

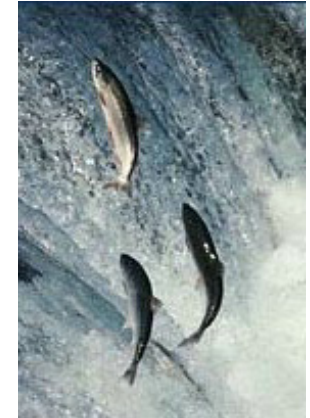
Rainwater Collection Tech Brief	Concepts
	System Sizing
	System Configuration
	Case Study & Resources

What is Rainwater Collection?

Rainwater collection is the process of collecting, storing and reusing water that falls on a building. Typically it is easier to harvest rainwater in this manner, rather than treating water from the site that has accumulated ground-based contaminants.

Goals for Rainwater Collection

Rainwater is collected in order to offset the use of municipally treated potable water. Use of rainwater benefits the local environment by reducing the draw from local water bodies and by decreasing the volume of runoff and contaminants that must be municipally treated. Storage is critical to rainwater collection, as it accommodates the inconsistent nature of rainfall. However, in order to minimize the size of storage tanks, the first goal should be to reduce the building and site water demand. Then, after water use is minimized, calculations can be performed to estimate the ability of the rainwater system to offset potable water use.



How Much Rainwater Can Be Collected?

The amount of rainwater available for collection is inherently limited by the local climate. Typically rainfall is assessed in terms of average daily or monthly volumes. However, it is important to understand that rainfall is a seasonally variable resource that varies from day to day. **Figure 1** shows the difference between average daily rainfall and actual daily rainfall in both volume and consistency. This underscores the importance of storage, and how collection capacity will affect the capability of a system to provide a consistent source of water through extended periods of dry weather.

Matching Use and Rainwater Volume

Selecting the appropriate use for rainwater is dependent on the volume, consistency and type (potable or non-potable) of the demand. There are three uses for rainwater that are typically considered: irrigation, toilet flushing, and domestic potable water. Treatment requirements vary for each use, as water used for toilet flushing or irrigation requires less purification than water supplied to sinks and lavatories. Most regulated water fixtures within a building, such as toilets and lavatories, are used consistently throughout the year. Process (sometimes called industrial) loads and irrigation, however, may vary seasonally or monthly. A water balance analysis can aid in matching the volume of rainwater that can be collected with an appropriate water demand of a building.

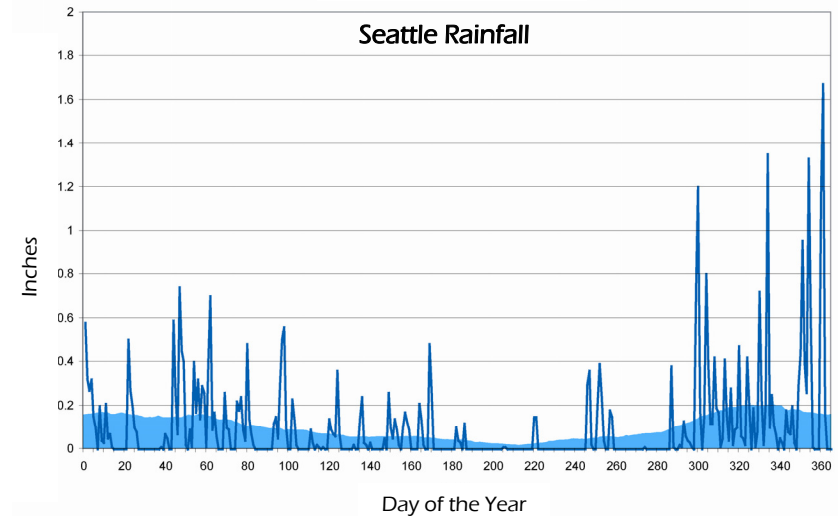


Figure 1: A comparative graph showing average daily rainfall (shaded area) and actual rainfall data (dark line) for the Seattle climate.

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System Components

1. Roof Collection

Water is collected off a roof surface, which is sloped towards one or more drainage points to support gravity-fed flow to the storage tank.

2. Screens

Screens are installed in-line with the drainage system to prevent large debris and sediments from entering the storage tank. One or more grades of screening can be used (1/4" and 1/16" are typical), and should be installed in a location that allows for easy access and maintenance.

3. Storage Tank

Storage tanks are installed to provide a constant flow of water to the building. Overflow valves are installed to prevent overflowing, while a float switch is installed to trigger municipally supplied makeup water when storage volumes drop below daily demand. This assures that water is always available through periods of dry weather.

4. Pumps

Pumps are installed to force outflow water through the filtration media and to supply adequate pressure for use inside the building. Pumps are triggered by a pressure drop in the supply side pressure tank, signaling fixture use.

5. Water Treatment

Different treatment options are available depending on the level of sanitation desired. Sewage conveyance requires only the removal of biological solids, which can typically be accomplished through the use of a 20-micron sand filter or cartridge. Potable water use requires more extensive filtration, in addition to redundant chemical or ozonation treatment.

6. Pressure Tank

A pressure tank reserves enough water to provide adequate pressure to the building and retains a large enough volume to prevent the pump from running excessively.

7. Fixtures

Sewage conveyance using rainwater requires an additional greywater line to toilets and other non-potable end uses, while potable water use connects directly into conventional plumbing lines. As with any water fixtures, drain lines must be connected to either the municipal sewer or to an on-site waste water treatment facility.

