PRODUCT HYDRAULIC DESIGN GUIDE

ABT, INC.

ABT, INC.
P. O. Box 837
259 Murdock Road
Troutman NC 28166
www.abtdrains.com
(800)438-6057

POLYDRAIN® TRENCH FORMER® INTERCEPTOR®

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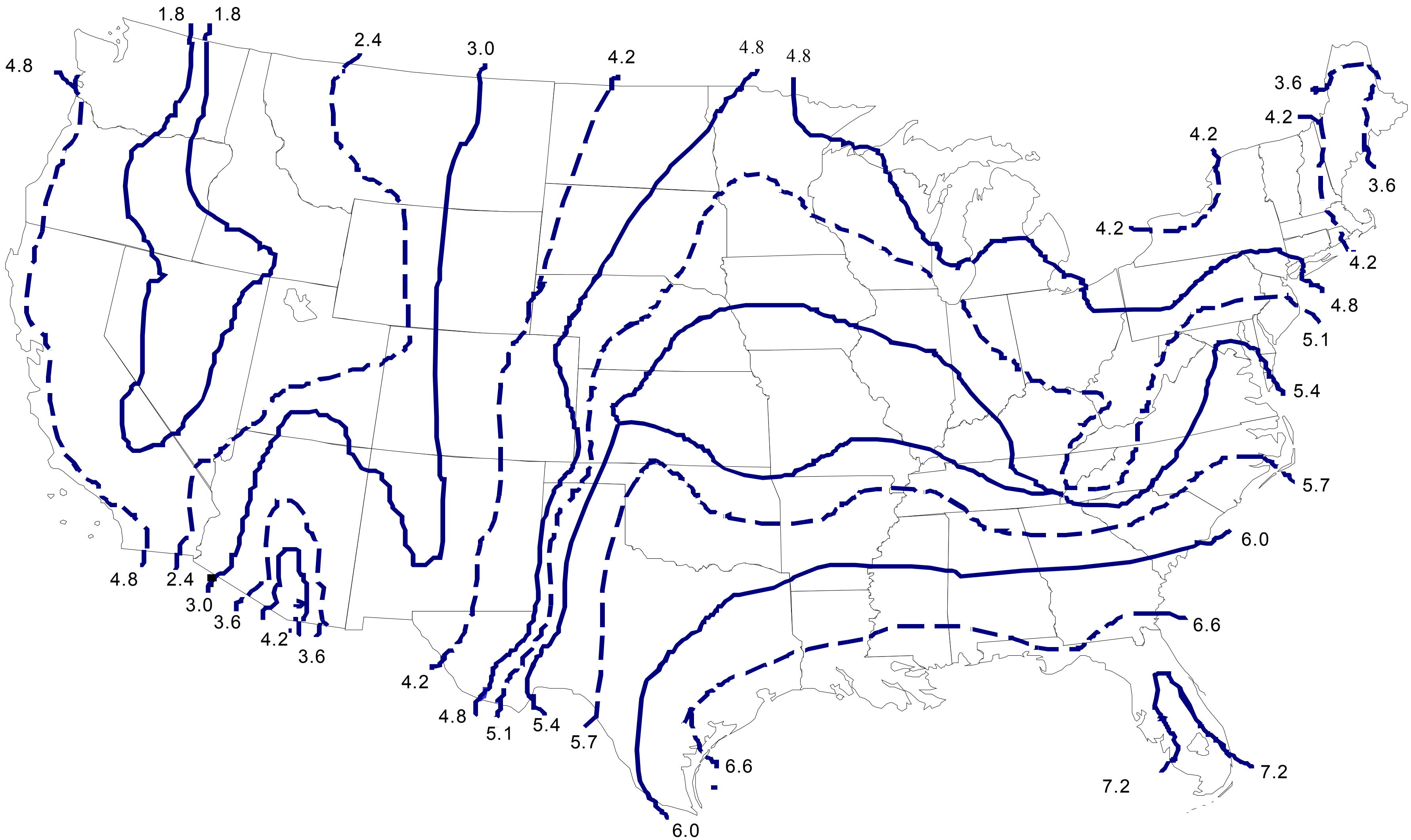
Table of Contents

Instructions

Diagram 1
Rainfall Intensity (I)
2 Year Frequency, 5 Minute Duration
(In/Hr)



Instructions

A. Introduction

This manual is written to provide information to design surface drainage systems to properly *collect, convey and discharge* the surface runoff. Standard engineering methods and formulas are used in this design manual to guide the designer in the selection and layout of the ABT modular trench drain units from inflow to discharge.

The key to designing a successful drainage system is a clear definition of what the system must accomplish. Some common reasons are:

1. Spread control of water on roadways for traffic safety
2. Prevent water invasion into structures or equipment for loss prevention
3. Collect and store harmful fluids for environmental and personnel protection
4. Remove fluids for pedestrian safety and convenience.

Design assistance is available from ABT upon request. ABT also offers various Professional Surface Drainage Design Workshops. See www.abtdrains.com for information on additional resources that are available.

B. Site Characteristics

Parameters to consider:

1. Flow path disruptions, restrictions, and concentrators
2. Permitted trench location
3. Site contours

Site slopes can also be used to increase the conveyance capacity of the trench. If the site does not have slope, **a sloped drainage system can provide it**. The slope can also be customized to increase flow or to overcome adverse site slope. It may be more cost effective overall to outfall the trench system more frequently than to add depth or width to the trench. This will also help to eliminate **utility conflicts**. Often the site contours can be changed for a more cost effective drainage design that meets requirements.

C. Hydraulic Loads

Many of the hydraulic loads for interior applications can be found in the building design documents. However, rainfall loads must be determined by analysis. Many rainfall analysis methods are available. The Rational Method, the SCS Method, USGS Regression Equations, and others are outlined in the FHWA, HEC 22 Manual (available at http://www.fhwa.dot.gov/bridge/hydlinks.htm)

This manual utilizes the **Rational Method**. This is the common method used for calculating peak flows of small tributary areas (200 acres or less).

Parameters to consider:

1. Rainfall intensity
2. Watershed area
3. Runoff Coefficient(s) for watershed
4. Quantity, location, and flow rate for each random and point source

* Note: All loads must be identified

- **Random Sources** can occur at any point in the drainage system such as wash down hoses, mobile equipment, and spills.
- **Point Sources** are loads at a fixed point. Examples are roof down spouts, process equipment discharge, and tank discharge.
- **Area Sources** are loads distributed over an area. Rainfall and Fire protection systems are the most common examples of area loads.

Table 1 Conversion Factor (k) for Hydraulic Load with Mixed Input Units Q = kCIA				
Flow	**k**	**C**	**I**	**A**
CFS	1.008	Unit Less	Inches per Hour	Acres
GPM	448.831	Unit Less	Inches per Hour	Acres
CFS	0.00002315	Unit Less	Inches per Hour	Square Feet
GPM	0.01039	Unit Less	Inches per Hour	Square Feet
CFS	0.002228	Unit Less	GPM per Sq. Ft.	Square Feet
GPM	1.000	Unit Less	GPM per Sq. Ft.	Square Feet
CFS	0.039685	Unit Less	mm per Hour	Acres
GPM	0.00409	Unit Less	mm per Hour	Square Feet
CMS	0.0705557	Unit Less	Inches per Hour	Hectares
CMS	2.7777778	Unit Less	CM per Hour	Hectares

- ***Divide square feet by 43,560 to obtain acres***

Table 2 Runoff Coefficient (C) and Manning Roughness (n) for Common Surfaces					
Surface	**C**	**n**	**Surface**	**C**	**n**
Asphalt	0.70 to 0.95	0.013 - 0.017	Lawns (Clay Soil)	0.13 to 0.35	0.020 - 0.050
Brick	0.70 to 0.85	0.012 - 0.018	Lawns (Sandy Soil)	0.05 to 0.20	0.020 - 0.050
Concrete	0.80 to 0.95	0.013 - 0.024	Roofing	0.75 to 0.95	0.010 - 0.015
Gravel	0.40 to 0.60	0.020 - 0.035	Woods	0.10 to 0.60	0.020 - 0.140
PolyDrain		0.010	Trench Former		0.013

Equation 1 – Rational Method

$$Q = k\ C\ I\ A$$

Q = Hydraulic load

k = Unit conversion factor. Choose the conversion factor (**k)** from **Table 1, page 4,** to use in Equation 1 for the application's mix of input units to obtain the output flow in CFS, GPM or CMS. Additional conversion factors are located on the last page of this document.

C = Coefficient of runoff is the ratio of fluid falling on the watershed area that enters the drainage system. Increase in ponding, evaporation, absorption, and etc. decrease the amount reaching the drainage system. **Table 2, page 4,** list value ranges for common surfaces. HEC 22 provides more specific values for additional materials and surfaces.

I = Intensity or average rate at which fluid is being applied to the watershed area. Units may be inches of rainfall per hour, gallon per minute per square foot from sprinkler heads, or as given for the specific application.

A = Area of the watershed contributing flow to the surface drainage system. Area measured in acres is common for exterior watershed sites. The common area measurement for interior applications is square feet.

> The values shown on **Diagram 1 - 2 Year Frequency, 5 Minute Duration Intensity Map,** located on page i may be used for intensity values. For more accurate rainfall rates and for other IDF many computer programs are available, or contact the National Weather Service nearest the site, FHWA HEC 12, IAF charts, or www.noaa.gov web site.

Event Frequency should be chosen carefully. Trench drain systems should be designed to capacity frequently to flush out debris. Designing the system for infrequent events increases the probability that the trench will be clogged with sedimentary debris when the event occurs, unless trench-cleaning maintenance is increased.

D. Grate Selection

Parameters to consider:

1. Mechanical Loads
    a. Light
        i. Pedestrian
        ii. Golf carts
    b. Medium
        i. Trucks, buses
        ii. Fork lifts
    c. Heavy
        i. Commercial aircraft
        ii. Ports
2. Dynamic Loads
    a. Maximum Vehicle Speed
    b. Traffic Direction
        i. Transverse
        ii. Longitudinal
        iii. Omni directional
    c. Braking or Turning Forces
3. Tire Construction
    a. Pneumatic tires only
    b. Solid tires
4. Pedestrian Requirements
    a. Heel proof
    b. ADA and the traffic direction
    c. Bicycle safe
5. Chemical Resistance of
    a. Grates
    b. Frames
    c. Rails
6. Aesthetics
    a. Brass
    b. Wrought Iron
    c. Ornamental
7. Special Applications
    a. Curb Return
    b. Heel proof / Roadway

Grates must be suitable for the all conditions for which they will be subjected. Construction or infrequent conditions may be more severe than normal usage conditions. Take precautions during the abnormal conditions or select a grate rated for worst-case situations.

The grates should stay in position if subjected to horizontal forces such as braking, accelerating, and turning traffic. Snowplows can generate upward forces.

Corrosion may dictate grate, frame, rail, and/or channel material.

The grate must comply with applicable regulatory requirements for pedestrian traffic. Grates should compensate for debris exposure.

See **Table 3, page 7,** for material, load capacity, pedestrian ratings, and hydraulic inlet capacity factors for popular grates offered by ABT.

Table 3 Grate Selection Properties								
Grate[1] Number	Gr./ Fr. Mat.	Load[2,3,4] (PSI)	ADA[5]	Heel[6] Proof	Inlet Area[7]		Sheet cfs/ft	**[r]** Inlet Factor[8]
					Ft^2 / LF	M^2 / L M		
2502	Du./-	575	No	No	0.21	0.06	0.16	0.52
2504	Du./-	575	No	No	0.17	0.05	0.13	0.44
2505	Du./-	775	Yes	No	0.10	0.03	0.09	0.25
2506	Du./-	331	Omni	Yes	0.13	0.04	0.10	0.33
2512AF	Du./Du.	575	No	No	0.21	0.06	0.16	0.52
2514AF	Du./Du.	575	No	No	0.17	0.05	0.13	0.44
2515AF	Du./Du.	775	Trans	No	0.17	0.05	0.13	0.43
2516AF	Du./Du.	331	Omni	Yes	0.13	0.04	0.10	0.33
2532AF	Ci./Ci.	775	Long	No	0.09	0.03	0.07	0.22
2534AF	Ci./Du.	775	Trans.	No	0.13	0.04	0.1	0.33
1468.14	Du./St.	Varies	Varies	Varies	Varies	Varies	Varies	Varies
1502.14	Du./St.	302	No	No	0.76	0.23	0.57	1.91
1504.14	Du./St.	775	Trans	No	0.25	0.08	0.28	0.93
2542 (A-67)	Du./Du.	521	No	No	0.27	0.09	0.30	1.00
2552 (A-67)	Du./Du.	417	No	No	0.27	0.09	0.30	1.00
2564 (A-32)	Du./Du.	331	Omni	Yes	0.13	0.04	0.10	0.33
MD 200	Du./St.	496	No	No	0.47	0.14	0.36	1.19
HD 200	Du./St.	1621	No	No	0.61	0.19	0.46	1.54
MD 300	Du./St.	558	No	No	0.81	0.25	0.61	2.05
HD 300	Du./St.	1558	No	No	0.79	0.24	0.60	2.01

Definition and Basis:

1. All grates this table are Bicycle Safe. A 20” bicycle tire drops less than 1” when crossing grate under worst conditions.
2. Transverse loads only.
3. Frames are required for solid forklift traffic.
4. For exterior applications frames are recommended to extend product life.
5. Slot width of 1/2" or less and traffic direction:
   a. Trans= transverse (across)
6. Grate/frame top surface openings are 1/4" or less in width.
7. Projected open area of grate's inlet openings.
8. Inlet area of the grate divided by A-67 grate inlet area and de-rated by 25% unless inlet is identical.

* Contact ABT for assistance with grate selection for non-typical loading conditions.

** See the specific Product Manual for more information on grate

The Interceptor A-67 grate interception capacity has been tested in a hydraulic flume at Washington State University. It has been determined that for 100% interception capacity of the A-67 is 0.3 CFS/Lf. Based upon open area of the other grates listed in **Table 3, Equation 2** can be used to adjust the length of drain required with other grates.

Equation 2 – Non A-67 Grate Length Adjustment

$$L = L_{A\text{-}67} / r$$

L = Adjusted Run Length

$L_{A\text{-}67}$ = Run Length from **Diagram 3, page 20**

r = Grate Area Ratio from **Table 3**

E. Grate Inflow Capacity

Parameters to consider:

1. Sheet Flow Conditions
2. Gutter Flow Conditions
3. Sump Conditions
4. Minimum trench length due to roadway geometry
5. Debris blockage of grate inlet area **(to be determined by local site characteristics, i.e. foliage, litter, ice, etc.) A 2:1 clogging factor is generally acceptable.**

Hydraulic loads can be grouped into 3 general categories.

