

Storm Water Management

CHAPTER 1481

Storm Water Management

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CROSS REFERENCES

Changing established grade - see Ohio R.C. 727.07  
Determination of grade levels - see ADM. 204.01  
Drainage of lots - see GEN. OFF. 660.11  
Drainage ditches - see S.U. & P.S. Ch. 1022  
Flood Damage Reduction - see B. & H. Ch. 1466  
Grading - see B. & H. Ch. 1468  
Controlling Construction Site Soil Erosion,  
Sediment and Other Wastes and Storm Water Runoff  
- see B. & H. Ch. 1488  
Controlling Post - Construction Water Quality  
Runoff - see B. & H. Ch. 1490  
Controlling Riparian Setbacks and Wetland  
Setbacks - see B. & H. Ch. 1492

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**1481.01 INTRODUCTION; PURPOSES; GENERAL PROVISIONS.**

(a) The prevention of accelerated flooding and stream channel erosion in conjunction with urban development requires control of the discharge rate and volume of runoff prior to its release to off-site land. The purposes of this chapter are to permit development without increasing the flooding of other lands and to provide a basis for the design of storm drainage systems on lands above or below undeveloped areas, which design will preserve the rights and options of both contributing and receiving property owners and ensure the long term adequacy of storm drainage systems.

(b) Accelerated channel erosion as well as increased flooding damage could be controlled if the predevelopment hydrograph could be maintained. It is usually not practical, however, to retain the predevelopment rate of infiltration when a large part of the watershed is covered with impervious surfaces. The concept of reducing peak flows below those of predevelopment storms was developed as an alternative to maintaining the predevelopment hydrograph. The logic of this concept is to compensate for the increased erosiveness of:

- (1) Increased volume of runoff due to less infiltration;
- (2) More frequent occurrences of the same flow. For example, a subdivision may have the peak flow of a predevelopment five-year storm occur once a year after development is complete.
- (3) Less sediment in the runoff water because the watershed is paved with nonerosive surfaces or good grass cover.

(c) The two-step standard requires that:

- (1) The peak rates of runoff from an area after development shall be not greater than the peak rates of runoff from the same area before development for all twenty-four hour storms from one to 100-year frequency. Designing for the one, two, five, ten, twenty-five, fifty and 100-year storms is considered adequate to meet the requirement. Storm water requirements must be met at each point storm water is discharged from a development area.

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(2) If the volume of runoff from an area after development will be greater than the volume of runoff from the same area before development, it shall be compensated by reducing the peak rate of runoff from the critical storm and all more frequent storms occurring on the development area to the peak rate of runoff from a one-year frequency, twenty-four hour storm occurring on the same area under predevelopment conditions. Storms of less frequent occurrence (longer return periods) than the critical storm up to the 100-year storm shall have peak runoff rates not greater than the peak runoff rates from equivalent size storms under predevelopment conditions.

- (d) The critical storm for a specific development area is determined as follows:
- (1) Determine the total volume of runoff from a one-year frequency, twenty-four hour storm occurring on the development area before and after development; and
  - (2) From the volumes determined in paragraph (d)(1) hereof, determine the percent of increase in volume of runoff due to development, and using this percentage, select the twenty-four hour critical storm from the following table:

If the percentage of increase in volume runoff is:		The twenty-four hour critical storm for discharge limitation will be:
<u>Equal to or greater than</u>	<u>and less than</u>	
0	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	--	100 year

This standard basically requires peak flow to be reduced in proportion to increased runoff volume. If runoff volume is not increased, peak flows are only

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required to match predevelopment peak runoff rates for equivalent size storms for all storms from one-year to 100-year storms. This criteria is designed to require more control when the change in the runoff pattern caused by development is more drastic. The quantity and cost of preventative control features will need to be in proportion to the level of increase in runoff caused by the change in land use, a fair and equitable criterion.

(e) Concern is frequently expressed in regard to the extremes of the accelerated storm water control standard, the one and 100-year frequency storms. Justification for using the one-year storm is based on the erosivity of stream flow and on what is known as the routing problem. Small or frequent storms are very erosive simply because they occur so often. Damage doesn't have time to heal before the next storm comes. Bankfull channel flow is essentially the most erodible state of stream flow on the channel itself. Any increase spills out over the flood plain with very little increase in the velocity of channel flow. Any flow less than bankfull generally has a corresponding decrease in velocity, and therefore, less erosion damage to the channel. Where there is a significant increase in runoff volume, it is very important to have the runoff occur at something less than bankfull flow, especially in watersheds approaching complete development. Longer duration of bankfull flow than that which occurred under predevelopment conditions, can have disastrous effects on the stream channel and resulting sediment pollution. Since channels generally size themselves for about one and one-half to a two-year frequency storm runoff event, the one-year storm was chosen as the control storm to prevent significant channel erosion.

