Football Field Layouts

One Pass Irrigation

Model	B140	T180	T200S
Required Supply Pressure	106 PSI	87 PSI	80 PSI
Required Supply Pressure (With 5Hp Booster Pump)	56 PSI	37 PSI	30 PSI
Required Supply Pressure (With 9Hp Booster Pump)	33 PSI	14 PSI	7 PSI
Flow	53 GPM	53 GPM	53 GPM

The B140, T180 or T200S can irrigate a football field in a single pass with 53 GPM and a minimum pressure of 80 to 106 PSI. The T200S requires less pressure due to shorter hose and larger diameter.

All performance data based on Nelson SR75 with a .50" nozzle.
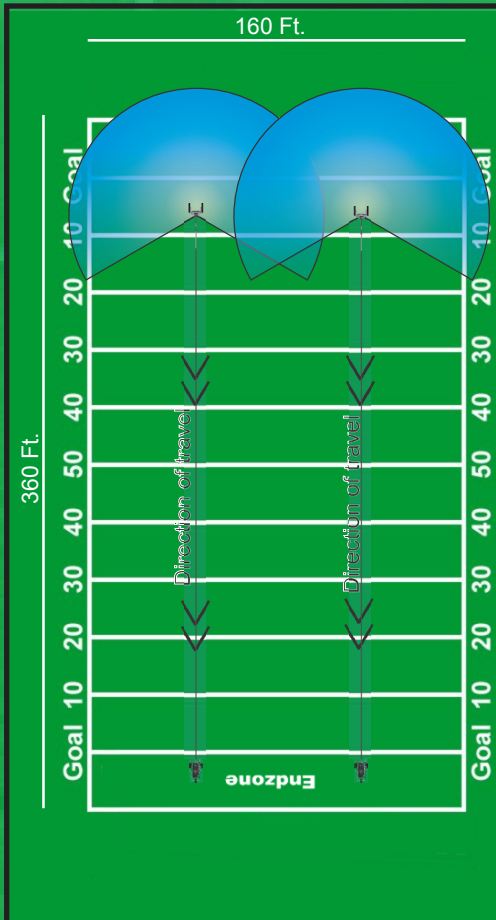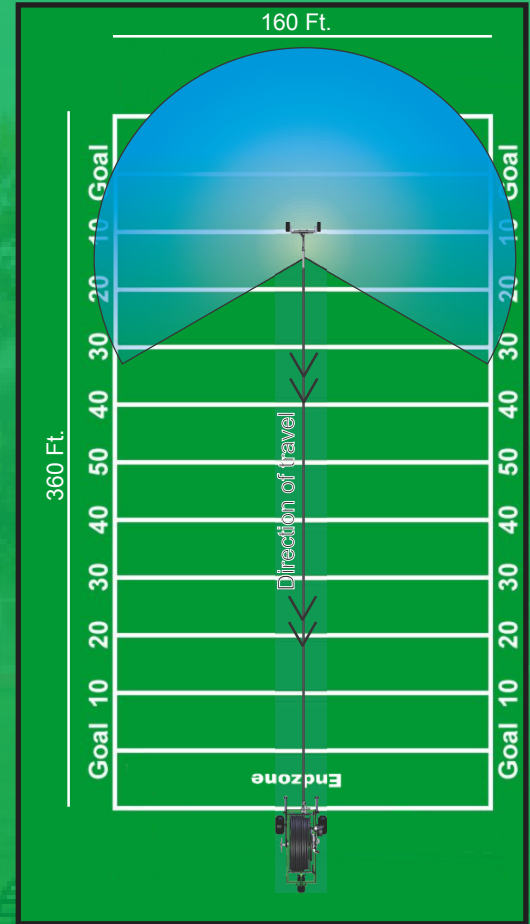
Two Pass Irrigation

Model	B110	B140
Required Supply Pressure	55 PSI	50 PSI
Flow	14 GPM	14 GPM

The B110 and B140 can irrigate a football field in two passes.

All performance data based on Sime K1 with 8mm nozzle.

All data contained herein are representative samples. Graphics may not be to scale as field dimensions and sprinkler performance vary. Please refer to model specific spec sheets for more detailed data.

Baseball Field Layouts

One Pass Irrigation
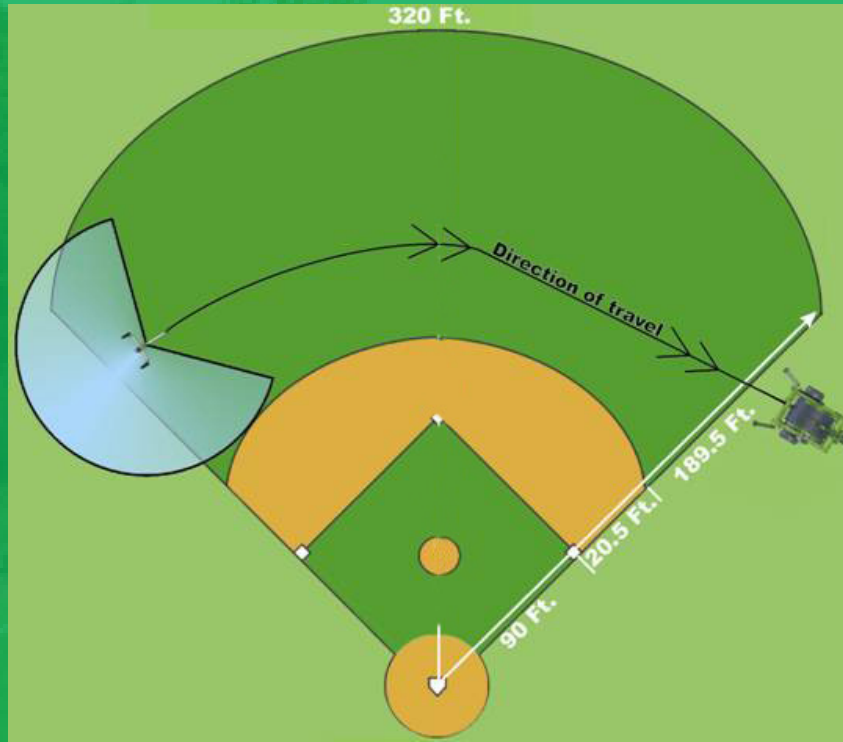
Kifco Water-Reels will follow the curve of a baseball field if pulled out along an arc. Note: The Water-Reel must be pulled out along an arc after a straight pull out of a minimum of 20% of the total tube length.

Model	B140	T180	T200S
Required Supply Pressure	90 PSI	81 PSI	77 PSI
Required Supply Pressure (With 5Hp Booster Pump)	40 PSI	31 PSI	27 PSI
Flow	42 GPM	42 GPM	42 GPM

The B140, T180 and T200S can all irrigate a baseball field in 1 pass with 35-40 GPM and a minimum pressure of 55 to 90 PSI. The T200S optimizes pressure and flow for the fastest application of water.

*All performance data based on SR75 w/ a .45" nozzle*

All data contained herein are representative samples. Graphics may not be to scale as field dimensions and sprinkler performance vary. Please refer to model specific spec sheets for more detailed data.

KIFCO

**700 S. Schrader Ave.
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(800) 452-7017
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Soccer Field Layouts

One Pass Irrigation

Model	T200S
Minimum Inlet Pressure	104 PSI
Minimum Inlet Pressure (With 5 or 9Hp Booster Pump)	56 or 29 PSI
Flow	61 GPM

The T200S can all irrigate a soccer field in a single pass with 61 GPM and a minimum pressure of 29 to 104 PSI. The T200S requires less pressure due to shorter hose and larger diameter.
All performance data based on Nelson SR75 w/ a .50" nozzle.
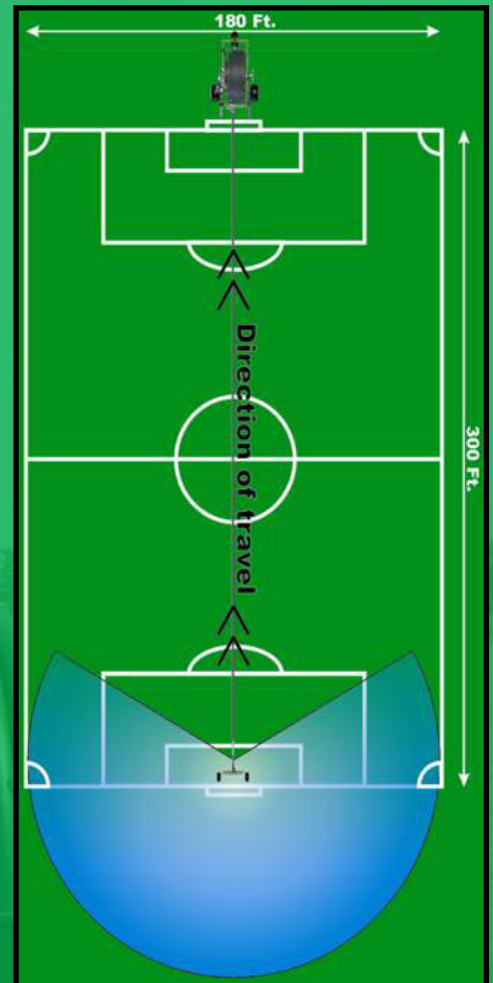
Two Pass Irrigation
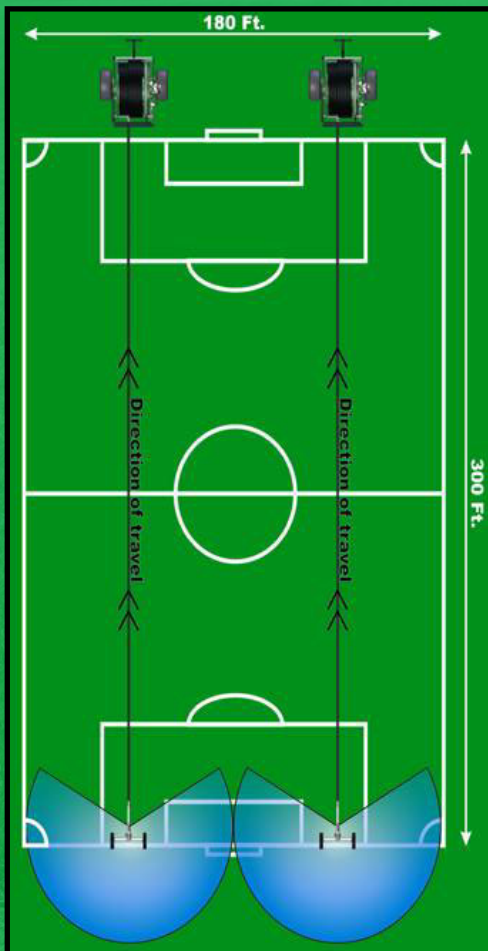
Model	B140	T180	T200S
Minimum Inlet Pressure	53 PSI	55 PSI	53 PSI
Flow	27 GPM	27 GPM	27 GPM

The B140, T180 and T200S can all irrigate a soccer field in 2 passes with less than 30 GPM and a minimum pressure of 55 PSI. The T200S requires less pressure due to shorter hose and larger diameter
All performance data based on SR75 w/ a .40" nozzle.

![KIFCO logo]

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Polo Field Layouts

Polo Field Dimensions: 900 ft. x 480 ft.

Model	T30/980	T37/1220
Minimum Inlet Pressure	71 PSI	106 PSI
Flow	100 GPM	260 GPM
Irrigated Width (70% of Wetted)	172 Ft.	238 Ft.
Passes Necessary	3	2
Nelson SR 150 Nozzle*	.86"	1.18"

480 Ft.

900 Ft.

Direction of travel

T30/980

480 Ft.

900 Ft.

Direction of travel

T37x1220

All data contained herein are representative samples. Graphics may not be to scale as field dimensions and sprinkler performance vary. Please refer to model specific spec sheets for more detailed data.

# Most Trusted Traveling Irrigation Systems Since 1964

Synthetic Turf Field Layouts

One Pass Irrigation

Model	E200SST
Minimum Inlet Pressure	98 PSI
Minimum Inlet Pressure (With 5 or 9Hp Booster Pump)	70 or 40 PSI
Flow	106 GPM

Note: The E200SST is specifically designed for application of water to cool and condition all types of synthetic turf. The machine will apply .1" to .2" of water to the playing surface in less than 30 minutes. The machine is equipped with a dual gun, gun cart for speed of water application.

All performance data based on Nelson SR75 with a .50" nozzle.
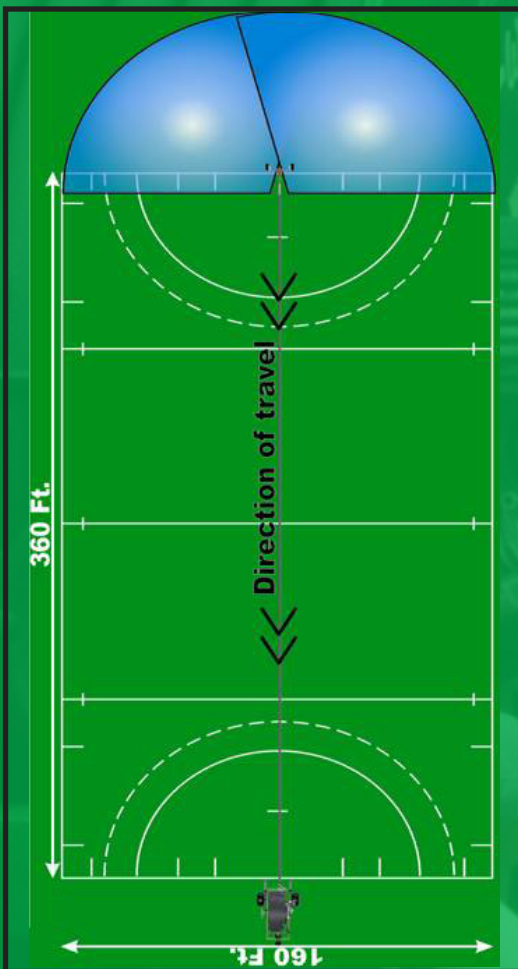
Hockey Field
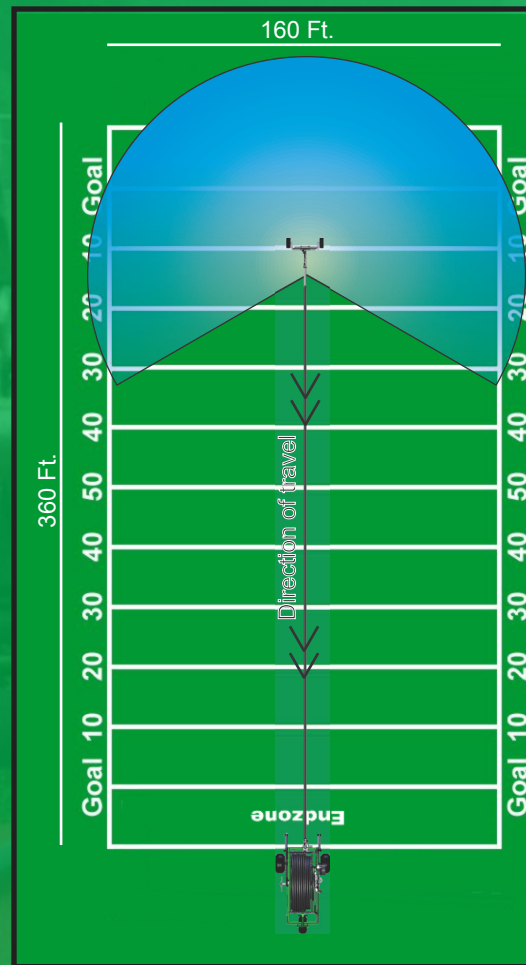
160 Ft.

360 Ft.

Direction of travel

Football Field

160 Ft.

360 Ft.

Direction of travel

Goal 10 20 30 40 50 40 30 20 10 Goal

Endzone

All data contained herein are representative samples. Graphics may not be to scale as field dimensions and sprinkler performance vary. Please refer to model specific spec sheets for more detailed data.

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®
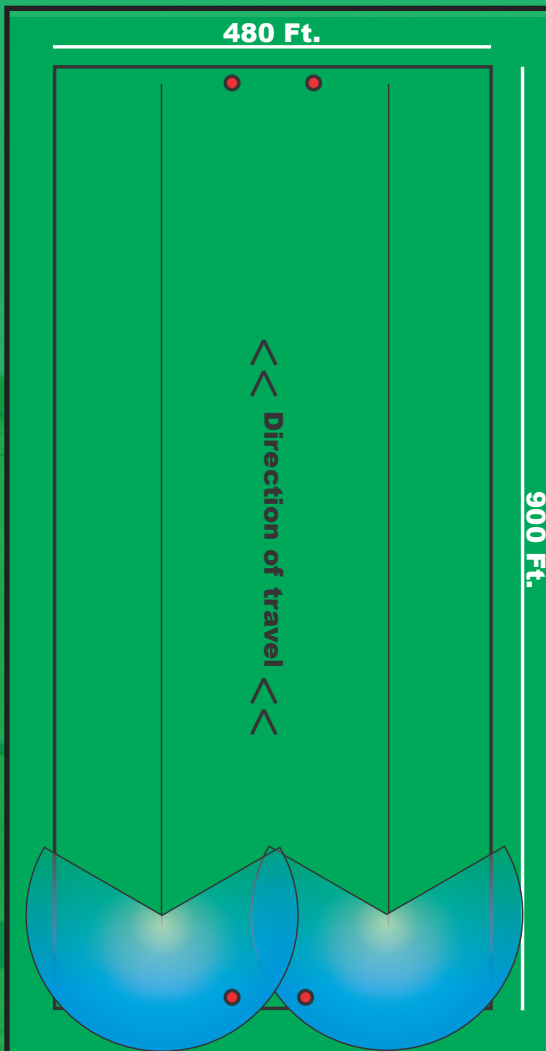
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WATER-REEL
KIFCO

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Cricket Field Layouts

Featured Models for Cricket Field Irrigation

Model	E110	B140	T200L	T23x600
Required Minimum PSI	23	81	60	74
Minimum Flow (GPM)	3	18	28	74

Kifco has a wide range of models to choose from and application designs for your cricket field irrigation. Below are several sample application designs as examples. For a detailed layout of your sports field complex, contact Kifco or your local Authorized Kifco Dealer.

