Old Growth Cellar rainwater catchment

From Appropedia

Introduction

Rainwater catchment is a method of capturing and storing rainwater in a tank for later use. This catchment system is designed and constructed for Old Growth Cellars in Freshwater, CA. This system will collect water off of a 482 square foot roof and store it in a 1,550 gallon tank. The harvested rainwater will be used to supplement the existing 300-foot well, which is the primary water source. The rainwater will be used to wash equipment used in the winemaking process, soak barrels in preparation for wine storage/aging, and some garden irrigation.

If you use this site as a reference for a rainwater catchment system, please tell us in the discussion tab. We would like to know that we are contributing to the assembling process and/or refurbishing of rainwater catchment or other related systems.

Old Growth Cellar's Barrels

Rainwater Warriors and Thei Creation

Criteria

1. Functional: The system needs to do its job -- capture and store rainwater from the roof, not leak or have components break, and reduce well water usage.
2. Non-intrusive: The system needs to be out of the way of winery operations.

Contents

3. Aesthetically pleasing: The system must blend in with the natural environment, especially so the neighbors will not be able to see it.
4. Durable: The rainwater catchment system must be able to withstand the most severe environmental conditions (e.g. strong winds, torrential rains, falling branches, etc.).

Design

When building a rainwater catchment system, it is important to consider numerous concepts that are critical to making a system work. Some of these include: installing a first flush system to divert the first 10 minutes of rainwater to prevent contamination by birds, dust and industry (Mollison, 166); constructing an overflow valve for excess rainwater (Mother); and selecting a closed container for storing water. We are not discussing aspects regarding roof and gutters because they

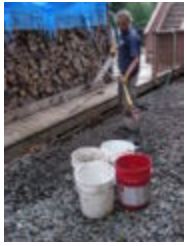
are already installed, but it is important to make sure that the gutters for the roof have been cleaned and cleared of debris.

Construction

Site preparation

Before we built the frame for the concrete slab, we cleared out the area for the main storage tank to sit. This involved cutting small trees and shrubs, leveling the earth, digging out small and large roots, and moving rock to this site.






Concrete Slab Preparation

After clearing the slab site, we started on the slab preparation. We built an 8-foot by 8-foot wooden frame for the concrete slab out of wood and nails found in the shop on site; we made sure that the ground was level for the frame to sit on by using string and a level. We filled the inside of the frame with rock and sand. The frame was designed to create a 4-6 inch slab. The frame was rebared and poured by a local contractor at the same time as a larger concrete driveway was poured at Old Growth Cellars.



Sediment extraction bucket

We measured and drilled a hole into the side of the 4 gallon square bucket. For inside the bucket, we pieced together one 90 degree PVC elbow into a 6 inch piece of 1-1/2 inch PVC pipe, fit another 90 degree elbow onto the 1-1/2 inch PVC piece and connected this piece to a reducing rubber coupler. The rubber coupler was the piece that connected the inside PVC components to the PVC tubing outside of the bucket. We made sure to silicon both inside the bucket as well as outside the bucket to seal the openings to prevent water from leaking. To secure the bucket from environmental factors such as wind, we used a 4-foot strip of flattened sheet metal and crafted it for the purpose of holding the bucket to the house. We used a drill and screws to attach the sheet metal and bucket to the house. We also set the

bucket on 2 levels of brick as well as a piece of 1-inch thick scrap wood to allow enough head from the roof catchment to the main storage tank. In order to have the water flow directly into the sediment extraction bucket, we had to cut the downspout with a hacksaw and reposition it to line up with the bucket.






First flush bucket

We measured a smaller hole and drilled into the side of the 15 gallon first flush tank. To get the plastic threaded tube inside the tank without losing it, we used a string, washer, magnet and a telescoping magnet pen to thread this piece through the tank into the opening we drilled. We placed a nut and gasket on either end of the threaded tube. Once we got the threaded tube through the hole and in the correct position, we tightened the nut/gasket with channel locks then used silicon to seal the opening and make it water-proof. At this point, we attached the plastic threaded gate valve to the threaded tube. These components make up the slow-release drip valve that will gradually let water out of the first flush system. At the top of the first flush tank, we reduced the opening to allow for PVC connection. Our primary design for the diversion of the first flush allowed some of the wash water to pass into the main storage tank. We rectified this by redesigning the T-junction (see pictures below).