(f) The routing problem is the problem of channel flow downstream from numerous smaller watersheds. As runoff from the smaller watersheds is altered, the effect on channel flow somewhere downstream where all of the watersheds come together can be favorable or adverse. Ideally, the entire large watershed should be hydraulically planned and the level of control of each sub-watershed should be based on the accumulative effects downstream. Since experience has proven the near impossibility, politically, of realizing that degree of organizational

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control, the one-year outlet rate is further justified in order to minimize adverse effects on the routing problem when compensation is necessary to control increased flow volumes.

(g) Many people suppose that runoff peaks and volumes do not increase from the large or infrequent storm because the ground is saturated by these storms and most of the rainfall will run off, whether the land is used for forest land, crop land or urban purposes. Urbanization can, in fact, cause an increase in both peak and volume of runoff. Most of the increase may be in the early part of such a storm, and perhaps the twenty-five or fifty-year storm control may adequately address the situation. There are many variables which affect the storm water runoff pattern - soil type, slope, kind of cover, percentage of impervious cover, kind of disturbance and compaction. The 100-year storm needs to be examined in a development situation to determine its specific effect. Emergency flow areas and emergency outlets from structural work need to account for such storms if we don't want basements full of water and structures failing. The additional control necessary for the 100-year frequency storm is not a highly significant factor in storm water management for accelerated runoff control.

(h) In addition to controlling channel erosion, this standard should make long range planning for storm water management easier. Storm sewers and stream channels can be designed in accordance with existing runoff conditions knowing that upstream runoff rates cannot be increased. This standard would also prevent an increase in flood levels and frequencies below future developments and, in many cases, reduce development costs because of reduced storm sewer size, particularly where multiple use detention facilities can be utilized in designated open space.

(i) A uniform standard for determining runoff would be helpful in designing to meet this standard. We are requiring the U.S. Soil Conservation Service procedures in Technical Release No. 55, 1986 edition or latest edition, which consider watershed area, watershed shape, change in land use, soil type, hydrologic condition, impervious area, modification of hydraulic channels, increased intensity of

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rainfall near the middle of a storm, initial abstraction (surface storage, interception and infiltration prior to runoff) and decreased infiltration as a storm progresses.

All procedures of SCS Technical Release No. 55 shall be followed with the below described modification:

<u>STORM FREQUENCY</u>	<u>24-HOUR RAINFALL VALUES (P) *</u>
1-YEAR	2.04
2-YEAR	2.50
5-YEAR	3.10
10-YEAR	3.60
25-YEAR	4.39
50-YEAR	5.11
100-YEAR	5.89

\* Rainfall Distribution from Rainfall Frequency Atlas of the Midwest, Bulletin 71 published in 1992 and authored by Huff and Angel.

**1481.02 DEFINITIONS.**

As used in this chapter:

(a) "Channel" means a natural or artificial watercourse which, continuously or periodically, contains moving water or which forms a connecting link between two bodies of water. It has a defined bed and banks which confine the water.

(b) "Channel flow" means the water flowing within the limits of the defined channel.

(c) "Developer" means any person who acts in his or her own behalf or as the agent or an owner of property and who engages in the alteration of land or vegetation in preparation for or in undertaking construction activity.

(d) "Development" means any alteration of land or vegetation in preparation for or in undertaking construction activity.

(e) "Drainageway" means a route or course along which water moves or may move to drain an area.

(f) "Emergency flow way" means the flow routes and drainageway necessary to convey the 100-year storm through a development.

(g) "Emergency spillway" must be included with all

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retention/detention basin designs. SCS methods must be utilized in the design. A design frequency of 100 years must be used.

(h) "Erosion" means the process by which the land surface is blown away by the action of water, wind, ice or gravity.

(i) "Fence" means a structure required around all storm water facilities, as required by Planning Commission.

(j) "Flood" means a general and temporary condition of partial or complete inundation of normally dry land areas from:

- (1) The overflow of inland or tidal waters, and/or
- (2) The unusual and rapid accumulation or runoff of surface waters from any source.