Pitch coverage with an E110 Water-Reel

Connection Points
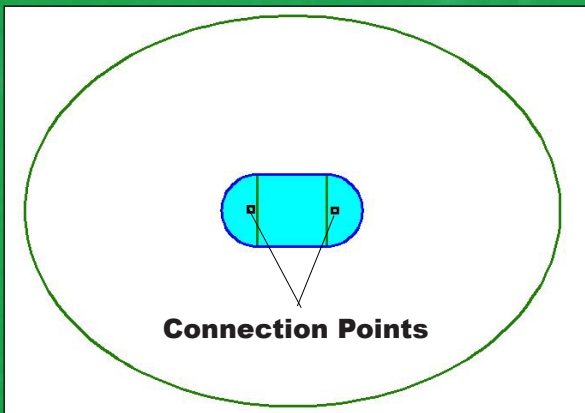
Complete Coverage with B140 Leaving Pitch Area Dry for More Frequent Light Coverage

Connection Point

Connection Point

Connection Point

Connection Point
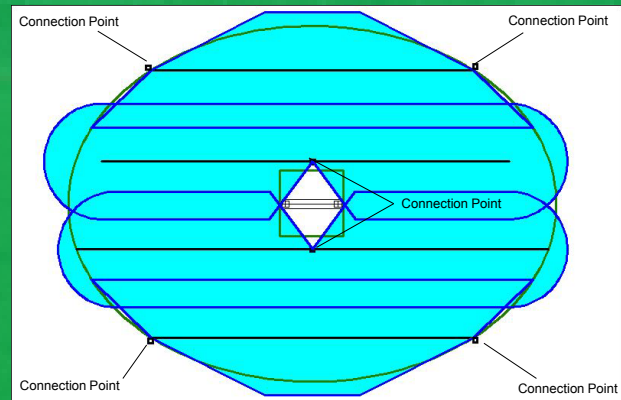
Connection Point

The T23x660 w/ computer control option for delayed start is an excellent system to easily manage and irrigate up to 5 fields in the general area.

Pass 1 w delayed start

Pass 2 w delayed start
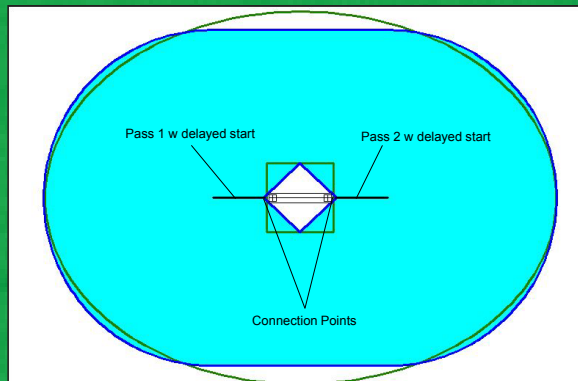
Connection Points

The T200L can cover the entire outfield and infield with fewest moves & connection points. Central pass shown.
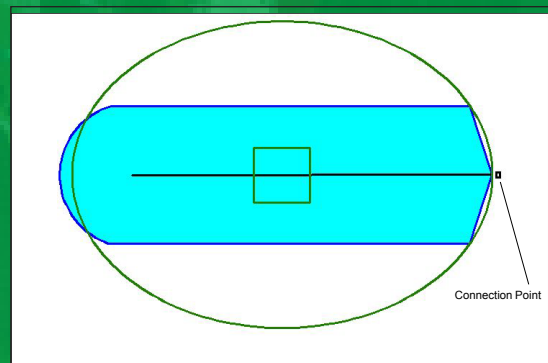
Connection Point

All data contained herein are representative samples. Graphics may not be to scale as field dimensions and sprinkler performance vary. Please refer to model specific spec sheets for more detailed data.

Common Water Reel Applications with Suggested Models

Please refer to model specific spec sheets for further information.

Sports Fields (Natural Grass)	No In-Field Obstructions	**B110/E110** **B140/E140** **T180** **T200S**
Sports Fields (Synthetic Turf)	Quickly Cools Playing Surfaces	**E180 ST** **E200SST** **E200LST** **E210LST**
Indoor & Outdoor Horse Arenas	Improves Footing	**E110** **B110** **E180 ST** **E200SST** **E200LST** **E210LST**
Pastures & Paddocks	Quickens Re-Growth	**B-Series Water-Reels** *(perfect for smaller areas)* **Ag-Rain Water-Reels** *(for more acreage)*

Common Water Reel Applications with Suggested Models

Please refer to model specific spec sheets for further information.

Increases Property Values

Ranches & Hobby Farms

B-Series Water-Reels
Ag-Rain Water-Reels

Lowers Labor Costs

Polo Fields

T30x980
T37x1220
T40x1250

High Quality

Vegetables & Produce

B-Series Water-Reels
(perfect for smaller areas)
Ag-Rain Water-Reels
(for more acreage)

Increased Production

Agricultural Irrigation

Ag-Rain Water-Reels

Common Water Reel Applications with Suggested Models

Please refer to model specific spec sheets for further information.

Slurry & Waste Disposal

Passes Large Solids

Engine Drive
Ag-Rain Water-Reels

Food Plots

Attracts Game

B110

E110

B140

E140

T200S

T200L

T200LSC

**Dust Suppression
(Construction, Mining,
Feed Lots, etc.)**

Healthier Environment

B110   E180 ST
               E200SST
E110   E200LST
               E210LST
E140

T180
T200S

T200L

T210

**Composting or
Waste Water Reuse**

Increased Production

Engine Drive B-Series and
Ag-Rain Water-Reels

Common Water Reel Applications with Suggested Models

Please refer to model specific spec sheets for further information.

Golf Courses, Parks & Recreation

Excellent For Hard To Reach Areas

B110/E110

B140/E140

T200S

T200L

T200LSC

Residential Landscape, Gardens & Nurseries

Beautifies Overall Landscape

B110

E110

B140

E140

T180

T200S

T200L

E200SST

Hydroseeding, Reclamation and Establishment

Quickly Establishes New Landscaping

B-Series and
Ag-Rain Water-Reels

Cemeteries

Increases The Value Of Burial Plots

B110/E110

B140/E140

T180

T200S

Introducing
REEL-DESIGN
KIFCO®

A first of its kind tool to aid in the design and quotation of Kifco® Water-Reels®.

Selling Water-Reels®
Has Never Been Easier!

With Kifco Reel Design, you will be able to create designs of your customer's actual property, prepare quotations and bill of materials all in one report and without ever leaving your computer!

Designs

Reel Design utilizes state of the art Satellite Imagery which allows you and your customer to select the actual field or area of land to be irrigated. Handing over a complete design of your customer's actual property is sure to impress!

Bill of Materials

As items are selected during your design, they are automatically compiled into a Bill of Materials. From the pipe in the ground to the nozzle on the end of your sprinkler, you will easily be able to show your customer exactly what's needed for the job.

Quotations

With up to date pricing included, professional quotations are simply added to the final report. Your logo is included to give your reports that personal touch.

Manage with Less Guess Work

With allowances for pipe type & diameter, friction loss and even head gain or loss due to elevation changes, Reel Design can precisely select the right equipment needed for any project!

Leading the Way

At Kifco we recognize that the ability to effectively stand apart from the rest is highly dependent on keeping our dealers supplied with marketing and training materials to aid in the sale. Kifco Reel-Design is just one more tool that will allow us to continue to lead the competition in traveling irrigation sales & service.

Get Started Today

Simply watch the training video by copying & pasting the following link in your web browser:

https://youtu.be/JEdOtDaDf3k

WATER-REEL®
KIFCO®

Most Trusted Traveling Irrigation Systems
Since 1964

Ag Layouts

Lost Corners

Supply:
26 gpm @ 105 psi

220' of 2" CL 160

2.2 Ac (21.5%)

B110 or E110

Example with 26 gpm and 100 psi

Per Day 1 Corner	Per Day 4 Corners	Per Week 1 Corner	Per Week 4 Corners
.58"	4.1"	.14"	1.0"

660 ft

Ag Layouts

Lost Corners

Supply:
60 gpm @ 105 psi

345' of 3" CL 160

4.84 Ac (21.5%)
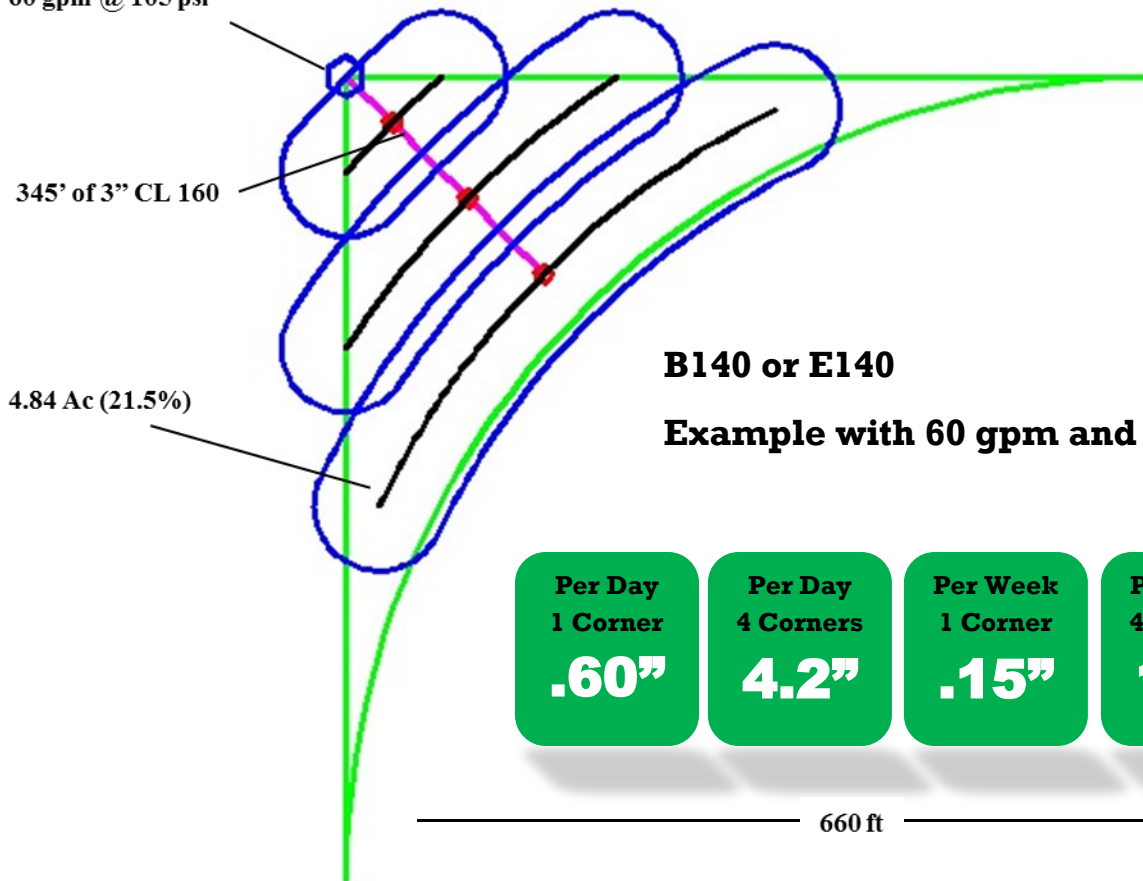
B140 or E140

Example with 60 gpm and 100 psi

Per Day 1 Corner	Per Day 4 Corners	Per Week 1 Corner	Per Week 4 Corners
.60"	4.2"	.15"	1.0"

660 ft

990 ft

Ag Layouts

Lost Corners

Supply:
85 gpm @ 105 psi

480' of 4" CL 160

8.6 Ac (21.5%)
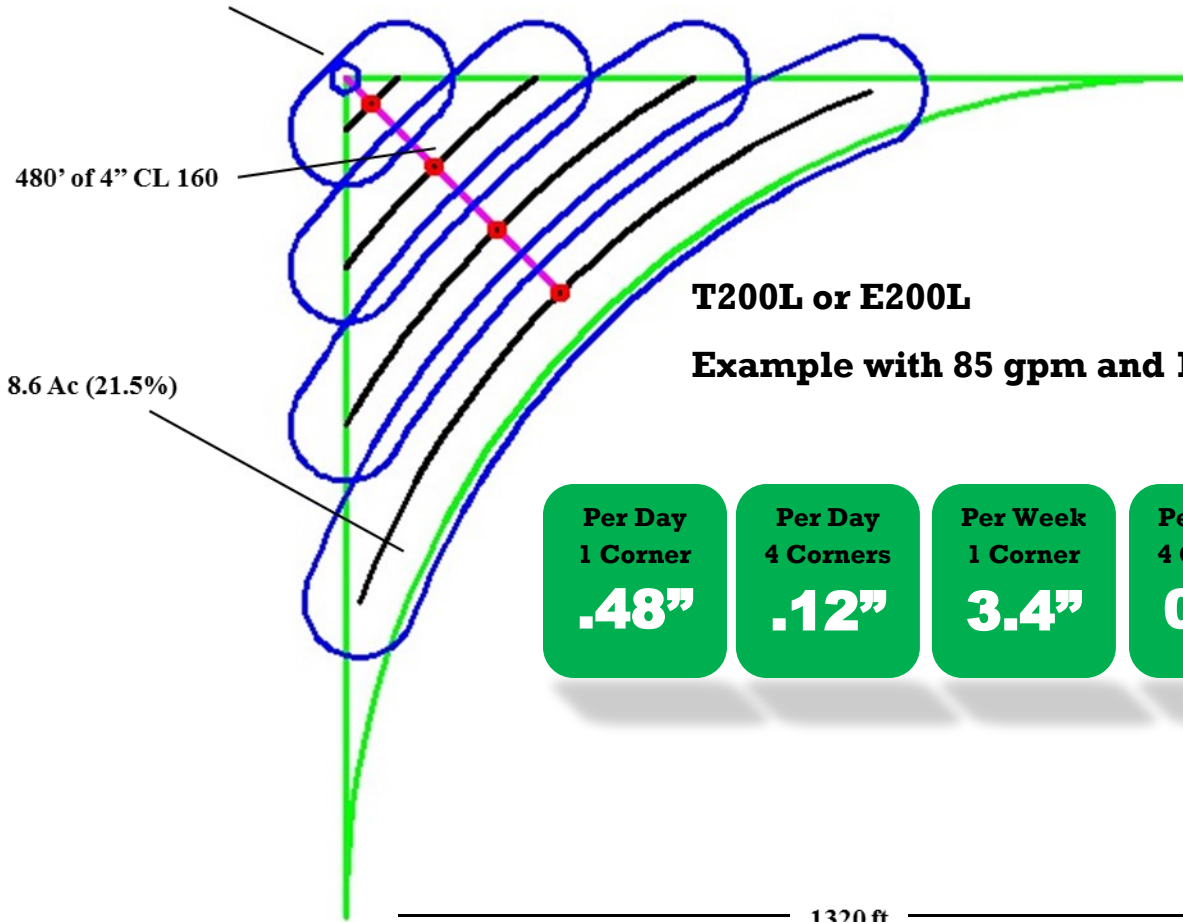
T200L or E200L

Example with 85 gpm and 100 psi

Per Day 1 Corner	Per Day 4 Corners	Per Week 1 Corner	Per Week 4 Corners
.48"	.12"	3.4"	0.8"

1320 ft

Ag Layouts

Lost Corners

Supply:
245 gpm @ 105 psi

480' of 6" CL 160

8.6 Ac (21.5%)

T30x660 or E330 660

Example with 245 gpm and 100 psi

Per Day 1 Corner	Per Day 4 Corners	Per Week 1 Corner	Per Week 4 Corners
1.0"	**.24"**	**6.9"**	**1.7"**

1320 ft

Ag Layouts

Lost Corners

Supply:
380 gpm @ 105 psi

1130' of 8" CL 160

19.4 Ac (21.5%)

T40x1250 or E40x1250

Example with 385 gpm and 100 psi

Per Day 1 Corner	Per Day 4 Corners	Per Week 1 Corner	Per Week 4 Corners
.96"	.24"	6.8"	1.7"

1980 ft

Ag Layouts

Lost Corners

Supply:
495 gpm @ 105 psi

960' of 8" CL 160

34.4 Ac (21.5%)

T45x1150 or T45x1150

Example with 495 gpm and 100 psi

Per Day 1 Corner	Per Day 4 Corners	Per Week 1 Corner	Per Week 4 Corners
.79"	.17"	4.9"	1.2"

