Hemp Irrigation

By Zoe Stapp
Brookdale Fruit Farm Inc.
Brookdale History

- Brookdale Fruit Farm established in 1847
- Currently Operated by the 5th, 6th, and 7th generations of the Hardy family
- Farming hundreds of acres
  – Certified Organic 10+ Acres
- 4 major business units
  – Wholesale, Retail, Pick Your Own, Supplies
Brookdale Hollis, NH

Brookdale Fruit Farm Inc
38 Broad St Hollis NH 03049
(603) 465 2240
Overview

- Water Requirements
- System Components
- Uniformity
- Install
- System Operation
- Fertigation
- Soil Moisture
# System Design

## Brookdale Fruit Farm Irrigation and Row Crop Supplies

**Customer:**
- **Name:** [Name]
- **Address:** [Address]
- **Contact:** [Contact]

**Irrigation Sales Slip**
- **Date:** 12/27/2016
- **Prepared by:** [Name]
- **Phone:** [Phone]

## Quantity | Units | Description | Unit Price | Total
--- | --- | --- | --- | ---
1 | 3400 feet | 2 inch poly pipe 100 psi | $0.97 | $3,296.00
2 | 1 assembly | 2 inch single disc filter built to backflush on cam locks | $490.00 | $490.00
3 | 1 assembly | 2 x 3/4 fertilizer injector | $305.00 | $305.00
4 | 30 feet | 2 inch red layflat hose connect filter and injector well | $1.25 | $37.50
5 | each | 2 inch cam lock c | $7.50 | $30.00
6 | each | 2 inch cam lock e | $4.50 | $22.50
7 | each | 2 inch super clamps 56-59 | $5.00 | $300.00
8 | each | gravity drain assembly | $128.00 | $142.00
9 | each | 1 inch insert caps | $2.25 | $33.75
10 | each | 1 inch couplers | $1.50 | $15.00
11 | each | 1 inch elbows | $1.85 | $18.50
12 | each | 1 inch barbed tee | $4.00 | $20.00
13 | each | 24 inch o.53 spacing orchard tubing | $155.00 | $6,045.00
14 | 200 each | xpando starter with grommet | $1.60 | $320.00
15 | each | figure 0 end cap | $0.20 | $40.00
16 | each | 1 inch ram coupler | $0.35 | $35.00
17 | 3 assembly | 3 way pipe valve tower with pressure gauge and air vent | $175.00 | $525.00
18 | 1 assembly | 3 way pipe valve tower with pressure gauge and air vent | $225.00 | $225.00
19 | 1 assembly | 2 way flow divider with 3/4” threaded | $110.00 | $110.00
20 | 40 field | apples | | 
21 | 5 field | apples | | 
22 | 3 field | apples | | 
23 | 1 field | apples | | 
24 | 1 field | apples | | 
25 | 2 field | apples | | 
26 | 4 field | apples | | 
27 | 5 field | apples | | 
28 | 1 field | apples | | 
29 | 1 field | apples | | 
30 | 1 field | apples | | 
31 | 1 field | apples | | 
32 | 1 field | apples | | 
33 | 1 field | apples | | 
34 | 1 field | apples | | 
35 | 1 field | apples | | 
36 | 1 field | apples | | 
37 | 1 field | apples | | 
38 | 1 field | apples | | 

## Notes

**Total:** $12,342.25

**186 totals:** 38550
Why Drip

• Delivers water directly to plant
  – Consistent amounts throughout field
  – Not weather dependent
• Incorporate fertilizers and chemicals into system
• 1 time set up per year
• Start it and leave it operating design
• Delivers water directly and uniformly to the plant
• Reduces evapotranspiration
• Conserves water, helps with limited sources
• Requires less pump capacity and fuel to operate
  Saves $$$$$$
Drip Tape

- Flat low pressure tube
- Various spaced emitters
- Various flow rates
- Install stripes/emitters up
Drip Tape

