

STORMWATER MANAGEMENT

124 Attachment 2

Township of Tobyhanna

Appendix B

STORMWATER MANAGEMENT DESIGN CRITERIA

Table B-1

Design Storm Rainfall Amount

Source: "Field Manual of Pennsylvania Department of Transportation"
Storm Intensity-Duration-Frequency Charts
PDT - IDF May 1986

Figure B-1

NRCS (SCS) Type II Rainfall Distribution S-Curve

Figure B-2

PennDOT Delineated Regions

Source: "Field Manual of Pennsylvania Department of Transportation"
Storm Intensity-Duration-Frequency Charts
PDT-IDF - May 1986

Figure B-3

Region 4 PennDOT Storm Intensity-Duration-Frequency Curve

Source: "Field Manual of Pennsylvania Department of Transportation"
Storm Intensity-Duration-Frequency Charts
PDT - IDF May 1986

Figure B-4

Region 5 PennDOT Storm Intensity-Duration-Frequency Curve

Source: "Field Manual of Pennsylvania Department of Transportation"
Storm Intensity-Duration-Frequency Charts
PDT - IDF May 1986

Table B-2

Runoff Curve Numbers

Source: NRCS (SCS) TR-55

Table B-3

Rational Runoff Coefficients

Table B-4

Manning Roughness Coefficients

Table B-5

Twenty-Four-Hour Storm Values Representing 90% of Annual Rainfall

Table B-6

Nonstandard Stormwater Management Stormwater Credits for Computing Proposed Conditions Hydrograph

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**Table B-1
Design Storm Rainfall Amount (inches)**

The design storm rainfall amount chosen for design should be obtained from the PennDOT region in which the site is located according to Figure B-2.

Source: "Field Manual of Pennsylvania Department of Transportation"
STORM INTENSITY-DURATION-FREQUENCY CHARTS
PDT - IDF May 1986

**Region 4
Precipitation Depth (in)**

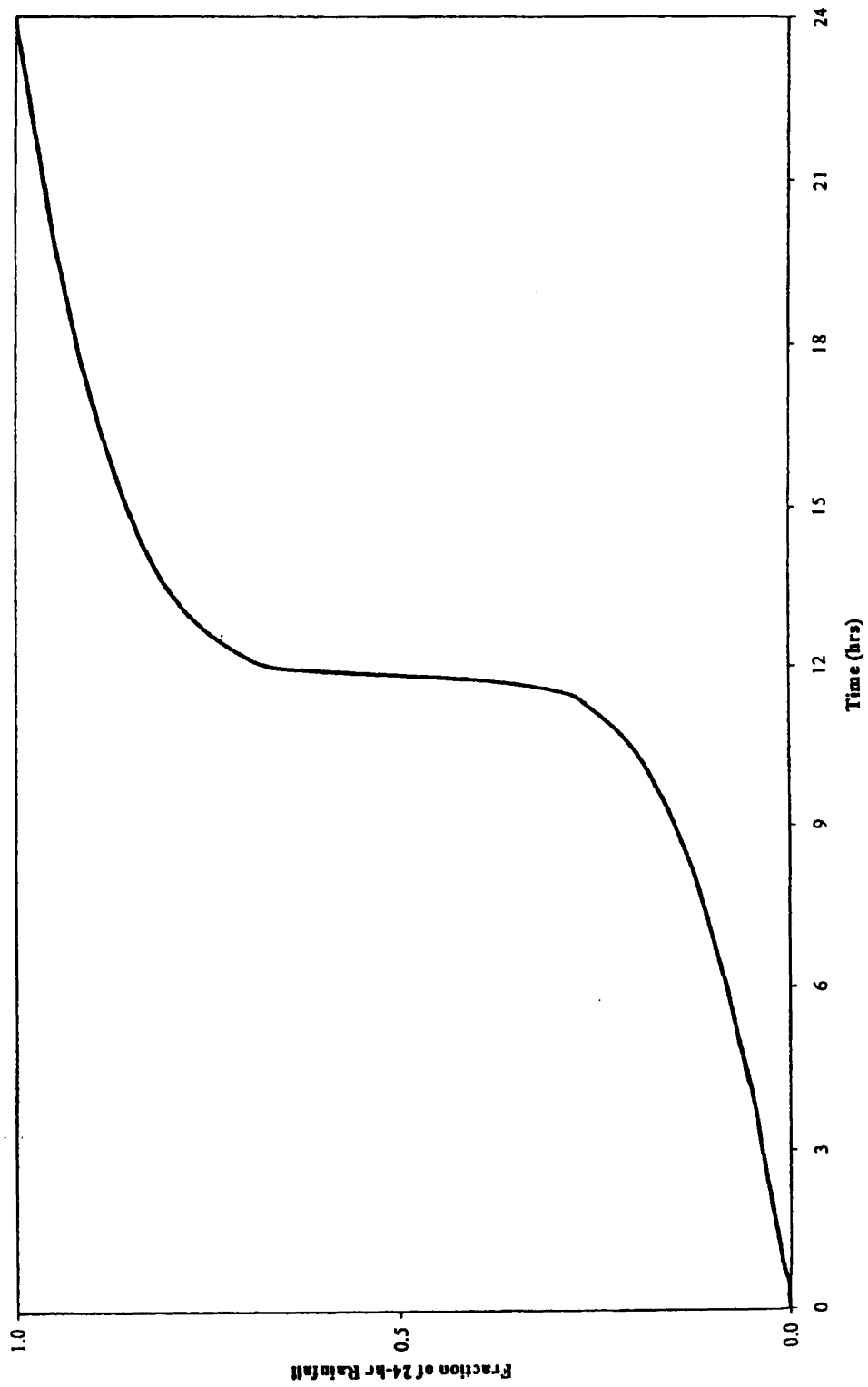
Duration	1 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
5 minute	0.30	0.35	0.41	0.45	0.50	0.55	0.61
15 minute	0.58	0.68	0.80	0.93	1.03	1.13	1.25
1 hour	1.01	1.22	1.48	1.70	1.91	2.16	2.41
2 hours	1.24	1.50	1.84	2.14	2.46	2.80	3.18
3 hours	1.38	1.71	2.10	2.43	2.82	3.24	3.69
6 hours	1.68	2.04	2.52	3.06	3.60	4.14	4.74
12 hours	2.04	2.52	3.00	3.84	4.56	5.16	6.00
24 hours	2.40	2.88	3.60	4.56	5.76	6.48	7.44

