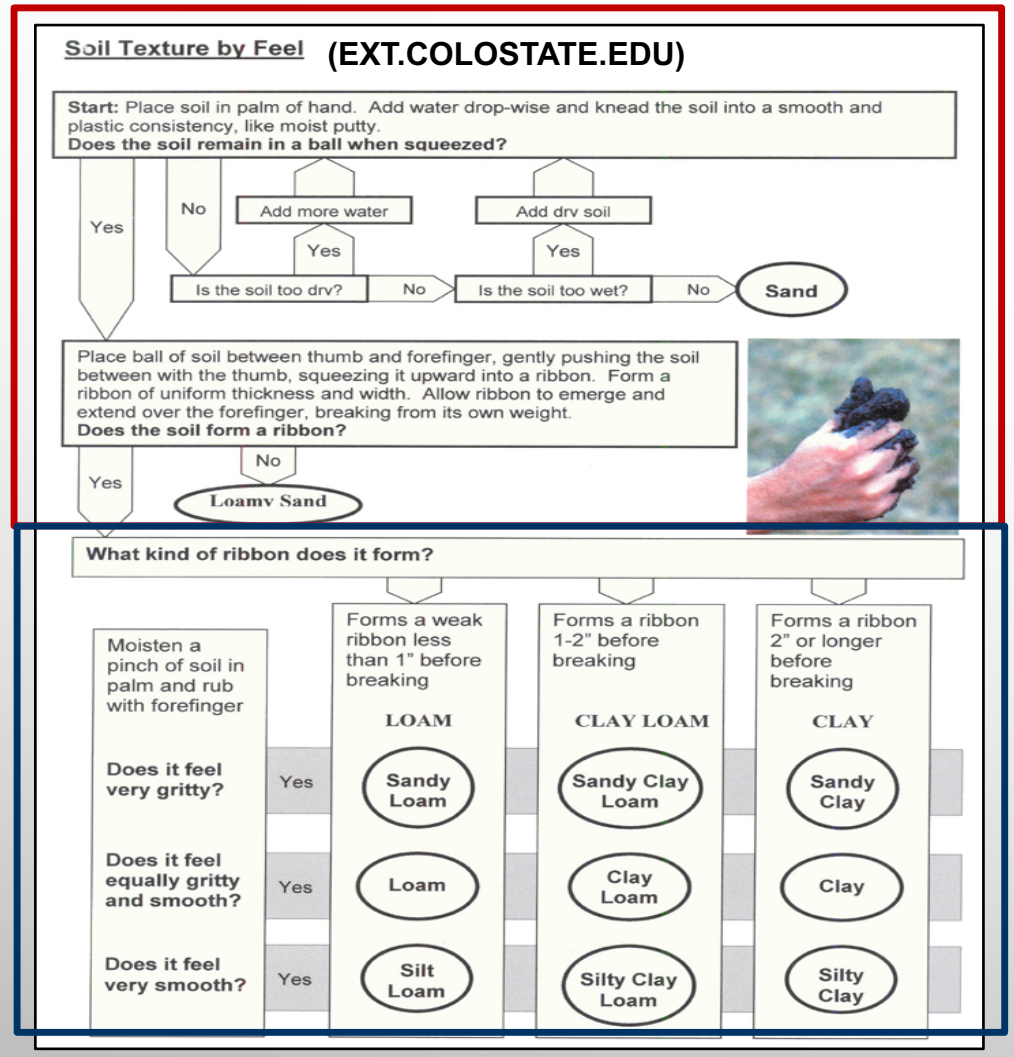
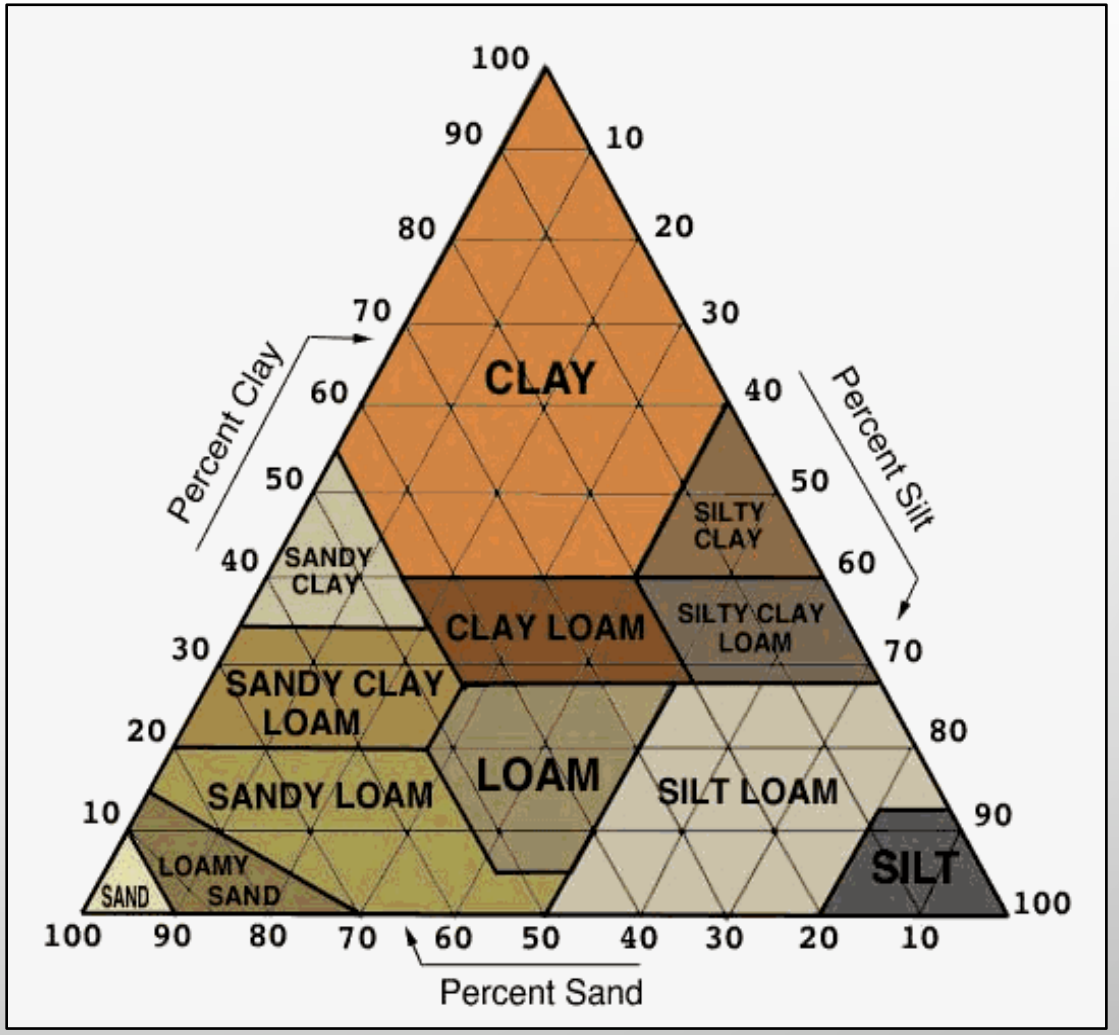
DRIPLINE INSTALLATION

