

Chapter 16 Special Use Tables, Charts, & Conversions

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652.1600 State Supplement

General

Several Exhibits in this chapter are reprints from the South Carolina Irrigation Guide 1987.

652.1601 English conversion units

Throughout this guide, English units generally are used followed with metric units in parenthesis. Exhibit 16-1 displays commonly used conversion factors relating to irrigation.

Exhibit 16-1 Irrigation related units conversion factors

Volume, weight, and flow units

1 gallon (gal)	= 231 cubic inches (in ³) = 0.13368 cubic feet (ft ³)
1 gallon of water weighs 1 million gallons (mg)	= 8.345 pounds (lb) = 3.0689 acre-feet (ac-ft) = 133,700 cubic feet (ft ³)
cubic foot water	= 1728 cubic inches (in ³) = 7.48 gallons
1 cubic foot of water weighs	= 62.4 pounds (lb)
1 acre-foot (ac-ft)	= amount of water to cover 1 acre 1 foot deep = 43,560 cubic foot (ft ³) = 325,850 gallons = 12 acre-inches (ac-in)
1 acre-inch per day (ac-in/da)	= 18.7 gallons per minute (gpm)
1 million gallons (mg)	= 3.0689 acre-feet (ac-ft)
1 million gallons per day (mgd)	= 1.547 cubic feet per second (ft ³ /s), = 695 gallon per minute (gpm)
1 cubic foot per second	= 448.83 (typically rounded to 450) gallons per minute (gpm) = 7.48 gallons per second = 0.646 million gallons per day (mgd) = 0.992 (typically rounded to 1) acre-inch per hour (ac-in/hr) = 1.983 (typically rounded to 2) acre-feet per day (ac-ft/d) = 40 miners inches (11.25 gpm)—AZ, CA, MT, NV, OR = 50 miners inches (9 gpm)—ID, KA, NE, NM, ND, UT = 38.4 miners inches—CO

Exhibit 16-1 Irrigation related units conversion factors—Continued**Pressure units**

1 atmosphere (1 bar)	= 14.697 pounds per square inch (lb/in ²) = 2116.3 pounds per square foot (lb/ft ²) = 33.93 feet of water = 29.92 inches of mercury
1 pound per square inch	= 144 pounds per square foot
1 pound per square foot	= 2.31 feet of head of water = 48 Pa = .0048 kPa
1 foot head of water (ft)	= 0.433 pounds per square inch = 0.0295 atmospheres (bars)

Energy units

1 hp	= 0.746 kw
1 kw	= 1.3405 hp

Soil and water chemistry units 1

meq/liter = 1 mg/liter/equiv. weight	1 mg/L	= 1 ppm
	1 ml water	= 1 cc water
	1 ml water	= 1 mg

Element	Equivalent weight	Element	Equivalent weight
Ca	2.0	CO ₃	30
Mg	12.2	HCO ₃	61
Na	23.0	SO ₄	48
Cl	35.4	NO ₃ -N	14

Common conversion units pertaining to water quality

10 ppm Nitrate – Nitrogen	= 27 lb/ac-ft of water = 2.25 lb/ac-in of water
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652.1602 Metric conversion units

Where metric units are used in this guide, they generally are presented in SI Units (International System of Units); however, other more common units may be used for ease of use, display, or conversion. Exhibit 16–2 displays commonly used conversion factors relating to irrigation.

Exhibit 16–2 Units of area, length, weight, volume, pressure, flow, velocity, temperature, yields, and rates

Area								
Units		m ²	ha	km ²	in ²	ft ²	acre	
1 square meter	=	1	.0001	—	1550	10.764	—	
1 hectare	=	10,000	1	.01	—	1.1 x 10 ⁵	2.4711	
1 square	=	1.0 x 10 ⁶	100	1	—	1.1 x 10 ⁷	247.1	
1 square foot	=	.0929	9.3 x 10 ⁻⁶	—	144	1	—	
1 acre	=	2.6 x 10 ⁶	.4047	.0040	—	43,560	1	
1 square mile	=	—	—	2.6	—	—	—	
Length								
Units		mm	cm	m	km	in	ft	mi
1 millimeter	=	1	.1	.001	—	.0394	.033	—
1 centimeter	=	10	1	.01	—	.3937	.0328	—
1 meter	=	1000	10	1	.001	39.37	3.2808	—
1 kilometer	=	—	—	1000	1	—	3280.8	.6214
1 inch	=	25.40	2.54	.0254	—	1	—	—
1 foot	=	304.8	30.48	.3048	—	12	1	—
1 mile	=	—	—	1609.3	1.6093	—	5280	1
1 yard	=	—	—	.9	—	—	—	—

Basic SI units are:

unit	metric unit	SI unit designation
length	meter	m
mass	kilogram	kg
time	second	s
time	hour	hr
time	day	d
temperature	degree Celsius	°C
temperature	Pascals	°C
pressure		Pa

Exhibit 16–2 Units of area, length, weight, volume, pressure, flow, velocity, temperature, yields, and rates — Continued**Weight**

Units		mg	g	kg	metric ton	lb	ton
1 milligram	=	1	.001	—	—	—	—
1 gram	=	1000	1	.001	—	—	—
1 kilogram	=	—	1,000	1	.001	2.2046	—
1 metric ton	=	—	—	1,000	1	2,204.6	1.102
1 pound	=	—	453.6	.4536	—	1	.0005
1 ton	=	—	—	907.18	.9072	2,000	1

Volume

Units		L	m ³	qt	gal	ft ³
1 liter	=	1	.001	.9081	.2270	.0358
1 cubic meter	=	1,000	1	—	264.2	35.31
1 quart	=	1.1012	—	1	.25	.0389
1 gallon	=	3.785	—	4	1	.1337
1 cubic foot	=	28.316	.02832	25.714	7.48	1
1 acre foot	=	—	1233	—	—	43,560
1 cubic yard	=	—	.80	—	—	—

Flow

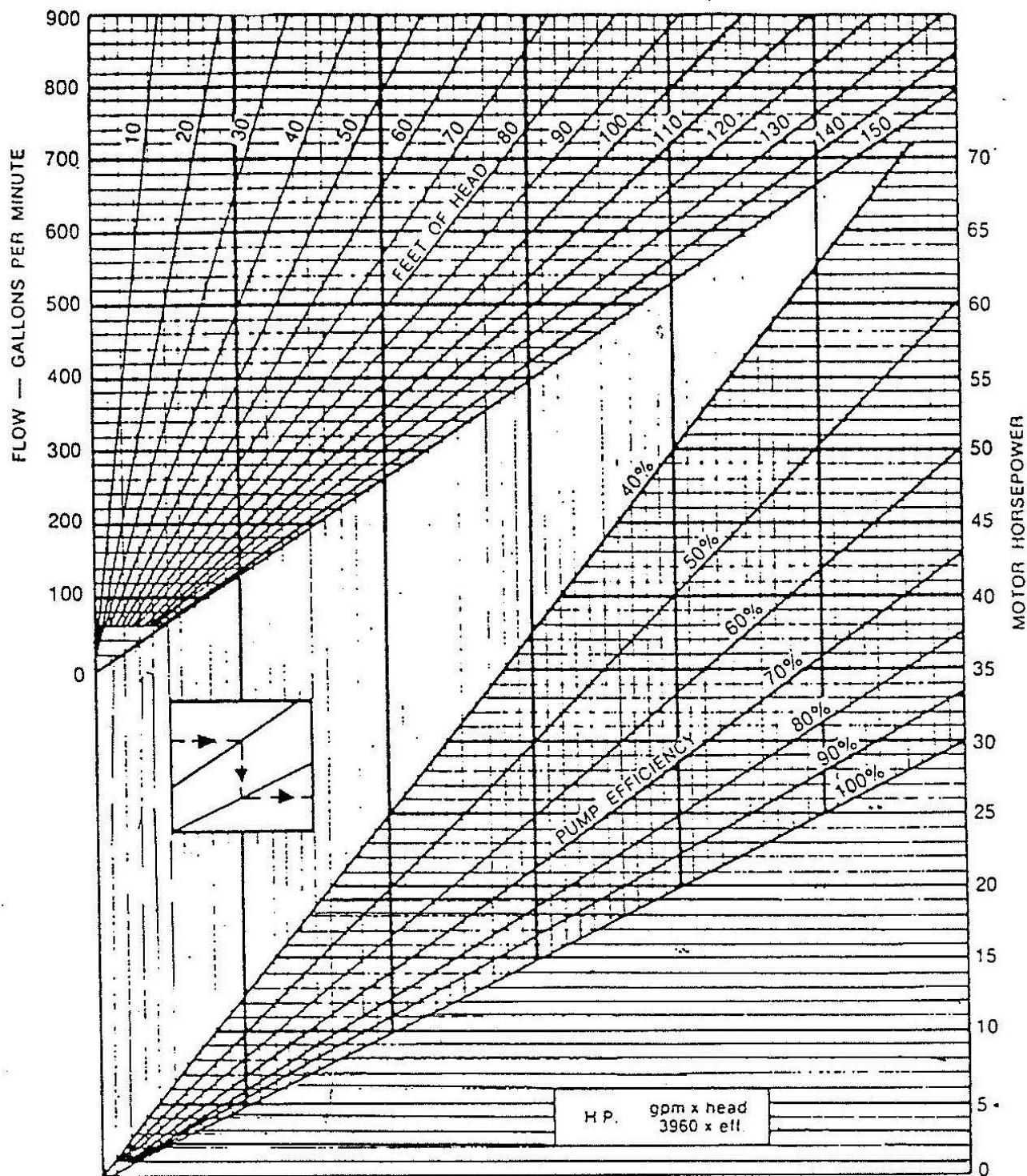
Units		L/s	m/s	gpm	ft/s	ac-ft/d	mg/d
1 liter per second	=	1	.001	15.85	.03531	.004419	—
1 cubic meter per second	=	1,000	1	15,850	35.31	70.04	22.82
1 gallon per minute	=	.0631	—	1	—	—	—
1 cubic foot per second	=	28.32	.02832	448.8	1	1.983	.6463
1 acre-foot per day	=	14.28	.01428	226.3	.5042	1	.3259
1 million gallons per day	=	43.81	.04381	694.4	1.547	3.069	1

Exhibit 16–2 Units of area, length, weight, volume, pressure, flow, velocity, temperature, yields, and rates —
Continued

Velocity					
Units		m/s	km/h	ft/s	mph
1 meter per second	=	1	3.6	3.281	2.237
1 kilometer per hour	=	.2778	1	.9113	.6214
1 foot per second	=	.3048	1.097	1	.6818
1 mile per hour	=	.447	1.609	1.467	1
Yield and rate					
Units		kg/ha	met ton/ha	lb/ac	L/ha gal/ac
1 kilogram per hectare	=	1	—	.893	— —
1 metric ton per hectare	=	—	1	893	— —
1 pound per acre	=	1.12	.00112	1	— —
1 liter per hectare	=	—	—	—	1 .107
1 gallon per acre	=	—	—	—	9.35 —
Pressure conversions					
1 atmosphere (1 bar)	=	100	kilopascal (kPa)		
1 foot of water (ft)	=	2.9890	"		
1 meter of water (m)	=	9.8064	"		
1 millibar	=	0.100	"		
1 pound per square foot (lb/ft ²)	=	.04788	"		= 47.8 Pascals
1 pound per square inch (lb/in ²)	=	6.8948	"		

Exhibit 16–2 Units of area, length, weight, volume, pressure, flow, velocity, temperature, yields, and rates —
Continued

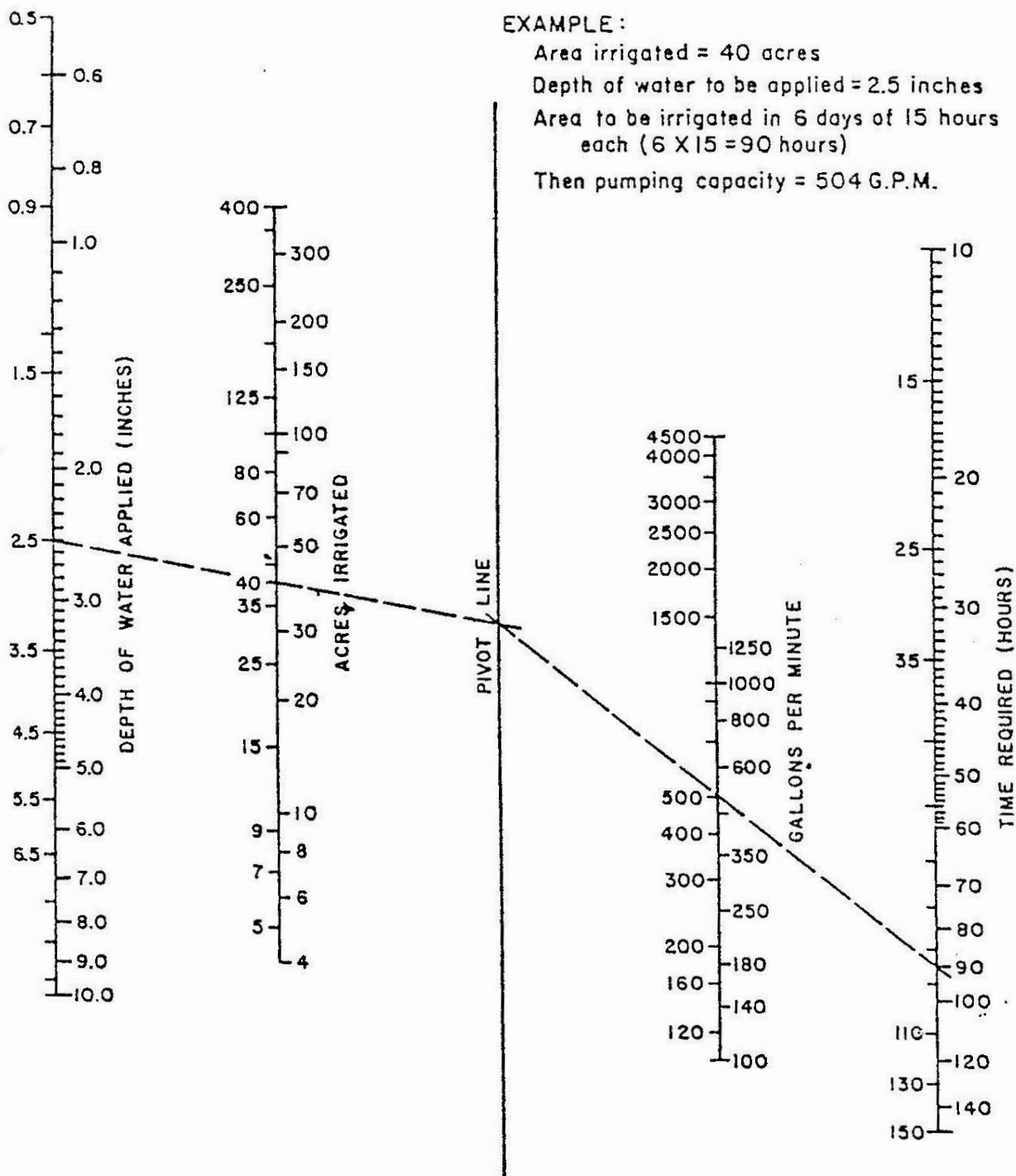
Temperature			
°C	°F	°F	°C
-10	14	32	0
-5	23	34	1.1
0	32	36	2.2
		38	3.3
2	36	40	4.4
4	39		
6	43	42	5.6
8	46	44	6.7
10	50	46	7.8
		48	8.9
12	54	50	10.0
14	57		
16	61	52	11.1
18	64	54	12.2
20	68	56	13.3
		58	14.4
22	72	60	15.6
24	75		
26	79	62	16.7
28	82	64	17.8
30	86	66	18.9
		68	20.0
32	90	70	21.1
34	93		
36	97	72	22.2
37	98.6	74	23.3
38	100	76	24.4
40	104	78	25.6
		80	26.7
45	113		
50	122		
55	131	82	27.8
60	140	84	28.9
65	149	86	30.0
70	158	88	31.1
		90	32.2
75	167		
80	176		
85	185	92	33.3
90	194	94	34.4
95	203	96	35.6
100	212	98	36.7
		100	37.8

Exhibit SC16-3 Horsepower Required to Pump Water

TO USE CHART: Start at value of flow and move horizontally to line of "feet of head." From this point move vertically downward to line of known or unknown "pump efficiency." From this point move horizontally to the right and read value of required "motor horsepower." Next select standard motor size equal to or larger than value obtained from the chart.

Exhibit SC16-4 Capacity Requirement Nomograph for Sprinkler Irrigation System

$$\text{Gallons per minute, } Q = \frac{453 \times \text{Acres irrigated (A)} \times \text{Depth of water applied (d)}}{\text{Number of days (F)} \times \text{Hours per day (H)}}$$



Reference:
 Agricultural Engineering, July 1951

Exhibit SC16-4a Planning System Capacity of a Sprinkler Irrigation System

During the "planning" phase, a Gross System Capacity (Q/acre) of a sprinkler irrigation system can be calculated using the following equations or read off Exhibit SC16-4b with an estimated daily peak ETc of 0.27 for spring and summer crops, 0.17 for fall crops and 0.12 for winter crops. The information shown below is also applicable to a microirrigation system.

The required capacity of a sprinkler system depends on the size of the area irrigated (design area), amount of water to be applied, and amount of time allowed to apply that amount of water:

$$\frac{Q}{A} = \frac{453 \times ETc}{T \times Eff} \quad \text{or} \quad \frac{Q}{A} = \frac{453 \times D}{f \times T \times Eff}$$

where:

Q = required minimum system discharge capacity (gpm or lps)

A = design area (a or ha)

ETc = daily peak (in/day or mm/day)

f = time allowed for completion of one irrigation cycle

T = actual operating time per day (hrs/day) to cover entire area

Eff = system Operating Efficiency (as decimal)

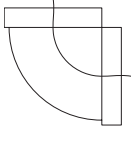
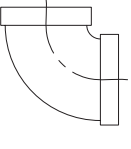
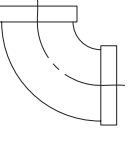
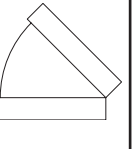
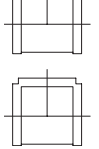
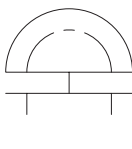
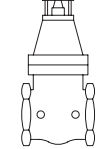
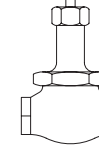
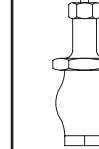
D = net depth of application or net irrigation application (in or mm)

453 = conversion factor from (ac-in)/hr to gpm; [453 for English units, or 2.78 for metric units]

Exhibit SC16-4b Gross System Capacity

Daily System Operation (hr)	Daily Peak ETc (in/day)				
	0.10	0.15	0.20	0.25	0.30
	Flow rate per acre (gpm/ac)				
1	50	76	101	126	151
2	25	38	50	63	76
3	17	25	34	42	50
4	13	19	25	31	38
5	10	15	20	25	30
10	5	8	10	13	15
12	4	6	8	10	13
14	4	5	7	9	11
16	3	5	6	8	9
18	3	4	6	7	8
20	3	4	5	6	8
22	2	3	5	6	7

Exhibit SC16-5 Friction Loss through Pipe Fittings in Terms of Equivalent Length of Standard Pipe
(Source: Crane Pumps)

									
Size of Pipe (Small Dia.)	Standard Elbow	Medium Radius Elbow	Long Radius Elbow	45° Elbow	Tee	Return Bend	Gate Valve Open	Globe Valve Open	Angle Valve Open
Length of Straight Pipe Giving Equivalent Resistance Flow									
1/2"	1.5	1.4	1.1	.77	3.4	3.8	.35	16	8.4
3/4"	2.2	1.8	1.4	1.0	4.5	5.0	.47	22	12
1"	2.7	2.3	1.7	1.3	5.8	6.1	.60	27	15
1 1/4"	3.7	3.0	2.4	1.6	7.8	8.5	.80	37	18
1 1/2"	4.3	3.6	2.8	2.0	9.0	10	.95	44	22
2"	5.5	4.6	3.5	2.5	11	13	1.2	57	28
2 1/2"	6.5	5.4	4.2	3.0	14	15	1.4	66	33
3"	8.1	6.8	5.1	3.8	17	18	1.7	85	42
3 1/2"	9.5	8.0	6.0	4.4	19	21	2.0	99	50
4"	11.0	9.1	7.0	5.0	22	24	2.3	110	58
4 1/2"	12.0	10	7.9	5.6	24	27	2.6	130	61
5"	14.0	12	8.9	6.1	27	31	2.9	140	70
6"	16.0	14	11	7.7	33	37	3.5	160	83
8"	21.0	18	14	10	43	49	4.5	220	110
10"	26.0	22	17	13	56	61	5.7	290	140
12"	32.0	26	20	15	66	73	6.7	340	170
14"	36.0	31	23	17	76	85	8	390	190
16"	42.0	35	27	19	87	100	9	430	220
18"	46.0	40	30	21	100	110	10.2	500	250
20"	52.0	43	34	23	110	120	12	560	280
22"	58.0	50	37	25	130	140	13	610	310
24"	63.0	53	40	28	140	150	14	680	340
30"	79.0	68	50	35	165	190	17	860	420
36"	94.0	79	60	43	200	220	20	1000	500
42"	120.0	95	72	50	240	260	23	1200	600
48"	135.0	110	82	58	275	300	26	1400	680

From "Engineering Data on Flow of Fluids In Pipes." - Crane Co.

Exhibit SC16-6 Head Loss Coefficients for Fitting and Special Corrections where $H = K(v^2/2g)$

Nature of Resistance	Typical Value K	Remarks
Check Valve	3.0 - 10.0	-
Elbows		
45°	0.4	-
90°	0.65	-
Entrance		
Square	0.5	-
Projecting	0.78	-
Rounded	0.05	-
Gate Valve, Open	0.25	-
Globe Valve, Open	6.0	-
Sudden Contraction	0.4	v = velocity of smaller pipe
Sudden Enlargement	$1 - \frac{d_1^2}{d_2^2}$	d_1 & d_2 = diameter of small and large pipe respectively
Taper Reducer	0.25	v = velocity of smaller pipe
Taper Increaser	0.15	v = velocity of smaller pipe
Tees or Crosses		
Straight flow	0.10	-
Angle flow	1.50	-
Angle Valve	5.0	-
Foot Valve	0.8	-
Strainers - basket type		
3 inch dia. -----	1.25	(will vary with mesh size) Ref. Pipe Friction Manual
4 inch dia. -----	1.05	
5 inch dia. -----	.95	
6 inch dia. -----	.85	
7 inch dia. -----	.80	
8 inch dia. -----	.75	

Exhibit SC16-7 Number of Rigid Pipe Joints for typical Glue/Lubricant applications

Pipe Size	Glue - joints per			Lubricant - joints per	
	Pint	Quart	Gallon	Pint	Quart
0.5	130	260	1040	-	-
0.75	80	160	640	-	-
1	70	140	560	-	-
1.25	50	100	400	-	-
1.5	35	70	280	175	350
2	20	40	160	124	248
2.5	17	34	136	106	212
3	15	30	120	85	170
4	10	20	80	71	142
5	8	16	64	-	-
6	-	6	24	46	92
8	-	3	12	28	56
10	-	-	10	20	40
12	-	-	6	12	24

Exhibit SC16-8 Standard Pipe Dimensions for Standard Dimension Ratio (SDR) Pipe

SDR 41 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
3"	3.5	3.32	0.085	100
4"	4.5	4.267	0.11	100
5"	5.563	5.27	0.136	100
6"	6.625	6.282	0.162	100
8"	8.625	8.18	0.21	100
10"	10.75	10.195	0.262	100
12"	12.75	12.091	0.311	100

SDR 32.5 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1-1/2"	1.9	1.773	0.06	125
2"	2.375	2.22	0.073	125
2-1/2"	2.875	2.688	0.088	125
3"	3.5	3.271	0.108	125
4"	4.5	4.207	0.138	125
5"	5.563	5.2	0.171	125
6"	6.625	6.193	0.204	125
8"	8.625	8.063	0.265	125
10"	10.75	10.048	0.331	125
12"	12.75	11.919	0.392	125

SDR 26 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1-1/2"	1.9	1.745	0.073	160
2"	2.375	2.182	0.091	160
2-1/2"	2.875	2.642	0.11	160
3"	3.5	3.214	0.135	160
4"	4.5	4.133	0.173	160
5"	5.563	5.109	0.214	160
6"	6.625	6.084	0.255	160
8"	8.625	7.921	0.332	160
10"	10.75	9.874	0.413	160
12"	12.75	11.711	0.49	160

SDR 21 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1-1/2"	1.9	1.709	0.09	200
2"	2.375	2.135	0.113	200
2-1/2"	2.875	2.585	0.137	200
3"	3.5	3.146	0.167	200
4"	4.5	4.046	0.214	200
6"	6.625	5.955	0.316	200
8"	8.625	7.754	0.41	200
10"	10.75	9.667	0.511	200
12"	12.75	11.465	0.606	200

SDR 17 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1-1/2"	1.9	1.641	0.112	250
2"	2.375	2.078	0.14	250
2-1/2"	2.875	2.517	0.169	250
3"	3.5	3.063	0.206	250
4"	4.5	3.938	0.265	250
6"	6.625	5.803	0.39	250
8"	8.625	7.553	0.508	250
10"	10.75	9.41	0.632	250
12"	12.75	11.16	0.75	250

(Adapted from JM Eagle Product Brochures)

Below are the most common colors and their use:

Blue – Water Main
Red – Fire Main
Purple – Reclaimed Water Main
Green – Sanitary Sewer & Forcemain
White – All Applications
Orange -- Telecommunications
Grey – Electrical Conduit
Yellow – Gas Distribution

SOLVENT WELD:

- * *SCHEDULE (SCH) Series*
(Meets ASTM D1785 and D2665)

Solvent Weld Schedule Series pipes are available for use in both pressure and drain, waste and vent applications.

Solvent Weld includes PVC Schedule 40 (ASTM D1785 and ASTM D2665) and 80 (ASTM D1785) for both pressure and non-pressure applications. The pipes are available in 10 and/or 20 foot lengths, in 1/2 to 16 inch diameters in Schedule 40, bell end, and 1/2 to 12 inch diameters in Schedule 80, plain end.

