Historic Staunton Foundation
20 South New Street
Staunton Virginia, 24401
www.historicstaunton.org

Best Practices for Rainwater Mitigation

City of Staunton – Rainwater Infiltration into the Sewer System - DON'T!

Problem: There may still be cases where rainwater downspouts are directed into the city sewer system. Most major cities have separate storm water and sewer water utilities to direct water to the appropriate catchments. Storm water is generally "gray water" (water without bio-contaminants) and can be directed through storm water piping to the river systems. Sewer water is "black water" (water with bio-contaminants) and is directed to sewer water treatment facilities before discharging into the river systems.

Historically in Staunton many of the older homes had the gutter downspouts, stairwell drains and foundation drains piped directly to the sewer systems at a time when ordinances did not prevent piping rainfall into the sewer system.

The Staunton Utilities departments have tested and determined that when there is a rain event the sewer treatment facilities are overwhelmed with an outfall of water that can only be traced to residential homes catchments directing the water to the sewer systems.

Over the last few years the city of Staunton has been contracting with a private company to video the water volumes in the sewer systems piping to determine which homes have their rainwater catchment systems connected to the sewer. When these homes are identified the homeowners are issued violations and given 90 days to correct the problems. The Staunton City Ordinance can be found in section 13.35.050, http://www.codepublishing.com/VA/Staunton/html/Staunton13/Staunton1335.html The contact people for the city of Staunton are Ray Moyer in the Engineering department and Dave Irvin in the Water and Sewer department.

Correction of the problem of routing rainwater into the local sewer line requires the homeowner to redirect gutter downspouts and drains that are piped into the storm system away from the storm system. The cost of this re-direction can be expensive. If the re-direction of the rainwater is spilled into the yard there can be unintended consequences including localized yard flooding, flooding of neighbor's yards, soil washouts, infiltration into foundations and basements and standing water that attracts mosquitoes.

In particular, the homeowner needs to understand the problems that water seeping behind foundation walls, into basements and behind historical retaining walls can cause. See this website for information on water infiltration into foundations, walls, basements and historic structures: https://www.nps.gov/tps/how-to-preserve/briefs/39-control-unwanted-moisture.htm

Rising damp can also be a problem when water is not drained away from structures properly, see this website for information: http://www.buildingconservation.com/articles/risingdamp/risingdamp.htm

Best Practices for Mitigation of Rainwater

Sample Rainwater Flow Calculations

A rooftop that measures 40’ x 40’ or 1600 square feet can produce 900 gallons of water for every 1” of rainfall. The calculation is .62 gallons of water per square foot (x .9 efficiency).

In order to mitigate the water from a 1” rainfall you would need to be able to catch and control over 900 gallons of water and allow it to slowly seep into the ground or slowly seep into the storm water collection system. There are rainfalls every year that exceed 1”. In these situations we may have backups if we engineer for 1” of rainfall.

There are several methods of capturing and controlling storm water that could be used in the Staunton VA area.

Rain Garden – A rain garden is a garden of native shrubs, perennials, and flowers planted in a small depression, which is generally formed on a natural slope. It is designed to temporarily hold and soak in rain water runoff that flows from roofs, driveways, patios or lawns. Rain gardens are effective in removing up to 90% of nutrients and chemicals and up to 80% of sediments from the rainwater runoff. Compared to a conventional lawn, rain gardens allow for 30% more water to soak into the ground. A good source of information can be found at this website: http://www.groundwater.org/action/home/raingardens.html

Installing a raingarden would be one of the best methods of removing Rainwater from rooftops and routing it away from the building and wall foundations.

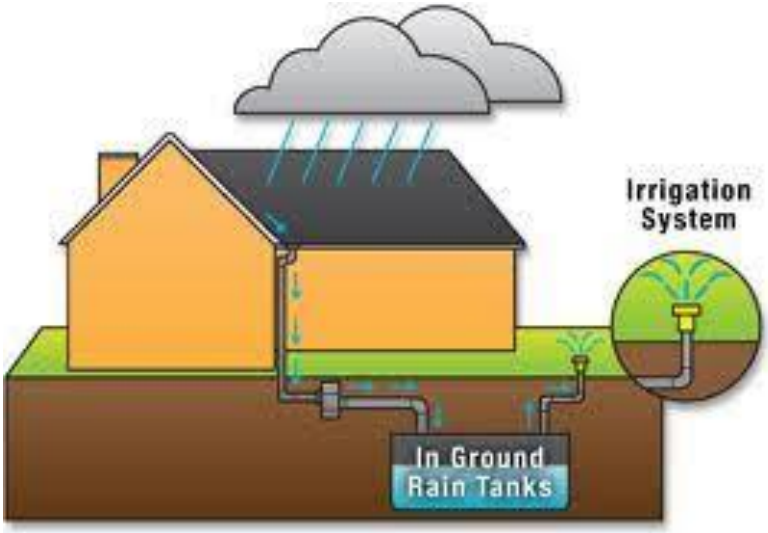
An area required to hold approximately 900 gallons would need to be 8’wide x 8’ long x 2’ deep.