**Region 5
Precipitation Depth (in)**

Duration	1 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
5 minute	0.33	0.38	0.45	0.50	0.56	0.63	0.68
15 minute	0.64	0.75	0.90	1.00	1.15	1.35	1.50
1 hour	1.10	1.35	1.61	1.85	2.15	2.60	2.98
2 hour	1.34	1.66	2.00	2.34	2.70	3.26	3.76
3 hour	1.50	1.86	2.28	2.67	3.09	3.69	4.29
6 hour	1.86	2.28	2.82	3.36	3.90	4.62	5.40
12 hour	2.28	2.76	3.48	4.20	4.92	5.76	6.72
24 hour	2.64	3.36	4.32	5.28	6.24	7.20	8.40

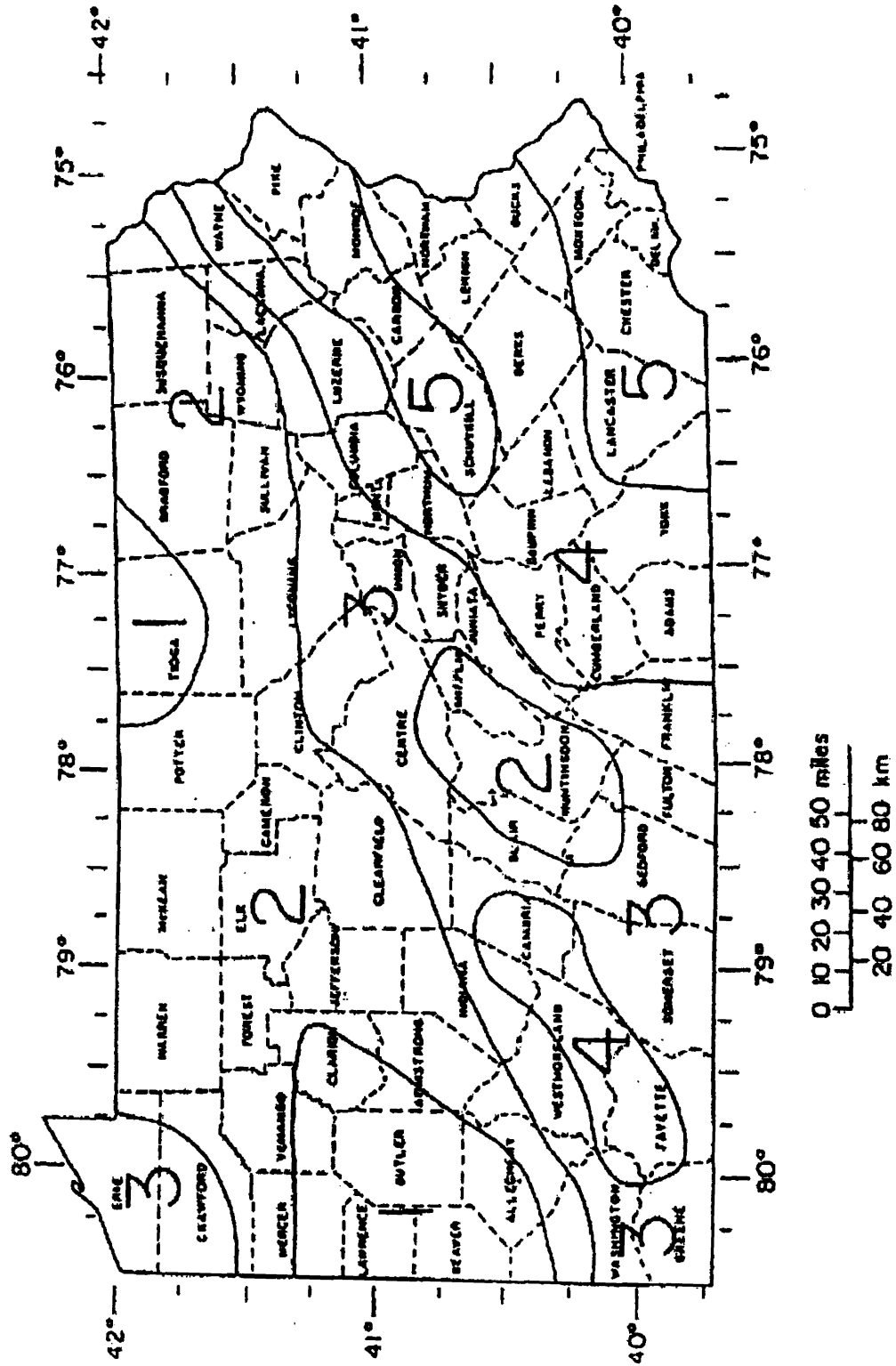
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Figure B-1
NRCS (SCS) Type II Rainfall Distribution – S Curve



