RAINWATER HARVESTER 2.0

Instructions below are for the Rainwater Harvester version 2.0; to download please visit www.bae.ncsu.edu/topic/waterharvesting/index.html, and click on 'Computer Model' at top.

Step 1: Site Characteristics

Before using the Rainwater Harvester Model to determine an appropriate cistern size, please determine the effectiveness of this BMP at treating an existing water quality concern. Specific information necessary to utilize this Model includes:

- Rooftop drainage area
- Water use type (what will the cistern water be used for)
- Water use demand (how much water will be needed) in gallons / day

Step 2: System Design Model Inputs

- Fill in data on the System Design section (farthest left tab)
- Rainfall Input File – click "browse" and choose "daily" file for city closest to project
- Roof Area – enter total contributing roof area in square-feet
- Capture Factor – default setting is 0.9
- City – choose city closest to project; this will fill in water and sewer costs, and nitrogen
- Water Quality Volume Depth or First Flush Depth refers to the depth of rainfall containing the most polluted runoff. The default is 1" for most counties. For the 20 coastal counties = 1.5".
- Cistern Volume – a value must be entered here. Fill in an estimated size based on contributing roof area; a good starting point may be 1 gallon per 1 square foot.
- Cistern Cost – a value must be filled in here, but it does not impact the model outputs.
- Backup Water Supply – this is typically NOT checked. It is only used for large designs where potable water is used as a backup system to fill the cistern.

Step 3: Water Usage Model Inputs

Accurate water usage data is essential. Ideally, water usage measurements should be collected at the location where the cistern will be installed. These usage estimations can be collected with a variety of inexpensive flow metering devices. A good estimate for the flow in a residential garden hose is 8-10 gallons/minute

Note: this model will simulate various situations, but cistern usage is best when landowner applications are at least weekly. For example, if the landowner will use this water only once/month (and rainfall is measured on a daily basis), perhaps this is not the best application.

Fill in water usage data on the appropriate tab; "Basic Usage", "Custom Usage" or "Irrigation". The information input on all tabs will be used to simulate situation.

- **Basic Usage tab** should be utilized if the cistern will be used to flush toilets, or if we have data on how many gallons will be used *per day* (consistently); also can be used to enter how many gallons will be used per day in a given month (if the landowner will be using more gallons per day in summer months, this can be reflected here).

- **Custom Usage tab** should be utilized if we have data on how many gallons will be used *per week* (consistently on a given day). This is the most commonly used.

- **Irrigation tab** should be utilized if cistern will be used for *irrigation*;
    - Load PET data (button on right) - Raleigh data can be used for all NC locations
    - Irrigated Area – enter total area in square feet that will be irrigated
    - Irrigation System – choose from drop down list – this will fill in Irrigation Efficiency
    - Soil Texture – select a soil texture and this will load the Plant Available Water
    - Irrigated Crop – select from the drop down list – this will fill in Effective Root Depth
    - Allowable Water Depletion can be customized, based upon how dry the crop will be allowed to become prior to irrigation (default setting is 50%)
    - Months of Irrigation – select these based upon landowner guidance

Step 4: Model Simulation

- Select "Output" tab (far right)
- Click "Simulate" in lower right-hand corner
- The Model will generate results… pay particular attention to 4 Output items:
    MAXIMIZE – Total Volume Captured
    MAXIMIZE – Usage Replaced
    MINIMIZE – Overflow Frequency
    MINIMIZE – Dry Cistern Frequency
- The desired outputs are when the frequency of a dry cistern is balanced with the frequency of the cistern overflowing.
- The cistern is too small if Usage Replaced and Total Volume Captured are low and Overflow Frequency is high.
- The cistern is too big if Dry Cistern Frequency and Overflow Frequency are close to zero and Usage Replaced and Total Volume Captured are close to 100%.

- The GOAL is to determine the best scenario for the least amount of money.
- It is recommended to run the model several times, changing the cistern volume, to find the optimal situation (you may wish to chart the 4 major outputs, based on cistern size).
- For CCAP purposes, it will be most important to maximize Total Volume Captured and minimize Overflow Frequency.

Step 5: CCAP Application Requirements

Once a compromise has been reached between system design and cost and an appropriate size has been determined ~

- Save your Output by clicking on the button at the bottom of the Outputs tab.
- This will allow you to Save the Excel file to a location on your computer.
- Please note that ONLY the 1st page of the file should be printed (the file is 200+ pages)
- The Rainwater Harvest Model Outputs must be sent in with the CCAP application.
- In addition, the Cistern Checklist is required as well to document the existing water quality concern and the effectiveness of a cistern at treating this problem.
- These documents are also required when submitting a CCAP Engineering Request.

For more information, please refer to the NCSU Rainwater Harvester 2.0 User Manual