Example of a Raingarden

Cisterns - Cisterns have been used for thousands of years to capture and hold water. A cistern is generally a concrete structure that is used to capture and hold rainwater. Historically in the city of Staunton cisterns were installed underground or in basements of older homes to capture rainwater and use the rainwater for potable uses. Many older homes still have cisterns that could be re-purposed for capture of rainwater and used for non-potable applications like irrigation. Cisterns in modern buildings are used to capture water for use in flushing toilets and for irrigation systems. A cistern would need an overflow into the storm system for any rainfall that would exceed the capacity of the cistern.

A cistern that would hold approximately 900 gallons would need to be 4'wide x 4' long x 8' deep.

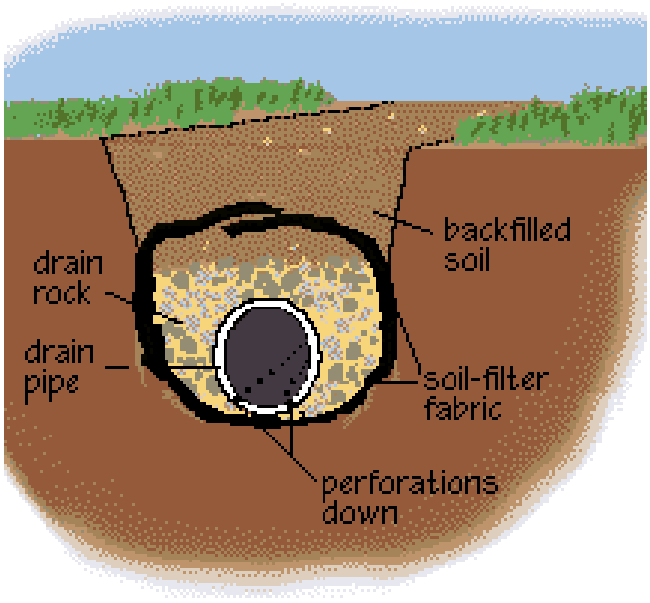
Example of a cistern



Example of a cistern that acts as a holding tank for irrigation water.

French Drain – A french drain can be installed in a soil area away from the building structure for routing gutter or drain water away from the building into the ground. The french drain consists of a drain tile pipe or PVC drain pipe set below grade in stone. The french drain is designed to allow water to soak into the ground over a large area. The french drain needs to be designed to drain water away from structures so that water does not collect around your structure foundations. The exact design is dependent on the soil profile, the grade of the land and the location of the drain or gutter down spouts. A french drain would have to be very long and drain a long way for it to handle 1" of Rainfall water. Here is an example of a simple french drain installation: https://youtu.be/stdBRIDYmDQ.

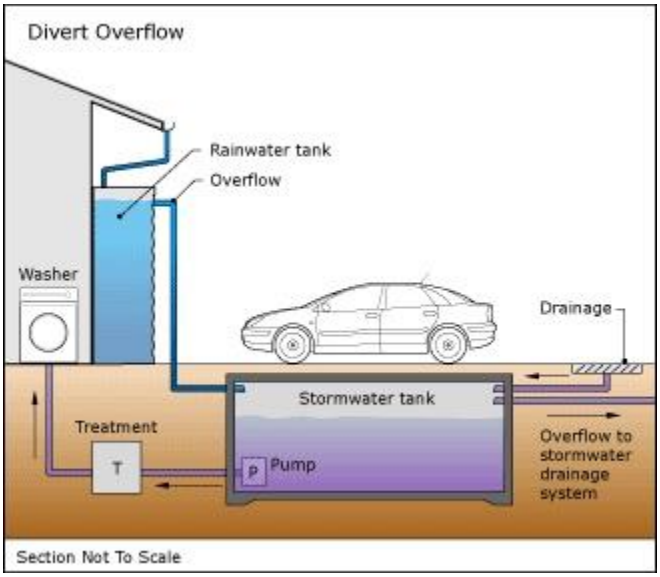
The downside of a French Drain is that it can become clogged with leaves from the rooftop. Installation of a clean out may be a good idea in case of clogs.



Example of a french drain.

Soak Well – A soakwell is generally a stack of polypropylene “boxes”, interlocking panels or a large polypropylene container buried underground that holds and disperses water into the surrounding soil. Some of the structures are strong enough to allow vehicular traffic to run over them. Storm water Drainage Polypropylene soakwells are an efficient storm water installation option which manages storm water runoff in both sandy and loamy soils. Surface storm water is usually intercepted by gutter systems and drains. These drainage points are connected by networks of pipes which then direct the water toward the polypropylene soakwell system. The polypropylene soakwell, through contact with surrounding permeable soil, discharges the storm water back into the underground water ways. All polypropylene soakwells are installed with permeable geotextile material or geo-fabric wrap.

