

Water Storage Calculations

for

Ruby Alton House Water Balance Table



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**TO: Lisa Dunn and Ardice Neudorf
Islands Trust Fund**
FROM: Bob Burgess
DATE: May 25, 2005
**RE: Water Balance Table and Water Requirements
Alton House: Rainwater Harvesting Demonstration Project**

The following summarizes the total estimated amount of water that will be required by the Ruby Alton House over a typical year. In addition it estimates how much of this total will be supplied by rainwater each month, and how much stream water will be required to supplement the rainwater supply.

This analysis updates the last water storage calculation that was done in March 2005, and reflects the larger cistern size.

The attached Projected Monthly Water Storage spreadsheet entitled "Ruby Alton House Water Balance Table May 25-05" describes the amount of water that would be in a 5,980 imperial gallon cistern at the end of each month (right hand column). It is based on the following.

Rainfall Amounts:

- Average precipitation statistics for St Mary's Lake weather station are used. The attached Historical Rainfall –Variation page summarizes 22 years of rainfall statistics starting in 1981. The average annual precipitation total is 38.4 inches (975mm).
- Rainfall for the Ruby Alton House location is estimated to be approx. 15% higher than St Mary's Lake which means that the rainwater amounts used in this table should be typical for a year that is 15% dryer than normal.

Catchment Area:

- The roof catchment comes entirely from the main house, and
- the roof catchment area is 2,100 sq. ft. (195m²)

Catchment Efficiency:

- The asphalt shingle roof has a lower water catchment efficiency than other smoother surfaces such as steel or glazed tile. This is due to higher evaporation rates for light or intermittent summer rainfall events as well as the need to reject a larger quantity of the first flush of each rain. This system is designed to reject the first 0.3 inch (0.75mm) of rainfall per 24-hour period per square foot (.093m²) of roof catchment area.

- It is assumed however that the catchment system is otherwise quite efficient and collects 80% of winter rains, 70% of shoulder season rain, and 65% of summer rain with a short shut-down period and cleaning during the pollen season in April.

Indoor Water Use:

- Indoor water use reflects a conservator attitude, and assumes the use of low water use fixtures such as low flush toilets, and a water efficient dishwasher and clothes washing machine.
- A standard of 40 US gal/person/day OR 151.5 litres OR 33.3 imperial gal/person/day (G/P/D)
- Use assumes full time occupancy by a family of 4 persons. Daily use would be 606 litres or 133 imperial gallons per day.
- Monthly use is assumed to be equal in each month at 18,425 litres or 4,050 imperial gallons.

Outdoor Water Use:

- A conservative assumption of approx. 500 gallons per month of outdoor water use is added during the peak outdoor watering months – June thru Sept.
- This assumes that most of the garden watering needs are met by the separate garden water rainwater system.
- It is further assumed that a minimum of 1,500 imp. gal. will be retained in the cistern at all times to provide emergency water for fire or earthquake.

Conclusions

Using the above assumptions, rainwater catchment over a 12 month period will total almost 31,000 imperial gallons (141,000 litres). This amounts to 61% of the total annual household water demand. The house would run entirely on the rainwater from November through January each year, but will require a total of 21,300 gallons of stream water to supplement the rainwater supply. The provision of this size of cistern reduces the summer stream water demand to 2,200-2,400 gallons per month during the driest summer months.

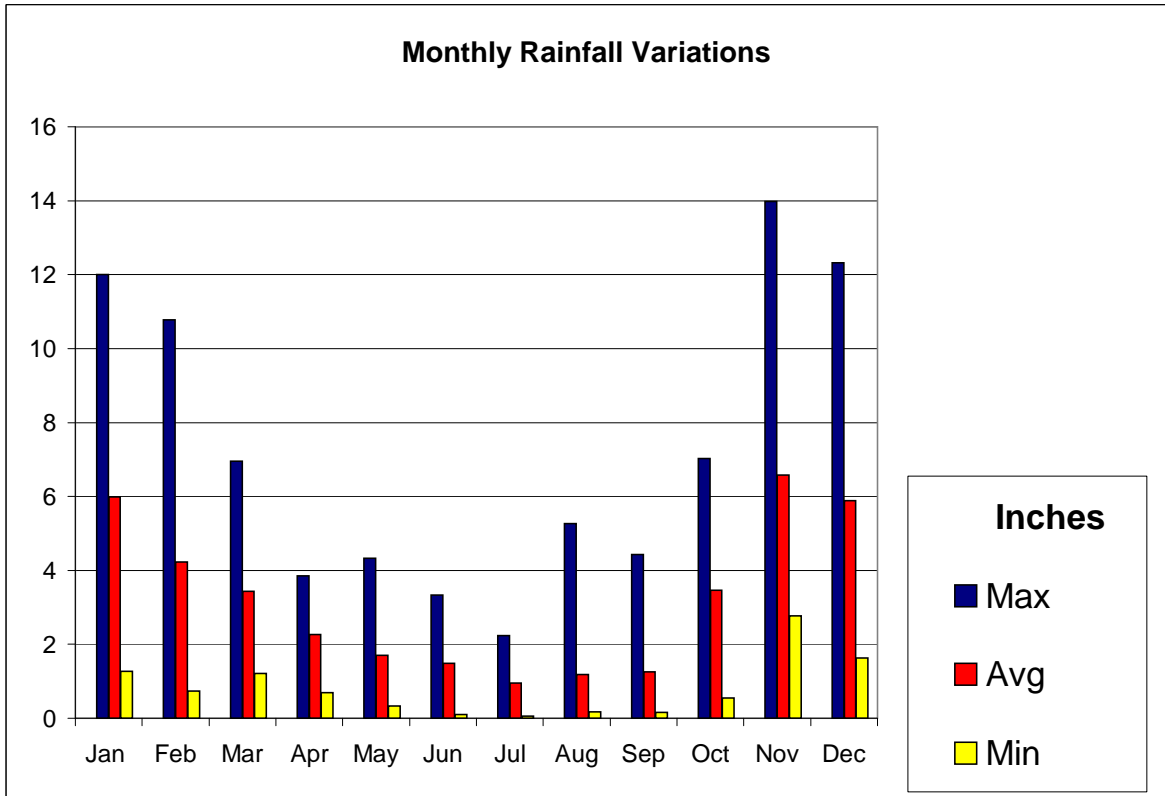
The summer draw on the stream water could be reduced by approximately 500 gallons per month if the 1,500 gallon emergency water supply requirement was used to supply the house.