INSTRUCTOR: JOHN RAFFIANI

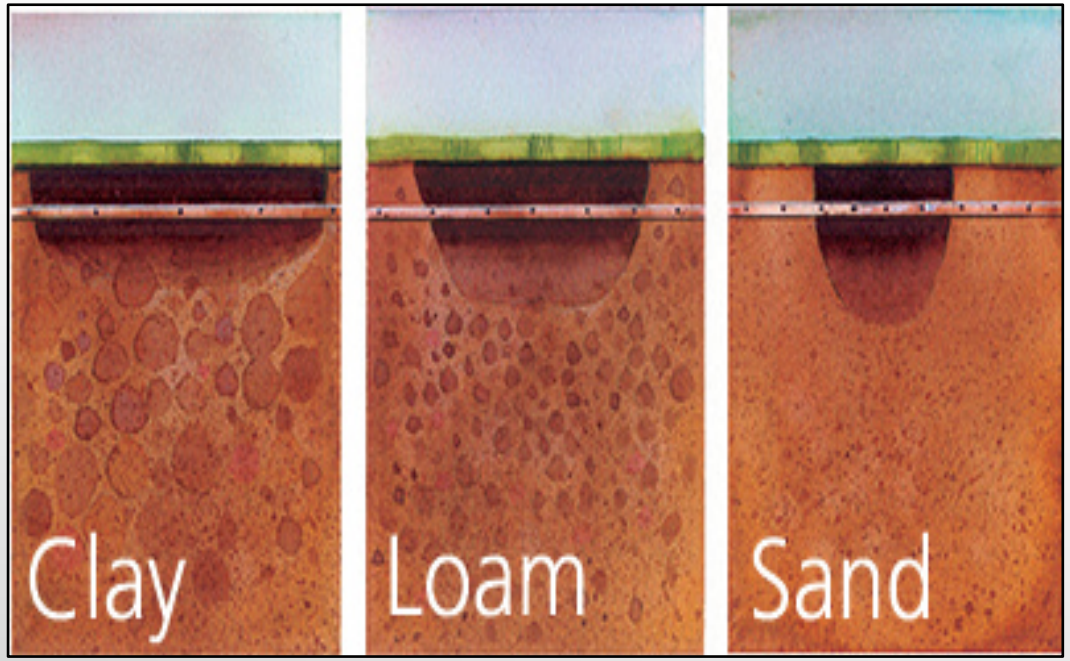
HANDOUT

IF YOU ARE UNSURE OF THE SOIL TEXTURE DON'T BE AFRAID TO USE THE "RIBBON AND FEEL" METHOD





WATER MOVEMENT IN SOILS



(NETAFIMUSA)

Inches of AW per Inch At Field Capacity

Soil Texture Class	Available Water (in./in.)	Basic Intake Rate (in./in.)
Clay	.17	.10
Silty Clay	.17	.15
Clay Loam	.18	.20
Loam	.17	.35
Sandy Loam	.12	.40
Loamy Sand	.08	.50
Sand	.06	.60

(WATERMOTION.COM)

QUICK QUIZ

IF YOUR SOIL IS CLAY LOAM AT FIELD CAPACITY HOW MUCH WATER IS AVAILABLE TO A SHRUB WITH 8 INCH ROOTS?

ANSWER:

AW =

8 INCH ROOTS X 0.18 INS./IN.

= 1.44 INCHES OF WATER

AVAILABLE TO THE PLANT

Soil Texture Class	Available Water (in./in.)	Basic Intake Rate (in./in.)
Clay	.17	.10
Silty Clay	.17	.15
Clay Loam	.18	.20
Loam	.17	.35
Sandy Loam	.12	.40
Loamy Sand	.08	.50
Sand	.06	.60

WATERING TO THE ROOT ZONE - QUICK QUIZ

$AW = FC - PWP$

Back to our chart showing ***AW*** per inch of 0.18 for clay loam:

As the soil approaches ***PWP*** (not MAD) it will need to

replace the prior 8 inch root zone's 1.44 inches

lost to ET. If your drip zone has a *PR* of

0.45 ins./hr. How long would you need to run

the zone to make up the 1.44 inches of water?

Soil Texture Class	Available Water (in./in.)	Basic Intake Rate (in./in.)
Clay	.17	.10
Silty Clay	.17	.15
Clay Loam	.18	.20
Loam	.17	.35
Sandy Loam	.12	.40
Loamy Sand	.08	.50
Sand	.06	.60

ANSWER:

1.44 / 0.45 = 3.2 x 60 = 192 minutes. Assume an *IR* of 0.20 ins./hr. for clay loam.

What would be your maximum run time before runoff? How many run cycles?

Answer: **0.20 *IR* / 0.45 *PR* x 60 = 26** minutes**. Number of cycles = 192m / 26m = 7 cycles minimum ***

* Chances are this plant is a goner. Not enough time unless runoff/ponding is not a problem for this emergency.

CONTROL KIT COMPONENTS

- LOW FLOW SOLENOID VALVES – 0.2 GPM MINIMUM (12 GPH)
- PRESSURE REDUCER (30-50 PSI)
- MESH FILTER (200 MESH = 75 MICRONS)

THE HIGHER THE MESH # THE SMALLER THE MICRONS AND THE SMALLER THE PARTICLE ALLOWED TO PASS THROUGH TO THE EMITTERS

WHEN DESIGNING A DRIPLINE INSTALLATION THINK IN *GALLONS PER HOUR* CONVERT TO *GPM* WHEN CHOOSING HEADER SIZE AND CONTROL KITS

- 100 GPH = 1.67 GPM
- 1000 GPH = 16.7 GPM

CONVERTING *GPH* TO GPM AND GPM TO *GPH*

GPH *(Gallons Per Hour)* TO **GPM *(Gallons Per Minute)***

EXAMPLE:

45 GPH — DIVIDED BY 60 = 0.75 GPM

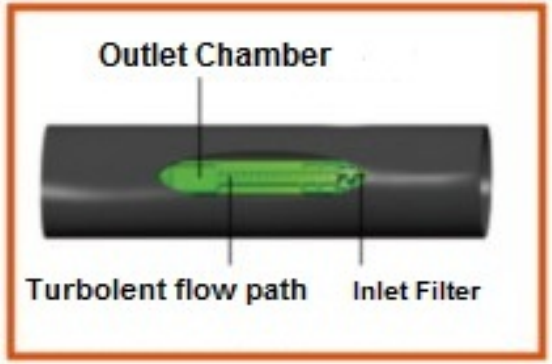
GPM *(Gallons Per Minute)* TO **GPH *(Gallons Per Hour)***

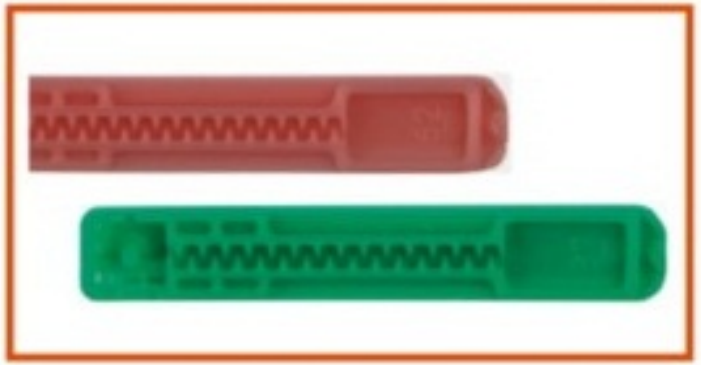
EXAMPLE:

3.5 GPM — MULTIPLY BY 60 = 210 GPH

17MM DRIPLINE

DRIPLINE (IMAGES COURTESY OF NETAFIM AND RAIN BIRD)





¼” LANDSCAPE DRIP LINE (COURTESY OF RAIN BIRD)

- 6" AND 12“ SPACING
- 100‘ COIL LENGTHS
- 10 TO 40 PSI OPERATING RANGE
- EMITTER FLOW RATE: 0.8 GPH AT 30 PSI
- NON PRESSURE COMPENSATING EMITTERS

Maximum Length of Run (feet)		
Emitter Spacing	Maximum Length of Run	Flow per Ft. @ 15 psi
6"	19 feet	1 GPH/ft.
12"	33 feet	0.5 GPH/ft

PRACTICE PROBLEM 1

DETERMINE GPM USED FOR 14 CIRCULAR PLANTERS

- ¼ INCH DRIPLINE 0.8 GPH EMITTERS @ 30 PSI - 6 INCH SPACINGS
- DIAMETER OF DRIPLINE RING IN PLANTER - 16 INCHES

SOLUTION:

- CIRCUMFERENCE IS 2 x 3.14159 (π 8 INS. = 50.27 INCHES
- 50.27 INCHES / 6 INCH EMITTER SPACING = 8 EMITTERS PER PLANTER
- 8 EMITTERS X 0.8 GPH = 6.4 GPH PER PLANTER
- 6.4 GPH / 60 = 0.11 GPM PER PLANTER
- 0.11 GPM x 14 PLANTERS = 1.54 GPM

BONUS QUIZ:

Prior to installing the dripline for your client they tell you they use 6.0 gallons every 3 days to keep the plants happy and don't want to lose the plants while on vacation. What is the run time per cycle every 3rd day?

6.0 GALLONS / 1.54 GPM ≈ 4 MINUTES

DRIPLINE TUBING FROM VARIOUS MANUFACTURERS

- EMITTER GPH DISCHARGE RATES OF 0.26, 0.33, 0.40, 0.53, 0.60, 0.77, 0.80, 0.90 AND 1.16
- EMITTER SPACINGS - 6 INCHES, 12 INCHES, 18 INCHES AND 24 INCHES
- EMITTERS WITH CHECK VALVES OPTIONAL FOR SLOPES
- OPTIONAL COPPER USED TO STOP ROOT INTRUSION

  (OR AN EMBEDDED HERBICIDE SUCH AS ROOTGUARD)

DRIPLINE EMITTERS WITH INTEGRATED CHECK VALVES

ADVANTAGES OF A CHECK VALVE:

- 3.5 PSI CHECK VALVE BUILT IN TO EVERY EMITTER
- UP TO 8' ELEVATION CHANGE
- NECESSARY FOR SLOPED AREAS
- HELPS PREVENT VACUUM ACTION & GRIT SUCTION
- EVEN WATERING TOP TO BOTTOM
- NO DRAINAGE AT LOW POINTS
- DRIPLINE REMAINS CHARGED AFTER IRRIGATION CYCLE

DISADVANTAGES:

- FREEZE DAMAGE IF NOT WINTERIZED CORRECTLY*

* COMPRESSED AIR INPUT @ 40 PSI OR LESS. WAIT UNTIL EMITTERS ARE "HISSING" THEN *BRIEFLY* OPEN FLUSH VALVE AT LOW POINT FOR FINAL WATER DISCHARGE (MY METHOD)

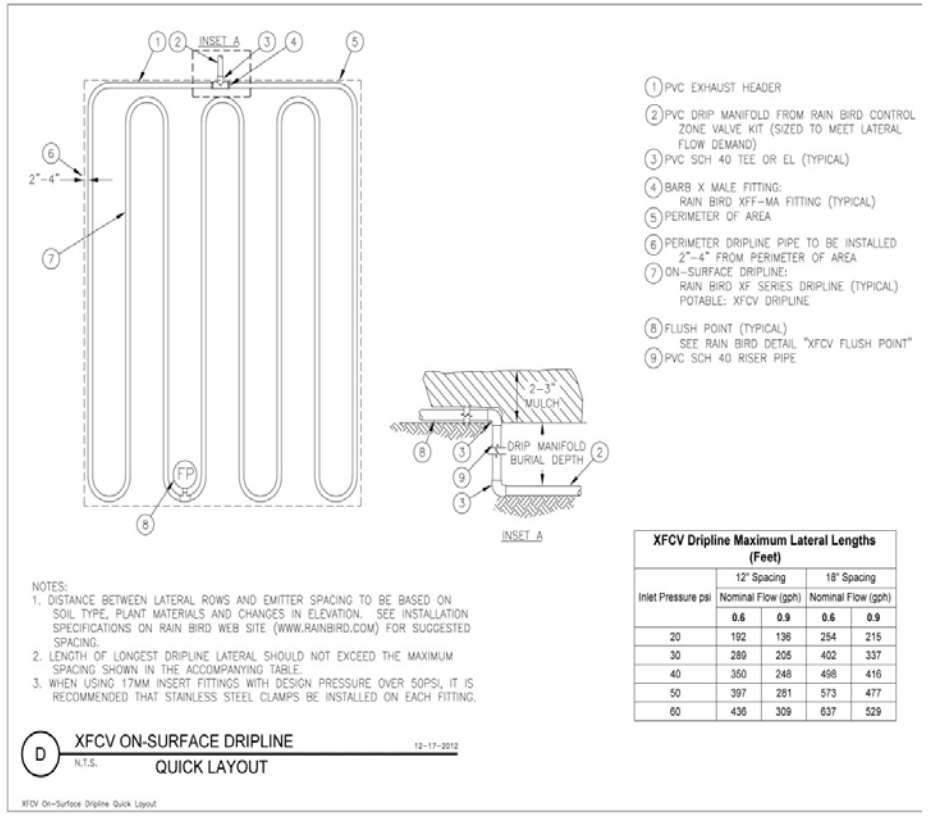
KEY POINTS TO REMEMBER FOR MOST SITUATIONS

