

MARION COUNTY

DEPARTMENT OF PUBLIC WORKS

ENGINEERING STANDARDS

**The Marion County Board of Commissioners
Adopted These Standards on**

April 11, 1990

**These standards prepared by and under
the auspices of the staff of the
Public Works Department**

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Board of Commissioners

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V. DRAINAGE STANDARDS

These standards shall apply to all drainage facilities which impact a public right-of-way or easement dedicated to Marion County and within all off-street parking and loading areas as required by the Marion County Zoning Ordinance.

All storm water runoff shall be conveyed to a public storm sewer, or natural drainage channel, having adequate capacity to carry the flow without overflowing or otherwise causing damage to public and private property. In the case of private development, the developer shall pay all costs associated with designing and constructing the facilities necessary to meet this requirement.

A. DESIGN

1. Calculations

Design calculations shall be submitted for all drainage facilities, and shall be completed on Marion County standard forms or an approved facsimile.

Peak design discharges shall be computed using the rational formula, $Q=CiA$, only for basins under 1,000 acres. For larger basins, gauged flows or Soil Conservation Service or other approved methods shall be used.

a. Design Storm

The intensity-duration frequency is based on the type area through which the facility (pipe or ditch) passes and the size of the drainage facility. The adopted criteria are listed in Table 9.

b. Rainfall Intensity-Duration Curve

The rainfall intensity-duration curve for Marion County is shown on Standard Drawing No. 27.

c. Runoff Coefficients

The recommended coefficients of runoff (C) are listed in Table 10.

d. Time of Concentration

For land in a pre-development condition, the minimum time of concentration from the most remote point in the basin to the first defined channel (e.g. gutter, ditch or pipe) shall be 10 minutes. (Pre-development is defined in Section II.) Longer times using the

TABLE 9

DESIGN STORM FREQUENCY

<u>Area</u>	<u>Frequency</u>
Residential Area	5-year storm
Commercial and high value districts	10-year storm
Trunk lines (24" pipe and larger)	25-year storm
Minor creeks and drainage ways (not shown as a flood plain on the Flood Insurance Rate Map (Firm))	50-year storm
Major Creek (shown as a flood plain on the FIRM)	100-year storm

TABLE 10

RUNOFF COEFFICIENTS

<u>Soil Cover</u>	<u>Flat Terrain s<2%</u>	<u>Rolling Terrain 2%<s<10%</u>	<u>Steep Terrain s>10%</u>
Relatively high permeability (lawns, pasture, woods)	0.20	0.25	0.30
Moderate impermeability			
1) Single-family residential in urban areas, except corner lots with duplex potential	0.40	0.45	0.50
2) Gravel parking lots	0.50	0.55	0.60
3) Mobile home parks	0.60	0.65	0.70
4) Multi-family residential, zero-lot-line single- family residential and potential duplex lots in Single-family residential	0.70	0.75	0.80
High impermeability (roofs and paved areas)	0.90	0.90	0.90

Soil Conservation Service (SCS) method or other approved methods shall be used where appropriate.

For developed residential and commercial/industrial property, the maximum time of concentration from the most remote point in the development to the closest inlet shall be 10 minutes, unless calculations by an acceptable method show the time to be longer.

2. Detention Facilities

a. Where Required

Peak storm water runoff shall be controlled by detention facilities for all subdivisions, all commercial and industrial developments and all parking lots with a total developed acreage of 0.5 acres or more and all other developments where the county engineer determines control is needed to prevent flooding or damage downstream. This requirement may be waived if the applicant can show that it is not effective for the basin as a whole.

b. Allowable Runoff Rate (Outflow)

Peak runoff rate shall be limited to that which would occur in a 5-year frequency storm with predevelopment conditions ($C=0.2$). Pre-development is defined in Section II.

c. Required Storage Capacity

Detention facilities shall have storage capacities to detain the difference between a 5-year frequency storm with pre-development conditions and a 10-year frequency storm with development conditions.

d. Design

- (1) The design shall be done in accordance with the Oregon Department of Transportation Publication 78-4, "Procedure Manual, Application of Detention Storage for Limiting Runoff", or other methods approved by the Director of Public Works.
- (2) The orifice size and the hydraulic head shall be adjusted to produce the allowable outflow.
- (3) To prevent excessive plugging, the minimum orifice diameter shall be 1-1/2 inches.
- (4) Detention facilities shall be designed to protect public and private

property.

