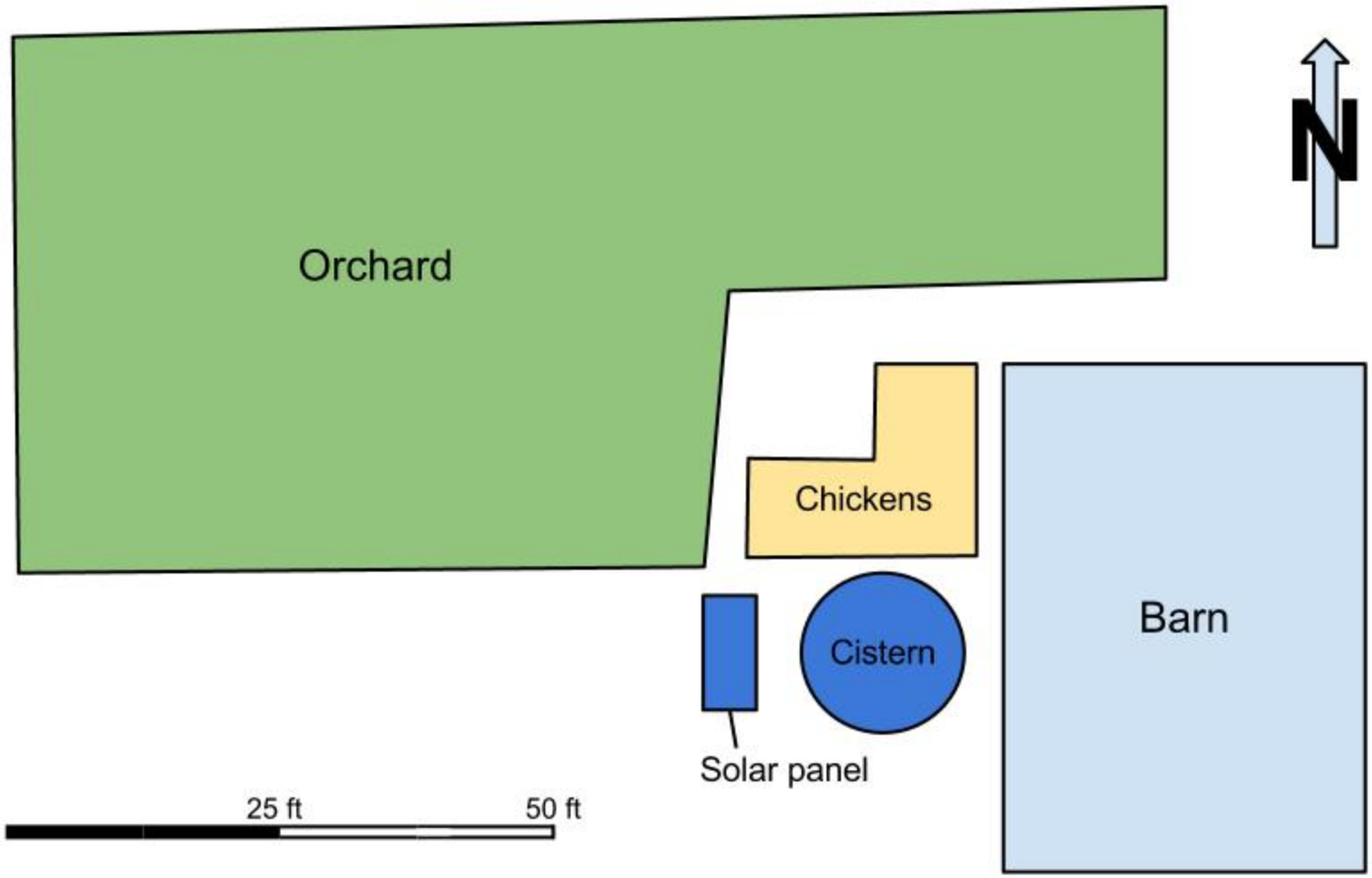
Water Catchment at a Small Farm

Ben Mills
Chris Pate
Kelly Raynor

Zenger farm

Rain Collection


Orchard
N
Chickens
Barn
Cistern
Solar panel
25 ft
50 ft


Apples
Plums
Pears
Cherries
Blueberries

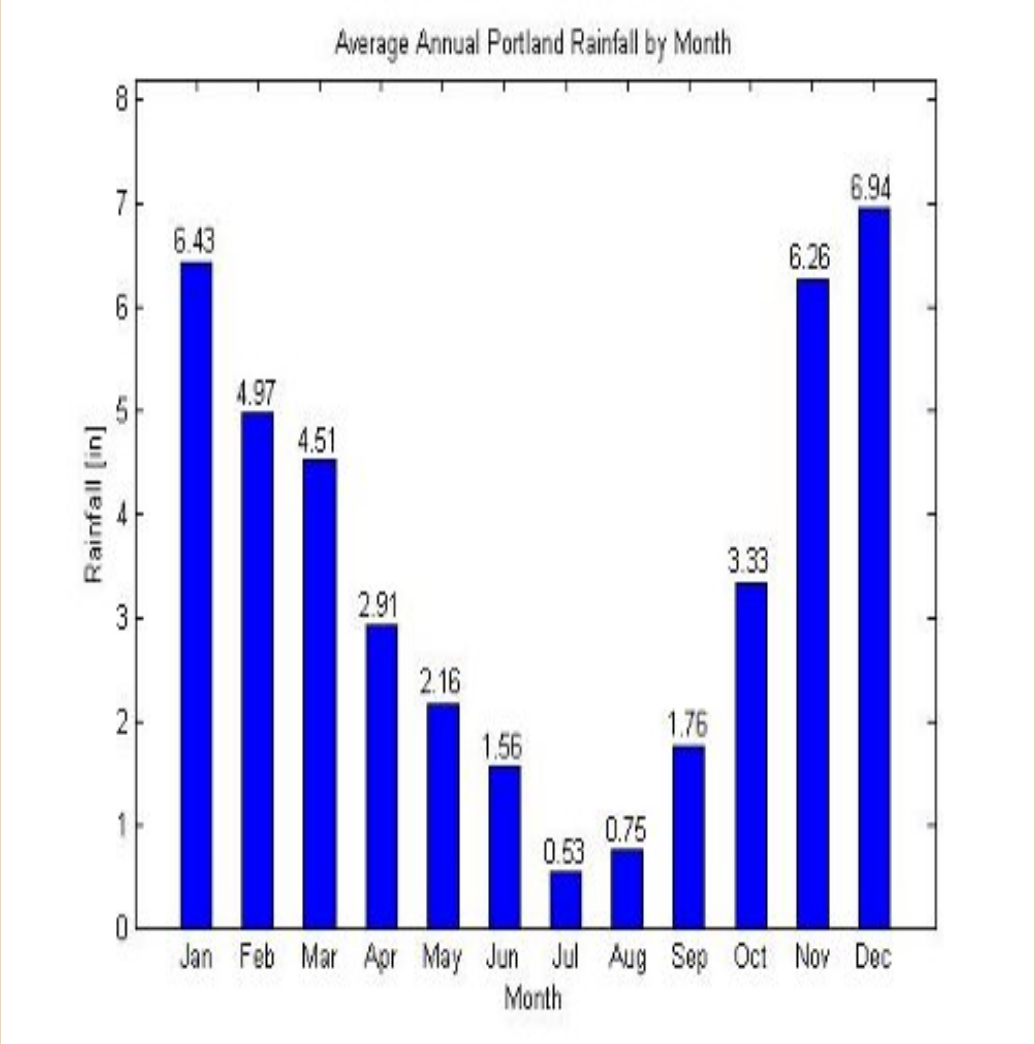
Irrigation needs

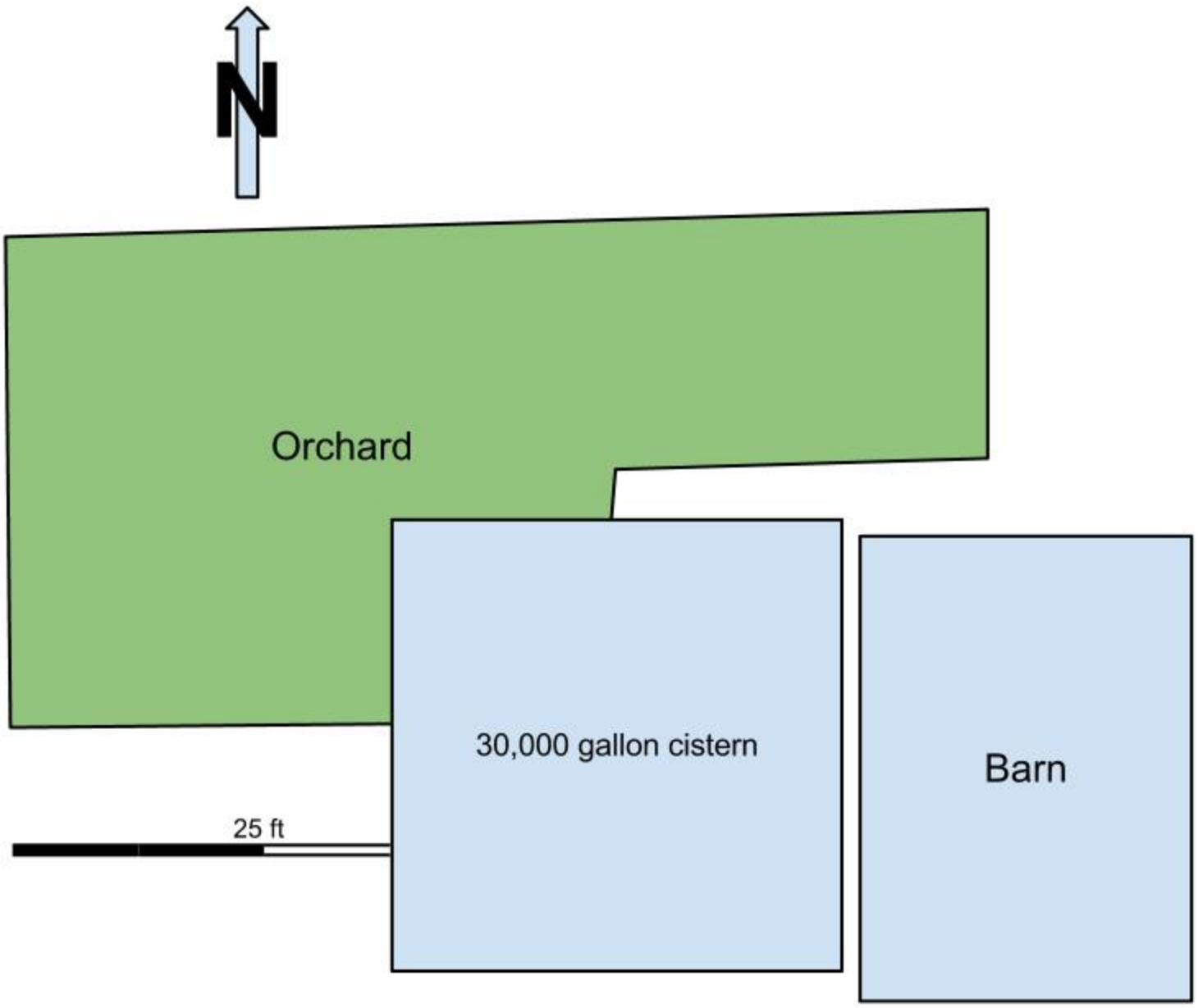
- Irrigation needs determined by assuming that less than half of 4,200 square foot area would need to be watered
- Four hundred square feet of each of the 5 crops
- Net irrigation needs from Oregon Extension Service, assuming adequate water for 7 out of 10 years

Month	Gallons needed
April	320
May	3892
June	7596
July	11904
August	9732
September	4552
October	352

Plenty of water... when we don't need it

- We are limited by our annual storage capacity, not rainfall
- To be completely independent of city water, we would need a 30,000 gallon cistern




N
Orchard
30,000 gallon cistern
Barn
25 ft

Storage options

Tank size	Gallons used	Gallons deficit
10,000	15,634	22,714
15,000	20,634	17,714
30,000	29,638	0

The Numbers

The Load

50W pump using a 12V battery

50W/12V= 4.16 Amps

4.16 Amps x 2.4 hours of operation= 10Ah

50W x 2.4 hours= 120 Wh

Water Need (Peak Demand)