- Most common 5/8”
- 12” emitters
- High Flow: 0.45 Q/100
- Low Flow: 0.22 Q/100
- Filtration: 150 micron
- 12-15 PSI

Q/100= Gallons per minute per 100 feet
Basic Layout

Water Source
Pond or River
Well or Municipal

Pump
Check Valve
Filter
Injector
Check Valve

Coupler
Pressure Regulator

Valve

End Caps

Drip Tape
Pressure Regulator
Starter Fittings

FLAT TUBE
LAY FLAT

FLAT TUBE
Water Requirements

- 1 acre inch of rain per week
- 27,154 gallons per acre per week
- Approx. 545,000 gallons per acre 20 week growing cycle

<table>
<thead>
<tr>
<th>Tape</th>
<th>Row Ft</th>
<th>GPM</th>
<th>4 Hour Gallons</th>
<th>Cycles per Week</th>
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</thead>
<tbody>
<tr>
<td>0.45</td>
<td>7210</td>
<td>32</td>
<td>7787</td>
<td>3.49</td>
</tr>
<tr>
<td>0.22</td>
<td>7210</td>
<td>16</td>
<td>3807</td>
<td>7</td>
</tr>
</tbody>
</table>
Water Sources

• Well/Town Water – 20 GPM/Acre
• Surface Water (most common north east)
  – River
  – Pond
• 100’ x 100’ x 8’ deep
  – 600,000 gallons
Pumps

• Electric
  – Allows for easy automation
  – Requires an electrician to install

• Gas
  – High pressure pump **NOT a trash pump**
  – Easy to use
  – Set it and forget it

• Diesel

• P.T.O
Pump Placement
Filter assemblies
Filters

- Filter to 150 microns
- Filters run in parallel reduce pressure loss
- Increase filter capacity
- Allow for back-flushing
Fertilizer Injectors

• Mazzei injector
  – Venturi action
  – Regulated by flow of water

• Mix Rite or Dosatron
  – Pump Style
  – Varying flow rates, Constant feed, precise measure

• Only use WATER SOLUBLE FERTILIZER
Mazzei Injectors work off of FLOW RATE
NEED CORRECT FLOW TO MAKE INJECTOR WORK

Flow Rate Calculations
Drip Tape used: 508-12-45

(Total row feet / 100) x 0.45

1 acre 12” spacing drip tape on 4 foot plastic 7210 feet of tape

(7210 / 100) = 72.1 x 0.45 = \textbf{32.45} GPM
Lay flat Hose

• High pressure supply line
• Can drive over
• Heavy Duty- 125 PSI
• Blue Lay flat- 80 PSI
Pressure Regulators

- High pressure inlet
- Low pressure outlet
- Many different settings
  - 12, 15, 20, 25, 30, 35

Diagram of pump and pressure regulator settings.
Header Hose
Drip Tape

- Flat low pressure tube
- Various spaced emitters
  - 12” most common
- Various flow rates
  - 0.22 low flow
  - 0.45 high flow
- Install stripe/emitters up
Drip Tape (Annual Systems)

508 (Size & Mil) 12 (Spacing) 450 (Flow Rate)  
508 – 12 – 450

Flow Rates 450 means 0.45 Gallons of water per minute emitted per 100 row feet

<table>
<thead>
<tr>
<th>Spacing</th>
<th>Flow Rate gpm per 100 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 High</td>
<td>0.45 50812450 524 ft</td>
</tr>
<tr>
<td>12 Low</td>
<td>0.22 50812220 835 ft</td>
</tr>
<tr>
<td>8 High</td>
<td>0.50 50808500 487 ft</td>
</tr>
<tr>
<td>8 Low</td>
<td>0.34 50808340 645 ft</td>
</tr>
<tr>
<td>6 High</td>
<td>0.67 50806670 412 ft</td>
</tr>
<tr>
<td>6 low</td>
<td>0.50 50806500 487 ft</td>
</tr>
<tr>
<td>4</td>
<td>0.67 50804670 412 ft</td>
</tr>
</tbody>
</table>
Flow Control Tape