(a) Freeboard

At maximum storage, the water surface elevation shall be a minimum of 0.5 feet below the top of the structure (curb, bank, berm, etc.) designed to contain the water.

(b) Overflow System

The detention facility shall have an overflow system with the capacity to pass a 50-year frequency storm. The overflow shall discharge into a public storm drain facility or the natural drainage course for the drainage basin where the development is located.

(5) Simplified design for sites between 0.5 acres and 5 acres.

For developments in this size range, the detention facility may be designed in accordance with Standard Drawing No. 30. This method is based on the following conditions:

(a) The sites are small enough so that there is an insignificant difference between the times of concentration for the different site sizes. For calculating the allowable runoff rate, a uniform time of concentration of 10 minutes is applicable and, as a result, the allowable runoff rate is 0.2 cfs per acre.

(b) The sites, when developed, will have surfaces that are almost entirely impermeable (buildings, pavement, etc.). For a site not conforming to this condition, the required storage capacity can be reduced by doing a detailed analysis instead of following the standard drawing.

3. Pipes

- a. Concrete pipe shall be used, except for temporary or unusual conditions, with a minimum diameter of 10 inches and a minimum cover of 12 inches. Based on the cover and anticipated loading, the required type ASTM C-76 (reinforced) or ASTM C-14(non-reinforced) and class of pipe shall be specified. Within county right-of-ways, under all public roadway areas, the pipe shall have rubber gasket joints. When the pipe has less that 12 inches of cover, Ductle Iron, Class 52 shall be installed. High-density polyethylene pipe with a corrugated exterior and a smooth interior (Advanced Design Systems, Inc., N-12 or equivalent), ASTM F-405 and F-667 or AASHTO M-252 and M-294, may be used for driveway culverts, provided a minimum cover of 18 inches can be placed and still

keep the surface of the driveway (at the ditch line) lower than the surface of the county road, in accordance with Standard Drawing No. 11J.

- b. Pipes shall be designed for free flow (i.e., not under head).
 - c. Allowance for energy loss due to turns, structures, pipe size change, etc., shall be considered in the design of the storm drainage facilities.
 - d. Mannings “n” value shall be 0.013 for concrete pipe.
 - e. Minimum velocity shall be 3.0 fps at peak design flow. Minimum velocity of 2.5 fps will be allowed if the developer provides a construction bond, or similar assurance, for the cost of relaying the pipe if it is laid flatter than 80% of the design grade between structures or pipe ends.
 - f. Pipe slopes greater than 20% shall have concrete encasement or anchor walls at 21-foot spacing, and shall be reviewed by the Director of Public Works for impact or excessive velocity and the need for energy dissipators.
 - g. Storm sewer and other utility lines should not meander across the road right-of-way, creating conflicts with existing and future utilities and preempting orderly future installation. With a few exceptions, underground utilities should parallel the roadway centerline and be placed per Standard Drawings Nos. 2, 3, and 4.
 - h. When fill or trench depths exceed 10 feet, design calculations for pipe loading and strength shall be submitted.
 - i. Pipe bedding and trench backfill shall conform to Standard Drawing No. 25.
 - j. Storm sewers crossing private property shall have minimum easement widths of 10 feet. Deep storm sewers, large pipe or unstable soil situations will require wider easements.
4. Storm Drain Manholes, Junction Boxes and Cleanouts
- a. Manholes shall be required at:
 - (1) All changes in horizontal or vertical alignment. Minor horizontal curvature in pipe less than 15 degrees may be allowed, (without manholes or cleanouts), depending on pipe size, street alignment, degree of curvature and reason. Maximum joint deflection shall be per manufacturer’s recommendation.
 - (2) All connections.