2640 ft
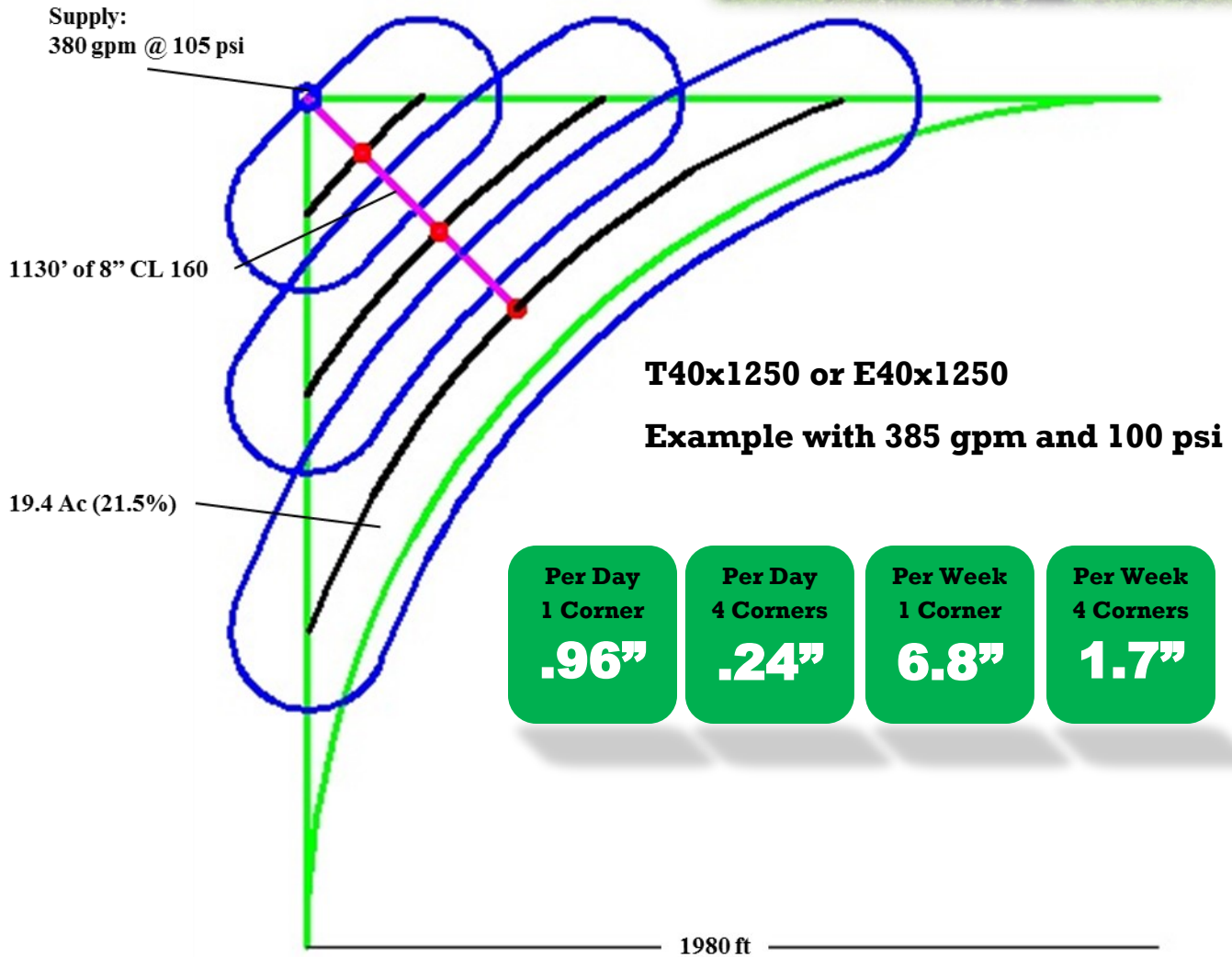
Ag Layouts

14.1 Ac, .35"/day
Water-Reel 2014 MSRP : $772/Ac
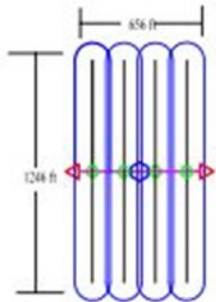
118.8 Ac, .27"/day
Water-Reel 2014 MSRP : $579/Ac
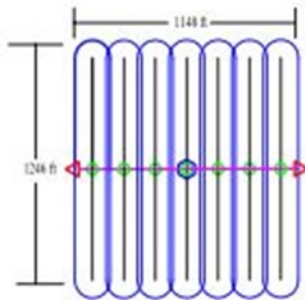
32.8 Ac, .15"/day
Water-Reel 2014 MSRP : $331/Ac

T200L
Pump
KSTB2x4
KFSH2x4
PIPE PVC IPS G CL160 4"

T200L
100gpm @ 104psi inlet
Dw = 184', W = 164', Li = 623', 2.34 ac/pass

Ag Layouts

15.4 Ac, .39"/day
Water-Reel 2014 MSRP : $702/Ac

19.3 Ac, .31"/day
Water-Reel 2014 MSRP : $562/Ac

38.7 Ac, .15"/day
Water-Reel 2014 MSRP : $281/Ac

T210x400
Pump
KS7B2x4
KFSH2x4
PIPE PVC IPS G CL160 4"

T210x400

122gpm @ 100psi inlet

Dw = 210', Di = 189', Li = 446', 1.93 ac/pass
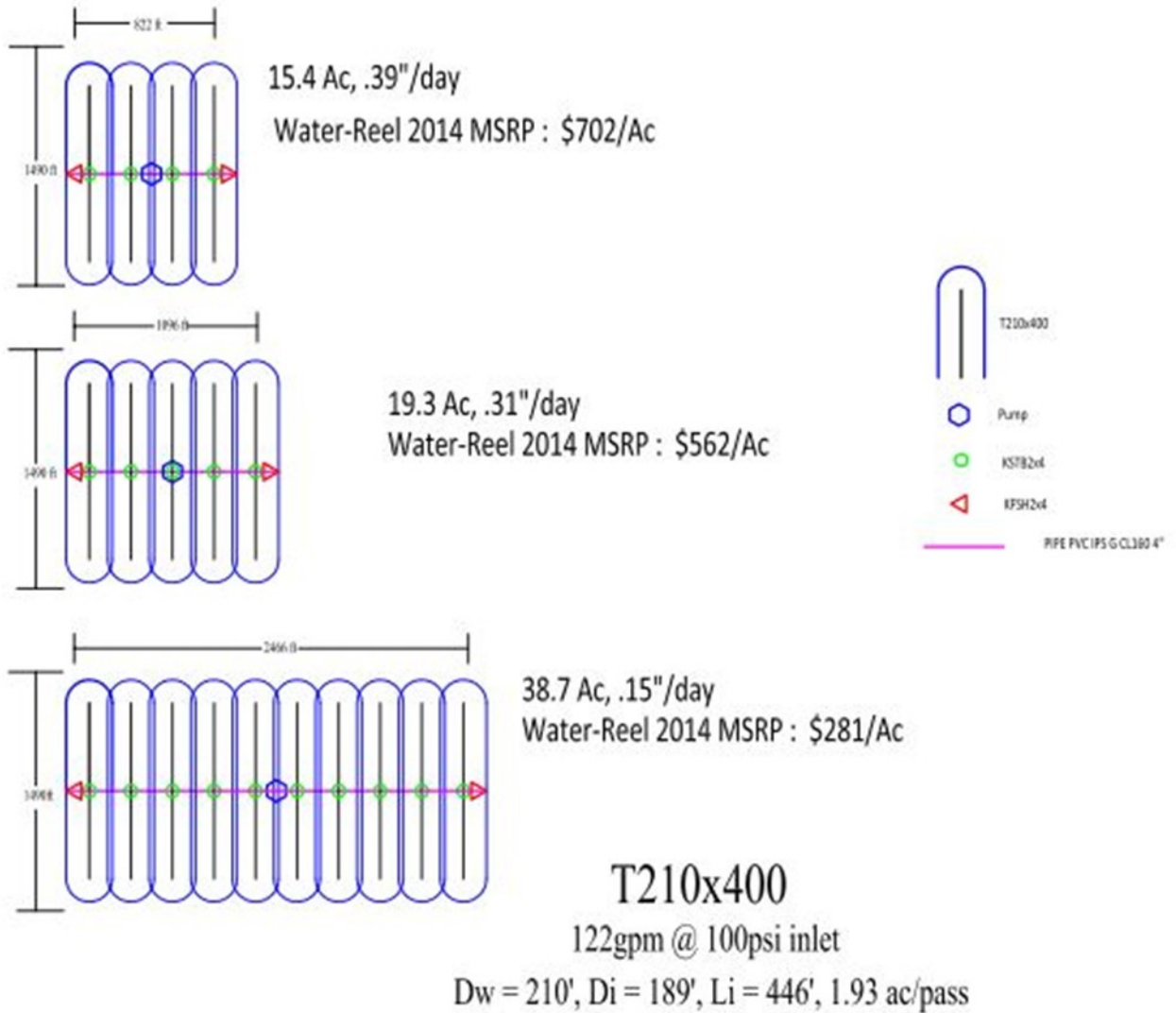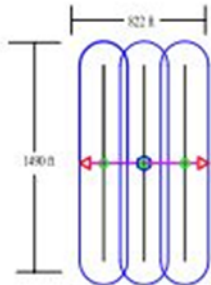
Ag Layouts

28.1 Ac, .45"/day
Water-Reel 2014 MSRP : $720/Ac
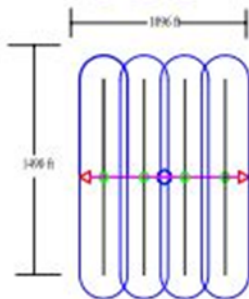
37.4 Ac, .33"/day
Water-Reel 2014 MSRP : $540/Ac
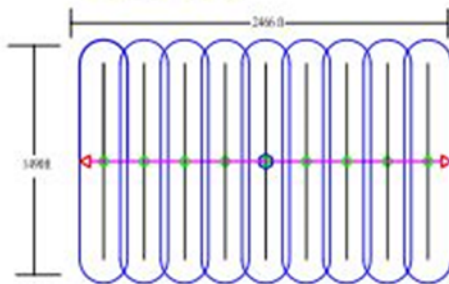
84.2 Ac, .15"/day
Water-Reel 2014 MSRP : $240/Ac

T30x660

- Pump
- KSTB4x6
- KFSH4x6
- PIPE PVC IPS G CL160 6"
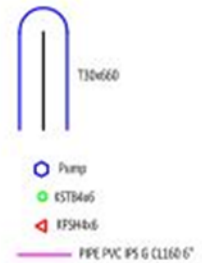
T30x660 systems

257gpm @ 104psi inlet

Dw = 322', Di = 274', Li = 744', 4.68 ac/pass

Ag Layouts
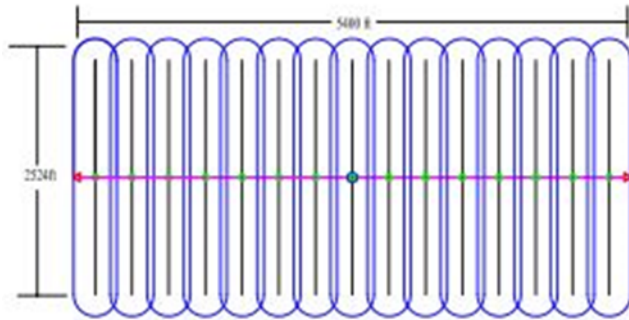
184.2 Ac, .15"/day

Water-Reel 2014 MSRP : $250/Ac
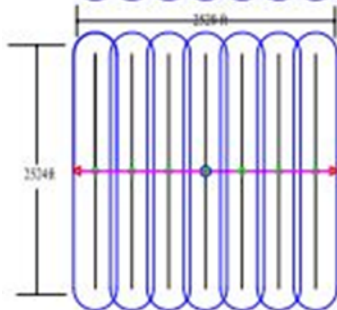
85.9 Ac, .31"/day

Water-Reel 2014 MSRP : $535/Ac
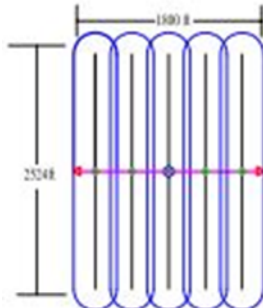
61.4 Ac, .43"/day

Water-Reel 2014 MSRP : $745/Ac

T45x1150

○ Pump
● KSTB6x8
◀ XFSH4x8
―― PIPE PVC IPS G CL160 8"
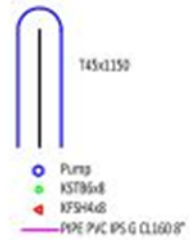
T45x1150 systems

542gpm @ 104psi inlet

Dw = 424', Di = 360', Li = 1262', 6.14ac/pass

Ag Layouts

T200L or E200L
82 gpm w 100 psi @ the inlet.
Gives .32"/day (2.25"/wk)
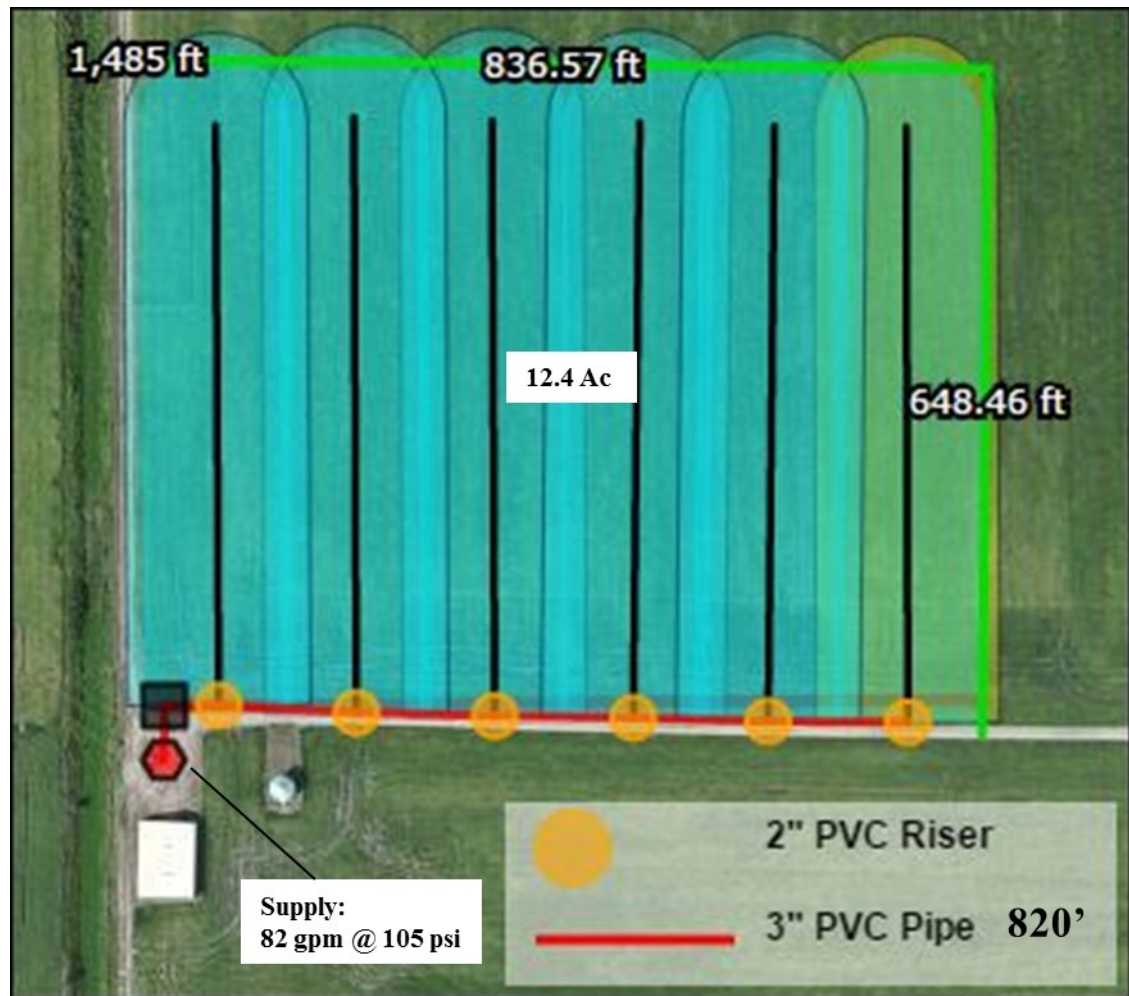
Ag Layouts

T200L 82 gpm w 100 psi @ the inlet.
Gives .22"/day (1.5"/wk)
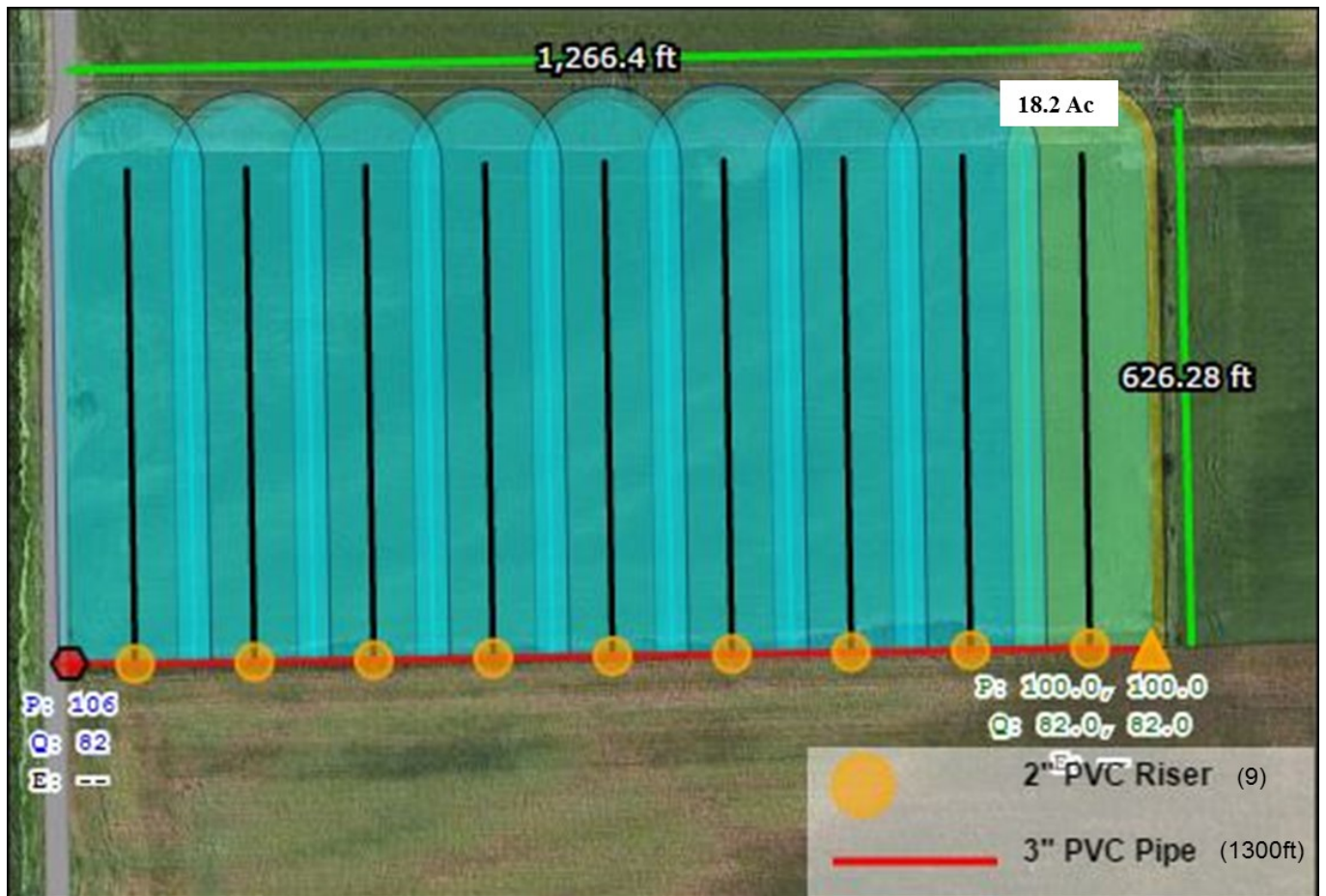
Ag Layouts