- Pressure moderating
- Longer rows
- Uniform yields
- Hilly terrain
- Ideal for heavy feeders
Flow Control Drip Tape

- Conserve water
- Apply evenly
- Hilly land
- Low cost big improvement

**STANDARD TAPE**

Standard tapes stress plants and reduce yield and efficiency by over- or under-watering as pressure changes throughout the run.

**RESULT:** Wasted water and fertilizer, stressed plants and reduced yields.

**AQUA-TRAXX® FC**

Toro Aqua-Traxx FC gives you uniform output regardless of elevation changes. So now you can adjust the amount of water you give your plants on hilly terrain, and they'll all receive the same amount through our uniform delivery system.

**RESULT:** More uniform plants and higher yields even in hilly terrain that might otherwise be impractical to farm.
### Pressure Moderating

**12 inch 0.22 gpm**

**Standard tape 835 feet**

**Flow Control 1008 feet**

<table>
<thead>
<tr>
<th>%&quot; DIAMETER</th>
<th>Length of Run (ft) @ 10 psi for 90% EU</th>
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</thead>
<tbody>
<tr>
<td>Q-100</td>
<td>Slopes</td>
</tr>
<tr>
<td>-2%</td>
<td>-1%</td>
</tr>
<tr>
<td>0.09</td>
<td>240</td>
</tr>
<tr>
<td>0.11</td>
<td>259</td>
</tr>
<tr>
<td>0.13</td>
<td>237</td>
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<tr>
<td>0.14</td>
<td>256</td>
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<td>0.17</td>
<td>255</td>
</tr>
<tr>
<td>0.22</td>
<td>249</td>
</tr>
<tr>
<td>0.25</td>
<td>246</td>
</tr>
<tr>
<td>0.28</td>
<td>243</td>
</tr>
<tr>
<td>0.29</td>
<td>243</td>
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<td>0.30</td>
<td>243</td>
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<tr>
<td>0.34</td>
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<td>0.38</td>
<td>236</td>
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<td>0.42</td>
<td>231</td>
</tr>
<tr>
<td>0.44</td>
<td>231</td>
</tr>
<tr>
<td>0.45</td>
<td>230</td>
</tr>
<tr>
<td>0.50</td>
<td>224</td>
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<tr>
<td>0.56</td>
<td>218</td>
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<tr>
<td>0.66</td>
<td>212</td>
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<tr>
<td>0.67</td>
<td>212</td>
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<tr>
<td>0.84</td>
<td>196</td>
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<tr>
<td>0.88</td>
<td>193</td>
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<tr>
<td>0.90</td>
<td>193</td>
</tr>
<tr>
<td>1.00</td>
<td>187</td>
</tr>
<tr>
<td>1.12</td>
<td>180</td>
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<td>1.33</td>
<td>169</td>
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<td>1.34</td>
<td>168</td>
</tr>
<tr>
<td>1.68</td>
<td>155</td>
</tr>
<tr>
<td>2.65</td>
<td>128</td>
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</tbody>
</table>
UNIFORMITY

GOOD UNIFORMITY

POOR UNIFORMITY - Dripline Length-of-Run Too Long

POOR UNIFORMITY - Severe slopes/undulations

Depth of Water

Depth of Water

Depth of Water
• More water at lower elevations
• Less water at higher elevations
• Wastes water, fertilizer
• Runoff, deep percolation
• Less yield, quality
• Crop stress
Tape Selection

Compensating Emitters (FC)  Non-Compensating Emitters
Soil Type Considerations

- Water holding capacity varies in different soil types
  - Clay
  - Loam
  - Sand

- Water holding capacity helps determine drip tape emitter spacing
Moisture Lateral Movement

