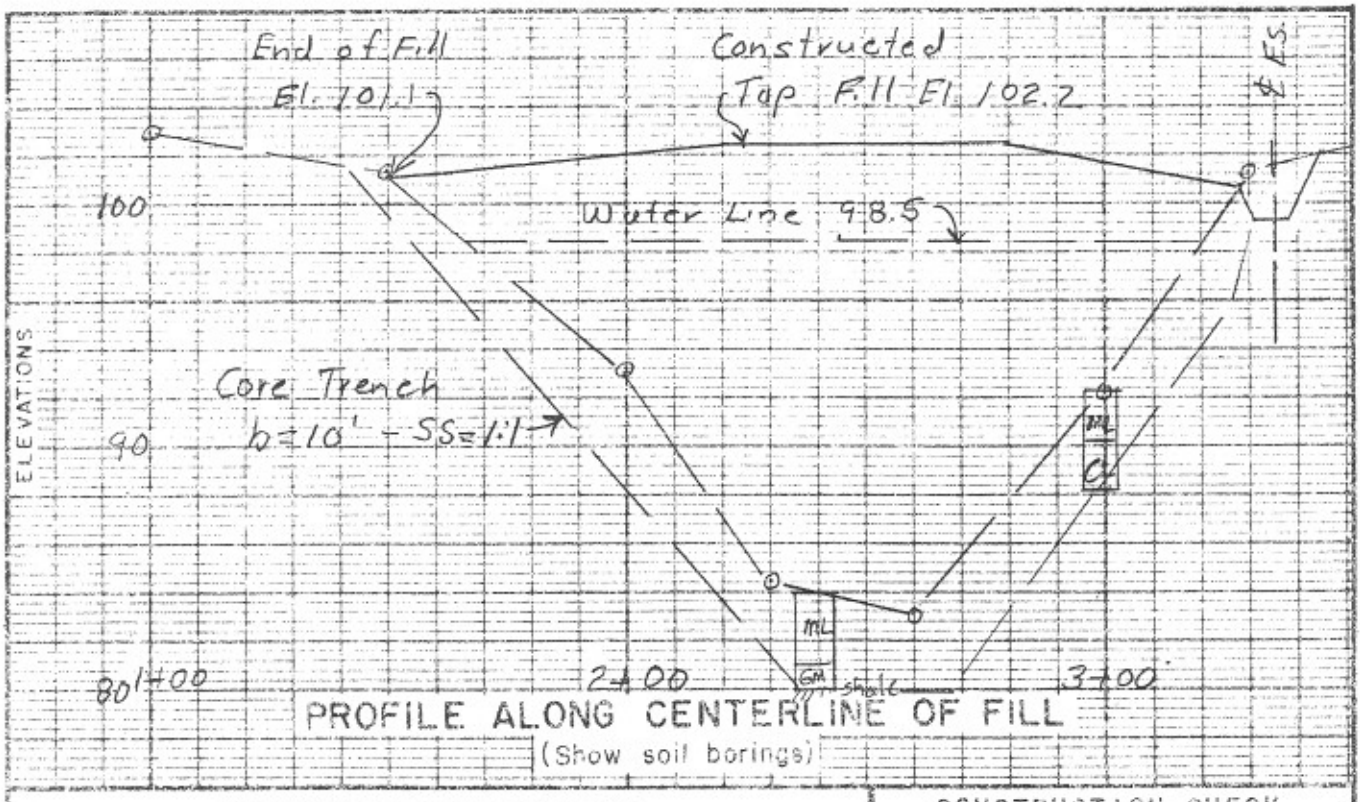
LOCATION OF BORINGS	DEPTH FEET	UNIFIED SOIL CLASSIFICATION
Sta. 2+40℄ Fill	0-3	ML
	3-4	GM
	4+	Shale
Sta. 3+00℄ Fill	0-2	ML
	2-4	CL

EMBANKMENT POND WITH LESS THAN 10 ACRE WATERSHED AND NO PRINCIPAL SPILLWAY

NAME Tom Kat

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	I.M.Quick	Date 3/81	Approved by I.M.Quick
Drawn			Title SCT 3-2-81
Checked	I.M.Quick	3/81	Title
Reviewed	D.C.Ready	3/81	Sheet No. 1 of 3



EARTHWORK COMPUTATIONS

Station	Elevation	Fill height +10% ft.	Cu.yd. per ft.	Average fill cu.yd.	Distance ft.	Fill cu.yd.
1+50	101.1	0	0			
				5.2	50	260
2+00	93.2	8.7	10.4			
				24.3	30	729
2+30	84.4	18.4	38.1			
				40.7	30	1221
2+60	83.2	19.7	43.3			
				27.9	40	1116
3+00	92.2	9.8	12.5			
				6.3	30	189
3+30	101.1	0	0			
						-
						3515
Core Trench - Excavation & Backfill						
b=10', SS=1:1, d=4' average						
$\frac{10+18}{2}$ x 4' x $\frac{180}{27}$ =						373
Total Cubic Yards						3888