(k) "Floodway" means the channel of a watercourse and the adjacent land areas that have been reserved in order to pass the base flood discharge.

(l) "Grassed waterway" means a broad and shallow natural course or constructed channel covered with erosion resistant grasses or similar herbaceous cover and used to conduct surface water.

(m) "Hydrologic and hydraulic study" means an engineering study utilizing SCS TR 55, 1986 edition or latest edition, to determine rates, volumes and distribution of storm runoff, and its collection, storage and conveyance.

(n) "Runoff" means the portion of rainfall, melted snow or irrigation water that flows across the ground surface and eventually is returned to streams. Specifically:

- (1) "Accelerated runoff" means increased runoff due to less permeable surface area primarily caused by urbanization.
- (2) "Peak rate of runoff" means the maximum rate of runoff for any storm.
- (3) "Runoff volume" means the total quantity or volume of runoff during a specified time period. It may be expressed in acres-feet or in inches-depth of the drainage area, or in other units of volume.

(o) "Storage" means the control, retention or detention of runoff. Specifically:

- (1) "Detention storage" means the storm runoff collected and stored for a short period of

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time and then released at a controlled rate (dry pond).

- (2) "Retention storage" means storm runoff collected and stored for a short period of time and which is released at a controlled rate, leaving in the facility a permanent pool of water. This facility is often associated with water related recreational or aesthetic uses (wet pond).

(p) "Storage facility" means any facility used to store, retain or detain storm runoff, including, but not limited to, retention and detention storage facilities, underground pipes, rooftop or parking lot storage, basins, depressions and pools.

(q) "Storm frequency" means the average period of time in which a storm of a given duration and intensity can be expected to be equaled or exceeded.

(r) "Storm drainage system" means the surface and subsurface system for the removal of water from the land, including both the natural elements of streams, gullies, ravines, marshes, swales and ponds, whether of an intermittent or continuous nature, and man-made elements which include conduits and appurtenant features, culverts, ditches, channels, storage facilities, streets and the storm sewerage system. Specifically:

- (1) "Initial drainage system" means that part of of the storm drainage system which is used regularly for collecting, transporting and disposing of storm runoff, snow melt and miscellaneous minor flows. The initial system is also termed the "convenience system," "minor system," or "storm sewerage system," and may include many features ranging from curbs and gutters to storm sewer pipes and open drainage ways.
- (2) "Major drainage system" means that storm drainage system which carries the runoff from a storm having a frequency of occurrence of once in 100 years. The major system will function whether or not it has been planned and designed and whether or not improvements are situated wisely in respect to it. The major system is also termed the

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"emergency flow way." The major system usually includes many features, such as streets, ravines and major drainage channels. Storm sewerage systems may reduce the flow in many parts of the major system by storing and transporting water underground.

- (s) "Stream" means a course of running water, usually flowing in a particular direction and in a definite channel, and discharging into some other stream or body of water.
- (t) "Watercourse" means a channel in which a flow of water occurs either continuously or intermittently in a definite direction. The term applies to either natural or artificially constructed channels.

**1481.03 HYDROLOGIC AND HYDRAULIC STUDIES REQUIRED.**

(a) A hydrologic and hydraulic study of each subdivision or development shall be submitted as part of the construction drawings.

(b) Such studies will be used to establish the adequacy of the drainage system of the development site. As part of these studies, the adequacy of the storm drainage facility necessary to carry the runoff from the initial storm design shall be shown. In addition, the flow routes and drainageways necessary to convey the 100-year storm (the emergency flow way or routing path) through the development shall be shown. All necessary easements shall be shown.

(c) These studies will also be used to establish the adequacy of the drainage system of the proposed development to receive and convey the initial and major storms from upstream properties.

(d) These studies will also be used to establish the adequacy of the drainage system of the proposed development so as not to create or worsen drainage problems downstream. As part of these studies, storage facilities will be located and identified by type.

(e) Along with the requirements of subsections

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(a) to (d) hereof, Storm Water Pollution Prevention Plan (SWP3) shall be submitted along with the other reports with all Planning Commission submittals.

**1481.04 STORM WATER RUNOFF LIMITATIONS.**

(a) If the hydrologic and hydraulic studies required in Section 1481.03 reveal that the proposed development or subdivision would not increase the total volume of runoff, the peak rate of runoff after development for all return periods of storms up to 100 years shall equal the predeveloped peak for all storm frequencies.