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Approximate Lateral Movement</th>
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<tbody>
<tr>
<td>Coarse Sand</td>
<td>0.5 - 1.5 feet</td>
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<tr>
<td>Fine Sand</td>
<td>1.0 - 3.0 feet</td>
</tr>
<tr>
<td>Loam</td>
<td>3.0 - 4.5 feet</td>
</tr>
<tr>
<td>Heavy Clay</td>
<td>4.0 - 6.0 feet</td>
</tr>
<tr>
<td>Soil Type</td>
<td>Inches per Foot</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>SAND</td>
<td>0.25 - 1.00</td>
</tr>
<tr>
<td>LOAMY SAND</td>
<td>0.75 - 1.50</td>
</tr>
<tr>
<td>LOAM AND SILT LOAM</td>
<td>1.25 - 1.75</td>
</tr>
<tr>
<td>CLAY LOAM</td>
<td>2.00 - 2.75</td>
</tr>
<tr>
<td>CLAY</td>
<td>1.75 - 2.50</td>
</tr>
</tbody>
</table>
Pulsed Irrigation

Continuous Irrigation
Long Rows - Different Flows

650' Row 8” .67 Q-100’

650' Row 8” .34 Q-100’
Long Rows – Manifold Location

650' Row 8” .67 Q-100’

Center-feed Same Row
Sub-Main / Manifold Size

6" Layflat

4" Layflat

3" Layflat

Dev. from ave. flow

217 gpm

12.0 psi

213 gpm

12.0 psi

182 gpm

12.0 psi

Sub - Main / Manifold Size
Friction Loss Charts
Oval Hose Pressure Loss

<table>
<thead>
<tr>
<th>Part No.</th>
<th>ID (inch)</th>
<th>Min. ID</th>
<th>Nom. ID</th>
<th>Min. Wall</th>
<th>Nom. Wall</th>
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<tbody>
<tr>
<td>EL0350</td>
<td>0.255</td>
<td>0.250</td>
<td>0.255</td>
<td>0.250</td>
<td>0.250</td>
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<tr>
<td>EL0430</td>
<td>0.315</td>
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<td>0.315</td>
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<tr>
<td>EL0510</td>
<td>0.375</td>
<td>0.370</td>
<td>0.375</td>
<td>0.370</td>
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<td>EL0690</td>
<td>0.435</td>
<td>0.430</td>
<td>0.435</td>
<td>0.430</td>
<td>0.430</td>
</tr>
<tr>
<td>EL0870</td>
<td>0.500</td>
<td>0.495</td>
<td>0.500</td>
<td>0.495</td>
<td>0.495</td>
</tr>
<tr>
<td>EL1050</td>
<td>0.565</td>
<td>0.560</td>
<td>0.565</td>
<td>0.560</td>
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</tr>
<tr>
<td>EL1230</td>
<td>0.630</td>
<td>0.625</td>
<td>0.630</td>
<td>0.625</td>
<td>0.625</td>
</tr>
<tr>
<td>EL1410</td>
<td>0.695</td>
<td>0.690</td>
<td>0.695</td>
<td>0.690</td>
<td>0.690</td>
</tr>
<tr>
<td>EL1590</td>
<td>0.760</td>
<td>0.755</td>
<td>0.760</td>
<td>0.755</td>
<td>0.755</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Flow (gpm)</th>
<th>Velocity (fps)</th>
<th>Velocity Loss (fps)</th>
<th>Pressure Loss (psi)</th>
</tr>
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<tbody>
<tr>
<td>1.0</td>
<td>0.38</td>
<td>0.04</td>
<td>0.15</td>
</tr>
<tr>
<td>2.0</td>
<td>0.76</td>
<td>0.08</td>
<td>0.31</td>
</tr>
<tr>
<td>5.0</td>
<td>1.90</td>
<td>0.25</td>
<td>0.82</td>
</tr>
<tr>
<td>10.0</td>
<td>3.80</td>
<td>0.50</td>
<td>1.64</td>
</tr>
<tr>
<td>20.0</td>
<td>7.60</td>
<td>1.00</td>
<td>3.28</td>
</tr>
<tr>
<td>30.0</td>
<td>11.40</td>
<td>1.50</td>
<td>4.92</td>
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<tr>
<td>40.0</td>
<td>15.20</td>
<td>2.00</td>
<td>6.56</td>
</tr>
<tr>
<td>50.0</td>
<td>19.00</td>
<td>2.50</td>
<td>8.20</td>
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</tbody>
</table>

