Irrigation System Characteristics and Costs

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Hand-Move (Sprinkler)

Characteristics
- initial cost: medium
- operating cost: medium
- labor: intensive
- acreage: small
- pressure: medium
- pipe: aluminum
- smallest recommended nozzle diameter: 0.25"
- application rate: 0.25" to 0.50"/hr
- maximum recommended event application: 0.50" to 1.00"
- consider used equipment

Hand-Move (Gun Sprinkler)

Characteristics
- initial cost: medium
- operating cost: medium to high
- labor: medium
acreage: small to medium
pressure: medium to high
pipe: aluminum
application rate: 0.30” to 0.75”/hr
maximum recommended event application: 0.50” to 1.00”
consider used equipment
runoff potential
affected by wind
flush lines after pumping sludge

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**Solid-Set (Sprinkler)**

**Characteristics**

- initial cost: high
- operating cost: medium
- labor: low to medium
- acreage: small
- pressure: medium
- pipe: aluminum
- smallest recommended nozzle diameter: 0.25”
- application rate: 0.25” to 0.50”/hr
- maximum recommended event application: 0.50” to 1.00”
- consider used equipment

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**Solid-Set (Gun Sprinkler)**

**Characteristics**

- initial cost: high
- operating cost: medium to high
- labor: low to medium
- acreage: small to medium
- pressure: medium to high
- pipe: aluminum
- application rate: 0.30” to 0.75”/hr
- maximum recommended event application: 0.50” to 1.00”
- consider used equipment
- runoff potential
- affected by wind
- flush lines after pumping sludge
Permanent (Sprinkler)

Characteristics

initial cost: medium to high
operating cost: medium
labor: low to medium
acreage: small to medium
pressure: medium
pipe: PVC
smallest recommended nozzle diameter: 0.25"
application rate: 0.25 n to 0.35"/hr
maximum recommended event application: 0.50" to 1.00"

System Components

<table>
<thead>
<tr>
<th>System size (ac)</th>
<th>Lateral size (in)</th>
<th>Lateral length (ft)</th>
<th>Main size (in)</th>
<th>Main length (ft)</th>
<th>Motor &amp; pump (hp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2</td>
<td>2,880</td>
<td>3</td>
<td>1,500</td>
<td>7.5</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>5,740</td>
<td>3</td>
<td>1,500</td>
<td>7.5</td>
</tr>
<tr>
<td>20</td>
<td>2.5</td>
<td>11,400</td>
<td>3</td>
<td>2,000</td>
<td>10 *</td>
</tr>
<tr>
<td>30</td>
<td>3</td>
<td>17,020</td>
<td>4</td>
<td>2,500</td>
<td>15 **</td>
</tr>
<tr>
<td>40</td>
<td>4</td>
<td>22,600</td>
<td>4</td>
<td>3,000</td>
<td>25 **</td>
</tr>
</tbody>
</table>

* Some power companies will allow single-phase, most desire 3-phase.

** Can only use 3-phase.

System Component Costs

<table>
<thead>
<tr>
<th>System size (Ac)</th>
<th>Lateral cost ($)</th>
<th>Main cost ($)</th>
<th>Valve &amp; riser cost ($)</th>
<th>Sprinkler, riser &amp; swing joint cost ($)</th>
<th>Pump motor cost ($)</th>
<th>Misc cost ($)</th>
<th>Total cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>576</td>
<td>675</td>
<td>490</td>
<td>(35) 300</td>
<td>1,600</td>
<td>300</td>
<td>3,941</td>
</tr>
<tr>
<td>10</td>
<td>1,148</td>
<td>675</td>
<td>980</td>
<td>(90) 300</td>
<td>1,600</td>
<td>600</td>
<td>10,400</td>
</tr>
<tr>
<td>20</td>
<td>3,990</td>
<td>900</td>
<td>1,960</td>
<td>(140) 450</td>
<td>2,100</td>
<td>1,000</td>
<td>10,400</td>
</tr>
<tr>
<td>30</td>
<td>7,659</td>
<td>1,625</td>
<td>2,940</td>
<td>(210) 600</td>
<td>2,500</td>
<td>1,500</td>
<td>16,824</td>
</tr>
<tr>
<td>40</td>
<td>14,690</td>
<td>1,950</td>
<td>3,920</td>
<td>(280) 850</td>
<td>3,200</td>
<td>2,000</td>
<td>26,610</td>
</tr>
</tbody>
</table>

* 20 percent extra sprinklers for each system.