1. **Sheet Flow Conditions** exist when flow across a flat or a simple sloped surface is unconstrained and there is little flow along the grate. It exists even if flow approaches from both sides of the grate. Sheet Flow capture is not as efficient as gutter or sump conditions because a grate has limited opportunity to capture the flow. However, capturing the flow on flat surfaces such as interior floors, suitable alternatives may not be available.

2. **Gutter Flow Conditions** is confined on one side by a barrier such as a curb, median barrier, sound wall, slope, etc. Flow along the barrier distinguishes it from sheet flow.

3. **Sump Condition** is when flow is constrained on two or more sides creating accumulation. Use **Equation 5, page 10 – Grate Inflow in Orifice Conditions** to determine the grate inflow capacity if the head above the grate exceeds the A-67 Interceptor's 4 inch test conditions.

Grate Inflow in Sheet Flow Conditions

The trench drain should be long enough to intercept the flow from all points of the watershed area and have sufficient inflow at the peak load point. Otherwise, part of the flow will bypass the system. Multiple runs may be required for 100% flow capture.

Equation 3 – Sheet Flow Grate Inflow

$$G = Q/ L_s \quad \text{or} \quad L_s = Q/G$$

G = Sheeting flow (**Table 3, page 7,** Grate Properties)
Q = Hydraulic load for water shed area
L_s = Total length of grates (Ft)

Compound slope that concentrates sheet flow can point overload the system. Avoid when possible or capture concentrated flow as gutter flow.

Grate Inflow in Gutter Flow Conditions

When the design intent is spread control, **Equation 4** is used to calculate the gutter flow that creates the maximum allowable spread in a curb and gutter application. Solve equation for Q_G and substitute this value for **Q** in **Equation 1, page 5,** and solve for length. This locates the point in the gutter to begin the line drain. Note that when selecting the watershed area, water flow paths are perpendicular to contour lines.

Equation 4 – Triangular Gutter Flow Capacity

$$Q_G = (C_G/n)T^{2.67}S_T^{1.67}\, S_L^{0.5}$$

Q_G = Gutter Flow (CFS)
n = Manning's Roughness Coefficient of Roadway from **Table 2**
T = Spread (Ft)
S_T = Transverse Slope (Ft/Ft) from road bed geometry
S_L = Longitudinal Slope (Ft/Ft) from road bed geometry
C_G = 0.56 English or 0.376 Metric

Grate Inflow in Sag/Sump Conditions

When the head of water above the grate exceeds 4 inches, grate inflow is calculated using **Equation 5** for orifice inflow conditions.

Equation 5 – Grate Inflow in Orifice Conditions

$$Q_O = 0.67\ A_G\ (2gH)^{0.5}$$

Q_O = Orifice Inflow (CFS)

A_G = Grate Inlet Area (Ft^2) from **Table 3, page 7**

g = Gravitational Constant (32.16 Ft /S^2)

H = Fluid Height Over Grate (Ft)

F. Trench Hydraulic Capacity

Manning's Equation (**Equation 6, page 12**) is generally accepted in the surface drainage community as the method to determine a channels conveyance or carrying capacity. This Manual utilizes Manning's Equation to determine the carrying capacity for ABT's products.

Random Load(s) should be introduced at the start of each applicable branch run but only counted once in the main run total hydraulic load.

Check channel capacity at each Point Load to determine if it is sufficient for the combined point and upstream load. Roof downspouts are often an overlooked point source load.

Area Load applications should be checked to determine if site contours are creating point loads at the trench. Inflow into the channel is assumed uniform over the run length on sheet and sag applications. Deviations from this assumption must be analyzed.

Hydraulic carrying capacity of standard systems with no site slope can be read directly from the flow tables below. Use **Equation 7**, **page 12**, to determine capacity when the application contains site slope and/or with Trench Former with custom trench slope.

Table 4A; 4B; 4C
4" PolyDrain System
Flat Site Flow Capacity

Table 5
MD Series
Hydraulic Flow Capacity

Table 6
HD Series
Hydraulic Flow Capacity

Table 7
TF14 Series
Hydraulic Flow Capacity

Trench Former MD and HD Series are available with custom slope and depths to handle most applications' hydraulic requirements, even the difficult ones.

Contact ABT for a Hydraulic Calculator for custom slopes.

Equation 6 – Manning's Equation

$$Q = (1.486 / n)*A*R^{2/3}*S^{1/2}$$

Q = Flow (CFS)
n = Manning's Roughness Coefficient of Trench surface (**Table 2, page 4**)
A = Cross Sectional Flow Area of Trench (Ft^2)
R = Hydraulic Radius (Ft) **=** Flow Area (Ft^2) ÷ Wetted Perimeter (Ft)
S = Invert Slope (units / units)

Equation 7 – Channel Flow Capacities for Sloped Sites or Custom Trench Former Slopes

$$Q_n = Q * K * (S_S+S_C)^{0.50}$$

Q_n = Capacity required for discharge Channel.
Q = Required flow capacity from **Equation 1**.
S_S = Site slope (units / units)
S_C = Channel slope (0.006 for PolyDrain and 0.010 for **Standard** Trench Former And MD/HD systems)

K = $1/S_C^{0.5}$ for custom slopes
12.91 for PolyDrain with 0.6% slope
10.00 for the 1.0% slope in **Standard** Trench Former and MD/HD systems

Solve for Q_n then find this flow volume in Tables 4 through Table 7 and read to the left to find the appropriate Channel or Section Number. Solve for S_C for custom slope in Trench Former and MD/HD systems.

** This methodology not applicable to Storage Capacities

Table 4A
Hydraulic Capacities
PolyDrain Channels without PolyWalls

Channel Length 1 M Nominal			Flow Capacity									Storage Capacity		
Channel Number	Maximum Channel Depth		Grate with Toggle	Grate and No Toggle	Interceptor	Grate with Toggle	Grate and No Toggle	Interceptor	Grate with Toggle	Grate and No Toggle	Interceptor	Chan. Only Sto. Cap.	Chan. Only Sto. Cap.	Chan. Only Sto. Cap.
	In.	CM	CFS	CFS	CFS	GPM	GPM	GPM	LPS	LPS	LPS	Cu. Ft.	Gal.	L.
010	5.31	13.5	0.12	0.24	0.34	55.4	107	154	3.49	6.73	9.72	0.28	2.11	7.98
020	5.55	14.1	0.14	0.26	0.36	62.1	116	163	3.92	7.30	10.3	0.30	2.26	8.57
021	5.55	14.1	-	-	-	-	-	-	-	-	-	0.31	2.36	8.92
030	5.79	14.7	0.15	0.28	0.38	69.0	125	173	4.35	7.88	10.9	0.32	2.42	9.15
040	6.02	15.3	0.17	0.30	0.41	76.0	134	182	4.80	8.46	11.5	0.34	2.57	9.73
050	6.26	15.9	0.19	0.32	0.43	83.2	143	191	5.25	9.05	12.1	0.36	2.73	10.3
060	6.50	16.5	0.20	0.34	0.45	90.5	153	201	5.71	9.63	12.7	0.39	2.88	10.9
070	6.73	17.1	0.22	0.36	0.47	98.0	162	210	6.18	10.2	13.3	0.41	3.03	11.5
080	6.97	17.7	0.24	0.38	0.49	106	171	220	6.66	10.8	13.9	0.43	3.19	12.1
090	7.20	18.3	0.25	0.40	0.51	113	181	229	7.14	11.4	14.5	0.45	3.34	12.7
091	7.20	18.3	-	-	-	-	-	-	-	-	-	0.46	3.44	13.0
100	7.44	18.9	0.27	0.42	0.53	121	190	239	7.63	12.0	15.1	0.47	3.50	13.2
110	7.68	19.5	0.29	0.44	0.55	129	199	248	8.13	12.6	15.7	0.49	3.65	13.8
120	7.91	20.1	0.30	0.47	0.57	137	209	258	8.63	13.2	16.3	0.51	3.81	14.4
130	8.15	20.7	0.32	0.49	0.60	145	218	267	9.13	13.8	16.9	0.53	3.96	15.0
140	8.39	21.3	0.34	0.51	0.62	153	228	277	9.6	14.4	17.5	0.55	4.12	15.6
150	8.62	21.9	0.36	0.53	0.64	161	237	286	10.2	15.0	18.1	0.57	4.27	16.2
160	8.86	22.5	0.38	0.55	0.66	169	247	296	10.7	15.6	18.7	0.59	4.42	16.7
170	9.09	23.1	0.40	0.57	0.68	177	256	305	11.2	16.2	19.3	0.61	4.58	17.3
180	9.33	23.7	0.41	0.59	0.70	186	266	315	11.7	16.8	19.9	0.63	4.73	17.9
190	9.57	24.3	0.43	0.61	0.72	194	275	324	12.2	17.4	20.5	0.65	4.89	18.5
191	9.57	24.3	-	-	-	-	-	-	-	-	-	0.67	4.98	18.9
200	9.80	24.9	0.45	0.63	0.74	203	285	334	12.8	18.0	21.1	0.67	5.04	19.1
210	10.04	25.5	0.47	0.66	0.77	211	294	343	13.3	18.6	21.7	0.69	5.20	19.7
220	10.28	26.1	0.49	0.68	0.79	220	304	353	13.9	19.2	22.3	0.72	5.35	20.3
230	10.51	26.7	0.51	0.70	0.81	228	313	363	14.4	19.8	22.9	0.74	5.51	20.8
240	10.75	27.3	0.53	0.72	0.83	237	323	372	14.9	20.4	23.5	0.76	5.66	21.4
250	11.0	27.9	0.55	0.74	0.85	245	332	382	15.5	21.0	24.1	0.78	5.81	22.0
260	11.2	28.5	0.57	0.76	0.87	254	342	391	16.0	21.6	24.7	0.80	5.97	22.6
270	11.5	29.1	0.59	0.78	0.89	263	351	401	16.6	22.2	25.3	0.82	6.12	23.2
280	11.7	29.7	0.60	0.80	0.91	271	361	410	17.1	22.8	25.9	0.84	6.28	23.8
290	11.9	30.3	0.62	0.83	0.94	280	371	420	17.7	23.4	26.5	0.86	6.43	24.3
291	11.9	30.3	-	-	-	-	-	-	-	-	-	0.87	6.52	24.7
300	12.2	30.9	0.64	0.85	0.96	289	380	430	18.2	24.0	27.1	0.88	6.59	24.9

Notes:

1. Maximum Channel Depth is from top of channel to the bottom at the deep end of each nominal 1 M section. Add 3.0 CM (1.18 In.) to overall depth for all frames. Subtract 2.0 CM (0.79 In.) to obtain invert depth.
2. Active hydraulic area is from bottom of grate to the invert for both Flow Capacity and Storage Capacity. Interceptor has 1.9 CM (0.75 In.) greater depth for both flow and storage.
3. Flow capacity is calculated at the deep end using Manning's Equation with roughness factor n = 0.010.
4. To calculate flow for sloped sites, $\mathbf{Q_{SLOPED} = Q_{FLAT} * 12.91 * (S_S + S_C)^{0.50}}$ for all units. S_C = 0.006 = 0.6% for all xx0 channels and 0.0 for all xx1 channels.

Table 4B
Hydraulic Capacities
PolyDrain Channels with PolyWall *I*

Channel Length Nominal 1 M			Flow Capacity									Storage Capacity		
Channel Number	Maximum Channel Depth		Grate with Toggle	Grate and No Toggle	Intercept or	Grate with Toggle	Grate and No Toggle	Intercept or	Grate with Toggle	Grate and No Toggle	Intercept or	Chan. Only Sto. Cap.	Chan. Only Sto. Cap.	Chan. Only Sto. Cap.
	In.	CM	CFS	CFS	CFS	GPM	GPM	GPM	LPS	LPS	LPS	Cu. Ft.	Gal.	L.
010 PWI	12.4	31.5	0.68	0.89	0.999	305.1	399	448	19.25	25.16	28.28	0.90	6.74	25.5
020 PWI	12.6	32.1	0.70	0.91	1.020	314.0	408	458	19.81	25.76	1.0	0.92	6.89	26.1
021 PWI	12.7	32.2	-	-	-	-	-	-	-	-	-	0.92	6.91	26.2
030 PWI	12.9	32.7	0.72	0.93	1.042	322.9	418	467	20.37	26.37	31.3	0.94	7.05	26.7
040 PWI	13.1	33.3	0.74	0.95	1.063	331.8	428	477	20.94	26.97	31.9	0.96	7.20	27.3
050 PWI	13.3	33.9	0.76	0.97	1.084	340.8	437	487	21.50	27.58	0.6	0.98	7.36	27.9
060 PWI	13.6	34.5	0.78	1.00	1.106	349.8	447	496	22.07	28.18	33.2	1.00	7.51	28.4
070 PWI	13.8	35.1	0.80	1.02	1.127	358.8	456	506	22.64	28.8	33.8	1.02	7.67	29.0
080 PWI	14.1	35.7	0.82	1.04	1.149	368	466	516	23.20	29.4	34.4	1.05	7.82	29.6
090 PWI	14.3	36.3	0.84	1.06	1.170	377	476	525	23.77	30.0	35.0	1.07	7.98	30.2
091 PWI	14.3	36.4	-	-	-	-	-	-	-	-	-	1.07	7.99	30.2
100 PWI	14.5	36.9	0.86	1.08	1.191	386	485	535	24.34	30.6	35.6	1.09	8.13	30.8
110 PWI	14.8	37.5	0.88	1.10	1.213	395	495	544	24.92	31.2	36.2	1.11	8.28	31.4
120 PWI	15.0	38.1	0.90	1.12	1.234	404	504	554	25.49	31.8	36.8	1.13	8.44	31.9
130 PWI	15.2	38.7	0.92	1.15	1.256	413	514	564	26.06	32.4	37.4	1.15	8.59	32.5
140 PWI	15.5	39.3	0.94	1.17	1.277	422	524	573	26.6	33.0	38.0	1.17	8.75	33.1
150 PWI	15.7	39.9	0.96	1.19	1.299	431	533	583	27.2	33.6	38.6	1.19	8.90	33.7
160 PWI	15.9	40.5	0.98	1.21	1.320	440	543	592	27.8	34.2	39.3	1.21	9.06	34.3
170 PWI	16.2	41.1	1.00	1.23	1.342	450	552	602	28.4	34.9	39.9	1.23	9.21	34.9
180 PWI	16.4	41.7	1.02	1.25	1.363	459	562	612	28.9	35.5	40.5	1.25	9.37	35.5
190 PWI	16.7	42.3	1.04	1.27	1.384	468	572	621	29.5	36.1	41.1	1.27	9.52	36.0
191 PWI	16.7	42.4	-	-	-	-	-	-	-	-	-	1.27	9.54	36.1
200 PWI	16.9	42.9	1.06	1.30	1.406	477	581	631	30.1	36.7	41.7	1.29	9.67	36.6
210 PWI	17.1	43.5	1.08	1.32	1.427	486	591	641	30.7	37.3	42.3	1.31	9.83	37.2
220 PWI	17.4	44.1	1.10	1.34	1.449	496	601	650	31.3	37.9	42.9	1.33	9.98	37.8
230 PWI	17.6	44.7	1.12	1.36	1.470	505	610	660	31.8	38.5	43.5	1.36	10.1	38.4
240 PWI	17.8	45.3	1.15	1.38	1.492	514	620	670	32.4	39.1	44.1	1.38	10.3	39.0
250 PWI	18.1	45.9	1.17	1.40	1.513	523	629	679	33.0	39.7	44.7	1.40	10.4	39.5
260 PWI	18.3	46.5	1.19	1.42	1.535	533	639	689	33.6	40.3	45.4	1.42	10.6	40.1
270 PWI	18.5	47.1	1.21	1.45	1.556	542	649	698	34.2	40.9	46.0	1.44	10.8	40.7
280 PWI	18.8	47.7	1.23	1.47	1.578	551	658	708	34.8	41.5	46.6	1.46	10.9	41.3
290 PWI	19.0	48.3	1.25	1.49	1.599	560	668	718	35.4	42.1	47.2	1.48	11.1	41.9
291 PWI	19.0	48.4	-	-	-	-	-	-	-	-	-	1.48	11.1	41.9
300 PWI	19.3	48.9	1.27	1.51	1.621	570	678	727	35.9	42.7	47.8	1.50	11.2	42.5