384 gallons/day total

80 plants with 2gph drip emitters= 160gph, or 2.66 gpm

384 gpd/160 gph= 2.4 hours/day

Efficiencies

120 Wh/(3.7 PSH x .90(Panel) x .85(Battery) x .98(Wiring))= 43.3 Wp

Battery Capacity

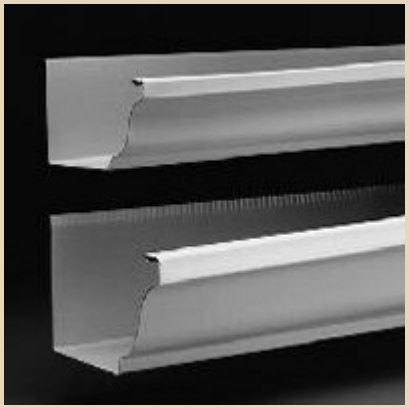
120 Wh x 3 days of autonomy, with 50% DOD= 60Ah

Materials: Solar

- One 100 Watt 100W W Monocrystalline Photovoltaic PV Solar Panel $190
- Universal One Panel Tilt Mount Kit $96
- 12 Gauge Primary Wires $25
- 12v 100 Ah marine battery $267
- Watering Timer for 12V Battery Operation $99.50
- 12v pump, battery, pressure switch, solar charge regulator, and a pressure accumulator $785 = $1462.50 for solar array, connection, and energy storage and timer

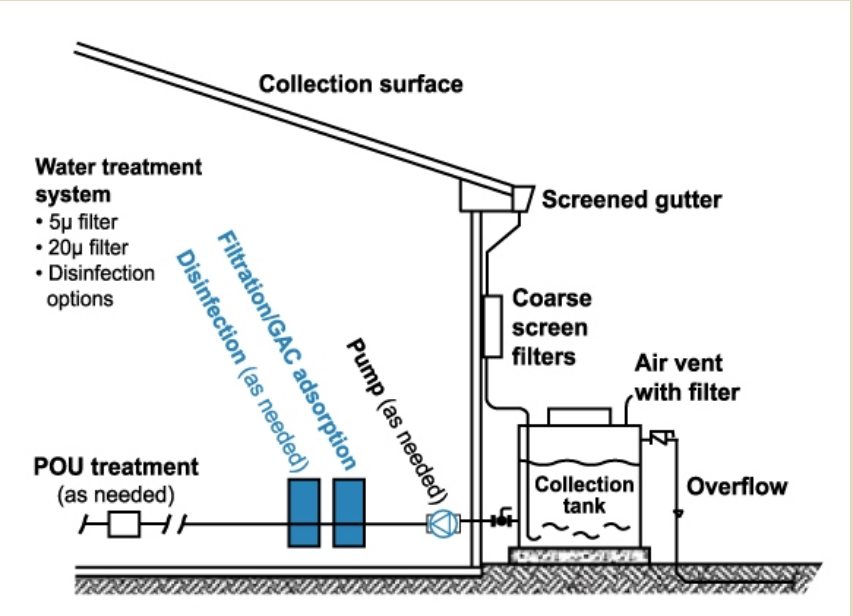
Materials: Catchment and Irrigation

- 50’- ¾” schedule 40 PVC- $12.50
- 400’- ½” drip irrigation pipe- $120
- 20 psi pressure regulator ¾”- $20
- ¾” backflow prevention check valve- $10
- 90 degree long-sweep elbow ¾”- $2
- 80- 2gph drip emitters- $25
- 10,000 gallon cistern- $5,191.50
- Gutters and downspout- $130
- $5,511 total for catchment and irrigation



Economic cost and benefit

- $6973.50 total for entire system
- Total savings for water volume: $64.50/year ($3.083 /100 cubic feet/748 gallons)
- System will pay for itself after only 109 years
- Is it worth it?



Energy Costs

- It takes 3.4 megajoules of energy to produce a 1-liter plastic bottle
- One megajoule = 2,780 watts
- Our plastic cistern holds 37,854 liters
- Roughly 128,704 megajoules or 357,796,008 watts to manufacture

References

Oregon Crop Water Use and Irrigation Requirements: http://extension.oregonstate.edu/catalog/pdf/em/em8530.pdf

Average Rainfall Chart: http://www.bryankappa.com/rainwater.html

Plastic production energy costs: http://www.pacinst.org/topics/water_and_sustainability/bottled_water/bottled_water_and_energy.html

Portland Water Bureau: http://www.portlandonline.com/water/

SunPumps: http://sunpumps.com/

System diagram: http://www.cleanairpurewater.com/rainwater.html

Energy conversion: http://www.ehow.com/how_5098975_convert-megajoules-kilowatts.html