- (3) All changes in pipe size.
- (4) At a spacing no greater than 500 feet.
- b. Standard catch basins, junction boxes, or cleanouts may be used in place of manholes for pipe no larger than 18 inches and with a depth less than 4.0 feet.
- c. In place of manholes, on new main line and lateral construction, catch basing laterals of 30 feet or less in length and 10 inches in diameter may connect to the main line with a shop fabricated 90 degree "T", provided the connection is located not more than 100 feet from a manhole or cleanout on the main line and the main line is 15 inches or larger in diameter.
- d. In place of manholes or cleanouts, laterals draining private property may be connected directly to the main line, provided the lateral diameter is 8 inches or less and is no more than one half the diameter of the main line. The hole in the main line shall be made with a drill designed for cutting concrete. The connection shall be properly grouted to provide a strong, leak-proof point. The lateral shall not project inside the main line.

5. Inlets and Catch Basins

Inlets and catch basins shall be required at:

- a. All low spots, whether on public or private property, and shall be connected to a storm drainage facility.
- b. A maximum gutter flow length of 500 feet.

6. Drywells and French Drains

Drywells and French drains shall not be allowed as the exclusive method for draining public right-of-ways but may be used for developments on private property for paved driveways, parking and loading areas, subject to the following conditions:

- a. There are no public storm drain facilities, available within a reasonable distance of the development.
- b. A soils test shall be provided to show that there is adequate permeability.
- c. The system shall be engineered to insure that adequate capacity is available.
- d. Provisions shall be made for grease and fines removal.

- e. The site shall be graded so that it does not drain onto a public right-of-way in the event that the drywell or French drain fails.
- f. The design shall be approved by the Department of Public Works.

7. Open Channels

- a. All existing streams and ditches and other open channels requiring a pipe diameter greater than 36 inches shall remain open channel except at road crossing.
- b. Where possible, ditches shall be located along or adjacent to lot lines. Within the UGB, creation of new open channels will not be allowed, unless it is to relocate an existing open channel.
- c. For reasons of maintenance and safety, bank slopes generally shall be 4:1 or flatter but may be a maximum of 2:1 with Department of Public Works approval.
- d. The maximum allowable design velocity shall be 7 fps.
- e. The minimum allowable design velocity shall be 2 fps. The installation of a concrete lined low-flow channel may be required to achieve minimum velocity.
- f. The normal maximum depth for an open ditch shall be 4 feet outside of road rights-of-way and 2 feet adjacent to the roadways.
- g. Channels crossing private property shall have a minimum easement width equal to the channel width at the top plus 10 feet along one side of the channel.

B. PLANS

- 1. All plans shall include a map outlining the drainage basin boundaries for which a storm water runoff system is being designed and those adjacent basins which may be affected. This drainage basin map shall show the existing and proposed drainage swale, stream or body of water. The scale of this map may vary from 1" equals 200' to 1" equals 2,000' depending on the size of the drainage basins.
- 2. All crossings and potential conflicts between storm sewers and other underground utilities shall be shown on the profile.
- 3. Means of preventing erosion along new channels, ditches and at pipe outfalls, are required and shall be shown on the plans.

4. Pipe sizes, types, classes and bedding shall be specified on the plan.
5. Pipe bedding and trench backfill shall be specified on plans and shall be per Standard Drawing No. 25.