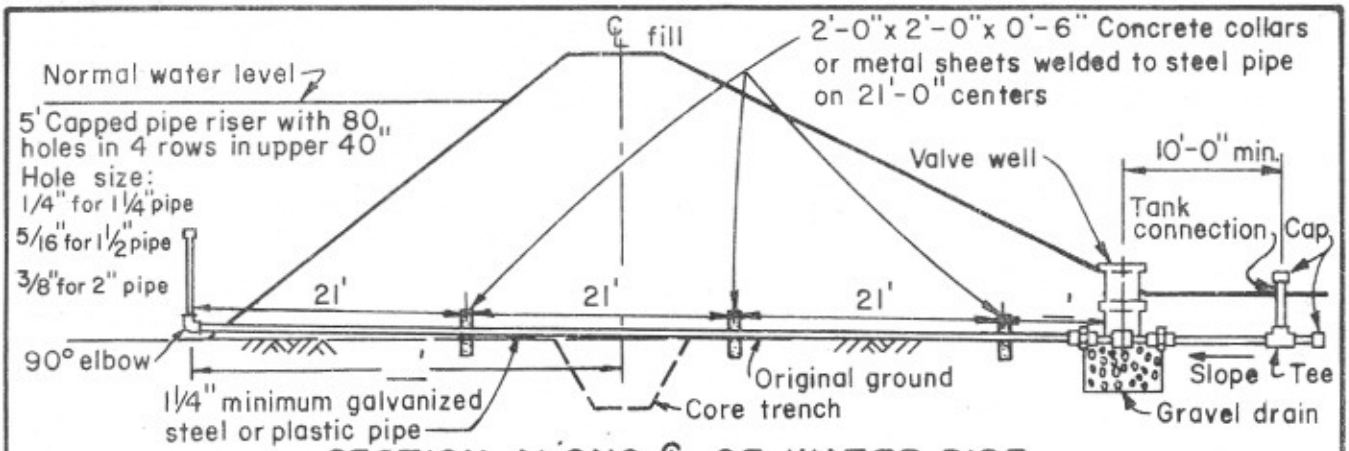
CONSTRUCTION CHECK

Length of fill 185 ft.
Top width 10 ft.
Side slopes 2½:1 - 3:1
Top dam el. 103.0
Veg. spiwy. el. 99.2
Top fill minus emerg. el. = 3.8 ft.
Veg. spiwy. width 8 ft.

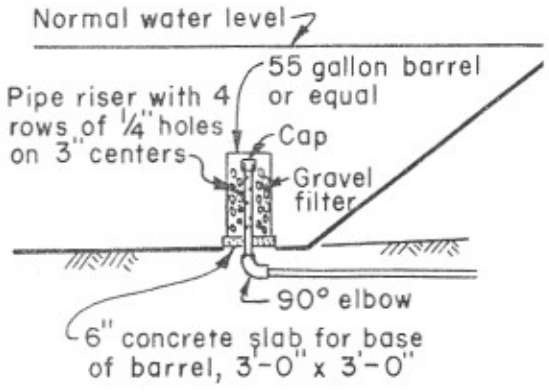
Clearing adequate (yes) (no) ____ Core trench adequate (yes) (no) ____
Stockwater system adequate (yes) (no) ____ Fencing adequate (yes) (no) ____
Seeding adequate (yes) (no) Not germinated Mulching completed Trickle tube adequate (yes) (no) ____

I certify that this job meets all the requirements of Indiana Standards and Specifications for Pond (Code 378) and the plans as designed.