(b) If the hydrologic and hydraulic studies reveal that the total volume of runoff is increased, the peak rate of runoff after development from the critical storm shall not exceed the predevelopment peak rate of runoff from a

one-year frequency storm for a twenty-four hour period. The critical storm shall be determined in accordance with Section 1481.01(d) and the peak rate of runoff for each storm of greater or lesser frequency shall be determined in accordance therewith. However, the peak rate of runoff after development may not exceed the peak rate of runoff before development.

(c) Compliance with the section shall not be required if the proposed site is less than or equal to one-quarter of an acre (10,890 square-feet) and storm calculations substantiate that the existing storm sewer, creek or drainageways can hydraulically accept the increased storm water generated from this site without adverse effects to the system.

**1481.05 DESIGN OF STORM SEWERS.**

(a) General Information.

These guidelines apply to storm sewers in the public right-of-way and on private property within the Municipality. Storm drainage shall be designed for conveyance in a separate gravity system.

(b) Investigations and Surveys.

(1) Information Required.

Each project shall be identified by name. A general description of the project shall be included indicating approximate project size, zoning, general description of discharge points,

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off site tributary area drainage area maps, and any special factors to be considered in the design.

(2) Investigations.

Information on all existing conditions shall be listed. This information shall include capacity of receiving sewers or downstream culverts and the ability of receiving waterways to provide an adequate outlet with respect to both depth and capacity in vicinity of storm outlet. Special analysis will be required for known flooding areas.

(c) Design Criteria for Storm Sewers.

(1) Design Storm Frequency.

Storm sewers shall be designed to accommodate the stormwater runoff from and have adequate capacity, flowing full, for the ten (10) year storm frequency.

(2) Rainfall Intensity - Duration.

5 - Year Storm	i = 1.50 Inches/Hr.
10 - Year Storm	i = 1.80 Inches/Hr.
25 - Year Storm	i = 2.00 Inches/Hr.
50 - Year Storm	i = 2.25 Inches/Hr.
100 - Year Storm	i = 2.50 Inches/Hr.

(3) Runoff Coefficient.

<u>Zoning</u>	<u>Lot Area (ft<sup>2</sup>)</u>	<u>c =</u>
Residential	0 - 5,000	0.7
	5,000 - 10,000	0.6
	10,000 - and over	0.5
Multifamily and Schools		0.75
Industrial/Commercial		0.90
Shopping Centers		0.90
Major Urban		0.90
Business Area		0.90
<u>Cover Type</u>		<u>c =</u>
Impervious Areas (pavement or building)		0.9
Lawns		0.3

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Woods, forest	0.3
Farmland/pasture	0.3

The above runoff coefficients assume typical ground cover and average slope.

(4) Concentration Times.

(a) Residential Areas.

The concentration times to the critical inlet varies between 12 and 20 minutes with 15 minutes to be used as the average case based upon full development of the land.

(b) Industrial - Multifamily - School Areas.

The concentration time to the critical inlet varies between 10 and 15 minutes with 12.5 minutes to be used as the average case based upon full development of the land.

(c) Major Urban Business Areas and Shopping Centers.

The concentration time to the critical inlet varies between 5 and 12 minutes with 10 minutes used as the average case based upon full development of the land.

(5) Standard Rainfall Intensity-Duration Tables.

The Standard Rainfall Intensity-Duration Tables shall be used to determine the rainfall intensity occurring at the time of concentration to the inlet under consideration.