Notes:

1. Maximum Channel Depth is from top of channel to the bottom at the deep end of each nominal 1 M section. Add 3.0 CM (1.18 In.) to overall depth for all frames. Subtract 2.0 CM (0.79 In.) to obtain invert depth.
2. Active hydraulic area is from bottom of grate to the invert for both Flow Capacity and Storage Capacity. Interceptor has 1.9 CM (0.75 In.) greater depth for both flow and storage.
3. Flow capacity is calculated at the deep end using Manning's Equation with roughness factor n = 0.010.
4. To calculate flow for sloped sites, $Q_{SLOPED} = Q_{FLAT} * 12.91 * (S_S + S_C)$^0.50 for all units. S_C = 0.006 = 0.6% for all xx0 channels and 0.0 for all xx1 channels.

Table 4C
Hydraulic Capacities
PolyDrain Channels with PolyWall *II*

Channel Length Nominal: 1 M	Maximum Channel Depth		Flow Capacity									Storage Capacity		
			Grate with Toggle	Grate and No Toggle	Intercept or	Grate with Toggle	Grate and No Toggle	Intercept or	Grate with Toggle	Grate and No Toggle	Intercept or	Chan. Only Sto. Cap.	Chan. Only Sto. Cap.	Chan. Only Sto. Cap.
Channel Number	In.	CM	CFS	CFS	CFS	GPM	GPM	GPM	LPS	LPS	LPS	Cu. Ft.	Gal.	L.
010 PWII	19.5	49.5	1.31	1.55	1.663	587	697	746	37.0	44.0	47.1	1.52	11.4	43.0
020 PWII	19.7	50.1	1.33	1.57	1.684	596	706	756	37.6	44.6	47.7	1.54	11.5	43.6
021 PWII	19.7	50.2	-	-	-	-	-	-	-	-	-	1.54	11.5	43.7
030 PWII	20.0	50.7	1.35	1.60	1.706	606	716	766	38.2	45.2	48.3	1.56	11.7	44.2
040 PWII	20.2	51.3	1.37	1.62	1.727	615	726	775	38.8	45.8	48.9	1.58	11.8	44.8
050 PWII	20.4	51.9	1.39	1.64	1.749	624	735	785	39.4	46.4	49.5	1.60	12.0	45.4
060 PWII	20.7	52.5	1.41	1.66	1.770	634	745	795	40.0	47.0	50.1	1.62	12.1	46.0
070 PWII	20.9	53.1	1.43	1.68	1.792	643	754	804	40.6	47.6	50.7	1.64	12.3	46.6
080 PWII	21.1	53.7	1.45	1.70	1.813	652	764	814	41.2	48.2	51.3	1.66	12.5	47.1
090 PWII	21.4	54.3	1.47	1.72	1.835	662	774	824	41.8	48.8	52.0	1.69	12.6	47.7
091 PWII	21.4	54.4	-	-	-	-	-	-	-	-	-	1.69	12.6	47.8
100 PWII	21.6	54.9	1.50	1.75	1.856	671	783	833	42.3	49.4	52.6	1.71	12.8	48.3
110 PWII	21.9	55.5	1.52	1.77	1.878	681	793	843	42.9	50.0	53.2	1.73	12.9	48.9
120 PWII	22.1	56.1	1.54	1.79	1.899	690	803	852	43.5	50.6	53.8	1.75	13.1	49.5
130 PWII	22.3	56.7	1.56	1.81	1.921	699	812	862	44.1	51.2	54.4	1.77	13.2	50.1
140 PWII	22.6	57.3	1.58	1.83	1.942	709	822	872	44.7	51.9	55.0	1.79	13.4	50.6
150 PWII	22.8	57.9	1.60	1.85	1.964	718	832	881	45.3	52.5	55.6	1.81	13.5	51.2
160 PWII	23.0	58.5	1.62	1.87	1.985	728	841	891	45.9	53.1	56.2	1.83	13.7	51.8
170 PWII	23.3	59.1	1.64	1.90	2.007	737	851	901	46.5	53.7	56.8	1.85	13.8	52.4
180 PWII	23.5	59.7	1.66	1.92	2.028	746	861	910	47.1	54.3	57.4	1.87	14.0	53.0
190 PWII	23.7	60.3	1.68	1.94	2.050	756	870	920	47.7	54.9	58.0	1.89	14.2	53.6
191 PWII	23.8	60.4	-	-	-	-	-	-	-	-	-	1.89	14.2	53.6
200 PWII	24.0	60.9	1.70	1.96	2.071	765	880	930	48.3	55.5	58.7	1.91	14.3	54.2
210 PWII	24.2	61.5	1.73	1.98	2.093	775	889	939	48.9	56.1	59.3	1.93	14.5	54.7
220 PWII	24.4	62.1	1.75	2.00	2.114	784	899	949	49.5	56.7	59.9	1.95	14.6	55.3
230 PWII	24.7	62.7	1.77	2.02	2.136	793	909	959	50.1	57.3	60.5	1.97	14.8	55.9
240 PWII	24.9	63.3	1.79	2.05	2.157	803	918	968	50.7	57.9	61.1	2.00	14.9	56.5
250 PWII	25.2	63.9	1.81	2.07	2.179	812	928	978	51.3	58.6	61.7	2.02	15.1	57.1
260 PWII	25.4	64.5	1.83	2.09	2.200	822	938	988	51.8	59.2	62.3	2.04	15.2	57.7
270 PWII	25.6	65.1	1.85	2.11	2.222	831	947	997	52.4	59.8	62.9	2.06	15.4	58.2
280 PWII	25.9	65.7	1.87	2.13	2.243	841	957	1007	53.0	60.4	63.5	2.08	15.5	58.8
290 PWII	26.1	66.3	1.89	2.15	2.265	850	967	1017	53.6	61.0	64.1	2.10	15.7	59.4
291 PWII	26.1	66.4	-	-	-	-	-	-	-	-	-	2.10	15.7	59.5
300 PWII	26.3	66.9	1.92	2.18	2.286	860	976	1026	54.2	61.6	64.7	2.12	15.9	60.0

Notes:

1. Maximum Channel Depth is from top of channel to the bottom at the deep end of each nominal 1 M section.
   Add 3.0 CM (1.18 In.) to overall depth for all frames. Subtract 2.0 CM (0.79 In.) to obtain invert depth.
2. Active hydraulic area is from bottom of grate to the invert for both Flow Capacity and Storage Capacity.
   Interceptor has 1.9 CM (0.75 In.) greater depth for both flow and storage.
3. Flow capacity is calculated at the deep end using Manning's Equation with roughness factor n = 0.010.
4. To calculate flow for sloped sites, $\mathbf{Q_{SLOPED} = Q_{FLAT} * 12.91 * (S_S + S_C)^{0.50}}$ for all units.
   S_C = 0.006 = 0.6% for all xx0 channels and 0.0 for all xx1 channels.

Table 5
Hydraulic Capacities
MD Series

Section Length = 2 M		MD200						MD300					
Sect.	Trench Depth		Flat Site Flow Cap.			Storage Cap. / 2 M Sect.			Flat Site Flow Cap.			Storage Cap. / 2 M Sect.	
No.	CM	In.	CFS	LPS	GPM	Cu. Ft.	Gal	L	CFS	LPS	GPM	Cu. Ft.	Gal	L
06	6.0	2.36	0.12	3.36	53.3	0.25	1.86	7.03	-	-	-	-	-	-
08	8.0	3.15	0.24	6.90	109	0.49	3.68	13.9	0.22	6.28	99.5	0.32	2.40	9.1
10	10	3.94	0.39	11.0	174	0.72	5.37	20.3	0.43	12.3	195	0.81	6.07	23.0
12	12	4.72	0.54	15.4	243	0.94	7.05	26.7	0.68	19.4	307	1.15	8.60	32.6
14	14	5.51	0.71	20.0	317	1.17	8.76	33.2	0.96	27.2	431	1.49	11.1	42.1
16	16	6.30	0.92	26.0	412	1.43	10.7	40.5	1.25	35.5	563	1.83	13.7	51.7
18	18	7.09	1.13	32.1	509	1.72	12.8	48.6	1.56	44.2	700	2.16	16.2	61.3
20	20	7.87	1.36	38.4	609	2.00	15.0	56.7	1.87	53.1	841	2.50	18.7	70.9
22	22	8.66	1.58	44.8	709	2.29	17.1	64.9	2.22	63.0	997	2.86	21.4	80.9
24	24	9.45	1.81	51.2	811	2.58	19.3	73.0	2.64	74.7	1184	3.26	24.4	92.2
26	26	10.2	2.04	57.7	914	2.86	21.4	81.1	3.06	86.7	1374	3.69	27.6	104
28	28	11.0	2.27	64.2	1018	3.15	23.6	89.3	3.49	98.9	1567	4.12	30.8	117
30	30	11.8	2.50	70.8	1122	3.44	25.7	97.4	3.93	111	1763	4.55	34.0	129
32	32	12.6	2.73	77.4	1227	3.73	27.9	106	4.37	124	1961	4.98	37.2	141
34	34	13.4	2.97	84.0	1332	4.01	30.0	114	4.81	136	2160	5.41	40.5	153
36	36	14.2	3.20	90.7	1437	4.30	32.2	122	5.26	149	2360	5.84	43.7	165
38	38	15.0	3.44	97.4	1543	4.59	34.3	130	5.71	162	2562	6.27	46.9	178
40	40	15.7	3.67	104	1649	4.87	36.5	138	6.16	175	2765	6.70	50.1	190
42	42	16.5	3.91	111	1755	5.16	38.6	146	6.62	187	2969	7.13	53.3	202
44	44	17.3	4.15	117	1861	5.45	40.8	154	7.07	200	3173	7.56	56.6	214
46	46	18.1	4.38	124	1967	5.74	42.9	162	7.53	213	3378	7.99	59.8	226
48	48	18.9	4.62	131	2074	6.02	45.0	171	7.99	226	3584	8.42	63.0	239
50	50	19.7	4.86	138	2181	6.31	47.2	179	8.45	239	3790	8.85	66.2	251
52	52	20.5	-	-	-	-	-	-	8.91	252	3997	9.28	69.4	263
54	54	21.3	-	-	-	-	-	-	9.37	265	4204	9.71	72.7	275
56	56	22.0	-	-	-	-	-	-	9.83	278	4412	10.1	75.9	287
58	58	22.8	-	-	-	-	-	-	10.3	292	4620	10.6	79.1	300
60	60	23.6	-	-	-	-	-	-	10.8	305	4828	11.0	82.3	312
62	62	24.4	-	-	-	-	-	-	11.2	318	5036	11.4	85.5	324
64	64	25.2	-	-	-	-	-	-	11.7	331	5245	11.9	88.8	336
66	66	26.0	-	-	-	-	-	-	12.2	344	5454	12.3	92.0	348
68	68	26.8	-	-	-	-	-	-	12.6	357	5663	12.7	95.2	360
70	70	27.6	-	-	-	-	-	-	13.1	371	5872	13.2	98.4	373

Notes:

1. Trench Depth is from top of grate (finished surface) to the invert at the deep end of each 2 M section.
2. Active hydraulic area is from the grate seat to the invert for both Flow Capacity and Storage Capacity.
3. Flow capacity is calculated at the deep end using Manning's Equation with roughness factor n = 0.013.
4. To calculate flow for sloped sites, **$Q_{SLOPED} = Q_{FLAT} * 10 * (S_S + S_C)$^0.5** for all units**.**
   S_C = 0.01 = 1.0% for all sections. Do not use equation for storage capacity.