Main storage tank

We transported the main storage tank from Resale Lumber in Eureka, CA and moved it from the truck to the correct position on the concrete slab. Next we assembled the various components that will connect the opening at the bottom of the main tank to a garden hose to access the stored water. To the top opening of the tank, we attached the rubber flexible coupler and a 90-degree PVC elbow to the coupler; these pieces connect to the PVC that runs from the first flush system to the main tank. The overflow tubing was attached to the main tank and a screen was attached to the end of the tubing to prevent unwanted guests from entering the tank.

Inflow.JPG

Assembly

Before we could assemble the various components of the rainwater catchment system, we first had to wash off the roof and clean the gutters of the catchment surface as well as remove redwood tree limbs from above the roof (to prevent rodent access and reduce bird droppings from entering the system). Once this acrobatic feat was accomplished, we were able to lay out the various pieces of PVC piping and their respective connection pieces (eg. 45/90 degree elbows, quick disconnects, T-junction, etc.) and glue them into place.





Final Design

- Rainwater enters the gutters attached to the roof
- Rainwater travels down the downspout and flows into the sediment extraction bucket
- Rainwater leaves the bucket, travels through the PVC pipe that runs across the roof

- At the 45 degree elbow, the rainwater changes its course and travels through PVC pipe running through the air (supported by high tensile wire) towards the main storage tank
- Rainwater is diverted to the 15 gallon first flush tank
- Once the first flush tank fills to the brim, water is channeled to the main storage tank
- A gate valve with reducers is connected to the main tank and allows for gravity-fed access to the stored water
- Once the 1550 gallon main storage tank fills to the brim, the excess water is diverted through overflow tubing downhill behind the main tank into the woods

Testing/Results

We tested our rainwater catchment system by placing a running hose into the gutters attached to the roof. We discovered that the water flows from the gutters to the first flush tank, but due to the high flow from the hose (which could easily be replicated by a storm) some water ran past the first flush tank into the main storage tank. We

redesigned the diversion configuration to rectify this problem. The only other issue that can easily be fixed is that some of the water running into the sediment extraction bucket shoots past the bucket onto the roof. We fixed this problem by adjusting the bucket's placement on the roof.

Materials/tools

Concrete Slab

- Scrap 2 by 4 wood (recovered from site)
- Rock, Sand (recovered from site)
- Concrete (factored into other concrete work done at same time by Old Growth Cellars)

Sediment Extraction Bucket

			Cost	Total

Quantity	Material	Source	($)	($)
1	4 gallon square bucket	recovered from site	0	0
	Scrap wood [for building frame for sediment extraction bucket]	recovered from site	0	0
2	square feet of wire mesh screening		1.79	3.58
2	90-degree PVC elbows		2.04	4.08
1	foot of 1-1/2 inch PVC pipe		1.90	3.80
4	foot strip sheet metal	recovered from site	0	0
1	1-1/2 inch to 1-1/4 inch reducing rubber coupler		.99	.99
4	bricks	recovered from site	0	0
			Total Cost	$12.45

From bucket to roof edge

Quantity	Material	Source	Cost ($)	Total ($)
1	quick disconnect		5.49	5.49
1	20 feet of 1-1/4 inch PVC pipe	recovered from site	0	0
1	45-degree PVC elbow		1.49	1.49
4	bricks	recovered from site	0	0
3	metal hose clamps	recovered from site	2.19	6.57
			Total Cost	$ 13.55

From roof edge to first flush tank

Quantity	Material	Source	Cost ($)	Total ($)
		recovered		

1	15 gallon first flush tank	from site	0	0
1	20 feet of 1-1/4 inch PVC pipe	recovered from site	0	0
1	45-degree PVC elbow		1.49	1.49
1	T-junction		1.29	1.29
1	2 inch to 1-1/2 inch PVC adapter		1.29	1.29
1	1-1/2 inch to 1-1/4 inch PVC adapter		.99	.99
1	quick disconnect		5.49	5.49
1	40 feet of high tensile wire	in tool shop on site	0	0
1	plastic threaded gate valve		7.00	7.00
1	plastic threaded tube		.99	.99
			Total Cost	$18.54

From first flush tank to main storage tank and beyond!