Notes: Losses in psi per 100 feet of hose (psi/100 ft) for hose sizes: 26 mm (1.043") ID through 160 mm (6.307") ID.
Tool & Fittings
End Plug

Install with Lines Facing UP
TORO TAPE BLUE TO THE SKY
Helpful Tools

- Impact tool for hose clamps
- Liquid Teflon
- Scissors for drip tape
- Sharp Knife
- Paint Marker
Install

1. Lay Plastic
2. Pump, Filter and Injector
3. Place H station in middle of zone
4. Run lay flat from pump/filter to H station
5. Connect Header Hose to H station
6. Punch starters in to header
7. Turn water on
8. Connect tape
9. Walk to end of field, put on end caps
10. Check System for leaks
11. Transplant
System Operation

<table>
<thead>
<tr>
<th>Tape</th>
<th>Row Ft</th>
<th>GPM</th>
<th>4 Hour Gallons</th>
<th>Cycles per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.45</td>
<td>7210</td>
<td>32</td>
<td>7787</td>
<td>3.49</td>
</tr>
<tr>
<td>0.22</td>
<td>7210</td>
<td>16</td>
<td>3807</td>
<td>7</td>
</tr>
</tbody>
</table>

1. Open zones
2. Check Oil
3. Start pump
4. Backflush filter
5. Check for leaks
6. Check pressure in field
### Fertigation

**• Water Soluble Fertilizer is a must!**

<table>
<thead>
<tr>
<th>Brand</th>
<th>Formula</th>
<th>Name</th>
<th>Type</th>
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<tbody>
<tr>
<td>Plant Marvel</td>
<td>12-5-19</td>
<td>Veggie Special</td>
<td>Conv</td>
</tr>
<tr>
<td>Plant Marvel</td>
<td>15-5-30</td>
<td>K Mag</td>
<td>Conv</td>
</tr>
<tr>
<td>Plant Marvel</td>
<td>15-0-15</td>
<td>Hi-Cal Special</td>
<td>Conv</td>
</tr>
<tr>
<td>Plant Marvel</td>
<td>12-45-10</td>
<td>Super Start</td>
<td>Conv</td>
</tr>
<tr>
<td>Nutri Ag</td>
<td>12-0-1</td>
<td></td>
<td>OMRI</td>
</tr>
<tr>
<td>Nutri Ag</td>
<td>5-0-20</td>
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<td>OMRI</td>
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<td>Nutri Ag</td>
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<td>Potassium</td>
<td>OMRI</td>
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<td>Nutri Ag</td>
<td></td>
<td>Calcium</td>
<td>OMRI</td>
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<tr>
<td>Nutri Ag</td>
<td></td>
<td>Zinc</td>
<td>OMRI</td>
</tr>
<tr>
<td>Nutri Ag</td>
<td></td>
<td>Boron</td>
<td>OMRI</td>
</tr>
<tr>
<td>Neptunes Harvest</td>
<td>2-4-1</td>
<td>Fish</td>
<td>OMRI</td>
</tr>
<tr>
<td>Neptunes Harvest</td>
<td>2-3-1</td>
<td>Fish and Seaweed</td>
<td>OMRI</td>
</tr>
<tr>
<td>Neptunes Harvest</td>
<td>2-4-2</td>
<td>Tomato Veg</td>
<td></td>
</tr>
<tr>
<td>Neptunes Harvest</td>
<td>2-6-2</td>
<td>Rose and Flowering</td>
<td></td>
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</table>
Fertigation
Sample Schedule