Table 6
Hydraulic Capacities
HD Series

Section Length = 2 M			HD200						HD300					
Sect.	Trench Depth		Flat Site Flow Cap.			Storage Cap. / 2 M Sect.			Flat Site Flow Cap.			Storage Cap. / 2 M Sect.		
No.	CM	In.	CFS	LPS	GPM	Cu. Ft.	Gal	L	CFS	LPS	GPM	Cu. Ft.	Gal	L
06	6.0	2.36	-	-	-	-	-	-	-	-	-	-	-	-
08	8.0	3.15	-	-	-	-	-	-	-	-	-	-	-	-
10	10	3.94	-	-	-	-	-	-	-	-	-	-	-	-
12	12	4.72	0.35	9.8	155	0.39	2.90	11.0	0.42	11.8	187	0.48	3.58	13.6
14	14	5.51	0.50	14.2	224	0.89	6.63	25.1	0.66	18.8	298	1.13	8.4	31.9
16	16	6.30	0.66	18.7	297	1.11	8.3	31.5	0.94	26.6	421	1.47	11.0	41.5
18	18	7.09	0.83	23.4	371	1.34	10.0	37.9	1.23	34.9	553	1.80	13.5	51.1
20	20	7.87	1.04	29.5	467	1.59	11.9	45.1	1.54	43.5	690	2.14	16.0	60.6
22	22	8.66	1.26	35.7	566	1.88	14.1	53.3	1.85	52.4	831	2.48	18.5	70.2
24	24	9.45	1.48	42.0	666	2.17	16.2	61.4	2.18	61.7	977	2.82	21.1	79.9
26	26	10.2	1.71	48.4	768	2.45	18.4	69.5	2.59	73.4	1163	3.21	24.0	91
28	28	11.0	1.94	54.9	870	2.74	20.5	77.7	3.01	85.4	1353	3.64	27.2	103
30	30	11.8	2.17	61.4	973	3.03	22.7	85.8	3.44	98	1546	4.07	30.4	115
32	32	12.6	2.40	68.0	1077	3.32	24.8	94	3.88	110	1741	4.50	33.7	127
34	34	13.4	2.63	74.6	1182	3.60	27.0	102	4.32	122	1939	4.93	36.9	140
36	36	14.2	2.87	81.2	1287	3.89	29.1	110	4.76	135	2138	5.36	40.1	152
38	38	15.0	3.10	87.8	1392	4.18	31.2	118	5.21	148	2338	5.79	43.3	164
40	40	15.7	3.34	95	1497	4.46	33.4	126	5.66	160	2540	6.22	46.5	176
42	42	16.5	3.57	101	1603	4.75	35.5	135	6.11	173	2742	6.65	49.8	188
44	44	17.3	3.81	108	1709	5.04	37.7	143	6.57	186	2946	7.08	53.0	201
46	46	18.1	4.05	115	1815	5.33	39.8	151	7.02	199	3150	7.51	56.2	213
48	48	18.9	4.28	121	1922	5.61	42.0	159	7.48	212	3356	7.94	59.4	225
50	50	19.7	4.52	128	2028	5.90	44.1	167	7.94	225	3561	8.38	62.6	237
52	52	20.5	4.758	134.7	2135	6.1863	46.274	175.2	8.40	238	3767	8.81	65.9	249
54	54	21.3	4.996	141.5	2242	6.4734	48.421	183.33	8.86	251	3974	9.24	69.1	262
56	56	22.0	5.234	148.2	2349	6.7604	50.568	191.46	9.32	264	4181	9.7	72.3	274
58	58	22.8	5.472	155	2455	7.0475	52.715	199.58	9.8	277	4389	10.1	75.5	286
60	60	23.6	5.711	161.7	2562	7.3345	54.862	207.71	10.2	290	4596	10.5	78.8	298
62	62	24.4	-	-	-	-	-	-	10.7	303	4805	11.0	82.0	310
64	64	25.2	-	-	-	-	-	-	11.2	316	5013	11.4	85.2	323
66	66	26.0	-	-	-	-	-	-	11.6	330	5222	11.8	88.4	335
68	68	26.8	-	-	-	-	-	-	12.1	343	5430	12.3	91.6	347
70	70	27.6	-	-	-	-	-	-	12.6	356	5640	12.7	94.9	359

Notes:

1. Trench Depth is from top of grate (finished surface) to the invert at the deep end of each 2 M section.
2. Active hydraulic area is from the grate seat to the invert for both Flow Capacity and Storage Capacity.
3. Flow capacity is calculated at the deep end using Manning's Equation with roughness factor n = 0.013.
4. To calculate flow for sloped sites, $\mathbf{Q_{SLOPED} = Q_{FLAT} * 10 * (S_S + S_C)^{0.5}}$ for all units.
   S_C = 0.01 = 1.0% for all sections. Do not use equation for storage capacity.

Table 7
Hydraulic Capacities
TF-14 Series

Section Length = 8'			TF-14					
Section	Trench Depth		Flat Site Flow Cap.			Storage Cap. / 8 Ft. Sect.		
Number	CM	In.	CFS	LPS	GPM	Ft^3	Gal	L
7	17.8	7.00	1.30	37.3	591	2.54	19.0	71.9
8	20	8.00	1.80	51.04	809	3.21	24.0	90.8
8N	20	8.00	-	-	-	3.48	26.0	98.4
9	23	9.00	2.30	75.7	1038	3.88	29.0	110
10	25	10.00	2.80	91.3	1274	4.55	34.0	129
11	28	11.00	3.40	107.1	1516	5.21	39.0	148
12	30	12.00	3.90	123.2	1762	5.88	44.0	167
12N	30	12.00	-	-	-	3.07	23.0	87
13	33	13.00	4.50	139.5	2012	6.55	49.0	185
14	36	14.0	5.00	155.9	2264	7.22	54.0	204
15	38	15.0	5.60	172.5	2519	7.89	59.0	223
16	41	16.0	6.20	189.1	2775	8.42	63.0	238
16N	41	16.0	-	-	-	8.82	66.0	250
17	43	17.0	6.80	205.8	3034	9.09	68.0	257
18	46	18.0	7.30	222.6	3293	9.76	73.0	276
19	48	19.0	7.90	239.4	3553	10.4	78.0	295
20	51	20.0	8.50	256.3	3815	11.1	83.0	314
20N	51	20.0	-	-	-	11.5	86.0	326
21	53	21.0	9.10	273	4077	11.8	88.0	333
22	56	22.0	9.70	290	4340	12.4	93.0	352
23	58	23.0	10.3	307	4604	13.1	98.0	371
24	61	24.0	10.8	324	4868	13.8	103	390
24N	61	24.0	-	-	-	14.2	106	401
25	64	25.0	11.4	341	5133	14.4	108	409
26	66	26.0	12.0	358	5398	15.1	113	428
27	69	27.0	12.6	376	5664	15.8	118	447
27N	69	27.0	-	-	-	16.0	120	454

Notes:

1. Trench Depth is the distance from top of grate (finished surface) to the invert at the deep end of each 8 foot section.
2. The active hydraulic area is that between the grate seat and the invert in both Flow Capacity and Storage Capacity.
3. Flow capacity is calculated at the deep end using Manning's Equation with a roughness factor of n = 0.013.
4. To calculate flow for sloped sites, $\mathbf{Q_{SLOPED} = Q_{FLAT} * 10 * (S_S + S_C)\text{^}0.5}$ for all units**.** S_C = 0.01 = 1.0% for all sections. Do not use equation for storage capacity.

G. Trench Length Required Based on Grate Inflow for Triangular Gutter Flow

Previous standards for the determination of the length or amount of trench required to intercept the design flow in triangular gutter flow had been calculated based on the Federal Highway Administration (FHWA) guidelines, HEC 12/22, for slotted inlets. Their testing indicated that for slotted inlets with slot widths ≥ 1.75 in, the following equation may be used for length of drain required:

Equation 8

$$L_{Required} = K_C * Q^{0.42} * S_L^{0.3} * [\ 1 / (n * S_X)\ ]^{0.6}$$

Where:

K_c = 0.6 English Units (0.817 Metric)
Q = Gutter Flow
n = Manning's Roughness Coefficient for Pavement
S_L = Longitudinal Slope
S_X = Transverse Slope

ABT, Inc. has conducted independent laboratory testing of the Interceptor A-67 grate and the test results have determined that the interception capacity of the Interceptor A-67 style grate far exceeds that of the FHWA's capacity calculations for slotted inlets.

The above FHWA formula may be used for a more conservative estimate of trench length required. However, whenever determination of trench length required is calculated, consideration should be given to available outlet locations. In many cases, it is more economical and feasible to continue the trench length beyond required length to that of an available outlet location.

Diagram 3 and Diagram 4 graph the ability of the Interceptor A-67 grate to remove water from a right triangular shaped gutter at different roadbed slopes. Follow the instructions on the diagrams to obtain the trench length required to remove the designed quantity of water with A-67 grates. Adjust this length using Equation 6 for other style grates. Gutters that are not right triangles but can be broken into 2 right triangular flow areas can use Diagram 3 and 4 to solve each triangle separately and then combine the trench length results for the total required length. *If longitudinal slope (**S_L**) is less than 1%, use 0.3 cfs per linear foot for A-67 grate inflow capacity.*

Sufficient water should be removed from the gutter to prevent the spread from exceeding the allowable before the next drainage system begins. Also, the hydraulic load from the watershed area created by the length of the run should be added to the total load for the trench to drain.

Diagram 3
A-67 Grate Inflow Capacity
(Ft)

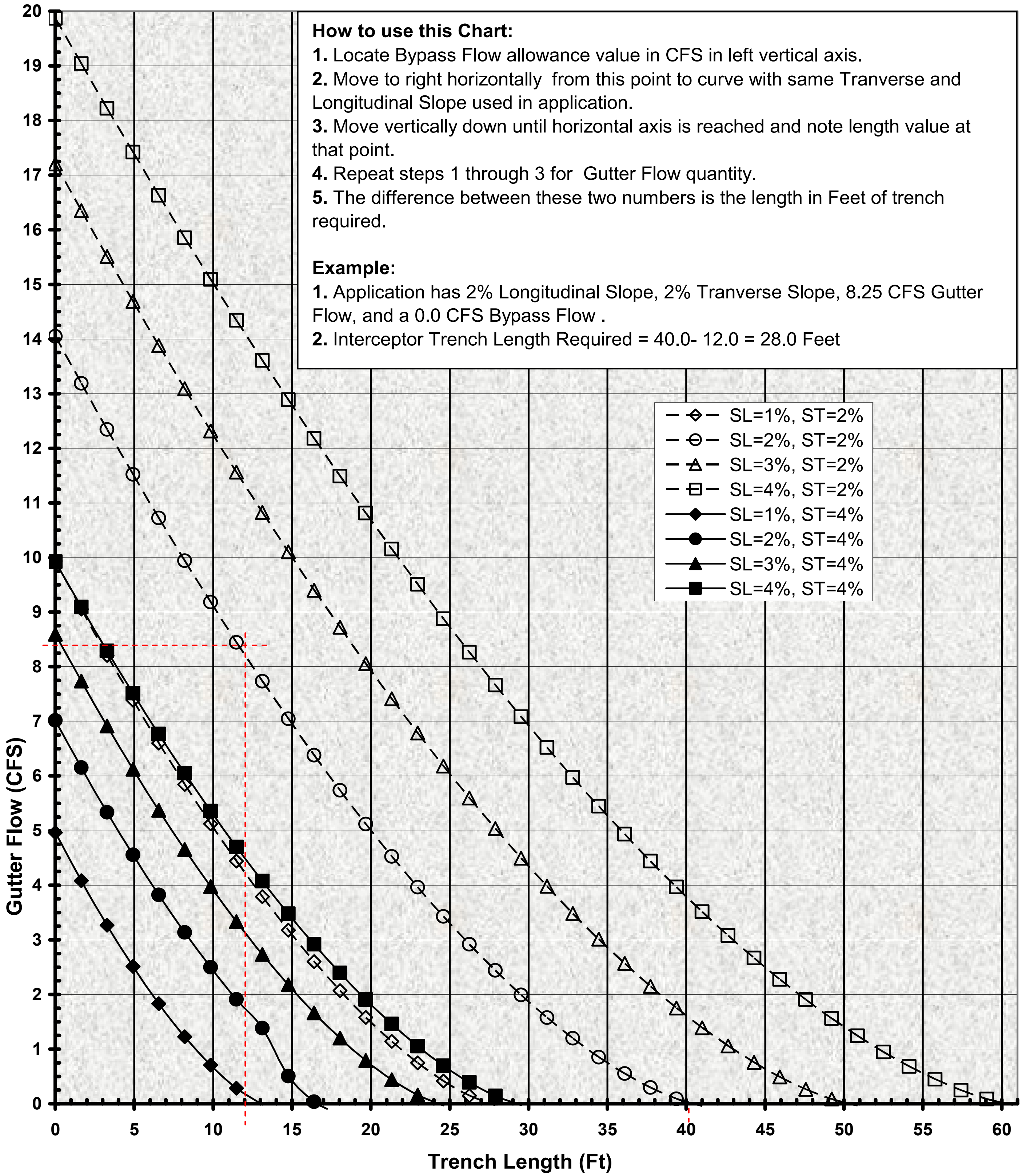
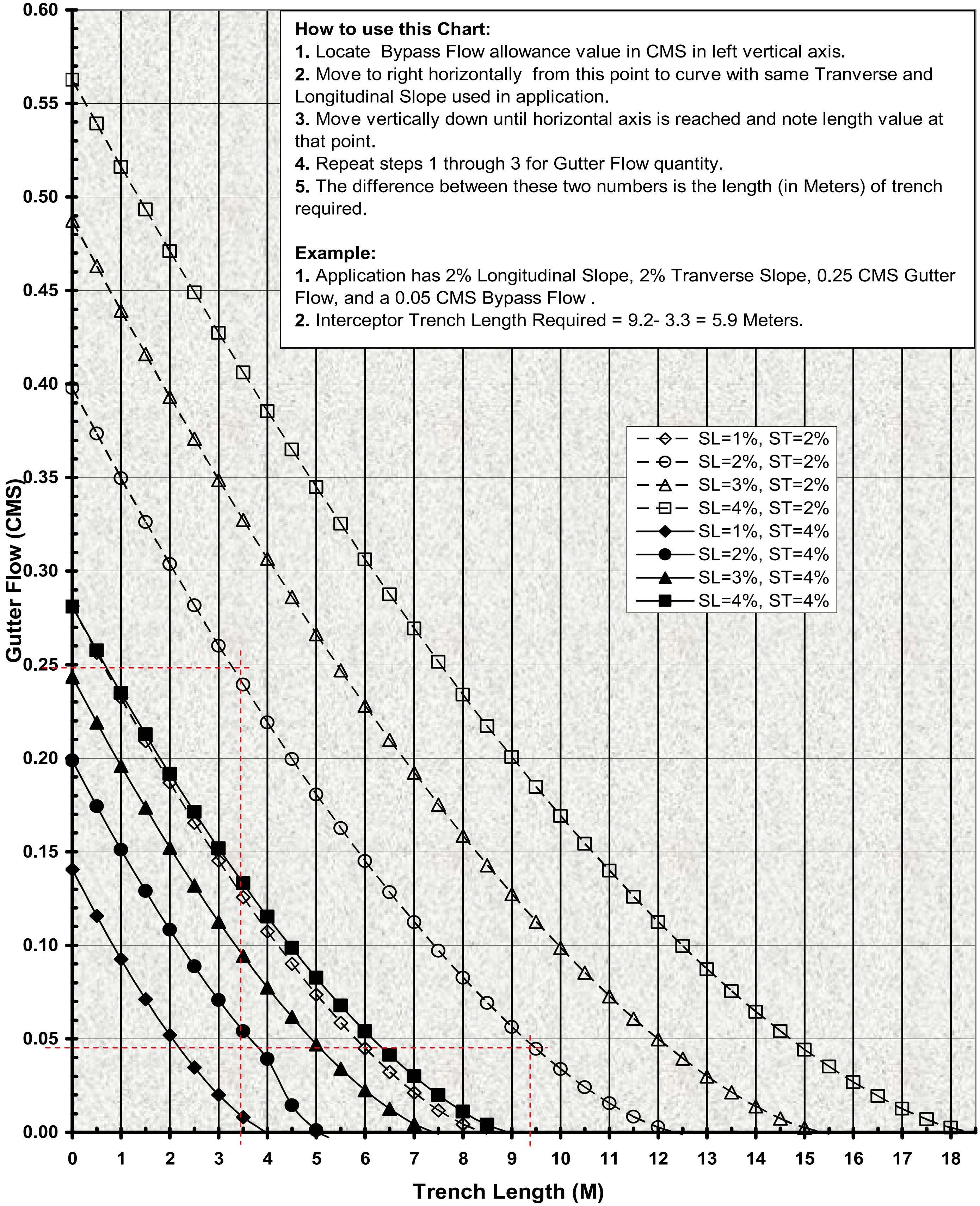


Diagram 4
A-67 Grate Inflow Capacity
(Meters)



H. System Discharge Capacity

If the trench flow discharges directly into a pipe or into an ABT catch basin or other which then discharges into a pipe, the minimum pipe connection size must be determined.