- * *STANDARD DIMENSION RATIO (SDR) Series*
(Meets ASTM D2441)

Solvent Weld SDR Series pipes are suitable for use in pressurized irrigation applications.

PVC solvent weld pressure rated pipes come in SDR 41 (100 psi), SDR 32.5 (125 psi), SDR 26 (160 psi), SDR 21 (200 psi), and SDR 13.5 (315 psi). The pipes are available in 20 foot lengths, bell end, in 1/2 to 12 inch diameters.

- * *PVC Acrylonitrile Butadiene Styrene (ABS) Series*
(Meets ASTM F628 or ASTM 2661)

Solvent Weld (ABS) pipes are suitable for use in commercial, residential, and industrial installations for sanitary drain, waste and vent applications.

PLASTIC IRRIGATION PIPE (PIP) Series

(Dimensionally complies with Annex A1 of ASTM D2441; Joint design is tested to the requirements of ASTM D3139 with rubber gaskets that confirm to ASTM F477)

Pipes are available in DR 64 (63 psi), DR 51 (80 psi), DR 41 (100 psi), and DR 32.5 (125 psi). PIP is available in 6 through 27 inch diameters.

Exhibit SC16-9 Nominal Pipe Size (NPS) for Rigid PVC Plastic Pipe

Schedule 40 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1/2"	0.84	0.622	0.109	600
3/4"	1.05	0.824	0.113	480
1"	1.315	1.049	0.133	450
1-1/4"	1.66	1.38	0.14	370
1-1/2"	1.9	1.61	0.145	330
2"	2.375	2.067	0.154	280
2-1/2"	2.875	2.469	0.203	300
3"	3.5	3.068	0.216	260
4"	4.5	4.026	0.237	220
5"	5.563	5.047	0.258	190
6"	6.625	6.065	0.28	180
8"	8.625	7.961	0.332	160
10"	10.75	9.976	0.365	140
12"	12.75	11.89	0.406	130

Schedule 80 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1/2"	0.84	0.546	0.147	850
3/4"	1.05	0.742	0.154	690
1"	1.315	0.957	0.179	630
1-1/4"	1.66	1.278	0.191	520
1-1/2"	1.9	1.5	0.2	470
2"	2.375	1.939	0.218	400
2-1/2"	2.875	2.323	0.276	420
3"	3.5	2.9	0.3	370
4"	4.5	3.826	0.337	320
5"	5.563	4.768	0.375	290
6"	6.625	5.761	0.432	280
8"	8.625	7.565	0.5	250
10"	10.75	9.492	0.593	230
12"	12.75	11.294	0.687	230

Class 160 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1"	1.315	1.195	0.060	160
1-1/4"	1.66	1.532	0.064	160
1-1/2"	1.90	1.754	0.073	160
2"	2.375	2.193	0.091	160
2-1/2"	2.875	2.655	0.110	160
3"	3.5	3.230	0.135	160
4"	4.5	4.154	0.173	160
6"	6.625	6.115	0.225	160

Class 200 PVC Pipe				
Size	O.D. (Inches)	I.D. (Inches)	Wall Thickness	Working P.S.I.
1/2"	0.84	0.716	0.062	200
3/4"	1.05	0.93	0.06	200
1"	1.315	1.189	0.063	200
1-1/4"	1.66	1.502	0.079	200
1-1/2"	1.9	1.72	0.09	200
2"	2.375	2.149	0.113	200
2-1/2"	2.875	2.601	0.137	200
3"	3.5	3.166	0.167	200
4"	4.5	4.072	0.214	200
6"	6.625	5.993	0.316	200
8"	8.625	7.74	0.41	200
10"	10.75	9.65	0.511	200
12"	12.75	11.45	0.606	200

Irrigation Association

(This page adapted from Irrigation Association Friction Loss Charts 2008)

Tables are based upon the following Hazen-Williams Equation:

$$H_f = 0.2083 \times \left(\frac{100}{C} \right)^{1.852} \times \frac{Q_{\text{gpm}}^{1.852}}{d^{4.866}}$$

The result is multiplied by 0.433 to give pounds per square inch [psi] loss for 100 feet of pipe.

where:

H_f = friction loss (psi/100 ft)

C = pipe coefficient of roughness

Q_{gpm} = flow rate (gpm)

d = inside diameter (inch)

The velocity values were derived using the following equation:

$$V = \frac{0.408 \times Q_{\text{gpm}}}{d^2}$$

The average inside diameter of outside diameter [OD] controlled pipe was based upon subtracting two times the minimum wall thickness plus one-half of the wall thickness tolerance from the outside diameter.

Information for pipe diameters and wall thicknesses came from the following resources:

- *ASABE Standards*. 2007. ANSI/ASAE S376.2 — Design, Installation and Performance of Underground, Thermoplastic Irrigation Pipes
- *Handbook of PVC Pipe*. Uni-Bell PVC Pipe Association
- Appropriate ASTM standards for nonplastic pipes

Pressure ratings for plastic pipes are based on 23°C or 73.4°F.

Head loss decreases (increases) approximately 1 percent for every 3 degrees Fahrenheit above (below) the reference temperature (73.4°F).

Supplement Chapter 16 includes friction loss tables for solvent weld Schedule and Pressure Rated (Class) pipes, Layflat and Polyethylene (Oval) hose and tubing, and Portable Aluminum pipe with couplings. Additional pipe material friction loss tables can be found at the Irrigation Association (IA) website. The IA friction loss tables use "average" inside diameter while tables in this chapter utilizes "nominal or hose" inside diameter.

Exhibit SC16-10 Friction Head Loss for PVC Class 200 psi IPS plastic pipe

(Source: Rainbird Landscape Irrigation Design Manual)

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Friction Head Loss for PVC Class 200 psi IPS plastic pipe																			
(1120, 1220) SDR 21 C = 150																			
psi Loss per 100 Feet of Pipe (psi/100 ft)																			
FLOW: 1 - 150 gpm																			
Size	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"		2-1/2"		3"		4"		
OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		
ID	0.716		0.930		1.189		1.502		1.720		2.149		2.601		3.166		4.072		
Wall Thk	0.062		0.060		0.063		0.079		0.090		0.113		0.137		0.167		0.214		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1	0.80	0.22	0.47	0.06	0.29	0.02	0.18	0.01	0.14	0.00									1
2	1.59	0.78	0.94	0.22	0.58	0.07	0.36	0.02	0.28	0.01	0.18	0.00							2
3	2.39	1.65	1.42	0.46	0.87	0.14	0.54	0.04	0.41	0.02	0.27	0.01	0.18	0.00					3
4	3.18	2.82	1.89	0.79	1.15	0.24	0.72	0.08	0.55	0.04	0.35	0.01	0.24	0.01					4
5	3.98	4.26	2.36	1.19	1.44	0.36	0.90	0.12	0.69	0.06	0.44	0.02	0.30	0.01					5
6	4.78	5.97	2.83	1.67	1.73	0.51	1.09	0.16	0.83	0.08	0.53	0.03	0.36	0.01	0.24	0.00			6
7	5.57	7.95	3.30	2.23	2.02	0.67	1.27	0.22	0.97	0.11	0.62	0.04	0.42	0.01	0.28	0.01			7
8	6.37	10.18	3.77	2.85	2.31	0.86	1.45	0.28	1.10	0.14	0.71	0.05	0.48	0.02	0.33	0.01			8
9	7.16	12.66	4.25	3.55	2.60	1.07	1.63	0.34	1.24	0.18	0.80	0.06	0.54	0.02	0.37	0.01			9
10	7.96	15.38	4.72	4.31	2.89	1.30	1.81	0.42	1.38	0.22	0.88	0.07	0.60	0.03	0.41	0.01			10
11	8.75	18.35	5.19	5.14	3.17	1.56	1.99	0.50	1.52	0.26	0.97	0.09	0.66	0.03	0.45	0.01			11
12	9.55	21.56	5.66	6.04	3.46	1.83	2.17	0.59	1.65	0.30	1.06	0.10	0.72	0.04	0.49	0.02	0.30	0.00	12
13	10.35	25.01	6.13	7.01	3.75	2.12	2.35	0.68	1.79	0.35	1.15	0.12	0.78	0.05	0.53	0.02	0.32	0.01	13
14	11.14	28.69	6.60	8.04	4.04	2.43	2.53	0.78	1.93	0.40	1.24	0.14	0.84	0.05	0.57	0.02	0.34	0.01	14
15	11.94	32.60	7.08	9.13	4.33	2.76	2.71	0.89	2.07	0.46	1.33	0.16	0.90	0.06	0.61	0.02	0.37	0.01	15
16	12.73	36.73	7.55	10.29	4.62	3.11	2.89	1.00	2.21	0.52	1.41	0.17	0.96	0.07	0.65	0.03	0.39	0.01	16
17	13.53	41.10	8.02	11.51	4.91	3.48	3.07	1.12	2.34	0.58	1.50	0.20	1.03	0.08	0.69	0.03	0.42	0.01	17
18	14.33	45.69	8.49	12.80	5.19	3.87	3.26	1.24	2.48	0.64	1.59	0.22	1.09	0.09	0.73	0.03	0.44	0.01	18
19			8.96	14.15	5.48	4.28	3.44	1.37	2.62	0.71	1.68	0.24	1.15	0.09	0.77	0.04	0.47	0.01	19
20			9.43	15.56	5.77	4.71	3.62	1.51	2.76	0.78	1.77	0.26	1.21	0.10	0.81	0.04	0.49	0.01	20
22			10.38	18.56	6.35	5.62	3.98	1.80	3.03	0.93	1.94	0.32	1.33	0.12	0.90	0.05	0.54	0.01	22
24			11.32	21.81	6.93	6.60	4.34	2.12	3.31	1.09	2.12	0.37	1.45	0.15	0.98	0.06	0.59	0.02	24
26			12.27	25.29	7.50	7.65	4.70	2.45	3.59	1.27	2.30	0.43	1.57	0.17	1.06	0.07	0.64	0.02	26
28			13.21	29.01	8.08	8.78	5.06	2.82	3.86	1.46	2.47	0.49	1.69	0.19	1.14	0.07	0.69	0.02	28
30			14.15	32.96	8.66	9.97	5.43	3.20	4.14	1.65	2.65	0.56	1.81	0.22	1.22	0.08	0.74	0.02	30
35					10.10	13.27	6.33	4.26	4.83	2.20	3.09	0.74	2.11	0.29	1.42	0.11	0.86	0.03	35
40					11.54	16.99	7.23	5.45	5.52	2.82	3.53	0.95	2.41	0.38	1.63	0.14	0.98	0.04	40
45					12.99	21.13	8.14	6.78	6.21	3.51	3.98	1.19	2.71	0.47	1.83	0.18	1.11	0.05	45
50					14.43	25.69	9.04	8.24	6.90	4.26	4.42	1.44	3.02	0.57	2.04	0.22	1.23	0.06	50
55							9.95	9.83	7.59	5.08	4.86	1.72	3.32	0.68	2.24	0.26	1.35	0.08	55
60							10.85	11.55	8.27	5.97	5.30	2.02	3.62	0.80	2.44	0.31	1.48	0.09	60
65							11.76	13.39	8.96	6.93	5.74	2.34	3.92	0.93	2.65	0.36	1.60	0.10	65
70							12.66	15.36	9.65	7.95	6.18	2.69	4.22	1.06	2.85	0.41	1.72	0.12	70
75							13.56	17.46	10.34	9.03	6.63	3.05	4.52	1.21	3.05	0.46	1.85	0.14	75
80							14.47	19.67	11.03	10.17	7.07	3.44	4.82	1.36	3.26	0.52	1.97	0.15	80
85									11.72	11.38	7.51	3.85	5.13	1.52	3.46	0.58	2.09	0.17	85
90									12.41	12.65	7.95	4.28	5.43	1.69	3.66	0.65	2.21	0.19	90
95									13.10	13.99	8.39	4.73	5.73	1.87	3.87	0.72	2.34	0.21	95
100									13.79	15.38	8.83	5.20	6.03	2.06	4.07	0.79	2.46	0.23	100
110											9.72	6.21	6.63	2.45	4.48	0.94	2.71	0.28	110
120											10.60	7.30	7.24	2.88	4.88	1.11	2.95	0.33	120
130											11.48	8.46	7.84	3.34	5.29	1.28	3.20	0.38	130
140											12.37	9.71	8.44	3.83	5.70	1.47	3.44	0.43	140
150											13.25	11.03	9.05	4.36	6.11	1.67	3.69	0.49	150

Exhibit SC16–10 Friction Head Loss for PVC Class 200 psi IPS plastic pipe
 (Source: Rainbird Landscape Irrigation Design Manual)

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Friction Head Loss for PVC Class 200 psi IPS plastic pipe															
(1120, 1220) SDR 21 C = 150															
psi Loss per 100 Feet of Pipe (psi/100 ft)															
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15															
FLOW: 1 - 150 gpm															
Size	2-1/2"		3"		4"		6"		8"		10"		12"		
OD	2.875		3.500		4.500		6.625		8.625		10.750		12.750		
ID	2.601		3.166		4.072		5.993		7.740		9.650		11.450		
Wall Thk	0.137		0.167		0.214		0.316		0.410		0.511		0.606		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1															1
2															2
3	0.18	0.00													3
4	0.24	0.01													4
5	0.30	0.01													5
6	0.36	0.01	0.24	0.00											6
7	0.42	0.01	0.28	0.01											7
8	0.48	0.02	0.33	0.01											8
9	0.54	0.02	0.37	0.01											9
10	0.60	0.03	0.41	0.01											10
11	0.66	0.03	0.45	0.01											11
12	0.72	0.04	0.49	0.02	0.30	0.00									12
13	0.78	0.05	0.53	0.02	0.32	0.01									13
14	0.84	0.05	0.57	0.02	0.34	0.01									14
15	0.90	0.06	0.61	0.02	0.37	0.01									15
16	0.96	0.07	0.65	0.03	0.39	0.01									16
17	1.03	0.08	0.69	0.03	0.42	0.01									17
18	1.09	0.09	0.73	0.03	0.44	0.01									18
19	1.15	0.09	0.77	0.04	0.47	0.01									19
20	1.21	0.10	0.81	0.04	0.49	0.01									20
22	1.33	0.12	0.90	0.05	0.54	0.01									22
24	1.45	0.15	0.98	0.06	0.59	0.02									24
26	1.57	0.17	1.06	0.07	0.64	0.02									26
28	1.69	0.19	1.14	0.07	0.69	0.02									28
30	1.81	0.22	1.22	0.08	0.74	0.02	0.34	0.00							30
35	2.11	0.29	1.42	0.11	0.86	0.03	0.40	0.01							35
40	2.41	0.38	1.63	0.14	0.98	0.04	0.45	0.01							40
45	2.71	0.47	1.83	0.18	1.11	0.05	0.51	0.01							45
50	3.02	0.57	2.04	0.22	1.23	0.06	0.57	0.01							50
55	3.32	0.68	2.24	0.26	1.35	0.08	0.62	0.01							55
60	3.62	0.80	2.44	0.31	1.48	0.09	0.68	0.01							60
65	3.92	0.93	2.65	0.36	1.60	0.10	0.74	0.02	0.44	0.00					65
70	4.22	1.06	2.85	0.41	1.72	0.12	0.80	0.02	0.48	0.01					70
75	4.52	1.21	3.05	0.46	1.85	0.14	0.85	0.02	0.51	0.01					75
80	4.82	1.36	3.26	0.52	1.97	0.15	0.91	0.02	0.54	0.01					80
85	5.13	1.52	3.46	0.58	2.09	0.17	0.97	0.03	0.58	0.01					85
90	5.43	1.69	3.66	0.65	2.21	0.19	1.02	0.03	0.61	0.01					90
95	5.73	1.87	3.87	0.72	2.34	0.21	1.08	0.03	0.65	0.01					95
100	6.03	2.06	4.07	0.79	2.46	0.23	1.14	0.04	0.68	0.01					100
110	6.63	2.45	4.48	0.94	2.71	0.28	1.25	0.04	0.75	0.01					110
120	7.24	2.88	4.88	1.11	2.95	0.33	1.36	0.05	0.82	0.01	0.53	0.00			120
130	7.84	3.34	5.29	1.28	3.20	0.38	1.48	0.06	0.89	0.02	0.57	0.01			130
140	8.44	3.83	5.70	1.47	3.44	0.43	1.59	0.07	0.95	0.02	0.61	0.01			140
150	9.05	4.36	6.11	1.67	3.69	0.49	1.70	0.08	1.02	0.02	0.66	0.01			150

Exhibit SC16–10 Friction Head Loss for PVC Class 200 psi IPS plastic pipe
(Source: Rainbird Landscape Irrigation Design Manual)

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Friction Head Loss for PVC Class 200 psi IPS plastic pipe																
(1120, 1220) SDR 21 C = 150																
psi Loss per 100 Feet of Pipe (psi/100 ft)																
FLOW: 151 - 1050 gpm <i>Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15</i>																
Size	2-1/2"		3"		4"		6"		8"		10"		12"			
OD	2.875		3.500		4.500		6.625		8.625		10.750		12.750			
ID	2.601		3.166		4.072		5.993		7.740		9.650		11.450			
Wall Thk	0.137		0.167		0.214		0.316		0.410		0.511		0.606			
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM	
151	9.11	4.41	6.15	1.69	3.72	0.50	1.72	0.08	1.03	0.02					151	
152	9.17	4.46	6.19	1.72	3.74	0.50	1.73	0.08	1.04	0.02	0.67	0.01			152	
154	9.29	4.57	6.27	1.76	3.79	0.52	1.75	0.08	1.05	0.02	0.67	0.01	0.48	0.00	154	
156	9.41	4.68	6.35	1.80	3.84	0.53	1.77	0.08	1.06	0.02	0.68	0.01	0.49	0.00	156	
158	9.53	4.80	6.43	1.84	3.89	0.54	1.79	0.08	1.08	0.02	0.69	0.01	0.49	0.00	158	
160	9.65	4.91	6.51	1.89	3.94	0.55	1.82	0.08	1.09	0.02	0.70	0.01	0.50	0.00	160	
170	10.25	5.49	6.92	2.11	4.18	0.62	1.93	0.09	1.16	0.03	0.74	0.01	0.53	0.00	170	
180	10.86	6.11	7.33	2.35	4.43	0.69	2.04	0.11	1.23	0.03	0.79	0.01	0.56	0.00	180	
190	11.46	6.75	7.73	2.59	4.68	0.76	2.16	0.12	1.29	0.03	0.83	0.01	0.59	0.00	190	
200	12.06	7.42	8.14	2.85	4.92	0.84	2.27	0.13	1.36	0.04	0.88	0.01	0.62	0.01	200	
225	13.57	9.23	9.16	3.55	5.54	1.04	2.56	0.16	1.53	0.05	0.99	0.02	0.70	0.01	225	
250			10.18	4.31	6.15	1.27	2.84	0.19	1.70	0.06	1.10	0.02	0.78	0.01	250	
275			11.19	5.14	6.77	1.51	3.12	0.23	1.87	0.07	1.20	0.02	0.86	0.01	275	
300			12.21	6.04	7.38	1.78	3.41	0.27	2.04	0.08	1.31	0.03	0.93	0.01	300	
325			13.23	7.01	8.00	2.06	3.69	0.31	2.21	0.09	1.42	0.03	1.01	0.01	325	
350			14.25	8.04	8.61	2.36	3.98	0.36	2.38	0.10	1.53	0.04	1.09	0.02	350	
375					9.23	2.68	4.26	0.41	2.55	0.12	1.64	0.04	1.17	0.02	375	
400					9.84	3.03	4.54	0.46	2.72	0.13	1.75	0.05	1.24	0.02	400	
425					10.46	3.38	4.83	0.52	2.89	0.15	1.86	0.05	1.32	0.02	425	
450					11.07	3.76	5.11	0.57	3.06	0.17	1.97	0.06	1.40	0.02	450	
475					11.69	4.16	5.40	0.63	3.23	0.18	2.08	0.06	1.48	0.03	475	
500					12.30	4.57	5.68	0.70	3.41	0.20	2.19	0.07	1.56	0.03	500	
525					12.92	5.01	5.96	0.76	3.58	0.22	2.30	0.08	1.63	0.03	525	
550					13.53	5.46	6.25	0.83	3.75	0.24	2.41	0.08	1.71	0.04	550	
575					14.15	5.92	6.53	0.90	3.92	0.26	2.52	0.09	1.79	0.04	575	
600					14.76	6.41	6.82	0.98	4.09	0.28	2.63	0.10	1.87	0.04	600	
625							7.10	1.05	4.26	0.30	2.74	0.10	1.95	0.05	625	
650							7.38	1.13	4.43	0.33	2.85	0.11	2.02	0.05	650	
675							7.67	1.22	4.60	0.35	2.96	0.12	2.10	0.05	675	
700							7.95	1.30	4.77	0.37	3.07	0.13	2.18	0.06	700	
725							8.24	1.39	4.94	0.40	3.18	0.14	2.26	0.06	725	
750							8.52	1.48	5.11	0.43	3.29	0.15	2.33	0.06	750	
775							8.80	1.57	5.28	0.45	3.40	0.15	2.41	0.07	775	
800							9.09	1.67	5.45	0.48	3.51	0.16	2.49	0.07	800	
825							9.37	1.76	5.62	0.51	3.61	0.17	2.57	0.08	825	
850									5.79	0.54	3.72	0.18	2.65	0.08	850	
875									5.96	0.57	3.83	0.19	2.72	0.08	875	
900									6.13	0.60	3.94	0.20	2.80	0.09	900	
925									6.30	0.63	4.05	0.21	2.88	0.09	925	
950											4.16	0.23	2.96	0.10	950	
975											4.27	0.24	3.03	0.10	975	
1000											4.38	0.25	3.11	0.11	1000	
1025											4.49	0.26	3.19	0.11	1025	
1050											4.60	0.27	3.27	0.12	1050	

Exhibit SC16-10 Friction Head Loss for PVC Class 200 psi IPS plastic pipe
 (Source: Rainbird Landscape Irrigation Design Manual)

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Friction Head Loss for PVC Class 200 psi IPS plastic pipe (1120, 1220) SDR 21 C = 150 psi Loss per 100 Feet of Pipe (psi/100 ft) FLOW: 1100 - 3250 gpm															
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15															
Size	2-1/2"		3"		4"		6"		8"		10"		12"		
OD	2.875		3.500		4.500		6.625		8.625		10.750		12.750		
ID	2.601		3.166		4.072		5.993		7.740		9.650		11.450		
Wall Thk	0.137		0.167		0.214		0.316		0.410		0.511		0.606		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1100	66.34	174.44	44.77	67.02	27.07	19.70	12.50	3.00	7.49	0.87					1100
1150	69.35	189.41	46.81	72.78	28.30	21.39	13.06	3.26	7.83	0.94	5.04	0.32			1150
1200	72.37	204.94	48.84	78.74	29.53	23.14	13.63	3.53	8.17	1.02	5.26	0.35	3.73	0.15	1200
1250	75.39	221.03	50.88	84.93	30.76	24.96	14.20	3.81	8.51	1.10	5.48	0.37	3.89	0.16	1250
1300	78.40	237.69	52.92	91.33	31.99	26.84	14.77	4.09	8.85	1.18	5.70	0.40	4.05	0.18	1300
1350	81.42	254.90	54.95	97.94	33.22	28.78	15.34	4.39	9.19	1.26	5.91	0.43	4.20	0.19	1350
1400	84.43	272.65	56.99	104.76	34.45	30.79	15.90	4.70	9.53	1.35	6.13	0.46	4.36	0.20	1400
1450	87.45	290.96	59.02	111.80	35.68	32.85	16.47	5.01	9.88	1.44	6.35	0.49	4.51	0.21	1450
1500	90.46	309.82	61.06	119.04	36.91	34.98	17.04	5.34	10.22	1.54	6.57	0.53	4.67	0.23	1500
1550	93.48	329.21	63.09	126.49	38.14	37.17	17.61	5.67	10.56	1.63	6.79	0.56	4.82	0.24	1550
1600	96.49	349.15	65.13	134.15	39.37	39.42	18.18	6.01	10.90	1.73	7.01	0.59	4.98	0.26	1600
1650			67.16	142.02	40.60	41.74	18.74	6.37	11.24	1.83	7.23	0.63	5.13	0.27	1650
1700			69.20	150.09	41.83	44.11	19.31	6.73	11.58	1.94	7.45	0.66	5.29	0.29	1700
1750			71.23	158.37	43.06	46.54	19.88	7.10	11.92	2.04	7.67	0.70	5.45	0.30	1750
1800			73.27	166.85	44.29	49.03	20.45	7.48	12.26	2.15	7.89	0.74	5.60	0.32	1800
1850			75.30	175.54	45.52	51.59	21.02	7.87	12.60	2.27	8.11	0.77	5.76	0.34	1850
1900					46.75	54.20	21.58	8.27	12.94	2.38	8.32	0.81	5.91	0.35	1900
1950					47.98	56.87	22.15	8.67	13.28	2.50	8.54	0.85	6.07	0.37	1950
2000					49.21	59.60	22.72	9.09	13.62	2.62	8.76	0.90	6.22	0.39	2000
2050					50.44	62.39	23.29	9.51	13.96	2.74	8.98	0.94	6.38	0.41	2050
2100					51.67	65.24	23.86	9.95	14.30	2.87	9.20	0.98	6.54	0.43	2100
2150					52.90	68.14	24.42	10.39	14.64	2.99	9.42	1.02	6.69	0.45	2150
2200					54.13	71.10	24.99	10.84	14.98	3.12	9.64	1.07	6.85	0.46	2200
2250					55.36	74.13	25.56	11.31	15.32	3.26	9.86	1.11	7.00	0.48	2250
2300					56.59	77.21	26.13	11.77	15.66	3.39	10.08	1.16	7.16	0.50	2300
2350					57.82	80.34	26.70	12.25	16.00	3.53	10.30	1.21	7.31	0.52	2350
2400							27.26	12.74	16.35	3.67	10.52	1.25	7.47	0.55	2400
2450							27.83	13.24	16.69	3.81	10.73	1.30	7.62	0.57	2450
2500							28.40	13.74	17.03	3.96	10.95	1.35	7.78	0.59	2500
2550							28.97	14.25	17.37	4.11	11.17	1.40	7.94	0.61	2550
2600							29.54	14.78	17.71	4.26	11.39	1.46	8.09	0.63	2600
2650							30.10	15.31	18.05	4.41	11.61	1.51	8.25	0.66	2650
2700							30.67	15.85	18.39	4.56	11.83	1.56	8.40	0.68	2700
2750							31.24	16.39	18.73	4.72	12.05	1.61	8.56	0.70	2750
2800							31.81	16.95	19.07	4.88	12.27	1.67	8.71	0.73	2800
2850									19.41	5.04	12.49	1.72	8.87	0.75	2850
2900									19.75	5.21	12.71	1.78	9.02	0.77	2900
2950									20.09	5.38	12.92	1.84	9.18	0.80	2950
3000									20.43	5.55	13.14	1.90	9.34	0.83	3000
3050											13.36	1.96	9.49	0.85	3050
3100											13.58	2.02	9.65	0.88	3100
3150											13.80	2.08	9.80	0.90	3150
3200											14.02	2.14	9.96	0.93	3200
3250											14.24	2.20	10.11	0.96	3250