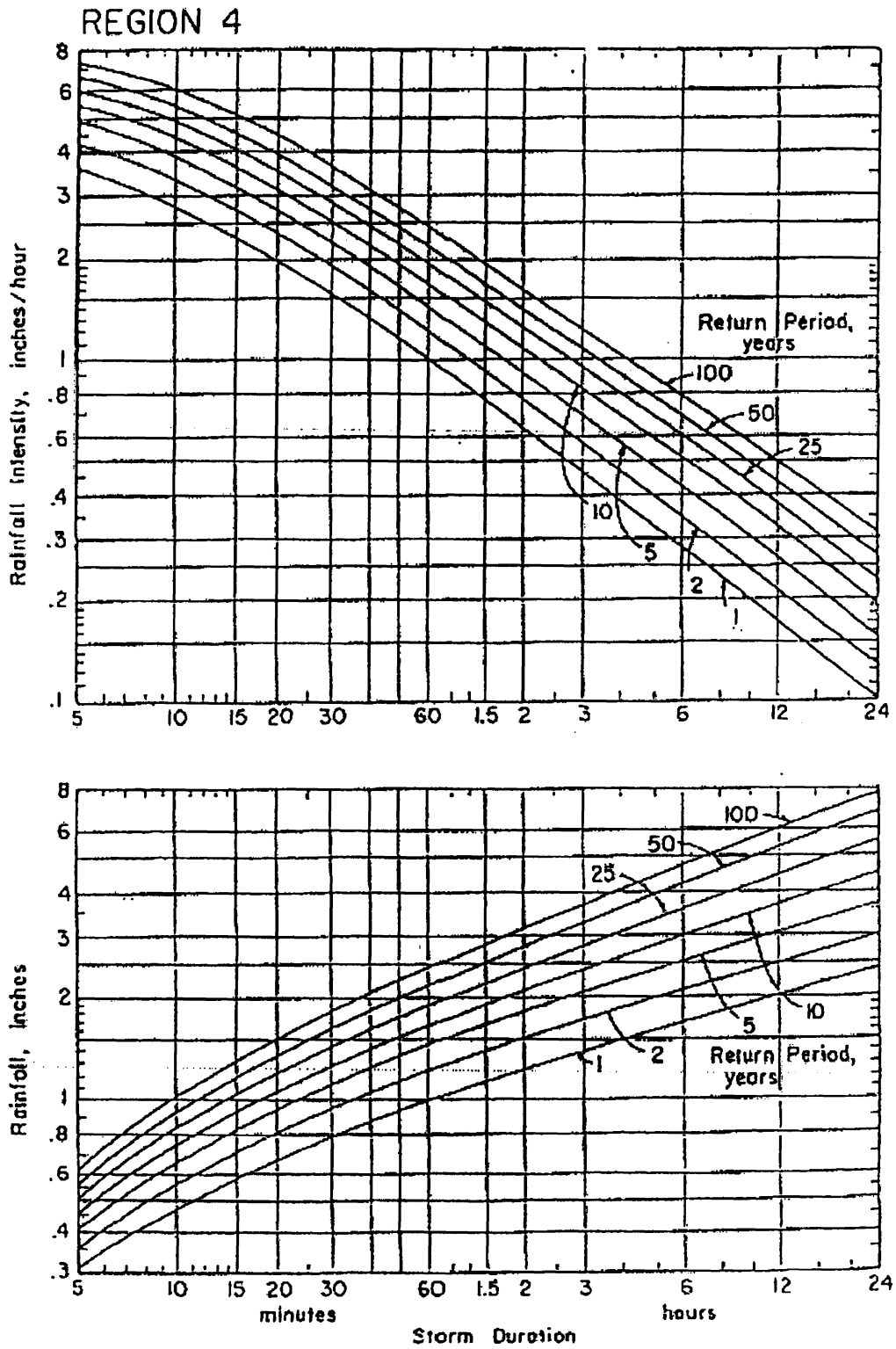
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Figure B-2
PennDOT Delineated Regions



