

Sample Rainwater Harvesting calculations						
<b>Data:</b>						
<b>one inch of rain on one square foot of roof = about 0.6 gallons of water</b>						
SF Rainfall data, 1960-2006, Richmond district (inches)						
	<b>Min</b>	<b>10%</b>	<b>Mean</b>	<b>90%</b>	<b>Max</b>	
<b>October</b>	0	0.2	1.2	2.1	5.5	
<b>November</b>	0.1	1.4	3.3	6.3	10.5	
<b>December</b>	2.6	2	4	4.8	12	
<b>January</b>	0.7	3.8	4.4	5.6	12	
<b>February</b>	1	2.3	3.8	3.2	15	
<b>March</b>	0.7	2.1	3.1	6.9	9	
<b>April</b>	0	0.6	1.4	3.3	5	
<b>May</b>	0	1.3	0.5	0.7	4	
<b>June</b>	0	0	0.2	0.4	1.4	
<b>July</b>	0	0	0	0	0.7	
<b>August</b>	0	0	0	0.3	0.8	
<b>September</b>	0	0	0.2	0.5	1.3	
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<b>Example 1 -- How big a tank?</b>						
<b>roof size:</b>	2000	<b>ft<sup>2</sup></b>	<b>runoff coefficient:</b>	0.6	<b>gal/ft<sup>2</sup></b>	
	[ 1 ]	[ 2 ]	[ 3 ]	[ 4 ]	[ 5 ]	[ 6 ]
	<b>rainfall (in)</b>	<b>rainfall (gal)</b>	<b>water used</b>	<b>surplus</b>	<b>storage</b>	<b>rain used</b>
<b>October</b>	1.2	1440	3600	-2160	0	1440
<b>November</b>	3.3	3960	3000	960	960	3000
<b>December</b>	4	4800	3000	1800	2760	3000
<b>January</b>	4.4	5280	3000	2280	5040	3000
<b>February</b>	3.8	4560	3000	1560	6600	3000
<b>March</b>	3.1	3720	3000	720	<b>7320</b>	3000
<b>April</b>	1.4	1680	3000	-1320	6000	3000
<b>May</b>	0.5	600	3600	-3000	3000	3600
<b>June</b>	0.2	240	3600	-3360	0	3240
<b>July</b>	0	0	3600	-3600	0	0
<b>August</b>	0	0	3600	-3600	0	0
<b>September</b>	0.2	240	3600	-3360	0	240
	<b>total rainfall</b>	26520			<b>total used:</b>	26520
<b>[ 1 ]</b> This is the mean monthly rainfall values from the Richmond district.						
<b>[ 2 ]</b> Using a 2000 ft <sup>2</sup> roof, convert inches to gallons by multiplying by: 2000 ft <sup>2</sup> * 0.6 gal / ft <sup>2</sup> per inch = <b>1200 gal per inch</b>						