Exhibit SC16-11 Friction Head Loss for PVC Class 160 psi IPS plastic pipe
(Source: Rainbird Landscape Irrigation Design Manual)

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Friction Head Loss for PVC Class 160 psi IPS plastic pipe

(1120, 1220) SDR 26 C = 150

psi Loss per 100 Feet of Pipe (psi/100 ft)

FLOW: 1 - 150 gpm

*Table based upon the Hazen-Williams Friction Loss Equation and general
Velocity equation found on Supplement Chapter 16, page 16-15*

Size	1"		1-1/4"		1-1/2"		2"		2-1/2"		3"		4"		6"		
OD	1.315		1.660		1.900		2.375		2.875		3.500		4.500		4.500		
ID	1.195		1.532		1.754		2.193		2.655		3.230		4.154		6.115		
Wall Thk	0.060		0.064		0.073		0.091		0.110		0.135		0.173		0.225		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1	0.29	0.02	0.17	0.01	0.13	0.00											1
2	0.57	0.06	0.35	0.02	0.27	0.01	0.17	0.00									2
3	0.86	0.14	0.52	0.04	0.40	0.02	0.25	0.01									3
4	1.14	0.23	0.70	0.07	0.53	0.04	0.34	0.01	0.23	0.00							4
5	1.43	0.35	0.87	0.11	0.66	0.05	0.42	0.02	0.29	0.01							5
6	1.71	0.49	1.04	0.15	0.80	0.08	0.51	0.03	0.35	0.01	0.23	0.00					6
7	2.00	0.66	1.22	0.20	0.93	0.10	0.59	0.03	0.41	0.01	0.27	0.01					7
8	2.29	0.84	1.39	0.25	1.06	0.13	0.68	0.04	0.46	0.02	0.31	0.01					8
9	2.57	1.05	1.56	0.31	1.19	0.16	0.76	0.05	0.52	0.02	0.35	0.01					9
10	2.86	1.27	1.74	0.38	1.33	0.20	0.85	0.07	0.58	0.03	0.39	0.01					10
11	3.14	1.52	1.91	0.45	1.46	0.23	0.93	0.08	0.64	0.03	0.43	0.01					11
12	3.43	1.78	2.09	0.53	1.59	0.28	1.02	0.09	0.69	0.04	0.47	0.01	0.28	0.00			12
13	3.71	2.07	2.26	0.62	1.72	0.32	1.10	0.11	0.75	0.04	0.51	0.02	0.31	0.00			13
14	4.00	2.37	2.43	0.71	1.86	0.37	1.19	0.12	0.81	0.05	0.55	0.02	0.33	0.01			14
15	4.29	2.70	2.61	0.80	1.99	0.42	1.27	0.14	0.87	0.06	0.59	0.02	0.35	0.01			15
16	4.57	3.04	2.78	0.91	2.12	0.47	1.36	0.16	0.93	0.06	0.63	0.02	0.38	0.01			16
17	4.86	3.40	2.96	1.01	2.25	0.53	1.44	0.18	0.98	0.07	0.66	0.03	0.40	0.01			17
18	5.14	3.78	3.13	1.13	2.39	0.58	1.53	0.20	1.04	0.08	0.70	0.03	0.43	0.01			18
19	5.43	4.18	3.30	1.25	2.52	0.65	1.61	0.22	1.10	0.09	0.74	0.03	0.45	0.01			19
20	5.71	4.59	3.48	1.37	2.65	0.71	1.70	0.24	1.16	0.09	0.78	0.04	0.47	0.01			20
22	6.29	5.48	3.82	1.64	2.92	0.85	1.87	0.29	1.27	0.11	0.86	0.04	0.52	0.01			22
24	6.86	6.44	4.17	1.92	3.18	0.99	2.04	0.34	1.39	0.13	0.94	0.05	0.57	0.01			24
26	7.43	7.47	4.52	2.23	3.45	1.15	2.21	0.39	1.50	0.15	1.02	0.06	0.61	0.02			26
28	8.00	8.56	4.87	2.56	3.71	1.32	2.38	0.45	1.62	0.18	1.09	0.07	0.66	0.02			28
30	8.57	9.73	5.22	2.91	3.98	1.50	2.55	0.51	1.74	0.20	1.17	0.08	0.71	0.02			30
35	10.00	12.95	6.08	3.87	4.64	2.00	2.97	0.67	2.03	0.27	1.37	0.10	0.83	0.03	0.38	0.00	35
40	11.43	16.58	6.95	4.95	5.30	2.56	3.39	0.86	2.32	0.34	1.56	0.13	0.95	0.04	0.44	0.01	40
45	12.86	20.62	7.82	6.16	5.97	3.19	3.82	1.07	2.60	0.42	1.76	0.16	1.06	0.05	0.49	0.01	45
50	14.29	25.07	8.69	7.48	6.63	3.87	4.24	1.31	2.89	0.52	1.96	0.20	1.18	0.06	0.55	0.01	50
55			9.56	8.93	7.29	4.62	4.67	1.56	3.18	0.61	2.15	0.24	1.30	0.07	0.60	0.01	55
60			10.43	10.49	7.96	5.43	5.09	1.83	3.47	0.72	2.35	0.28	1.42	0.08	0.65	0.01	60
65			11.30	12.16	8.62	6.30	5.51	2.12	3.76	0.84	2.54	0.32	1.54	0.09	0.71	0.01	65
70			12.17	13.95	9.28	7.22	5.94	2.44	4.05	0.96	2.74	0.37	1.66	0.11	0.76	0.02	70
75			13.04	15.86	9.95	8.21	6.36	2.77	4.34	1.09	2.93	0.42	1.77	0.12	0.82	0.02	75
80			13.91	17.87	10.61	9.25	6.79	3.12	4.63	1.23	3.13	0.47	1.89	0.14	0.87	0.02	80
85					11.27	10.35	7.21	3.49	4.92	1.38	3.32	0.53	2.01	0.16	0.93	0.02	85
90					11.94	11.50	7.64	3.88	5.21	1.53	3.52	0.59	2.13	0.17	0.98	0.03	90
95					12.60	12.72	8.06	4.29	5.50	1.69	3.72	0.65	2.25	0.19	1.04	0.03	95
100					13.26	13.98	8.48	4.72	5.79	1.86	3.91	0.72	2.36	0.21	1.09	0.03	100
110							9.33	5.63	6.37	2.22	4.30	0.85	2.60	0.25	1.20	0.04	110
120							10.18	6.61	6.95	2.61	4.69	1.00	2.84	0.30	1.31	0.04	120
130							11.03	7.67	7.52	3.02	5.08	1.16	3.07	0.34	1.42	0.05	130
140							11.88	8.79	8.10	3.47	5.47	1.34	3.31	0.39	1.53	0.06	140
150							12.73	9.99	8.68	3.94	5.87	1.52	3.55	0.45	1.64	0.07	150

Exhibit SC16-11 Friction Head Loss for PVC Class 160 psi IPS plastic pipe

(Source: Rainbird Landscape Irrigation Design Manual & Harvel PVC SDR 8 inch Series)

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Friction Head Loss for PVC Class 160 psi IPS plastic pipe													
(1120, 1220) SDR 26 C = 150													
psi Loss per 100 Feet of Pipe (psi/100 ft)													
FLOW: 151 - 1050 gpm													
Size	2"		2-1/2"		3"		4"		6"		8"		
OD	2.375		2.875		3.500		4.500		4.500		8.625		
ID	2.193		2.655		3.230		4.154		6.115		7.921		
Wall Thk	0.091		0.110		0.135		0.173		0.225		0.332		
Flow GPM	Velocity	psi	Velocity	psi	Velocity	psi	Velocity	psi	Velocity	psi	Velocity	psi	Flow GPM
					fps	Loss	fps	Loss	fps	Loss	fps	Loss	
151	12.81	10.12	8.74	3.99	5.91	1.54	3.57	0.45	1.65	0.07	0.98	0.02	151
152	12.90	10.24	8.80	4.04	5.94	1.56	3.59	0.46	1.66	0.07	0.99	0.02	152
154	13.06	10.49	8.91	4.14	6.02	1.59	3.64	0.47	1.68	0.07	1.00	0.02	154
156	13.23	10.75	9.03	4.24	6.10	1.63	3.69	0.48	1.70	0.07	1.01	0.02	156
158			9.15	4.34	6.18	1.67	3.74	0.49	1.72	0.07	1.03	0.02	158
160			9.26	4.44	6.26	1.71	3.78	0.50	1.75	0.08	1.04	0.02	160
170			9.84	4.97	6.65	1.91	4.02	0.56	1.85	0.09	1.11	0.02	170
180			10.42	5.52	7.04	2.13	4.26	0.63	1.96	0.10	1.17	0.03	180
190			11.00	6.11	7.43	2.35	4.49	0.69	2.07	0.11	1.24	0.03	190
200			11.58	6.72	7.82	2.59	4.73	0.76	2.18	0.12	1.30	0.03	200
225			13.02	8.35	8.80	3.22	5.32	0.95	2.45	0.14	1.46	0.04	225
250			14.47	10.15	9.78	3.91	5.91	1.15	2.73	0.18	1.63	0.05	250
275					10.75	4.67	6.50	1.37	3.00	0.21	1.79	0.06	275
300					11.73	5.48	7.09	1.61	3.27	0.25	1.95	0.07	300
325					12.71	6.36	7.68	1.87	3.55	0.28	2.11	0.08	325
350					13.69	7.29	8.28	2.14	3.82	0.33	2.28	0.09	350
375					14.67	8.29	8.87	2.44	4.09	0.37	2.44	0.11	375
400							9.46	2.75	4.36	0.42	2.60	0.12	400
425							10.05	3.07	4.64	0.47	2.76	0.13	425
450							10.64	3.41	4.91	0.52	2.93	0.15	450
475							11.23	3.77	5.18	0.58	3.09	0.16	475
500							11.82	4.15	5.46	0.63	3.25	0.18	500
525							12.41	4.54	5.73	0.69	3.41	0.20	525
550							13.00	4.95	6.00	0.75	3.58	0.21	550
575							13.60	5.38	6.27	0.82	3.74	0.23	575
600							14.19	5.82	6.55	0.89	3.90	0.25	600
625							14.78	6.27	6.82	0.96	4.06	0.27	625
650									7.09	1.03	4.23	0.29	650
675									7.36	1.10	4.39	0.31	675
700									7.64	1.18	4.55	0.33	700
725									7.91	1.26	4.71	0.36	725
750									8.18	1.34	4.88	0.38	750
775									8.46	1.42	5.04	0.40	775
800									8.73	1.51	5.20	0.43	800
825									9.00	1.60	5.36	0.45	825
850									9.27	1.69	5.53	0.48	850
875									9.55	1.78	5.69	0.51	875
900									9.82	1.88	5.85	0.53	900
925									10.09	1.98	6.02	0.56	925
950									10.37	2.08	6.18	0.59	950
975									10.64	2.18	6.34	0.62	975
1000									10.91	2.28	6.50	0.65	1000
1025									11.18	2.39	6.67	0.68	1025
1050									11.46	2.50	6.83	0.71	1050

Exhibit SC16–11 Friction Head Loss for PVC Class 160 psi IPS plastic pipe
 (Source: Harvel PVC SDR Series: Pressure Rated Pipe Data sheets)

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Friction Head Loss for PVC Class 160 psi IPS plastic pipe							
(1120, 1220) SDR 26 C = 150							
psi Loss per 100 Feet of Pipe (psi/100 ft)							
FLOW: 1100 - 3250 gpm							
Size	8"		10"		12"		
OD	8.625		10.750		12.750		
ID	7.921		9.874		11.711		
Wall Thk	0.332		0.413		0.490		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1100	7.15	0.77					1100
1150	7.48	0.84	4.81	0.29			1150
1200	7.80	0.91	5.02	0.31	3.57	0.14	1200
1250	8.13	0.98	5.23	0.34	3.72	0.15	1250
1300	8.45	1.05	5.44	0.36	3.87	0.16	1300
1350	8.78	1.13	5.65	0.39	4.02	0.17	1350
1400	9.10	1.21	5.86	0.41	4.16	0.18	1400
1450	9.43	1.29	6.07	0.44	4.31	0.19	1450
1500	9.75	1.37	6.28	0.47	4.46	0.20	1500
1550	10.08	1.46	6.49	0.50	4.61	0.22	1550
1600	10.40	1.55	6.70	0.53	4.76	0.23	1600
1650	10.73	1.64	6.90	0.56	4.91	0.24	1650
1700	11.05	1.73	7.11	0.59	5.06	0.26	1700
1750	11.38	1.83	7.32	0.63	5.21	0.27	1750
1800	11.71	1.92	7.53	0.66	5.35	0.29	1800
1850	12.03	2.02	7.74	0.69	5.50	0.30	1850
1900	12.36	2.13	7.95	0.73	5.65	0.32	1900
1950	12.68	2.23	8.16	0.76	5.80	0.33	1950
2000	13.01	2.34	8.37	0.80	5.95	0.35	2000
2050	13.33	2.45	8.58	0.84	6.10	0.37	2050
2100	13.66	2.56	8.79	0.88	6.25	0.38	2100
2150	13.98	2.67	9.00	0.92	6.40	0.40	2150
2200	14.31	2.79	9.21	0.96	6.54	0.42	2200
2250	14.63	2.91	9.42	1.00	6.69	0.43	2250
2300	14.96	3.03	9.63	1.04	6.84	0.45	2300
2350			9.83	1.08	6.99	0.47	2350
2400			10.04	1.12	7.14	0.49	2400
2450			10.25	1.17	7.29	0.51	2450
2500			10.46	1.21	7.44	0.53	2500
2550			10.67	1.26	7.59	0.55	2550
2600			10.88	1.30	7.73	0.57	2600
2650			11.09	1.35	7.88	0.59	2650
2700			11.30	1.40	8.03	0.61	2700
2750			11.51	1.44	8.18	0.63	2750
2800			11.72	1.49	8.33	0.65	2800
2850			11.93	1.54	8.48	0.67	2850
2900			12.14	1.59	8.63	0.69	2900
2950			12.35	1.64	8.78	0.72	2950
3000			12.55	1.70	8.92	0.74	3000
3050			12.76	1.75	9.07	0.76	3050
3100			12.97	1.80	9.22	0.79	3100
3150			13.18	1.86	9.37	0.81	3150
3200			13.39	1.91	9.52	0.83	3200
3250			13.60	1.97	9.67	0.86	3250

Exhibit SC16-12 Friction Head Loss for PVC Schedule 40 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 40 IPS plastic pipe (1120, 1220) SDR 21 C = 150 psi Loss per 100 Feet of Pipe (psi/100 ft) FLOW: 1 - 150 gpm																			
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																			
Size	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3.5										
OD	0.840	1.050	1.315	1.660	1.900	2.375	2.875	3.500	4.000										
ID	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	3.548										
Wall Thk	0.109	0.113	0.133	0.140	0.145	0.154	0.203	0.216	0.226										
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1	1.05	0.43	0.60	0.11	0.37	0.03	0.21	0.01	0.16	0.00									1
2	2.11	1.55	1.20	0.39	0.74	0.12	0.43	0.03	0.31	0.02	0.19	0.00							2
3	3.16	3.28	1.80	0.84	1.11	0.26	0.64	0.07	0.47	0.03	0.29	0.01	0.20	0.00					3
4	4.22	5.59	2.40	1.42	1.48	0.44	0.86	0.12	0.63	0.05	0.38	0.02	0.27	0.01					4
5	5.27	8.45	3.00	2.15	1.85	0.66	1.07	0.17	0.79	0.08	0.48	0.02	0.33	0.01	0.22	0.00			5
6	6.33	11.85	3.61	3.02	2.22	0.93	1.29	0.25	0.94	0.12	0.57	0.03	0.40	0.01	0.26	0.01			6
7	7.38	15.76	4.21	4.01	2.60	1.24	1.50	0.33	1.10	0.15	0.67	0.05	0.47	0.02	0.30	0.01			7
8	8.44	20.18	4.81	5.14	2.97	1.59	1.71	0.42	1.26	0.20	0.76	0.06	0.54	0.02	0.35	0.01	0.26	0.00	8
9	9.49	25.10	5.41	6.39	3.34	1.97	1.93	0.52	1.42	0.25	0.86	0.07	0.60	0.03	0.39	0.01	0.29	0.01	9
10	10.55	30.51	6.01	7.77	3.71	2.40	2.14	0.63	1.57	0.30	0.95	0.09	0.67	0.04	0.43	0.01	0.32	0.01	10
11	11.60	36.40	6.61	9.26	4.08	2.86	2.36	0.75	1.73	0.36	1.05	0.11	0.74	0.04	0.48	0.02	0.36	0.01	11
12	12.65	42.77	7.21	10.88	4.45	3.36	2.57	0.89	1.89	0.42	1.15	0.12	0.80	0.05	0.52	0.02	0.39	0.01	12
13	13.71	49.60	7.81	12.62	4.82	3.90	2.79	1.03	2.05	0.48	1.24	0.14	0.87	0.06	0.56	0.02	0.42	0.01	13
14	14.76	56.90	8.41	14.48	5.19	4.47	3.00	1.18	2.20	0.56	1.34	0.16	0.94	0.07	0.61	0.02	0.45	0.01	14
15			9.01	16.45	5.56	5.08	3.21	1.34	2.36	0.63	1.43	0.19	1.00	0.08	0.65	0.03	0.49	0.01	15
16			9.61	18.54	5.93	5.73	3.43	1.51	2.52	0.71	1.53	0.21	1.07	0.09	0.69	0.03	0.52	0.02	16
17			10.22	20.75	6.30	6.41	3.64	1.69	2.68	0.80	1.62	0.24	1.14	0.10	0.74	0.03	0.55	0.02	17
18			10.82	23.06	6.67	7.12	3.86	1.88	2.83	0.89	1.72	0.26	1.20	0.11	0.78	0.04	0.58	0.02	18
19			11.42	25.49	7.04	7.87	4.07	2.07	2.99	0.98	1.81	0.29	1.27	0.12	0.82	0.04	0.62	0.02	19
20			12.02	28.03	7.42	8.66	4.28	2.28	3.15	1.08	1.91	0.32	1.34	0.13	0.87	0.05	0.65	0.02	20
22			13.22	33.44	8.16	10.33	4.71	2.72	3.46	1.28	2.10	0.38	1.47	0.16	0.95	0.06	0.71	0.03	22
24			14.42	39.29	8.90	12.14	5.14	3.20	3.78	1.51	2.29	0.45	1.61	0.19	1.04	0.07	0.78	0.03	24
26					9.64	14.08	5.57	3.71	4.09	1.75	2.48	0.52	1.74	0.22	1.13	0.08	0.84	0.04	26
28					10.38	16.15	6.00	4.25	4.41	2.01	2.67	0.60	1.87	0.25	1.21	0.09	0.91	0.04	28
30					11.12	18.35	6.43	4.83	4.72	2.28	2.86	0.68	2.01	0.28	1.30	0.10	0.97	0.05	30
35					12.98	24.41	7.50	6.43	5.51	3.04	3.34	0.90	2.34	0.38	1.52	0.13	1.13	0.06	35
40					14.83	31.26	8.57	8.23	6.30	3.89	3.82	1.15	2.68	0.49	1.73	0.17	1.30	0.08	40
45							9.64	10.24	7.08	4.83	4.30	1.43	3.01	0.60	1.95	0.21	1.46	0.10	45
50							10.71	12.44	7.87	5.88	4.77	1.74	3.35	0.73	2.17	0.25	1.62	0.13	50
55							11.78	14.84	8.66	7.01	5.25	2.08	3.68	0.88	2.38	0.30	1.78	0.15	55
60							12.85	17.44	9.44	8.24	5.73	2.44	4.02	1.03	2.60	0.36	1.94	0.18	60
65							13.93	20.23	10.23	9.55	6.21	2.83	4.35	1.19	2.82	0.41	2.11	0.20	65
70									11.02	10.96	6.68	3.25	4.69	1.37	3.03	0.48	2.27	0.23	70
75									11.81	12.45	7.16	3.69	5.02	1.55	3.25	0.54	2.43	0.27	75
80									12.59	14.03	7.64	4.16	5.35	1.75	3.47	0.61	2.59	0.30	80
85									13.38	15.70	8.12	4.65	5.69	1.96	3.68	0.68	2.75	0.34	85
90									14.17	17.45	8.59	5.17	6.02	2.18	3.90	0.76	2.92	0.37	90
95									14.95	19.29	9.07	5.72	6.36	2.41	4.12	0.84	3.08	0.41	95
100											9.55	6.29	6.69	2.65	4.33	0.92	3.24	0.45	100
110											10.50	7.50	7.36	3.16	4.77	1.10	3.57	0.54	110
120											11.46	8.82	8.03	3.71	5.20	1.29	3.89	0.64	120
130											12.41	10.22	8.70	4.31	5.63	1.50	4.21	0.74	130
140											13.37	11.73	9.37	4.94	6.07	1.72	4.54	0.85	140
150											14.32	13.33	10.04	5.61	6.50	1.95	4.86	0.96	150

Exhibit SC16-12 Friction Head Loss for PVC Schedule 40 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 40 IPS plastic pipe

(1120, 1220) SDR 21 C = 150

psi Loss per 100 Feet of Pipe (psi/100 ft)

*Table based upon the Hazen-Williams Friction Loss Equation and general
Velocity equation found on Supplement Chapter 16, page 16-15***FLOW: 1 - 150 gpm**

Size	3"		3.5"		4"		5"		6"		8"		10"		12"		
OD	3.500		4.000		4.500		5.563		6.625		8.625		10.750		12.750		
ID	3.068		3.548		4.026		5.047		6.065		7.981		10.020		11.814		
Wall Thk	0.216		0.226		0.237		0.258		0.280		0.322		0.365		0.406		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1																	1
2																	2
3																	3
4																	4
5	0.22	0.00															5
6	0.26	0.01															6
7	0.30	0.01															7
8	0.35	0.01	0.26	0.00													8
9	0.39	0.01	0.29	0.01													9
10	0.43	0.01	0.32	0.01													10
11	0.48	0.02	0.36	0.01													11
12	0.52	0.02	0.39	0.01	0.30	0.00											12
13	0.56	0.02	0.42	0.01	0.33	0.01											13
14	0.61	0.02	0.45	0.01	0.35	0.01											14
15	0.65	0.03	0.49	0.01	0.38	0.01											15
16	0.69	0.03	0.52	0.02	0.40	0.01											16
17	0.74	0.03	0.55	0.02	0.43	0.01											17
18	0.78	0.04	0.58	0.02	0.45	0.01											18
19	0.82	0.04	0.62	0.02	0.48	0.01											19
20	0.87	0.05	0.65	0.02	0.50	0.01											20
22	0.95	0.06	0.71	0.03	0.55	0.01	0.35	0.00									22
24	1.04	0.07	0.78	0.03	0.60	0.02	0.38	0.01									24
26	1.13	0.08	0.84	0.04	0.65	0.02	0.42	0.01									26
28	1.21	0.09	0.91	0.04	0.70	0.02	0.45	0.01									28
30	1.30	0.10	0.97	0.05	0.76	0.03	0.48	0.01									30
35	1.52	0.13	1.13	0.06	0.88	0.04	0.56	0.01	0.39	0.00							35
40	1.73	0.17	1.30	0.08	1.01	0.04	0.64	0.01	0.44	0.01							40
45	1.95	0.21	1.46	0.10	1.13	0.06	0.72	0.02	0.50	0.01							45
50	2.17	0.25	1.62	0.13	1.26	0.07	0.80	0.02	0.55	0.01							50
55	2.38	0.30	1.78	0.15	1.38	0.08	0.88	0.03	0.61	0.01							55
60	2.60	0.36	1.94	0.18	1.51	0.10	0.96	0.03	0.67	0.01							60
65	2.82	0.41	2.11	0.20	1.64	0.11	1.04	0.04	0.72	0.02							65
70	3.03	0.48	2.27	0.23	1.76	0.13	1.12	0.04	0.78	0.02	0.45	0.00					70
75	3.25	0.54	2.43	0.27	1.89	0.14	1.20	0.05	0.83	0.02	0.48	0.01					75
80	3.47	0.61	2.59	0.30	2.01	0.16	1.28	0.05	0.89	0.02	0.51	0.01					80
85	3.68	0.68	2.75	0.34	2.14	0.18	1.36	0.06	0.94	0.02	0.54	0.01					85
90	3.90	0.76	2.92	0.37	2.27	0.20	1.44	0.07	1.00	0.03	0.58	0.01					90
95	4.12	0.84	3.08	0.41	2.39	0.22	1.52	0.07	1.05	0.03	0.61	0.01					95
100	4.33	0.92	3.24	0.45	2.52	0.25	1.60	0.08	1.11	0.03	0.64	0.01					100
110	4.77	1.10	3.57	0.54	2.77	0.29	1.76	0.10	1.22	0.04	0.70	0.01					110
120	5.20	1.29	3.89	0.64	3.02	0.34	1.92	0.11	1.33	0.05	0.77	0.01					120
130	5.63	1.50	4.21	0.74	3.27	0.40	2.08	0.13	1.44	0.05	0.83	0.01	0.53	0.00			130
140	6.07	1.72	4.54	0.85	3.52	0.46	2.24	0.15	1.55	0.06	0.90	0.02	0.57	0.01			140
150	6.50	1.95	4.86	0.96	3.78	0.52	2.40	0.17	1.66	0.07	0.96	0.02	0.61	0.01			150