Checked by: I.M.Quick Date: 8-20-81



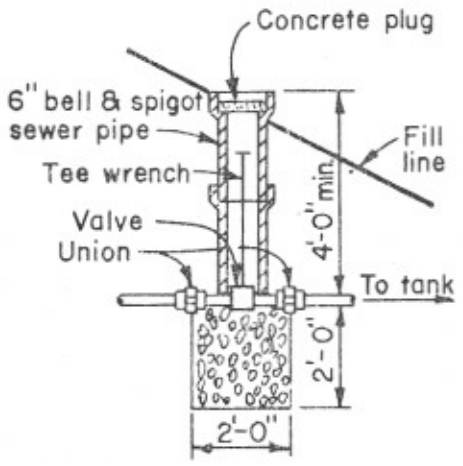
SECTION ALONG ℄ OF WATER PIPE



ALTERNATE INLET

Use This Inlet

NOT TO SCALE



VALVE WELL DETAIL

QUAN.	BILL OF MATERIALS ITEM	LENGTH
6	1¼" Galv. Iron Pipe ~~or Plastic~~ Pipe (1¼" Min.)	21'-0"
1	1¼" Galv. Iron or ~~Plastic~~ Pipe	10'
1	___" Galv. Iron or ~~Plastic~~ Tee	
1	___" Galv. Iron or Plastic Pipe W/80 ___" Holes	5'
1	1¼" Galv. Iron Pipe ~~or Plastic~~ 90° Elbow	
3	1¼" Galv. Iron Pipe ~~or Plastic~~ Cap	
2	1¼" Galv. Iron ~~or Plastic~~ Female Union	
2	1¼" x 2½" Galv. Nipple or ~~Plastic~~ Connectors	
1	1¼" Gate Valve	
1	Tee Handle Wrench	3'-5"
1	6" Bell Joint V.C. Tile	4'-0"
1	~~Treated Wood Plug to Fit Bell or~~ Concrete Plug	
~~1~~	~~Galv. Sheet Metal Disc 8" Dia.~~	
~~1~~	~~Brass D Handle With 2-1¼" Screws~~	
	Pit-Run Sand and Gravel (Drain) - 0.34 Cu. Yd.	
	Coarse Gravel Mix For Barrel	
	Concrete (2 C.F. Per Collar - 5 C.F. Per Base)	

NOTES:

1. Plastic pipe shall be Acrylonitrile-butydiene-styrene (ABS), Polyethylene (PE), or Polyvinyl chloride (PVC).
2. Collars may also be made from butyl rubber.

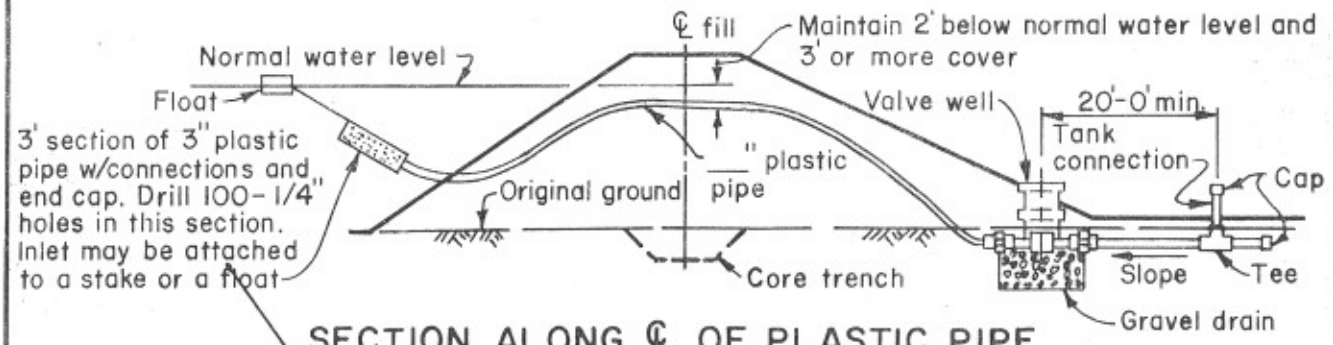
STOCKWATER SYSTEM

NAME Tom Kat

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

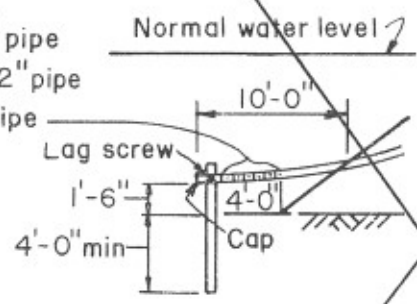
Designed	Date	Approved by
Drawn		Title
Checked		Title
Reviewed	Sheet No. 2 of 3	Drawing No.

IN-ENG-23 2(2) Rev. 6-81

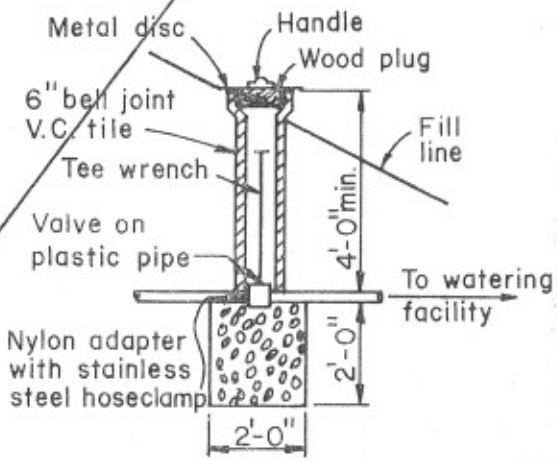


SECTION ALONG ℄ OF PLASTIC PIPE

Perforated section
80 holes in 4 rows
Hole size:
1/4" for 1 1/4" pipe
5/16" for 1 1/2" pipe
3/8" for 2" pipe