23 Ac, .25'/day, 1.75"/wk

🟩	KIFCO T210 (1)
⬡ Pump 122gpm @ 110psi (1)	
X	4" KISO (2)

<	4"x2" KRed (2)
◀	2" KFSH (2)
☐	4" KT (1)

🟠	2" PVC Riser (13)
—	4" PVC Pipe 2060'
—	2" PVC Pipe 180'

459.15 ft

2,184.9 ft
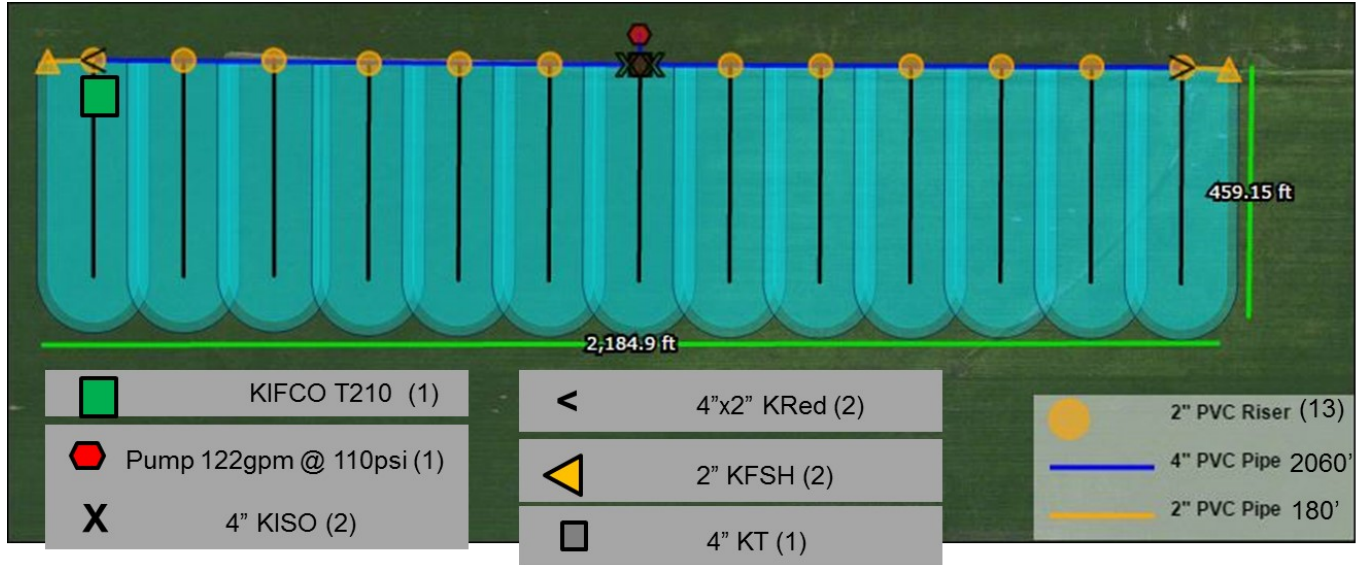
Ag Layouts

17.7 Ac, .32'/day, 2.24"/wk

839.58 ft	
919.74'	

Legend:
- **KIFCO T210** (1)
- **Pump 122gpm @ 110psi** (1)
- **2" KFSH** (1)
- **4"x2" KRed**
- **2" PVC Riser** (5)
- **4" PVC Pipe** 760'
- **2" PVC Pipe** 85'
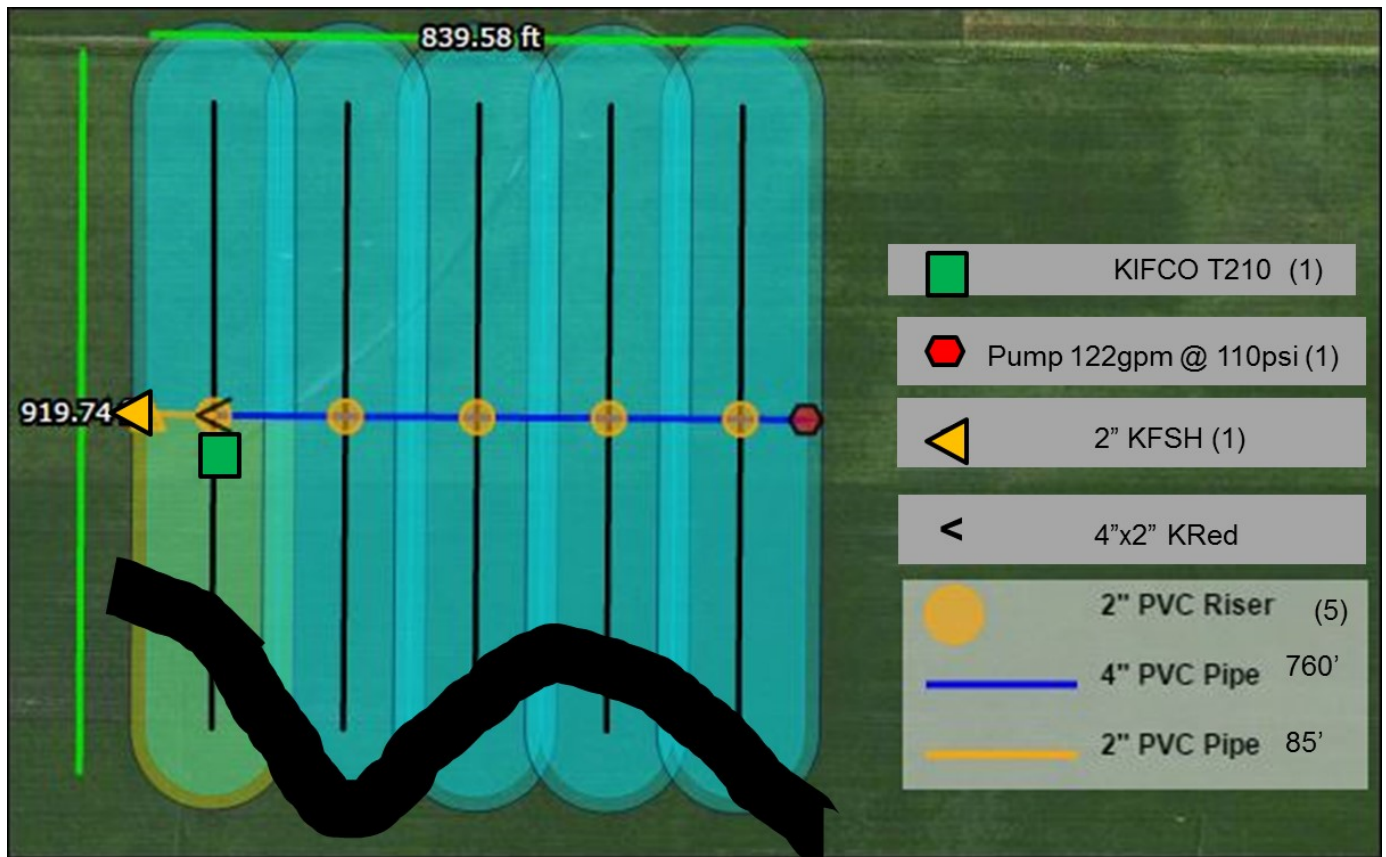
Ag Layouts

Cost-Effective Operation

8 – 10 hr run

.75" – 1.5" per run

Irrigation Lane

Irrigated Length

Main water Line

To water Source

Irrigated Width
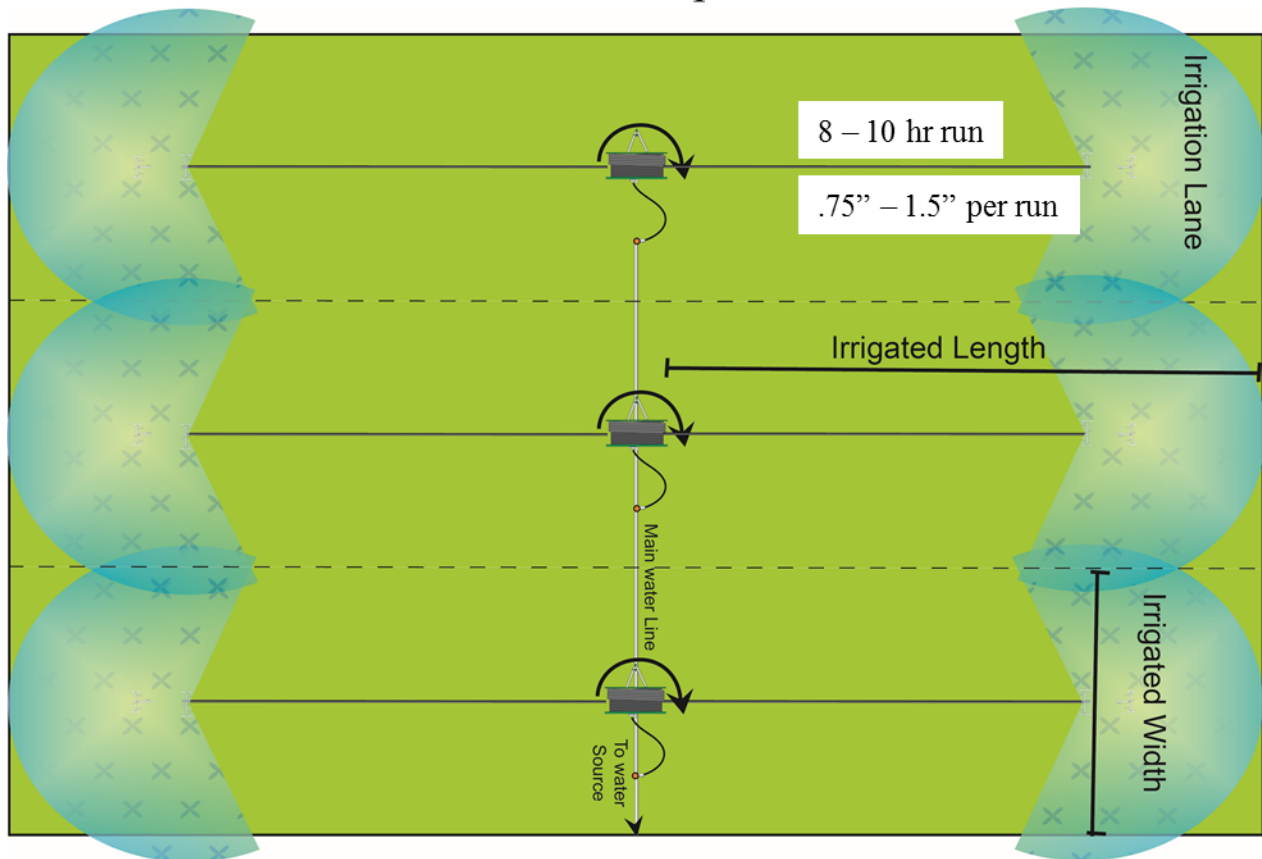
20 – 23 hrs /day operation w two 30 minute visits per day

Details in Installation - For Water-Reel Models B110 & E110

KSTB1.5Q Details

Isolation valve and French drain
recommended for use in freezing temperatures.
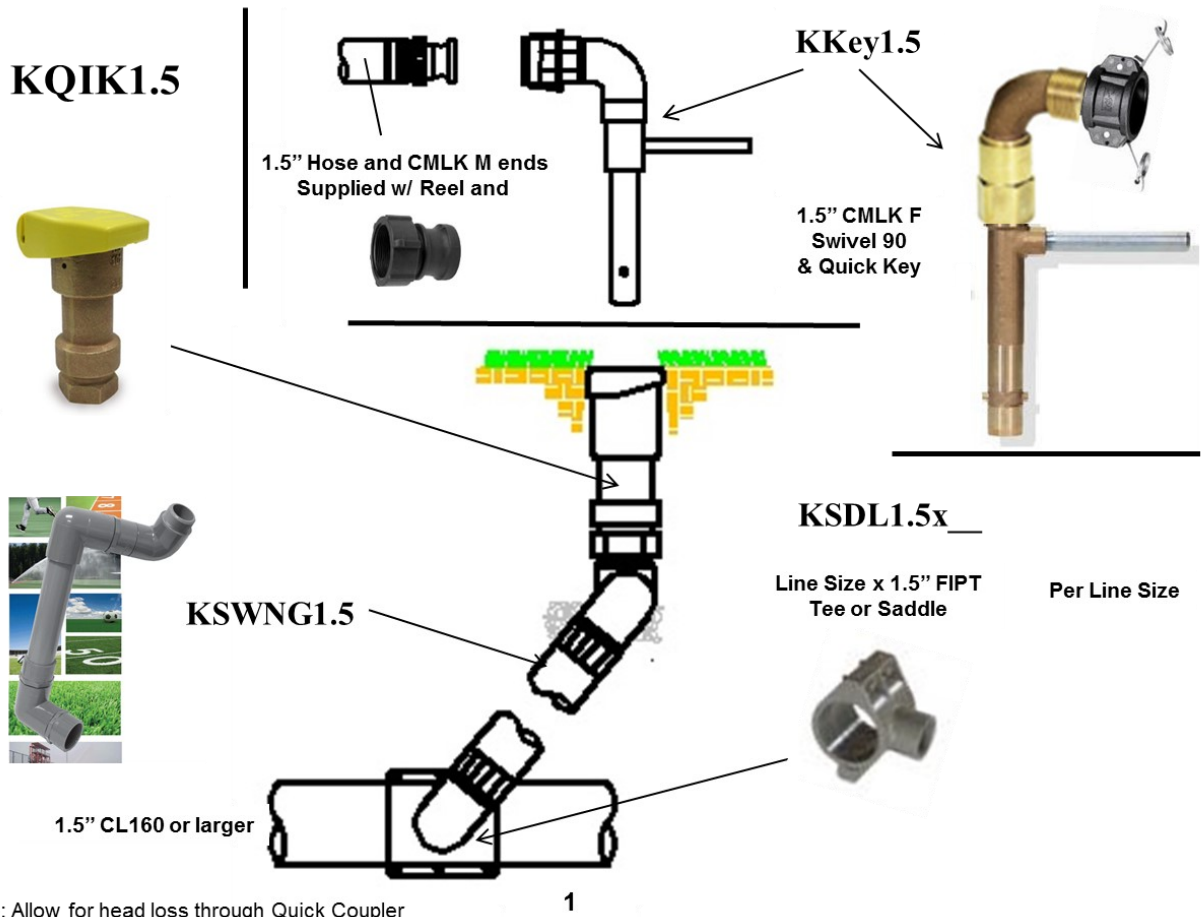
KQIK1.5

KKey1.5

1.5" Hose and CMLK M ends
Supplied w/ Reel and

1.5" CMLK F
Swivel 90
& Quick Key

KSDL1.5x__

Line Size x 1.5" FIPT
Tee or Saddle

Per Line Size

KSWNG1.5

1.5" CL160 or larger

KSTB1.5Q

Note: Allow for head loss through Quick Coupler

1

Details in Installation - For Water-Reel Models B110, E110, B140 & E140

KSTB1.5 Details

Isolation valve and French drain
recommended for use in freezing temperatures.

KSTB1.5x___ Assembly

Per Line Size

1.5" Hose and CMLK M ends
Supplied w/ Reel and

KBOX1.5

**For Below Grade
Installation**

1.5" CL160

1.5" MA

90 Degree EL comes
with KSTB Assembly

1.5" CL160 or larger

KSWNG1.5

Line Size x 1.5" FIPT
Tee or Saddle

To reduce the possibility of
mainline damage
Rotate Tee (or Saddle) and
use KSWNG2

KSTB1.5

2

Details in Installation - For Water-Reel Models B110, E110, B140 & E140

KSTB1.5 Details

Isolation valve and French drain
recommended for use in freezing temperatures.

