

APPENDIX A STORM WATER MANAGEMENT PLAN CERTIFICATIONS

CERTIFICATE FOR APPROVAL BY EAST HEMPFIELD TOWNSHIP BOARD OF SUPERVISORS

At a meeting on _____, 20____, the East Hempfield Township Board of Supervisors approved this project, and all conditions have been met. This approval includes the complete set of plans and information that are filed with the Township in File No. _____, based upon its conformity with the standards of the East Hempfield Township Storm Water Management Ordinance.

_____ Signature
Township Seal

CERTIFICATE FOR APPROVAL BY EAST HEMPFIELD TOWNSHIP BOARD OF SUPERVISORS DESIGNEE

I, (Board of Supervisors Designee), on this date, have reviewed and hereby certify that to the best of my knowledge the Storm Water Management Site Plan meets all design standards and criteria of the Township Storm Water Management Ordinance. Approved by the East Hempfield Township Board of Supervisors Designee this ____ day of _____, 20____.

* _____

*Signature of the Designee

STORM WATER MANAGEMENT DESIGNER CERTIFICATION

I hereby certify that, to the best of my knowledge, the storm water management facilities shown and described hereon are designed in conformance with the Township Storm Water Management Ordinance. I also certify that the proposed detention basin (circle one) is/is not underlain by carbonate geology.

_____, 20____ * _____
**

*Signature of the qualified professional responsible for the preparation of the plan.

**Seal of the individual.

APPENDIX B STORM INTENSITY-DURATION-FREQUENCY CHART

PDT-IDF

Storm Frequency⇒	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
Time (Minutes)	Rainfall Intensity (Inches per Hour)					
5.0	4.63	5.40	6.02	6.70	7.51	8.19
6.0	4.34	5.15	5.70	6.39	7.22	7.90
7.0	4.12	4.95	5.42	6.10	6.95	7.62
8.0	3.92	4.70	5.17	5.85	6.70	7.36
9.0	3.75	4.50	4.95	5.62	6.47	7.12
10.0	3.59	4.30	4.75	5.41	6.26	6.90
11.0	3.45	4.15	4.58	5.22	6.07	6.70
12.0	3.32	4.00	4.42	5.05	5.88	6.50
13.0	3.21	3.85	4.27	4.89	5.71	6.33
14.0	3.10	3.70	4.16	4.74	5.56	6.16
15.0	3.00	3.55	4.00	4.60	5.40	6.00
20.0	2.60	3.10	3.50	4.03	4.78	5.34
25.0	2.31	2.65	3.15	3.61	4.30	4.83
30.0	2.09	2.45	2.82	3.27	3.92	4.41
40.0	1.76	2.05	2.39	2.78	3.34	3.79
50.0	1.53	1.77	2.08	2.42	2.92	3.33
60.0	1.35	1.60	1.85	2.15	2.60	2.98

APPENDIX C RUNOFF COEFFICIENTS "C" FOR RATIONAL FORMULA

Soil Group ⇒	A			B			C			D		
	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Land Use												
Cultivated Land:												
Winter Conditions	.14	.23	.34	.21	.32	.41	.27	.37	.48	.34	.45	.56
Summer Conditions	.10	.16	.22	.14	.20	.28	.19	.26	.33	.23	.29	.38
Fallowed Fields:												
Poor Conditions	.12	.19	.28	.17	.25	.34	.23	.33	.40	.27	.35	.45
Good Conditions	.08	.13	.16	.11	.15	.21	.14	.19	.26	.18	.23	.31
Forest/Woodland	.08	.11	.14	.10	.14	.18	.12	.16	.20	.15	.20	.25
Grass Areas:												
Good Conditions	.10	.16	.20	.14	.19	.26	.18	.22	.30	.21	.25	.35
Average Conditions	.12	.18	.22	.16	.21	.28	.20	.25	.34	.24	.29	.41
Poor Conditions	.14	.21	.30	.18	.28	.37	.25	.35	.44	.30	.40	.50
Impervious Areas	.90	.91	.92	.91	.92	.93	.92	.93	.94	.93	.94	.95
Weighted Residential:												
Lot Size 1/8 Acre	.29	.33	.36	.31	.35	.40	.34	.38	.44	.36	.41	.48
Lot Size 1/4 Acre	.26	.30	.34	.29	.33	.38	.32	.36	.42	.34	.38	.46
Lot Size 1/3 Acre	.24	.28	.31	.26	.32	.35	.29	.35	.40	.32	.36	.45
Lot Size 1/2 Acre	.21	.25	.28	.24	.27	.32	.27	.31	.37	.30	.34	.43
Lot Size 1 Acre	.18	.23	.26	.21	.24	.30	.24	.29	.36	.28	.32	.41