Exhibit SC16–12 Friction Head Loss for PVC Schedule 40 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 40 IPS plastic pipe																	
(1120, 1220) SDR 21 C = 150																	
psi Loss per 100 Feet of Pipe (psi/100 ft)																	
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																	
FLOW: 151 - 1050 gpm																	
Size	3"		3.5"		4"		5"		6"		8"		10"		12"		
OD	3.500		4.000		4.500		5.563		6.625		8.625		10.750		12.750		
ID	3.068		3.548		4.026		5.047		6.065		7.981		10.020		11.814		
Wall Thk	0.216		0.226		0.237		0.258		0.280		0.322		0.365		0.406		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
151	6.55	1.97	4.89	0.97	3.80	0.53	2.42	0.18	1.67	0.07	0.97	0.02					151
152	6.59	2.00	4.93	0.99	3.83	0.53	2.43	0.18	1.69	0.07	0.97	0.02	0.62	0.01			152
154	6.68	2.05	4.99	1.01	3.88	0.55	2.47	0.18	1.71	0.07	0.99	0.02	0.63	0.01	0.45	0.00	154
156	6.76	2.10	5.06	1.03	3.93	0.56	2.50	0.19	1.73	0.08	1.00	0.02	0.63	0.01	0.46	0.00	156
158	6.85	2.15	5.12	1.06	3.98	0.57	2.53	0.19	1.75	0.08	1.01	0.02	0.64	0.01	0.46	0.00	158
160	6.94	2.20	5.19	1.08	4.03	0.59	2.56	0.20	1.77	0.08	1.02	0.02	0.65	0.01	0.47	0.00	160
170	7.37	2.46	5.51	1.21	4.28	0.66	2.72	0.22	1.89	0.09	1.09	0.02	0.69	0.01	0.50	0.00	170
180	7.80	2.73	5.83	1.35	4.53	0.73	2.88	0.24	2.00	0.10	1.15	0.03	0.73	0.01	0.53	0.00	180
190	8.24	3.02	6.16	1.49	4.78	0.81	3.04	0.27	2.11	0.11	1.22	0.03	0.77	0.01	0.56	0.00	190
200	8.67	3.32	6.48	1.64	5.03	0.89	3.20	0.29	2.22	0.12	1.28	0.03	0.81	0.01	0.58	0.00	200
225	9.75	4.13	7.29	2.04	5.66	1.10	3.60	0.37	2.50	0.15	1.44	0.04	0.91	0.01	0.66	0.01	225
250	10.84	5.02	8.10	2.48	6.29	1.34	4.00	0.45	2.77	0.18	1.60	0.05	1.02	0.02	0.73	0.01	250
275	11.92	5.99	8.91	2.95	6.92	1.60	4.40	0.53	3.05	0.22	1.76	0.06	1.12	0.02	0.80	0.01	275
300	13.00	7.04	9.72	3.47	7.55	1.88	4.81	0.62	3.33	0.26	1.92	0.07	1.22	0.02	0.88	0.01	300
325	14.09	8.17	10.53	4.03	8.18	2.18	5.21	0.72	3.60	0.30	2.08	0.08	1.32	0.03	0.95	0.01	325
350	15.17	9.37	11.34	4.62	8.81	2.50	5.61	0.83	3.88	0.34	2.24	0.09	1.42	0.03	1.02	0.01	350
375	16.25	10.64	12.15	5.25	9.44	2.84	6.01	0.94	4.16	0.39	2.40	0.10	1.52	0.03	1.10	0.02	375
400	17.34	12.00	12.96	5.91	10.07	3.20	6.41	1.06	4.44	0.44	2.56	0.11	1.63	0.04	1.17	0.02	400
425	18.42	13.42	13.77	6.62	10.70	3.58	6.81	1.19	4.71	0.49	2.72	0.13	1.73	0.04	1.24	0.02	425
450	19.51	14.92	14.58	7.36	11.33	3.98	7.21	1.32	4.99	0.54	2.88	0.14	1.83	0.05	1.32	0.02	450
475	20.59	16.49	15.40	8.13	11.96	4.40	7.61	1.46	5.27	0.60	3.04	0.16	1.93	0.05	1.39	0.02	475
500	21.67	18.13	16.21	8.94	12.59	4.83	8.01	1.61	5.55	0.66	3.20	0.17	2.03	0.06	1.46	0.03	500
525					13.22	5.29	8.41	1.76	5.82	0.72	3.36	0.19	2.13	0.06	1.53	0.03	525
550					13.84	5.77	8.81	1.92	6.10	0.79	3.52	0.21	2.24	0.07	1.61	0.03	550
575					14.47	6.26	9.21	2.08	6.38	0.85	3.68	0.22	2.34	0.07	1.68	0.03	575
600					15.10	6.77	9.61	2.26	6.66	0.92	3.84	0.24	2.44	0.08	1.75	0.04	600
625							10.01	2.43	6.93	0.99	4.00	0.26	2.54	0.09	1.83	0.04	625
650							10.41	2.62	7.21	1.07	4.16	0.28	2.64	0.09	1.90	0.04	650
675							10.81	2.81	7.49	1.15	4.32	0.30	2.74	0.10	1.97	0.04	675
700							11.21	3.00	7.76	1.23	4.48	0.32	2.84	0.11	2.05	0.05	700
725							11.61	3.20	8.04	1.31	4.64	0.34	2.95	0.11	2.12	0.05	725
750							12.01	3.41	8.32	1.39	4.80	0.37	3.05	0.12	2.19	0.05	750
775							12.41	3.62	8.60	1.48	4.96	0.39	3.15	0.13	2.27	0.06	775
800							12.81	3.84	8.87	1.57	5.12	0.41	3.25	0.14	2.34	0.06	800
825							13.21	4.07	9.15	1.66	5.28	0.44	3.35	0.14	2.41	0.06	825
850											5.44	0.46	3.45	0.15	2.48	0.07	850
875											5.60	0.49	3.56	0.16	2.56	0.07	875
900											5.76	0.51	3.66	0.17	2.63	0.08	900
925											5.92	0.54	3.76	0.18	2.70	0.08	925
950													3.86	0.19	2.78	0.08	950
975													3.96	0.20	2.85	0.09	975
1000													4.06	0.21	2.92	0.09	1000
1025													4.17	0.22	3.00	0.10	1025
1050													4.27	0.23	3.07	0.10	1050

Exhibit SC16-12 Friction Head Loss for PVC Schedule 40 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 40 IPS plastic pipe																		
(1120, 1220) SDR 21 C = 150																		
psi Loss per 100 Feet of Pipe (psi/100 ft)																		
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																		
FLOW: 1100 - 3250 gpm																		
Size		3"		3.5"		4"		5"		6"		8"		10"		12"		
OD		3.500		4.000		4.500		5.563		6.625		8.625		10.750		12.750		
ID		3.068		3.548		4.026		5.047		6.065		7.981		10.020		11.814		
Wall Thk		0.216		0.226		0.237		0.258		0.280		0.322		0.365		0.406		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM	
1100									12.20	2.83	7.05	0.75					1100	
1150									12.76	3.08	7.37	0.81	4.67	0.27			1150	
1200									13.31	3.33	7.69	0.88	4.88	0.29	3.51	0.13	1200	
1250									13.86	3.59	8.01	0.94	5.08	0.31	3.65	0.14	1250	
1300									14.42	3.86	8.33	1.02	5.28	0.34	3.80	0.15	1300	
1350									14.97	4.14	8.65	1.09	5.49	0.36	3.95	0.16	1350	
1400											8.97	1.16	5.69	0.39	4.09	0.17	1400	
1450											9.29	1.24	5.89	0.41	4.24	0.18	1450	
1500											9.61	1.32	6.10	0.44	4.38	0.20	1500	
1550											9.93	1.41	6.30	0.46	4.53	0.21	1550	
1600											10.25	1.49	6.50	0.49	4.68	0.22	1600	
1650											10.57	1.58	6.71	0.52	4.82	0.23	1650	
1700											10.89	1.67	6.91	0.55	4.97	0.25	1700	
1750											11.21	1.76	7.11	0.58	5.12	0.26	1750	
1800											11.53	1.86	7.31	0.61	5.26	0.28	1800	
1850											11.85	1.95	7.52	0.65	5.41	0.29	1850	
1900											12.17	2.05	7.72	0.68	5.55	0.30	1900	
1950											12.49	2.15	7.92	0.71	5.70	0.32	1950	
2000											12.81	2.26	8.13	0.75	5.85	0.33	2000	
2050											13.13	2.36	8.33	0.78	5.99	0.35	2050	
2100											13.45	2.47	8.53	0.82	6.14	0.37	2100	
2150											13.77	2.58	8.74	0.85	6.28	0.38	2150	
2200											14.09	2.69	8.94	0.89	6.43	0.40	2200	
2250											14.41	2.80	9.14	0.93	6.58	0.42	2250	
2300											14.73	2.92	9.35	0.97	6.72	0.43	2300	
2350													9.55	1.00	6.87	0.45	2350	
2400													9.75	1.04	7.02	0.47	2400	
2450													9.96	1.09	7.16	0.49	2450	
2500													10.16	1.13	7.31	0.51	2500	
2550													10.36	1.17	7.45	0.52	2550	
2600													10.57	1.21	7.60	0.54	2600	
2650													10.77	1.26	7.75	0.56	2650	
2700													10.97	1.30	7.89	0.58	2700	
2750													11.18	1.34	8.04	0.60	2750	
2800													11.38	1.39	8.19	0.62	2800	
2850													11.58	1.44	8.33	0.64	2850	
2900													11.78	1.48	8.48	0.67	2900	
2950													11.99	1.53	8.62	0.69	2950	
3000													12.19	1.58	8.77	0.71	3000	
3050													12.39	1.63	8.92	0.73	3050	
3100													12.60	1.68	9.06	0.75	3100	
3150													12.80	1.73	9.21	0.78	3150	
3200													13.00	1.78	9.35	0.80	3200	
3250													13.21	1.83	9.50	0.82	3250	

Exhibit SC16-13 Friction Head Loss for PVC Schedule 80 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 80 IPS plastic pipe																			
(1120, 1220) SDR 21 C = 150																			
psi Loss per 100 Feet of Pipe (psi/100 ft)																			
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																			
FLOW: 1 - 150 gpm																			
Size	1/2"		3/4"		1"		1-1/4"		1-1/2"		2"		2-1/2"		3"		3.5		
OD	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.000		
ID	0.546		0.742		0.957		1.278		1.500		1.939		2.323		2.900		3.364		
Wall Thk	0.147		0.154		0.179		0.191		0.200		0.218		0.276		0.300		0.318		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1	1.37	0.81	0.74	0.18	0.45	0.05	0.25	0.01	0.18	0.01	0.11	0.00							1
2	2.74	2.92	1.48	0.66	0.89	0.19	0.50	0.05	0.36	0.02	0.22	0.01	0.15	0.00					2
3	4.11	6.19	2.22	1.39	1.34	0.40	0.75	0.10	0.54	0.05	0.33	0.01	0.23	0.01					3
4	5.47	10.54	2.96	2.37	1.78	0.69	1.00	0.17	0.73	0.08	0.43	0.02	0.30	0.01					4
5	6.84	15.94	3.71	3.58	2.23	1.04	1.25	0.25	0.91	0.12	0.54	0.03	0.38	0.01	0.24	0.00			5
6	8.21	22.34	4.45	5.02	2.67	1.46	1.50	0.36	1.09	0.16	0.65	0.05	0.45	0.02	0.29	0.01			6
7	9.58	29.72	5.19	6.68	3.12	1.94	1.75	0.47	1.27	0.22	0.76	0.06	0.53	0.03	0.34	0.01	0.25	0.00	7
8	10.95	38.05	5.93	8.55	3.56	2.48	2.00	0.61	1.45	0.28	0.87	0.08	0.60	0.03	0.39	0.01	0.29	0.01	8
9	12.32	47.33	6.67	10.64	4.01	3.08	2.25	0.75	1.63	0.35	0.98	0.10	0.68	0.04	0.44	0.01	0.32	0.01	9
10	13.69	57.53	7.41	12.93	4.45	3.75	2.50	0.92	1.81	0.42	1.09	0.12	0.76	0.05	0.49	0.02	0.36	0.01	10
11	15.05	68.63	8.15	15.43	4.90	4.47	2.75	1.09	1.99	0.50	1.19	0.14	0.83	0.06	0.53	0.02	0.40	0.01	11
12	16.42	80.63	8.89	18.13	5.35	5.26	3.00	1.29	2.18	0.59	1.30	0.17	0.91	0.07	0.58	0.02	0.43	0.01	12
13	17.79	93.52	9.63	21.02	5.79	6.09	3.25	1.49	2.36	0.68	1.41	0.20	0.98	0.08	0.63	0.03	0.47	0.01	13
14	19.16	107.28	10.37	24.12	6.24	6.99	3.50	1.71	2.54	0.78	1.52	0.23	1.06	0.09	0.68	0.03	0.50	0.02	14
15			11.12	27.40	6.68	7.94	3.75	1.94	2.72	0.89	1.63	0.26	1.13	0.11	0.73	0.04	0.54	0.02	15
16			11.86	30.88	7.13	8.95	4.00	2.19	2.90	1.01	1.74	0.29	1.21	0.12	0.78	0.04	0.58	0.02	16
17			12.60	34.55	7.57	10.02	4.25	2.45	3.08	1.12	1.84	0.32	1.29	0.13	0.82	0.05	0.61	0.02	17
18			13.34	38.41	8.02	11.14	4.50	2.73	3.26	1.25	1.95	0.36	1.36	0.15	0.87	0.05	0.65	0.02	18
19			14.08	42.45	8.46	12.31	4.75	3.01	3.45	1.38	2.06	0.40	1.44	0.16	0.92	0.06	0.69	0.03	19
20			14.82	46.69	8.91	13.53	5.00	3.31	3.63	1.52	2.17	0.44	1.51	0.18	0.97	0.06	0.72	0.03	20
22			16.30	55.70	9.80	16.15	5.50	3.95	3.99	1.81	2.39	0.52	1.66	0.22	1.07	0.07	0.79	0.04	22
24			17.79	65.44	10.69	18.97	6.00	4.64	4.35	2.13	2.60	0.61	1.81	0.25	1.16	0.09	0.87	0.04	24
26					11.58	22.00	6.49	5.39	4.71	2.47	2.82	0.71	1.97	0.29	1.26	0.10	0.94	0.05	26
28					12.47	25.24	6.99	6.18	5.08	2.83	3.04	0.81	2.12	0.34	1.36	0.11	1.01	0.06	28
30					13.36	28.68	7.49	7.02	5.44	3.22	3.26	0.92	2.27	0.38	1.46	0.13	1.08	0.06	30
35					15.59	38.16	8.74	9.34	6.35	4.28	3.80	1.23	2.65	0.51	1.70	0.17	1.26	0.08	35
40					17.82	48.86	9.99	11.96	7.25	5.49	4.34	1.57	3.02	0.65	1.94	0.22	1.44	0.11	40
45							11.24	14.87	8.16	6.82	4.88	1.96	3.40	0.81	2.18	0.28	1.62	0.13	45
50							12.49	18.08	9.07	8.29	5.43	2.38	3.78	0.99	2.43	0.34	1.80	0.16	50
55							13.74	21.57	9.97	9.89	5.97	2.84	4.16	1.18	2.67	0.40	1.98	0.19	55
60							14.99	25.34	10.88	11.62	6.51	3.33	4.54	1.38	2.91	0.47	2.16	0.23	60
65							16.24	29.39	11.79	13.48	7.05	3.87	4.91	1.60	3.15	0.55	2.34	0.26	65
70									12.69	15.46	7.60	4.43	5.29	1.84	3.40	0.63	2.52	0.30	70
75									13.60	17.57	8.14	5.04	5.67	2.09	3.64	0.71	2.70	0.35	75
80									14.51	19.80	8.68	5.68	6.05	2.36	3.88	0.80	2.88	0.39	80
85									15.41	22.16	9.22	6.35	6.43	2.64	4.12	0.90	3.06	0.44	85
90									16.32	24.63	9.77	7.06	6.80	2.93	4.37	1.00	3.24	0.48	90
95									17.23	27.22	10.31	7.81	7.18	3.24	4.61	1.10	3.43	0.53	95
100											10.85	8.58	7.56	3.56	4.85	1.21	3.61	0.59	100
110											11.94	10.24	8.32	4.25	5.34	1.44	3.97	0.70	110
120											13.02	12.03	9.07	4.99	5.82	1.70	4.33	0.82	120
130											14.11	13.95	9.83	5.79	6.31	1.97	4.69	0.96	130
140											15.19	16.01	10.58	6.64	6.79	2.26	5.05	1.10	140
150											16.28	18.19	11.34	7.55	7.28	2.57	5.41	1.25	150

Exhibit SC16-13 Friction Head Loss for PVC Schedule 80 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 80 IPS plastic pipe																			
(1120, 1220) SDR 21 C = 150																			
psi Loss per 100 Feet of Pipe (psi/100 ft)																			
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																			
FLOW: 1 - 150 gpm																			
Size	2-1/2"	3"	3.5	4"	5"	6"	8"	10"	12"										
OD	2.875	3.500	4.000	4.500	5.563	6.625	8.625	10.750	12.750										
ID	2.323	2.900	3.364	3.826	4.813	5.761	7.625	9.564	11.376										
Wall Thk	0.276	0.300	0.318	0.337	0.375	0.432	0.500	0.593	0.687										
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1																			1
2	0.15	0.00																	2
3	0.23	0.01																	3
4	0.30	0.01																	4
5	0.38	0.01	0.24	0.00															5
6	0.45	0.02	0.29	0.01															6
7	0.53	0.03	0.34	0.01	0.25	0.00													7
8	0.60	0.03	0.39	0.01	0.29	0.01													8
9	0.68	0.04	0.44	0.01	0.32	0.01													9
10	0.76	0.05	0.49	0.02	0.36	0.01	0.28	0.00											10
11	0.83	0.06	0.53	0.02	0.40	0.01	0.31	0.01											11
12	0.91	0.07	0.58	0.02	0.43	0.01	0.33	0.01											12
13	0.98	0.08	0.63	0.03	0.47	0.01	0.36	0.01											13
14	1.06	0.09	0.68	0.03	0.50	0.02	0.39	0.01											14
15	1.13	0.11	0.73	0.04	0.54	0.02	0.42	0.01											15
16	1.21	0.12	0.78	0.04	0.58	0.02	0.45	0.01											16
17	1.29	0.13	0.82	0.05	0.61	0.02	0.47	0.01											17
18	1.36	0.15	0.87	0.05	0.65	0.02	0.50	0.01											18
19	1.44	0.16	0.92	0.06	0.69	0.03	0.53	0.01	0.33	0.00									19
20	1.51	0.18	0.97	0.06	0.72	0.03	0.56	0.02	0.35	0.01									20
22	1.66	0.22	1.07	0.07	0.79	0.04	0.61	0.02	0.39	0.01									22
24	1.81	0.25	1.16	0.09	0.87	0.04	0.67	0.02	0.42	0.01									24
26	1.97	0.29	1.26	0.10	0.94	0.05	0.72	0.03	0.46	0.01									26
28	2.12	0.34	1.36	0.11	1.01	0.06	0.78	0.03	0.49	0.01									28
30	2.27	0.38	1.46	0.13	1.08	0.06	0.84	0.03	0.53	0.01	0.37	0.00							30
35	2.65	0.51	1.70	0.17	1.26	0.08	0.98	0.04	0.62	0.01	0.43	0.01							35
40	3.02	0.65	1.94	0.22	1.44	0.11	1.11	0.06	0.70	0.02	0.49	0.01							40
45	3.40	0.81	2.18	0.28	1.62	0.13	1.25	0.07	0.79	0.02	0.55	0.01							45
50	3.78	0.99	2.43	0.34	1.80	0.16	1.39	0.09	0.88	0.03	0.61	0.01							50
55	4.16	1.18	2.67	0.40	1.98	0.19	1.53	0.10	0.97	0.03	0.68	0.01							55
60	4.54	1.38	2.91	0.47	2.16	0.23	1.67	0.12	1.06	0.04	0.74	0.02							60
65	4.91	1.60	3.15	0.55	2.34	0.26	1.81	0.14	1.14	0.05	0.80	0.02	0.46	0.00					65
70	5.29	1.84	3.40	0.63	2.52	0.30	1.95	0.16	1.23	0.05	0.86	0.02	0.49	0.01					70
75	5.67	2.09	3.64	0.71	2.70	0.35	2.09	0.18	1.32	0.06	0.92	0.03	0.53	0.01					75
80	6.05	2.36	3.88	0.80	2.88	0.39	2.23	0.21	1.41	0.07	0.98	0.03	0.56	0.01					80
85	6.43	2.64	4.12	0.90	3.06	0.44	2.37	0.23	1.50	0.08	1.04	0.03	0.60	0.01					85
90	6.80	2.93	4.37	1.00	3.24	0.48	2.51	0.26	1.59	0.08	1.11	0.04	0.63	0.01					90
95	7.18	3.24	4.61	1.10	3.43	0.53	2.65	0.29	1.67	0.09	1.17	0.04	0.67	0.01					95
100	7.56	3.56	4.85	1.21	3.61	0.59	2.79	0.31	1.76	0.10	1.23	0.04	0.70	0.01					100
110	8.32	4.25	5.34	1.44	3.97	0.70	3.07	0.38	1.94	0.12	1.35	0.05	0.77	0.01	0.49	0.00			110
120	9.07	4.99	5.82	1.70	4.33	0.82	3.34	0.44	2.11	0.14	1.48	0.06	0.84	0.02	0.54	0.01			120
130	9.83	5.79	6.31	1.97	4.69	0.96	3.62	0.51	2.29	0.17	1.60	0.07	0.91	0.02	0.58	0.01			130
140	10.58	6.64	6.79	2.26	5.05	1.10	3.90	0.59	2.47	0.19	1.72	0.08	0.98	0.02	0.62	0.01			140
150	11.34	7.55	7.28	2.57	5.41	1.25	4.18	0.67	2.64	0.22	1.84	0.09	1.05	0.02	0.67	0.01			150

Exhibit SC16–13 Friction Head Loss for PVC Schedule 80 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 80 IPS plastic pipe

(1120, 1220) SDR 21 C = 150

psi Loss per 100 Feet of Pipe (psi/100 ft)

*Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation
found on Supplement Chapter 16, page 16-15***FLOW: 151 - 1050 gpm**

Size	3"	3.5"	4"	5"	6"	8"	10"	12"	
OD	3.500	4.000	4.500	5.563	6.625	8.625	10.750	12.750	
ID	2.900	3.364	3.826	4.813	5.761	7.625	9.564	11.376	
Wall Thk	0.300	0.318	0.337	0.375	0.432	0.500	0.593	0.687	
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
151	7.33	2.60	5.44	1.26	4.21	0.67	2.66	0.22	151
152	7.37	2.63	5.48	1.28	4.24	0.68	2.68	0.22	152
154	7.47	2.69	5.55	1.31	4.29	0.70	2.71	0.23	154
156	7.57	2.76	5.62	1.34	4.35	0.72	2.75	0.23	156
158	7.67	2.82	5.70	1.37	4.40	0.73	2.78	0.24	158
160	7.76	2.89	5.77	1.40	4.46	0.75	2.82	0.25	160
170	8.25	3.23	6.13	1.57	4.74	0.84	2.99	0.27	170
180	8.73	3.60	6.49	1.75	5.02	0.93	3.17	0.31	180
190	9.22	3.97	6.85	1.93	5.30	1.03	3.35	0.34	190
200	9.70	4.37	7.21	2.12	5.57	1.13	3.52	0.37	200
225	10.92	5.44	8.11	2.64	6.27	1.41	3.96	0.46	225
250	12.13	6.61	9.01	3.21	6.97	1.72	4.40	0.56	250
275	13.34	7.88	9.91	3.83	7.66	2.05	4.84	0.67	275
300	14.55	9.26	10.82	4.50	8.36	2.40	5.28	0.79	300
325			11.72	5.22	9.06	2.79	5.72	0.91	325
350			12.62	5.98	9.76	3.20	6.16	1.05	350
375			13.52	6.80	10.45	3.64	6.60	1.19	375
400			14.42	7.66	11.15	4.10	7.05	1.34	400
425					11.85	4.58	7.49	1.50	425
450					12.54	5.10	7.93	1.67	450
475					13.24	5.63	8.37	1.84	475
500					13.94	6.19	8.81	2.03	500
525					14.63	6.78	9.25	2.22	525
550							9.69	2.42	550
575							10.13	2.63	575
600							10.57	2.84	600
625							11.01	3.06	625
650							11.45	3.30	650
675							11.89	3.53	675
700							12.33	3.78	700
725							12.77	4.03	725
750							13.21	4.30	750
775							13.65	4.56	775
800							14.09	4.84	800
825							14.53	5.12	825
850									850
875									875
900									900
925									925
950									950
975									975
1000									1000
1025									1025
1050									1050

