4.3. Cisterns and Rain Barrels

Rain barrels, cisterns, and tanks are structures designed to intercept and store runoff from rooftops. Rain barrels are used on a small scale while cisterns and tanks may be larger. These systems may be above or below ground, and they may drain by gravity or be pumped. Stored water may be slowly released to a pervious area, used for irrigation, or plumbed into buildings per code for use inside. These techniques only serve as an effective storm water control function if the stored water is emptied between most storms, freeing up storage volume for the next storm.

Key elements:

- Storage devices designed to capture small, frequent storm events with opportunity for larger storm volume capture.
- Storage techniques may include rain barrels, underground concrete or prefabricated tanks, above ground vertical storage tanks, or other systems.
- Systems must provide for storage, overflow or bypass of large storm events per local storm water management requirements.
- Placement of storage elements higher than areas where water will be reused may reduce or eliminate pumping needs.
- For effective storm water control, water must be used or discharged before the next storm event.
- Most effective when designed to meet a specific water need for reuse.

Table 4.3.1: Rain Barrel Potential Application and Storm Water Regulation

Potential applications			**Storm water regulations**				
				Infiltration		No Infiltration	
Residential Subdivision:	Yes			RB	Cistern	RB	Cistern
Commercial:	Yes		Water Quality Benefit	Yes	Yes	Yes	Yes
Ultra Urban:	Limited		Volume Reduction	Yes	Yes	Yes	Yes
Industrial:	Yes		Attenuation Benefit	Yes	Yes	Yes	Yes
Retrofit:	Yes						
Highway Road:	No		Level of Benefit dependent on design criteria				

Acceptable forms of pre-treatment

- Screens
- First Flush bypass

Rain Barrels, Cisterns, and Tanks in the Urban Landscape

Rain barrels, cisterns, and other tanks are storage devices meant to promote detention of storm water runoff. Collectively or alone, these systems can be effective at preventing large volumes of storm water from entering the sewer system. Rain barrels, cisterns, and vertical storage are suitable where there is a use and need for the stored water or where there are areas to which water can be slowly released between storms. Rain harvesting storage can be used with existing buildings, new development, and redevelopment areas. Each of these areas can incorporate these systems into their storm water management plan. The design of these systems can be flexible due to the numerous design opportunities to capture and reuse storm water. The application and use of rain barrels, cisterns, or other tank storage systems are not limited to the examples provided below.

Rain Barrels on Individual Homes

The most common use of rain barrels is connection of one roof leader (downspout) to a single barrel on a residential property. Stored water can provide irrigation for a garden or can be released slowly to a lawn. Barrels can either be purchased or can be built by the homeowner. They are ideal for gardeners and concerned citizens who want to manage storm water without a large initial investment. They are also an easy retrofit. A design professional and storm water design calculations are typically not needed. The labor and installation can generally be performed by the property owner or handyman. The materials necessary are generally low cost and can be found at local retail hardware or plumbing supply stores.

Large Surface Tanks

Surface tanks may be larger than rain barrels but serve the same function. They can be integrated into sites where a significant water need exists or rain harvesting and reuse is desired. They may drain by gravity or be pumped. These typically need design professional assistance for more complex water collection and delivery system design. Typically need to be installed to local code by a certified and bonded plumbing or construction contractor.

Subsurface Storage and Water Reuse

Subsurface systems can be larger and more elaborate than rain barrels. These systems are typically pumped and may be used to supply water for building use or for irrigation systems. Because the cisterns are below the surface, they do not interfere with the landscape. These systems have higher initial costs than rain barrels and are ideal for commercial and institutional sites.

Water Features in Public and Institutional Landscapes

Architectural designs have incorporated water storage into site design. Features such as water fountains and ponds capture storm water from design storms to provide a water sources for these landscape features. These typically need design professional assistance for more complex water

collection and delivery system design. Typically need to be installed to local code by a certified and bonded plumbing or construction contractor.