- PLANTS NEED WATER ON AT LEAST TWO SIDES
- USE THE SAME EMITTER SPACING THROUGHOUT THE DRIP ZONE
- THE CLOSER THE EMITTERS AND LATERALS ARE THE HIGHER THE *PR*
- IF USED FOR THE GROW-IN PHASE ON NEW LANDSCAPES KEEP IN MIND THE TYPE OF PLANT AND HOW IT'S MATURE SIZE MIGHT AFFECT YOUR INSTALLATION
- INCREASE OR DECREASE EMITTER SPACINGS AND LATERAL LINE SPACING ACCORDING TO SOIL TEXTURE, GENERAL SOIL CONDITIONS AND SLOPE
- TYPE OF PLANTS AT TOP AND BOTTOM OF SLOPED BEDS AND THEIR SPACINGS
- LOCATE DRIPLINES AN APPROPRIATE DISTANCE AWAY FROM HARDSCAPES TO AVOID DAMAGE FROM ROUTINE MAINTENANCE
- BE WARY OF DRIPLINES CLOSER THAN TWO FEET TO BUILDINGS. CHECK ADJACENT BASEMENT WALLS FOR ANY DAMPNESS ISSUES PRIOR TO DESIGNING
- ASCERTAIN AREA FACTORS THAT COULD COMPROMISE THE FUTURE FUNCTIONAL EFFICIENCY OF THE DRIPLINES (SUCH AS RODENTS, FOOT TRAFFIC, CHILDREN PLAYING)

WATER MOVEMENT ON STEEP SLOPES WITHIN THE SOIL PROFILE CAN BE SIGNIFICANT

- CONSIDER A SEPARATE ZONE FOR THE BOTTOM 1/3 OF THE SLOPE
- ALWAYS RUN DRIPLINE LATERALS PERPENDICULAR (ACROSS) THE SLOPE WHENEVER POSSIBLE
- **WHEN USING A SINGLE ZONE WITH SLOPES GREATER THAN 3% INCREASE THE DRIPLINE SPACING BY 25% IN THE BOTTOM 1/3 OF THE ZONE**

PLANTING BED LAYOUTS CAN TAKE ANY FORM



1. PVC EXHAUST HEADER
2. PVC DRIP MANIFOLD FROM RAIN BIRD CONTROL ZONE VALVE KIT (SIZED TO MEET LATERAL FLOW DEMAND)
3. PVC SCH 40 TEE OR EL (TYPICAL)
4. BARB X MALE FITTING: RAIN BIRD XFF–MA FITTING (TYPICAL)
5. PERIMETER OF AREA
6. PERIMETER DRIPLINE PIPE TO BE INSTALLED 2"–4" FROM PERIMETER OF AREA
7. ON–SURFACE DRIPLINE: RAIN BIRD XF SERIES DRIPLINE (TYPICAL) POTABLE: XFCV DRIPLINE
8. FLUSH POINT (TYPICAL) SEE RAIN BIRD DETAIL "XFCV FLUSH POINT"
9. PVC SCH 40 RISER PIPE

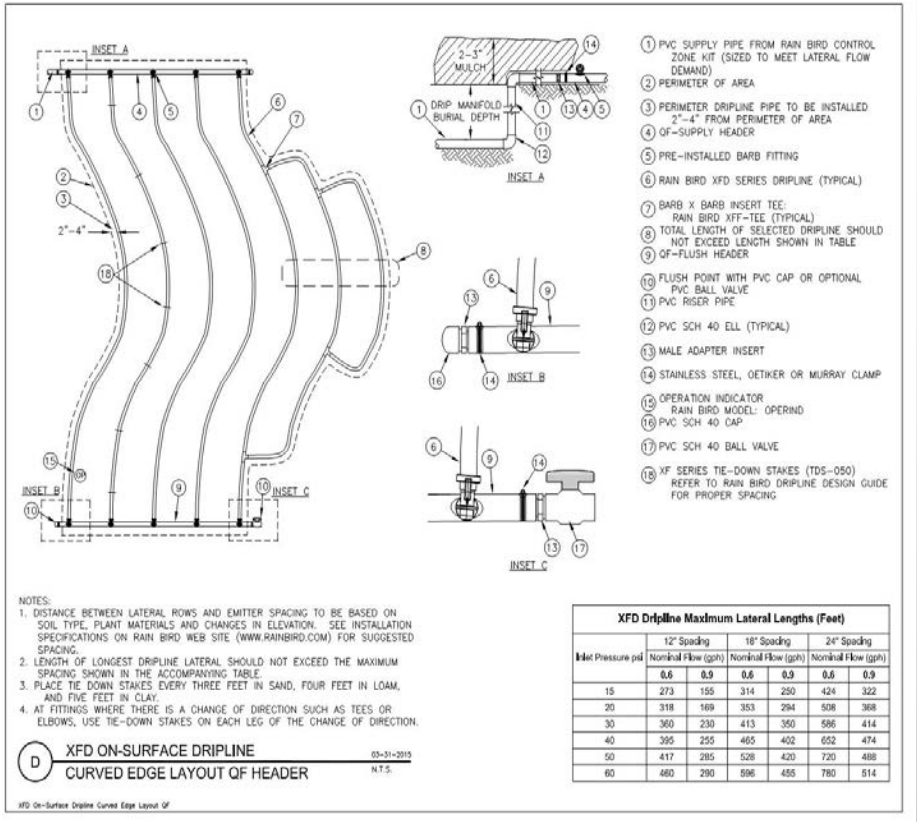
XFCV Dripline Maximum Lateral Lengths (Feet)

Inlet Pressure psi	12" Spacing		18" Spacing	
	Nominal Flow (gph)		Nominal Flow (gph)	
	0.6	0.9	0.6	0.9
20	192	136	254	215
30	289	205	402	337
40	350	248	498	416
50	397	281	573	477
60	436	309	637	529

NOTES:
1. DISTANCE BETWEEN LATERAL ROWS AND EMITTER SPACING TO BE BASED ON SOIL TYPE, PLANT MATERIALS AND CHANGES IN ELEVATION. SEE INSTALLATION SPECIFICATIONS ON RAIN BIRD WEB SITE (WWW.RAINBIRD.COM) FOR SUGGESTED SPACING.
2. LENGTH OF LONGEST DRIPLINE LATERAL SHOULD NOT EXCEED THE MAXIMUM SPACING SHOWN IN THE ACCOMPANYING TABLE.
3. WHEN USING 17MM INSERT FITTINGS WITH DESIGN PRESSURE OVER 50PSI, IT IS RECOMMENDED THAT STAINLESS STEEL CLAMPS BE INSTALLED ON EACH FITTING.