<table>
<thead>
<tr>
<th>Stage</th>
<th>Fertilizer</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Transplant</td>
<td>12-45-10</td>
<td>1/2 bag (12.5 lbs)</td>
</tr>
<tr>
<td>Week 1</td>
<td>12-45-10</td>
<td>1/2 bag (12.5 lbs)</td>
</tr>
<tr>
<td>Week 2-Bloom</td>
<td>12-5-19</td>
<td>1/2 bag (12.5 lbs)</td>
</tr>
<tr>
<td>Bloom-Harvest</td>
<td>15-5-30</td>
<td>1/2 bag (12.5 lbs)</td>
</tr>
</tbody>
</table>

- Prior to putting the fertilizer through fill the lines for 20-30 minutes!
- Rinse with clear water for 15 minutes after
Weed Mat

- 1.77 OZ Black Row Cover Fabric
- UV Stabilized
- Pinned every 3 feet with staples
- 3 to 5 year life span
- Reusable weed barrier for field or greenhouse

- Brookdale Fruit Farm exclusive product
- Permeable for rain water filtration
- Cost effective weeding solution
- 4 and 5 foot widths
Weed Mat
Is Soil Wet? #1

• How to check moisture level
  – Moisture meter
  – Feel method
• Trees measure at 20” and 40”
• Blues Raspberry at 12” and 24”
• Strawberry at 6” and 12”

Taking Data is only good if you act on it

<table>
<thead>
<tr>
<th>Available Soil Moisture Percent</th>
<th>Coarse Texture</th>
<th>Moderately Coarse Texture</th>
<th>Medium Texture</th>
<th>Fine Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Texture</td>
<td>Fine Sand and Loamy Sand</td>
<td>Sandy Loam and Fine Sandy Loam</td>
<td>Sandy Clay Loam, Loam, and Silt Loam</td>
<td>Clay, Clay Loam, or Silty Clay Loam</td>
</tr>
<tr>
<td>Available Water Capacity</td>
<td>0.6 to 1.2 inches per foot</td>
<td>1.2 to 1.7 inches per foot</td>
<td>1.5 to 2.1 inches per foot</td>
<td>1.6 to 2.4 inches per foot</td>
</tr>
</tbody>
</table>

0 to 25
- Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure. SMD 1.2 to 0.5
- Dry, forms a very weak ball, aggregated soil grains break away easily from ball. SMD 1.7 to 1.0
- Dry, soil aggregations break away easily, no moisture staining on fingers, clods crumble with applied pressure. SMD 2.1 to 1.1

25 to 50
- Slightly moist, forms a very weak ball with well-defined finger marks, light coating of loose and aggregated sand grains remain on fingers. SMD 0.9 to 0.3
- Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers, grains break away. SMD 1.2 to 0.7
- Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away. SMD 1.6 to 0.8
- Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure. SMD 1.8 to 0.6

50 to 75
- Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, moderate water staining on fingers, will not ribbon. SMD 0.9 to 0.2
- Moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color, will not stick. SMD 0.9 to 0.3
- Moist, forms a ball, very light water staining on fingers, darkened color, pliable, forms a weak ribbon between thumb and forefinger. SMD 1.1 to 0.4
- Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger. SMD 1.2 to 0.4

75 to 100
- Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon. SMD 0.3 to 0.0
- Wet, forms a ball with wet outline left on hand, light to medium water staining on fingers, makes a weak ribbon between thumb and forefinger. SMD 0.4 to 0.0
- Wet, forms a ball with well defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger. SMD 0.5 to 0.0
- Wet, forms a ball, uneven medium to heavy soil/water coating on fingers, ribbons easily between thumb and forefinger. SMD 0.6 to 0.0