ALTERNATE INLET ARRANGEMENT



ALTERNATE VALVE WELL DETAIL

BILL OF MATERIALS

QUAN.	ITEM	LENGTH
	1 1/4" PLASTIC PIPE	
2	1 1/4" PLASTIC CAP	
1	1 1/4" PLASTIC TEE	
2	1 1/4" PLASTIC FEMALE UNION	
1	3" PLASTIC PIPE INLET SECTION	
1	BRASS - CHECK AND DRAIN VALVE	
1	TEE HANDLE WRENCH	3'-5"
2	6" BELL AND SPIGOT SEWER PIPE	4'-0"

NOT TO SCALE

STOCKWATER SYSTEM

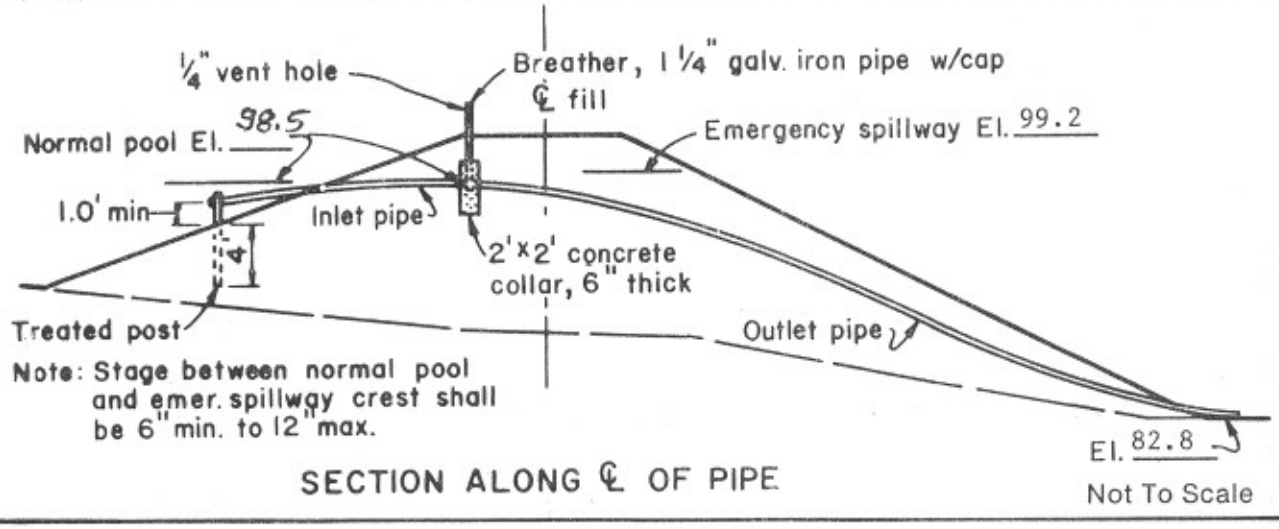
NAME

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed — Date — Approved by
Drawn — Title
Checked — Title
Reviewed — Sheet No. of — Drawing No.

(EFM Notice IN38, August 1981)

IN-ENG-23 1(2) Rev. 6-81



Note: Stage between normal pool and emer. spillway crest shall be 6" min. to 12" max.

SECTION ALONG ℄ OF PIPE

Not To Scale

BILL OF MATERIALS

Combination 1		Combination 2 or 3	
Quan.	Item	Quan.	Item
20 l.f.	Flexible plastic pipe, 2"	20 l.f.	Semi-rigid plastic pipe, 3"
90 l.f.	Flexible plastic pipe, 1¼"	1 ea.	Plastic cap, 3"
1 ea.	Post treated, 4" top, 6' lgth.	__ l.f.	Flexible plastic pipe, __"
1 ea.	Stainless steel hose clamp, 2"	1 ea.	Post treated, 4" top, 6' lgth.
1 ea.	Stainless steel hose clamp, 1¼"	1 ea.	Stainless steel hose clamp, "
1 ea.	Nylon adapter, 2"	1 ea.	Nylon adapter, 3"
1 ea.	Nylon adapter, 1¼"	1 ea.	Galv. iron tee, 3" x __" x 1¼"
1 ea.	Galv. iron tee, 2" x 1¼" x 1¼"	1 ea.	Nylon adapter, __" diam.
4 l.f.	Galv. iron pipe, 1¼" dia. w/¼" vent hole	4 l.f.	Galv. iron pipe, 1¼" w/¼" vent hole
1 ea.	G.I. pipe cap. 1¼"	1 ea.	Galv. iron pipe cap. 1¼"
2 c.f.	Concrete, 5-bag mix	2 c.f.	Concrete, 5-bag mix