Exhibit SC16-13 Friction Head Loss for PVC Schedule 80 IPS plastic pipe

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Friction Head Loss for PVC SCHEDULE 40 IPS plastic pipe																	
(1120, 1220) SDR 21 C = 150																	
psi Loss per 100 Feet of Pipe (psi/100 ft)																	
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																	
FLOW: 1100 - 3250 gpm																	
Size	3"		3.5"		4"		5"		6"		8"		10"		12"		
OD	3.500		4.000		4.500		5.563		6.625		8.625		10.750		12.750		
ID	2.900		3.364		3.826		4.813		5.761		7.625		9.564		11.376		
Wall Thk	0.300		0.318		0.337		0.375		0.432		0.500		0.593		0.687		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1100									13.52	3.64	7.72	0.93					1100
1150									14.14	3.95	8.07	1.01	5.13	0.34			1150
1200									14.75	4.28	8.42	1.09	5.35	0.36	3.78	0.16	1200
1250											8.77	1.18	5.58	0.39	3.94	0.17	1250
1300											9.12	1.27	5.80	0.42	4.10	0.18	1300
1350											9.47	1.36	6.02	0.45	4.26	0.19	1350
1400											9.82	1.45	6.24	0.48	4.41	0.21	1400
1450											10.18	1.55	6.47	0.52	4.57	0.22	1450
1500											10.53	1.65	6.69	0.55	4.73	0.24	1500
1550											10.88	1.76	6.91	0.58	4.89	0.25	1550
1600											11.23	1.86	7.14	0.62	5.04	0.27	1600
1650											11.58	1.97	7.36	0.65	5.20	0.28	1650
1700											11.93	2.08	7.58	0.69	5.36	0.30	1700
1750											12.28	2.20	7.81	0.73	5.52	0.31	1750
1800											12.63	2.32	8.03	0.77	5.67	0.33	1800
1850											12.98	2.44	8.25	0.81	5.83	0.35	1850
1900											13.33	2.56	8.47	0.85	5.99	0.37	1900
1950											13.68	2.69	8.70	0.89	6.15	0.38	1950
2000											14.03	2.82	8.92	0.93	6.31	0.40	2000
2050											14.39	2.95	9.14	0.98	6.46	0.42	2050
2100											14.74	3.08	9.37	1.02	6.62	0.44	2100
2150													9.59	1.07	6.78	0.46	2150
2200													9.81	1.12	6.94	0.48	2200
2250													10.04	1.16	7.09	0.50	2250
2300													10.26	1.21	7.25	0.52	2300
2350													10.48	1.26	7.41	0.54	2350
2400													10.71	1.31	7.57	0.56	2400
2450													10.93	1.36	7.72	0.59	2450
2500													11.15	1.41	7.88	0.61	2500
2550													11.37	1.47	8.04	0.63	2550
2600													11.60	1.52	8.20	0.65	2600
2650													11.82	1.57	8.35	0.68	2650
2700													12.04	1.63	8.51	0.70	2700
2750													12.27	1.69	8.67	0.72	2750
2800													12.49	1.74	8.83	0.75	2800
2850													12.71	1.80	8.99	0.77	2850
2900													12.94	1.86	9.14	0.80	2900
2950													13.16	1.92	9.30	0.83	2950
3000													13.38	1.98	9.46	0.85	3000
3050													13.60	2.04	9.62	0.88	3050
3100													13.83	2.11	9.77	0.90	3100
3150													14.05	2.17	9.93	0.93	3150
3200													14.27	2.23	10.09	0.96	3200
3250													14.50	2.30	10.25	0.99	3250

Exhibit SC16-14 Friction Head Loss for Layflat Hose (pressure rating from 80 to 50 psi)
(Hose I.D. Source: <http://www.hollandpump.com/suction-layflat-hose.php>)

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Friction Head Loss for Vinylflow PVC Layflat Hose (pressure rating 80 to 50 psi)																		
C = 140																		
psi Loss per 100 Feet of Pipe (psi/100 ft)																		
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15																		
FLOW: 1 - 150 gpm																		
Size	1-1/2"		2"		2-1/2"		3"		4"		5"		6"		8"			
ID	1.673		2.165		2.598		3.130		4.134		5.039		6.181		8.169			
Wall Thk	0.0669		0.0669		0.0787		0.0787		0.0827		0.0866		0.0866		0.1063			
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM	
1	0.15	0.00	0.09	0.00	0.06	0.00											1	
2	0.29	0.01	0.17	0.00	0.12	0.00											2	
3	0.44	0.03	0.26	0.01	0.18	0.00											3	
4	0.58	0.05	0.35	0.01	0.24	0.01	0.17	0.00									4	
5	0.73	0.08	0.44	0.02	0.30	0.01	0.21	0.00									5	
6	0.87	0.11	0.52	0.03	0.36	0.01	0.25	0.01									6	
7	1.02	0.15	0.61	0.04	0.42	0.02	0.29	0.01									7	
8	1.17	0.19	0.70	0.05	0.48	0.02	0.33	0.01									8	
9	1.31	0.23	0.78	0.07	0.54	0.03	0.37	0.01									9	
10	1.46	0.28	0.87	0.08	0.60	0.03	0.42	0.01									10	
11	1.60	0.34	0.96	0.10	0.66	0.04	0.46	0.02	0.26	0.00							11	
12	1.75	0.39	1.04	0.11	0.73	0.05	0.50	0.02	0.29	0.00							12	
13	1.90	0.46	1.13	0.13	0.79	0.05	0.54	0.02	0.31	0.01							13	
14	2.04	0.52	1.22	0.15	0.85	0.06	0.58	0.02	0.33	0.01							14	
15	2.19	0.60	1.31	0.17	0.91	0.07	0.62	0.03	0.36	0.01							15	
16	2.33	0.67	1.39	0.19	0.97	0.08	0.67	0.03	0.38	0.01							16	
17	2.48	0.75	1.48	0.21	1.03	0.09	0.71	0.04	0.41	0.01	0.27	0.00					17	
18	2.62	0.84	1.57	0.24	1.09	0.10	0.75	0.04	0.43	0.01	0.29	0.00					18	
19	2.77	0.92	1.65	0.26	1.15	0.11	0.79	0.04	0.45	0.01	0.31	0.00					19	
20	2.92	1.02	1.74	0.29	1.21	0.12	0.83	0.05	0.48	0.01	0.32	0.00					20	
22	3.21	1.21	1.91	0.35	1.33	0.14	0.92	0.06	0.53	0.01	0.35	0.01					22	
24	3.50	1.42	2.09	0.41	1.45	0.17	1.00	0.07	0.57	0.02	0.39	0.01					24	
26	3.79	1.65	2.26	0.47	1.57	0.19	1.08	0.08	0.62	0.02	0.42	0.01					26	
28	4.08	1.89	2.44	0.54	1.69	0.22	1.17	0.09	0.67	0.02	0.45	0.01					28	
30	4.37	2.15	2.61	0.61	1.81	0.25	1.25	0.10	0.72	0.03	0.48	0.01	0.32	0.00			30	
35	5.10	2.86	3.05	0.82	2.12	0.34	1.46	0.14	0.84	0.04	0.56	0.01	0.37	0.00			35	
40	5.83	3.66	3.48	1.05	2.42	0.43	1.67	0.17	0.95	0.04	0.64	0.02	0.43	0.01			40	
45	6.56	4.56	3.92	1.30	2.72	0.54	1.87	0.22	1.07	0.06	0.72	0.02	0.48	0.01			45	
50	7.29	5.54	4.35	1.58	3.02	0.65	2.08	0.26	1.19	0.07	0.80	0.03	0.53	0.01			50	
55	8.02	6.61	4.79	1.89	3.32	0.78	2.29	0.31	1.31	0.08	0.88	0.03	0.59	0.01	0.34	0.00	55	
60	8.75	7.77	5.22	2.21	3.63	0.91	2.50	0.37	1.43	0.10	0.96	0.04	0.64	0.01	0.37	0.00	60	
65	9.48	9.01	5.66	2.57	3.93	1.06	2.71	0.43	1.55	0.11	1.04	0.04	0.69	0.02	0.40	0.00	65	
70	10.20	10.33	6.09	2.95	4.23	1.21	2.92	0.49	1.67	0.13	1.12	0.05	0.75	0.02	0.43	0.00	70	
75	10.93	11.74	6.53	3.35	4.53	1.38	3.12	0.56	1.79	0.14	1.21	0.05	0.80	0.02	0.46	0.01	75	
80	11.66	13.23	6.96	3.77	4.84	1.55	3.33	0.63	1.91	0.16	1.29	0.06	0.85	0.02	0.49	0.01	80	
85	12.39	14.80	7.40	4.22	5.14	1.74	3.54	0.70	2.03	0.18	1.37	0.07	0.91	0.03	0.52	0.01	85	
90	13.12	16.45	7.83	4.69	5.44	1.93	3.75	0.78	2.15	0.20	1.45	0.08	0.96	0.03	0.55	0.01	90	
95	13.85	18.19	8.27	5.19	5.74	2.14	3.96	0.86	2.27	0.22	1.53	0.09	1.01	0.03	0.58	0.01	95	
100	14.58	20.00	8.70	5.70	6.04	2.35	4.16	0.95	2.39	0.25	1.61	0.09	1.07	0.03	0.61	0.01	100	
110	16.03	23.86	9.57	6.81	6.65	2.80	4.58	1.13	2.63	0.29	1.77	0.11	1.17	0.04	0.67	0.01	110	
120	17.49	28.03	10.45	8.00	7.25	3.29	5.00	1.33	2.86	0.34	1.93	0.13	1.28	0.05	0.73	0.01	120	
130	18.95	32.51	11.32	9.27	7.86	3.82	5.41	1.54	3.10	0.40	2.09	0.15	1.39	0.06	0.79	0.01	130	
140	20.41	37.29	12.19	10.64	8.46	4.38	5.83	1.77	3.34	0.46	2.25	0.17	1.50	0.06	0.86	0.02	140	
150	21.87	42.38	13.06	12.09	9.07	4.98	6.25	2.01	3.58	0.52	2.41	0.20	1.60	0.07	0.92	0.02	150	

Exhibit SC16-14 Friction Head Loss for Layflat Hose (pressure rating from 80 to 50 psi)
(Hose I.D. Source: <http://www.hollandpump.com/suction-layflat-hose.php>)

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Friction Head Loss for Vinylflow PVC Layflat Hose (pressure rating 80 to 50 psi)											
C = 140			Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15								
psi Loss per 100 Feet of Pipe (psi/100 ft)											
FLOW: 151 - 1050 gpm											
Size	3"		4		5		6		8		
ID	3.130		4.134		5.039		6.181		8.169		
Wall Thk	0.0787		0.0827		0.0866		0.0866		0.1063		
Flow	Velocity	psi	Velocity	psi	Velocity	psi	Velocity	psi	Velocity	psi	Flow
GPM	fps	Loss	fps	Loss	fps	Loss	fps	Loss	fps	Loss	GPM
151											151
152											152
154											154
156	6.50	2.16									156
158	6.58	2.21									158
160	6.66	2.27									160
170	7.08	2.54									170
180	7.50	2.82									180
190	7.91	3.12									190
200	8.33	3.43									200
225	9.37	4.26	5.37	1.10							225
250	10.41	5.18	5.97	1.34							250
275	11.45	6.18	6.57	1.60							275
300	12.49	7.26	7.16	1.87							300
325	13.53	8.42	7.76	2.17							325
350	14.58	9.66	8.36	2.49							350
375	15.62	10.97	8.95	2.83	6.03	1.08					375
400	16.66	12.37	9.55	3.19	6.43	1.22					400
425	17.70	13.84	10.15	3.57	6.83	1.36					425
450	18.74	15.38	10.74	3.97	7.23	1.52					450
475	19.78	17.00	11.34	4.39	7.63	1.68					475
500	20.82	18.69	11.94	4.83	8.03	1.84					500
525	21.86	20.46	12.53	5.28	8.44	2.02					525
550	22.91	22.30	13.13	5.76	8.84	2.20					550
575	23.95	24.22	13.73	6.25	9.24	2.39	6.14	0.88			575
600	24.99	26.20	14.32	6.77	9.64	2.58	6.41	0.96			600
625	26.03	28.26	14.92	7.30	10.04	2.79	6.67	1.03			625
650	27.07	30.39	15.52	7.85	10.44	3.00	6.94	1.11			650
675	28.11	32.59	16.11	8.42	10.85	3.21	7.21	1.19			675
700	29.15	34.86	16.71	9.00	11.25	3.44	7.48	1.27	4.28	0.33	700
725	30.19	37.20	17.31	9.61	11.65	3.67	7.74	1.36	4.43	0.35	725
750	31.23	39.61	17.91	10.23	12.05	3.90	8.01	1.45	4.59	0.37	750
775	32.28	42.09	18.50	10.87	12.45	4.15	8.28	1.54	4.74	0.40	775
800	33.32	44.64	19.10	11.53	12.85	4.40	8.54	1.63	4.89	0.42	800
825	34.36	47.26	19.70	12.21	13.26	4.66	8.81	1.72	5.04	0.44	825
850	35.40	49.95	20.29	12.90	13.66	4.92	9.08	1.82	5.20	0.47	850
875	36.44	52.70	20.89	13.61	14.06	5.19	9.34	1.92	5.35	0.49	875
900	37.48	55.52	21.49	14.34	14.46	5.47	9.61	2.03	5.50	0.52	900
925	38.52	58.41	22.08	15.09	14.86	5.76	9.88	2.13	5.66	0.55	925
950	39.56	61.37	22.68	15.85	15.26	6.05	10.15	2.24	5.81	0.58	950
975	40.60	64.40	23.28	16.63	15.67	6.35	10.41	2.35	5.96	0.60	975
1000	41.65	67.49	23.87	17.43	16.07	6.65	10.68	2.46	6.11	0.63	1000
1025	42.69	70.65	24.47	18.25	16.47	6.96	10.95	2.58	6.27	0.66	1025
1050	43.73	73.87	25.07	19.08	16.87	7.28	11.21	2.69	6.42	0.69	1050

Exhibit SC16-15 Friction Head Loss for Polyethylene (PE) Oval Hose (pressure rating (psi) at 21, 29^{1/} or 42)
(Hose I.D. Source: Netafim Brochure A015, May 2011)

1 of 2

Friction Head Loss for Polyethylene (Oval) Hose (pressure rating 21 psi; 29 psi ^{1/})													
(1120, 1220) SDR 21 C = 140													
psi Loss per 100 Feet of Pipe (psi/100 ft)													
Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15													
FLOW: 1 - 150 gpm													
Size	1-1/4"		1-1/2"		2"		2-1/2"		3"		4"		
ID	1.365		1.595		2.052		2.450		3.042		3.996		
Wall Thk	0.048		0.040		0.051		0.058		0.073		0.095		
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1	0.22	0.01	0.16	0.00	0.10	0.00	0.07	0.00					1
2	0.44	0.04	0.32	0.02	0.19	0.01	0.14	0.00					2
3	0.66	0.08	0.48	0.04	0.29	0.01	0.20	0.00	0.13	0.00			3
4	0.88	0.14	0.64	0.07	0.39	0.02	0.27	0.01	0.18	0.00			4
5	1.09	0.21	0.80	0.10	0.48	0.03	0.34	0.01	0.22	0.00	0.13	0.00	5
6	1.31	0.29	0.96	0.14	0.58	0.04	0.41	0.02	0.26	0.01	0.15	0.00	6
7	1.53	0.39	1.12	0.18	0.68	0.05	0.48	0.02	0.31	0.01	0.18	0.00	7
8	1.75	0.50	1.28	0.23	0.78	0.07	0.54	0.03	0.35	0.01	0.20	0.00	8
9	1.97	0.62	1.44	0.29	0.87	0.09	0.61	0.04	0.40	0.01	0.23	0.00	9
10	2.19	0.76	1.60	0.35	0.97	0.10	0.68	0.04	0.44	0.02	0.26	0.00	10
11	2.41	0.90	1.76	0.42	1.07	0.12	0.75	0.05	0.48	0.02	0.28	0.00	11
12	2.63	1.06	1.92	0.50	1.16	0.15	0.82	0.06	0.53	0.02	0.31	0.01	12
13	2.85	1.23	2.08	0.58	1.26	0.17	0.88	0.07	0.57	0.02	0.33	0.01	13
14	3.07	1.41	2.25	0.66	1.36	0.19	0.95	0.08	0.62	0.03	0.36	0.01	14
15	3.28	1.60	2.41	0.75	1.45	0.22	1.02	0.09	0.66	0.03	0.38	0.01	15
16	3.50	1.81	2.57	0.85	1.55	0.25	1.09	0.10	0.71	0.04	0.41	0.01	16
17	3.72	2.02	2.73	0.95	1.65	0.28	1.16	0.12	0.75	0.04	0.43	0.01	17
18	3.94	2.25	2.89	1.05	1.74	0.31	1.22	0.13	0.79	0.05	0.46	0.01	18
19	4.16	2.48	3.05	1.16	1.84	0.34	1.29	0.14	0.84	0.05	0.49	0.01	19
20	4.38	2.73	3.21	1.28	1.94	0.38	1.36	0.16	0.88	0.06	0.51	0.01	20
22	4.82	3.26	3.53	1.53	2.13	0.45	1.50	0.19	0.97	0.07	0.56	0.02	22
24	5.26	3.83	3.85	1.80	2.33	0.53	1.63	0.22	1.06	0.08	0.61	0.02	24
26	5.69	4.44	4.17	2.08	2.52	0.61	1.77	0.26	1.15	0.09	0.66	0.02	26
28	6.13	5.09	4.49	2.39	2.71	0.70	1.90	0.30	1.23	0.10	0.72	0.03	28
30	6.57	5.79	4.81	2.71	2.91	0.80	2.04	0.34	1.32	0.12	0.77	0.03	30
35	7.66	7.70	5.61	3.61	3.39	1.06	2.38	0.45	1.54	0.16	0.89	0.04	35
40	8.76	9.86	6.42	4.62	3.88	1.36	2.72	0.57	1.76	0.20	1.02	0.05	40
45	9.85	12.27	7.22	5.75	4.36	1.69	3.06	0.71	1.98	0.25	1.15	0.07	45
50	10.95	14.91	8.02	6.99	4.84	2.05	3.40	0.87	2.20	0.30	1.28	0.08	50
55	12.04	17.79	8.82	8.34	5.33	2.45	3.74	1.03	2.42	0.36	1.41	0.10	55
60	13.14	20.90	9.62	9.80	5.81	2.87	4.08	1.21	2.65	0.42	1.53	0.11	60
65	14.23	24.24	10.42	11.36	6.30	3.33	4.42	1.41	2.87	0.49	1.66	0.13	65
70	15.33	27.80	11.23	13.03	6.78	3.82	4.76	1.61	3.09	0.56	1.79	0.15	70
75	16.42	31.59	12.03	14.81	7.27	4.35	5.10	1.83	3.31	0.64	1.92	0.17	75
80	17.52	35.61	12.83	16.69	7.75	4.90	5.44	2.07	3.53	0.72	2.04	0.19	80
85	18.61	39.84	13.63	18.67	8.24	5.48	5.78	2.31	3.75	0.81	2.17	0.21	85
90	19.71	44.28	14.43	20.76	8.72	6.09	6.12	2.57	3.97	0.90	2.30	0.24	90
95	20.80	48.95	15.24	22.94	9.21	6.73	6.46	2.84	4.19	0.99	2.43	0.26	95
100	21.90	53.83	16.04	25.23	9.69	7.40	6.80	3.13	4.41	1.09	2.56	0.29	100
110	24.09	64.22	17.64	30.10	10.66	8.83	7.48	3.73	4.85	1.30	2.81	0.34	110
120	26.28	75.45	19.25	35.36	11.63	10.38	8.16	4.38	5.29	1.53	3.07	0.41	120
130	28.47	87.50	20.85	41.01	12.60	12.04	8.84	5.08	5.73	1.77	3.32	0.47	130
140	30.66	100.37	22.45	47.05	13.57	13.81	9.52	5.83	6.17	2.03	3.58	0.54	140
150	32.85	114.05	24.06	53.46	14.53	15.69	10.20	6.62	6.61	2.31	3.83	0.61	150

1/ Only applicable to 1-1/4" diameter

Exhibit SC16-15 Friction Head Loss for Polyethylene (PE) Oval Hose (pressure rating at 21 psi)
(Hose I.D. Source: Netafim Brochure A015, May 2011)

2 of 2

Friction Head Loss for Polyethylene (Oval) Hose (pressure rating 21 psi)				
(1120, 1220) SDR 21 C = 140			Table based upon the Hazen-Williams Friction Loss Equation and general Velocity equation found on Supplement Chapter 16, page 16-15	
psi Loss per 100 Feet of Pipe (psi/100 ft)				
FLOW: 151 - 900 gpm				
Size	3"		4"	
ID	3.042		3.996	
Wall Thk	0.073		0.0950	
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss
151	6.66	2.34	3.86	0.62
152	6.70	2.37	3.88	0.63
154	6.79	2.43	3.93	0.64
156	6.88	2.48	3.99	0.66
158	6.97	2.54	4.04	0.67
160	7.05	2.60	4.09	0.69
170	7.50	2.91	4.34	0.77
180	7.94	3.24	4.60	0.86
190	8.38	3.58	4.85	0.95
200	8.82	3.94	5.11	1.04
225	9.92	4.89	5.75	1.30
250	11.02	5.95	6.39	1.58
275	12.12	7.10	7.03	1.88
300	13.23	8.34	7.67	2.21
325	14.33	9.67	8.30	2.56
350	15.43	11.09	8.94	2.94
375	16.53	12.61	9.58	3.34
400	17.64	14.21	10.22	3.77
425	18.74	15.90	10.86	4.22
450	19.84	17.67	11.50	4.69
475	20.94	19.53	12.14	5.18
500			12.78	5.70
525			13.41	6.23
550			14.05	6.80
575			14.69	7.38
600			15.33	7.98
625			15.97	8.61
650			16.61	9.26
675			17.25	9.93
700			17.89	10.62
725			18.52	11.33
750			19.16	12.07
775			19.80	12.82
800			20.44	13.60
825				
850				
875				
900				

Exhibit SC16-16

Friction Head Loss for Polyethylene (PE) Lateral Tubing
(Hose I.D. Source: Netafin Brochure A001, October 2012)

1 of 1

Friction Head Loss for Polyethylene (PE) Tubing (pressure rating 47 to 66 psi)											
(1120, 1220) SDR 21 C = 140						Table based upon the Hazen-Williams Friction					
psi Loss per 100 Feet of Pipe (psi/100 ft)						Loss Equation and general Velocity equation					
FLOW: 1 - 60 gpm						found on Supplement Chapter 16, page 16-15					
Size	13 mm	16 mm	18 mm	20 mm	26 mm						
ID	0.520	0.620	0.720	0.820	1.060						
Wall Thk	0.0500	0.045	0.050	0.055	0.070						
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Flow GPM
1	1.51	1.17	1.06	0.50	0.79	0.24	0.61	0.13			1
2	3.02	4.21	2.12	1.79	1.57	0.86	1.21	0.46			2
3	4.53	8.91	3.18	3.79	2.36	1.83	1.82	0.97	1.09	0.28	3
4	6.04	15.19	4.25	6.45	3.15	3.12	2.43	1.66	1.45	0.47	4
5	7.54	22.96	5.31	9.76	3.94	4.71	3.03	2.50	1.82	0.72	5
6	9.05	32.18	6.37	13.67	4.72	6.61	3.64	3.51	2.18	1.01	6
7	10.56	42.82	7.43	18.19	5.51	8.79	4.25	4.67	2.54	1.34	7
8	12.07	54.83	8.49	23.30	6.30	11.25	4.85	5.98	2.90	1.71	8
9	13.58	68.19	9.55	28.98	7.08	14.00	5.46	7.43	3.27	2.13	9
10	15.09	82.88	10.61	35.22	7.87	17.01	6.07	9.04	3.63	2.59	10
11	16.60	98.89	11.68	42.02	8.66	20.30	6.67	10.78	3.99	3.09	11
12	18.11	116.18	12.74	49.36	9.44	23.85	7.28	12.66	4.36	3.63	12
13	19.62	134.74	13.80	57.25	10.23	27.66	7.89	14.69	4.72	4.21	13
14			14.86	65.67	11.02	31.72	8.49	16.85	5.08	4.83	14
15			15.92	74.63	11.81	36.05	9.10	19.14	5.45	5.49	15
16			16.98	84.10	12.59	40.63	9.71	21.58	5.81	6.19	16
17			18.04	94.09	13.38	45.45	10.32	24.14	6.17	6.92	17
18			19.11	104.60	14.17	50.53	10.92	26.83	6.54	7.69	18
19			20.17	115.62	14.95	55.85	11.53	29.66	6.90	8.50	19
20					15.74	61.42	12.14	32.62	7.26	9.35	20
22					17.31	73.27	13.35	38.91	7.99	11.16	22
24					18.89	86.08	14.56	45.72	8.71	13.11	24
26					20.46	99.84	15.78	53.02	9.44	15.20	26
28							16.99	60.82	10.17	17.44	28
30							18.20	69.11	10.89	19.82	30
35							21.24	91.95	12.71	26.36	35
40									14.52	33.76	40
45									16.34	41.99	45
50									18.16	51.04	50
55									19.97	60.89	55
60									21.79	71.54	60

Exhibit SC16-17a

Friction Head Loss for 16 mm O.D. (ID = 0.600 inch) PE Lateral Tubing (utilizing "gph/ft")
(Source: James Hardie Irrigation Design Manual)