APPENDIX D RUNOFF CURVE NUMBERS "CN" FOR SCS METHOD*

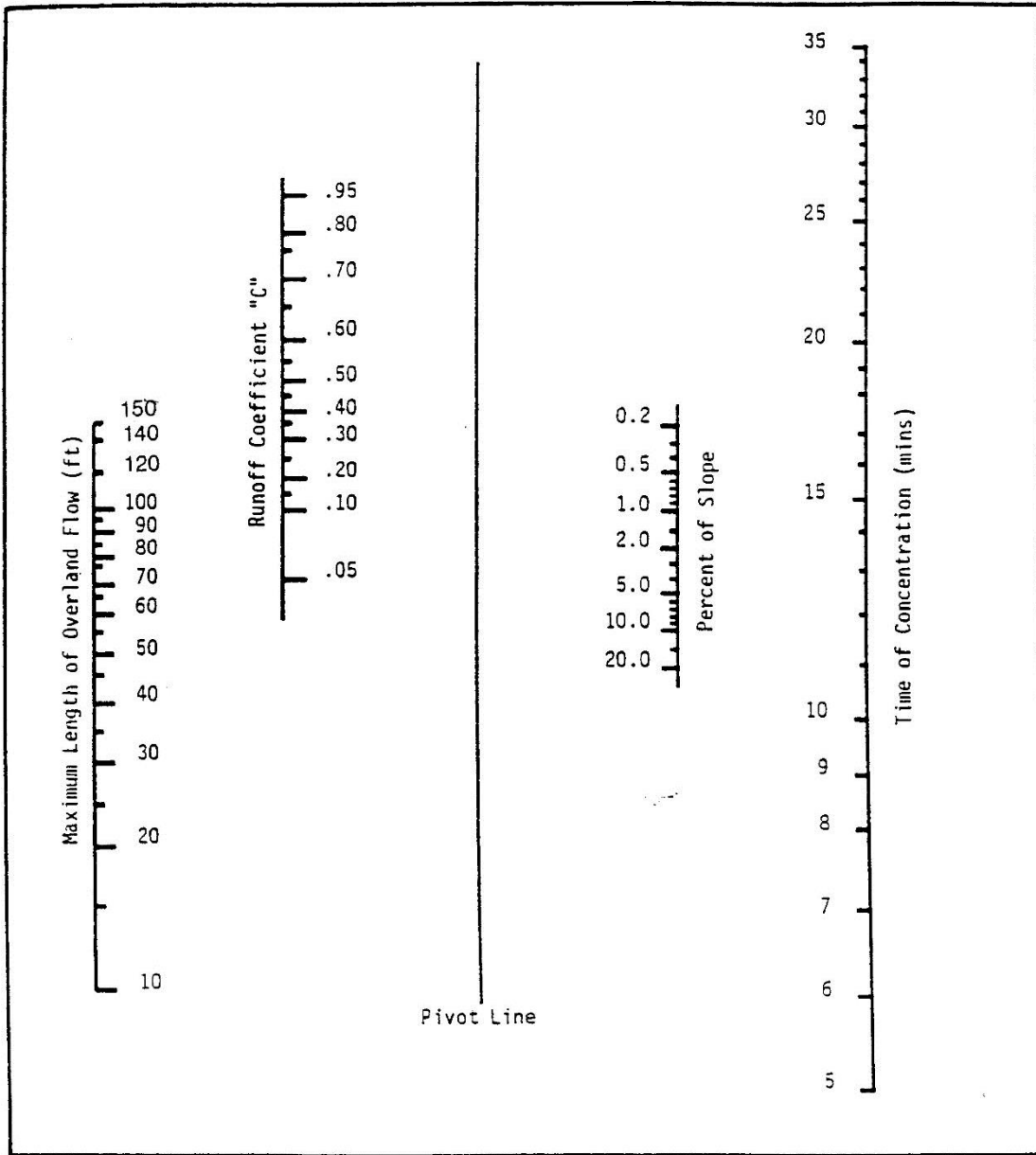
Soil Group ⇒	A			B			C			D		
	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Land Use												
Cultivated Land:												
Winter Conditions	48	60	65	62	73	73	68	78	79	77	81	88
Summer Conditions	35	51	61	48	55	70	57	65	77	64	69	80
Fallowed Fields:												
Poor Conditions	45	54	76	56	63	85	64	74	90	69	77	93
Good Conditions	30	44	74	43	48	83	48	54	88	56	60	90
Forest/Woodland	30	30	40	42	46	55	45	50	70	50	56	77
Grass Areas:												
Good Conditions	35	39	51	48	54	61	56	59	74	62	63	80
Average Conditions	45	49	53	52	55	69	60	63	79	65	69	84
Poor Conditions	48	55	68	56	67	79	66	74	86	73	81	89
Impervious Areas	96	97	98	96	97	98	96	97	98	96	97	98
Weighted Residential:												
Lot Size 1/8 Acre	71	75	77	74	76	85	78	80	90	81	83	92
Lot Size 1/4 Acre	61	62	67	66	69	75	67	69	83	75	78	87
Lot Size 1/3 Acre	57	59	65	64	66	72	65	66	81	74	77	86
Lot Size 1/2 Acre	54	57	63	62	64	70	63	65	80	72	76	85
Lot Size 1 Acre	51	55	62	61	63	68	61	64	79	71	75	84

