RAINFALL CATCHMENT REPORT FOR:

Emerald Mines Corp.

Dinsmore, CA

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CPESC #361

Contents

Introduction

This report was prepared for designing a rainfall catchment system to collect and store rain water for irrigation uses at the Emerald Mines Corp. farm in Dinsmore, CA. The property owner wants to store up to 100,000 gallons of rainwater during the rainy season for irrigation during the dry season. Computing rainfall catchment water volumes and flow rates was done using the best available data on rainfall frequencies and depths and by using widely accepted methodologies. Data sources are listed at the end of this report.

The property owner requires a total water storage volume of 100,000 gallons to ensure sufficient irrigation capacity through the dry season. Rainfall catchment areas consist of existing buildings on the property, as well as one of the greenhouses. The total catchment area using these structures is 4,015 square feet (sq ft).

Rainfall and Catchment Volumes

Average annual rainfall for the subject property is estimated at 65 inches. Rainfall can vary a lot from year-to-year. To ensure sufficient irrigation water is harvested for a range of rainfall years, catchment volumes for wet, average and dry years were estimated. Table 1 presents annual rainfall depths and catchment volumes for the annual average, maximum, and minimum rainfall, along with averages for the ten driest years ("Dry Years") and the ten wettest years ("Wet Years") for the available record (1950-2022; 73 years). The driest year of record (2013) had only 26.6 inches, less than half the average, while the wettest (1983) had 121 inches. These extremes are presented for informational purposes only. For sizing the catchment system, mean rainfall for the ten driest years has been chosen as a conservative catchment area target, and the owner has designated four structures to meet this target (Table 2). Using the "Dry Years" rainfall of 41 inches, the annual catchment volume is estimated at 102,500 gallons, which meets the owner's target of 100,000 gallons.

Annual Catchment Volumes	Minimum	Dry Years	Average	Wet Years	Maximum
Total Catchment Area (sq ft) =	4,015	4,015	4,015	4,015	4,015
Annual Rainfall Depth (in) =	26.6	41.0	65.4	93.3	121.0
Annual Catchment Volume (gal) =	66,446	102,517	163,715	233,518	302,875

Table 1. Range of annual rainfall depths and catchment volumes for subject property.

Should the owner wish to increase storage capacity in the future, there will be substantial rainfall catchment volume excess in most years (i.e., excluding severe drought years) for expansion of the catchment storage system.

Table 2 lists catchment volumes as proportioned among the four individual catchment structures to be utilized. Average, minimum, and maximum annual volumes, along with averages for the ten wettest and driest years for the available record are also shown to describe the range of expected conditions likely to occur over time.

Rainfall Catchment Source(s)	Total Area	Greenhouse #4	Ag. Barn	Guest House	Harvest Bldg.
Rainfall Catchment Effective Area (sq. feet) =	4,015	2,520	728	575	192
Proportional Area =	1.00	0.63	0.18	0.14	0.05
Average Annual Catchment Volume (gal)	163,715	102,755	29,685	23,446	7,829
Expected Annual Catchment Volume Range (gal)					
Minimum Annual Catchment Volume	66,446	41,705	12,048	9,516	3,178
Ten Driest Years Annual Catchment Volume	102,517	64,345	18,588	14,682	4,902
Ten Wettest Years Annual Catchment Volume	233,518	146,567	42,341	33,443	11,167
Maximum Annual Catchment Volume	302,875	190,098	54,917	43,376	14,484

Table 2. Estimated annual catchment volumes for individual catchment areas spanning the range of expected rainfall conditions.

A shorter time step for estimating catchment volumes can help with intra-annual irrigation water management. Table 3 shows the distribution of monthly average rainfall and catchment volumes. Dry years will harvest proportionally lower water volumes, while wet years will harvest proportionally higher volumes than the data shown in Table 3. The seasonality of rainfall in the area causes high variability from month-to-month. Management of the rainfall catchment system would benefit from taking this into consideration.

Average Monthly Catchment Volumes						
Total Catchment Area (sq ft) =	4,015	4,015	4,015	4,015	4,015	4,015
Month =	Jan	Feb	Mar	Apr	May	Jun
Monthly Rainfall Depth (in) =	11.02	10.56	8.61	5.55	2.80	1.08
Monthly Catchment Volume (gal) =	27,582	26,433	21,553	13,877	7,004	2,707
Month =	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Rainfall Depth (in) =	0.11	0.09	0.78	4.33	7.83	13.30
Monthly Catchment Volume (gal) =	273	223	1,950	10,848	19,583	33,291

Table 3. Monthly average rainfall and catchment volumes.

Piping and Storage Facilities

Rainfall catchment storage will consist of an array of tanks of various sizes as shown below:

Storage Tank Array		
Tank Vol. (gal)	#	Total Vol. (gal)
5000	14	70000
3000	4	12000
2500	4	10000
	Total =	**92000**

Details of catchment piping systems (layout and plumbing specifications) will be determined prior to construction. Runoff from the four catchment structures (see Table 2) will be captured by downspouts and piped to the tanks. To avoid exceeding the capacity of the plumbing system and causing leaks or backup, pipes connecting the downspouts to the tank array, and between individual tanks, will be sized to meet or exceed estimated peak stormflow catchment flow rates. A default pipe size is 3 inches in

diameter, which conforms to joining with typical residential gutter and downspout sizes. Large rainfall collection areas, such as Greenhouse #4 at 2,520 square feet, may require larger downspouts and piping, depending on the location and number of downspouts utilized, and how they are connected. For such areas, the required pipe size can be calculated, if necessary, using data assembled for this report.

Gutters will collect roof runoff, which will discharge into downspouts and then into the PVC piping system. It is recommended that gutters be fitted with screens and that leaf debris diverters be installed below all downspouts to prevent blockages and maintain good water quality in the tanks. For maintaining the highest water quality, first flush diverters may also be installed below the downspouts. Tanks will be fitted with overflow spouts as needed, with each having a flap valve screen to prevent debris or pests entering the tanks. These possible system components are shown below.

Catchment System Maintenance

This catchment system is designed to require a modest amount of maintenance, consisting mainly of inspecting, and if needed, cleaning debris from gutters, piping, and tanks on a periodic basis. Depending on which ancillary equipment is utilized and site conditions (presence of trees, localized dust conditions, etc.), this may be a very small or a larger task, and be required yearly or more frequently.

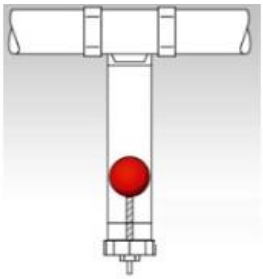
Possible Ancillary Equipment

(no product endorsement is implied)

Gutter Screen

Leaf Debris Diverter

First Flush Diverter



Tank Overflow Spout

Data Sources

Rainfall frequency estimates: https://hdsc.nws.noaa.gov/hdsc/pfds

Site-specific rainfall: https://prism.oregonstate.edu/