System Cost Per Acre *

<table>
<thead>
<tr>
<th>Size (ac)</th>
<th>Equipment cost/ac ($)</th>
<th>Contract installation ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>788</td>
<td>524 ($ .60/ft)</td>
</tr>
<tr>
<td>10</td>
<td>530</td>
<td>434 ($ .60/ft)</td>
</tr>
</tbody>
</table>
Permanent (Gun Sprinkler)

Characteristics

- initial cost: medium to high
- operating cost: medium to high
- labor: low to medium
- acreage: small to medium
- pressure: medium to high
- pipe: PVC
- application rate: 0.30" to 0.75"/hr
- maximum recommended event application: 0.50" to 1.00"
- runoff potential
- affected by wind
- flush lines after pumping sludge

Hard-Hose Traveler

Characteristics

- initial cost: medium
- operating cost: high
- labor: low
- acreage: medium
- pressure: high
- main line pipe: aluminum or PVC
- hard hose: polyethylene
- application rate: 0.40" to 0.75"/hr
- maximum recommended event application: 0.50" to 1.00"
- runoff potential
- affected by wind
- portable system, need main line at each location
- use engine reel drive unit for sludges
- flush lines after pumping sludge
Flow Rates for Different Size Travelers

<table>
<thead>
<tr>
<th>Hose size (in)</th>
<th>Flow (gpm) *</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>110 - 150</td>
</tr>
<tr>
<td>3.0</td>
<td>170 - 230</td>
</tr>
<tr>
<td>3.3</td>
<td>225 - 300</td>
</tr>
<tr>
<td>3.7 - 3.75</td>
<td>275 - 400</td>
</tr>
<tr>
<td>4.0 - 4.2</td>
<td>375 - 550</td>
</tr>
<tr>
<td>4.5</td>
<td>500 - 670</td>
</tr>
</tbody>
</table>

* 3-5 psi friction Loss / 100 ft of hose.

Hard-Hose Traveler Cost *

<table>
<thead>
<tr>
<th>Machine size</th>
<th>Approximate cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 in, 800 ft hose</td>
<td>$ 12,000</td>
</tr>
<tr>
<td>3 in, 850 - 1000 ft hose</td>
<td>$ 15,500 - 17,000</td>
</tr>
<tr>
<td>3.3 in, 900 - 1200 ft hose</td>
<td>$ 18,500 - 20,000</td>
</tr>
<tr>
<td>3.7 - 3.75 in, 950 - 1300 ft hose</td>
<td>$ 22,000 - 25,000</td>
</tr>
<tr>
<td>4 - 4.2 in, 1000 - 1250 ft hose</td>
<td>$ 23,000 - 26,000</td>
</tr>
<tr>
<td>4 in, 1500 ft hose</td>
<td>$ 32,000 - 33,000</td>
</tr>
<tr>
<td>4.5 in, 1050 ft hose</td>
<td>$ 23,500 - 24,500</td>
</tr>
<tr>
<td>4.5 in, 1300 ft hose</td>
<td>$ 32,000 - 33,000</td>
</tr>
</tbody>
</table>

*Most units are equipped with 3.5 to 5 hp gasoline engines.
Some may be available with small diesel engine.
Could use water drive for clean lagoon liquid.
Definitely need engine for wastewater containing solids.

Center Pivot

Characteristics

- initial cost: medium
- operating cost: low to medium-high
- labor: low
- acreage: medium to high
- pressure: low, medium or high
- main line pipe: PVC
- sprinkler: rotary impact, gun, or spray nozzles
- application rate: 0.75" to 3.00"/hr
- maximum recommended event application: 0.50" to 1.00"
- runoff potential
- affected by wind
- towable systems available
- flush lines after pumping sludge
Center-Pivot Cost *

Pivot - impact sprinkler

< 1000 feet  $ 35 - 40 / ft
1000 feet    $ 30 - 32 / ft
> 1000 feet   $ 25 - 28 / ft

Slurry shooter $ 40 - 45 / ft

Example: a 4-tower pivot with: impact sprinkler  slurry shooter

approximately 760 - 780 ft  $ 28,000  $ 33,000
approximately 50 ac         $ 560 / ac  $ 660 / ac

* Need to add pump, power unit, and slurry pipe to determine total cost of system, which would add another $300 - 350 per acre.