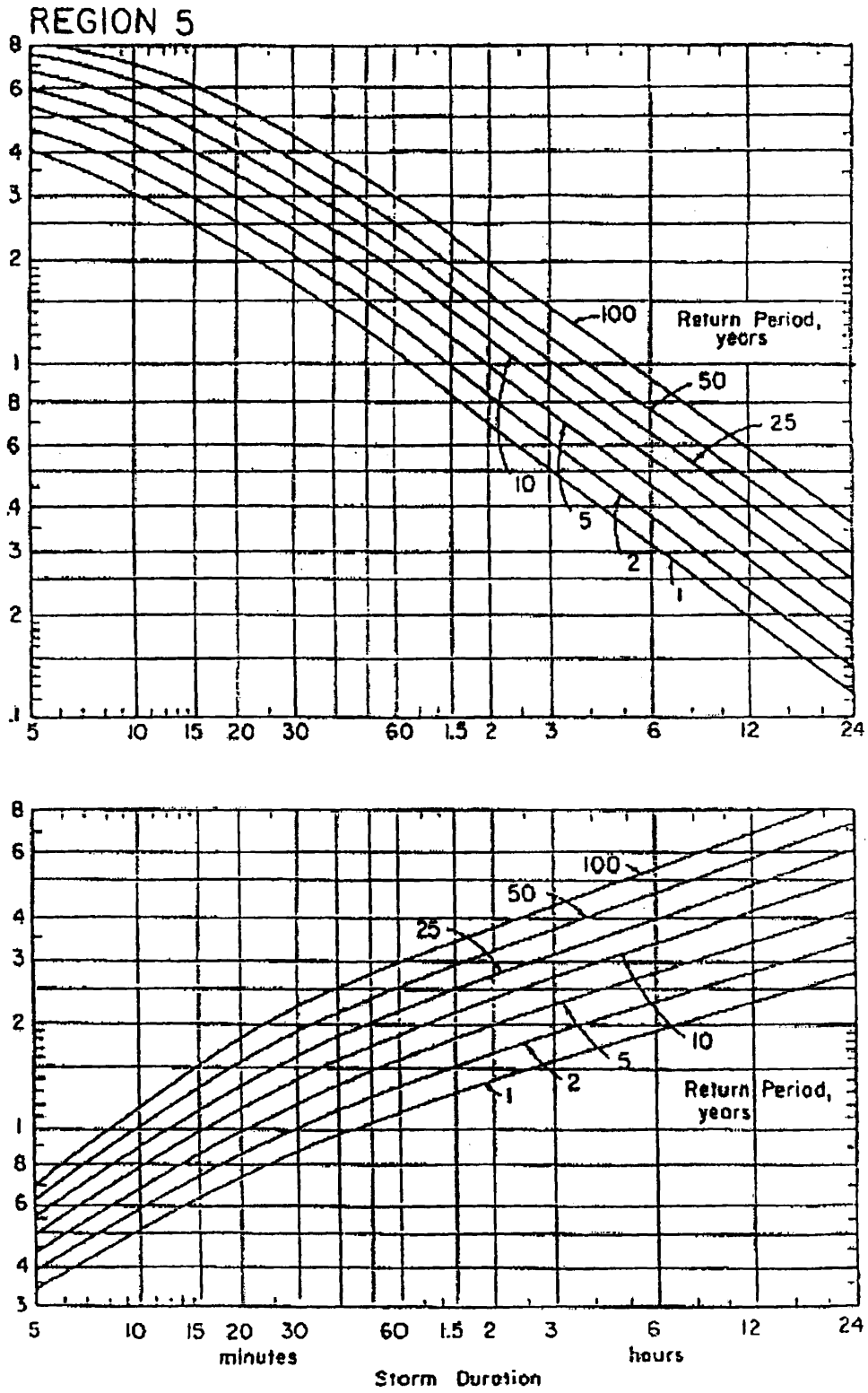
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Figure B-3
PennDOT Storm Intensity-Duration-Frequency Curve