D XFCV ON-SURFACE DRIPLINE QUICK LAYOUT N.T.S. 12-17-2012

XFCV On-Surface Dripline Quick Layout



1. PVC SUPPLY PIPE FROM RAIN BIRD CONTROL ZONE KIT (SIZED TO MEET LATERAL FLOW DEMAND)
2. PERIMETER OF AREA
3. PERIMETER DRIPLINE PIPE TO BE INSTALLED 2"–4" FROM PERIMETER OF AREA
4. QF–SUPPLY HEADER
5. PRE–INSTALLED BARB FITTING
6. RAIN BIRD XFD SERIES DRIPLINE (TYPICAL)
7. BARB X BARB INSERT TEE: RAIN BIRD XFF–TEE (TYPICAL)
8. TOTAL LENGTH OF SELECTED DRIPLINE SHOULD NOT EXCEED LENGTH SHOWN IN TABLE
9. QF–FLUSH HEADER
10. FLUSH POINT WITH PVC CAP OR OPTIONAL PVC BALL VALVE
11. PVC RISER PIPE
12. PVC SCH 40 ELL (TYPICAL)
13. MALE ADAPTER INSERT
14. STAINLESS STEEL, OETIKER OR MURRAY CLAMP
15. OPERATION INDICATOR RAIN BIRD MODEL: OPERIND
16. PVC SCH 40 CAP
17. PVC SCH 40 BALL VALVE
18. XF SERIES TIE–DOWN STAKES (TDS–050) REFER TO RAIN BIRD DRIPLINE DESIGN GUIDE FOR PROPER SPACING

NOTES:
1. DISTANCE BETWEEN LATERAL ROWS AND EMITTER SPACING TO BE BASED ON SOIL TYPE, PLANT MATERIALS AND CHANGES IN ELEVATION. SEE INSTALLATION SPECIFICATIONS ON RAIN BIRD WEB SITE (WWW.RAINBIRD.COM) FOR SUGGESTED SPACING.
2. LENGTH OF LONGEST DRIPLINE LATERAL SHOULD NOT EXCEED THE MAXIMUM SPACING SHOWN IN THE ACCOMPANYING TABLE.
3. PLACE TIE DOWN STAKES EVERY THREE FEET IN SAND, FOUR FEET IN LOAM, AND FIVE FEET IN CLAY.
4. AT FITTINGS WHERE THERE IS A CHANGE OF DIRECTION SUCH AS TEES OR ELBOWS, USE TIE–DOWN STAKES ON EACH LEG OF THE CHANGE OF DIRECTION.

D XFD ON-SURFACE DRIPLINE CURVED EDGE LAYOUT QF HEADER 03-31-2015 N.T.S.

XFD On-Surface Dripline Curved Edge Layout QF

XFD Dripline Maximum Lateral Lengths (Feet)

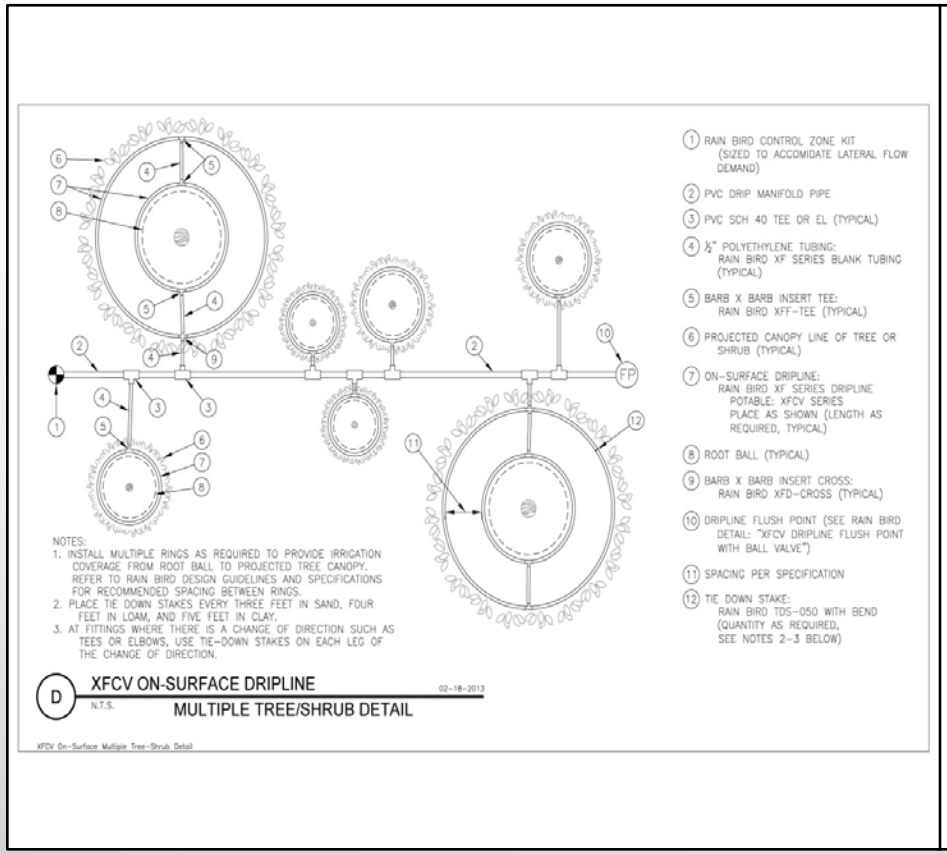
Inlet Pressure psi	12" Spacing		18" Spacing		24" Spacing	
	Nominal Flow (gph)		Nominal Flow (gph)		Nominal Flow (gph)	
	0.6	0.9	0.6	0.9	0.6	0.9
15	273	155	314	250	424	322
20	318	169	353	294	508	368
30	360	230	413	350	586	414
40	395	255	465	402	652	474
50	417	285	528	420	720	488
60	460	290	596	455	780	514