Quantity	Material	Source	Cost ($)	Total ($)
1	1550 gallon storage tank		730.00	730.00
1	2 inch brass gate valve		25.99	25.99
1	2 inch by 3/4 inch bell reducer		3.99	3.99
1	2 inch threaded plastic pipe		2.29	2.29
1	2 inch threaded metal pipe		1.29	1.29
1	3/4 inch garden hose adapter		4.39	4.39
1	garden hose	in tool shop on site	0	0
1	rubber flexible coupler		4.79	4.79
3	90-degree PVC elbow		1.29	3.87
1	24 feet of black, flexible overflow tubing		12.49	12.49

1	square foot of wire mesh screening		1.79	1.79
			Total Cost	$790.89

Miscellaneous

Quantity	Material	Source	Cost ($)	Total ($)
	nails, screws, washers, gaskets, bolts, nuts	in tool shop on site	0	0
	zip ties	in tool shop on site	0	0
1	tube of marine grade silicon		5.79	5.79
1	can PVC primer	in tool shop on site	0	0
1	can PVC glue		2.79	2.79
			Total Cost	$8.58

Total Cost=$844 (Cost for pouring the cement foundation not factored in)

Tools

- Chainsaw
- Axe
- Pick
- Level
- Tape measurer
- Pencil/pen
- Channel locks
- Pipe wrench
- Hacksaw
- Ladder
- Handsaw
- Hammer
- Drill and associated bits
- Tin snips
- Pliers

- Screw drivers (Phillips and regular)
- Pry bar
- Shovel
- Rake
- String
- Hose and water
- Dirty rags
- Sand paper

Labor

We began this project in the beginning of February, 2007. We first took measurements of the roof and calculated the roof surface area to see how much rainwater we would be able to potentially collect. We decided on the size of the main storage tank from these calculations. Next, we cleared the area where the storage tank would sit of brush, leveled the ground for the concrete slab, built a frame for the slab and had the concrete poured into the frame. Because the labor for the concrete slab was contracted out, it was poured at the end of March;

due to this fact, we were not able to construct the actual rainwater catchment system until the beginning of April. Constructing the rainwater catchment system took approximately three days; this construction included moving the main storage tank to the designated location, piecing together all of the PVC tubing and fittings, making the sediment extraction bucket, cleaning the gutters on the roof, and all the other unforeseen details involved in this process.

Maintenance

For maintaining this rainwater catchment system, keeping the gutters on the catchment surface clean and clear of debris is crucial; the gutters will most likely need to be checked and cleaned every year. The sediment extraction bucket will need to be checked and most likely cleaned twice a year. On the sediment extraction bucket, we designed the wire mesh screening to have a conic shape so that leaf litter and other debris that will pass through the downspout from the roof will collect on the screen and eventually fall off. The main storage tank will need to be cleaned on an annual basis.

Conclusions/Discussion

Our rainwater catchment system is functioning adequately. Because we are not God and cannot spontaneously make rain clouds appear from out of nowhere, it is difficult to realistically test how light and heavy rainfall on our catchment surface will affect the whole rainwater catchment system. We are expecting to make minor adjustments as we see fit in the future. Currently, we are very pleased with the outcome of this project. If we were to do this project again, we would like to have been more involved with the actual process of pouring the concrete slab (since the work for this happened to be contracted). Other than small details we learned along the way, mostly involving materials and design/construction techniques, we feel that we have produced an exceptional product.

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See also

- Rainwater catchment basin for emergency use, Terceira island, Azores (posting inspired by this Old Growth Cellar page)

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