The generally accepted equation for determining the inlet capacity into an opening is shown in Equation 3. This equation was used to create Tables 8 through 11. The calculation basis used to generate a table typically appears in that's table's notes.

The pipe size required for the discharge load from the catch basin or channel is often larger than the minimum connection size. Insufficient capacity in this pipe is a common problem. Like a chain, a drainage system is as good as its weakest link. Information to size this pipe is available from the pipe manufactures and in HEC22.

Channels #021, #050, #091, #096, #100, #150, #191, #200, #250, #291, and #300 have a cut out guide molded into their bottom surfaces for the installation of a 4" round and 6" oval pipe adapter. All channels can be modified to accept the 8" and 12" size pipe adapter. Select the Table with the desired discharge flow units. Find the discharge channel number in the leftmost column. If A-67 grates are being used, select a channel number that is 5 greater than actual. If 2564 Series grates are being used, select a channel number that is 10 greater to obtain actual discharge capacity. Move to the right on this row until the discharge flow capacity is equal to or greater than the required discharge capacity. Read pipe size in the header of that column for the minimum pipe size required. If discharge capacity is not sufficient, a catch basin must be used.

Table 8 4" (100 mm) PolyDrain System - Channel Discharge Capacity -Vertical Pipe Outlet (GPM)

Table 9 4" (100 mm) PolyDrain System - Channel Discharge Capacity -Vertical Pipe Outlet (CFS)

Table 10 4" (100 mm) PolyDrain System - Channel Discharge Capacity -Vertical Pipe Outlet (LPS)

Table 11 4" (100 mm) PolyDrain System - Channel Discharge Capacity -Vertical Pipe Outlet (CMH)

Table 12 4" (100 mm) PolyDrain Channel - Horizontal Discharge Capacity

Channels #050, #100, #150, #200, #250, and #300 have end plates available that have 4" round or 6" oval size stub pipe installed. This table is read the same as tables above.

Table 13
PolyDrain Special Products
Vertical Discharge Capacity

This table is read the same as other Discharge Tables. Suitable pipe diameters are listed within the table. If the discharge capacity for all the available pipe sizes is less than the hydraulic load in the channel, a catch basin or multiple outlets will be required.

Table - 8
4" (100 mm) PolyDrain System - Channel Discharge Capacity - Vertical Pipe Outlet
(GPM)

Chan. Size	Ø 4"	Ø 6"	Ø 8"	Ø 12"	Size	Ø 4"	Ø 6"	Ø 8"	Ø 12"	Size	Ø 4"	Ø 6"	Ø 8"	Ø 12"
010	-	-	591	1300	010 PWI	-	-	823	1809	010 PWII	-	-	1154	2538
020	-	-	609	1340	020 PWI	-	-	836	1838	020 PWII	-	-	1163	2559
030	-	-	627	1379	030 PWI	-	-	849	1867	030 PWII	-	-	1173	2579
040	-	-	644	1416	040 PWI	-	-	861	1895	040 PWII	-	-	1182	2600
050	165	337	661	1453	050 PWI	219	445	874	1922	050 PWII	298	607	1191	2620
060	-	-	677	1489	060 PWI	-	-	886	1950	060 PWII	-	-	1200	2640
070	-	-	693	1524	070 PWI	-	-	899	1977	070 PWII	-	-	1209	2660
080	-	-	709	1558	080 PWI	-	-	911	2003	080 PWII	-	-	1218	2680
090	-	-	724	1592	090 PWI	-	-	923	2029	090 PWII	-	-	1227	2699
100	185	376	739	1625	100 PWI	234	476	934	2055	100 PWII	310	630	1236	2719
110	-	-	753	1657	110 PWI	-	-	946	2081	110 PWII	-	-	1245	2738
120	-	-	768	1689	120 PWI	-	-	957	2106	120 PWII	-	-	1254	2757
130	-	-	782	1720	130 PWI	-	-	969	2131	130 PWII	-	-	1262	2776
140	-	-	796	1750	140 PWI	-	-	980	2156	140 PWII	-	-	1271	2795
150	203	412	809	1780	150 PWI	248	505	991	2180	150 PWII	320	652	1279	2814
160	-	-	823	1809	160 PWI	-	-	1002	2204	160 PWII	-	-	1288	2833
170	-	-	836	1838	170 PWI	-	-	1013	2228	170 PWII	-	-	1296	2852
180	-	-	849	1867	180 PWI	-	-	1024	2251	180 PWII	-	-	1305	2870
190	-	-	861	1895	190 PWI	-	-	1034	2275	190 PWII	-	-	1313	2888
200	219	445	874	1922	200 PWI	262	532	1045	2298	200 PWII	331	673	1321	2907
210	-	-	886	1950	210 PWI	-	-	1055	2321	210 PWII	-	-	1330	2925
220	-	-	899	1977	220 PWI	-	-	1065	2343	220 PWII	-	-	1338	2943
230	-	-	911	2003	230 PWI	-	-	1076	2366	230 PWII	-	-	1346	2961
240	-	-	923	2029	240 PWI	-	-	1086	2388	240 PWII	-	-	1354	2978
250	234	476	934	2055	250 PWI	274	558	1096	2410	250 PWII	341	694	1362	2996
260	-	-	946	2081	260 PWI	-	-	1106	2432	260 PWII	-	-	1370	3014
270	-	-	957	2106	270 PWI	-	-	1115	2453	270 PWII	-	-	1378	3031
280	-	-	969	2131	280 PWI	-	-	1125	2475	280 PWII	-	-	1386	3048
290	-	-	980	2156	290 PWI	-	-	1135	2496	290 PWII	-	-	1394	3066
300	248	505	991	2180	300 PWI	287	583	1144	2517	300 PWII	351	714	1402	3083

Notes:
1. Flow calculations exclude head from grate seat to finished surface. Discharge capacity per Q=0.85*Pipe Area*(2*g*H)^0.5 equation.
2. For discharge capacity of non-sloping channels, use value from channels with same first 2 channel numbers. ie. 191 = 190

Table - 9
4" (100 mm) PolyDrain System - Channel Discharge Capacity - Vertical Pipe Outlet
(CFS)

Chan. Size	Ø 4"	Ø 6"	Ø 8"	Ø 12"	Size	Ø 4"	Ø 6"	Ø 8"	Ø 12"	Size	Ø 4"	Ø 6"	Ø 8"	Ø 12"
010	-	-	1.32	2.90	010 PWI	-	-	1.83	4.03	010 PWII	-	-	2.57	5.65
020	-	-	1.36	2.99	020 PWI	-	-	1.86	4.10	020 PWII	-	-	2.59	5.70
030	-	-	1.40	3.07	030 PWI	-	-	1.89	4.16	030 PWII	-	-	2.61	5.75
040	-	-	1.43	3.16	040 PWI	-	-	1.92	4.22	040 PWII	-	-	2.63	5.79
050	0.37	0.75	1.47	3.24	050 PWI	0.49	0.99	1.95	4.28	050 PWII	0.66	1.35	2.65	5.84
060	-	-	1.51	3.32	060 PWI	-	-	1.98	4.34	060 PWII	-	-	2.67	5.88
070	-	-	1.54	3.40	070 PWI	-	-	2.00	4.40	070 PWII	-	-	2.69	5.93
080	-	-	1.58	3.47	080 PWI	-	-	2.03	4.46	080 PWII	-	-	2.71	5.97
090	-	-	1.61	3.55	090 PWI	-	-	2.06	4.52	090 PWII	-	-	2.73	6.01
100	0.41	0.84	1.65	3.62	100 PWI	0.52	1.06	2.08	4.58	100 PWII	0.69	1.40	2.75	6.06
110	-	-	1.68	3.69	110 PWI	-	-	2.11	4.64	110 PWII	-	-	2.77	6.10
120	-	-	1.71	3.76	120 PWI	-	-	2.13	4.69	120 PWII	-	-	2.79	6.14
130	-	-	1.74	3.83	130 PWI	-	-	2.16	4.75	130 PWII	-	-	2.81	6.19
140	-	-	1.77	3.90	140 PWI	-	-	2.18	4.80	140 PWII	-	-	2.83	6.23
150	0.45	0.92	1.80	3.97	150 PWI	0.55	1.13	2.21	4.86	150 PWII	0.71	1.45	2.85	6.27
160	-	-	1.83	4.03	160 PWI	-	-	2.23	4.91	160 PWII	-	-	2.87	6.31
170	-	-	1.86	4.10	170 PWI	-	-	2.26	4.96	170 PWII	-	-	2.89	6.35
180	-	-	1.89	4.16	180 PWI	-	-	2.28	5.02	180 PWII	-	-	2.91	6.39
190	-	-	1.92	4.22	190 PWI	-	-	2.30	5.07	190 PWII	-	-	2.93	6.44
200	0.49	0.99	1.95	4.28	200 PWI	0.58	1.19	2.33	5.12	200 PWII	0.74	1.50	2.94	6.48
210	-	-	1.98	4.34	210 PWI	-	-	2.35	5.17	210 PWII	-	-	2.96	6.52
220	-	-	2.00	4.40	220 PWI	-	-	2.37	5.22	220 PWII	-	-	2.98	6.56
230	-	-	2.03	4.46	230 PWI	-	-	2.40	5.27	230 PWII	-	-	3.00	6.60
240	-	-	2.06	4.52	240 PWI	-	-	2.42	5.32	240 PWII	-	-	3.02	6.64
250	0.52	1.06	2.08	4.58	250 PWI	0.61	1.24	2.44	5.37	250 PWII	0.76	1.55	3.03	6.68
260	-	-	2.11	4.64	260 PWI	-	-	2.46	5.42	260 PWII	-	-	3.05	6.71
270	-	-	2.13	4.69	270 PWI	-	-	2.49	5.47	270 PWII	-	-	3.07	6.75
280	-	-	2.16	4.75	280 PWI	-	-	2.51	5.51	280 PWII	-	-	3.09	6.79
290	-	-	2.18	4.80	290 PWI	-	-	2.53	5.56	290 PWII	-	-	3.11	6.83
300	0.55	1.13	2.21	4.86	300 PWI	0.64	1.30	2.55	5.61	300 PWII	0.78	1.59	3.12	6.87

Notes:
1. Flow calculations exclude head from grate seat to finished surface. Discharge capacity per Q=0.85*Pipe Area*(2*g*H)^0.5 equation.
2. For discharge capacity of non-sloping channels, use value from channels with same first 2 channel numbers. ie. 191 = 190

Table - 10

4" (100 mm) PolyDrain System - Channel Discharge Capacity - Vertical Pipe Outlet

(LPS)