SURFACE TREATMENT

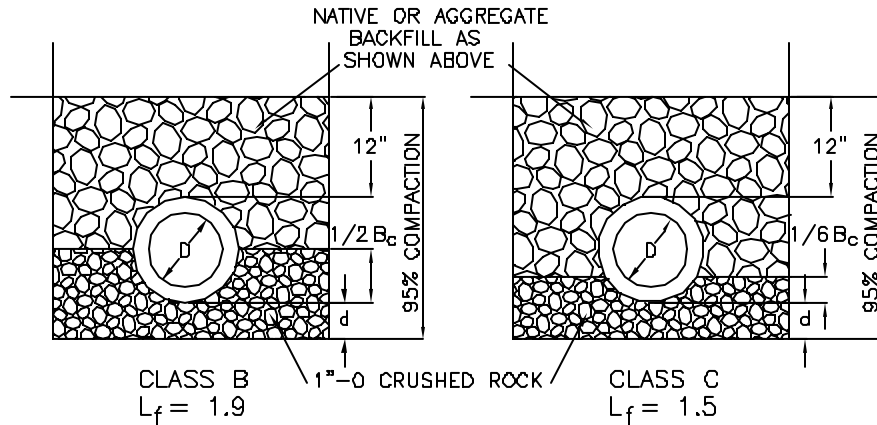
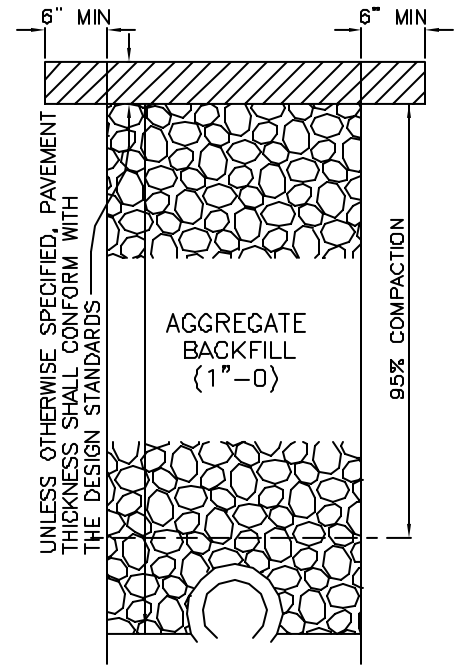
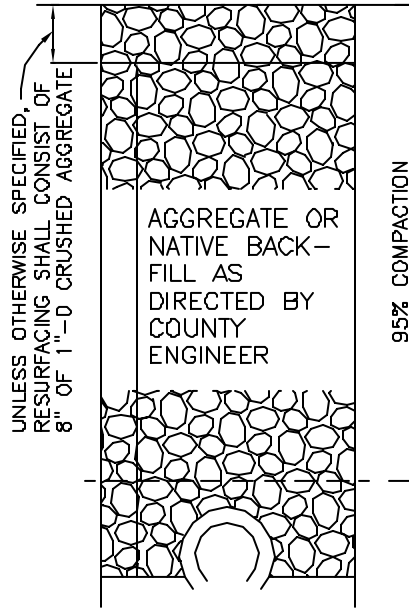
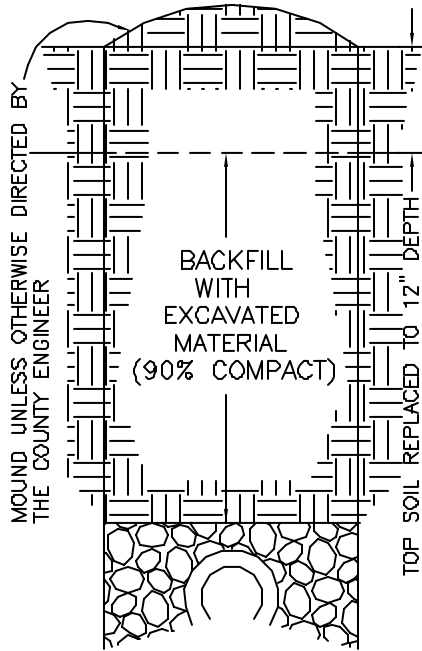
TRENCH BACKFILL

PIPE AND BEDDING ZONE

NATURAL OR OTHER THAN ROADWAY SURFACE (IN EASEMENT)