Example plant spacing 20-ft in row w/ 3 emitters per plant @ 0.5 gph per emitter
 600 Series most common tubing
 Internal diameter = 0.600 inch

$$\frac{3(0.5 \text{ gph})}{20 \text{ ft}} = 0.075 \text{ gph/ft}$$

 16 mm O.D. POLYETHYLENE HOSE

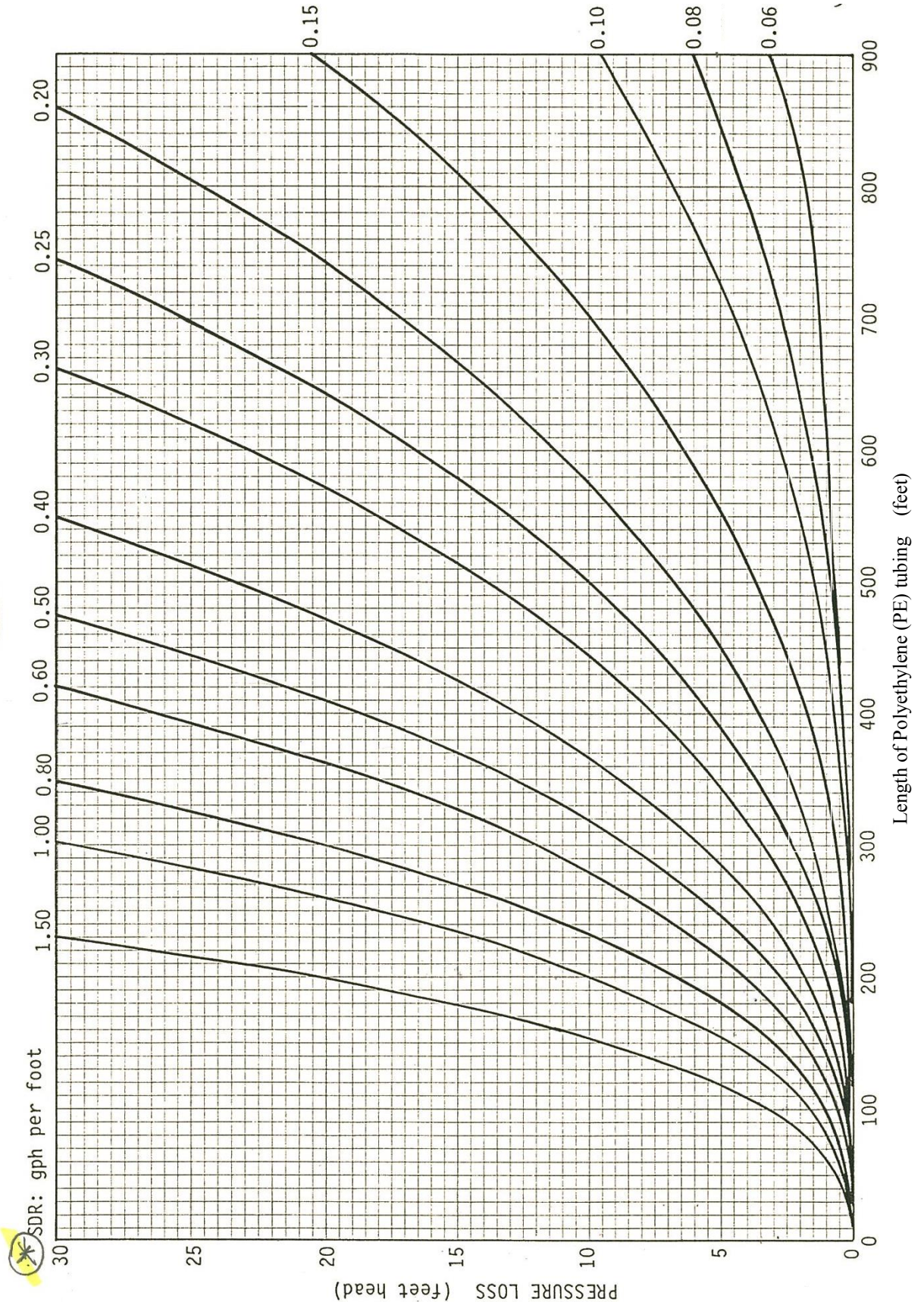


Exhibit SC16-17b

Friction Head Loss for 16 mm I.D. (ID = 0.630 inch) PE Lateral Tubing (utilizing "gph/ft")
(Source: James Hardie Irrigation Design Manual)

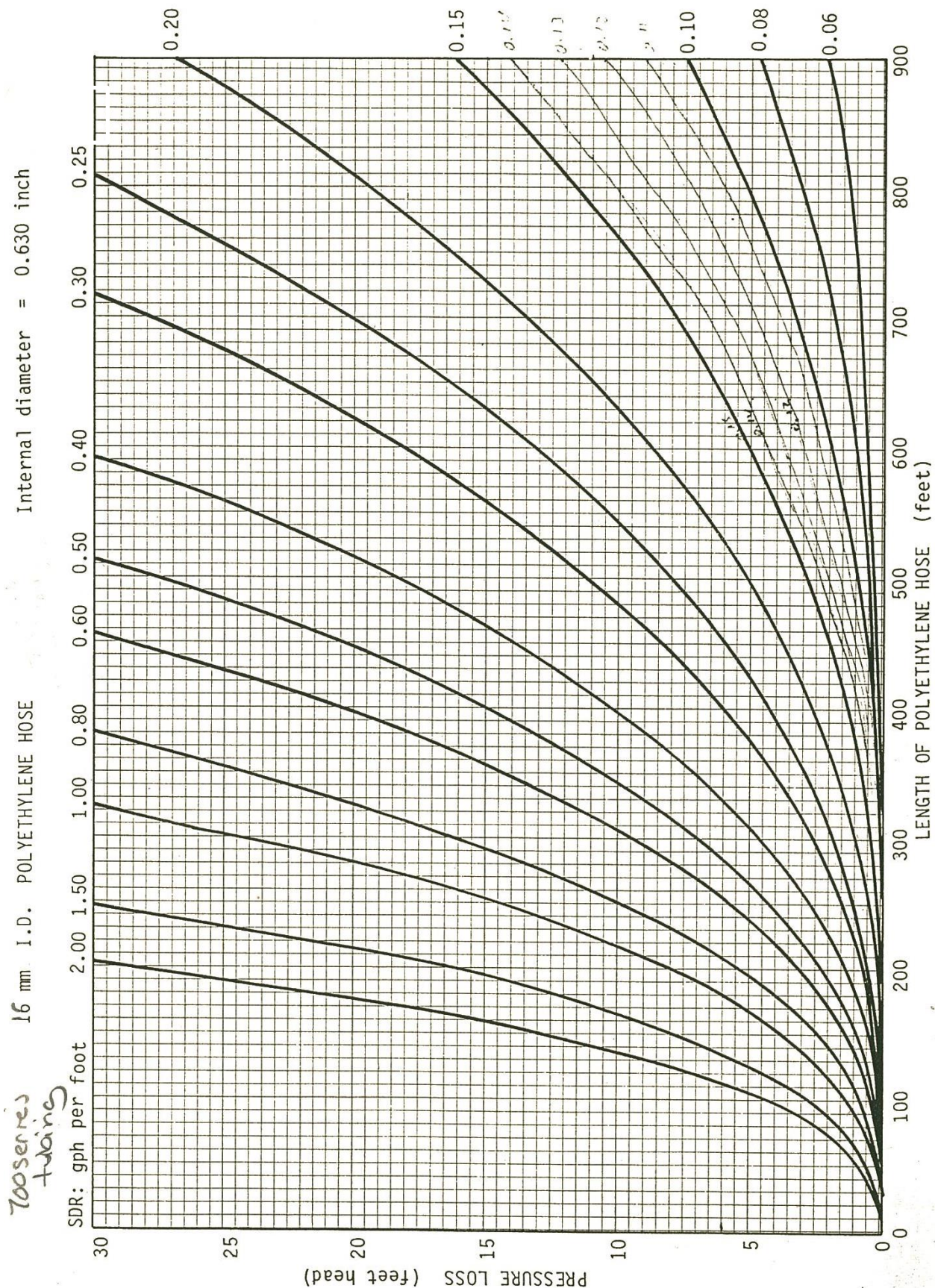


Exhibit SC16-17c

Friction Head Loss for 20 mm I.D. (ID = 0.800 inch) PE Lateral Tubing (utilizing "gph/ft")
(Source: James Hardie Irrigation Design Manual)

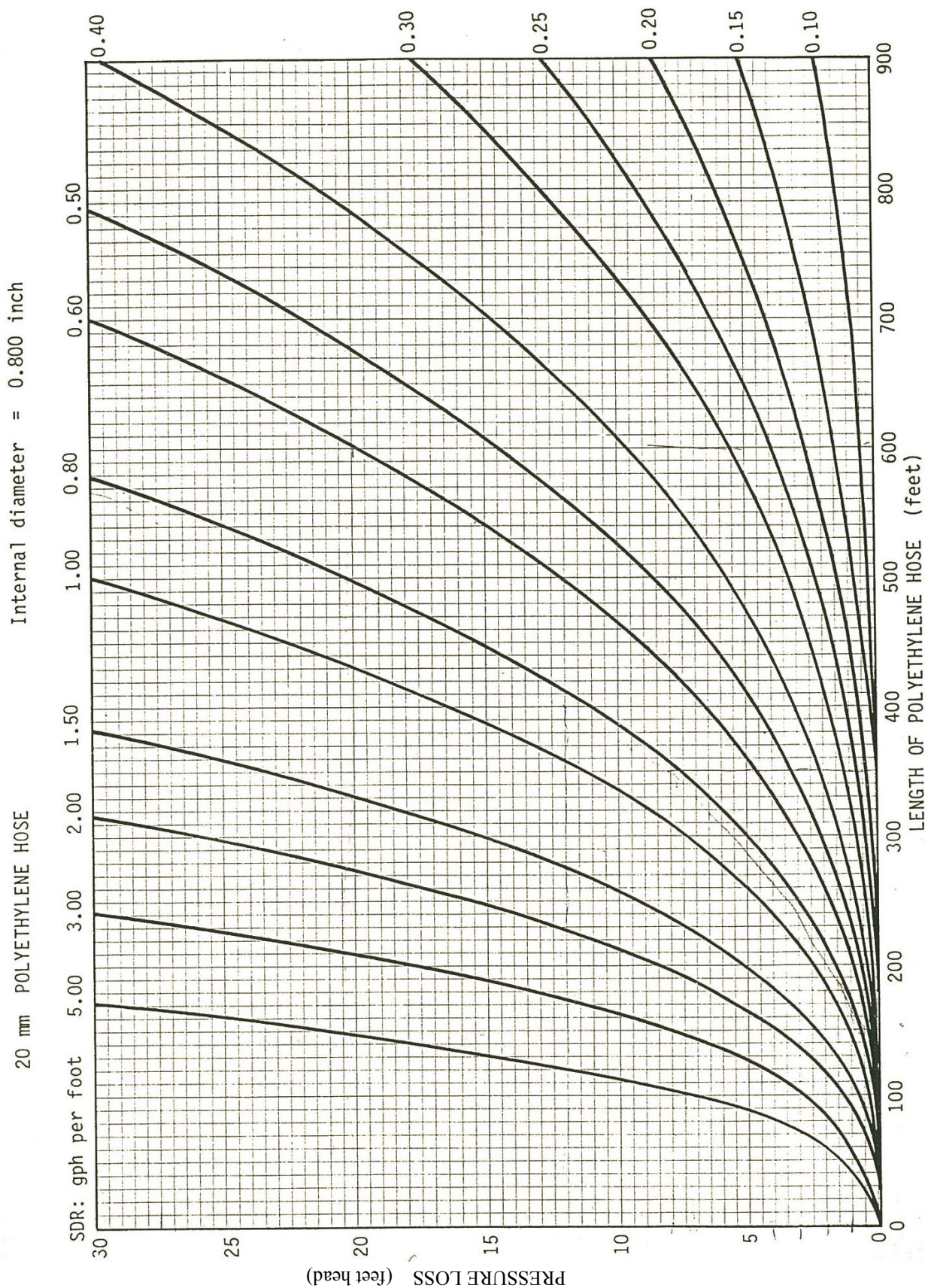


Exhibit SC16-17d

Friction Head Loss for 26 mm I.D. (ID = 1.000 inch) PE Lateral Tubing (utilizing "gph/ft")
(Source: James Hardie Irrigation Design Manual)

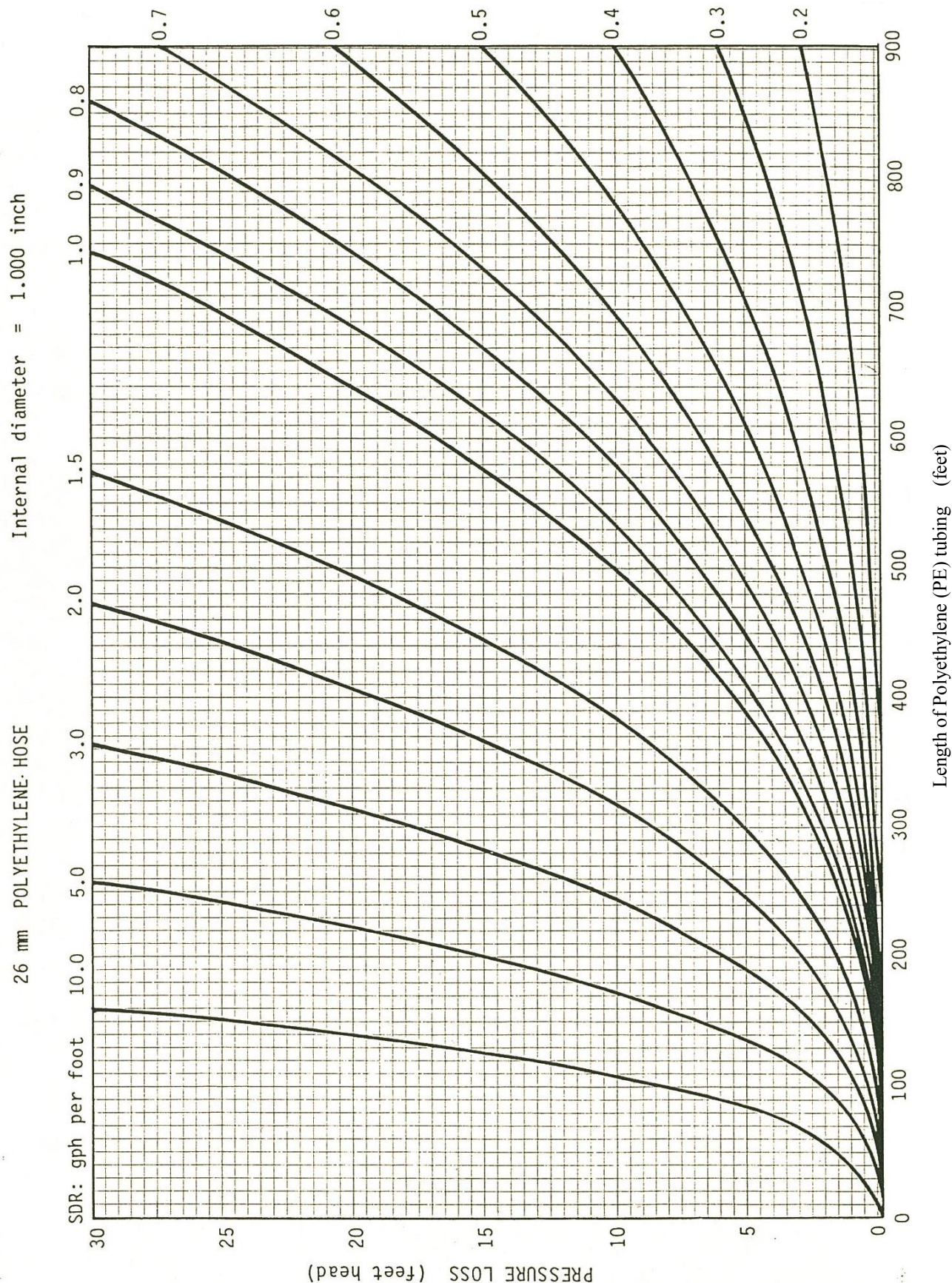


Exhibit SC16-18 Feeder Line Friction Head Loss

Friction Head Loss for Feeder Line							
C = 150				Table based upon the Hazen-Williams Friction			
psi Loss per 100 Feet of Pipe (psi/100 ft)				Loss Equation and general Velocity equation			
FLOW: 1 - 8 gpm (30 - 480 GPH)				found on Supplement Chapter 16, page 16-15			
Size	3/8"		1/2"		3/4"		
ID	0.375		0.580		0.800		
Flow	Velocity	psi	Velocity	psi	Velocity	psi	Flow
GPM	fps	Loss	fps	Loss	fps	Loss	GPH
0.5	1.45	1.39	0.61	0.17	0.32	0.03	30
0.6	1.74	1.95	0.73	0.23	0.38	0.05	36
0.7	2.03	2.60	0.85	0.31	0.45	0.07	42
0.8	2.32	3.33	0.97	0.40	0.51	0.08	48
0.9	2.61	4.14	1.09	0.50	0.57	0.10	54
1.0	2.90	5.03	1.21	0.60	0.64	0.13	60
1.2	3.48	7.05	1.46	0.85	0.77	0.18	72
1.4	4.06	9.39	1.70	1.12	0.89	0.24	84
1.6	4.64	12.02	1.94	1.44	1.02	0.30	96
1.8	5.22	14.95	2.18	1.79	1.15	0.37	108
2.0	5.80	18.17	2.43	2.18	1.28	0.46	120
2.2	6.38	21.68	2.67	2.60	1.40	0.54	132
2.4	6.96	25.47	2.91	3.05	1.53	0.64	144
2.6	7.54	29.54	3.15	3.54	1.66	0.74	156
2.8	8.12	33.88	3.40	4.06	1.79	0.85	168
3.0	8.70	38.50	3.64	4.61	1.91	0.96	180
3.2	9.28	43.39	3.88	5.20	2.04	1.09	192
3.4	9.86	48.54	4.12	5.81	2.17	1.22	204
3.6	10.44	53.96	4.37	6.46	2.30	1.35	216
3.8	11.03	59.65	4.61	7.14	2.42	1.49	228
4.0	11.61	65.59	4.85	7.86	2.55	1.64	240
4.2	12.19	71.79	5.09	8.60	2.68	1.80	252
4.4	12.77	78.25	5.34	9.37	2.81	1.96	264
4.6	13.35	84.97	5.58	10.18	2.93	2.13	276
4.8	13.93	91.93	5.82	11.01	3.06	2.30	288
5.0	14.51	99.15	6.06	11.88	3.19	2.48	300
5.2	15.09	106.62	6.31	12.77	3.32	2.67	312
5.4	15.67	114.34	6.55	13.70	3.44	2.86	324
5.6	16.25	122.31	6.79	14.65	3.57	3.06	336
5.8	16.83	130.52	7.03	15.63	3.70	3.27	348
6.0	17.41	138.98	7.28	16.65	3.83	3.48	360
6.2	17.99	147.68	7.52	17.69	3.95	3.70	372
6.4	18.57	156.63	7.76	18.76	4.08	3.92	384
6.6	19.15	165.81	8.00	19.86	4.21	4.15	396
6.8	19.73	175.24	8.25	20.99	4.34	4.39	408
7.0	20.31	184.90	8.49	22.15	4.46	4.63	420
7.2			8.73	23.33	4.59	4.88	432
7.4			8.98	24.55	4.72	5.13	444
7.6			9.22	25.79	4.85	5.39	456
7.8			9.46	27.06	4.97	5.66	468
8.0			9.70	28.36	5.10	5.93	480

Exhibit SC16-19 Application Rate for Planning Sprinkler Irrigation Systems

Table C-20

APPLICATION RATE FOR PLANNING IRRIGATION SYSTEMS (Inches Per Hour)																		
Gallons Per Minute from each Sprinkler																		
Sprinkler Spacing(ft.)	1	2	3	4	5	6	8	10	12	15	18	20	25	30	35	40	45	50
20x20	.24	.48	.72	.96	1.20	1.44	1.92	1.60	1.93									
20x30	.16	.32	.48	.64	.80	.96	1.28	1.20	1.45	1.81	2.17							
20x40	.12	.24	.36	.48	.60	.72	.96	1.00	1.20	1.50	1.80	2.00						
20x50	.10	.20	.30	.40	.50	.60	.80	.80	.96	1.20	1.44	1.60	2.00					
20x60	.08	.16	.24	.32	.40	.48	.64	1.54	1.85	2.31	1.93	2.14		2.40				
25x25	.15	.30	.46	.61	.77	.92	1.23	1.07	1.28	1.61	1.45	1.61	2.01	1.92				
30x30	.11	.21	.32	.43	.54	.64	.86	.80	.96	1.20	1.15	1.28	1.60	1.61	1.87	2.14		
30x40		.16	.24	.32	.40	.48	.64	.64	.76	.96	.96	1.07	1.54	1.80	2.10	2.40		
30x50		.13	.19	.25	.32	.38	.51	.53	.64	.80	.96	1.20	1.50	1.80	1.68	1.92		
30x60		.11	.16	.21	.27	.32	.43	.60	.72	.90	1.08	.96	1.20	1.44	1.40	1.60	2.16	2.00
40x40		.12	.18	.24	.30	.36	.48	.48	.58	.72	.86	.80	1.00	1.20	1.40	1.60	1.80	1.50
40x50		.10	.14	.19	.24	.29	.38	.48	.58	.60	.72	.60	.75	.90	1.05	1.20	1.35	1.92
40x60			.12	.16	.20	.24	.32	.40	.48	.60	.54	.60	.80	1.15	1.35	1.54	1.73	1.60
40x80			.09	.12	.15	.18	.24	.30	.36	.45	.54	.60	.77	.96	1.12	1.28	1.44	1.37
50x50			.12	.15	.19	.23	.31	.39	.46	.58	.69	.77	.96	1.15	1.35	1.54	1.73	1.60
50x60			.10	.13	.16	.19	.26	.32	.39	.48	.58	.64	.80	.96	1.12	1.28	1.44	1.37
50x70				.11	.14	.17	.22	.28	.33	.41	.49	.55	.69	.82	.96	1.10	1.24	1.34
60x60				.11	.13	.16	.21	.27	.32	.40	.48	.53	.67	.80	.93	1.07	1.20	1.34
60x70					.11	.14	.18	.23	.27	.34	.41	.46	.57	.69	.80	.92	1.03	1.15
60x80					.10	.12	.16	.20	.24	.30	.36	.40	.50	.60	.70	.80	.90	1.00
70x70					.10	.12	.16	.20	.24	.29	.35	.39	.49	.59	.69	.79	.88	.98
70x80						.10	.14	.17	.21	.26	.31	.34	.43	.52	.60	.69	.77	.86
70x90							.12	.15	.18	.23	.28	.30	.37	.46	.53	.61	.69	.76
80x80							.12	.15	.18	.23	.27	.30	.38	.45	.53	.60	.68	.75
80x90							.11	.13	.16	.20	.24	.27	.33	.40	.47	.53	.60	.67
80x100							.10	.12	.14	.18	.22	.24	.30	.36	.42	.48	.54	.60
100x100							.10	.10	.12	.14	.17	.19	.24	.29	.34	.39	.43	.48

Brass sprinklers should only be used for frost protection. Plastic is an insulator, and many times this keeps the “heat” of the water passing through the sprinkler from moving to the outside of the sprinkler body, which means they tend to freeze up. (Source: communication with Bryan Smith, Clemson University, Area Extension Agent (Laurens) - Agricultural Engineer, March 2015). Exhibit SC16-20 shows sample design data for various brass impact sprinklers.

Exhibit SC16-20 Impact Sprinkler Performance Data, Size 3/4” to 1-1/4” (Courtesy of Rainbird Corp)

	PERFORMANCE DATA Uses: Irrigation, Waste Water Application & Frost Protection 1/ STRAIGHT BORE NOZZLE (SBN-3*) (Stream Height: 9 ft.) <table><tr><th rowspan="2">PSI @ Nozzle</th><th colspan="4">NOZZLE SIZE US STANDARD</th></tr><tr><th>7/64"</th><th>1/8"</th><th>9/64"</th><th>5/32"</th></tr><tr><td>25</td><td>38</td><td>39</td><td>40</td><td>41</td></tr><tr><td>30</td><td>39</td><td>39</td><td>40</td><td>42</td></tr><tr><td>35</td><td>39</td><td>40</td><td>41</td><td>43</td></tr><tr><td>40</td><td>39</td><td>40</td><td>41</td><td>44</td></tr><tr><td>45</td><td>40</td><td>41</td><td>42</td><td>44</td></tr><tr><td>50</td><td>40</td><td>41</td><td>42</td><td>45</td></tr><tr><td>55</td><td>40</td><td>42</td><td>43</td><td>45</td></tr><tr><td>60</td><td>41</td><td>42</td><td>43</td><td>46</td></tr><tr><td>65</td><td>41</td><td>43</td><td>44</td><td>-</td></tr><tr><td>70</td><td>41</td><td>43</td><td>44</td><td>-</td></tr><tr><td>75</td><td>41</td><td>43</td><td>-</td><td>-</td></tr><tr><td>80</td><td>42</td><td>43</td><td>-</td><td>-</td></tr></table>	PSI @ Nozzle	NOZZLE SIZE US STANDARD				7/64"	1/8"	9/64"	5/32"	25	38	39	40	41	30	39	39	40	42	35	39	40	41	43	40	39	40	41	44	45	40	41	42	44	50	40	41	42	45	55	40	42	43	45	60	41	42	43	46	65	41	43	44	-	70	41	43	44	-	75	41	43	-	-	80	42	43	-	-
PSI @ Nozzle	NOZZLE SIZE US STANDARD																																																																					
	7/64"	1/8"	9/64"	5/32"																																																																		
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60	41	42	43	46																																																																		
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70	41	43	44	-																																																																		
75	41	43	-	-																																																																		
80	42	43	-	-																																																																		
30PWH 3/4" 19mm Full Circle, Aluminum Arm Impact Sprinkler Bearing: 3/4" Male NPT, Brass Trajectory Angle: 27° Operating Range: 25-80 psi 1.7-5.5 bars Flow Rate: 1.7-5.5 GPM 0.39-1.22 m³/h Radius: 38-46 ft. 11.74-14.03 meters Range: One 1/4" Female NPT Nozzle Port Spreader: One 1/8" Female NPT Spreader Nozzle Port																																																																						

	PERFORMANCE DATA Uses: Irrigation & Waste Water Application ADJUSTABLE STRAIGHT BORE NOZZLE (ADJN-4) (Stream Height: 10 ft.) <table><tr><th rowspan="2">PSI @ Nozzle</th><th colspan="2">NOZZLE SIZE US STANDARD</th></tr><tr><th>1/4"</th><th>1/2"</th></tr><tr><td>50</td><td>57</td><td>12.90</td></tr><tr><td>55</td><td>57</td><td>13.60</td></tr><tr><td>60</td><td>58</td><td>14.20</td></tr><tr><td>65</td><td>62</td><td>14.80</td></tr><tr><td>70</td><td>63</td><td>15.40</td></tr><tr><td>75</td><td>64</td><td>16.00</td></tr><tr><td>80</td><td>65</td><td>16.50</td></tr></table> Available without Nozzle or assembled with a 1/4" (16) Straight Bore Nozzle.	PSI @ Nozzle	NOZZLE SIZE US STANDARD		1/4"	1/2"	50	57	12.90	55	57	13.60	60	58	14.20	65	62	14.80	70	63	15.40	75	64	16.00	80	65	16.50
PSI @ Nozzle	NOZZLE SIZE US STANDARD																										
	1/4"	1/2"																									
50	57	12.90																									
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75	64	16.00																									
80	65	16.50																									
65PJ 1" 25 mm Full or Part Circle, Brass Impact Sprinkler Bearing: 1" Female NPT, Brass Trajectory Angle: 27° Operating Range: 50-80 psi 3.5-5.5 bars Flow Rate: 12.9-16.5 GPM 2.93-3.75 m³/h Radius: 57-65 ft. 17.4-19.8 meters One 3/8" Female NPT Nozzle Port																											