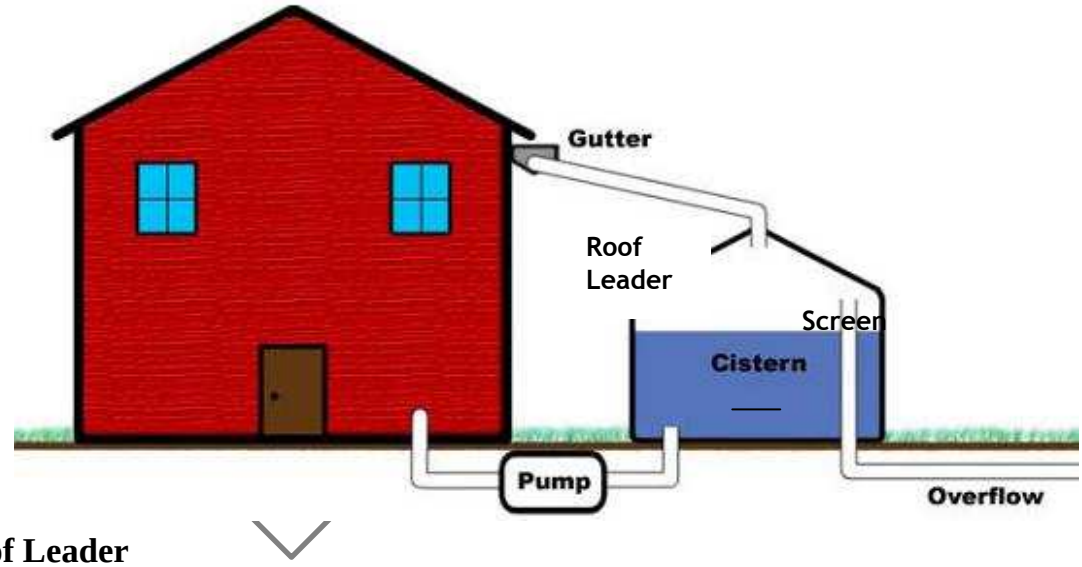
Reusing Storm Water for Indoor Use

Roof runoff can be captured and stored for reuse for residential, commercial or industrial needs. Roof runoff used in toilets does not need to meet potable water standards, but care must be used in plumbing to the building. Potable re-use systems for harvested rain water must comply with local plumbing and health codes. Supplementary and/or backup potable water systems must be maintained separately with all appropriate backflow prevention protection.

Components of Rain Barrels, Cisterns, and Tanks

Rain barrels, cisterns, and tanks all require the following basic components:

- a roof leader or other means of conveying roof runoff to the storage element,
- a screen to prevent debris and mosquitoes from entering,
- a storage element,
- a slow release mechanism or pump, a reuse opportunity, or infiltration area, and
- an overflow mechanism to bypass larger storms, after the storage element has filled.



Roof Leader

The gutter and roof leader system collects rooftop runoff and conveys it to the rain barrel, cistern, or other storage element. In most cases conventional roof leaders and downspouts can be used for this purpose.

Screen

A screen keeps leaves and other debris from entering and clogging the storage element. A screen also prevents mosquitoes from breeding in the storage element. A screen is typically placed at the end of the roof leader, before flow enters the rain barrel or cistern. A leaf strainer may also be placed where the gutter connects to the roof leader.

Storage Element

The storage element is the barrel, cistern, or tank itself. Rain barrels are typically made of plastic. Underground cisterns may be poured concrete or prefabricated plastic tanks similar to septic tanks. Proprietary products that store water in a variety of structures are also available. Tanks larger than rain barrels may be used above or below ground.

Slow Release Mechanism or Pump

For the storage element to serve its storm water control function, it must be partially or completely drained between most wet weather events. Rain barrels are typically drained in one of two ways: manually by means of a spigot similar to ordinary outside water faucets; and, the continual, slow release using a soaker hose to a garden or infiltration area. Larger surface tanks may drain by gravity or may be pumped. Subsurface systems and systems where storm water is reused for needs other than irrigation are typically pumped.

Overflow Mechanism

The storage capacity of rain barrels, cisterns, and other tanks may be exceeded in large storms. In rain barrels, a flexible hose is provided at an elevation near the top of the barrel. The diameter of the hose is at least equal in size to the roof leader to allow runoff to flow unimpeded during large events. The overflow from cisterns and larger tanks can occur through a weir, pipe, or other mechanism.