GRAVELLED OR DIRT ROAD SURFACE (COUNTY ROAD)

ASPHALT CONCRETE OR OILED GRAVEL SURFACE (COUNTY ROAD)



DEPTH OF BEDDING MATERIAL BELOW PIPE	
D	D(MIN.) ^①
27" AND SMALLER	4"
30" - 60"	5"
66" AND LARGER	6"

LEGEND

- B_c = OUTSIDE DIAMETER
- D = INSIDE DIAMETER
- d = DEPTH OF BEDDING MATERIAL BELOW PIPE
- L_f = LOAD FACTOR

NOTES

1. FOR ROCK OR OTHER INCOMPRESSIBLE MATERIALS, THE TRENCH SHALL BE OVEREXCAVATED A MINIMUM OF 6" AND REFILLED WITH AGGREGATE MATERIAL AS DIRECTED BY THE ENGINEER.
2. BEDDING AND BACKFILL MATERIALS IN THE PIPE ZONE SHALL BE COMPACTED AS SPECIFIED PRIOR TO BACKFILLING THE REMAINDER OF THE TRENCH.

**Marion County Dept. of Public Works
Engineering**

TEL. 688-6036

Salem, Oregon

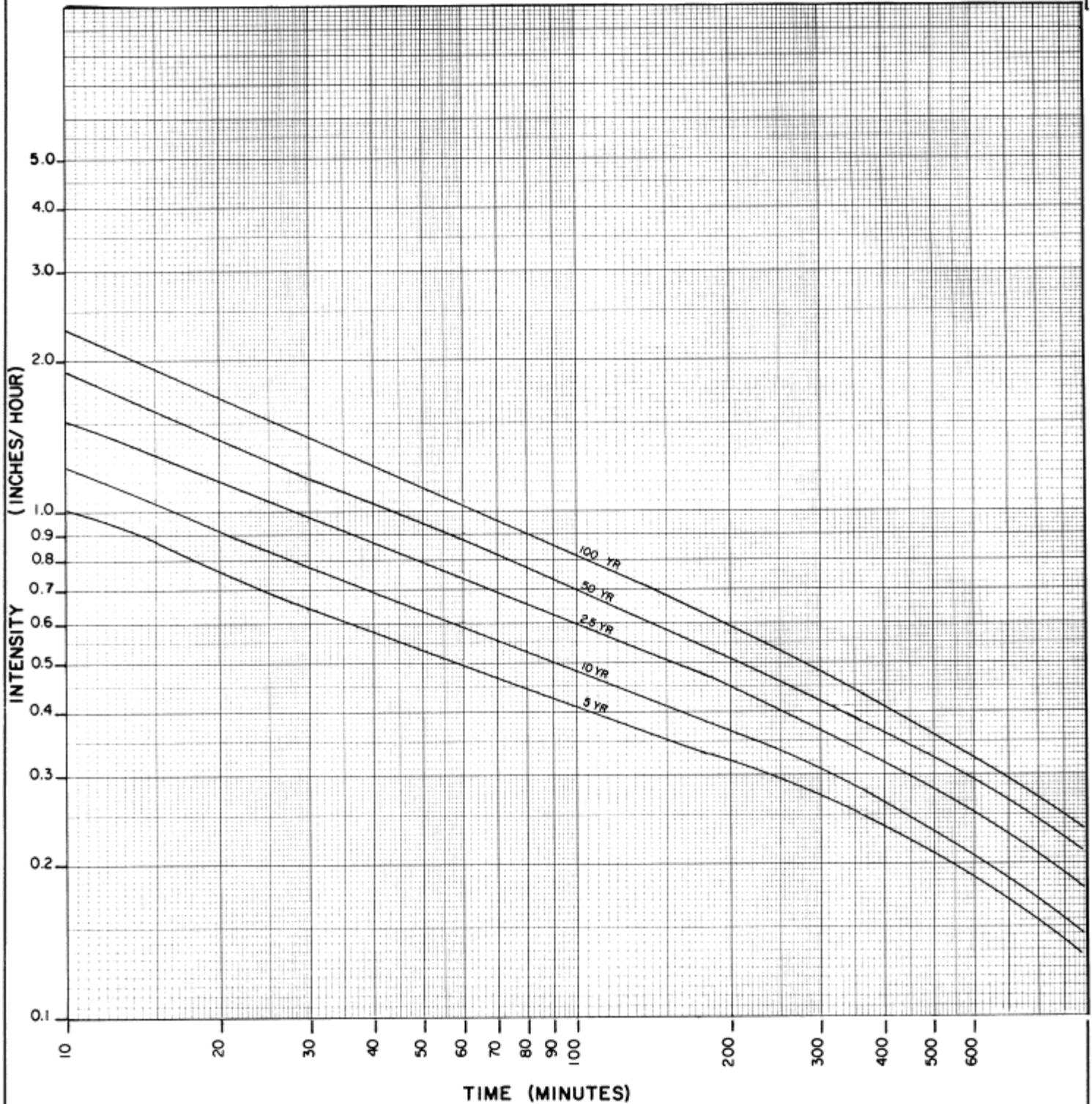
25

PIPE BEDDING AND TRENCH BACKFALL

Des.	Eng.	Date: 7-5-84	Revised:
Reviewed By: Survey	Datum: NONE	SCALES	
Appd.	Inspec:	Drwn: CDM	Hor: NONE Vert: NONE



RAINFALL INTENSITY-DURATION CURVES FOR MARION COUNTY



Source: U.S. Geological Survey
Water Resources Investigation
for Salem, Oregon

MARION COUNTY, OREGON DEPARTMENT OF PUBLIC WORKS	
RAINFALL INTENSITY-DURATION CURVES	
DATE: 1/18/83	STD. DWG. NO. 27

SOIL CONSERVATION SERVICE

TR-55 LAG-T_c METHOD PEAK DISCHARGE COMPUTATION SHEET

PROJECT _____ WATERSHED CONDITION _____