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STANDARD RAINFALL INTENSITY-DURATION TABLES

Rainfall Intensity in Inches Per Hour

<u>Time of Concentration In Minutes</u>	<u>5 Yr. 1.50"/Hr.</u>	<u>10 Yr. Design 1.80"/Hr.</u>	<u>25 Yr. Storm 2.00"/Hr.</u>	<u>50 Yr. Frequency 2.25"/Hr.</u>	<u>100 Yr. 2.50"/Hr.</u>
10	4.30	4.95	5.20	5.75	6.15
11	4.14	4.78	5.04	5.58	5.98
12	4.00	4.63	4.89	5.41	5.81
13	3.87	4.48	4.74	5.26	5.65
14	3.74	4.34	4.61	5.11	5.51
15	3.62	4.21	4.48	4.98	5.37
16	3.51	4.09	4.36	4.85	5.23
17	3.41	3.98	4.25	4.72	5.11
18	3.31	3.87	4.14	4.60	4.99
19	3.22	3.76	4.04	4.49	4.87
20	3.13	3.67	3.94	4.39	4.76
21	3.05	3.57	3.85	4.28	4.65
22	2.97	3.49	3.76	4.19	4.55
23	2.89	3.40	3.67	4.09	4.46
24	2.82	3.32	3.59	4.01	4.37
25	2.76	3.25	3.51	3.92	4.28
26	2.69	3.17	3.44	3.84	4.19
27	2.63	3.10	3.37	3.76	4.11
28	2.57	3.04	3.30	3.69	4.03
29	2.52	2.97	3.23	3.61	3.96
30	2.46	2.91	3.17	3.54	3.88
35	2.22	2.64	2.89	3.23	3.58
40	2.03	2.41	2.65	2.97	3.28
45	1.86	2.22	2.45	2.75	3.04
50	1.72	2.06	2.28	2.56	2.84
55	1.60	1.92	2.13	2.40	2.66
60	1.50	1.80	2.00	2.25	2.50
70	1.33	1.60	1.78	2.01	2.23
80	1.19	1.43	1.60	1.81	2.02
90	1.08	1.30	1.46	1.65	1.84
100	0.99	1.19	1.34	1.51	1.70
110	0.91	1.10	1.24	1.40	1.57
120	0.84	1.02	1.15	1.30	1.46

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(6) Flow Formulas.

(a) Quantity of Runoff by Rational Method.

(1) Areas up to 25 Acres.

$Q = CIA$  in cubic feet per second where  
A is the area to be drained in acres,  
C is the runoff coefficient for the  
area under consideration and I is the  
rainfall intensity derived from the  
Standard Rainfall Intensity-Duration  
Tables for the concentration time to  
the inlet under consideration.

(2) Areas Greater Than 25 Acres.

U.S. Soil Conservation Service  
procedures in Technical Release  
No. 55, 1986 edition or latest  
edition with modifications described in  
Section 1481.01 (i) shall be used for  
computing runoff quantities.

(b) Manning's Formula.

$$V = \frac{1.486}{n} (R)^{\frac{2}{3}} (S)^{\frac{1}{2}}$$

where S is slope in feet per foot; R is  
hydraulic radius; and n is the roughness  
coefficient. The roughness coefficient  
shall be  $n = 0.015$  for sizes up to and  
including 27 inches;  $n = 0.013$  for sizes  
including 30 inches through 84 inches and  $n$   
 $= 0.011$  for 90 inches and larger. Graphs  
for the Manning Formula are provided in the  
following table. This table is based on  
Quantity of flow  $Q = Av$  where A is the  
cross-sectional area of the conduit  
developed by the nominal conduit diameter.

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Manning's Formula Flow Table

$$Q = AV \qquad V = \frac{1.486}{n} (R)^{\frac{2}{3}} (S)^{\frac{1}{2}}$$

DIAMETER (IN)	CAP. @ 1% (CFS)	AREA (ft. <sup>2</sup> )	CAP. @ 1% (MGD)
n=0.015			
6	0.485	0.196	0.313
8	1.061	0.349	0.686
10	1.906	0.545	1.232
12	3.087	0.785	1.995
15	5.567	1.227	3.598
16	6.604	1.389	4.266
18	9.105	1.767	5.827
21	13.730	2.405	8.870
24	19.610	3.142	12.670
27	26.750	3.977	17.290
n=0.013			
30	40.790	4.909	26.370
33	53.030	5.940	34.280
36	66.670	7.069	43.090
39	82.410	8.296	53.260
42	100.200	9.621	64.760
48	143.600	12.570	92.840
54	196.000	15.900	126.700
60	260.400	19.640	168.300
66	334.800	23.760	216.400
72	423.400	28.270	273.700
78	523.100	33.180	338.100
84	638.800	38.490	412.900
n=0.011			
90	906.000	44.180	585.600
96	1077.700	50.270	696.500
102	1264.900	56.750	817.500
108	1475.600	63.620	953.700
120	1954.400	78.540	1263.200
132	2520.200	95.030	1628.800
144	3177.900	113.100	2053.900

TO FIND CAPACITY AT ANY SLOPE  
MULTIPLY; CAPACITY LISTED @ 1% BY  $(S)^{\frac{1}{2}}$  in %

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Where other than circular pipe is proposed, the actual cross-sectional area developed may be used.