Chan. Size	Ø100mm	150 Oval	Ø200mm	Ø300mm	Size	Ø100mm	150 Oval	Ø200mm	Ø300mm	Size	Ø100mm	150 Oval	Ø200mm	Ø300mm
010	-	-	37.3	82.0	010 PWI	-	-	51.90	114.2	010 PWII	-	-	72.8	160.1
020	-	-	38.4	84.5	020 PWI	-	-	52.73	116.0	020 PWII	-	-	73.4	161.4
030	-	-	39.6	87.0	030 PWI	-	-	53.55	117.8	030 PWII	-	-	74.0	162.7
040	-	-	40.6	89.4	040 PWI	-	-	54.36	119.6	040 PWII	-	-	74.6	164.0
050	10.4	21.2	41.7	91.7	050 PWI	13.8	28.1	55.15	121.3	050 PWII	18.8	38.3	75.2	165.3
060	-	-	42.7	94.0	060 PWI	-	-	55.93	123.0	060 PWII	-	-	75.7	166.6
070	-	-	43.7	96.2	070 PWI	-	-	56.70	124.7	070 PWII	-	-	76.3	167.8
080	-	-	44.7	98.3	080 PWI	-	-	57.47	126.4	080 PWII	-	-	76.9	169.1
090	-	-	45.7	100.4	090 PWI	-	-	58.22	128.0	090 PWII	-	-	77.4	170.3
100	11.7	23.7	46.6	102.5	100 PWI	14.8	30.0	58.96	129.7	100 PWII	19.5	39.7	78.0	171.5
110	-	-	47.5	104.6	110 PWI	-	-	59.69	131.3	110 PWII	-	-	78.6	172.8
120	-	-	48.4	106.5	120 PWI	-	-	60.41	132.9	120 PWII	-	-	79.1	174.0
130	-	-	49.3	108.5	130 PWI	-	-	61.13	134.5	130 PWII	-	-	79.6	175.2
140	-	-	50.2	110.4	140 PWI	-	-	61.84	136.0	140 PWII	-	-	80.2	176.4
150	12.8	26.0	51.1	112.3	150 PWI	15.7	31.9	62.54	137.5	150 PWII	20.2	41.1	80.7	177.6
160	-	-	51.9	114.2	160 PWI	-	-	63.23	139.1	160 PWII	-	-	81.3	178.7
170	-	-	52.7	116.0	170 PWI	-	-	63.91	140.6	170 PWII	-	-	81.8	179.9
180	-	-	53.6	117.8	180 PWI	-	-	64.59	142.1	180 PWII	-	-	82.3	181.1
190	-	-	54.4	119.6	190 PWI	-	-	65.26	143.5	190 PWII	-	-	82.9	182.2
200	13.8	28.1	55.2	121.3	200 PWI	16.5	33.6	65.92	145.0	200 PWII	20.9	42.5	83.4	183.4
210	-	-	55.9	123.0	210 PWI	-	-	66.57	146.4	210 PWII	-	-	83.9	184.5
220	-	-	56.7	124.7	220 PWI	-	-	67.22	147.9	220 PWII	-	-	84.4	185.7
230	-	-	57.5	126.4	230 PWI	-	-	67.87	149.3	230 PWII	-	-	84.9	186.8
240	-	-	58.2	128.0	240 PWI	-	-	68.50	150.7	240 PWII	-	-	85.4	187.9
250	14.8	30.0	59.0	129.7	250 PWI	17.3	35.2	69.14	152.1	250 PWII	21.5	43.8	85.9	189.0
260	-	-	59.7	131.3	260 PWI	-	-	69.76	153.4	260 PWII	-	-	86.5	190.1
270	-	-	60.4	132.9	270 PWI	-	-	70.38	154.8	270 PWII	-	-	87.0	191.2
280	-	-	61.1	134.5	280 PWI	-	-	71.00	156.2	280 PWII	-	-	87.4	192.3
290	-	-	61.8	136.0	290 PWI	-	-	71.61	157.5	290 PWII	-	-	87.9	193.4
300	15.7	31.9	62.5	137.5	300 PWI	18.1	36.8	72.21	158.8	300 PWII	22.1	45.1	88.4	194.5

Notes:
1. Flow calculations exclude head from grate seat to finished surface. Discharge capacity per Q=0.85*Pipe Area*(2*g*H)^0.5 equation.
2. For discharge capacity of non-sloping channels, use value from channels with same first 2 channel numbers. ie. 191 = 190

Table - 11

4" (100 mm) PolyDrain System - Channel Discharge Capacity - Vertical Pipe Outlet

(CMH)

Chan. Size	Ø100mm	150 Oval	Ø200mm	Ø300mm	Size	Ø100mm	150 Oval	Ø200mm	Ø300mm	Size	Ø100mm	150 Oval	Ø200mm	Ø300mm
010	-	-	134	295	010 PWI	-	-	187	411	010 PWII	-	-	262	577
020	-	-	138	304	020 PWI	-	-	190	418	020 PWII	-	-	264	581
030	-	-	142	313	030 PWI	-	-	193	424	030 PWII	-	-	266	586
040	-	-	146	322	040 PWI	-	-	196	430	040 PWII	-	-	268	591
050	37.6	76.5	150	330	050 PWI	49.7	101	199	437	050 PWII	67.8	138	271	595
060	-	-	154	338	060 PWI	-	-	201	443	060 PWII	-	-	273	600
070	-	-	157	346	070 PWI	-	-	204	449	070 PWII	-	-	275	604
080	-	-	161	354	080 PWI	-	-	207	455	080 PWII	-	-	277	609
090	-	-	164	362	090 PWI	-	-	210	461	090 PWII	-	-	279	613
100	42.0	85.5	168	369	100 PWI	53.2	108	212	467	100 PWII	70.3	143	281	618
110	-	-	171	376	110 PWI	-	-	215	473	110 PWII	-	-	283	622
120	-	-	174	384	120 PWI	-	-	217	478	120 PWII	-	-	285	626
130	-	-	178	391	130 PWI	-	-	220	484	130 PWII	-	-	287	631
140	-	-	181	398	140 PWI	-	-	223	490	140 PWII	-	-	289	635
150	46.0	93.7	184	404	150 PWI	56.4	115	225	495	150 PWII	72.8	148	291	639
160	-	-	187	411	160 PWI	-	-	228	501	160 PWII	-	-	293	643
170	-	-	190	418	170 PWI	-	-	230	506	170 PWII	-	-	294	648
180	-	-	193	424	180 PWI	-	-	233	511	180 PWII	-	-	296	652
190	-	-	196	430	190 PWI	-	-	235	517	190 PWII	-	-	298	656
200	49.7	101	199	437	200 PWI	59.4	121	237	522	200 PWII	75.2	153	300	660
210	-	-	201	443	210 PWI	-	-	240	527	210 PWII	-	-	302	664
220	-	-	204	449	220 PWI	-	-	242	532	220 PWII	-	-	304	668
230	-	-	207	455	230 PWI	-	-	244	537	230 PWII	-	-	306	672
240	-	-	210	461	240 PWI	-	-	247	542	240 PWII	-	-	308	677
250	53.2	108	212	467	250 PWI	62.3	127	249	547	250 PWII	77.5	158	309	681
260	-	-	215	473	260 PWI	-	-	251	552	260 PWII	-	-	311	685
270	-	-	217	478	270 PWI	-	-	253	557	270 PWII	-	-	313	688
280	-	-	220	484	280 PWI	-	-	256	562	280 PWII	-	-	315	692
290	-	-	223	490	290 PWI	-	-	258	567	290 PWII	-	-	317	696
300	56.4	115	225	495	300 PWI	65.1	132	260	572	300 PWII	79.7	162	318	700

Notes:
1. Flow calculations exclude head from grate seat to finished surface. Discharge capacity per Q=0.85*Pipe Area*(2*g*H)^0.5 equation.
2. For discharge capacity of non-sloping channels, use value from channels with same first 2 channel numbers. ie. 191 = 190

Table 12
4" (100) PolyDrain System
Channel Discharge Capacity - Horizontal Pipe Outlet

Channel Number	FLOW = GPM		FLOW = CFS		FLOW = LPS		FLOW = CMH	
	4" Dia.	6" Oval	4" Dia.	6" Oval	100mm Dia.	150mm Oval	100mm Dia.	150mm Oval
050	124.2	-	0.277	-	7.83	-	28.2	-
100	148.9	-	0.332	-	9.40	-	33.8	-
150	170.1	-	0.379	-	10.73	-	38.6	-
200	188.9	317.4	0.421	0.707	11.92	20.03	42.9	72.10
250	206.0	354.8	0.459	0.791	13.00	22.39	46.8	80.60
300	221.8	388.7	0.494	0.866	13.99	24.52	50.4	88.3
050 PWI	236.5	419.8	0.527	0.935	14.92	26.49	53.73	95.36
100 PWI	250.4	448.7	0.558	1.000	15.80	28.32	56.88	101.94
150 PWI	263.5	476.0	0.587	1.060	16.63	30.03	59.86	108.12
200 PWI	276.0	501.7	0.615	1.118	17.42	31.66	62.71	113.97
250 PWI	288.0	526.2	0.642	1.172	18.17	33.20	65.43	119.5
300 PWI	299.5	549.6	0.667	1.225	18.90	34.68	68.04	124.8
050 PWII	310.6	572.0	0.692	1.274	19.60	36.09	70.55	129.94
100 PWII	321.3	593.6	0.716	1.323	20.27	37.46	72.98	134.84
150 PWII	331.6	614.4	0.739	1.369	20.93	38.77	75.33	139.57
200 PWII	341.6	634.5	0.761	1.414	21.56	40.04	77.61	144.15
250 PWII	351.4	654.1	0.783	1.457	22.17	41.27	79.82	148.58
300 PWII	360.9	673.0	0.804	1.500	22.77	42.47	81.98	152.9

Table 13
PolyDrain Special Products
Vertical Pipe Discharge Capacity

Channel Number	FLOW = GPM			FLOW = CFS			FLOW = LPS			FLOW = CMH		
	4" Dia.	6" Dia.	8" Dia.	4" Dia.	6" Dia.	8" Dia.	100mm	150mm	200mm	100mm	150mm	200mm
850	216.6	500.7	-	0.483	1.116	-	13.67	31.53	-	49.2	113.7	-
860	264.0	610.1	1058	0.588	1.359	2.356	16.66	38.5	66.68	60.0	138.6	240.0
870	265.3	613.2	1064	0.591	0.366	2.368	16.74	38.63	67.2	60.3	139.3	241.4
Piccolo 1.08	106.1	-	-	0.236	-	-	6.697	-	-	24.1	-	-
Piccolo 1.10	126.3	-	-	0.281	-	-	7.971	-	-	28.7	-	-
PolySelf	153.2	-	-	0.341	-	-	9.666	-	-	34.8	-	-

Table 14
PolyDrain Special Products
Horizontal Pipe Discharge Capacity

Channel Number	FLOW = GPM		FLOW = CFS		FLOW = LPS		FLOW = CMH	
	6" DIA	8" DIA	6" DIA	8" DIA	150mm	200mm	150mm	200mm
850	394.5	-	0.879	-	24.89	-	89.62	-
860	526.5	860.9	1.173	1.918	33.22	54.33	119.6	195.6
870	530.1	867.5	1.181	1.933	33.45	54.74	120.4	197.1

Notes:

1. 6" oval is fabricated from Sch 35 pipe.
2. Flow is based upon inlet flow control and is calculated by using the formula $Q = 0.85*Area*(2*g*H)^{1/2}$.
3. Vertical discharge hydraulic head "H" is measured from channel invert to grate seat surface. Grate seat area is excluded for both vertical and horizontal discharge conditions.
4. Horizontal discharge hydraulic head "H" is measured from center of discharge pipe to grate seat surface. Discharge pipe invert is same elevation as channel invert.

Table 14
PolyDrain Special Products
Horizontal Discharge Capacity

This table is read the same as other Discharge Tables.

Table 15
4” (100 mm) PolyDrain Catch Basin
Discharge Capacity

Select a 600 or 900 Series catch basin that satisfies the application’s other requirements. Select the Table Section in the appropriate units and verify that the selected catch basin has sufficient capacity. If not, another style or multiple catch basins may be required.

EPS Foam Outlet

EPS foam outlets are available for both PolyDrain and Trench Former. EPS adapters to connect an 8” or 12” pipe to the bottom of PolyDrain channels are available as standard. Horizontal forms or adapters to connect a PolyDrain or Trench Former run to a structure are available on a custom basis. The EPS Outlet is especially useful when special requirements exist and standard components will not satisfy design requirements.

Table 15
4" (100 mm) PolyDrain Catch Basin
Maximum System Discharge Capacity

Flow = GPM

PolyDrain	Head = Pipe Diameter						Head = Bottom of Grate						
Catch Basin	SDR 35 Pipe Dia. (In.)				RCP Dia.(In.)		SDR 35 Pipe Dia. (In.)					RCP Dia.(In.)	
Model No.	4	6	8	10	12	15	4	6	8	10	12	15	18
609	154.2	424.8	872.1	1524	-	-	267.0	600.8	1068	1669	-	-	-
610	154.2	424.8	872.1	1524	2403	4198	422.2	950.0	1689	2639	3800	5937	-
611	154.2	424.8	872.1	1524	2403	4198	531.3	1195	2125	3320	4781	7471	-
900	154.2	424.8	872.1	1524	2403	4198	353.2	795	1413	2208	3179	4968	-
900 + A-67	154.2	424.8	872.1	1524	2403	4198	363.2	817	1453	2270	3269	5107	-
900 + A-68	154.2	424.8	872.1	1524	2403	4198	372.9	839.0	1492	2331	3356	5244	-

Flow = CFS

PolyDrain	Head = Pipe Diameter						Head = Bottom of Grate						
Catch Basin	SDR 35 Pipe Dia. (In.)				RCP Dia.(In.)		SDR 35 Pipe Dia. (In.)					RCP Dia.(In.)	
Model No.	4	6	8	10	12	15	4	6	8	10	12	15	18
609	0.34	0.95	1.94	3.39	-	-	0.59	1.34	2.38	3.72	-	-	-
610	0.34	0.95	1.94	3.39	5.35	9.35	0.94	2.12	3.76	5.88	8.47	13.2	-
611	0.34	0.95	1.94	3.39	5.35	9.35	1.18	2.66	4.74	7.40	10.7	16.6	-
900	0.34	0.95	1.94	3.39	5.35	9.35	0.79	1.77	3.15	4.92	7.1	11.1	-
900 + A-67	0.34	0.95	1.94	3.39	5.35	9.35	0.81	1.82	3.24	5.06	7.3	11.4	-
900 + A-68	0.34	0.95	1.94	3.39	5.35	9.35	0.83	1.87	3.32	5.19	7.48	11.7	-

Flow = LPS

PolyDrain	Head = Pipe Diameter						Head = Bottom of Grate						
Catch Basin	Nom. SDR 35 Pipe Dia. (mm)				RCP Dia.(mm)		Nom. SDR 35 Pipe Dia. (mm)					RCP Dia.(mm)	
Model No.	100	150	200	250	320	380	100	150	200	250	320	380	450
609	9.7	26.8	55.0	96.1	-	-	16.9	37.9	67.4	105	-	-	-
610	9.7	26.8	55.0	96.1	152	265	26.6	59.9	107	167	240	375	-
611	9.7	26.8	55.0	96.1	152	265	33.5	75.4	134	210	302	471	-
900	9.7	26.8	55.0	96.1	152	265	22.3	50.2	89	139	201	313	-
900 + A-67	9.7	26.8	55.0	96.1	152	265	22.9	51.6	92	143	206	322	-
900 + A-68	9.7	26.8	55.0	96.1	152	265	23.5	52.9	94.1	147	212	331	-

Flow = CMH

PolyDrain	Head = Pipe Diameter						Head = Bottom of Grate						
Catch Basin	Nom. SDR 35 Pipe Dia. (mm)				RCP Dia.(mm)		Nom. SDR 35 Pipe Dia. (mm)					RCP Dia.(mm)	
Model No.	100	150	200	250	320	380	100	150	200	250	320	380	450
609	35.02	96.51	198.1	346.1	-	-	60.66	136.5	242.6	379.1	-	-	-
610	35.02	96.51	198.1	346.1	545.9	953.7	95.91	215.8	383.6	599.4	863.2	1349	-
611	35.02	96.51	198.1	346.1	545.9	953.7	120.7	271.5	482.7	754.3	1086	1697	-
900	35.02	96.51	198.1	346.1	545.9	953.7	80.2	180.6	321.0	501.5	722	1128	-
900 + A-67	35.02	96.51	198.1	346.1	545.9	953.7	82.5	185.6	330.0	515.7	743	1160	-
900 + A-68	35.02	96.51	198.1	346.1	545.9	953.7	84.71	190.6	338.8	529.4	762	1191	-

Notes:

1. Discharge flow capacity based on inlet controlled flow conditions using the formula
   Q = 0.85*Area*(2*g*H)0.5.
2. Hydraulic head measured from center of horizontal discharge pipe to bottom of grate.
3. Discharge pipe invert is at catch basin floor.
4. The Interceptor A-67 Grate adds 30 mm (1.2") to head and the Terminator A-68 Grate adds 60 mm (2.4").