	U.S. STANDARD DATA PERFORMANCE DATA Uses: Irrigation & Waste Water Application STRAIGHT BORE NOZZLE (SBN-5) WITH PLUG* (Stream Height: 14 ft.) <table><tr><th rowspan="2">PSI @ Nozzle</th><th colspan="10">NOZZLE SIZE US STANDARD</th></tr><tr><th>11/32"</th><th>3/8"</th><th>13/32"</th><th>7/16"</th><th>15/32"</th><th>1/2"</th><th>17/32"</th><th>9/16"</th><th>5/8"</th><th>11/16"</th></tr><tr><td>25</td><td>61</td><td>62</td><td>64</td><td>66</td><td>66</td><td>66</td><td>66</td><td>66</td><td>66</td><td>66</td></tr><tr><td>30</td><td>64</td><td>65</td><td>68</td><td>69</td><td>72</td><td>73</td><td>73</td><td>73</td><td>73</td><td>73</td></tr><tr><td>35</td><td>67</td><td>68</td><td>72</td><td>74</td><td>77</td><td>79</td><td>79</td><td>79</td><td>79</td><td>79</td></tr><tr><td>40</td><td>69</td><td>71</td><td>75</td><td>77</td><td>80</td><td>83</td><td>83</td><td>83</td><td>83</td><td>83</td></tr><tr><td>45</td><td>71</td><td>73</td><td>77</td><td>79</td><td>82</td><td>85</td><td>85</td><td>85</td><td>85</td><td>85</td></tr><tr><td>50</td><td>73</td><td>75</td><td>79</td><td>81</td><td>84</td><td>87</td><td>87</td><td>87</td><td>87</td><td>87</td></tr><tr><td>55</td><td>75</td><td>77</td><td>81</td><td>83</td><td>86</td><td>89</td><td>89</td><td>89</td><td>89</td><td>89</td></tr><tr><td>60</td><td>77</td><td>79</td><td>83</td><td>85</td><td>88</td><td>91</td><td>91</td><td>91</td><td>91</td><td>91</td></tr><tr><td>65</td><td>79</td><td>81</td><td>85</td><td>87</td><td>90</td><td>93</td><td>93</td><td>93</td><td>93</td><td>93</td></tr><tr><td>70</td><td>81</td><td>83</td><td>87</td><td>89</td><td>92</td><td>95</td><td>95</td><td>95</td><td>95</td><td>95</td></tr><tr><td>75</td><td>82</td><td>84</td><td>88</td><td>90</td><td>93</td><td>96</td><td>96</td><td>96</td><td>96</td><td>96</td></tr><tr><td>80</td><td>83</td><td>86</td><td>89</td><td>92</td><td>95</td><td>98</td><td>98</td><td>98</td><td>98</td><td>98</td></tr><tr><td>85</td><td>85</td><td>87</td><td>90</td><td>93</td><td>96</td><td>99</td><td>99</td><td>99</td><td>99</td><td>99</td></tr><tr><td>90</td><td>86</td><td>89</td><td>92</td><td>95</td><td>98</td><td>101</td><td>101</td><td>101</td><td>101</td><td>101</td></tr><tr><td>95</td><td>87</td><td>90</td><td>93</td><td>96</td><td>99</td><td>102</td><td>102</td><td>102</td><td>102</td><td>102</td></tr><tr><td>100</td><td>88</td><td>91</td><td>94</td><td>97</td><td>100</td><td>103</td><td>103</td><td>103</td><td>103</td><td>103</td></tr></table> * Nozzle and plugs must be purchased separately.	PSI @ Nozzle	NOZZLE SIZE US STANDARD										11/32"	3/8"	13/32"	7/16"	15/32"	1/2"	17/32"	9/16"	5/8"	11/16"	25	61	62	64	66	66	66	66	66	66	66	30	64	65	68	69	72	73	73	73	73	73	35	67	68	72	74	77	79	79	79	79	79	40	69	71	75	77	80	83	83	83	83	83	45	71	73	77	79	82	85	85	85	85	85	50	73	75	79	81	84	87	87	87	87	87	55	75	77	81	83	86	89	89	89	89	89	60	77	79	83	85	88	91	91	91	91	91	65	79	81	85	87	90	93	93	93	93	93	70	81	83	87	89	92	95	95	95	95	95	75	82	84	88	90	93	96	96	96	96	96	80	83	86	89	92	95	98	98	98	98	98	85	85	87	90	93	96	99	99	99	99	99	90	86	89	92	95	98	101	101	101	101	101	95	87	90	93	96	99	102	102	102	102	102	100	88	91	94	97	100	103	103	103	103	103
PSI @ Nozzle	NOZZLE SIZE US STANDARD																																																																																																																																																																																																					
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80EHD 1 1/4" 32 mm Full Circle, Brass Impact Sprinkler Bearing: 1 1/4" Male NPT, Brass Trajectory Angle: 27° Operating Range: 25-100 psi 1.7-6.9 bars Flow Rate: 17.1-127.7 GPM 2.88-2.9 m³/h Radius: 61-116 ft. 18.6-35.4 meters Features																																																																																																																																																																																																						

1/ Frost protection:

As a general rule, anything the size of a #30 (full circle) or #35 (part circle) (Nelson or Walla Walla sprinklers would be #F33) or smaller will work fine. The tipping point is the time a sprinkler takes to make a full rotation over its coverage area. If it rotates in 45 seconds or less it works fine – if it's more than 45 seconds then you begin to get some freezing issues. A larger sprinkler (#65, #70, #80) could be used in a "part circle" system – just make sure it makes a full pass over the covered area (be it half circle, two-thirds circle, etc.) in 45 seconds or less.

Exhibit SC16-21 Nozzle Discharge (gpm) and average wetted diameter for Sprinkler Nozzle

Nozzle Discharge in g.p.m. and
Average Wetted Diameter for Sprinkler Nozzles

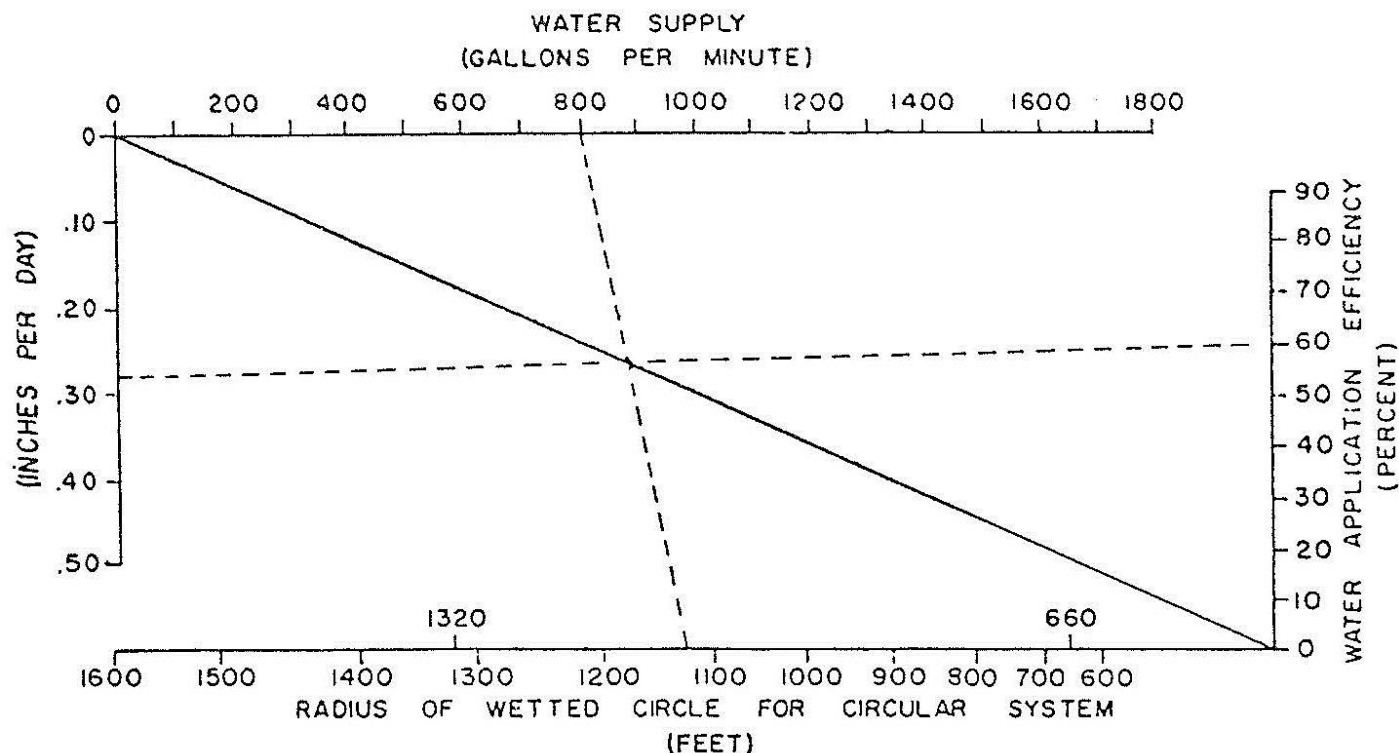
Nozzle Size (Inches)	Nozzle Pressure #/Sq. In.										
	25	30	35	40	45	50	55	60	65	70	75
3/32	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	70		
7/64	1.7	1.9	2.0	2.2	2.3	2.4	2.6	2.7	80		
1/8	2.2	2.4	2.6	2.8	3.0	3.2	3.3	3.5	90		
9/64	2.9	3.2	3.4	3.6	3.8	4.0	4.2	4.4	100		
5/32	3.5	3.9	4.2	4.5	4.7	5.0	5.2	5.5	110		
11/64	4.3	4.7	5.1	5.4	5.7	6.0	6.3	6.6	120		
3/16	5.0	5.5	6.0	6.4	6.8	7.2	7.5	7.8	130		
13/64	5.9	6.5	7.1	7.6	8.1	8.5	8.9	9.2	140		
7/32	6.8	7.6	8.3	8.9	9.4	9.9	10.3	10.7	150		
1/4		9.9	10.7	11.4	12.1	12.8	13.5	14.1	160		
9/32		12.4	13.4	14.3	15.2	16.1	17.0	17.9	170		
5/16	120	15.2	16.5	17.7	18.9	20.0	21.0	22.0	23.0	23.9	24.8
11/32		130	19.7	21.1	22.4	23.6	24.8	25.9	27.0	28.1	29.2
3/8		140	22.8	24.4	26.0	27.6	29.2	30.6	32.0	33.3	34.5
13/32			150	27.2	29.1	30.9	32.7	34.3	35.9	37.4	38.9
7/16				33.9	35.9	37.8	39.7	41.5	43.3	45.1	46.8
15/32			160	38.9	41.1	43.3	45.4	47.4	49.4	51.4	53.3
1/2				43.6	46.0	48.4	50.7	53.0	55.3	57.5	59.6
17/32				170	51.6	54.0	56.4	58.8	61.2	63.5	65.8
9/16				180	57.5	60.6	63.6	66.5	69.4	72.2	74.9
5/8					70.0	73.6	77.2	80.8	84.4	87.8	91.0
				190				200		210	

Approximate diameter of coverage. For a sprinkler with 2 different nozzles, the wetted diameter is coverage of the larger nozzle. Ref. North Dakota I.G. Notice ND-1

Exhibit SC16-22 Pressure (Friction) Loss in (ft/100 ft) for Portable Aluminum Pipe with Couplings (Based on Scobey's Formula $K_s = 0.40$, and 30-ft pipe lengths)^{1/}

Gallons Per Minute	Pipe Diameters						
	3-in. OD 2.914 ID	4-in. OD 3.906 ID	5-in. OD 4.896 ID	6-in. OD 5.884 ID	7-in. OD 6.872 ID	8-in. OD 7.856 ID	10-in. OD 9.818 ID
40	.658	.157					
50	1.006	.239					
60	1.423	.339					
70	1.906	.449	.150				
80	2.457	.584	.193				
90	3.073	.731	.242				
100	3.754	.893	.295	.120			
120	5.307	1.263	.417	.170			
140	7.113	1.693	.560	.227			
160	9.169	2.182	.721	.293			
180	11.47	2.729	.967	.366			
200	14.01	3.333	1.102	.448	.209		
220	16.79	3.996	1.321	.537	.251		
240	19.81	4.713	1.558	.633	.296		
260	23.06	5.488	1.814	.737	.344		
280	26.55	6.316	2.089	.849	.397		
300	30.27	7.203	2.381	.967	.452	.235	
320	34.22	8.142	2.692	1.094	.511	.265	
340	38.39	9.137	3.020	1.227	.573	.298	
360	42.80	10.18	3.366	1.368	.639	.332	
380	47.43	11.29	3.731	1.516	.708	.368	
400	52.28	12.44	4.113	1.671	.781	.399	.136
420		13.65	4.513	1.833	.857	.445	.149
440		14.57	4.930	1.988	.936	.486	.163
460		16.23	5.364	2.179	1.019	.529	.177
480		17.59	5.815	2.363	1.104	.573	.192
500		19.01	6.284	2.554	1.193	.620	.208
550		22.79	7.532	3.060	1.430	.742	.249
600		26.88	8.886	3.611	1.687	.876	.294
650		31.30	10.35	4.204	1.965	1.020	.342
700		36.03	11.91	4.839	2.262	1.174	.394
750		41.08	13.58	5.517	2.520	1.339	.449
800			15.35	6.237	2.915	1.513	.507
850			17.22	6.999	3.271	1.698	.569
900			19.20	7.801	3.646	1.893	.635
950			21.28	8.645	4.041	2.097	.703
1000			23.45	9.530	4.454	2.312	.775
1100			28.11	11.42	5.338	2.771	.929
1200			31.75	13.58	6.298	3.269	1.096
1300				15.69	7.333	3.806	1.277
1400				18.06	8.441	4.382	1.470
1500				20.59	9.264	4.996	1.675
1600				23.28	10.88	5.648	1.894
1700				26.12	12.21	6.337	2.125
1800					13.61	7.064	2.369
1900					15.08	7.829	2.625
2000					16.62	8.630	2.894

^{1/} For 20-ft pipe lengths, increase values in the table by 7.0 percent. For 40-ft lengths, decrease values by 3.0 percent. Velocity of values below dotted line exceed 5 fps.

Exhibit SC16-23 Center Pivot Water Supply Nomograph

The nomograph above can be used to calculate water supply requirements for self-propelled center pivot sprinkler systems. Its use is explained by the following examples.

Example 1:

Given: Water supply, 800 gpm; plant water use rate, 0.28" per day; water application efficiency, 60%. What is the radius of the circle that this system will adequately irrigate?

Solution: Locate 0.28" on the "Water Use Rate" scale and 60 on the application efficiency scale. Connect the two points by using a straightedge and note the point of intersection on the solid diagonal line. Locate 800 gpm on the upper scale labeled "Water Supply"; connect this point with the point located on the diagonal line and project this line to the lower scale labeled "Radius of Wetted Circle." This point reads slightly more than 1,100' - the maximum radius of the wetted circle that 800 gpm will properly irrigate.

Example 2:

Given: Desired radius of wetted circle, 1,320'; water use rate 0.20" per day; application efficiency, 60%. What is the required water supply?

Solution: Locate 1320 on the lower scale, then draw a line from this point through the intersection point on the diagonal and extend it on to the upper scale labeled "Water Supply." The point on the upper scale is between 1,100 and 1,150 gpm. A water supply of 1,125 gpm is required to adequately irrigate a circle this size under the given conditions. It is obvious that an increase in water application efficiency will reduce the total water requirements.

Exhibit SC16-24 Pressure Loss in Center Pivot System (psi)

System Length	Pipe Size	"q" gpm at Pivot									
		300	400	500	600	700	800	900	1000	1100	1200
600	4"	11	18	27							
	5"	3.5	6	9							
700	5"	4.0	7	11	15						
	6"	1.7	3	4.5	6						
800	5"	4.5	8	12	18	24					
	6"	2.0	3.5	5	7	10					
900	5"	5.0	9	14	20	27	34				
	6"	2.3	4.0	6	8	11	14				
	6½"	--	--	--	--	7	10				
1000	5"	5.5	10	16	23	30	38	--			
	6"	2.6	4.5	6.5	9	12	15	19			
	6½"	--	--	--	--	8	11	14			
1100	5"	6.0	11	17	25	33	42	--	--		
	6"	3.0	5	7	10	13	17	21	26		
	6½"	--	--	--	6	9	12	15	18		
1200	5"		12	19	27	36	--	--	--	--	
	6"		5.5	7.5	11	15	19	23	28	35	
	6½"		3.5	5.0	7	10	13	16	19	23	
1300	6"			8	12	16	20	25	31	37	45
	6½"			5.5	8	11	14	17	21	25	30
	7"			--	5	7	9	12	15	18	22
1400	6"				13	17	22	27	33	40	48
	6½"				9	12	15	19	23	27	32
	7"				6	8	10	13	16	19	23
1500	6"					18	23	29	35	42	51
	6½"					13	16	20	24	28	34
	7"					9	11	14	17	20	24
1600	6"						25	31	37	45	54
	6½"						17	21	26	30	36
	7"						12	15	18	21	25
1700	6"							33	39	47	57
	6½"							23	27	32	38
	7"							16	19	22	26
1800	6"								41	50	60
	6½"								29	34	40
	7"								20	23	27

Exhibit SC16-25 Factors (F) for Computing Friction Head Loss in a line with Multiple Outlets

		No Outlets	F		No Outlets	F		
		1	1.000		24	.372		
		2	.639		25	.371		
		3	.534		26	.370		
		4	.485		28	.369		
		5	.457		30	.368		
		6	.438		32	.367		
		7	.425		34	.366		
		8	.416		36	.365		
		9	.408		38	.364		
		10	.402		40	.363		
		11	.398		45	.362		
		12	.394		50	.361		
		13	.390		55	.360		
		14	.387		60	.359		
		15	.385		70	.358		
		16	.383		80	.357		
		17	.381		90	.356		
		18	.379		100	.356		
		19	.378		110	.355		
		20	.376		120	.355		
		21	.375		130	.355		
		22	.374		140	.355		
		23	.373		150	.355		

Exhibit SC16-26 Center Pivot Systems Time Required to Apply 1 inch Gross Application

Total Lateral Length	Area * Covered (acres)	Hours Per 1" Application (Col. 1) Gross Capacity in in./day (Col. 2)									
		400 gpm		600 gpm		800 gpm		1000 gpm		1200 gpm	
		hrs/ in.,	in./ day	hrs/ in.,	in./ day	hrs/ in.,	in./ day	hrs/ in.,	in./ day	hrs/ in.,	in./ day
500	26	29.2	.82	19.5	1.23	14.6	1.65	11.7	2.06	9.8	2.44
550	30.5	34.4	.70	23.0	1.04	17.2	1.4	13.7	1.75	11.4	2.10
600	35.3	38.7	.62	26.4	.91	19.8	1.2	15.9	1.51	13.2	1.82
650	40.6	45.6	.52	30.4	.79	22.9	1.05	18.2	1.32	15.2	1.58
700	52.1	58.6	.41	39.0	.61	29.4	.82	23.4	1.02	19.5	1.23
800	58.4	66.1	.36	44.0	.54	32.8	.73	26.3	.91	21.9	1.09
850	65.0	73.0	.33	48.7	.49	36.6	.65	29.3	.82	24.3	.99
900	72.2	81.2	.29	54.2	.44	40.6	.59	32.5	.74	27.1	.89
950	79.5	89.2	.27	59.5	.40	44.8	.53	35.8	.67	29.8	.81
1000	87.4	98.3	.24	65.5	.37	49.2	.49	39.4	.61	32.8	.73
1050	95.3	107	.22	71.5	.33	53.6	.45	42.9	.56	35.7	.67
1100	104.0	117	.20	78.0	.31	58.5	.41	46.8	.51	39.0	.61
1150	112.6	126	.19	84	.29	63.4	.38	50.7	.47	42.2	.57
1200	121.9	137	.17	91.5	.26	68.6	.35	54.9	.44	45.6	.52
1250	130.0	146	.16	97.5	.25	73.1	.33	58.5	.41	48.7	.49
1300	141.3	159	.15	106	.23	79.5	.30	63.6	.38	53.0	.45
1350	151.6	170	.14	113	.21	85.5	.28	68.3	.35	56.7	.42
1400	162.0	182	.13	122	.20	91.2	.26	73.0	.33	60.7	.40
1450	173.2	194	.12	130	.18	97.5	.25	78.0	.31	65.0	.37
1500	184.7	203	.11	138	.17	104	.23	83.0	.29	69.2	.35

*With gun sprinkler on entire circle.

Table SC16-1 Crop Coefficient Values (K_c), Adapted from North Carolina Irrigation Guide, Table NC4-4

page 1 of 2

CROP NAME	% GROWING SEASON K _c FACTORS									
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Asparagus	0.25	0.43	0.69	0.95	1.00	1.00	1.00	1.00	0.93	0.25
Barley	0.25	0.53	0.93	1.05	1.05	1.05	1.05	0.89	0.57	0.25
Beets	0.25	0.25	0.36	0.57	0.79	1.00	1.00	1.00	0.98	0.90
Berries, other	0.40	1.05	1.05	1.05	1.05	1.05	0.85	0.75	0.50	0.50
Blueberries	0.46	1.10	1.10	1.10	1.04	0.97	0.87	0.82	0.75	0.67
Broccoli	0.25	0.28	0.44	0.59	0.75	0.90	0.95	0.95	0.94	0.80
Cabbage	0.25	0.28	0.44	0.59	0.75	0.90	0.95	0.95	0.94	0.80
Cantaloupe & Honeydew	0.25	0.28	0.44	0.59	0.75	0.90	0.95	0.95	0.94	0.80
Carrots	0.25	0.25	0.50	0.75	1.00	1.00	1.00	1.00	0.88	0.70
Cauliflower	0.25	0.28	0.44	0.59	0.75	0.90	0.95	0.95	0.94	0.80
Citrus	0.79	0.81	0.89	0.96	1.04	1.05	1.05	1.02	0.90	0.79
Collards	0.25	0.25	0.48	0.72	0.95	0.95	0.95	0.95	0.95	0.90
Corn, grain/silage ^{1/}	0.25	0.25	0.64	1.05	1.25	1.25	1.25	1.04	0.77	0.50
Corn, sweet	0.25	0.25	0.43	0.66	0.89	1.03	1.03	1.03	1.02	0.95
Cotton ^{1/}	0.25	0.25	0.43	0.70	0.97	1.15	1.15	0.99	0.74	0.50
Cucumbers	0.25	0.27	0.51	0.74	0.90	0.90	0.90	0.90	0.83	0.70
Deciduous Orchard ^{2/}	0.50	0.75	1.00	1.00	1.00	1.10	1.10	1.10	0.85	0.85
Eggplant	0.25	0.25	0.43	0.64	0.86	0.95	0.95	0.95	0.89	0.80
Flowers (cut)	0.25	0.25	0.33	0.51	0.70	0.89	0.95	0.95	0.95	0.90
Forage - warm season ^{1/}	0.50	0.50	0.94	0.95	0.95	0.80	0.80	0.80	0.76	0.60
Garlic	0.30	0.50	0.69	0.95	1.00	1.00	1.00	0.95	0.75	0.50
Grapes	0.50	0.50	0.60	0.65	0.75	0.80	0.80	0.75	0.65	0.65
Greens, Mustard	0.25	0.25	0.33	0.51	0.70	0.89	0.95	0.95	0.95	0.90
Hay, alfalfa	0.25	0.44	0.72	0.99	1.05	1.05	1.05	1.05	0.98	0.25
Hops ^{1/}	0.25	0.40	0.62	0.83	1.01	1.06	1.01	0.85	0.64	0.60
Kale	0.25	0.25	0.48	0.72	0.95	0.95	0.95	0.95	0.95	0.90
Lettuce	0.25	0.25	0.33	0.51	0.70	0.89	0.95	0.95	0.95	0.90
Lima Beans	0.25	0.25	0.41	0.62	0.83	0.95	0.95	0.95	0.94	0.85

Table SC16-1 Crop Coefficient Values (K_c), Adapted from North Carolina Irrigation Guide, Table NC4-4 (continued)

CROP NAME	% GROWING SEASON K _c FACTORS									
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Oats	0.25	0.53	0.93	1.05	1.05	1.05	1.05	0.89	0.57	0.25
Okra	0.25	0.25	0.48	0.72	0.95	0.95	0.95	0.95	0.90	0.80
Onion (dry), yellow & Leeks	0.30	0.50	0.69	0.95	1.00	1.00	1.00	0.95	0.75	0.50
Onion, green	0.50	0.50	0.60	0.70	1.00	1.00	1.00	1.00	1.00	1.00
Peaches & Nectarines	0.50	0.70	0.70	0.90	1.00	1.00	1.00	0.95	0.75	0.75
Peanuts ^{1/}	0.30	0.41	0.79	1.10	1.10	1.10	1.10	1.01	0.81	0.60
Peas, garden, sweet	0.25	0.25	0.55	0.84	1.05	1.05	1.05	1.05	1.02	0.95
Peas, southern	0.25	0.25	0.55	0.84	1.05	1.05	1.05	1.05	1.02	0.95
Pecans & Walnuts	0.50	0.50	0.70	0.90	1.10	1.10	1.10	0.90	0.70	0.65
Peppers	0.25	0.25	0.48	0.72	0.95	0.95	0.95	0.95	0.90	0.80
Potatoes, Irish	0.25	0.25	0.57	0.89	1.05	1.05	1.05	1.05	0.88	0.70
Potatoes, Sweet	0.25	0.25	0.57	0.89	1.05	1.05	1.05	1.05	0.88	0.70
Pumpkin	0.25	0.25	0.47	0.68	0.90	0.90	0.90	0.90	0.80	0.70
Radish	0.25	0.25	0.43	0.62	0.80	0.80	0.80	0.80	0.79	0.75
Snap Beans	0.25	0.25	0.41	0.62	0.83	0.95	0.95	0.95	0.94	0.85
Sorghum	0.25	0.37	0.65	0.94	1.00	1.00	1.00	0.90	0.70	0.50
Soybeans	0.25	0.42	0.76	1.00	1.00	1.00	1.00	1.00	0.74	0.45
Spinach	0.25	0.25	0.48	0.72	0.95	0.95	0.95	0.95	0.95	0.90
Squash, Hardshell / Winter ^{3/}	0.25	0.25	0.47	0.68	0.90	0.90	0.90	0.90	0.80	0.70
Squash, Summer	0.25	0.25	0.47	0.68	0.90	0.90	0.90	0.90	0.80	0.70
Strawberries	0.25	0.40	0.55	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Sunflower ^{1/}	0.30	0.30	0.70	1.15	1.15	1.15	1.15	1.09	0.72	0.35
Tobacco ^{1/}	0.50	0.50	0.71	0.96	1.15	1.15	1.15	1.07	0.93	0.80
Tomatoes	0.25	0.25	0.52	0.78	1.05	1.05	1.05	1.05	0.95	0.85
Watermelons	0.25	0.25	0.53	0.82	1.10	1.10	1.10	1.10	0.93	0.60
Wheat, Winter	0.25	0.53	0.93	1.05	1.05	1.05	1.05	0.89	0.57	0.25

^{1/} Plant data and harvest information from H.Farahani, NRCS-ENTSC (Greensboro)

^{2/} NCIG, Table 4-4 - includes (Apples, Pears, Cherries). Apple K_c values used to represent Pears & Cherries

^{3/} NCIG, Table 4-4 Pumpkin K_c values used. Use Squash, Summer_fall design peak E_{Tc} since similar planting date range

The following tables provide long term SERCC climate data from twelve stations across the state which are located near certain Reference ET stations (see Supplement Chapter 4, Fig. SC4-4).