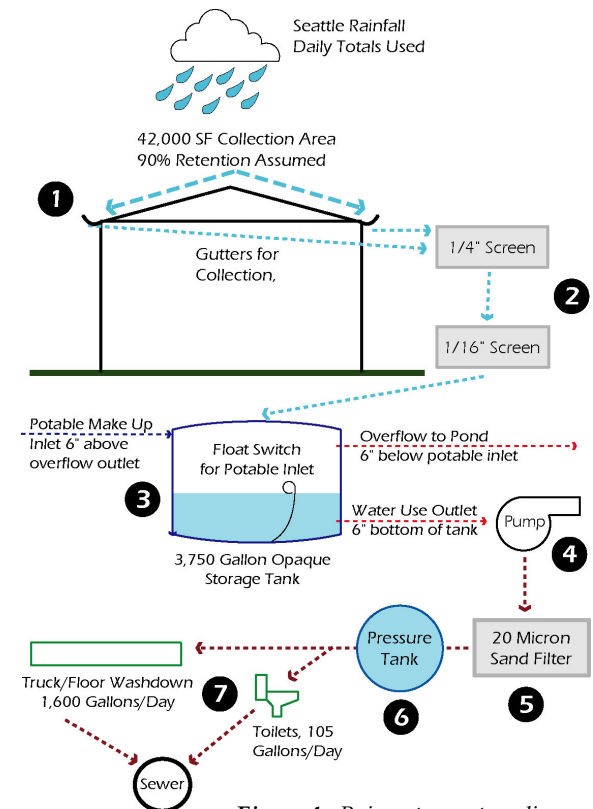


Figure 4: Rainwater system diagram.



Figure 5: Examples of system components: pump, filter and tank.

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Case Study

1st NE Transfer Station, Shoreline, WA

The 1st NE Transfer Station is a municipal waste transfer facility which will be located in Shoreline, WA. While the facility will use a significant amount of water for people (toilets, showers, and sinks), it was discovered that much more water will be used to wash the 42,000 SF floor of the facility. This process water is an ideal match with rainwater collection as it is a consistent water use and does not require potable water. To wash the floor each day requires approximately 1,600 gallons of water, or roughly 585,000 gallons annually.

When preliminary sizing calculations were performed, it was quickly apparent that rainwater collection was feasible due to two key factors: 1) the facility has a large roof area and 2) the typical small rain events prevalent in the Seattle climate could supply consistent water volumes. To optimize the system, different sizing scenarios were calculated for three different areas of collection and four different tank sizes (**Figure 6**).

The optimization calculation helped the design team realize that the critical sizing factor was the area of roof collection and not the size of the tank. Ultimately scenario A-1 was selected that proposed a collection area of 42,000 SF and a 3,750 gallon storage tank. This scenario saves the facility more than 254,000 gallons per year, which represents a 57% reduction in annual water use. While scenario A-4 could save roughly 16% more water, the 14,800 gallon tank was significantly more expensive than a 3,700 gallon tank. As the annual dollar saving difference between the two tanks was only \$393 more per year, it was determined that a larger tank was not worth the added capital expenditure for it. Please refer to **Figure 4** for a diagram of the proposed rainwater system.

The project has been slated for construction in 2006.

Additional Resources

- ❑ The Texas Manual on Rainwater Harvesting:
http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf
- ❑ King County Sustainable Stormwater Management Tech Brief:
<http://www.metrokc.gov/dnrp/swd/about/green-building-team/documents.asp>
- ❑ King Street Center virtual tour, including a description of the rainwater catchment system:
http://dnr.metrokc.gov/dnrp/ksc_tour/

1st NE Transfer Station Sizing Assumptions:

- 105 gallons per day for occupants (potable)
- 1,600 gallons per day for process (non-potable)
- Seattle Climate Data for a typical year
- 42,000 SF roof
- 90% of water that falls on roof enters the tank
- Municipally supplied water is used as a backup

	Tank Size	Roof Area	Potable Inflow	Savings	Water Reduction
C-1	3,700	16,800	338,015	\$ 1,011	42%
C-2	7,400	16,800	307,548	\$ 1,136	47%
C-3	11,100	16,800	298,105	\$ 1,175	49%
B-1	3700	25,200	293,409	\$ 1,194	50%
C-4	14,800	16,800	292,499	\$ 1,198	50%
B-2	7,400	25,200	254,744	\$ 1,352	56%
A-1	3,700	42,000	254,430	\$ 1,353	57%
B-3	11,100	25,200	234,642	\$ 1,434	60%
B-4	14,800	25,200	223,542	\$ 1,480	62%
A-2	7,400	42,000	205,338	\$ 1,554	65%
A-3	11,100	42,000	180,409	\$ 1,656	69%
A-4	14,800	42,000	158,630	\$ 1,746	73%
Total Water Use			585,000	\$ 0.0041	Cost/Gallon H2O

Figure 6: Savings comparison chart for different system scenarios. Option A-1 was selected as the optimal combination of tank size, cost and savings.

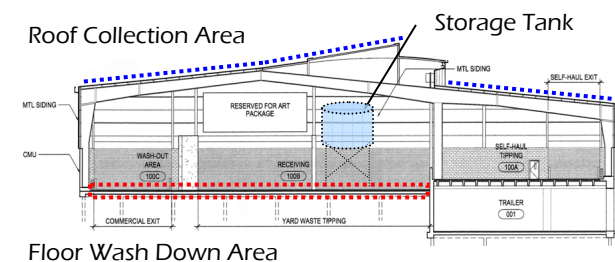


Figure 7: Section of the 1st NE Transfer Station with relative placement of the rainwater system components.