Table 4.3.2: Suggested Storage Design Values for Rain Barrels	
Rain Barrel	50 - 150 gallons
Cistern	500 - 7,000 gallons
Larger Above Ground Tank	3,000 - 12,000 gallons

Siting Procedure Recommendation

Identify opportunities and areas where water can be reused for irrigation, released to an infiltration area, or meet indoor use needs. Estimate the rate at which water can be reused. If the process of reuse is proposed to meet the Water Quality requirement, check the local storm water design codes and ordinances. For irrigation or garden use, determine the water needs of the plants; an assumption of 1 inch per week over the soil area may be used for approximate results. Identify potential infiltration areas where water may be discharged to at a slow rate.

Rain Barrels

- Identify roof leaders where rain barrels can be installed.
- Decide whether to purchase a commercial rain barrel or to construct your own rain barrel.
- Choose between a faucet and a soaker hose. Position the outlet as low on the barrel as the design will allow to maximize storage volume. It is recommended that the design allow retention of 2 inches at the bottom of the barrel to help trap sediment and provide stability.
- Consider elevating the barrel by placing it on a stable platform (ie. cinder blocks) to increase water pressure at ground level.
- It is easiest to install soaker hoses on the ground surface. The hoses can then be easily reconfigured and moved whenever necessary. However, underground soaker hoses provide greater irrigation benefits for gardens, because the water does not evaporate. If buried, soaker hoses should be placed 2-4 inches under soil or 1-2 inches under mulch. Soaker hoses that are buried too deep can be difficult to monitor and are more prone to damage from root growth. Solid hose can be use if desired location of soaker hose is away from rain barrel.
- If emptying the barrel manually, develop a plan so that it is partially or completely emptied on average every 3 to 4 days. This is necessary so that the entire storage capacity is available at the beginning of most storms.
- Position the overflow hose to discharge larger storms. The overflow should be discharged to an area protected from erosion. At a minimum, direct the overflow to the same location as the roof leader before placing rain barrel.

Cisterns (Subsurface or Surface)

- Identify which roof leaders can drain to the cistern, and the area of roof draining to each leader.
- Estimate the storage needed. A rough estimate may be obtained by performing a weekly water balance of rainfall and water reuse. Depending on the complexity of system and/or intended reuse options, a Design Professional may need to be contracted to perform more rigorous analysis in order to best meet water demand needs.
- Design to local codes and ordinances, preparing complete construction plans and specifications.

Materials and Construction Guidelines
Rain Barrels

- Rain barrels are commonly pre-fabricated structures constructed with plastic, wood or steel.
- The container should be made of an opaque material to prevent algae growth in the stored water.
- Debris screen to keep leaves and other debris from entering and clogging the storage element.

Cisterns

- Cisterns may be constructed of fiberglass, concrete, plastic, brick, or other materials.

Maintenance Guidelines

As with other storm water management practices, these storm water storage systems require regular maintenance to ensure a prolonged life. The following table suggests maintenance activities to perform on rain barrels, cisterns, or vertical storage.

Table 4.3.3: Rain Barrels & Cisterns Typical Maintenance Guidelines (*)

Activity	Schedule
Occasional cleaning may be necessary to remove debris, such as leaves, coming off the drainage area.	As needed
Flush to remove sediment Brush the inside surfaces and thoroughly disinfect. To avoid structural damage, unprotected storage elements should be drained prior to freezing weather.	Annually
Maintain records of all inspections and maintenance activity.	Ongoing

(*) Maintenance requirements are dependent on water reuse system design.

4.3.1. Cistern/Rain Barrel Designer/Reviewer Checklist

Type and size (gallons) of storage system provided:_____

Item	Yes	No	N/A	Notes
Capture area defined and calculations performed?				
Pretreatment provided to prevent debris/sediment from entering storage system?				
Water use identified and calculations performed?				
If the use is seasonal, has off-season operation been considered?				
Draw-down time considered?				
Is storage system located optimally for the use?				
Is a pump required?				
If so, has an adequate pump system been developed?				
Acceptable overflow provided?				
Winter operation (protection from freezing) considered?				
Observation/clean-out port provided?				
Maintenance accounted for and plan provided?				