Field Capacity (100 percent)
- Wet, forms a weak ball, moderate to heavy soil/water coating on fingers, wet outline of soft ball remains on hand. SMD 0.0
- Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. SMD 0.0
- Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers. SMD 0.0
- Wet, forms a soft ball, free water appears on soil surface after squeezing or shaking, thick soil/water coating on fingers, sticky and sticky. SMD 0.0

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/technical/ecoscience/agronomy/?cid=nrcs144p2_056491
Moisture Meters

Watermark and Irrrometer

Watermark and Irrrometer Scale 0 to 100
0 is wet 100 is dry
Above 40 turn water on
Shut off when hit 20

Irrrometer installation detail - Orchards

NOTE: Irrrometer placement depth is a function of crop root depth.

1. Set tips in active root system area in tree row.
2. Sensor location should be near dripline of tree and on the South/West side (in Northern hemispheres).
3. If utilizing furrow irrigation, angle tubes slightly towards furrow.
4. With sprinkler irrigation, locate irrometers in sprinkler wetted pattern.
5. With drip irrigation, locate irrometers 12” to 18” from emitter, or 24” to 36” from a micro-sprinkler.
Sensor Information

- **0-10 Centibars** = Saturated soil
- **10-30 Centibars** = Soil is adequately wet (except coarse sands, which are beginning to lose water)
- **30-60 Centibars** = Usual range for irrigation (most soils)
- **60-100 Centibars** = Usual range for irrigation in heavy clay

- Two sensors at 6” and 12” depth
Rainfall vs Soil Moisture 16

RainwiseNet Detailed Graph

Rainfall (in) vs Soil Moisture (kPa)

April '16 to December '16
### System Design

#### Irrigation and Row Crop Supplies

**Customer:**
- **Name:** [Details redacted]
- **Address:** [Details redacted]
- **Contact:** [Details redacted]

**Prepared by:** [Details redacted]

**Date:** 12/27/2016

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<th>No.</th>
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**Notes:**

**Total:** $12,342.25

---

**Irrigation System Details:**

- **3 way valve tower:**
  - **Crop:** apples
  - **Field:** A
  - **# Rows:** 6
  - **Length:** 420 ft
  - **Row FT:** 20
  - **Spacing:** 10.8
  - **Flow:** 1.1
  - **GPM:** 11.1

- **2 way valve tower:**
  - **Crop:** apples
  - **Field:** B
  - **# Rows:** 11
  - **Length:** 210 ft
  - **Row FT:** 20
  - **Spacing:** 10.8
  - **Flow:** 1.2
  - **GPM:** 10.2

- **Well:**
  - **Field:** C1
  - **# Rows:** 8
  - **Length:** 500 ft
  - **Row FT:** 20
  - **Spacing:** 17.7
  - **Flow:** 1.1
  - **GPM:** 17.7

- **Main Line:**
  - **Crop:** apples
  - **Field:** D1
  - **# Rows:** 10
  - **Length:** 450 ft
  - **Row FT:** 20
  - **Spacing:** 10.8
  - **Flow:** 1.2
  - **GPM:** 19.9

- **Sub Main:**
  - **Crop:** xmas
  - **Field:** F
  - **# Rows:** 40
  - **Length:** 150 ft
  - **Row FT:** 20
  - **Spacing:** 10.8
  - **Flow:** 1.2
  - **GPM:** 25.5

- **Gravity Drain:**
  - **Crop:** apples
  - **Field:** G
  - **# Rows:** 7
  - **Length:** 250 ft
  - **Row FT:** 17.8
  - **Spacing:** 10.8
  - **Flow:** 1.2
  - **GPM:** 7.5

**Total:** 186 totals 36550
Questions?

Julian Post, Sept. 19
Contact

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