Constructing Cistern Installations for Stormwater Management

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Installing Rain Gardens & Cisterns

Trainings for contractors, 11/3/2011

www.seattle.gov/util/rainwise
Example
Cistern Layout

• Follow manufacturer’s instructions!

Gutter (ideally with leaf screens)

Downspout

Self-cleaning leaf filter

Screened inlet
Finer screens keep more dirt out.

Overflow – 2-4 inch pipe,
- optional “P” trap

Cistern – typically heavy plastic or fiberglass

Low-flow orifice
- to drain tank slowly between storms during rainy season

Drain – 3/4 inch pipe with faucet

Overflow to rain garden or sewer

Cleanout plug
(min. 1.5-inch diameter)
Clean tank annually by squirting hose into inlet and cleanout, and scrubbing with long-handled brush. Or provide for cleaning from top with shop vac.

Level foundation – concrete slab, or 6” packed 3/8” crushed rock, or concrete block, over packed subsoil
What makes a cistern work for storm water detention?

• The “low-flow orifice”
  In this case, a ¼ inch hole that’s left open October-May, to allow tank to drain out between storm events, so there’s space to store and slowly release the next rainfall.

• If the cistern is full when it rains hard, it provides no stormwater benefit.
  It must be able to drain between storms!
Step 1: Build a level foundation to support a cistern full of water

- Excavate topsoil at least 3 inches: create hard a level surface
  - don’t place on un-compacted fill
- Pack subsoil with hand tamper or mechanical compactor
- Place a level foundation:
  - Ground-contact-treated lumber box, filled with 6 inches of 3/8 crushed rock, well compacted. May top with 1 inch of sand or fine gravel to get smooth level surface under cistern.
  - Concrete blocks or heavy (min. 3-inch thick) pavers – perfectly level on top
  - Concrete slab
    No property setbacks or DPD permit required as long as cistern is less than 4.5 ft. tall, 4 ft. wide, or 600 gallons in size.
Example: connection to underground pipe to rain garden (schedule 40 PVC required)
Example: cinderblock foundation (but inlet pipe is poorly supported)
Step 2: Place cistern tank

- Don’t block opening of doors & windows, emergency egress, vents, utilities access, etc.
- Plan for downspout flow to cistern, and overflow routing
- Consider appearance and consult neighbors
- Follow manufacturer’s instructions
- Don’t use tank that’s taller than wide. (Tall narrow tanks require earthquake securement, which is usually impractical, so it’s best not to use them.)
Connect additional tanks, if used
Step 3: Install a screened inlet, to keep debris & mosquitoes out

- At minimum, wrap and secure aluminum screen over inlet opening
- Additional protection against clogging:
  - Gutter screens and wire cages in gutter outlets to exclude leaves
  - Self-cleaning leaf excluder in downspout run to cistern – commercially available or home-assembled – Google “Downspout filters, screens”
  - Divert dirtier initial flow after dry period: Google “First flush diverters”, “Roof washers”, or “Cistern Installation” for ideas.
This is NOT an adequate screened inlet
Step 4: Make gutter connections

- 3-4” Aluminum, ABS, or PVC NDS pipe
- Secure all connections with stainless steel screws & silicone seal, or glue
- Strap & support as needed
- May put a self-cleaning leaf excluder in line: typically a sloped screen so leaves are pushed aside
- Arrange so water falls into screened inlet, with access to clean screen
Step 5: Install overflow pipe that’s as big as the inlet pipe

- Watertight bulkhead fitting at top, or internal overflow riser, or both (if less than 3 inch)

- Should be big enough to carry full gutter flow once cistern fills – (2” minimum, 3” is better).

- Optional: install “P” trap, to prevent mosquito and rat entry.

Low-flow orifice detail, see next slide.
Step 6: Install drain valve, and “low-flow” orifice connecting to overflow

- Use oversize (1-3") bulkhead fitting, so entire fitting can be removed for cleaning tank. Or install separate cleanout plug.
- “Hose bibb” garden hose faucet works for draining tank, and summer water use
- Tee off small line, with valve to drain “low-flow” orifice to main overflow line from October through May.
Low-flow ¼” orifice drain into main overflow, to drain cistern slowly in between storms – one possible design, using easily available fittings

- 1” ID FIP bulkhead fitting
- 1” FIP tee, Sched 80 PVC
- 1/2” FIP PVC valve: Open in Oct., close in May to store water for summer use.
- 1/2” FIP union, with 1 ¼” x ¼” rubber washer inside, to create 1/4” orifice
- 1/2” MIP to 2” barb (to ½” ID tubing)
- 2” MIP to 2” slip PVC adaptor
- 2” ABS pipe
- 2” MIP to 1/2” FIP bushing
- 1” MIP to 1/2” FIP bushing
- 1” MIP to 3/4” FIP bushing
- 1” ID FIP to garden hose bibb
- 2” street “el” ABS
- 2” to 3” ABS bushing
- 2” slip to 1/2” FIP bushing
- 3” ABS pipe, main overflow line

1” MIP nipple
½” MIP Sched 80 nipples
3/4” MIP to garden hose bibb
Step 7: Extend overflow pipe to an approved discharge point

1. **To a rain garden**
2. **Into landscape** at least 5’ from buildings, or 10’ from building with basement + 1 ft. for each foot the basement extends below 5’
3. **Into sewer** (make connection above ground, to avoid requirement for side sewer permit from DPD)
   - Rubber “hubless” unions protect against breakage, and allow maintenance
   - Use rocks or gravel to prevent erosion and disperse overflow into rain garden
Consider appearance

- Can screen cistern with fencing, latticework, cedar or bamboo wrap, etc.
- Plastic paint works on ABS & PVC pipe
- Blend with existing architectural finishes
- Consult with neighbors

South Seattle Community College cistern overflowing to rain garden in a downpour, Nov. 2009
Low-flow orifice plumbing for Code-permitted cisterns (example from Lakewood project)

Note: For illustrative purposes only. Pipe segments between fittings to be the shortest length possible and must be approved by the Engineer prior to gluing.
Example:
Above ground connection to side sewer

Locate drain and overflow fittings 6 inches above bottom of tank.
Example: foundation of treated timbers filled with compacted gravel. Overflow goes to rain garden.