DESIGN INFORMATION

Combination No.	Pipe Size		Inlet Perforations		Controlled Head. Ft.	Outlet Pipe Length Ft.	Capacity GPM(Max.)
	Outlet	Inlet	No.	Size			
(1)	1¼"	2"	100	¼"	10	50	24.0
					15	70	24.6
					20	90	25.2
2	1½"	3"	100	5/16"	10	50	40
					15	70	41
					20	90	42
3	2"	3"	100	7/16"	10	50	81.5
					15	70	84.2
					20	90	87.0

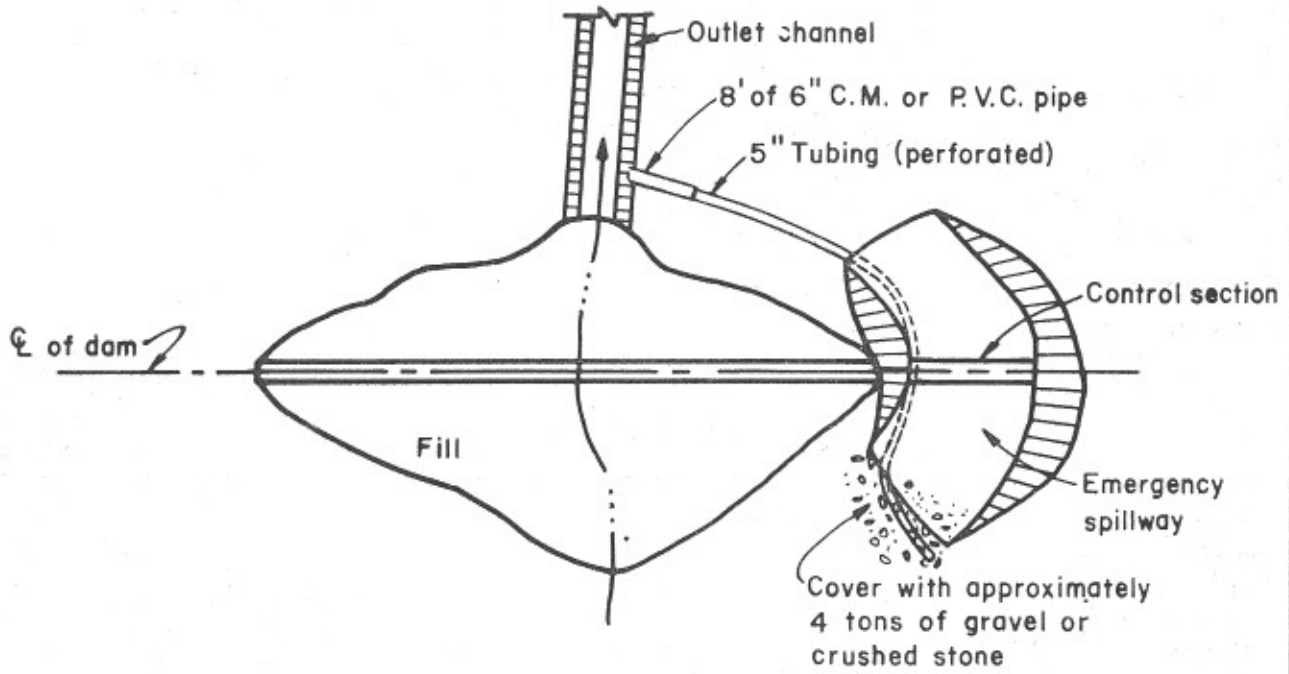
Notes:
(1) Use only in combinations shown. These provide inlet to discharge ratio 4:1
(2) Inlet perforations drilled in 4 rows on 2" centers starting at support post. Be certain end of inlet pipe is capped or squeezed shut.
(3) Combination #1 should be used if spring flow does not exceed 5 g.p.m.
(4) Breather pipe and tee are galv. iron since they are subject to mechanical damage from row boat tie-up chains, mowing machines, etc. The concrete anti-seep collar is mechanical support of the breather pipe.