APPENDIX E MANNING “N” VALUES FOR PIPES

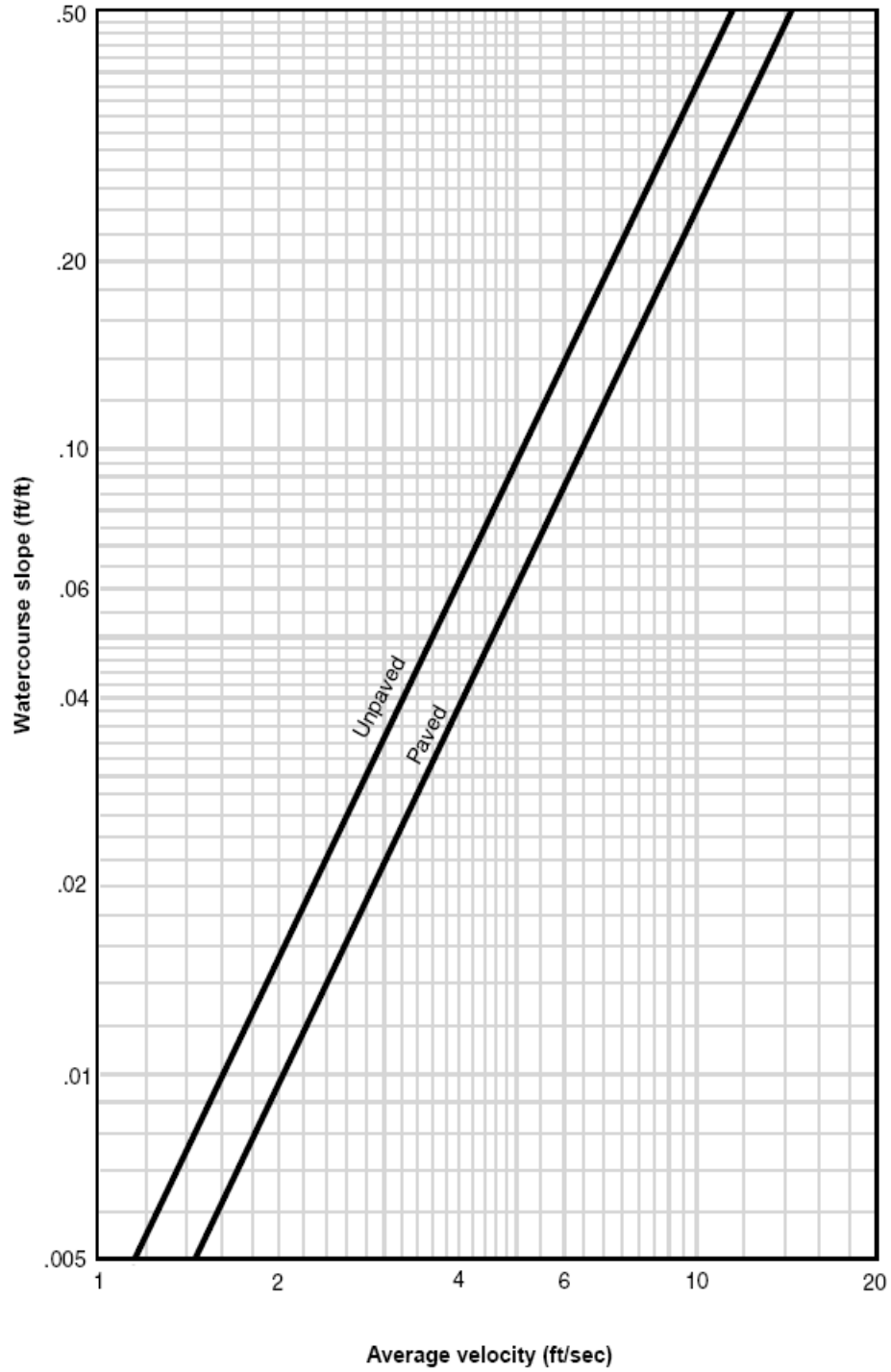
Pipe Material	Manning “n” Value
Helical Corrugated Steel/Aluminum 2 2/3 × 1/2 Corrugations Diameter (Inches)	
15	0.014
18	0.015
21	0.016
24	0.017
27	0.018
30	0.019
36	0.020
42	0.021
48	0.021
Reinforced Concrete – All Diameters	0.013
Corrugated Polyethylene – Smooth Lining – All Diameters	0.012
Note: Arch pipe shall have the Manning “n” value of an equal periphery of circular pipe.	

APPENDIX F TIME OF CONCENTRATION (TC) NOMOGRAPH

For Determining Sheet Flow (For Use with Rational Method)



**APPENDIX G AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME
FOR SHALLOW CONCENTRATED FLOW**



APPENDIX H TIME OF CONCENTRATION WORKSHEET

Worksheet #1: Time of Concentration (T_c) or Travel Time (T_t)

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle One: Present Developed _____

Circle One: T_c T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
 Include a map, schematic or description of flow segments.

Sheet Flow (Applicable to T_c Only)

Segment ID

1. Surface description (table 3-1).....			
2. Manning's roughness coefficient, n (table 3-1).....			
3. Flow length, L (total L ≤ **150 ft).....ft			
4. Two-year 24-Hour rainfall, P_2in			
5. Land slope, s.....ft/ft			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} \times S^{0.4}}$ Compute T_thr		+	= <input type="text"/>