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Figure B-4
PennDOT Storm Intensity-Duration-Frequency Curve



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Table B-2
Runoff Curve Numbers
[From NRCS (SCS) TR-55]

Land Use Description	Hydrologic Condition	Hydrologic Soil Group			
		A	B	C	D
Open Space					
Grass cover < 50%	Poor	68	79	86	89
Grass cover 50% to 75%	Fair	49	69	79	84
Grass cover > 75%	Good	39	61	74	80
Meadow		30	58	71	78
Agricultural					
Pasture, grassland, or range – Continuous forage for grazing	Poor	68	79	86	89
Pasture, grassland, or range – Continuous forage for grazing	Fair	49	69	79	84
Pasture, grassland, or range – Continuous forage for grazing	Good	39	61	74	80
Brush-brush-weed-grass mixture with brush the major element	Poor	48	67	77	83
Brush-brush-weed-grass mixture with brush the major element	Fair	35	56	70	77
Brush-brush-weed-grass mixture with brush the major element	Good	30	48	65	73
Fallow Bare soil	—	77	86	91	94
Crop residue cover (CR)	Poor	76	85	90	93
	Good	74	83	88	90
Woods — grass combination (orchard or tree farm)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Commercial	(85% Impervious)	89	92	94	95
Industrial	(72% Impervious)	81	88	91	93
Institutional	(50% Impervious)	71	82	88	90

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Land Use Description	Hydrologic Condition	Hydrologic Soil Group			
		A	B	C	D
Residential districts by average lot size:					
	% Impervious				
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Farmstead		59	74	82	86
Smooth surfaces (concrete, asphalt, gravel or bare compacted soil)		98	98	98	98
Water		98	98	98	98
Mining/newly graded areas (pervious areas only)		77	86	91	94

* Includes Multi-Family Housing unless justified lower density can be provided.

NOTE: Existing site conditions of bare earth or fallow ground shall be considered as meadow when choosing a CN value.