- (c) Hydraulic Radius.  
The formula for the hydraulic radius is  $R = A/p$  where  $p$  is wetted perimeter developed by the nominal pipe diameter. Where other than circular pipe is proposed, the actual wetted perimeter developed may be used.
- (d) Velocities.  
Storm sewers shall have a minimum flowing full velocity of three (3) feet per second and a maximum velocity of 15 feet per second.
- (7) Pavement Drainage.  
Pavement inlets or catch basins shall be spaced to limit the spread of storm water flow on the traveled lane to 6-feet (allowable spread). Design shall be based upon the 2-year storm frequency. Pavement inlet spacing and bypass calculations shall be in accordance with the latest edition of the Ohio Department of Transportation Location and Design Manual, Volume 2 - Drainage Design.
- (8) Hydraulic Grade Line.  
Starting at the storm sewer system outlet and working upstream, the elevation of the Hydraulic Grade Line (HGL) shall be determined for the 25 - and 100-year storm frequencies. The outlet shall be analyzed to determine if it is free draining or if the storm sewer system is operating under a submerged condition. In general, the HGL will be above the top of the pipe, causing the system to operate under pressure.
- (9) Layout of Sewers.
  - (a) General Information.  
  
The layout of the storm system shall place the storm and sanitary sewers on opposite sides of roadways and within the tree lawn

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areas where practical. Where opposite side construction is not practical, every effort shall be made to separate the storm and sanitary sewers by six feet (6') barrel to barrel. Manhole spacing interval shall be a maximum of 400-feet. Catch basins shall be used prior to the connection of inlets into the main storm sewer system. Consideration shall be given to installing traps or other methods to control the release of floatable debris into the sewer system.

(b) Minimum Size.

The minimum size of all storm sewers, excluding connections, shall be 12 inches in diameter.

(c) Type of Conduits.

All storm sewer conduits excluding connections within the public rights-of-way within the Municipality shall be reinforced concrete pipe in accordance with American Society for Testing Materials (ASTM) Designation C-76 or as directed by the City Engineer.

Beyond the public right-of-way limits, other conduit types may be specified provided that proper backfill, pipe cover and bedding is specified and approved by the City Engineer.

Only wye branch fittings will be accepted for service connections for sewers up to and including 21" diameter. For sewers 24 inches and larger, tee connections are permitted.

Deflection test is required on all plastic pipe with a pipe stiffness less than 200 P.S.I. Air testing is not required for storm sewers.

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All storm sewer pipes between manholes increments shall be one type and class of pipe. In case of lateral connections, transition connections of different materials may be permitted.

(d) Lateral Connections.

Lateral connections to building sites shall be a minimum of six inches (6") in diameter at a minimum slope of 1-percent. Building footer drains shall be free draining and outlet above the 100-year storm frequency hydraulic grade line.

(e) Storm Sewer Joints.

Storm sewers shall have premium joints conforming to ASTM D-3212 for plastic pipes or ASTM C-443 for concrete pipes or as approved by the City Engineer.

(f) Manholes.

Storm sewer manholes shall be constructed in accordance with the following specifications or as approved by the City Engineer.

- (1) All storm sewer manholes shall be constructed of reinforced precast concrete sections in accordance with ASTM Designation C-478.
- (2) All storm sewer manhole wall joints shall be rubber O-Ring type conforming to ASTM Designation C-443.
- (3) Adjustment of the storm sewer manhole casting to the final grade shall be accomplished with precast concrete adjusting rings.
- (4) All storm sewer manholes shall have steps installed internally in accordance to the latest OSHA requirements.

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- (g) Headwalls, Inlet Basins and Catch Basins.

All headwall, inlet and catch basin structures shall be in accordance with the latest Ohio Department of Transportation (ODOT) Standard Construction Drawings or as approved by the City Engineer. All yard inlet basins shall be installed with a 'beehive' type grate.

- (10) Culverts.

Culverts under all roads within the Municipality shall be designed for a 25 year storm flow with headwater of one (1) foot below the edge of the roadway. Consideration shall be given to the headwater elevation with respect to adjacent buildings.

**1481.06 SUBDIVISION OR DEVELOPMENT DRAINAGE SYSTEMS.**

(a) Storm drainage facilities for a subdivision or development shall be designed to accommodate runoff from the ten year storm frequency. Site design and grading plans shall provide emergency drainageways in order to avoid both damage to structures and endangering public safety, which emergency drainageways shall be designed to accommodate runoff from storms exceeding the ten year storm frequency, but not exceeding the 100-year storm frequency.