<b>[ 3 ]</b> Four people in the house * 25 gal/day of non-potable use = 3000 gal/month						
plus 20 gal/day May-Oct outside = 3600 gal/month						
<b>[ 4 ]</b> Subtract <b>water used</b> from <b>rainfall</b> to get the surplus amount of water for that month (or the amount you'll use out of the tank if it's negative)						
<b>[ 5 ]</b> Starting from the first positive number, add up the numbers in <b>surplus</b> to get the total amount of surplus rainwater you <b>could</b> have in your storage tank at the end of that month. The <b>largest</b> number is most important.						
<b>[ 6 ]</b> This is how much rainwater is used over the month, from rainfall and what's stored in the						
<b>Conclusion:</b> The largest number in the <b>storage</b> column is <b>7320 gallons</b> , so rounding up, if we had a <b>10,000 gal</b> tank then on average we'd probably get all the water we needed starting in November, and run out by June. A larger tank would let us have water longer, but only in years that are wetter than average.						
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<b>Example 2 -- How much water?</b>						
<b>roof size:</b>	2000	<b>ft<sup>2</sup></b>	<b>runoff coefficient:</b>	0.6	<b>gal/ft<sup>2</sup></b>	
<b>tank size:</b>	2000	<b>gal</b>				
	[ 1 ]	[ 2 ]	[ 3 ]	[ 4 ]	[ 5 ]	[ 6 ]
	<b>rainfall (in)</b>	<b>rainfall (gal)</b>	<b>water used</b>	<b>surplus</b>	<b>storage</b>	<b>rain used</b>
<b>October</b>	1.2	1440	3600	-2160	0	1440
<b>November</b>	3.3	3960	3000	960	960	3000
<b>December</b>	4	4800	3000	1800	2000	3000
<b>January</b>	4.4	5280	3000	2280	2000	3000
<b>February</b>	3.8	4560	3000	1560	2000	3000
<b>March</b>	3.1	3720	3000	720	2000	3000
<b>April</b>	1.4	1680	3000	-1320	680	3000
<b>May</b>	0.5	600	3600	-3000	0	1280
<b>June</b>	0.2	240	3600	-3360	0	240
<b>July</b>	0	0	3600	-3600	0	0
<b>August</b>	0	0	3600	-3600	0	0
<b>September</b>	0.2	240	3600	-3360	0	240
	<b>total rainfall</b>	26520			<b>total:</b>	21200
<b>[ 1 ] - [ 4 ]</b> Same as in example (1) -- 2000- ft <sup>2</sup> roof, four people...						
<b>[ 5 ]</b> Now suppose we have only a 2000 gallon tank, so the number in <b>storage</b> can't be larger than 2000 -- add the <b>surplus</b> from the month to the <b>storage</b>						

from the previous month, and cap it at 2000 gallons.

**[ 6 ]** Rain water used: this shows the amount of rain we used that month.

**[ 7 ] Conclusion:** With a 2000 gallon tank, we'd only have water until sometime in May, on average, and would save about 20,000 gallons of Hetch-Hetchy water.

Let's see what that would look like in a dry year:

	rainfall (in)	rainfall (gal)	water used	surplus	storage	rain used
<b>October</b>	0.2	250	3600	-3350	0	250
<b>November</b>	1.4	1750	3000	-1250	0	1750
<b>December</b>	2	2500	3000	-500	0	2500
<b>January</b>	3.8	4750	3000	1750	1750	3000
<b>February</b>	2.3	2875	3000	-125	1625	3000
<b>March</b>	2.1	2625	3000	-375	1250	3000
<b>April</b>	0.6	750	3000	-2250	0	2000
<b>May</b>	1.3	1625	3600	-1975	0	1625
<b>June</b>	0	0	3600	-3600	0	0
<b>July</b>	0	0	3600	-3600	0	0
<b>August</b>	0	0	3600	-3600	0	0
<b>September</b>	0	0	3600	-3600	0	0
	<b>total rainfall</b>	17125			<b>total:</b>	17125

**[ 7 ]** Here I used the 10% water year from the Richmond district. This means we get a year this dry about once every ten years.

**[ 8 ] Conclusion:** With a 2000 gallon tank in a particularly dry year, we'd only store water in it for longer than a month during January, February, and March... but we still use 17,000 gallons of water from the roof!

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**Blank sheets for your calculations:**

	rainfall (in)	rainfall (gal)	water used	surplus	storage	rain used
<b>October</b>						
<b>November</b>						
<b>December</b>						
<b>January</b>						
<b>February</b>						
<b>March</b>						
<b>April</b>						
<b>May</b>						
<b>June</b>						
<b>July</b>						
<b>August</b>						
<b>September</b>						

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<b>February</b>						
<b>March</b>						
<b>April</b>						
<b>May</b>						
<b>June</b>						
<b>July</b>						
<b>August</b>						
<b>September</b>						