Shallow Concentrated Flow

Segment ID

7. Surface description (paved or unpaved).....			
8. Flow Length, L.....ft			
9. Watercourse slope, s.....ft/ft			
10. Average velocity, V (figure 3-1).....ft/s			
11. $T_t = \frac{L}{3,600 \times V}$ Compute T_thr		+	= <input type="text"/>

Channel Flow

Segment ID

12. Cross sectional flow area, a.....ft ²			
13. Wetted perimeter, P_wft			
14. Hydraulic radius, $R = \frac{a}{P_w}$ Compute rft			
15. Channel slope, s.....ft/ft			
16. Manning's roughness coefficient, n.....			
17. $V = \frac{1.49 \times r^{2/3} \times s^{1/2}}{n}$ Compute Vft/s			
18. Flow Length, L.....ft/s			
19. $T_t = \frac{L}{3,600 \times V}$ Compute T_thr		+	= <input type="text"/>
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11 and 19).....hr			<input type="text"/>

* Table 3-1 per latest TR-55, Urban Hydrology for Small Watersheds

** 150 Feet Sheet flow length per latest TR-55 revision

**APPENDIX I OPERATION AND MAINTENANCE (O&M) AGREEMENT
STORMWATER MANAGEMENT FACILITIES**

THIS AGREEMENT, made and entered into this _____ day of _____, 20____, by and between _____, (hereinafter the “Landowner”), and _____, _____ County, Pennsylvania, (hereinafter “Township”);

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of _____ County, Pennsylvania, Deed Book _____ at page _____, (hereinafter “Property”).