4.3.2. Cistern/Rain Barrel Operation and Maintenance Inspection Checklist

Cistern/ Rain Barrel - O & M Manual

Address of Property

BMP Narrative:

Regular inspection and maintenance is critical to the effective use of a cistern/rain barrel. It is the responsibility of the property owner to maintain all storm water facilities in accordance with the minimum design standards required by the City of Fort Wayne and this Operations & Maintenance Manual. The local jurisdiction has the authority to impose additional maintenance required where deemed necessary. The city has the right to inspect the system and to require replacement if it fails or is a threat to public safety. If maintenance does not correct the problem, full or partial replacement may be required.

Cisterns/Rain Barrels shall be in accordance with the following inspection and maintenance criteria:

Inspection Activities	**Suggested Frequency**
• Inspect to ensure that cistern/rain barrel was installed and working properly. • Certification shall be required that the constructed system meets the conditions specified on the approved plans. • Certification regarding the water tightness of the underground storage tank is required after its installation.	Post-construction
• Leaf screens, gutters, and downspouts should be inspected and cleaned to prevent clogging. • Inspect overflow device for obstructions or debris that would prevent proper drainage when storage capacity is exceeded. • Inspect to ensure overflow runoff is safely conveyed to a stable outfall that causes no problems to down gradient properties. • Dewatering in between rain events so that the required storage volume is available. • Inspect for presence of mosquito larvae.	Annually and after large storm events
• Inspect all fittings and valves for water tightness seal.	Monthly
• Above-ground systems should be disconnected, drained, and cleaned at the start of the Winter season.	Annually
Maintenance Activities	**Suggested Frequency**
• Clean leaf screens, gutters, and downspouts. • Replace overflow device if any obstructions or debris prevent proper drainage when storage capacity is exceeded. • If overflow runoff is not safely conveyed to a stable outfall and/or signs of erosion exist, stabilize and remedy problem. • Dewater in between rain events so that the required storage volume is available and sediment is removed. • Replace any system components that are not performing properly.	Annually, as needed
• Above-ground systems should be disconnected, drained, and	Annually

cleaned at the start of the Winter season.	

Address of property

Inspector:
Date:
Time:
Weather: Rainfall over previous 2-3 days? Site conditions:
Owner change since last inspection?: Y N

Mark items in the table below using the following key:

- **X** Needs immediate attention
- **–** Not Applicable
- ✓ Okay
- **?** Clarification Required

Cistern Components:

Items Inspected	Checked		Maintenance Needed		Inspection Frequency
SYSTEM COMPONENTS	Y	N	Y	N	**A, AMS**
1. Signs of clogging (e.g. screens, gutters, downspouts)?					
2. Debris accumulation?					
3. Sediment accumulation?					
4. Standing water present around base?					
5. Are valves and fittings watertight?					
ADJACENT AREAS/OVERFLOW SPILLWAY					**A, AMS**
6. Is overflow outlet clean of debris?					
7. Erosion from overflow path?					
8. Signs of water ponding?					
9. Is outlet for storm sewer system free from debris and in good working order?					
DEWATERING					**A**
10. When was Cistern/Rain Barrel Last Drained?					
OTHER					**A**
11. Physical appearance of water, any odor?					
12. Are mosquito larvae present?					
13. Have there been complaints from residents?					
14. Public hazards noted?					
15. Other (describe)?					

Inspection Frequency Key A= Annual, M= Monthly, AMS= After Major Storm

COMMENTS:

OVERALL CONDITION OF FACILITY:

In accordance with approved design plans? Y / N

In accordance with As Built plans? Y / N

Maintenance required as detailed above? Y / N

Compliance with other consent conditions? Y / N

Comments: _____

_____

_____

Dates by which maintenance must be completed: ____/ ___ / ___

Dates by which outstanding information as per consent conditions is required by: ____ / ___ / ____

Inspector's signature: _____

Consent Holder/Engineer/Agent's signature: _____

Consent Holder/Engineer/Agent's name printed: _____