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**Table B-3
Rational Runoff Coefficients**

Land Use Description	Hydrologic Soil Group			
	A	B	C	D
Cultivated Land:				
Without conservation treatment	0.49	0.67	0.81	0.88
With conservation treatment	0.27	0.43	0.61	0.67
Pasture or range land:				
Poor condition	0.38	0.63	0.78	0.84
Good condition	—*	0.25	0.51	0.65
Meadow: good condition	—*	—*	0.44	0.61
Wood or Forest Land:				
Thin stand, poor cover, no mulch	—*	0.34	0.59	0.70
Good cover	—*	—*	0.45	0.59
Open Spaces, lawns, parks, golf courses, cemeteries				
Good condition: grass cover on 75% or more of the area	—*	0.25	0.51	0.65
Fair condition: grass cover on 50% to 75% of the area	—*	0.45	0.63	0.74
Commercial and business areas (85% impervious)	0.84	0.90	0.93	0.96
Industrial districts (72% impervious)	0.67	0.81	0.88	0.92
Residential:				
Average lot size	Average % Impervious			
1/8 acre or less	65	0.59	0.76	0.86
1/4 acre	38	0.25	0.49	0.67
1/3 acre	30	—*	0.49	0.67
1/2 acre	25	—*	0.45	0.65
1 acre	20	—*	0.41	0.63
Paved parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Streets and roads:				
Paved with curbs and storm sewers	0.99	0.99	0.99	0.99
Gravel	0.57	0.76	0.84	0.88
Dirt	0.49	0.69	0.80	0.84

NOTES: Values are based on S.C.S. definitions and are average values. Values indicated by “—” should be determined by the design engineer based on site characteristics.

Source: New Jersey Department of Transportation, Technical Manual for Stream Encroachment, August, 1984

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**Table B-4
Roughness Coefficients (Manning's "n") for Overland Flow
(U.S. Army Corps Of Engineers, HEC-1 Users Manual)**

Surface Description	n
Dense Growth	0.4 – 0.5
Pasture	0.3 – 0.4
Lawns	0.2 – 0.3
Bluegrass Sod	0.2 – 0.5
Short Grass Prairie	0.1 – 0.2
Sparse Vegetation	0.05 – 0.13
Bare Clay-Loam Soil (eroded)	0.01 – 0.03
Concrete/Asphalt	
Very shallow depths (less than 1/4 inch)	0.10 – 0.15
Small depths (1/4 inch to several inches)	0.05 – 0.10

Roughness Coefficients (Manning's "n") For Channel Flow

Reach Description	n
Natural stream, clean, straight, no rifts or pools	0.03
Natural stream, clean, winding, some pools or shoals	0.04
Natural stream, winding, pools, shoals, stony with some weeds	0.05
Natural stream, sluggish deep pools and weeds	0.07
Natural stream or swale, very weedy or with timber underbrush	0.10
Concrete pipe, culvert or channel	0.012
Corrugated metal pipe	0.012-0.027 ⁽¹⁾
High Density Polyethylene (HDPE) Pipe	
Corrugated	0.021-0.029 ⁽²⁾
Smooth Lined	0.012-0.020 ⁽²⁾

NOTES:

- (1) Depending upon type, coating and diameter.
- (2) Values recommended by the American Concrete Pipe Association, check Manufacturer's recommended value.

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**Table B-5
Twenty-Four-Hour Storm Values Representing 90% of Annual Rainfall**

PennDOT Rainfall Region	P Inches
1	1.13
2	1.48
3	1.60
4	1.95
5	2.04

**Table B-6
Nonstandard Stormwater Management
Stormwater Credits for Computing Proposed conditions Hydrograph**

The developer may, subject to approval of the municipal engineer, use the stormwater credits, described in the following table, in computing proposed conditions hydrograph:

Nonstructural Stormwater Measure	Description
Natural Area Conservation	Conservation of natural areas such as forest, wetlands, or other sensitive areas in a protected easement thereby retaining their existing hydrologic and water quality characteristics.
Disconnection of Rooftop Runoff	Rooftop runoff is disconnected and then directed over a pervious area where it may either infiltrate into the soil or filter over it. This is typically obtained by grading the site to promote overland flow or by providing bioretention on single-family residential lots.
Disconnection of Non-Rooftop Runoff	Disconnect surface impervious cover by directing it to pervious areas where it is either infiltrated or filtered through the soil.
Buffers	Buffers effectively treat stormwater runoff. Effective treatment constitutes capturing runoff from pervious and impervious areas adjacent to the buffer and treating the runoff through overland flow across a grass or forested area.
Grass Channel (Open Section Roads)	Open grass channels are used to reduce the volume of runoff and pollutants during smaller storms.
Environmentally Sensitive Rural Development	Environmental site design techniques are applied to low density or rural residential development.