(b) If the collector facilities cannot be located in street rights of way, then they shall be located adjacent to side or rear lot lines where easements shall be provided to and along the facilities.

(c) All storm water flow from the proposed subdivision or development, including flow from upstream areas passing through, and further including increased flow attributable to changes in time of concentration or changes in the former runoff factor (imperviousness), shall be conveyed to the proper outlet for the entire tributary area via a natural channel or pipe/culvert, either or both of which shall be improved so as to be of adequate capacity.

(d) These requirements must be met at each point storm water is discharged from a development area.

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(e) In some cases the City Engineer may require the submittal of additional information on the existing and proposed drainage system and on the effects on existing drainage or natural waterways.

**1481.07 EASEMENTS AND ACCESS.**

Access to flood control or storm drainage facilities for emergency, inspection, maintenance and improvement purposes shall be provided as follows:

- (a) Access to flood control or storm drainage ditches, channels and storage facilities shall be by means of easements. Such an easement shall be not less than twenty feet in width, exclusive of the width of the ditch, channel or other facility it is to serve. An easement of this type shall be provided on one side of the flood control or storm drainage ditch, channel or similar facility.
- (b) Access along flood control or storm drainage ditches and channels shall be by means of easements. Such an easement shall be not less than twenty feet in width, exclusive of the width of the ditch, channel or other facility it is to serve. An easement of this type shall be provided on both sides of a flood control or storm drainage ditch, channel or similar facility.
- (c) Access along the initial drainage system shall be by means of easements. Such an easement shall be not less than twenty feet in width, with a minimum of ten feet in width on each side of the centerline.
- (d) Access around storage facilities shall be a twenty-five foot easement in the case of detention (dry) basins, and a twenty-five foot easement with a twenty-five foot level bench in the case of retention (wet) basins, measured from the top of the bank and shall include the storage facility itself.
- (e) Easements for emergency flow ways shall be a minimum of twenty feet in width or larger if required.

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- (f) Flood control or storm drainage easements containing underground facilities shall have a minimum width of twenty feet.
- (g) Those lots crossed by an easement are restricted against the planting within such easement of trees, shrubbery or plantings with woody growth characteristics, and against the construction therein of buildings, accessory buildings, fences, walls or other obstructions to the free flow of storm water. Such lots are also restricted against changing of the final grade from that described by the approved grading plan.

**1481.08 MAINTENANCE OF SYSTEMS.**

- (a) Any portion of the drainage system on private property including on-site and off-site storage facilities, shall be continuously maintained by the owner of the property unless such system or portion thereof is officially accepted by the City for maintenance. The developer/owner shall cause the maintenance obligation to be inserted in the chain of title to the affected lands as a covenant running with the land in favor of the City.
- (b) The need for maintenance can be minimized by designing low maintenance facilities. There are many design options which can result in nearly maintenance-free storm water control. Low maintenance is a priority in the design of all facilities.
- (c) Multi-use facilities incorporating assets such as aesthetics and recreation can be incorporated with the design of these facilities.
- (d) All facilities must be inspected yearly by the Engineering Department or a designated substitute during the months of November through April to ensure that the facilities are 100% operational based on their design. A written report shall be generated by the Engineering Department and delivered to the Storm Water Committee no later than the last business day of June. The report will include the status of the

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system and any corrective measures to be taken by the responsible party.

(e) The Engineering Department or a designated substitute will create a Master Map of Storm Water storage facilities. Each and every storm water storage facility will be given a consecutive numerical nomenclature in that no two basins have the same number, and a GPS location will be recorded and placed on file at the point of water over flow. The numerical nomenclature will be placed onto the Master Map of Storm Water storage facilities and updated in May and December of each year.

(f) In the event that corrective measures are required, the City Engineer or his/her designated substitute may issue a notice of violation which shall identify all of the deficiencies and permit 30 days for correction. If after subsequent inspection the corrections are not made, then the City Engineer or his/her designated substitute may issue a citation to the owner or person(s) responsible for maintenance of the facility. Said citation may be filed in Mayor's Court. If all of the corrective actions are not performed within the prescribed time period, the City will then make the necessary repairs and assess the costs as a tax assessment to the responsible party/property in accordance with Ohio Law.