ABT, Inc.
Storage Capacity
Instructions

Catch Basin Storage Capacities- are listed in Table A. Move down the Catch Basin Number column to the desired catch basin or to its components. Move to the right on that line until the desired unit of measure column.

The volume of 600 series catch basins are found by totaling the component's capabilities.

Example: Find the capacity in Gallons of a 611 catch basin with frame.

$V_{Total} = V_{Top\ w/Frame} + V_{Int.} + V_{Bot.}$

= 13.50 Gal. + 12.19 Gal. + 11.65 Gal.

= 37.34 Gallons

Special Products Storage Capacities- are found in Table B using the same method as above. The system volume is calculated by multiplying the volume per length value times the total system length.

Example: Find the storage capacity in Liters for a 30 Meter run of 24" PolyDuct.

V = V (Liters per Meter) x Length of Run (Meters)

= 209.4 (Liters per Meter) x 30 (Meters)

= 6,282 Liters

Flat Site Channel Storage Capacities- are listed in Table 16. The storage capacity for a given channel is found by moving down the Channel Number column until the channel number is found. Move to the right on that line to the appropriate PolyWall section and read the value in the desired volumetric units within that section.

Example: The capacity of a 300 channel with PolyWall II in Liters is 60.36 Liters.

The system storage capacity if calculated by adding together the storage capacity of all the components in the system. If the system has site slope, the storage capacity will be reduced and a detail engineering analysis will be required for accurate results.

Table A
Catch Basin Storage Capacity

Catch Basin Number	Gal.	Cu. Ft.	Liters	Cu. M
600 Top (w/o Frame)	12.17	1.630	46.16	0.046
600 Top (with Frame)	13.50	1.810	51.26	0.051
601 Intermediate	12.19	1.630	46.16	0.046
602 Bottom	11.65	1.560	44.18	0.044
610 Top (w/o Frame)	25.10	3.360	95.16	0.095
610 Top (with Frame)	36.62	4.890	138.5	0.138
900	7.31	0.977	27.67	0.028

Notes:
1. Storage volume does not include grate seat area.
2. Storage capacity will be reduced if installed on sloped sites. Engineering analysis will be required.

Table B
Special Products Storage Capacity

Catch Basin	Vol. Per Lin. Ft.		Vol. Per Lin. M.	
Part Number	Gal.	Cu. Ft.	Liters	Cu. M.
850	3.065	0.410	37.9	0.038
860	7.116	0.951	88.1	0.088
870	11.95	1.597	147.9	0.148
Piccolo 1.08	0.384	0.051	4.76	0.005
Piccolo 1.10	0.551	0.074	6.82	0.007
PolySelf	0.81	0.108	10	0.01
12" PolyDuct	8.26	1.104	102.2	0.102
16" PolyDuct	11.16	1.492	138.2	0.138
20" PolyDuct	14.04	1.877	173.8	0.174
24" PolyDuct	16.91	2.261	209.4	0.209

Appendix A
Equations

Equation 1 – Rational Method , page 5

$$Q=KCIA$$

Q = Hydraulic load
K = Unit conversion factor **Table 1, page 4**
C = Coefficient of runoff **Table 2, page 4**
I = Intensity or average rate at which fluid is being applied to the watershed area. Typically in in/hr.
A = Area of the watershed

Equation 2 – Non A-67 Grate Length Adjustment, page 8

$$L = L_{A\text{-}67}/r$$

L = Adjusted Run Length
r = Grate Area Ratio from **Table 3, page 7**
$L_{A\text{-}67}$ = Run Length **Equation 8, page 19**

Equation 3 – Sheet Flow Grate Inflow, page 9

$$G = Q/L_S$$

G = Sheeting flow from **Table 3, page 7**
Q = Hydraulic load of water shed are from **Equation 1, page 5**
L_S = Total length of grates

Equation 4 –Triangular Gutter Flow Capacity, page 9

$$Q_G = (C_G/n)T^{2.67} S_T^{1.67} S_L^{0.5}$$

Q_G = Gutter Flow (CFS)
n = Manning's Roughness coefficient of Roadway from **Table 2, page 4**
T = Spread (Ft)
S_T = Transverse Slope (Ft/Ft) from road bed geometry
S_L = Longitudinal Slope (Ft/Ft) from road bed geometry
C_G = 0.56 English units or 0.376 Metric units

Equation 5 – Grate Inflow in Orifice Conditions, page 10

$$Q_o = 0.67 A_G (2gH)^{0.5}$$

Q_0 = Orifice Inflow (CFS)
g = Gravitational Constant (32.16 Ft/S^2)
A_G = Grate Inlet Area (Ft^2) from **Table 3, page 7**
H = Fluid Height Over Grate (Ft)

Equation 6 – Manning's Equation

$$Q = (1.486 / n)*A*R^{2/3}*S^{1/2}$$

Q = Flow (CFS)
n = Manning's Roughness Coefficient of Trench surface (**Table 2, page 4**)
A = Cross Sectional Flow Area of Trench (Ft^2)
R = Hydraulic Radius (Ft) **=** Flow Area (Ft^2) ÷ Wetted Perimeter (Ft)
S = Invert Slope (units / units)

Equation 7 – Channel Flow Capacities for Sloped Sites or Custom Trench Former slopes, page 12

$$Q_n = Q / K(S_S+S_C)^{0.5}$$

Q_n = Capacity required for discharge Channel.
Q = Required flow capacity from **Equation 1**.
S_S = Site slope (units / units)
S_C = Channel slope (0.006 for PolyDrain and 0.010 for **Standard** Trench Former And MD/HD systems)

K = $1/S_C^{0.5}$ for custom slopes
4.08 for PolyDrain with 0.6% slope
10.0 for the 1.0% slope in **Standard** Trench Former and MD/HD systems

Equation 8 – Trench Length Required Based on Grate Inflow for Triangular Gutter Flow, page 19

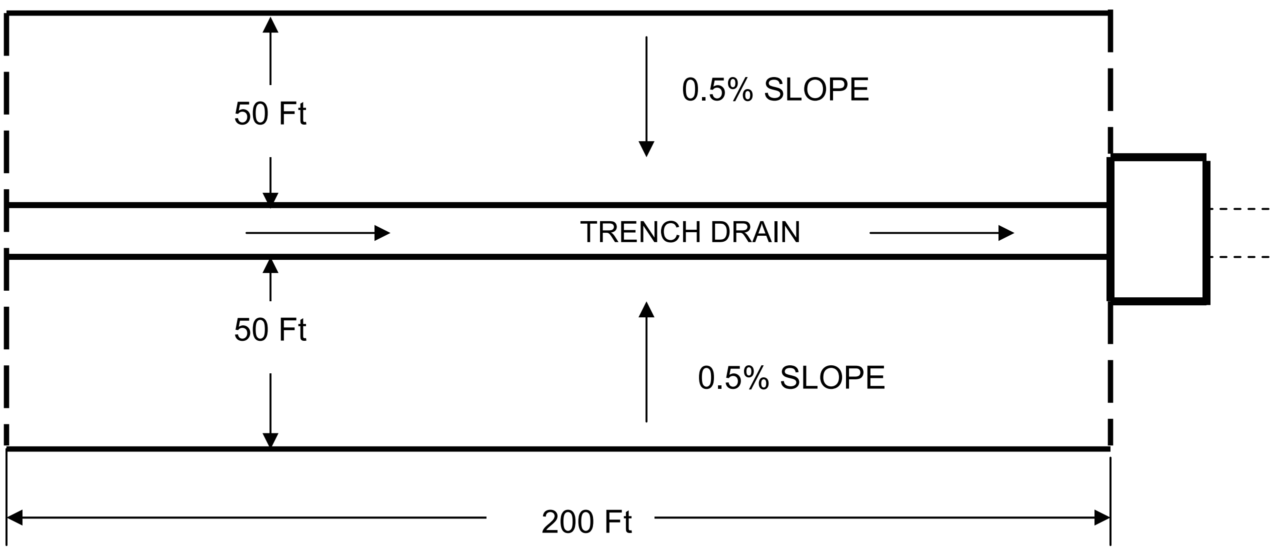
$$L_{Required} = K_C * Q^{0.24} * S_L^{0.3} * [1/(n*S_X)]^{0.6}$$

K_C= 0.6 English units or 0.817 Metric units
Q = Gutter Flow
n = Manning's Roughness Coefficient of Pavement from **Table 2, page 4**
S_L = Longitudinal Slope
S_X = Transverse Slope

Appendix B
Calculation and Application Examples

Example 1
Exterior PolyDrain

A 100 foot by 200 foot section of concrete airport apron located in western Montana is being renovated and requires drainage. The apron has a 0.5% cross-slope draining to the center but no longitudinal slope. Adjacent area does not drain to this area. An existing structure with a 12" diameter discharge pipe is located at one edge of the apron. The grates are required to handle commercial aircraft with omni directional vehicular traffic loads. Grates need to be locked in place.



The logical location for the trench drain is the center of the area running full length and discharging into the existing catch basin.

Step 1

Identify and quantify all hydraulic loads and their location

Q = k C I A (Equation 1)
k = 0.00002315 from **Table 1, page 4**, for area in Ft^2 and intensity in inches per hour
I = 2.5 inches per hour **(Diagram 1, page 2)**
C = 0.95 for concrete **(Table 2, page 4)**

Q = kCIA = (0.00002315)*(0.95) * (2.5 in/hr)*(20,000 Ft^2 ÷ 43560) =
1.1 cfs (in acres)

Step 2
Determine the channel size required.

Use **Table 4** for a flat site to determine which channel will meet the 1.1cfs requirement.
Grate will require locking device . Find the required capacity from the chart and read to the left. Grate with toggle= 1.1 cfs from chart = #220 with PolyWall PolyWall I = 1.104cfs capacity. Capacity - OK

Step 3
Determine the channel size layout for the hydraulic load, run length, and site contours.

Q = 1.1 cfs
L = 200 ft = 200/3.28 = 61 Meters
Slope = none affecting conveyance capacity

From **Table 4** select channel #'s 010- 010 with PolyWall II = 61 meters.
Check hydraulic capacity of last channel.
From **Table 4** channel #010 with PolyWall II with locks = 1.31 cfs - OK

Step 4
Select grate based on loading and hydraulic requirements.

Given commercial aircraft loading with omni directional traffic.
From **Table 3, page 7** – 530 series meets needs

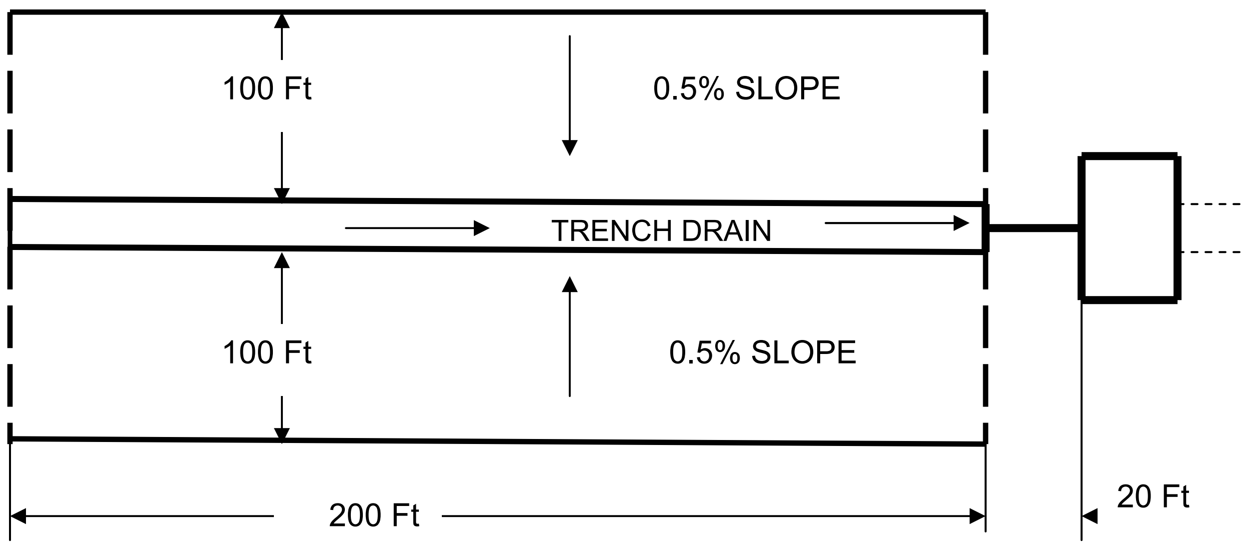
Hydraulic requirement = 1.1cfs / 200' = .0055cfs/Lf required
From **Table 3, page 7** #530 series = .07cfs/Lf inflow capacity – OK

Step 5
Select appropriate outlet size.
1.1cfs required
From **Table 9** select 8" outlet for #010 with PolyWall II
8" outlet capacity = 2.57cfs – OK

Answer:
Channel selection : #010 through #010 with PolyWall II = 61 meters
Grate selection : #530 series grates with locks
Outlet selection: 8" outlet from #010 with PolyWall II

Example 2
Exterior Trench Former

A 200 foot by 200 foot section of asphalt airport apron located in southern Florida is being built and requires drainage. The apron has a 0.5% cross-slope draining to the center and 0.2% longitudinal slope toward a structure located 20 feet off the edge of the apron. A grassy 1 acre area with sandy soil drains to the new apron. The grassy area flow is uniformly distributed and is perpendicular to the trench drain. The existing catch basin has a 36" RCP discharge pipe with 0.5% slope that receives 15 cfs flow from other courses. Commercial jet aircraft cross the apron.