KSTB1.5x Assembly

Per Line Size

1.5" Hose and CMLK M ends
Supplied w/ Reel and

KBOX1.5

**For Below Grade
Installation**

1.5" CL160

1.5"

**90 Degree EL comes
with KSTB Assembly**

1.5" MA

1.5" CL160 or larger

KSWNG1.5

**Line Size x 1.5" FIPT
Tee or Saddle**

**To reduce the possibility of
mainline damage
Rotate Tee (or Saddle) and
use KSWNG2**
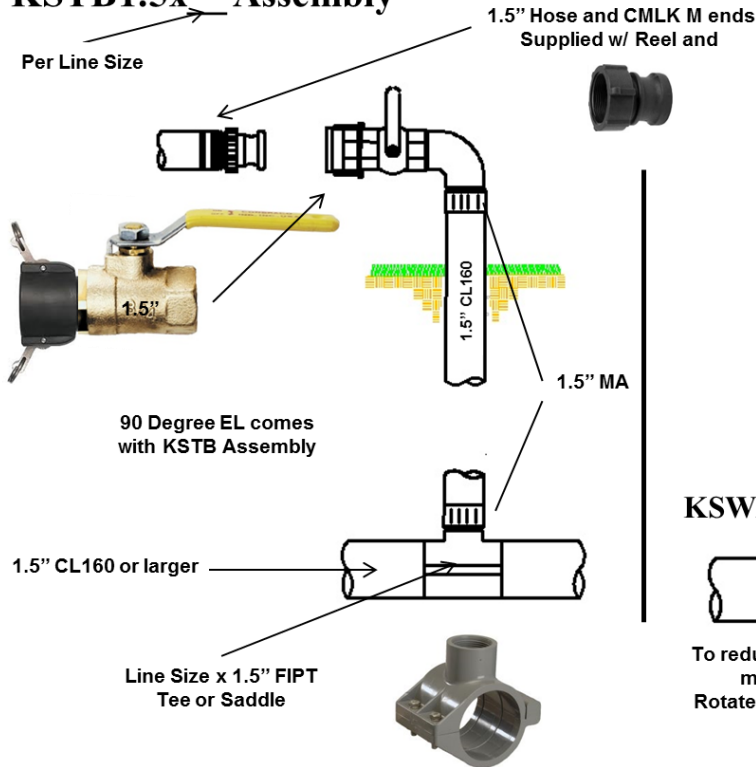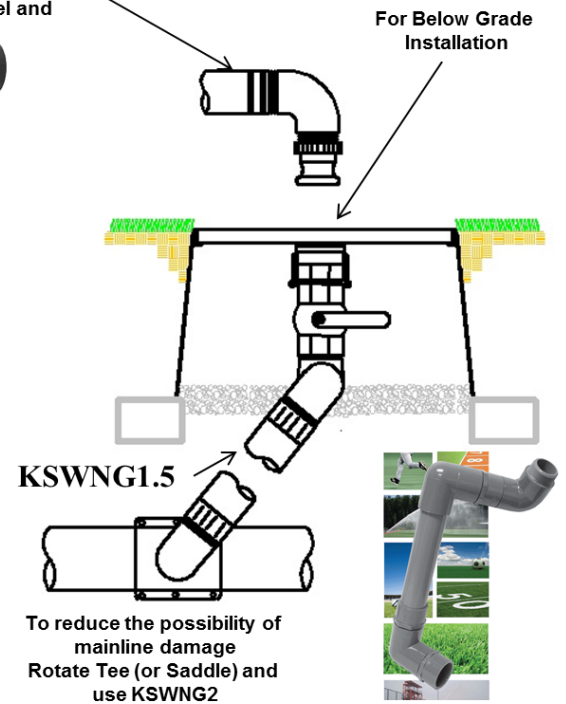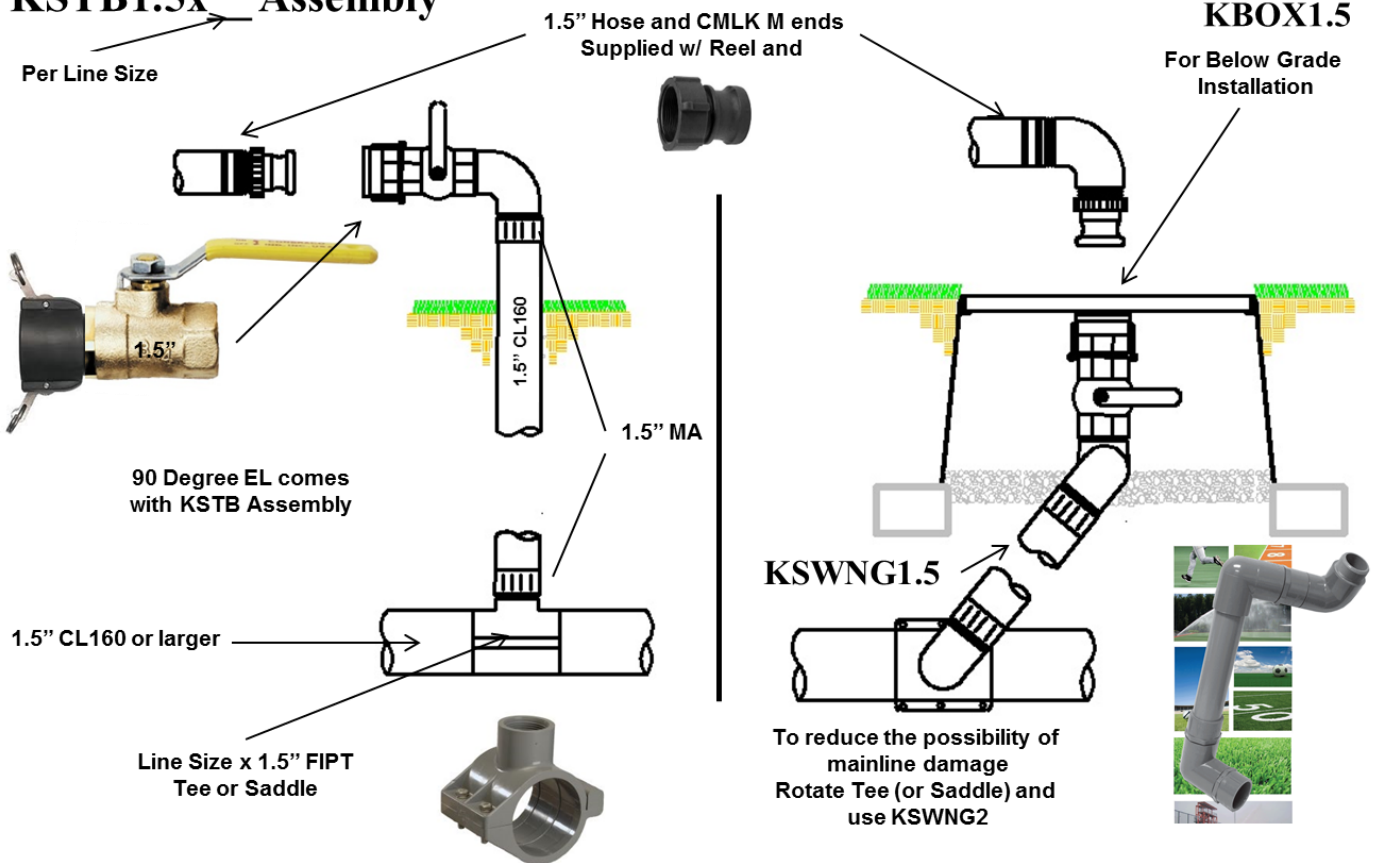
KSTB1.5

Details in Installation - For Water-Reel Models T180, T200S, T200L & T210

KSTB2 Details

Isolation valve and french drain
recommended for use in freezing temperatures.

KSTB2x__ Assembly

2" x 15' Hose and CMLK M ends
Supplied w/ Reel. Additional length as needed

KBOX2

Per Line Size
3" or greater.

For Below Grade
Installation

2" CL160

2" MA

90 Degree EL comes
with KSTB Assembly

2" CL160 or larger

KSWNG2

Line Size x 2" FIPT
Tee or Saddle

To reduce the possibility of
mainline damage
Rotate Tee (or Saddle) and
use KSWNG2
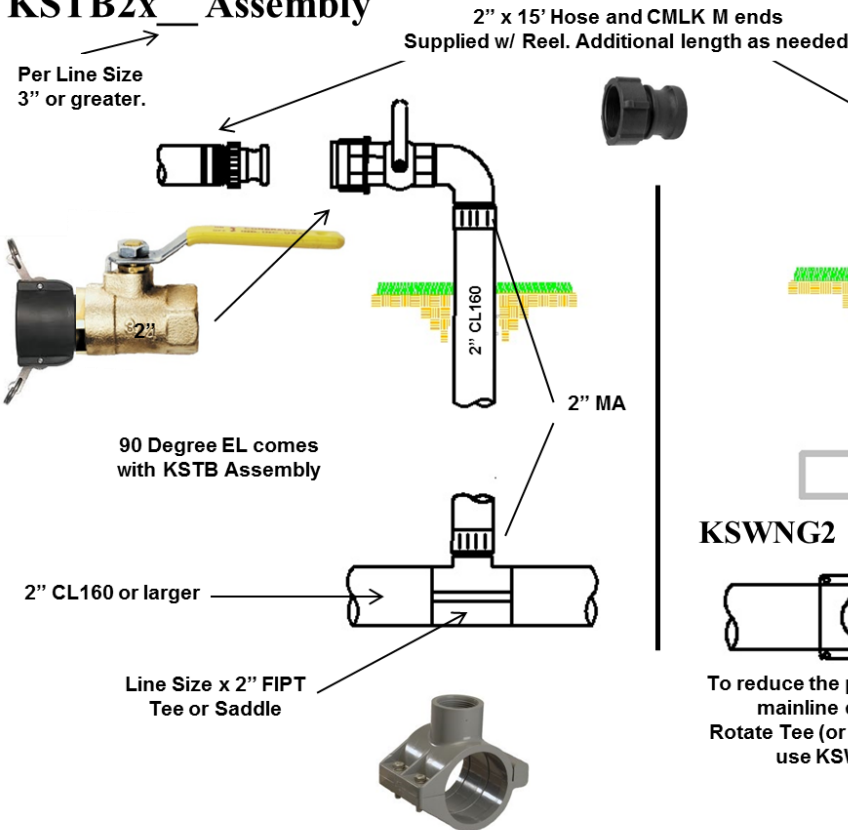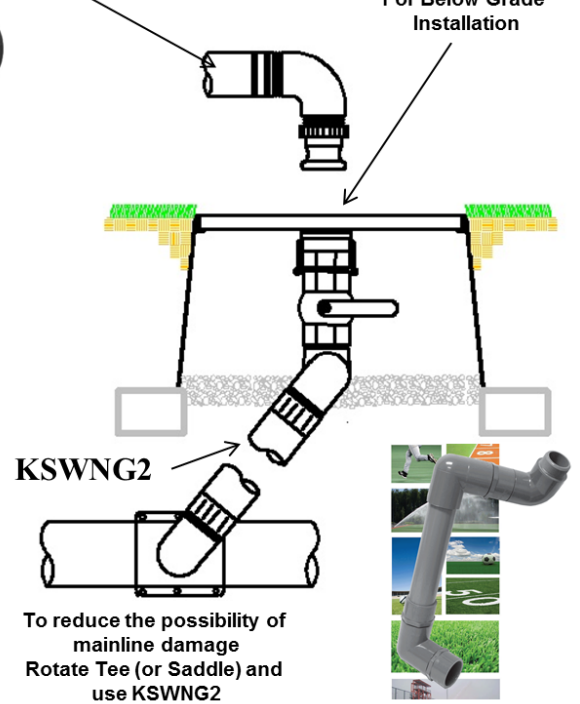
KSTB2

Details in Installation - For Water-Reel Models T200L, T210, T23x600, T27x980, T30x660, T30x980, T30x1200 & T33x1120

STUB4 Details

Isolation valve and French drain
recommended for use in freezing temperatures.

KSTB4x__ Assembly

Per Line Size

KSTB4

4" FIPT

4" IPS CL180

36"

4" MA

4" FIPT

4" CL160
or larger

Line Size x 4" FIPT
Tee or Saddle

KSTB4

KBOX4

**For Below Grade
Installation**

To reduce the possibility of mainline damage
Rotate Tee (or Saddle) and use KSWNG4

Per Line Size

KSWNG4x__
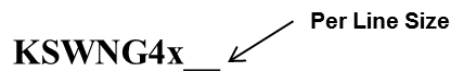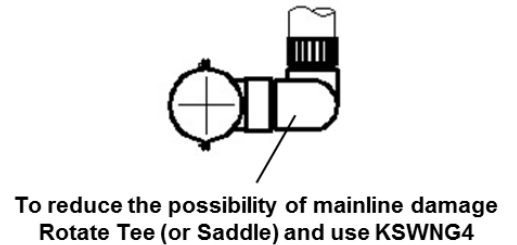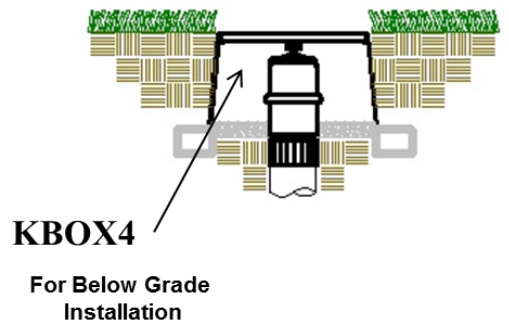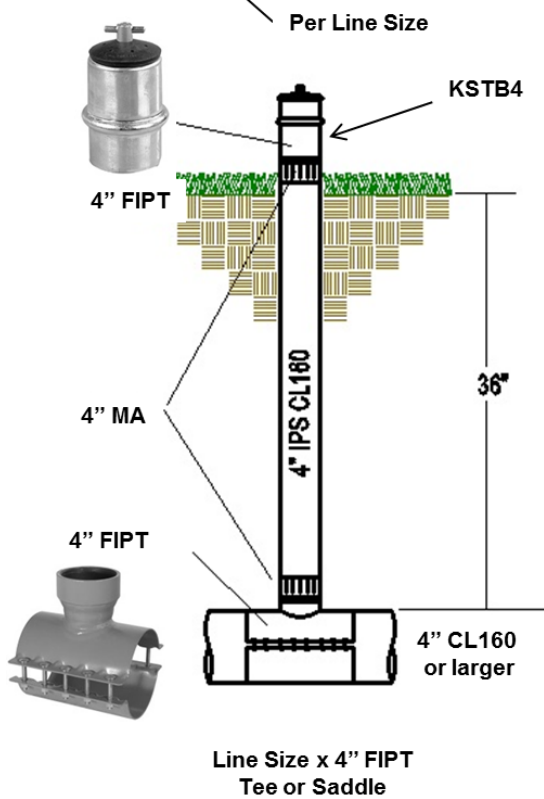
Details in Installation - For Water-Reel Models T23x600, T27x980, T30x660, T30x980, T30x1200 & T33x1120

KVOL4x4 Details

Isolation valve and French drain
recommended for use in freezing temperatures.

KVOL4x4

**With 4" RLC CLMP
Mounts on the KSTB4
To open and close it.**

4" RLC F

4" RLC CLMP

4" RLC F

4" RLC M

Each Ag-Rain Water-Reels come with a 30' Hose .
The Hose mates with the KVOL and the Reel
One KVOL per Water-Reel needs to be ordered separately.

KSTB4

KVOL6x6
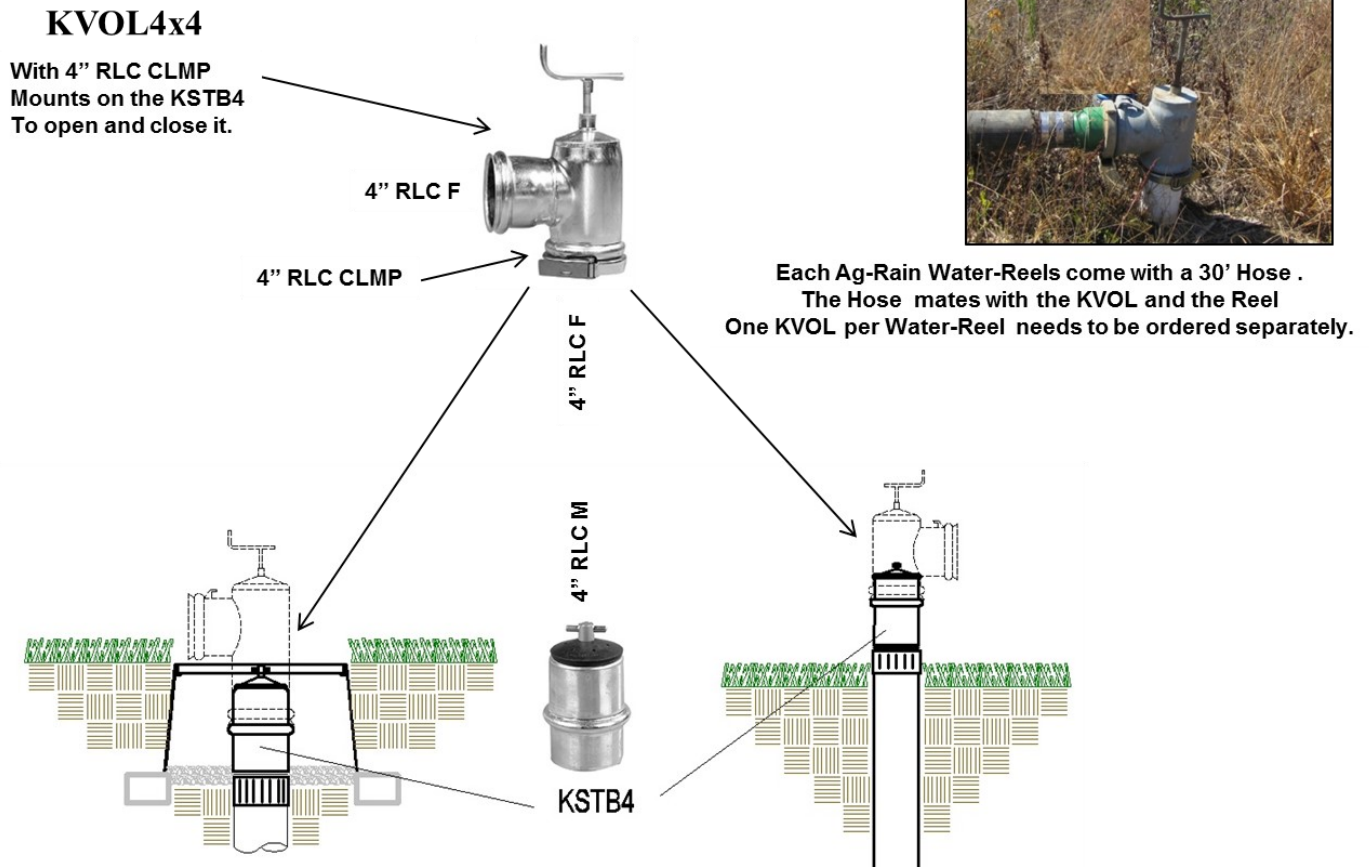
Details in Installation - For Water-Reel Models T37x1080, T37x1220, T40x1240, T40x1320, T41x1575, T45x1150, T45x1320

KSTB6 Details

Isolation valve and French drain
recommended for use in freezing temperatures.