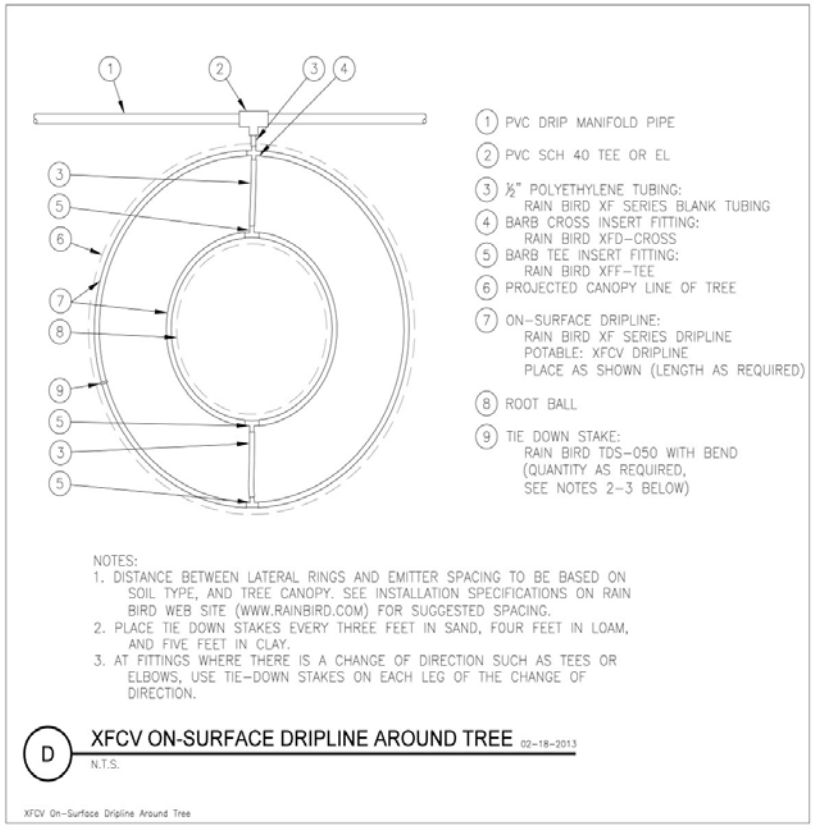
CIRCULAR VS. LATERAL DESIGN

GENERALLY HIGHER PR

NUMBER OF CIRCLES CAN INCREASE TO WATER LARGER SPECIMENS

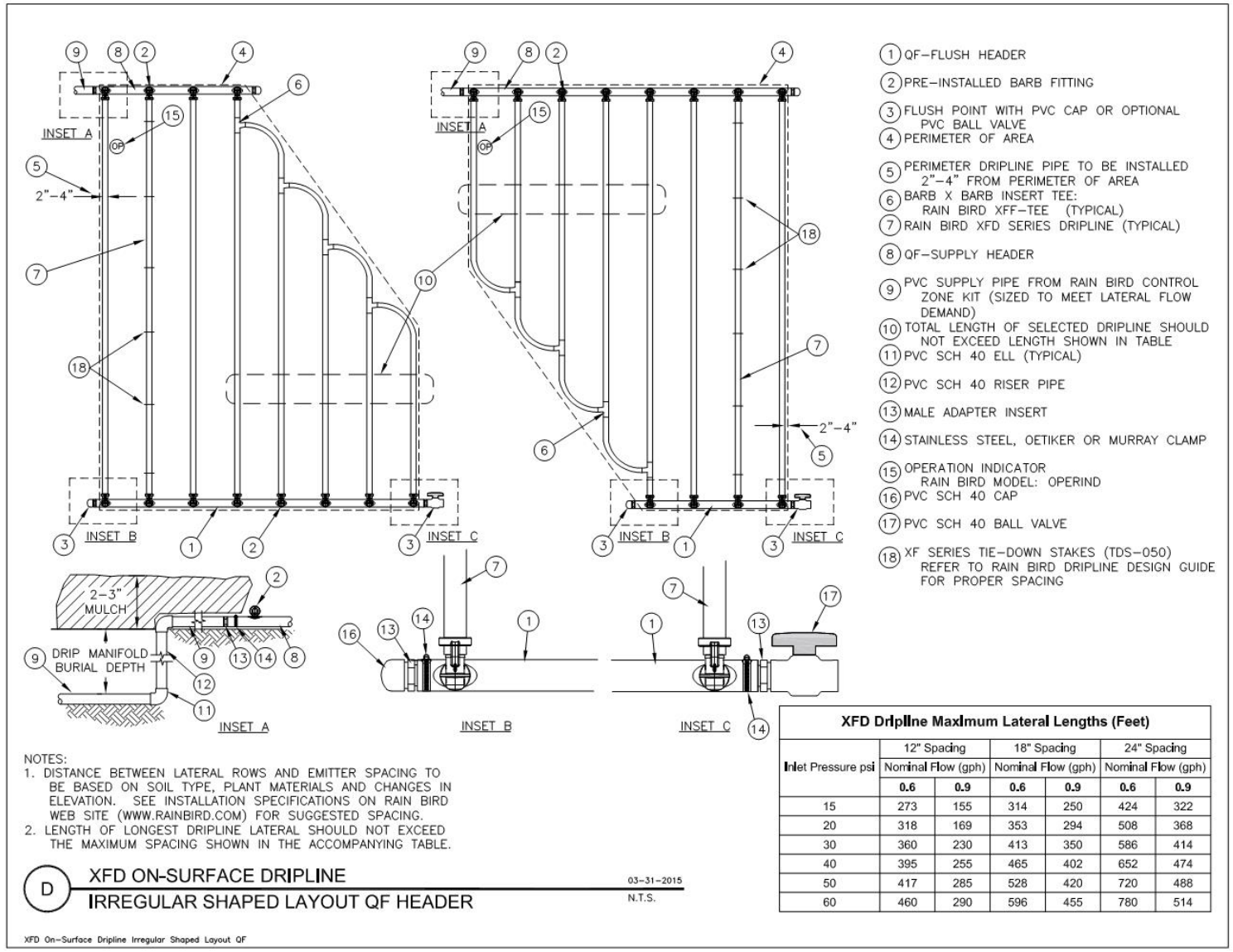
USE BLANK TUBING TO SEND WATER TO INDIVIDUAL PLANTS





SUBSURFACE DESIGN PATTERNS – TURF

NOTE: PATTERNS MUST BE CONSISTENT IN TURF APPLICAIONS

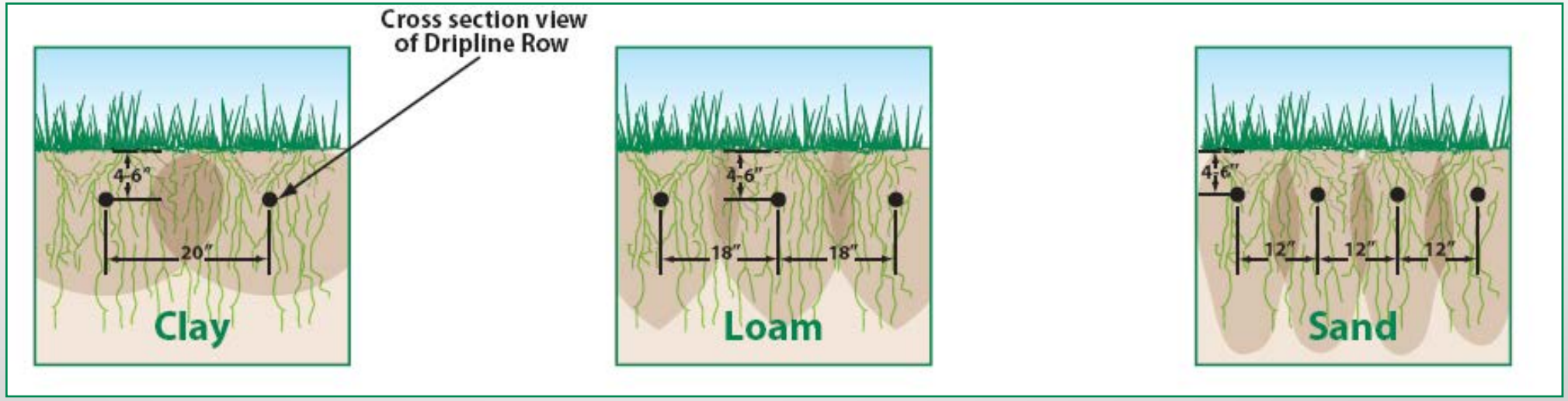


XFD Dripline Maximum Lateral Lengths (Feet)

Inlet Pressure psi	12" Spacing		18" Spacing		24" Spacing	
	Nominal Flow (gph)		Nominal Flow (gph)		Nominal Flow (gph)	
	0.6	**0.9**	**0.6**	**0.9**	**0.6**	**0.9**
15	273	155	314	250	424	322
20	318	169	353	294	508	368
30	360	230	413	350	586	414
40	395	255	465	402	652	474
50	417	285	528	420	720	488
60	460	290	596	455	780	514

ALWAYS CONSIDER AERATION WHEN DESIGNING DRIPLINE INSTALLATIONS FOR TURF

- TO AVOID AERATION DAMAGE TURF DRIPLINE SHOULD BE BURIED A MINIMUM OF 4”



BASIC DESIGN SPECS BY SOIL TEXTURE

Guidelines	Clay	Loam	Sand
Emitter Flow Rate	0.4 GPH	0.6 GPH	0.9GPH
Emitter Spacing	18”	18”	12”
Lateral Tubing Spacing	18”-24”	18”-24”	16”-20”
Maximum Burial Depth	6”	6”	6”
Application Rate – in/hr Basic Soil Intake Rate-in/hr	.29 - .21 0.10	.42 - .35 0.35	1.08 - .87 0.60
Minutes to Apply 0.25 inches of Water	52 - 71	36 - 43	14 - 17

YOU GET THE CALL-YOUR CLIENT HAS HAD ENOUGH OF LOOKING AT THE NEIGHBOR'S UNKEMPT YARD

- THEY WANT TO INSTALL FENCING BUT IT ONLY RISES 6 FEET AND THEY NEED 8 TO BLOCK THE VIEW
- YOU RECOMMEND 5 FOOT EMERALD ARBORVITAE FOR THE JOB – 80 FEET OF THEM SPACED 3 FEET APART PLANTED IN A 42 INCH WIDE BERM OF SANDY LOAM TOPSOIL
- YOU TELL THE CLIENT THE BMP FOR FAST GROWTH WOULD BE TO ADD A SURFACE DRIPLINE ZONE COVERED BY 2 INCHES OF MULCH
- YOU CHOOSE 0.6 GPH EMITTERS AT 12" SPACINGS-A TOTAL LENGTH OF 160 FEET.

KC = SPECIES FACTOR X DENSITY FACTOR X MICROCLIMATE FACTOR