BY _____ DATE _____

CHECKED BY _____ DATE _____

INPUT

1.	<input style="width: 90%;" type="text"/> (IN) (24 HOUR) (____ -YR FREQ.) RAINFALL (MAP EXHIBIT 2-3A)	FIGURE 10	
2.	<input style="width: 90%;" type="text"/> RUNOFF CURVE NO. (EXHIBIT 2-2A)	T_c FACTOR <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 5px 0;">1.67</div> CONSTANT X	
3.	<input style="width: 90%;" type="text"/> FT HYDRAULIC LENGTH	FIGURE 3-3	9. <input style="width: 90%;" type="text"/> HR BASIC LOG X
4.	<input style="width: 90%;" type="text"/> % WATERSHED SLOPE	FIGURE 3-4	10. <input style="width: 90%;" type="text"/> HYDR. LENGTH ADJ. X
5.	<input style="width: 90%;" type="text"/> % HYDR. LENGTH MODIFIED		11. <input style="width: 90%;" type="text"/> IMP. AREA ADJ. =
6.	<input style="width: 90%;" type="text"/> % IMPERVIOUS AREA		12. <input style="width: 90%;" type="text"/> HR T_c
7.	<input style="width: 90%;" type="text"/> SQ MI DRAINAGE AREA (DA)		15. <input style="width: 90%;" type="text"/> SQ. MI. DRAINAGE AREA X
8.	<input style="width: 90%;" type="text"/> % PONDS, SWAMPS	TABLE E-2, E-3, OR E-4 (LOCATION DETERMINES TABLE)	16. <input style="width: 90%;" type="text"/> PONDS, SWAMPS ADJ. =
	ADJUSTED PEAK DISCHARGE		17. <input style="width: 90%;" type="text"/> CFS

