

# Runoff Reduction for Stormwater Management

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# Virginia has been blessed

- Abundant natural resources
- Support and sustain economic growth
- Historically enough water, clean water
- Drought versus human demands
- Human demands versus aquatic life needs
- “Pollution drought” & “Growth drought”
- Energy is cheap & pollution removable
- Water gets little respect (until you are thirsty)

# Stormwater

*As defined in VA Stormwater Regulations:*

“means precipitation that is discharged across the land surface or through conveyances to one or more waterways and that may include stormwater runoff, snow melt runoff, and surface runoff and drainage.”



# Rainfall → Stormwater

- VA receives 40 to 46 inches a year
- Rain water is “high quality” water
- Water flowing across land surface picks up pollutants and delivers to streams
- Greater impervious % area:
  - greater runoff volume
  - higher flow velocities
  - greater pollutant load to stream
  - stream erosion & downstream flooding

# Stormwater: Best Management Practice Principles

1. Avoid destruction of water usefulness by pollution (1<sup>st</sup> rule of water conservation)
2. Stormwater is a water resource
3. Deal with rainwater where it falls.
4. Integrate stormwater management, water supply and aquatic life needs
5. Stop creating “retrofit” opportunities

# Proposed Stormwater Management Regulations – a new approach

Change from the “**Simple Method**” to a

**“Runoff Reduction Method”** for runoff calculations:

- ✓ Accommodates variations in runoff based on land cover conditions
- ✓ Allows for consideration of more variables & practices
- ✓ Engages site layout considerations
- ✓ More closely mimics real-world runoff conditions
- ✓ Volume reduction results in pollutant reduction



# Uniform Plumbing Code “Harvested Rainwater”

*Defined:* stormwater conveyed from a building roof, stored in a cistern and disinfected and filtered before being used (depending upon use)

*Use:* toilet flushing, outdoor hose bibb, irrigation, cooling make-up, fire suppression, vehicle washing



# Stormwater Harvesting

Two sources for harvesting:

1. Stormwater Harvesting (Landscape runoff )
  - All runoff from site
  - All runoff minus roof runoff
2. Rainwater Harvesting (Roof runoff)

System type depends greatly on:

- **stormwater capture point** (roof or site)
- **use purpose** (domestic, commercial or industrial)
- **economics** (initial capitol costs and future savings)
- **site physical constraints**
- **human considerations**

# Water Use

- >60,000 water supply plants in US
- Typical US indoor per capita water use is 70 gallons per day; add outdoor use can go to 165 gpd
- Clothes washing & toilet flushing ~50% of indoor use
- ~65% of potable water is used for toilet flushing and irrigation

# Potable Water = Energy

Urban potable water has a high embedded energy content, between 1,100 and 20,100 kilowatt-hours per million gallons.  
(California Energy Commission, 6/2005)

Uses 3% of US generated electricity

Electricity is 1/3<sup>rd</sup> of water utilities operating costs

# Harvested Rainwater Uses

- flush toilets
- wash clothes
- landscape irrigation
- fountains/ponds
- cooling towers
- wildlife watering
- infiltration
- building washdown
- fire protection
- vehicle washing
- stream flow
- dust suppression
- cleaning water
- potable water

USA: >1,000,000 systems

Virginia: >10,000 systems

(Source: Estimate provided by Rainwater Management Systems, Inc. June 1, 2009)

# Simple Design Considerations

- Rule of thumb: 600 gallons = 1 inch rain per 1,000 s.f. of roof area
- Capture rate is approximately 80%.
- Locations in the southeast U.S. typically experience greater than 50 inches per year; **VA ~ 43 inches**
- A 2,000 square ft (horizontal basis) roof will therefore receive rain in excess of the indoor water needs for a family of four that observes moderate water conserving practices.
  
- Design of a 5000 gallon rainwater harvesting system, including all interior and exterior components
- Cost range ~\$4,000 to \$25,000.

# VA State Agency Guidance

## **Dept. of General Services- DEB Notice 050908**

Rainwater Harvesting System; in Construction & Professional Services Manual

- Rainwater harvesting is permitted for the purposes of flushing water closets and urinals; landscape irrigation systems; fire protection systems, and other water handling systems to the extent such rainwater harvesting systems are feasible, reasonable and consistent with the agency mission, program, functionality, and project budget.

# U. S. DoE: Federal Energy Mgmt Program – Water Efficiency

## BMP #14 – Alternative Water Sources

- Supports non-potable uses
- Differs between municipal reclaimed water, gray water, rainwater harvesting & stormwater harvesting uses
- Economic viability:
  - Water costs are high
  - Lack of quality freshwater supply
  - Reuse as cost-effective disposal
  - Encouraged by local policies
  - Water use efficiency

# Proposed VA Stormwater Management Regulations- Concept

- Protect quality & quantity of state waters
- Improve quality & quantity of state waters
- Achieved by “Runoff Reduction Methods”
  - Rainwater & stormwater harvesting & use
  - Infiltration designs
  - Grass lined swales and channels
  - Ponds and wetlands

Eliminating “runoff” prevents water from picking up pollutants reducing quality controls and reducing quantity control needs.



# Proposed VA Stormwater Management Regulations- Concept

Concept Example (1 inch rain storm):

Roof designed as “green roof” provides storage and reduces runoff 45% - 60%

Green roof runoff collected to cisterns further reduce runoff by 50% -75%

Can results in total runoff reduction of 72% - 90%

(Added benefits - reduce heating and cooling costs, reduces potable water demand, lowers energy costs)



# Summary



- Virginia promotes rainwater harvesting; a key component of “**runoff reduction**”
- Has a “place” in water supply
- Very suitable for high density development
- Guidance on acceptable methods and uses expanding
- Technologies to capture, convey, store, treat and distribute exist & are improving
- Need better information on savings from infrastructure reduction and energy
- Has a element of “homeland security”
- Need clear state guidance on capture, storage & use