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Pipe Cost

<table>
<thead>
<tr>
<th>Size</th>
<th>Material</th>
<th>Cost Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>Aluminum Ring-Lok</td>
<td>$2.90 - 3.15 / ft</td>
</tr>
<tr>
<td>2&quot;</td>
<td>Class 160 PVC</td>
<td>$0.20 - 0.35 / ft</td>
</tr>
<tr>
<td>2.5&quot;</td>
<td>Class 160 PVC</td>
<td>$0.35 - 0.50 / ft</td>
</tr>
<tr>
<td>3&quot;</td>
<td>Class 160 PVC</td>
<td>$0.45 - 0.70 / ft</td>
</tr>
<tr>
<td>4&quot;</td>
<td>Class 160 PVC</td>
<td>$0.65 - 1.00 / ft</td>
</tr>
<tr>
<td>6&quot;</td>
<td>Class 160 PVC</td>
<td>$1.40 - 2.00 / ft</td>
</tr>
<tr>
<td>6&quot;</td>
<td>Class 200 PVC</td>
<td>$1.75 - 2.40 / ft</td>
</tr>
<tr>
<td>8&quot;</td>
<td>Class 160 PVC</td>
<td>$2.40 - 3.00 / ft</td>
</tr>
<tr>
<td>8&quot;</td>
<td>Class 200 PVC</td>
<td>$2.90 - 4.00 / ft</td>
</tr>
</tbody>
</table>

Hydrants, 6" with air-relief: $200 - 225 each

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Pump and Power Unit Costs

3 cylinder diesel or 4 cylinder gas and pump, 150 - 250 gpm  $7,000 - 8,000

Small 6 cylinder gas or 4 cylinder diesel and pump, 200 - 350 gpm  $9,000 - 11,000

6 cylinder diesel and pump, 350 - 550 gpm  $12,000 - 14,000

6 cylinder diesel, slurry pump, 350 - 550 gpm with hydraulic assist pump on suction  $19,000 - 21,000

Small PTO pump, 150 - 250 gpm need 40 - 50 hp tractor  $1,800 - 2,300

Large PTO pump, 250 - 550 gpm need 60 - 130 hp tractor  $3,000 - 4,000
## Power Costs for Applying Wastewater

<table>
<thead>
<tr>
<th>System</th>
<th>Gasoline</th>
<th>Diesel</th>
<th>Electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable pipe (sprinkler)</td>
<td>$5.65</td>
<td>$3.61</td>
<td>$4.08</td>
</tr>
<tr>
<td>Portable pipe (gun sprinkler)</td>
<td>$7.53</td>
<td>$4.81</td>
<td>$5.45</td>
</tr>
<tr>
<td>Solid-set (sprinkler)</td>
<td>$5.33</td>
<td>$3.40</td>
<td>$3.86</td>
</tr>
<tr>
<td>Solid-set (gun sprinkler)</td>
<td>$7.22</td>
<td>$4.61</td>
<td>$5.22</td>
</tr>
<tr>
<td>Permanent (sprinkler)</td>
<td>$5.02</td>
<td>$3.21</td>
<td>$3.63</td>
</tr>
<tr>
<td>Permanent (gun sprinkler)</td>
<td>$6.90</td>
<td>$4.41</td>
<td>$4.99</td>
</tr>
<tr>
<td>Hard-hose traveler</td>
<td>$10.04</td>
<td>$6.41</td>
<td>$7.02</td>
</tr>
<tr>
<td>Center-pivot (sprinkler)</td>
<td>$5.96</td>
<td>$3.81</td>
<td>$4.22</td>
</tr>
<tr>
<td>Center-pivot (gun sprinkler)</td>
<td>$7.53</td>
<td>$4.81</td>
<td>$5.26</td>
</tr>
</tbody>
</table>

* Gasoline and diesel fuel = $1.00/gallon; electricity = $0.08/KWH; pump efficiency = 65%; gasoline engine efficiency = 65%; diesel engine efficiency = 70%; electric motor efficiency = 90%. More efficient pumps would decrease pumping costs. Proper pipe size to reduce friction loss should also reduce pumping costs.