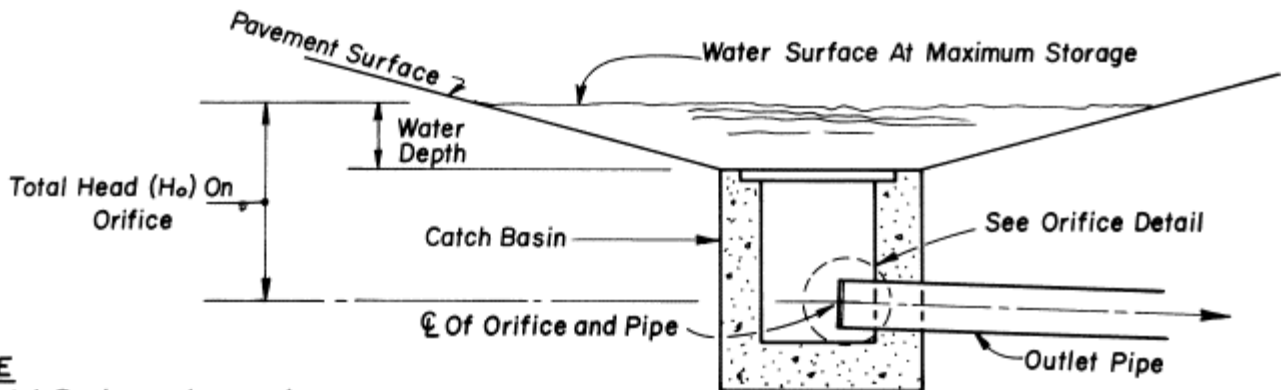
PEAK FACTOR

13. IN
 RUNOFF VOLUME
 X
 FIG. 2
 14. CSM/IN
 BASIC PEAK DISCHARGE
 X

Area of Developed Site (acres) ①	Allowable Outflow (cubic feet per second)	Orifice Diameter (inches) ②	Volume of Water to Be Stored (cubic feet)	Water Depth Over Inlet Grate (feet) ③	Water Storage Area (square feet) ③
0.5	0.10	1-11/16	780	0.5	4,690
1.0	0.20	2-3/8	1,560	"	9,380
1.5	0.30	2-7/8	2,350	"	14,070
2.0	0.40	3-5/16	3,130	"	18,760
2.5	0.50	3-11/16	3,910	"	23,450
3.0	0.60	4	4,690	"	28,150
3.5	0.70	4-3/8	5,470	"	32,830
4.0	0.80	4-11/16	6,250	"	37,520
4.5	0.90	4-15/16	7,040	"	42,220
5.0	1.00	5-3/16	7,820	"	46,910

- ① For areas less than 0.5 acre, detention is not required. For areas greater than 5.0 acres, the detention system must be designed on a site-specific basis with an allowable outflow based on a 5-year storm with a runoff factor of 0.20 and storage for a 10-year storm with a runoff factor of 0.90.
- ② Orifice diameter (D_o) is based on the allowable flow (Q_o) and an assumed total head (H_o) on the orifice of 2.00 feet (see typical details). If the total head is different, the diameter must be determined from the graph on Sheet 2.
- ③ If site conditions necessitate the use of a different water storage area, the water depth must be calculated and an orifice diameter determined per Note 2 above. In most cases, the following formula can be used for calculating the depth:

$$\text{Water Depth} = 3 \times \text{Volume of Stored Water} \div \text{Water Storage Area}$$

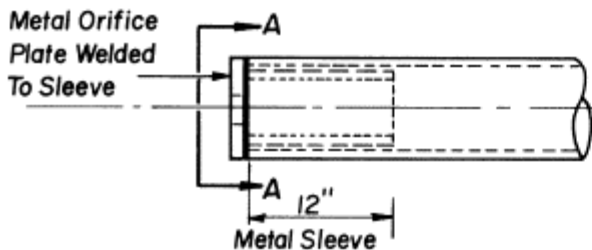


NOTE

Catch Basin may be round, square, or rectangular.