SMALL TRICKLE TUBE FOR EMBANKMENT POND WITH D. A. LESS THAN 10 ACRES

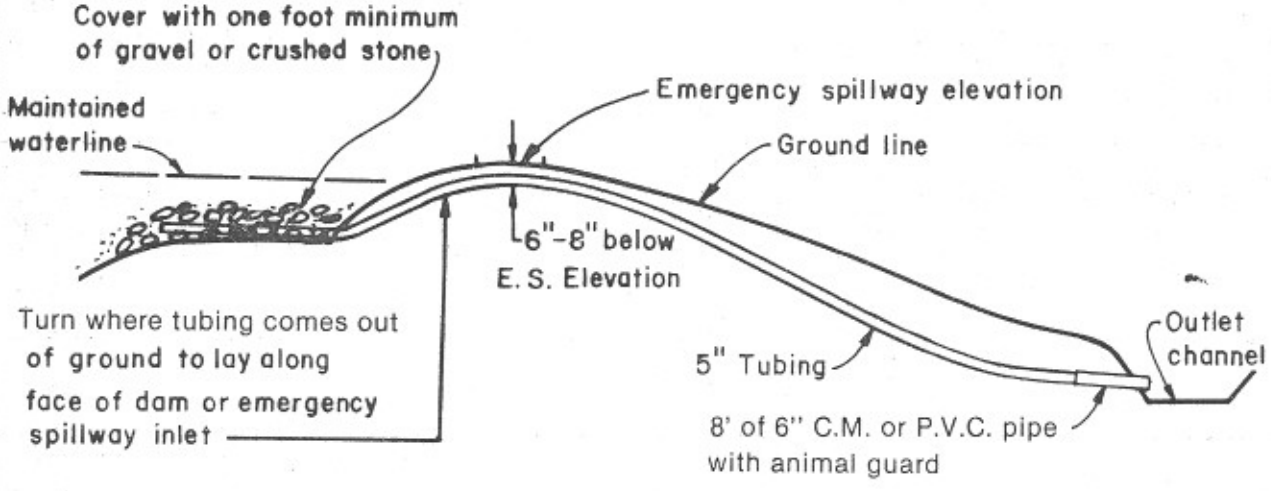
NAME Tom Kat

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
Designed
Drawn
Checked
Revised
Approved by
Title
Title
Sheet No. 3 of 3
Drawing No



TYPICAL PLAN VIEW



TUBING PROFILE

Not To Scale

BILL OF MATERIALS	
Quan.	Item
8 L.F.	C.M. or P.V.C. Pipe
L.F.	Perforated plastic tubing
Tons	Gravel or crushed stone

PERFORATED TRICKLE TUBE FOR EMBANKMENT POND WITH D. A. LESS THAN 10 ACRES

NAME

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Date
Designed
Drawn
Checked
Reviewed
Approved by
Title
Title
Sheet No. of
Drawing No.

IN-ENG-41 1(2) Rev. 6-81

(EFM Notice IN38, August 1981)

SAMPLE CONSTRUCTION SPECIFICATION FOR A POND

CONSTRUCTION SPECIFICATIONS

_____

_____COUNTY, INDIANA

A. GENERAL - The work covered by this specification consists of furnishing all labor and equipment and performing all excavation, fill, and all other operations in connection with the construction as shown on the drawings or as herein specified.

CLEARING -

1. Trees, brush, shrubs, stumps, and other woody growth in the work area shall be cleared to a height not exceeding twelve (12) inches above the ground surface. Such growth may be cleared by cutting pulling, grubbing, or other approved methods.

2. Trees shall be felled in such a manner as to avoid damage to trees left standing and to existing structures or installations and with due regard for the safety of persons and property.

3. All stumps, roots, and other objectionable material shall be grubbed and removed from the foundation and borrow areas and areas upon which improvements are to be constructed.

4. All cleared material shall be buried, left in piles outside the work area in designated locations, and/or burned in accordance with state law.

FOUNDATION PREPARATION-

1. After completion of all required clearing and grubbing operations, the entire area to be occupied by fill shall be stripped to a sufficient depth to remove all materials not suitable for the foundation, such as grass, weeds, underbrush and other matter that would be objectionable on the foundation for the fill, and this area roughened by plowing or scarifying.

2. All topsoil material which is suitable for vegetative growth shall be stripped from the embankment foundation, excavation, and borrow areas and shall be transported and deposited in storage piles

3. When fill material is to be placed against sloping sides of excavations or natural slopes, the slopes shall be cut or scarified on 1:1 slope or flatter until it shows the characteristic color of moist material.

4. Springs encountered in preparing the site shall be drained or sealed.

D. CORE TRENCH CONSTRUCTION

1. Excavate a trench in the foundation along the centerline of fill and extending the full length of the embankment as shown on the drawings. Excavate the trench to the dimensions shown on the drawings into firm clay or to sound rock or shale. Side slopes of the trench shall be 1:1 or flatter.

2. Backfill with the most impervious material available at the site, with moisture content and compaction as indicated below for "Homogeneous Earth Fill."

E. LIVESTOCK WATER SYSTEM

When specified, a livestock water system shall be installed as shown on the drawings. Backfill shall be in accordance with Section F-4 of these specifications.

F. CONSTRUCTION OF FILL

1. The embankment fill shall be constructed to the lines, grades, and cross-sections indicated on the drawings. All finished surfaces shall be generally smooth and pleasing in appearance.

2. a. Homogeneous Earth Fill

All fill materials shall be obtained from required excavations, designated borrow areas, or other approved borrow sources, and shall not contain any concentration of vegetation, roots, stones over six (6) inches in diameter, frozen soil, or other foreign substance. Moisture content shall be such that when kneaded in the hand, the soil should just form a ball which does not readily separate. The distribution of materials throughout a fill shall be such that there will be no lenses, pockets, streaks, or layers of material differing substantially in texture from the surrounding material in the fill.