KSTB6x__ Assembly

Per Line Size

KSTB6

6" FIPT

6" MA

6" IPS CL160

36"

6" FIPT

6" CL160
or larger

Line Size x 6" FIPT
Tee or Saddle
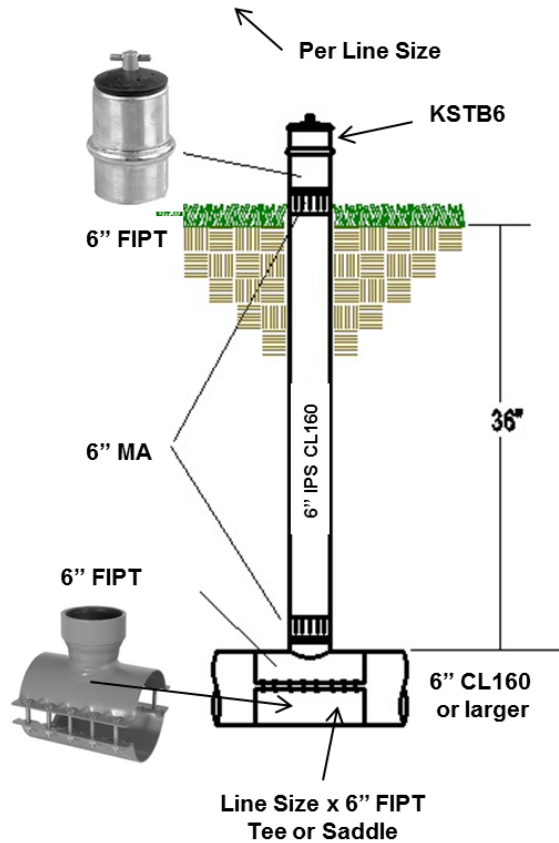
Options
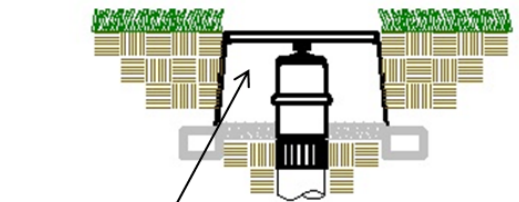
KBOX6

For Below Grade
Installation
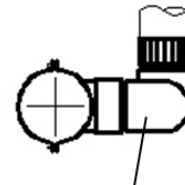
To reduce the possibility of mainline damage
Rotate Tee (or Saddle) and use KSWNG6

KSWNG6x__

Per Line Size

KSTB6

Details in Installation

VOL6x4 Details

Isolation valve and French drain
recommended for use in freezing temperatures.

KVOL6x4

**With 6" RLC CLMP
Mounts on the KSTB6
To open and close it.**

4" RLC F

6" RLC CLMP

6" RLC F

6" RLC M

**Each Ag-Rain Water-Reels come with a 30' Hose .
The Hose mates with the KVOL and the Reel
One KVOL per Water-Reel needs to be ordered separately.**

KSTB6

Details in Installation

KVOL

4" RLC F

6" RLC F
w/ CLMP

Included with reel along with
4"x30' Hose to connect to the reel

Mounts
to KSTB6

KSTB6

6"MA

6" IPS CL160

36"

Saddle or Tee
Per line size

Per Line Size
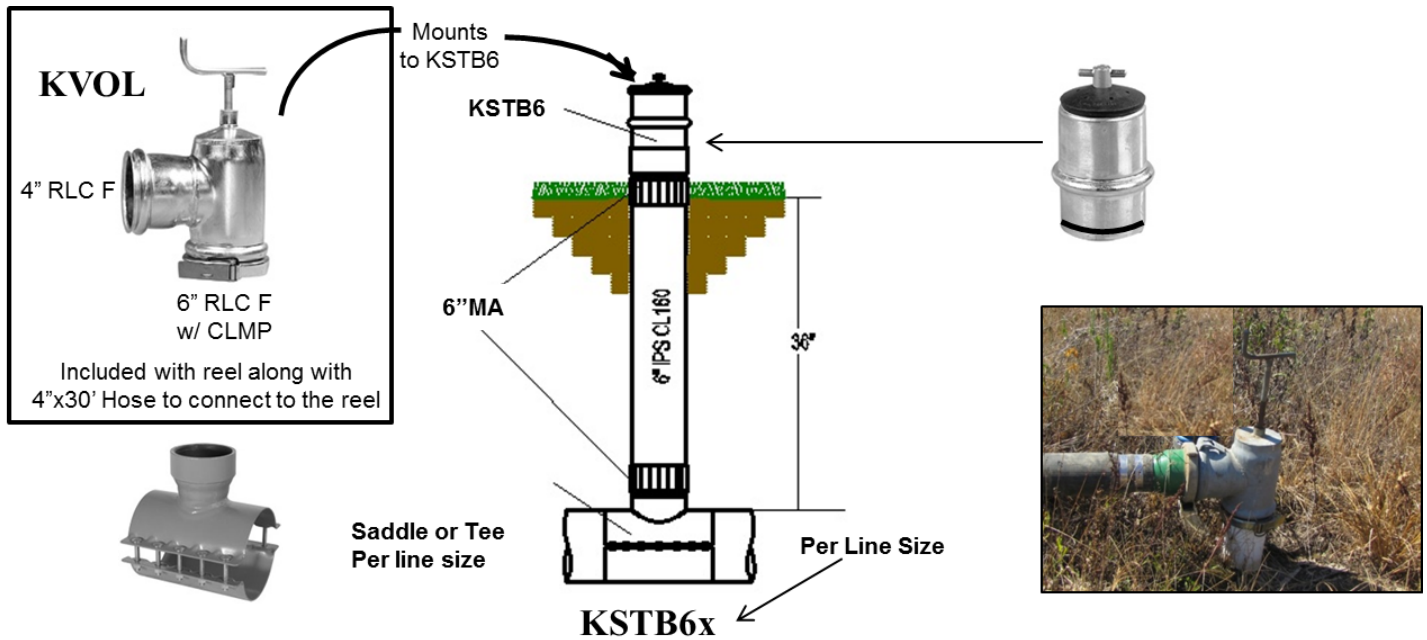
KSTB6x__

KSTB

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA	
KSTB6x06	3	3	0	0	0	Tee
KSTB6x08	41	10	5	12	14	Saddle
KSTB6x10	32	11	5	2	14	Saddle
KSTB6x12	8	2	6	0	0	Saddle
KSTB6x15	0	0	0	0	0	Saddle
Total	84	26	16	14	28	

Details in Installation
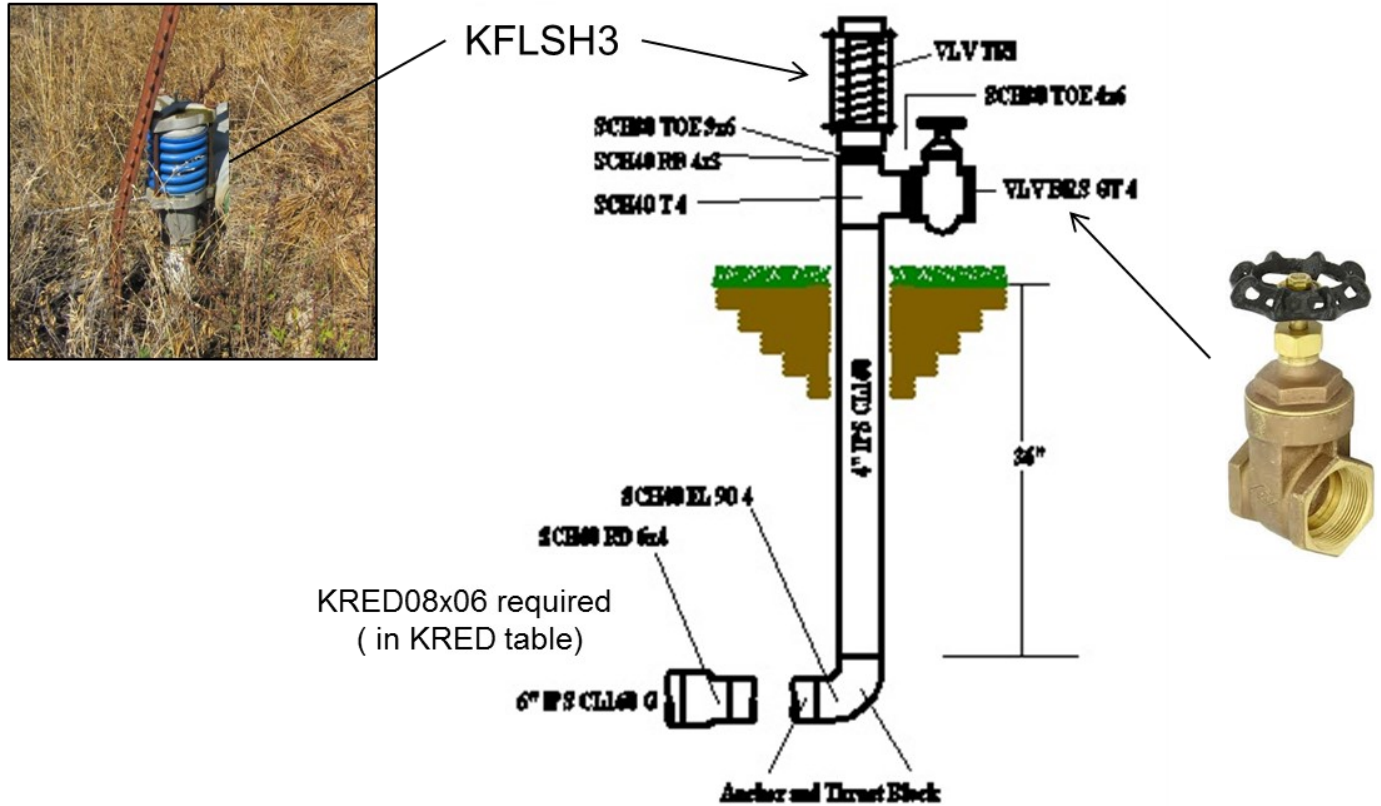
KFLSH3

VLV TR3

SCH80 TOE 4x6

SCH80 TOE 9x6

SCH40 RB 4x3

VLVBR3 GT 4

SCH40 T 4

4" IPS CL160

36"

SCH40 EL 90 4

SCH40 RD 6x4

KRED08x06 required
(in KRED table)

6" IPS CL160 G

Anchor and Thrust Block

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KFLSH3x06	8	3	1	2	2

KVNT

Details in Installation

2"FA

KVNT2

KVNT2x__

↑

Per Line Size

36"

3x2RB, 2"MA

2" PSC 160

Per Line Size

EPX SDLx3FIPT
Per line size

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KVNT2x06	1	1	0	0	0
KVNT2x08	8	3	1	0	4
KVNT2x10	4	0	1	0	3
KVNT2x12	1	0	1	0	0
KVNT2x15	0	0	0	0	0
Total	14	4	3	0	7

Details in Installation

KTAV

KTAV__

↑
Per Line Size

EPX SDLx3FIPT
Per line size

3"MA

3" IPS CL160

36"

Per line size

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KTAV06	0	0	0	0	0
KTAV08	0	0	0	0	0
KTAV10	5	3	0	2	0
KTAV12	4	1	1	0	2
KTAV15	0	0	0	0	0
Total	9	4	1	2	2

Details in Installation

X KISO __

Per Line Size

WBFV GO

EPX WTxFLG (two)

WBFV

48"EXT

12"

36"

Per Line Size

WFR BP

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KISO6	1	1	0	0	0
KISO8	0	0	0	0	0
KISO10	6	2	0	2	2
KISO12	1	1	0	0	0
Total	8	4	0	2	2
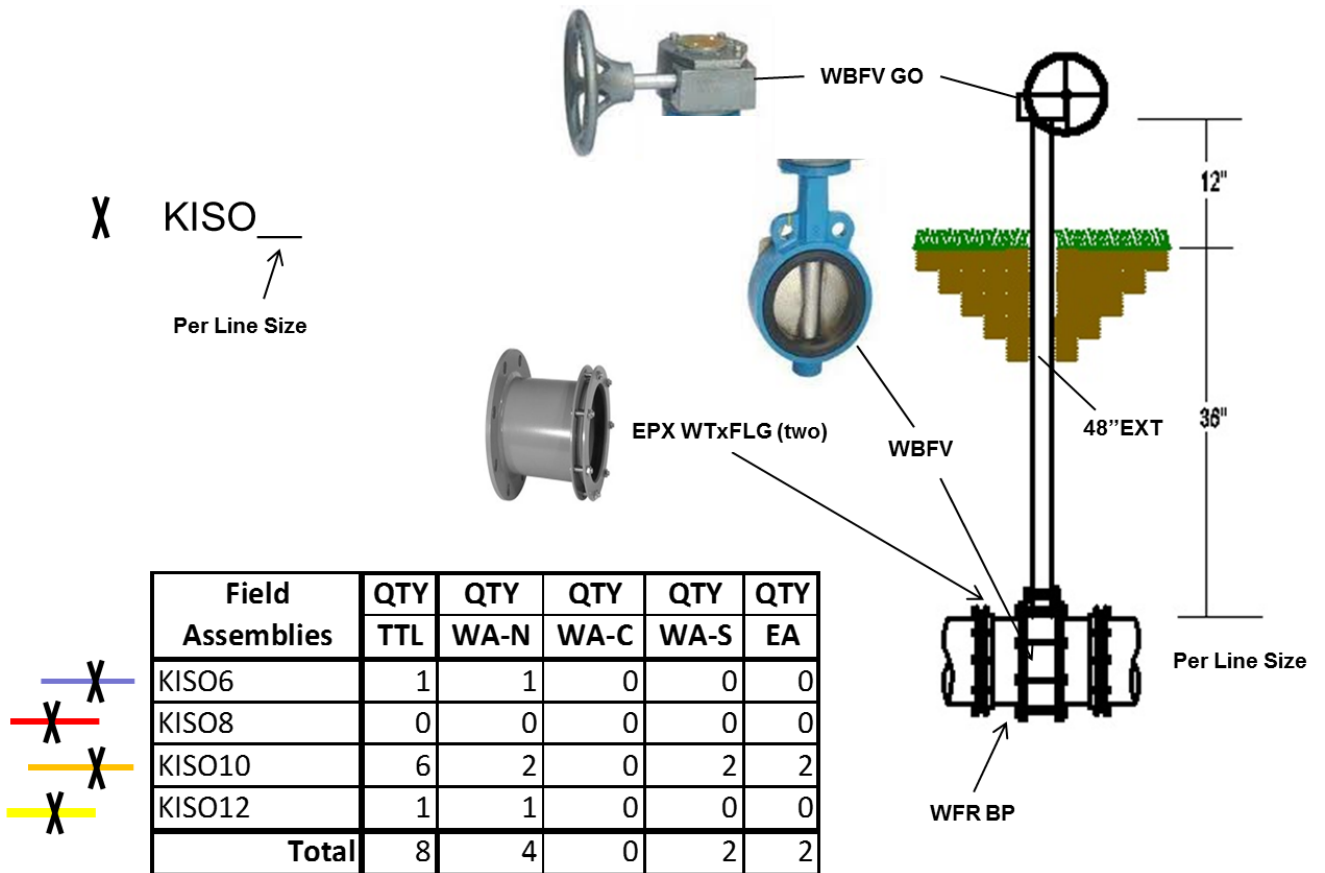
Details in Installation

Spare Repair Couplers

Field Assemblies	QTY TTL
KCPLG06	1
KCPLG08	3
KCPLG10	3
KCPLG12	2
KCPLG15	1
Sub-Total	10
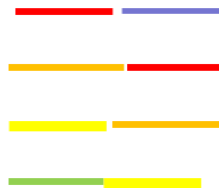
Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KRED08x06	7	2	1	2	2
KRED10x08	8	3	1	2	2
KRED12x10	4	1	1	0	2
KRED15x12	0	0	0	0	0
Sub-Total	19				

Per Line Size

KRED__x__
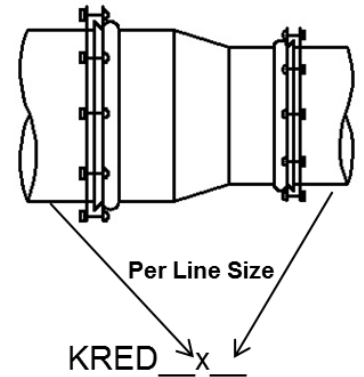
Details in Installation

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KT06	1	1	0	0	0
KT10	2	0	0	1	1
KT12	1	1			
KT15	0	0	0	0	0
KT15x06	0	0	0	0	0
Sub-total	4				