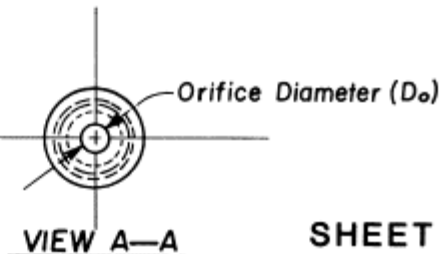
TYPICAL CATCH BASIN DETAIL

NO SCALE



TYPICAL ORIFICE DETAIL

NO SCALE



SHEET 1 OF 2



MARION COUNTY, OREGON
DEPARTMENT OF PUBLIC WORKS

**STORM WATER
DETENTION**
FOR SITES OF 5 ACRES OR LESS

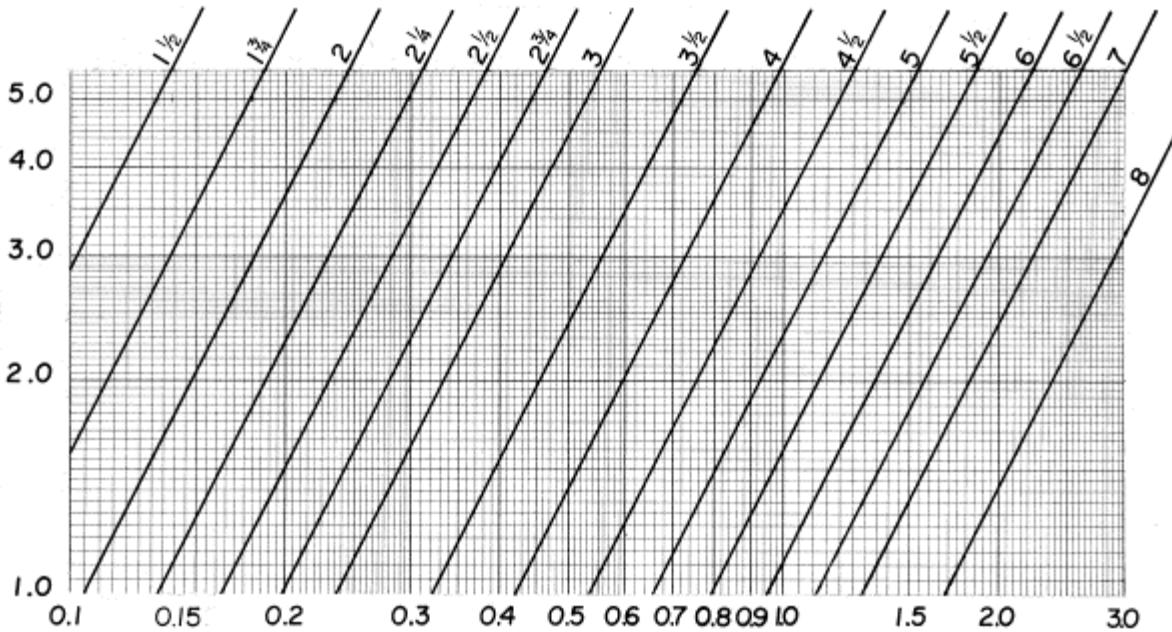
DRAWN BY: MWS DATE: 10/10/85

APPROVED BY: *[Signature]* DWG. NO.: 30

REV.	DESCRIPTION	DATE	BY	APPVD.

TOTAL HEAD ON ORIFICE (H_o) -
feet

ORIFICE DIAMETER (D_o) -
inches



ALLOWABLE OUTFLOW (Q_o) -
cubic feet per second

SHEET 2 OF 2

MARION COUNTY, OREGON
DEPARTMENT OF PUBLIC WORKS

**STORM WATER
DETENTION**

FOR SITES OF 5 ACRES OR LESS

DRAWN BY: MWS

DATE: 10/10/85

APPROVED BY:

DWG. NO.: 30



REV.	DESCRIPTION	DATE	BY	APPVD.