HIGH X HIGH X HIGH =

WATER LOVING SHRUB *DENSE SPACING* *DIRECT SUN*

0.9 X 1.3 X 1.4 = 1.64

Most Important

TABLE 4-2: ESTIMATED SPECIES FACTORS

Plant Type	Low	Average	High
Trees	0.2	0.5	0.9
Shrubs	0.2	0.5	0.7
Ground covers	0.2	0.5	0.7
Mixed trees, shrubs, ground covers	0.2	0.5	0.9

TABLE 4-3: ESTIMATED DENSITY FACTORS

Plant Type	Low	Average	High
Trees	0.5	1.0	1.3
Shrubs	0.5	1.0	1.1
Ground covers	0.5	1.0	1.1
Mixed trees, shrubs, ground cover	0.6	1.1	1.3

TABLE 4-4: ESTIMATED MICROCLIMATE FACTORS

Plant Type	Low	Average	High
Trees	0.5	1.0	1.4
Shrubs	0.5	1.0	1.3
Ground covers	0.5	1.0	1.2
Mixed trees, shrubs, ground cover	0.5	1.0	1.4

You plant in July in Summit NJ – your monthly ***PET*** is 4.46 inches / 31 = 0.144 inches per day.

Your (**Kc**) is 1.64 x 0.144 inches per day = 0.24 inches per day

USE THE CHART TO FIND THE *PR* THAT MATCHES YOUR CHOICE OF EMITTER SPACING, GPH AND ROW SPACING

- OUR ARBORVITAE DRIPLINE ZONE *PR* IS 0.83 INCHES PER HOUR BY CHART

TABLE 5: APPLICATION RATE

Emitter Spacing	Lateral Row Spacing (in Inches)										
	12″	13″	14″	15″	16″	17″	18″	19″	20″	22″	24″
0.4 GPH Emitter Flow (Inches per hour)											
12″	0.67	0.62	0.58	0.54	0.51	0.48	0.45	0.43	0.40	0.37	0.34
18″	0.45	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.27	0.25	0.22
24″	0.34	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.18	0.17
0.6 GPH Emitter Flow (Inches per hour)											
12″	0.96	0.89	0.83	0.77	0.72	0.68	0.64	0.61	0.58	0.53	0.48
18″	0.64	0.59	0.55	0.51	0.48	0.45	0.43	0.41	0.39	0.35	0.32
24″	0.48	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.29	0.26	0.24
0.9 GPH Emitter Flow (Inches per hour)											
12″	1.44	1.33	1.24	1.16	1.08	1.02	0.96	0.91	0.87	0.79	0.72
18″	0.96	0.89	0.83	0.77	0.72	0.68	0.64	0.61	0.58	0.53	0.48
24″	0.72	0.67	0.62	0.58	0.54	0.51	0.48	0.46	0.43	0.39	0.36