Historical Rainfall - Variation
Alton Water Balance Table May25 05.xls

Factor >>>	10%	20%	30%	50%	Max	Avg	Min
Jan	4.2	4.6	5.1	6.1	12.0	6.0	1.3
Feb	3.0	3.3	3.6	4.3	10.8	4.2	0.7
Mar	2.4	2.6	2.9	3.5	7.0	3.4	1.2
Apr	1.6	1.7	1.9	2.3	3.9	2.3	0.7
May	1.2	1.3	1.5	1.7	4.3	1.7	0.3
Jun	1.0	1.1	1.3	1.5	3.3	1.5	0.1
Jul	0.7	0.7	0.8	1.0	2.2	1.0	0.1
Aug	0.8	0.9	1.0	1.2	5.3	1.2	0.2
Sep	0.9	1.0	1.1	1.3	4.4	1.3	0.2
Oct	2.4	2.7	3.0	3.5	7.0	3.5	0.5
Nov	4.6	5.1	5.6	6.7	14.0	6.6	2.8
Dec	4.1	4.5	5.0	6.0	12.3	5.9	1.6
Annual	27.0	29.6	32.8	39.3	86.5	38.4	9.7
Wet	20.8	22.8	25.2	30.2	63.1	29.6	8.2
Dry	6.2	6.8	7.6	9.1	23.5	8.9	1.5
Summer	3.4	3.8	4.2	5.0	15.3	4.9	0.5

Wet = Jan, Feb, Mar, Oct, Nov, Dec
 Dry = Apr, May, Jun, Jul, Aug, Sep
 Summer = Jun, Jul, Aug, Sep

- 10% = The 10% occurrence level indicates that 90% of the time monthly rainfall is higher
- 20% = The 20% occurrence level indicates that 80% of the time monthly rainfall is higher
- 30% = The 30% occurrence level indicates that 30% of the time monthly rainfall is higher
- 50% = The 50% (median) occurrence level indicates that 50% of the time monthly rainfall is higher
- Max = The maximum recorded occurrence is the highest recorded rainfall over the period of the data
- Avg = the average monthly (mean) occurrence levels factors in precipitation extremes
- Min = The minimum recorded occurrence is the lowest recorded rainfall over the period of the data



Alton Water Balance Table May25 05.xls
Projected Monthly Water Storage

Location
 Property
 Scenario

Collection Area #1 (sqft)
 Collection Area #2 (sqft)
 Collection Area #3 (sqft)
 TOTAL Collection Area

Max Storage Cap (gal)

Volume Units

Choose one of gal or litre

Assumed Rainfall Level used in Calculation

Enter 10% : 20% : 30% : 50% : Max : Avg :Min

Month	Indoor Usage gal/mon	Outdoor Usage gal/mon	Assumed Rainfall inches	Assumed Collection Efficiency	Rainfall Collected gal/mon	Alternate Supply gal/mon	End of month Storage gal/mon
Start							0
November	4050	0	6.6	80%	5744	0	1694
December	4050	0	5.9	80%	5139	0	2784
January	4050	0	6.0	80%	5235	0	3969
February	4050	0	4.2	80%	3689	2000	5608
March	4050	0	3.4	70%	2621	1800	5979
April	4050	0	2.3	45%	1112	2900	5941
May	4050	0	1.7	70%	1307	2800	5980
June	4050	500	1.5	65%	1058	3500	5980
July	4050	500	1.0	65%	679	2200	4309
August	4050	500	1.2	65%	842	2200	2801
September	4050	500	1.3	65%	894	2400	1546
October	4050	0	3.5	70%	2647	1500	1643
TOTAL	48,600	2,000	38.4		30,968	21,300	1,668 Surplus Supply