Place the most impervious fill material in the core trench and the upstream half of the embankment, and the least impervious material in the downstream part of the embankment.

Zoned Fill

When sufficient earth fill material suitable for use is not available at the site for constructing the required fill, a zoned fill shall be constructed. The downstream part of the fill may be constructed with rock fragments and the most pervious material at the site. Rock fill shall be placed in such a manner to assure that no pockets exist between individual rocks and all voids are filled with smaller rock particles and compacted soil material. The center core of the fill shall contain the most impervious material available and conform with the requirements of (a) above for homogeneous fill. The upstream part of the fill may be composed of rock fragments and impervious fill material. The rock shall not exceed 1/3 of the volume of the fill and be distributed such that individual pieces are not in contact with each other so as to create pockets, lenses, streaks, or layers.

3. The fill shall be placed in approximately 9-inch layers before compaction and extend over the full width of the dam. Each layer shall be compacted by the operation of tractors, earth-moving equipment and/or rolled with sheepsfoot rollers. If the moisture content of the preceding layer of fill or the abutment surface becomes too dry to permit satisfactory bond, sprinkle with water prior to placing the next layer.

4. Backfill adjacent to any conduit shall be placed in 4-inch layers and well tamped. Heavy equipment shall not be driven over the conduit until a minimum of 2 feet of compacted fill has been placed above the top of the conduit. Backfill over and around structures shall be brought up uniformly on all sides to avodd undue stresses in the structure.

5. Fill shall not be placed on frozen soil. If the surface of the fill becomes saturated or slick, it shall be allowed to dry and then thoroughly scarified before placing additional layers of fill.

6. The topsoil material saved in the site preparation shall be spread evenly as a topdressing on the surface of the emergency spillway.

7. Topsoil shall be placed in the outside six (6) inches of the fill in approximately horizontal lifts as the fill is being constructed.

G. PRINCIPAL SPILLWAY

The principal spillway consisting of a _____inch diameter _____ pipe with appurtenances shall be installed as shown on the drawings.

H. SEEDING

1. General - The fill and emergency spillway as well as other bared areas above waterline shall be seeded and mulched.

2. Limestone shall be uniformly spread at the rate of _____tons per acre, or in accordance with soil test.

3. Fertilizer - The areas to be seeded shall be uniformly fertilized. The following minimum amounts of fertilizer shall be applied per acre:

Nitrogen (N)	_____pounds
Phosphoric (P_2O_5)	_____pounds
Potash (K_2O)	_____pounds

The required application can be met by applying the following amount of material with given analysis:

_____-_____-_____	_____lb/acre
_____-_____-_____	_____lb/acre

4. Seedbed Preparation - The areas to be seeded shall be disked or otherwise scarified to a depth of 3 inches after fertilizer and lime has been applied.

5. Seeding - The following rates per acre of seed shall be uniformly sown per acre:

_____	_____ lbs./acre
_____	_____ lbs./acre

Also, when the seeding operation is completed between October 1 and April 15, a small grain seeding shall be made to provide temporary cover until the permanent seeding can become established.

6. Mulching - Mulch shall be applied to the areas seeded.

Mulch consisting of the straw from any threshed cereal grain shall be relatively clean and dry, and shall be uniformly applied at a rate of 2 tons per acre.

Mulch consisting of hay from a grass crop shall be relatively clean and dry, and shall be uniformly applied at a rate of 1 ton per acre.

In areas where mulch is likely to blow away or be carried off by concentrated water flow, the mulch should be secured to the ground by on of the following methods:

a. The mulch may be secured to the ground by the use of a disc with blades set at a straight angle and operated as nearly as possible on the contour.

b. The mulch may be held in place with binder twine fastened down with No. 9 wire staples, 6 inches long, spaced 4 feet apart. The twine shall be placed parallel to and also at 60 degrees with the centerline of fill in both directions. The distance between the intersections of the diagonal strands measured along the strands shall be 12 feet. The strand parallel to the centerline of fill shall cross the diagonal strands at their intersections, thus forming equilateral triangles 12 feet on a side.

c. The mulch may be secured to the ground by the use of an IMCO mulch anchoring tool. This tool should be operated over the mulch as nearly on the contour as possible.

These specifications prepared for the _____ County Soil and Water Conservation District, Indiana, by the Soil Conservation Service, _____, Indiana, _____, 19____.

PART VI. ESTIMATING SEDIMENT ACCUMULATION IN PONDS AND SEDIMENT BASINS

The attached form IN-ENG-38 may be used to estimate sediment accumulation in ponds and sediment basins. Consult Section III of the technical guide for basic soil loss computations.

1. Type Erosion - Include data used in soil loss equation to estimate Tons/Ac soil lost (soil series, slope, rotations, practices).