FAST FACTORING OF DRIP LINE ***GROSS APPLICATION RATE*** USING GPM AND ROW SPACING YIELDS ABOUT THE SAME RESULT

AR = (0.963 X QT) / ST

- WHERE:

  AR = GROSS APPLICATION RATE IN INCHES/HOUR

  QT = TUBING FLOW RATE IN GPM/100 FEET

  ST = TUBING SPACING IN FEET

- EXAMPLE:

  160 FEET 0.6 GPH EMITTERS EVERY 12 INCHES WITH ROW SPACING 14 INCHES APART

  0.6 GPH DRIP LINE / 60 = .01 GPM X 100 = 1.0 GPM (BY CHART 1.02 GPM)

  0.963 X 1.02 / 1.17 FT. (14” / 12”)

1.54 / 1.17 = 0.84 IN./HR.

SCHEDULING ZONE RUN TIMES AND FREQUENCY

- ✓ THE NEW ARBORVITAE NEED **0.24 INCHES PER DAY** DURING THEIR ESTABLISHMENT PERIOD (*PWR*)
- ✓ THE NEW DRIPLINE ZONE APPLIES WATER AT AN AVERAGE *PR* OF **0.83 INS./HR.**

THE FORMULA FOR DETERMINING RUN TIMES:

$$Run\ Time = \frac{PWR}{PR} \times 60$$

OUR EXAMPLE: **18 MINUTES** ≈ 0.24 / 0.83 X 60

(ALWAYS ROUND UP WHEN IRRIGATING)

MAXIMUM TIME TO RUNOFF

- VARIOUS CHARTS NOTE **SANDY LOAM SOIL INTAKE RATES** FROM **0.4 TO 1.02 INS./HR.** SINCE SANDY LOAM DRAINS RAPIDLY LET'S USE THE AVERAGE OF THE SCALE **0.71 INS./HR.** FOR A MAXIMUM RUN TIME BEFORE RUNOFF OCCURS:

$$\text{Cycle Run Time} = \frac{\text{IR}}{\text{PR}} \text{ x } 60$$

OUR EXAMPLE: **51 MINUTES** = 0.71 / 0.83 X 60

THUS OUR RUN TIME OF **18 MINUTES** IS GOOD

FINAL PROGRAM

- 18 MINUTES OF RUN TIME APPLIES 0.24 INCHES OF WATER (DAILY ***PWR***)
- **DUE TO RAPID SOIL PERCOLATION BREAK THIS INTO TWO 9 MINUTE CYCLES AT LEAST TWO HOURS APART (KEEP TO THE HEAVY SIDE FOR ESTABLISHMENT) EVERY DAY**
- WATER EVERY DAY FROM JULY TO EARLY AUGUST UNTIL PLANTS START ROOTING (4-6 WEEKS)
- REDUCE CROP FACTOR FROM **"TREE"** TO **"SHRUB"** (KC = **1.00**) AND RECALCULATE TO AUGUST ***PET***

  OF 3.80 / 31 = 0.123 INCHES PER DAY:

  NEW RUN TIME = 9 MINUTES DAILY (0.123/0.83 X 60)

  AFTER THAT WATER A TOTAL OF 9 MINUTES **ONCE EVERY DAY** AND READJUST FOR

  SEPTEMBER'S *PET* AND REPEAT STEPS TO DETERMINE SEPTEMBER PROGRAM

NEXT SEASON: ***JULY-DAILY PET*** *OF 0.144 INCHES PER DAY X 7 = 1.00 IN./WK. WATER 4 DAYS/WEEK FOR* ***72 MINUTES TOTAL*** **(1.00/0.83 X 60)** AS FOLLOWS:

72 MINUTES/4 DAYS = 18 MINUTES TOTAL RUN TIME FOUR DAYS PER WEEK

TWO CYCLES 9 MINUTES EACH AT LEAST 2 HOURS APART ON THE FOUR CHOSEN DAYS

TECHLINE CV® Flow per 100 Feet

Emitter Spacing	0.26 GPH Emitter		0.4 GPH Emitter		0.6 GPH Emitter		0.9 GPH Emitter	
	GPH	GPM	GPH	GPM	GPH	GPM	GPH	GPM
12"	26.4	0.44	42.3	0.71	60.8	1.01	92.5	1.54
18"	17.6	0.29	28.2	0.47	40.5	0.68	61.6	1.03
24"	13.2	0.22	21.2	0.35	30.4	0.51	46.2	0.77

ADDITIONAL CHARTS

MAXIMUM PRECIPITATION RATES (inches per hour)

	0% to 5% Slope		5% to 8% Slope		8% to 12% Slope		12% to 20% Slope	
Soil Texture	Covered	Bare	Covered	Bare	Covered	Bare	Covered	Bare
Coarse Sandy Soil	2.00	2.00	2.00	1.50	1.50	1.00	1.00	1.00
Coarse Sandy Soil Over Compact Sub Soil	1.75	1.50	1.25	1.00	1.00	0.75	0.75	0.40
Light Sandy Loam	1.75	1.00	1.25	0.80	1.00	0.60	0.75	0.40
Light Sandy Loam Over Compact Sub Soil	1.25	0.75	1.00	0.50	0.75	0.40	0.50	0.30
Uniform Silt Loam	1.00	0.50	0.80	0.40	0.60	0.30	0.40	0.20
Silt Loam Over Compact Sub Soil	0.60	0.30	0.50	0.25	0.40	0.15	0.30	0.10
Heavy Clay / Clay Loam	0.20	0.15	0.15	0.10	0.12	0.08	0.10	0.06

Note: The above average values are for reference purposes. Data may vary with respect to actual soil and site conditions. Data from USDA.

TECHLINE CV® Maximum Length of a Single Lateral (feet)

Emitter Spacing		12"				18"				24"	
Emitter Flow Rate (GPH)		0.26	0.4	0.6	0.9	0.26	0.4	0.6	0.9	0.6	0.9
Inlet Pressure (psi)	20	331	242	190	144	468	344	270	204	342	260
	25	413	302	238	180	584	429	338	257	430	326
	30	471	345	272	206	668	491	387	293	492	374
	35	518	380	299	227	737	540	426	323	542	412
	40	559	410	223	244	794	584	459	348	584	444
	45	594	436	343	260	845	620	489	371	622	472
	50	626	459	361	274	890	654	515	390	656	498
	55	655	480	378	287	932	684	539	410	686	522
	60	681	500	393	298	969	713	561	426	716	544