**1481.09 COMPLIANCE WITH CHAPTERS 1466, 1488, 1490 AND 1492.**

- (a) All the provisions of Chapter 1466 - Flood Damage Reduction; Chapter 1488 - Controlling Construction Site Soil Erosion, Sediment and other Wastes and Storm Water Runoff; Chapter 1490 - Controlling Post - Construction Water Quality Runoff; and Chapter 1492 - Controlling Riparian Setbacks and Wetlands Setbacks shall be complied with.
- (b) These regulations are not intended to repeal any existing ordinances (resolutions) including subdivision regulations, zoning or building codes. In the event of a conflict between these

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regulations and any other ordinance (resolution), the more restrictive shall be followed.

**1481.10 CONTENTS OF HYDROLOGIC AND HYDRAULIC STUDIES.**

Submittals for review shall include, but not be limited to:

- (a) A soils map drawn to a scale of one inch equals 200 feet. In addition:
  - (1) Contours shall be at a minimum of two-foot intervals.
  - (2) All soil types shall be noted along with all ground cover, woodlands and other ground conditions.
  - (3) The total drainage area tributary to the proposed project, including the project, shall be noted. (Before and after development conditions must be noted.)
  - (4) A legend must be provided noting the soils, area in acres and soil groups (before and after development).
  - (5) A copy of the U.S. Department of Agriculture SCS Soil Survey of Cuyahoga County, Ohio, 1980, or latest edition, showing the entire drainage area and subarea, shall be provided.
  - (6) All existing drainage facilities must be noted (i.e. storm sewer culverts, lake and swamps, etc.).
- (b) A drainage area map (before and after development). Specifically:
  - (1) An aerial photograph with a scale of one inch equals 100 feet must be supplied with the entire drainage area, and all subareas shall be noted along with all existing land use conditions.

Contours shall be at a minimum of two-foot intervals. Any other submittal shall meet with the prior approval of the City Engineer.
  - (2) All existing drainage facilities must be noted along with all necessary field data.
  - (3) All natural waterways must be noted, and cross sections of all waterways must be submitted along with any other data to

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- sufficiently determine the exact time of concentration or travel time.
- (4) All existing and proposed modifications to the drainage system must be noted.
  - (5) A complete storm sewer design noting all proposed storm sewers, culverts and other storm water management facilities must be submitted.
  - (6) Emergency flow ways must be shown on this plan.
- (c) Soil Conservation Service, Technical Release No. 55, June, 1986, or latest edition, Urban Hydrology for Small Watersheds (before and after development). The following procedures must be utilized in the design of any storm water facility:
- (1) A Type II rainfall distribution and City rainfall data;
  - (2) Runoff curve summary showing pre and post development conditions;
  - (3) Runoff calculations;
  - (4) Travel time and time of concentration calculations;
  - (5) Calculations on peak discharge and discharge volume;
  - (6) Pre and post hydrographs;
  - (7) Storage volume requirements.

All storms must then be routed through the the proposed drainage facility using the storage-indication method of routing.

SCS emergency spillway design calculations must be submitted for a 100-year storm.

Any additional information required by the City Engineer must be submitted at this time.

The TR 55 computer programs may be utilized in this process.

**1481.98 VIOLATIONS.**

No person shall violate, or cause, or knowingly permit to be violated, any of the provisions of these regulations, or fail to comply with any such provisions or with any lawful requirements of any public authority made pursuant to these regulations, or knowingly use or cause or permit the use of any lands in violation of these regulations or in violation of any permit granted under these regulations.

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**1481.99 PENALTIES.**

(a) Whoever violates or fails to comply with any provision of this regulation is guilty of a misdemeanor of the first degree and shall be fined no more than one thousand dollars (\$1,000.00) or imprisoned for no more than one hundred eighty (180) days, or both, for each offense.

(b) A separate offense shall be deemed committed each day during or on which a violation or noncompliance occurs or continues.

(c) Upon notice from the City Engineer, or designated representative, that work is being performed contrary to this regulation, such work shall immediately stop. Such notice shall be in writing and shall be given to the owner or person responsible for the development area, or person performing the work, and shall state the conditions under which such work may be resumed; provided, however, in instances where immediate action is deemed necessary for public safety or the public interest, the City Engineer may require that work be stopped upon verbal order pending issuance of the written order.

(d) The imposition of any other penalties provided herein shall not preclude the City, by or through its Law Director and/or any of his or her assistants, from instituting an appropriate action or proceeding in a Court of Proper Jurisdiction to prevent an unlawful development or to restrain, correct or abate a violation, or to require compliance with the provisions of this regulation or other applicable laws, or ordinances, rules or regulations or the orders of the City Engineer.