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KL90-08	1	0	0	0	1
KL90-10	2	1	1	0	0
KL90-12	5	1	2	1	1
KL90-15	0	0	0	0	0
Sub-Total	8				

Field Assemblies	QTY TTL	QTY WA-N	QTY WA-C	QTY WA-S	QTY EA
KL22-06	1	1	0	0	0
KL22-08	0	0	0	0	0
KL22-10	3				3
KL45-08	0	0	0	0	0
KL45-10	4	0	0	0	4
Sub-Total	8				

Efficiency Tables

Net PET (in.day)	Cool Humid	Cool Dry	Warm Humid	Warm Dry	Hot Humid	Windy Hot Humid	Hot Arid	Windy Hot Arid
Max Yield	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45
90% Yield	0.09	0.14	0.19	0.24	0.29	0.34	0.39	0.44
50% Yield	0.08	0.13	0.18	0.23	0.28	0.33	0.38	0.43
20% Yield	0.07	0.12	0.17	0.22	0.27	0.32	0.37	0.42
Sustain only	0.06	0.11	0.16	0.21	0.26	0.31	0.36	0.41

Decrease by reliable beneficial precipitation
in Peak Use frequency window divided by # of days in frequency

Effiency (%)	Subsurface Dri	Surface Drip	Pivot	Water-Reel	Solid Set Perminate	Solid Set Temp	Surface
Well Managed	95%	90%	80%	80%	75%	70%	65%
Managed	90%	85%	75%	75%	70%	65%	60%
Poorly Managed	80%	75%	70%	72%	65%	60%	55%
Not Managed	65%	65%	65%	65%	60%	55%	50%

Devide Net PET by Effiency to get Gross PET

Crop	Factor @ PET	Crop	Factor @ PET	Crop	Factor @ PET
Safflower	1.2	Coffee	0.9	Castor beans	0.8
Potatoes	1.2	Tea	0.9	guar	0.8
Sweet Corn	1.2	peas	0.9	cotton	0.8
Barley	1.1	Almonds	0.9	Flax	0.8
Cantalope	1.1	Apples	0.9	Sugar Beets	0.8
Surgum	1.1	Apricots	0.9	Grapes	0.7
Wheat	1.1	Bananas	0.9	Soybean	0.7
Berries	1.1	Cherries	0.9	Citrus	0.6
onions dry	1.1	Peaches	0.9	Broccli	0.6
Sugar Cane	1.1	Pears	0.9	Cabbage	0.6
Alfalfa	1.0	Pecans	0.9	Carrots	0.6
Pumpkin	1.0	Plums	0.9	Caulflower	0.6
sesbania	1.0	Strawberries	0.9	Onions Green	0.6
Turf Grass	1.0	Walnuts	0.9	Lettus	0.4
Bermuda Grass	0.9	Blue Panic Grass	0.8	non production pasture	0.3

Design PET (design depth) = (Net PET (reference PET) x Crop Factor) ÷ Efficiency

Less beneficial precipitation

Common Water Reel Applications with Suggested Models

Efficiency Tables

Design PET			Operating Hours per Day								
Gross Application			22	20	18	16	14	12	10	8	6
in/day	in/wk	in/2 wks	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac
0.02	0.14	0.28	0.41	0.45	0.50	0.57	0.65	0.75	0.91	1.13	1.51
0.04	0.28	0.56	0.82	0.91	1.01	1.13	1.29	1.51	1.81	2.26	3.02
0.04	0.28	0.56	0.82	0.91	1.01	1.13	1.29	1.51	1.81	2.26	3.02
0.06	0.42	0.84	1.23	1.36	1.51	1.70	1.94	2.26	2.72	3.39	4.53
0.08	0.56	1.12	1.65	1.81	2.01	2.26	2.59	3.02	3.62	4.53	6.03
0.10	0.7	1.4	2.06	2.26	2.51	2.83	3.23	3.77	4.53	5.66	7.54
0.12	0.84	1.68	2.47	2.72	3.02	3.39	3.88	4.53	5.43	6.79	9.05
0.14	0.98	1.96	2.88	3.17	3.52	3.96	4.53	5.28	6.34	7.92	10.56
0.16	1.12	2.24	3.29	3.62	4.02	4.53	5.17	6.03	7.24	9.05	12.07
0.18	1.26	2.52	3.70	4.07	4.53	5.09	5.82	6.79	8.15	10.18	13.58
0.20	1.4	2.8	4.11	4.53	5.03	5.66	6.46	7.54	9.05	11.31	15.08
0.22	1.54	3.08	4.53	4.98	5.53	6.22	7.11	8.30	9.96	12.44	16.59
0.24	1.68	3.36	4.94	5.43	6.03	6.79	7.76	9.05	10.86	13.58	18.10
0.26	1.82	3.64	5.35	5.88	6.54	7.35	8.40	9.80	11.77	14.71	19.61
0.28	1.96	3.92	5.76	6.34	7.04	7.92	9.05	10.56	12.67	15.84	21.12
0.30	2.1	4.2	6.17	6.79	7.54	8.48	9.70	11.31	13.58	16.97	22.63
0.32	2.24	4.48	6.58	7.24	8.04	9.05	10.34	12.07	14.48	18.10	24.13
0.34	2.38	4.76	6.99	7.69	8.55	9.62	10.99	12.82	15.39	19.23	25.64
0.36	2.52	5.04	7.40	8.15	9.05	10.18	11.64	13.58	16.29	20.36	27.15
0.38	2.66	5.32	7.82	8.60	9.55	10.75	12.28	14.33	17.20	21.49	28.66
0.40	2.8	5.6	8.23	9.05	10.06	11.31	12.93	15.08	18.10	22.63	30.17
0.42	2.94	5.88	8.64	9.50	10.56	11.88	13.58	15.84	19.01	23.76	31.68
0.44	3.08	6.16	9.05	9.96	11.06	12.44	14.22	16.59	19.91	24.89	33.18
0.46	3.22	6.44	9.46	10.41	11.56	13.01	14.87	17.35	20.82	26.02	34.69
0.48	3.36	6.72	9.87	10.86	12.07	13.58	15.51	18.10	21.72	27.15	36.20
0.50	3.5	7	10.28	11.31	12.57	14.14	16.16	18.85	22.63	28.28	37.71

Enter the left side of chart a the calculated Design PET

Follow the row to the right to the column noting the operating hours available read the gpm/ac at the intersection.

Multiply this value by the total number of acres to be irrigated to get required system flow.

If you have a know flow and you wish to determine the number of acres you can irrigate.

Divide the flow by the gpm/ac to determine the number of acres that can be irrigated.ame value

If you have a know flow and acreage and wish to determine how much water can be applied,

Devide the flow by the acres. Enter the chart at the available operating hours column.

Follow it down until you finde the gpm/ac value calculated.

Read the resulting application on the left side of that row.

Efficiency Tables

Head Loss & Velocity CL160 PVC

Pipe Dia	1 1.1		1.5 1.754		2 2.193		3 3.23		4 4.154		6 6.115		8 7.961		10 9.924		12 11.774	
GPM	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'	FPS	PSI/C'
1	0.28	0.02																
2	0.57	0.06																
3	0.85	0.14																
4	1.14	0.23																
5	1.44	0.36	0.66	0.05	0.42	0.02												
10	2.88	1.30	1.32	0.20	0.84	0.07	0.39	0.01										
15	4.61	3.11	1.99	0.42	1.27	0.14	0.58	0.02										
20	5.77	4.71	2.65	0.71	1.69	0.24	0.78	0.04	0.47	0.01								
25			3.31	1.08	2.12	0.37	0.97	0.06	0.54	0.02								
30			3.97	1.50	2.54	0.51	1.17	0.08	0.70	0.02								
35			4.64	2.00	2.96	0.68	1.36	0.10	0.82	0.03								
40			5.30	2.56	3.39	0.86	1.56	0.13	0.94	0.04								
45					3.81	1.08	1.75	0.16	1.06	0.05								
50					4.24	1.31	1.95	0.20	1.18	0.06								
55					4.66	1.56	2.15	0.24	1.30	0.07								
60					5.09	1.83	2.34	0.28	1.41	0.08								
65							2.54	0.32	1.53	0.09								
70							2.73	0.37	1.65	0.11								
75							2.93	0.42	1.77	0.12								
80							3.12	0.47	1.89	0.14								
85							3.32	0.53	2.00	0.16								
90							3.51	0.59	2.12	0.17								
95							3.71	0.65	2.24	0.19								
100							3.91	0.72	2.36	0.21	1.09	0.03						
110							4.30	0.86	2.60	0.25	1.20	0.04						
120							4.69	1.01	2.83	0.30	1.30	0.05						
130							5.08	1.17	3.07	0.34	1.41	0.05						
140									3.31	0.39	1.52	0.06						
150									3.54	0.45	1.63	0.07						
160									3.78	0.50	1.74	0.08						
170									4.01	0.56	1.85	1.09						
180									4.25	0.63	1.96	0.10						
190									4.49	0.69	2.07	0.11						
200									4.72	0.76	2.18	0.12	1.28	0.03				
225									5.31	0.95	2.45	0.14	1.44	0.04				
250											2.72	0.18	1.60	0.05				
275											3.00	0.21	1.77	0.06				
300											3.27	0.25	1.93	0.07				
325											3.54	0.29	2.09	0.08				
350											3.81	0.33	2.25	0.09				
375											4.09	0.37	2.41	0.10				
400											4.36	0.42	2.57	0.12				
425											4.63	0.47	2.73	0.13				
450											4.90	0.52	2.89	0.14	1.86	0.05		
475											5.18	0.58	3.05	0.16	1.96	0.05		
500													3.21	0.18	2.07	0.06		
550													3.54	0.21	2.27	0.07		
600													3.86	0.25	2.48	0.08		
650													4.18	0.29	2.69	0.10		
700													4.50	0.33	2.89	0.11	2.06	0.05
750													4.82	0.37	3.10	0.13	2.20	0.06
800													5.15	0.42	3.31	0.14	2.35	0.06
850													5.47	0.47	3.52	0.16	2.50	0.07
900													5.79	0.52	3.72	0.18	2.65	0.08
950															3.93	0.20	2.79	0.09
1000															4.14	0.22	2.94	0.09
1050															4.34	0.02	3.09	0.10
1100															4.55	0.26	3.23	0.11
1150															4.76	0.28	3.38	0.12
1200															4.97	0.30	3.53	0.13
1250															5.17	0.33	3.68	0.14
1300															5.36	0.35	3.82	0.15
1350															5.59	0.38	3.97	0.16
1400															5.79	0.40	4.12	0.18
1450															6.00	0.43	4.27	0.19
1500															6.21	0.46	4.41	0.20
1550															6.42	0.49	4.56	0.21
1600															6.62	0.52	4.71	0.23
1650																	4.85	0.24
1700																	5.00	0.25
1750																	5.15	0.27
1800																	5.30	0.28
1850																	5.44	0.30
1900																	5.59	0.31
1950																	5.74	0.33
2000																	5.89	0.34
2100																	6.18	0.37
2200																	6.47	0.41
2300																	6.77	0.44
2400																	7.06	0.48
2500																	7.36	0.52

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Efficiency Tables

Head Loss & Velocity MDPE SDR12

GPM	1.2 FPS	1.3 PSI/C'	1.4 FPS	1.5 PSI/C'	1.8 FPS	2.2 PSI/C'	1.9 FPS	2.3 PSI/C'	2.1 FPS	2.5 PSI/C'	2.3 FPS	2.8 PSI/C'	2.7 FPS	3.2 PSI/C'	3.0 FPS	3.5 PSI/C'	3.3 FPS	3.9 PSI/C'	3.7 FPS	4.3 PSI/C'	4.0 FPS	4.7 PSI/C'	4.5 FPS	5.3 PSI/C'
1	0.29	0.02																						
2	0.57	0.07	0.42	0.03																				
3	0.86	0.16	0.62	0.07	0.38	0.02																		
4	1.14	0.27	0.83	0.12	0.50	0.04	0.45	0.03																
5	1.43	0.40	1.04	0.19	0.63	0.05	0.57	0.04	0.46	0.03														
10	2.86	1.45	2.08	0.67	1.26	0.20	1.13	0.15	0.93	0.09	0.77	0.06												
15	4.29	3.07	3.12	1.42	1.89	0.42	1.70	0.32	1.39	0.20	1.16	0.13	0.84	0.06										
20	5.71	5.22	4.16	2.42	2.52	0.71	2.26	0.55	1.85	0.34	1.54	0.22	1.12	0.10	0.91	0.06								
25	7.14	7.90	5.20	3.65	3.15	1.08	2.83	0.83	2.31	0.51	1.93	0.33	1.40	0.15	1.13	0.09	0.94	0.06						
30	8.57	11.07	6.24	5.12	3.78	1.51	3.39	1.16	2.78	0.71	2.31	0.46	1.68	0.21	1.36	0.13	1.12	0.08						
35			7.29	6.81	4.41	2.01	3.96	1.54	3.24	0.95	2.70	0.61	1.96	0.28	1.59	0.17	1.31	0.11	1.04	0.06				
40			8.33	8.73	5.04	2.57	4.52	1.97	3.70	1.21	3.09	0.78	2.24	0.36	1.81	0.21	1.50	0.13	1.19	0.08	1.02	0.05		
45			9.37	10.85	5.67	3.19	5.09	2.46	4.16	1.51	3.47	0.97	2.52	0.44	2.04	0.27	1.69	0.17	1.34	0.10	1.15	0.07	0.91	0.04
50			10.41	13.19	6.30	3.88	5.65	2.98	4.63	1.83	3.86	1.18	2.80	0.54	2.27	0.32	1.87	0.20	1.49	0.12	1.28	0.08	1.01	0.04
55			11.45	15.74	6.93	4.63	6.22	3.56	5.09	2.19	4.24	1.41	3.08	0.64	2.49	0.39	2.06	0.24	1.64	0.14	1.40	0.10	1.11	0.05
60			12.49	18.49	7.56	5.44	6.78	4.18	5.55	2.57	4.63	1.65	3.36	0.76	2.72	0.45	2.25	0.29	1.79	0.16	1.53	0.11	1.21	0.06
65			13.53	21.44	8.19	6.31	7.35	4.85	6.01	2.98	5.01	1.92	3.64	0.88	2.95	0.53	2.44	0.33	1.94	0.19	1.66	0.13	1.31	0.07
70			14.57	24.60	8.81	7.24	7.91	5.57	6.48	3.42	5.40	2.20	3.92	1.01	3.17	0.60	2.62	0.38	2.09	0.22	1.79	0.15	1.41	0.08
75			15.61	27.95	9.44	8.23	8.48	6.32	6.94	3.89	5.78	2.50	4.20	1.14	3.40	0.69	2.81	0.43	2.24	0.25	1.91	0.17	1.51	0.10
80			16.65	31.50	10.07	9.27	9.04	7.13	7.40	4.38	6.17	2.81	4.48	1.29	3.63	0.77	3.00	0.49	2.38	0.28	2.04	0.19	1.61	0.11
85					10.70	10.37	9.61	7.97	7.86	4.90	6.56	3.15	4.76	1.44	3.85	0.86	3.18	0.54	2.53	0.31	2.17	0.21	1.71	0.12
90					11.33	11.53	10.17	8.87	8.33	5.45	6.94	3.50	5.04	1.60	4.08	0.96	3.37	0.60	2.68	0.35	2.30	0.24	1.81	0.13
95					11.96	12.75	10.74	9.80	8.79	6.02	7.33	3.87	5.32	1.77	4.31	1.06	3.56	0.67	2.83	0.38	2.42	0.26	1.91	0.15
100					12.59	14.02	11.30	10.78	9.25	6.62	7.71	4.25	5.60	1.95	4.53	1.17	3.75	0.73	2.98	0.42	2.55	0.29	2.01	0.16
110					13.85	16.72	12.43	12.86	10.18	7.90	8.48	5.07	6.16	2.33	4.99	1.39	4.12	0.88	3.28	0.50	2.81	0.34	2.22	0.19
120					15.11	19.65	13.56	15.10	11.10	9.28	9.26	5.96	6.72	2.73	5.44	1.64	4.50	1.03	3.58	0.59	3.06	0.40	2.42	0.23
130							14.69	17.52	12.03	10.76	10.03	6.91	7.28	3.17	5.89	1.90	4.87	1.19	3.87	0.68	3.32	0.47	2.62	0.26
140							15.82	20.09	12.95	12.35	10.80	7.93	7.84	3.63	6.35	2.18	5.25	1.37	4.17	0.78	3.57	0.54	2.82	0.30
150							16.95	22.83	13.88	14.03	11.57	9.01	8.40	4.13	6.80	2.47	5.62	1.56	4.47	0.89	3.83	0.61	3.02	0.34
160											12.34	10.16	8.95	4.65	7.25	2.79	5.99	1.75	4.77	1.00	4.08	0.69	3.22	0.39
170											13.11	11.36	9.51	5.21	7.71	3.12	6.37	1.96	5.07	1.12	4.34	0.77	3.43	0.43
180											13.88	12.63	10.07	5.79	8.16	3.47	6.74	2.18	5.36	1.25	4.59	0.86	3.63	0.48
190													10.63	6.40	8.61	3.83	7.12	2.41	5.66	1.38	4.85	0.95	3.83	0.53
200													11.19	7.04	9.07	4.21	7.49	2.65	5.96	1.52	5.10	1.04	4.03	0.59
225													12.59	8.75	10.20	5.24	8.43	3.30	6.71	1.89	5.74	1.29	4.53	0.73
250															11.33	6.37	9.37	4.01	7.45	2.30	6.38	1.57	5.04	0.89
275															12.47	7.60	10.30	4.78	8.20	2.74	7.01	1.87	5.54	1.06
300															13.60	8.93	11.24	5.62	8.94	3.22	7.65	2.20	6.04	1.24
325															14.73	10.36	12.18	6.51	9.69	3.73	8.29	2.55	6.55	1.44
350															15.87	11.88	13.11	7.47	10.43	4.28	8.93	2.93	7.05	1.65
375																			11.18	4.86	9.56	3.33	7.56	1.88
400																			11.92	5.48	10.20	3.75	8.06	2.12
425																			12.67	6.13	10.84	4.20	8.56	2.37
450																			13.41	6.82	11.48	4.67	9.07	2.63
475																			14.16	7.54	12.11	5.16	9.57	2.91
500																					12.75	5.67	10.07	3.20
550																					14.03	6.77	11.08	3.81
600																							12.09	4.48
650																							13.10	5.20
700																							14.10	5.96