The logical location for the trench drain is the center of the area running full length and discharging into the existing catch basin.

<u>Step 1</u>
Identify and quantify all hydraulic loads and their location

> Q = k C I A (Paved Area)(Equation 1) + kCIA (Grass Area) = k I (C_P*A_P + C_G*A_G)
> k = 1.008 from **Table 1**, **page 4,** for area in Acres and intensity in inches per hour
> I = 7.2 in / hr from **Diagram 1, page i** - Grassy area dimensions are not given to determine alternative rainfall event duration.
> Acre = 43,560 Ft^2 from "**Useful Conversions**"
> C = 0.95 for asphalt C = 0.20 for field from **Table 2, page 4**
> Q = (1.008*7.2 in/hr)*[0.95*(200*200 / 43,560 Ft^2/ A) + 0.20)]
> Q = 7.8 cfs hydraulic load

<u>Step 2</u>
Determine the trench layout for the hydraulic load, run length, and site contours.

Q = 7.8 cfs
L = 200 ft = 61 Meters
Slope = 0.2% positive slope

This problem has two solutions. One is to start at the shallow end and select a standard continuously sloped 61 meter run. Some trial and error will be needed. By referencing the **Tables 4, 6, and 7** for flat sites (worst case) we find that a 12 inch (300mm) trench will be required to meet the hydraulic needs. Since MD/HD 300 standard full length is 30 - two Meter Sections, add a 1 Meter non-sloped section at the shallow end. Using **Equation 7**, **page 12**, this provides a system with

$$\mathbf{Q_n = Q/K(S_S + S_C)^{0.5}}$$

$Q = 12.6*(0.01+0.002)^{0.5} = 13.8$ cfs discharge capacity which is 177% of requirement.

The second solution is to select a custom sloped system which provides sufficient hydraulic capacity without the extra depth and associated trenching and concrete cost. The solution is by trial and error utilizing the **Channel Flow Capacities for Sloped Sites and Custom Trench Former Slopes, Equation 7, page 12**. Contact ABT for assistance and a free electronic hydraulic calculator for determining custom trench slopes.

Step 3

Select a grate for heavy load and with sufficient sheet flow inflow capacity. No special pedestrian features are required.

Although longitudinal slope is present, sheet inflow is chosen because of the location of the grassy area. If its flow was parallel to trench, gutter flow would be appropriate.

Sheet flow inflow = 0.3 CFS / L Ft. for 100 % capture
Run Length = 200 Ft.
$Q_s = r\, f\, L_s$ for sheet inflow conditions ***or*** $r = Q_s / f\, L_s$
r = 7.8 / (0.30*200) = 0.13 which is less than any grate in **Table 3, page 7**

Referencing **Table 3** for grate selection and **Table 6** for hydraulic capacity, HD300 is the best product to choose because both its grate and hydraulic capacity are suitable for this application. It provides a 15 X clogging safety factor.

Step 4

Piping the discharge from the trench to the structure is a convenient method. The pipe should be sized (by others) to carry the hydraulic load and not create a “choke” point.

Size the pipe diameter and slope to carry the flow from the trench run to the existing structure. Pipe entry location into the structure will determine slope which in turn will determine pipe size. The capacity of the exit pipe from the structure with the additional 7.8 cfs load needs to be verified.

Answer:

Channel selection: 12” (300mm) trench width = 61 meters (30 two meter sections with 1% slope and a 1 meter neutral section at the shallow end. Invert below grate: 3.94” to 27.6”.
Grate selection: HD series grates
Outlet selection: to be determined – minimum 7.8 cfs capacity

Example 3
Interior PolyDrain

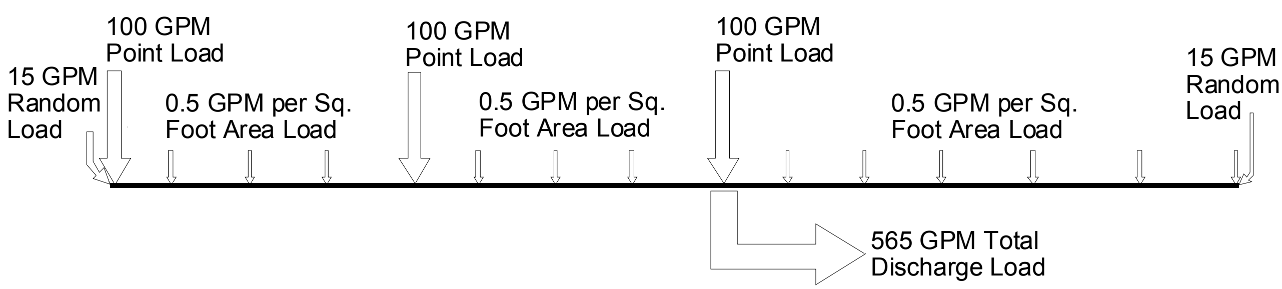
Interior Applications are usually point loaded from process equipment, area loaded from fire protection sprinklers, random loaded from sources such as wash down hoses, or from a combination of these loads. Flow rates from these sources are obtained from the equipment manufacturers, fire protection design data, process water distribution design data, and/or potable water distribution design data. The trench run(s) receiving these load(s) and where the load(s) are applied should be noted.

For point load, the channel at the point load must be sized to carry the point load plus any flow from upstream. Random load requires that all channels be able to carry the random load plus any upstream load. Area load requires the channel at the down stream edge of the area to be sized to handle the total area load.

Example: What channel layout provides the least expensive design to satisfy the following hydraulic flow and location requirements?

Install trench drain the length of a 10 Foot by 50 Foot slope-free interior area with a 0.5 GPM/Ft^2 fire protection load, a 15 GPM wash down hose in the area, and three 100 GPM point loads piped into the trench spaced 10 Feet apart starting at one end of the area. Location and direction of discharge from trench drain is not a constraint.

__Step 1__
System Length = 50'/3.27 = 15 Channels. Total System Hydraulic Load is equal to the sum of the components. In this example,
Q_{Total} = (0.5 GPM/Ft^2 *10 Ft*50 Ft) + 15 GPM + (3 ea.*100 GPM) = 565 GPM.



__Hydraulic Load Diagram__

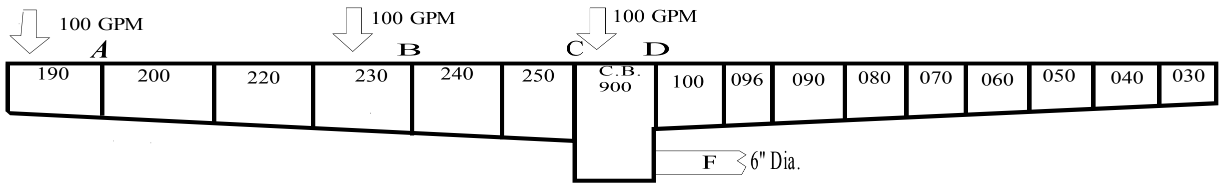
Per **Table 4A**, this flow exceeds the carrying and discharge capacity of channels without PolyWalls. Either a Number 200PW I channel, multiple discharge outlets, or a catch basin receiving flow from both ends will be required to handle the hydraulic load. Use of PolyWalls is the most expensive option. Multiple pipe outlets is an option but has the disadvantage of possible blockage at the under floor pipe junction. By locating a catch basin at the third point load, the shallowest set of channels may be used to carry the hydraulic load and thereby minimizes trenching and encapsulation concrete cost.

Step 2

Total the Loads at Point D (Q_C) = all upstream hydraulic loads

Q_D = 100 GPM Point Load Number 1 + 100 GPM Point Load Number 2
+ (6 Channels *3.27 x 10 x 0.5) GPM area load + 15 GPM random load

Q_D = 313.1 GPM



Interior Application Example Layout

Per Table 4, a Number 230 Channel provides 313 GPM capacity and is sufficient. However, increase channel size to Number 250 to mate with the Number 900 catch basin and increase the upstream channels accordingly for installation convenience.

Step 3

Total Load at Point C (Q_B) = Point Load Number 2 plus all upstream hydraulic load

Q_C = 100 GPM Point Load Number 1 + 100 GPM Point Load Number 2
+ (4 x 3.27 x 10 x 0.5) GPM area load + 15 GPM random load

Q_C = 280.4 GPM

Per **Table 4**, a Number 200 Channel provides 285 GPM capacity. The 230 channel per the layout is suitable for this location.

Step 4

Load at Point A

(Q_A) = Point Load #1 = 100 GPM + 15 GPM from wash down hose + (1 x 3.27 x 10 x 0.5)GPM area load = 131.4 GPM

From **Table 4**, a Number 190 has 275 GPM capacity and is suitable for this location.

Step 5

Total Load from remaining area = Q_D

Q_D = 0 GPM point load + ((15 Channels -6.5 Channels) x 3.27*10*0.5) GPM area load + 15 GPM random load = 154 GPM

Per **Table 4**, a 070 Channel will provide sufficient capacity (162 GPM). Therefore, begin the run with a 100 channel use a 096 channel for the ½ Meter length.

Step 6

As calculated previously, the total system hydraulic load (Q_F) is 565 GPM. Per **Table 15**, a 6" diameter SDR 35 pipe (795 GPM) is required to discharge the flow. A larger pipe (by others) may be required to transport the hydraulic load to its discharge point.

Step 7

Select grate from **Table 3** using the following considerations:

1. Safety
2. Physical loading
3. Corrosion resistance requirements
4. Life cycle cost
5. Aesthetics

Example 4
Roadway PolyDrain

A roadway has four 12 foot lanes and one 7 foot outside shoulder. The roadway is on a tangent section and is crowned in the middle. A curb and gutter has been constructed at the outside of the shoulder creating a triangular gutter flow situation. The slope of the roadway is 2% to the outside and the shoulder slope is 4% to the outside. The longitudinal slope of the roadway is 1%. Both the roadway and the shoulder are asphalt surface. Allowable spread on the shoulder is not to exceed 6 feet. There are no adjacent tributary areas contributing to the runoff other than the roadbed. It has been determined to use a rainfall intensity for this project of 6.0 in/hr. Determine the location and layout of the trench drain system to maintain the allowable spread criteria. Design will begin from a high point in the roadway to a sag 1000 ft away.

Step 1
Determine the flow at which the allowable spread is met (From **Equation 4, page 9**):

n = 0.017
T = Allowable Spread = 6 Ft.
S_T = Transverse Slope = 4% = 0.04
S_L = Longitudinal Slope = 1% = 0.01

From **Equation 4**:
$Q_G = (0.56 / n) * T^{2.67} * S_T^{1.67} * S_L^{0.5} = (0.486 / 0.017) * 6^{2.67} * 0.04^{1.67} * 0.01^{0.5}$
Q_G = 1.82 cfs
This is the allowable flow to maintain a 6 Ft. spread.

For this Q and application, we will design using the Interceptor A-67.

Step 2
Determine the location to begin the trench drain (From **Equation 1, page 5**):

Beginning from the high point;
Use the Rational Method to determine the length from the high point at which the allowable flow is met.

C = 0.90
i = 6.0 in/hr
K = 1.008
A = (L * W) / 43,560 Ac/ft^2
Q_G = 1.82 cfs

W = (4 * 12 Ft) + (7 Ft) = 55 Ft
$Q_G = K * C * i * A$
1.82 = 1.008 * 0.90 * 6.0 * {(L * 55) / 43,560}
L = 265 Ft
This is the length from the high point at which the runoff interception must begin.

Step 3

Determine the length of drain required to remove the design flow (From **Equation 8, page 19**):

At 265 Ft from the high point, the flow of runoff is 1.82 cfs

$L_D = K_C * Q^{0.42} * S_L{}^{0.3} * \{1.0 / (n * S_T)\}^{0.6}$
$L_D = 0.6 * 1.82^{0.42} * 0.01^{0.3} * \{1.0 / (0.017 * 0.04)\}^{0.6}$
$L_D = 15.4$ Ft

If the channel can be discharged at this point, 265 Ft + 15.4 Ft = 280.4 Ft. from the high point, the channel can be sized for the previously calculated design flow.

Note:
If no outlet is available at this location, the trench can be run longer to an available outlet. The design flow would be recalculated to adjust for the additional length.

Step 4

Determine the required channel to carry the required runoff (From **Equation 7, page 12**):

Assuming an outlet is available at this location;

$Q_n = Q/K(S_S + S_C)^{0.5}$
S_S = Site slope = 0.01
S_c = Channel slope = 0.006
K = 4.08 for PolyDrain with .6% slope

$Q_n = 1.82 * 4.08 * .1265$
= 1.105

From Table, Interceptor A-67;
An 060 channel with a PW I provides a capacity of 1.106cfs

Therefore, length of drain required was 15.4 Ft. Each PolyDrain channel has a laying length of 3.27 Ft. The required number of channels is 15.4 / 3.27 = 4.7 channel = 5 channels.

Working from the 060 w/ PWI back, the design layout would be:
060 w/ PWI, 050 w/ PWI, 040 w/ PWI, 030 w/ PWI and 020 w/ PWI channels.

Step 5

Repeat this procedure as required for the length of design.

USEFUL CONVERSIONS

TO CONVERT	MULTIPLY BY	TO OBTAIN
LENGTH		
Meters	3.281	Feet
Meters	39.37	Inches
Millimeters	0.03937	Inches
AREA		
Acres	43,560	Square Feet
Acres	4047	Square Meters
Hectar	107,600	Square Feet
Hectar	10,000	Square Meters
Hectar	2.471	Acres
Square Meters	10.76	Square Feet
VOLUME		
Acre Feet	1233.49	Cubic Meters
Acre Feet	325,851	Gallons
Cubic Feet	7.48052	Gallons
Cubic Feet	28.32	Liters
Cubic Meters	264.2	Gallons
Cubic Meters	1,000	Liters
RATE		
Cubic Feet per Second	448.831	Gallons per Minute
Cubic Meters per Hour	0.009808	Cubic Feet per Second
Liters per Second	0.03531	Cubic Feet per Second
Liters per Second	0.0600	Cubic Meters per Hour
Liters per Second	15.852	Gallons per Minute
Cubic Meters per Second	35.31	Cubic Feet per Second
FORCE		
Kilo Newton	224.8	Pounds (Force)
Kilo Pascal	0.145	Pounds per Square Inch

Notes

To convert unit in right column to those in left column, divide instead of multiply.