Table SC16–2 Yemassee Station (9469) Mean Precipitation [r_t], Maximum & Minimum Temperatures

Month	9469 Mean Precip. [r_t] (in)	9469 Mean Max. Temp [F]	9469 Mean Min. Temp [F]
Jan	3.24	61.0	36.4
Feb	3.62	63.7	38.2
Mar	3.96	70.9	44.4
Apr	3.15	78.2	50.7
May	3.79	85.3	58.7
Jun	5.95	90.2	66.2
Jul	6.68	91.9	69.2
Aug	6.37	91.0	68.8
Sep	4.96	86.6	64.2
Oct	3.05	78.3	52.9
Nov	2.32	69.7	43.2
Dec	3.13	62.0	37.3

Table SC16–3 Pinopolis Dam Station (6893) Mean Precipitation [r_t], Maximum & Minimum Temperatures

Month	6893 Mean Precip. [r_t] (in)	6893 Mean Max. Temp [F]	6893 Mean Min. Temp [F]
Jan	3.63	57.4	35.5
Feb	3.37	60.2	37.2
Mar	4.20	67.1	43.7
Apr	2.85	75.4	51.4
May	3.99	82.6	59.8
Jun	5.16	88.2	67.1
Jul	6.28	90.7	70.6
Aug	6.36	89.6	69.6
Sep	4.76	85.1	64.7
Oct	3.04	76.5	53.5
Nov	2.37	68.0	44.0
Dec	3.02	59.4	36.5

Table SC16-4 Brookgreen Gardens Station (1093) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	1093 Mean Precip. [rt] (in)	1093 Mean Max. Temp	1093 Mean Min. Temp
Jan	4.05	57.3	36.2
Feb	3.66	60.3	38.3
Mar	4.37	67.2	44.6
Apr	2.96	75.1	51.9
May	3.75	81.8	60.3
Jun	5.08	86.8	67.7
Jul	6.34	89.8	71.3
Aug	6.42	88.5	70.7
Sep	5.92	84.3	65.4
Oct	4.02	76.4	54.5
Nov	2.93	68.4	45.6
Dec	3.82	60.0	38.2

Table SC16-5 Aiken 4 NE Station (74) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	74 Mean Precip. [rt] (in)	74 Mean Max. Temp [F]	74 Mean Min. Temp [F]
Jan	3.99	58.1	35.9
Feb	4.32	61.4	37.7
Mar	4.57	69.1	44.0
Apr	3.39	77.3	51.1
May	3.45	84.4	59.4
Jun	4.54	90.0	66.8
Jul	5.15	91.7	69.6
Aug	4.75	90.5	69.4
Sep	3.91	85.9	64.5
Oct	2.78	77.0	53.2
Nov	2.61	67.5	43.3
Dec	3.69	59.1	36.7

Table SC16–6 Orangeburg 2 Station (6527) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	6527 Mean Precip. [rt] (in)	6527 Mean Max. Temp	6527 Mean Min. Temp
Jan	3.77	56.8	33.5
Feb	3.85	60.8	36.2
Mar	4.33	68.3	43.1
Apr	3.03	77.0	50.6
May	3.80	83.8	58.8
Jun	4.77	89.1	66.6
Jul	5.47	91.7	70.1
Aug	5.23	90.9	69.5
Sep	4.20	85.7	63.8
Oct	3.01	76.8	51.7
Nov	2.59	68.6	42.4
Dec	3.20	59.7	35.4

Table SC16–7 Sandhill Experiment Station (7666) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	7666 Mean Precip. [rt] (in)	7666 Mean Max. Temp	7666 Mean Min. Temp
Jan	4.14	53.9	32.5
Feb	3.79	58.0	34.8
Mar	4.52	65.9	42.0
Apr	3.13	75.1	50.5
May	3.24	82.0	58.8
Jun	4.51	87.8	66.1
Jul	5.18	90.7	69.8
Aug	4.50	89.3	69.0
Sep	3.73	84.1	62.9
Oct	3.19	74.6	51.6
Nov	2.89	66.2	43.0
Dec	3.35	57.0	35.0

Table SC16–8 Florence FAA Airport Station (3106) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	3106 Mean Precip. [rt] (in)	3106 Mean Max. Temp	3106 Mean Min. Temp
Jan	3.24	56.1	35.0
Feb	3.16	59.6	37.1
Mar	3.68	67.2	43.4
Apr	2.89	76.0	50.9
May	3.24	83.1	59.7
Jun	4.51	88.4	67.4
Jul	5.39	90.9	71.1
Aug	4.91	89.6	70.1
Sep	3.79	84.4	64.4
Oct	2.72	75.7	52.6
Nov	2.47	67.1	43.4
Dec	2.94	58.2	36.5

Table SC16–9 Greenwood 3 SW Station (3754) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	3754 Mean Precip. [rt] (in)	3754 Mean Max. Temp	3754 Mean Min. Temp
Jan	4.31	53.2	31.9
Feb	4.46	56.3	33.0
Mar	4.88	64.4	39.8
Apr	3.51	73.6	48.1
May	3.55	81.6	57.2
Jun	3.84	88.1	65.2
Jul	4.64	90.4	68.5
Aug	4.27	89.1	67.8
Sep	3.49	83.9	61.9
Oct	3.09	74.0	49.9
Nov	3.08	63.7	39.7
Dec	4.02	54.2	32.9

Table SC16–10 Santuck 4 SE Station (7722) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	7722 Mean Precip. [rt] (in)	7722 Mean Max. Temp	7722 Mean Min. Temp
Jan	4.12	54.2	32.6
Feb	4.33	57.3	33.9
Mar	4.67	65.7	40.6
Apr	3.34	74.5	48.3
May	3.39	82.3	57.0
Jun	3.93	88.9	64.9
Jul	4.68	90.8	68.5
Aug	5.02	89.7	67.6
Sep	3.82	84.0	61.8
Oct	3.15	74.2	49.7
Nov	3.07	64.1	40.0
Dec	3.86	55.0	33.5

Table SC16–11 Winthrop College Station (9350) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	9350 Mean Precip. [rt] (in)	9350 Mean Max. Temp	9350 Mean Min. Temp
Jan	3.93	53.2	32.9
Feb	3.95	56.4	34.5
Mar	4.43	64.7	41.4
Apr	3.32	73.7	49.4
May	3.57	81.5	58.0
Jun	4.13	87.9	65.7
Jul	4.93	90.2	69.1
Aug	4.51	88.7	68.1
Sep	3.76	83.3	62.4
Oct	3.12	73.8	51.1
Nov	2.91	63.7	41.2
Dec	3.82	54.4	34.2

Table SC16–12 Walhalla (8887) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	8887 Mean Precip. [r _t] (in)	8887 Mean Max. Temp	8887 Mean Min. Temp
Jan	5.58	53.2	30.4
Feb	5.36	56.3	31.7
Mar	6.32	64.0	37.9
Apr	4.62	72.8	45.1
May	4.70	80.1	53.7
Jun	4.96	86.7	62.0
Jul	5.61	88.7	65.5
Aug	5.71	87.8	64.8
Sep	4.80	82.9	59.3
Oct	4.13	73.5	47.5
Nov	4.17	63.3	37.8
Dec	5.72	54.4	31.5

Table SC16–13 Greenville/Spartanburg Airport Station (3747) Mean Precipitation [rt], Maximum & Minimum Temperatures

Month	3747 Mean Precip. [r _t] (in)	3747 Mean Avg. Max Temp	3747 Mean Avg. Min Temp
Jan	3.99	51.1	31.2
Feb	3.93	55.0	33.3
Mar	5.09	63.8	40.7
Apr	3.61	72.6	48.2
May	4.05	79.4	56.7
Jun	4.23	86.1	64.9
Jul	4.59	88.8	68.8
Aug	4.13	87.5	68.0
Sep	3.98	81.3	61.7
Oct	3.71	71.9	49.6
Nov	3.61	62.5	40.6
Dec	3.95	53.5	33.6

The following information represents the time it would take for a microirrigation system to restore the soil-water content in sand and clay for the different depth of moisture replacement (DMR) groups.

Figure SC16-1 Total Irrigation Run Time to Restore Soil-Water Depletion in Sand and Clay for DMR (8 inch)

Inputs:

DMR (in) ^{1/}	8
MAD (%)	50
SOIL Texture	Sand (S)
AWC (in/in)	0.085
Emitter Wetted Dia. (ft)	1

1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

Inputs:

DMR (in) ^{1/}	8
MAD (%)	50
SOIL Texture	Clay (CL)
AWC (in/in)	0.135
Emitter Wetted Dia. (ft)	5

1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

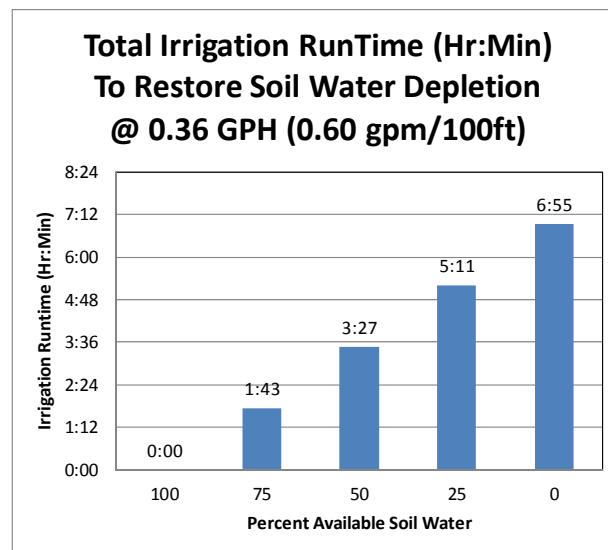
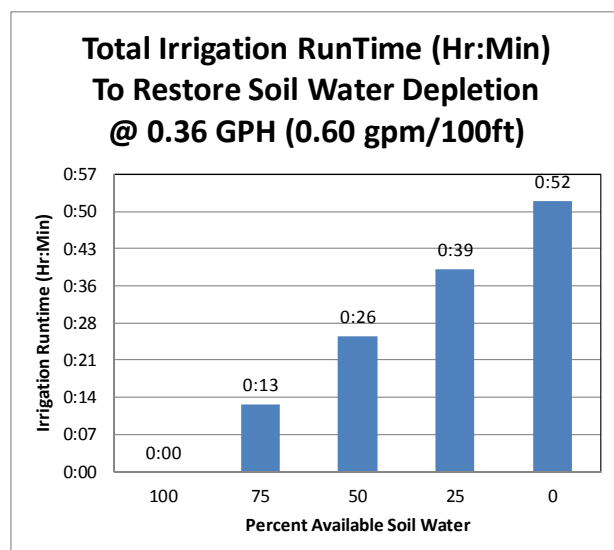
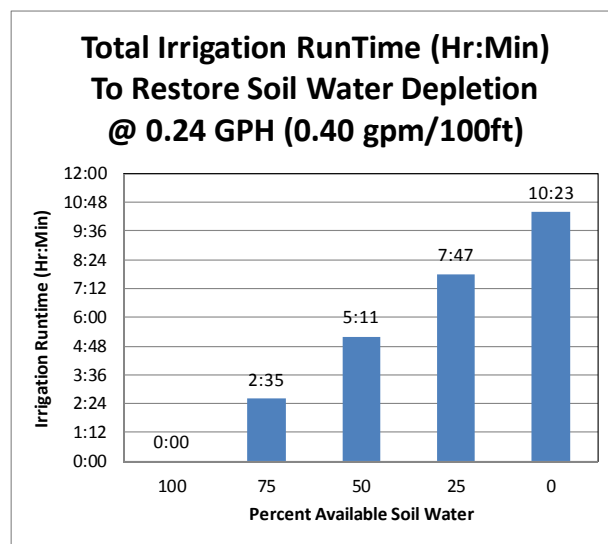
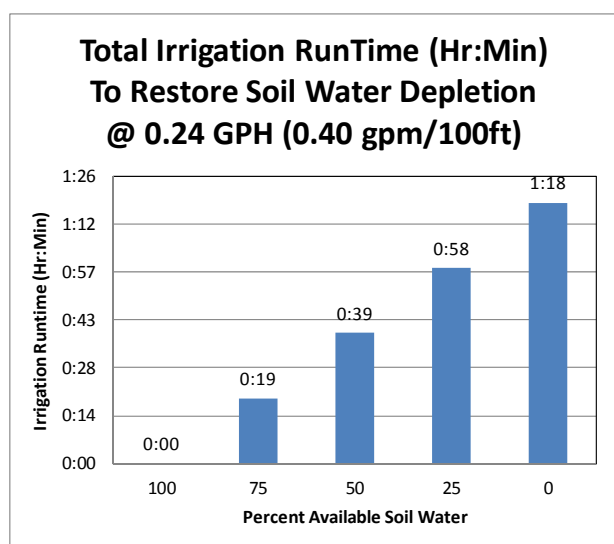


Figure SC16–2 Total Irrigation Run Time to Restore Soil-Water Depletion in Sand and Clay for DMR (12 inch)**Inputs:**

DMR (in) ^{1/}	12
MAD (%)	50
SOIL Texture	Sand (S)
AWC (in/in)	0.085
Emitter Wetted Dia. (ft)	1

1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

Inputs:

DMR (in) ^{1/}	12
MAD (%)	50
SOIL Texture	Clay (CL)
AWC (in/in)	0.135
Emitter Wetted Dia. (ft)	5

1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

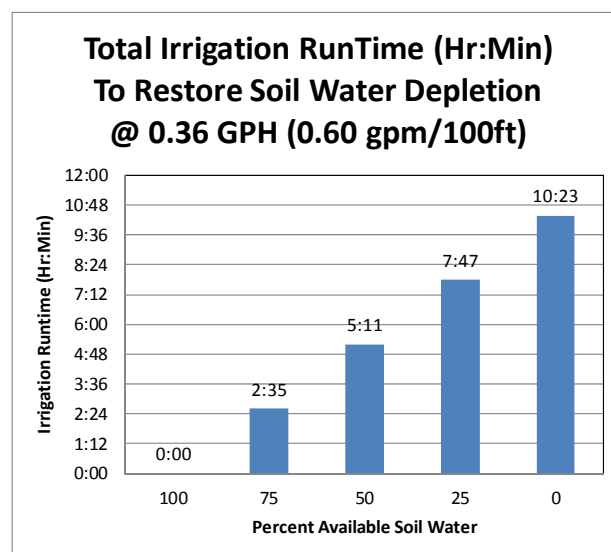
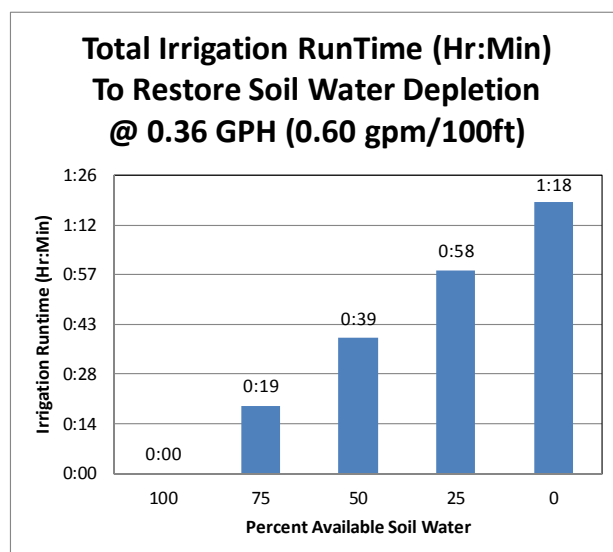
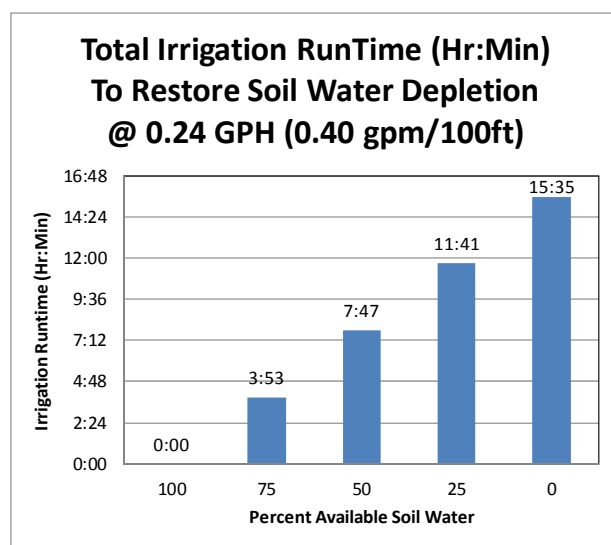
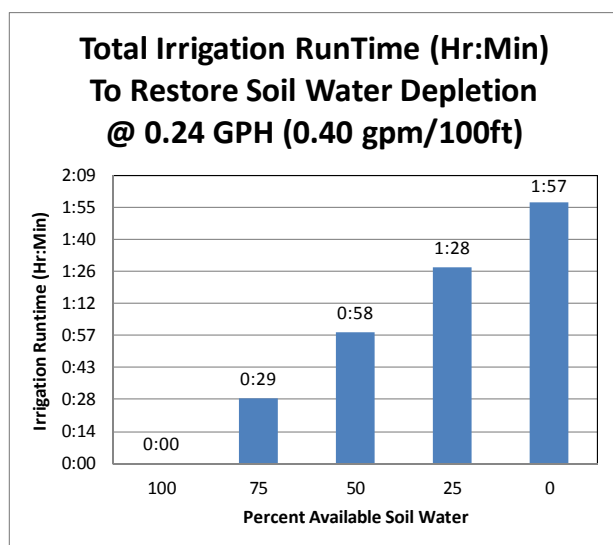


Figure SC16-3 Total Irrigation Run Time to Restore Soil-Water Depletion in Sand and Clay for DMR (18 inch)**Inputs:**

DMR (in) ^{1/}	18
MAD (%)	50
SOIL Texture	Sand (S)
AWC (in/in)	0.085
Emitter Wetted Dia. (ft)	1

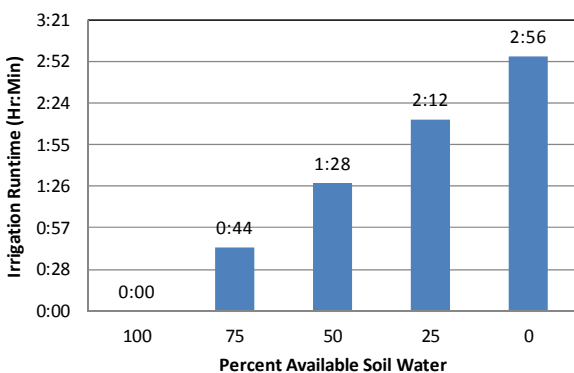
1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

Inputs:

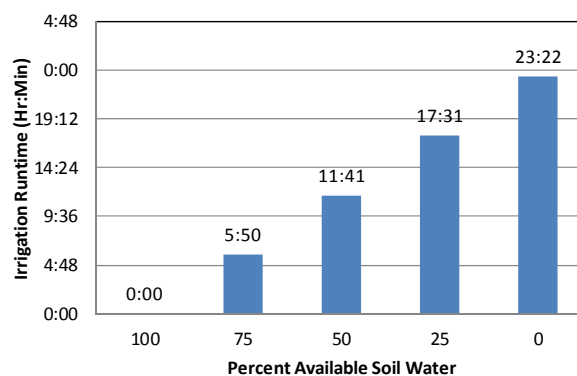
DMR (in) ^{1/}	18
MAD (%)	50
SOIL Texture	Clay (CL)
AWC (in/in)	0.135
Emitter Wetted Dia. (ft)	5

1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

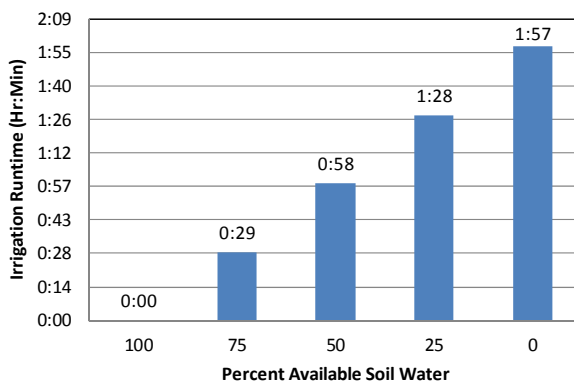
**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.24 GPH (0.40 gpm/100ft)**



**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.24 GPH (0.40 gpm/100ft)**



**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.36 GPH (0.60 gpm/100ft)**



**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.36 GPH (0.60 gpm/100ft)**

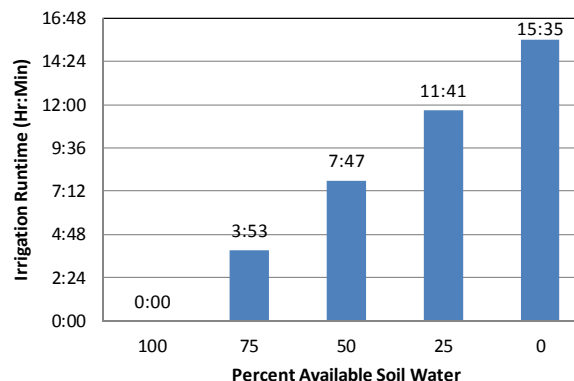


Figure SC16-4 Total Irrigation Run Time to Restore Soil-Water Depletion in Sand and Clay for DMR (24 inch)**Inputs:**

DMR (in) ^{1/}	24
MAD (%)	50
SOIL Texture	Sand (S)
AWC (in/in)	0.085
Emitter Wetted Dia. (ft)	1

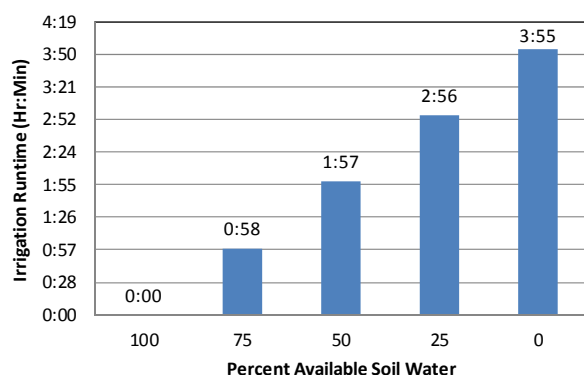
1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

Inputs:

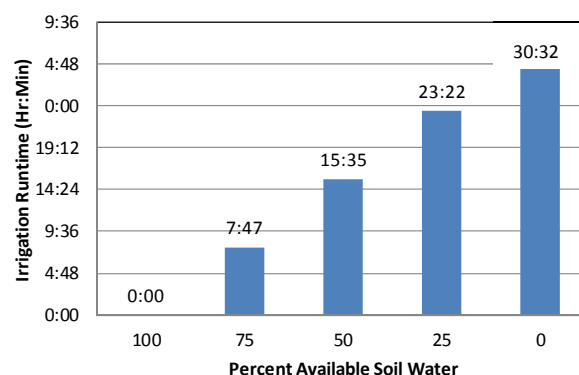
DMR (in) ^{1/}	24
MAD (%)	50
SOIL Texture	Clay (CL)
AWC (in/in)	0.135
Emitter Wetted Dia. (ft)	5

1/ Depth of Moisture Replacement (DMR) value from Chap 3 (pg 3-29)

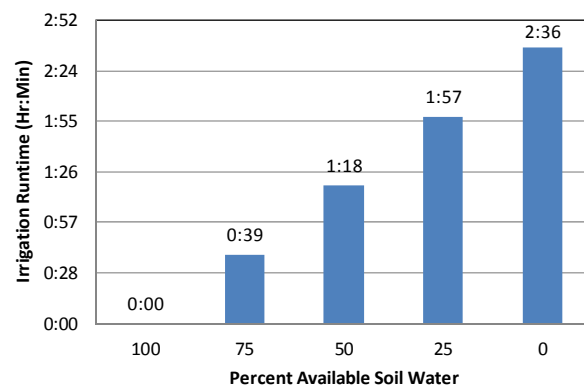
**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.24 GPH (0.40 gpm/100ft)**



**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.24 GPH (0.40 gpm/100ft)**



**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.36 GPH (0.60 gpm/100ft)**



**Total Irrigation RunTime (Hr:Min)
To Restore Soil Water Depletion
@ 0.36 GPH (0.60 gpm/100ft)**