2. Acres - Estimate acres at each different soil loss rate.

3. Soil Loss - Fill in estimated soil loss in Tons/Acre using the soil loss equation for expected land treatment and rotation. For construction areas, divide the estimated soil loss per acre by the design years and enter in Soil Loss column.

4. Total - Multiply Acres x Tons of soil loss per acre and enter result in Total (tons) column.

5. Estimate Delivery Rate - Use 0.35 for normal watersheds and increase to 0.55 for fan-shaped watersheds. Multiply Delivery Rate x Total Tons of sheet erosion to get Tons sheet erosion Delivered.

6. Estimate gully or streambank erosion. Relatively minor gully or streambank erosion usually ranges from 2% to 10% of total sheet erosion. For severely eroded areas, consult the area staff.

7. Estimate Delivery Rate for non-sheet erosion - usually 0.8 to 0.9. Multiply Delivery Rate x Total Tons non-sheet erosion to get Tons non-sheet erosion delivered.

8. Add total sheet erosion delivered to total non-sheet erosion delivered to get Total Tons Delivered.

9. Complete calculation of Tons Delivered x Trap efficiency x Design Years[1/] of structure to get Total Tons accumulated for design life of the structure.

10. Estimate lb/ft^3 and multiply Sediment Storage in Tons x AcFt/Ton taken from Conversion Table to get Total Acre Feet accumulated in pond. Use 50 or 55 lb/ft^3 for most soils in Indiana and higher weights for sands and gravels.

11. Fill in sketch map.

1/ A 25-year design life should be considered for ponds (see Sec. V of technical guide).

This amount of sediment should be added to other needs to determine total storage needed. Estimated volume of the reservoir may be obtained by the formula V = 0.4 AD where V is volume in acre-feet, A is the surface area in acres and D is maximum depth. A topographic map should be used if available.

This procedure is optional but should be used on larger drainage areas and on high sediment producing drainage areas. This method is limited to 250 acres drainage area but may be used in preliminary work on larger drainage areas with detailed estimates made by the geologist for final design.

EXHIBIT 11-10

IN-ENG-38
2/79

U.S. Department of Agriculture
Soil Conservation Service

SAMPLE

ESTIMATING SEDIMENT ACCUMULATION IN PONDS AND SEDIMENT BASINS

Location _____ Site No. _____ Date _____

Total Acres _____ County _____ Computed by _____
(Limited to 250 Ac.)

Present or Future Conditions (Circle one)

AVERAGE ANNUAL SEDIMENT YIELD

	TYPE EROSION		(ACRES)	SOIL LOSS (TONS/AC.)	TOTAL (TONS)
Sheet Erosion	Cropland	Miami IIe, 4% 3-1-1	20	3.5	70
		Russell IIIe,10% 1-1-4	40	2.5	100
	Pasture or Woods		30	0.5	15
	Construction Area				
	Idle		10	2.0	20
	Other				

Delivery Rate (0.5) (Use 0.35 to 0.55) X 205 = 103 Tons Sheet Erosi Delivered

Gully Erosion Est. 5% of Sheet (0.05 X 205)	10
Streambank Erosion Est. 2% of Sheet (0.02 X 205)	4

Delivery Rate (.8) (Use 0.80 to 0.90) X 14 = 11 Tons Non-Sheet Erosion Delivere

114 TOTAL TONS DELIVERED/YR.

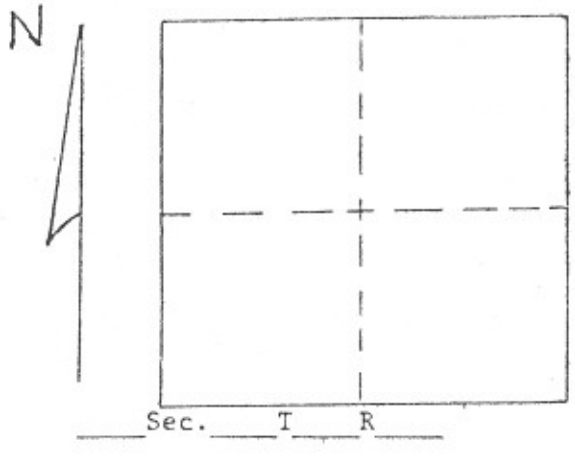
Tons Delivered 114 X 0.90 (Trap Efficiency) = 103 Tons X 15 (Design Years) = 1545 Tons

Sediment Storage 1545 Tons X .00092 Ac.Ft./Ton = 1.42 Acre Feet.

For Sediment Basins: 1.42 Acre Feet X 1.5 = 2.1 Acre Feet.

Conversion Table

lb/ft^3	AcFt/Ton
50	0.00092 ← Most Soils
55	0.00084
60	0.00077
65	0.00071
70	0.00066 ← Sand or Gravel



1/ Correction Factor to account for reduced trap efficiency as sediment accumulation approaches maximum design capacity.