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the SWM FACILITIES Operation and Maintenance (O&M) Plan approved by the Municipality (hereinafter referred to as the “O&M Plan”) for the property identified herein, which is attached hereto as Appendix __ and made part hereof, as approved by the Township, provides for management of stormwater within the confines of the Property through the use of Stormwater Management Best Management Practices (BMPs); and

WHEREAS, the Township, and the Landowner, his successors and assigns, agree that the health, safety, and welfare of the residents of the Township and the protection and maintenance of water quality require that on-site SWM Facilities be constructed and maintained on the Property; and

WHEREAS, the Township requires, through the implementation of the SWM Site Plan, that SWM Facilities as required by said SWM Site Plan and the Municipal Stormwater Management Ordinance be constructed and adequately operated and maintained by the Landowner, successors, and assigns.

NOW, THEREFORE, in consideration of the foregoing promises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The Landowner shall construct the SWM Facilities in accordance with the plans and specifications identified in the SWM Site Plan.
2. The Landowner shall operate and maintain the SWM Facilities as shown on the SWM Plan in good working order in accordance with the specific operation and maintenance requirements noted on the approved O&M Plan.

3. The Landowner hereby grants permission to the Township, its authorized agents and employees, to enter upon the property, at reasonable times and upon presentation of proper credentials, to inspect the SWM Facilities whenever necessary. Whenever possible, the Township shall notify the Landowner prior to entering the property.
4. In the event the Landowner fails to operate and maintain the SWM Facilities per paragraph 2, the Township or its representatives may enter upon the Property and take whatever action is deemed necessary to maintain said SWM Facilities. It is expressly understood and agreed that the Township is under no obligation to maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Township.
5. In the event the Township, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner shall reimburse the Township for all expenses (direct and indirect) incurred, plus a 10% penalty, within 10 days of receipt of invoice from the Township.
6. The intent and purpose of this Agreement is to ensure the proper maintenance of the onsite SWM Facilities by the Landowner; provided, however, that this Agreement shall not be deemed to create or effect any additional liability of any party for damage alleged to result from or be caused by stormwater runoff.
7. The Landowner, its executors, administrators, assigns, and other successors in interests, shall release the Township from all damages, accidents, casualties, occurrences, or claims which might arise or be asserted against said employees and representatives from the construction, presence, existence, or maintenance of the BMP(s) by the Landowner or Township.
8. The Township intends to inspect the SWM Facilities at a minimum of once every three years to ensure their continued functioning.

This Agreement shall be recorded at the Office of the Recorder of Deeds of Lancaster County, Pennsylvania, and shall constitute a covenant running with the Property and/or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs, and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL)

For the Township:

ATTEST:

_____ (City, Township, Township)

County of _____, Pennsylvania

I, _____, a Notary Public in and for the county and state aforesaid, whose commission expires on the _____ day of _____, 20____, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20____, has acknowledged the same before me in my said county and state.

GIVEN UNDER MY HAND THIS _____ day of _____, 20_____.

NOTARY PUBLIC

(SEAL)

For the Landowner:

ATTEST:

_____ (City, Township, Township)

County of _____, Pennsylvania

I, _____, a Notary Public in and for the county and state aforesaid, whose commission expires on the _____ day of _____, 20____, do hereby certify that _____ whose name(s) is/are signed to the foregoing Agreement bearing date of the _____ day of _____, 20____, has acknowledged the same before me in my said county and state.

GIVEN UNDER MY HAND THIS _____ day of _____, 20_____.

NOTARY PUBLIC

(SEAL)