Add 15 PSI for Turbine loss
Add 15 PSI for HPSV loss

Efficiency Tables

Highest Point of the System

Elevation Change

KIFCO Water Reel
Flow & Inlet Pressure

Eye of the Impeller

Suction Lift

Dynamic water level

Head Loss due to friction through pipe,
fittings, valves, filters, etc.

$$HP = (TDH \times Q) \div (EFF \times 3960)$$

HP = Horse Power
      Required at pump shaft

TDH = Total Dynamic Head
         in ft of H_2O

Q = Total system flow in GPM

EFF = Pump efficiency at this performance point

Head Required	PSI	Feet of H2O
Water-Reel inlet pressure		
Turbine Loss		
HPSV Loss		
Elevation gain or Loss		
Lift gain or loss		
Head loss due to flow through pipe		
Headloss due to fittings		
Head loss due to screens and filters		
Head loss due to valves, etc.		
TDH		

Eye Of Impeller

Grade   3'

Max Water Level   2' Free Board

10'

Min Water Level

Atmospheric
Pressure
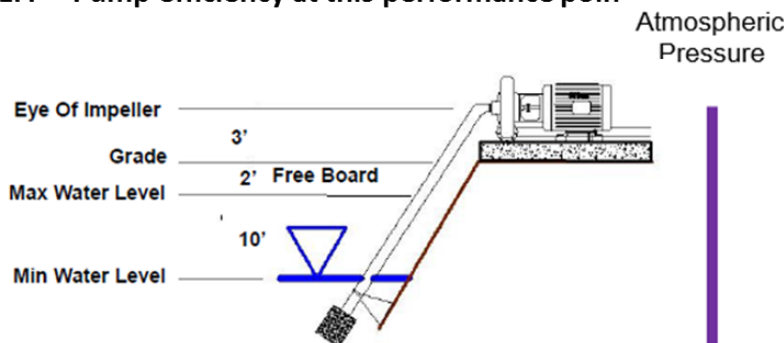
	PSI	Feet of Water
Lift		
Entrance Loss		
Exit Loss		
Fitting Loss		
Filter /screen Loss		
Head loss through Pipe		
NPSH Losses		

Elevation ABSL (ft)	Pressure (PSI)	Pressure Ft of H_2O
0	14.7	33.9
500	14.43	33.3
1000	14.17	32.7
1500	13.91	32.1
2000	13.66	31.5
2500	13.41	31.0
3000	13.17	30.4
3500	12.93	29.9
4000	12.69	29.3
4500	12.46	28.8
5000	12.23	28.2
5500	12	27.7
6000	11.77	27.2
6500	11.55	26.7
7000	11.34	26.2
7500	11.13	25.7
8000	10.91	25.2
8500	10.71	24.7
9000	10.5	24.2
9500	10.3	23.8
10000	10.1	23.3
10500	9.91	22.9
11000	9.72	22.4
11500	9.53	22.0
12000	9.34	21.6
12500	9.16	21.2
13000	8.99	20.8
13500	8.81	20.3
14000	8.63	19.9
14500	8.46	19.5
15000	8.29	19.1

Efficiency Tables

BHP = Horse Power Required at the Pump Shaft

CHP = Continuous Horse Power provided by the drive engine or electric motor

IHP = Intermitent Horse Power of drive engine or electric motor

Engine CHP < IHP, The relation ship between CHP & IHP is not constant.

Increase BHP by the transfer loss percentage below.

Power plants for Irrigation Pumps should be sized using CHP not IHP

CHP should be provided by MFG as per standard testing.

Published engine CHP typically need to be derated for:

     Accessories: - 10 % w/o fan, -15% w fan

      Elevation: -3% per 1000' > 3000'ABSL for non-turbo; 0% for engine with turbo

    Temperature: -1% per 10 °F > 85 °F w Turbo; -1% per 5 °F > 85°F wo Turbo

All horsepowers should be at the required RPM

Transfer Loss	
SAE Couple	1.0%
Close Coupled	0.5%
Frame & Coupling	2.0%
PTO	3.0%
Belts & Pulleys	3-7%
VHS Motor	0.5%
RAG	3.0%
Extended PTO shaft	+
Vertical Shaft	+

 + Consult MFG

The drive Engine (or motor) CHP after de-rating should be greater than the BHP plus transfer loss.

Specifying Water-Reels: Consumptive Use Method

To size a machine inquire what depth of water is to be applied and how many hours a day they will run. Use the corresponding gpm/acre figure multiplied by the total acres to determine the required flow. If the referenced depth used was a net value, divide by the efficiency. If the crop has a crop factor other than one, multiply by the crop factor. It is important to discuss operating hours with the client. Flow rate and capital cost of the system increase dramatically with a decrease in operating hours.

PET Crop Factor = 1			Operating Hours per Day								
	Gross ET		22	20	18	16	14	12	10	8	6
in/day	in/wk	in/2 wks	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac	gpm/ac
0.02	0.14	0.28	0.41	0.45	0.50	0.57	0.65	0.75	0.91	1.13	1.51
0.04	0.28	0.56	0.82	0.91	1.01	1.13	1.29	1.51	1.81	2.26	3.02
0.04	0.28	0.56	0.82	0.91	1.01	1.13	1.29	1.51	1.81	2.26	3.02
0.06	0.42	0.84	1.23	1.36	1.51	1.70	1.94	2.26	2.72	3.39	4.53
0.08	0.56	1.12	1.65	1.81	2.01	2.26	2.59	3.02	3.62	4.53	6.03
0.10	0.7	1.4	2.06	2.26	2.51	2.83	3.23	3.77	4.53	5.66	7.54
0.12	0.84	1.68	2.47	2.72	3.02	3.39	3.88	4.53	5.43	6.79	9.05
0.14	0.98	1.96	2.88	3.17	3.52	3.96	4.53	5.28	6.34	7.92	10.56
0.16	1.12	2.24	3.29	3.62	4.02	4.53	5.17	6.03	7.24	9.05	12.07
0.18	1.26	2.52	3.70	4.07	4.53	5.09	5.82	6.79	8.15	10.18	13.58
0.20	1.4	2.8	4.11	4.53	5.03	5.66	6.46	7.54	9.05	11.31	15.08
0.22	1.54	3.08	4.53	4.98	5.53	6.22	7.11	8.30	9.96	12.44	16.59
0.24	1.68	3.36	4.94	5.43	6.03	6.79	7.76	9.05	10.86	13.58	18.10
0.26	1.82	3.64	5.35	5.88	6.54	7.35	8.40	9.80	11.77	14.71	19.61
0.28	1.96	3.92	5.76	6.34	7.04	7.92	9.05	10.56	12.67	15.84	21.12
0.30	2.1	4.2	6.17	6.79	7.54	8.48	9.70	11.31	13.58	16.97	22.63
0.32	2.24	4.48	6.58	7.24	8.04	9.05	10.34	12.07	14.48	18.10	24.13
0.34	2.38	4.76	6.99	7.69	8.55	9.62	10.99	12.82	15.39	19.23	25.64
0.36	2.52	5.04	7.40	8.15	9.05	10.18	11.64	13.58	16.29	20.36	27.15
0.38	2.66	5.32	7.82	8.60	9.55	10.75	12.28	14.33	17.20	21.49	28.66
0.40	2.8	5.6	8.23	9.05	10.06	11.31	12.93	15.08	18.10	22.63	30.17
0.42	2.94	5.88	8.64	9.50	10.56	11.88	13.58	15.84	19.01	23.76	31.68
0.44	3.08	6.16	9.05	9.96	11.06	12.44	14.22	16.59	19.91	24.89	33.18
0.46	3.22	6.44	9.46	10.41	11.56	13.01	14.87	17.35	20.82	26.02	34.69
0.48	3.36	6.72	9.87	10.86	12.07	13.58	15.51	18.10	21.72	27.15	36.20
0.50	3.5	7	10.28	11.31	12.57	14.14	16.16	18.85	22.63	28.28	37.71

Sometimes the term Supplemental Watering is used to justify values below the calculated required flow. In this case the producer should be advised without precipitation the system cannot sustain production.

Metric to US Conversions

- Millimeters (mm) x 0.03937 = inches (") (in)

- Centimeters (cm) x 0.3937 = inches (") (in)

- Meters (m) x 39.37 = inches (") (in)

- Meters (m) x 3.281 = feet (') (ft)

- Meters (m) x 1.094 = yards (yds)

- Kilometers (km) x 0.62137 = miles (mi)

- Kilometers (km) x 3280.87 = feet (') (ft)

- Liters (1) x 0.2642 = gallons (U.S.) (gals)

- Liters (1) x 0.0353 = cubic feet

- Bars x 14.5038 = pounds per square inch (PSI)

- Kilograms (kg) x 2.205 = Pounds (P)

- Kilometers (km) x 1093.62 = yards (yds)

- Square centimeters x 0.155 = square inches

- Square meters x 10.76 = square feet

- Square kilometers x 0.386 = square miles

- Cubic centimeters x 0.06102 = cubic inches

Cubic meters x 35.315 = cubic feet

US to Metric Conversions

- Inches (") (in) x 25.4 = millimeters (mm)

- Inches (") (in) x 2.54 = centimeters (cm)

- Inches (") (in) x 0.0254 = meters (m)

- Feet (') (ft) x 0.3048 = meters (m)

- Yards (yds) x 0.9144 = meters (m)

- Miles (mi) x 1.6093 = kilometers (km)

- One mile = 5,280 feet (ft)

- Feet (') (ft) x 0.0003048 = kilometers (km)

- Gallons (gals) x 3.78 = liters (l)

- Cubic feet x 28.316 = liters (l)

- Pounds (P) x 0.4536 = kilograms (kg)

- Square inches x 6.452 = square centimeters

- Square feet x 0.0929 = square meters

- Square miles x 2.59 = square kilometers

- Acres x 4046.85 = square meters

- Cubic inches x 16.39 = cubic centimeters

- Cubic feet x 0.0283 = cubic meters

Useful Irrigation Formulas

Water Measurement

- 1 cubic foot = 7.48 gallons = 62.4 pounds of water

- 1 acre-foot = 43,560 cubic feet = 325,851 gallons = 12 acre-inches

- 1 acre-foot covers 1 acre of land 1 foot deep; 1 acre-inch = 27,154 gallons

- 1 cubic meter = 1,000 liters = 264.18 gallons

- 1 acre-inch = 450 gallons per minute (GPM)

- 1 gallon = 128 ounces = 3,785 milliliters = 8.33 pounds

- 1 pound = 454 grams

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Useful Irrigation Formulas Continued:

Water Measurement
- 1 cubic foot = 7.48 gallons = 62.4 pounds of water
- 1 acre-foot = 43,560 cubic feet = 325,851 gallons = 12 acre-inches
- 1 acre-foot covers 1 acre of land 1 foot deep; 1 acre-inch = 27,154 gallons
- 1 cubic meter = 1,000 liters = 264.18 gallons

1 acre-inch = 450 gallons per minute (GPM)

        hour   or 1 cubic foot per second (cfs)

- 1 gallon = 128 ounces = 3,785 milliliters = 8.33 pounds

1 pound = 454 grams

Pressure
- 1 pound per square inch (psi) = 2.31
- Feet of head x .433 = psi

A column of water 2.31 feet deep exerts a pressure of 1 psi

     feet of head = psi x 2.31

- Total Dynamic Head (TDH) includes: Pumping Lift, Elevation Change, Friction Loss and Irrigation System Operating Pressure

TDH = Lift + Elevation + Friction + System Pressure

Area/Length
1 acre = 0.405 hectare (ha) = 43,560 feet²

Horsepower
Water Horsepower (WHP) – power required to lift a given quantity of water

                        against a given total dynamic head

$$WHP = \frac{Q \times H}{3,960} \quad \text{where: } Q = \text{flow rate, GPM} \atop H = \text{total dynamic head, feet}$$

Brake Horsepower (BHP) – required power input at the pump

$$BHP = \frac{WHP}{E} \quad \text{where: } E = \text{pump efficiency}$$

Power Unit Horsepower

     Electric Units: approximate name plate horsepower = $\underline{BHP}$

Useful Irrigation Formulas Continued:

Internal combustion units:

20% for continuous duty
5% for right-angle drive
3% for each 1,000 feet above sea level
1% for each 10º above 60ºF

Approximate Engine
Horsepower Required =

$$\frac{BHP}{\underset{\text{duty}}{0.80} \times \underset{\text{cont. drive}}{0.95} \times \underset{\text{3,000' elevation}}{0.91} \times \underset{\text{100ºF}}{0.96}}$$

Nebraska Performance Criteria (NPC)

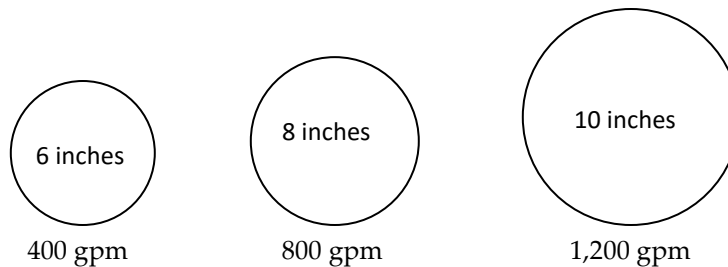| Energy source	WHp-hours per unit of fuel
Diesel	12.5 WHp-hrs per gallon
Propane	6.89 WHp-hrs per gallon
Natural Gas:	
925 BTU/ft³	61.7 WHp-hrs per 1,000 ft³ (MCF)
1,000 BTU/ft³	66.7 WHp-hrs per 1,000 ft³ (MCF)
Electric	0.885 WHp-hrs per kilowatt-hour

Water Application

Average Application (inches) = $\dfrac{Q\,T}{A}$

Where: Q = Flow Rate, Acre-Inches/Hour or GPM/450
T = Length of Application, Hours
A = Area Irrigated, Acres

Set Size (Acres) is computed by the formula:

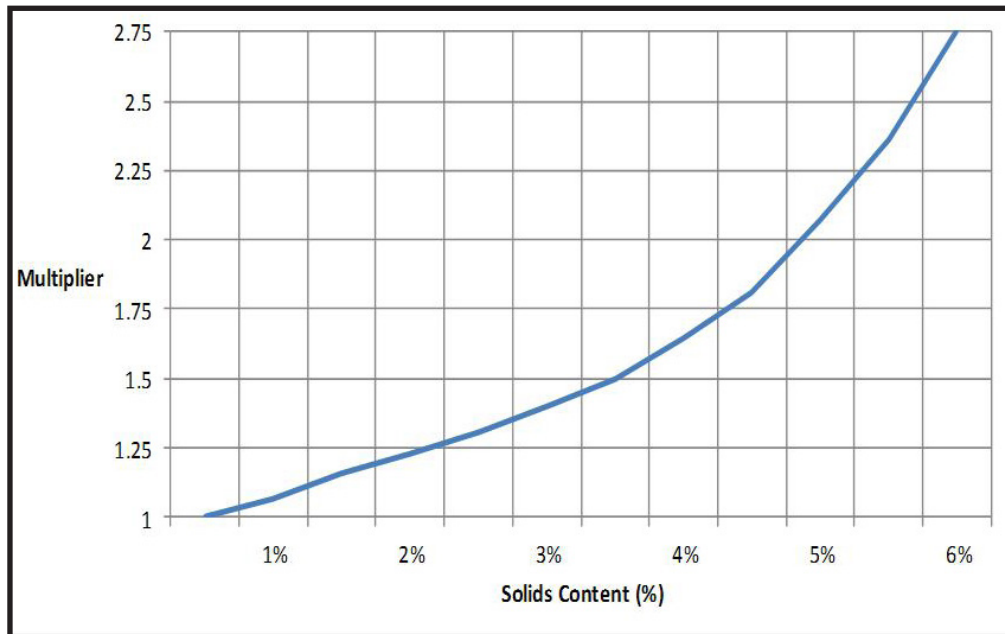$$\frac{\text{No. of Rows x Width of Row (Feet) x Length of Run (Feet)}}{43,560 \text{ Feet}^2/\text{Acre}}$$

6 inches
400 gpm

8 inches
800 gpm

10 inches
1,200 gpm

Wastewater Friction Loss In Pipelines

The information contained in this bulletin gives a guide to the additional friction loss of water in pipelines due to solids content up to 6%

To Find Wastewater Friction Loss:
1. Calculate the standard friction loss for water.
2. Establish the solids content of wastewater.
3. Find the multiplier from graph above.
4. Friction loss for water x multiplier = wastewater friction loss.

Guide To Flow Characteristics

1 - 2%	3%	4%	5%	5.5%	6%
45°	30°	15°	0°	-30°	-45°