Example of a soak well.



Example of a storm water mitigation tank under the driveway.

Dry Well – A dry well is a hole in the ground that generally has a precast concrete structure and is similar to a soak well. The dry well is designed to hold and slowly dissipate water into the surrounding soils. They generally work better in sandy soils or loamy soils. In clay soils a larger hole is needed and a large amount of stone is installed around the dry well. Generally you want the inside of the concrete structure to be free of stone except near the bottom to allow for as much water holding capacity as possible. Dry wells act similarly to a small septic system. Here is an example of a dry well installation: https://youtube/SzwRYma7W4c . An issue with piping away from a downspout is that leaves can be washed from the rooftop down the downspout into the drain line and clog the line. It would be a good practice to put a "clean out" in-line with the line feeding the dry well. If the dry well is not large enough to handle the water from the rooftop the water will pool in the ground area.

Example of the concrete precast structure of a dry well

Example of a dry well in the ground.

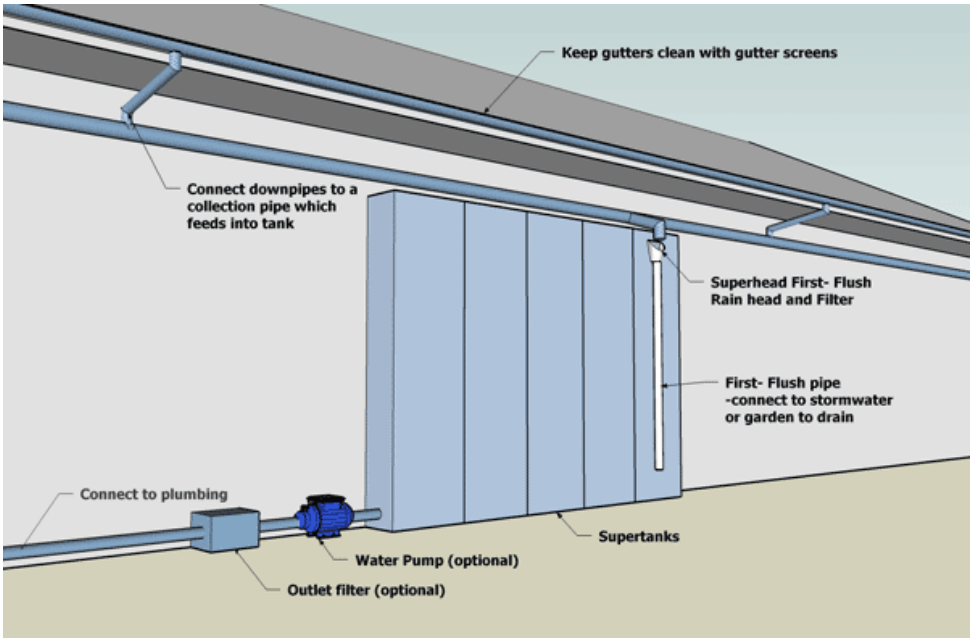
Rain Barrel – A rain barrel can be attached to a downspout to capture rainfall and store it for irrigating plants and for washing off impermeable surfaces. The barrel may not be big enough to handle the rain water from a rain event. Generally rain barrels hold up to 55 gallons of water. The rain barrel has to be manually emptied by the home owner often to make room for water from a new rain event. The barrel will have an overflow at the top and when it is full will overflow onto the ground near the rain barrel. The homeowner should insure that the water from the overflow does not seep into the ground area near the homes foundation. A rain barrel would not be a first choice recommendation for mitigating rainfall from a rooftop unless it is from a small rooftop drain area.

A rain barrel may be big enough to mitigate the water from a small rooftop section. You can use the same formula above to calculate the amount of water you could expect to collect from a small subsection of rooftop. The formula is .62 gallons of water per square foot x efficiency (.9 or less) = x gallons of water per 1" of rainfall. So an area 10' x 10' x .62 x .9 = 55 gallons of water. One rain barrel attached to one downspout would be large enough to mitigate the water from 1" of rainfall. You could run a hose from the barrel to an area of your yard that can absorb the water without creating ponding that might affect your foundation.

Rain barrels can be purchased from a variety of outlets including Amazon, Home Depot, Lowes and other hardware stores and garden outlets.

Rain Tank – Polypropylene above ground tanks come in a variety of sizes and shapes. You can pipe water from your downspouts to a poly tank that can hold from 100 to 2000 gallons of water. Again you can use the area formula to determine the size of the tank necessary to catch the water from the area of your rooftop section. In the commercial world of rainwater capture this is often the most preferred method because it is easy to service and maintain. Often when you bury tanks they can become clogged and are hard to service. Rainwater is permanently piped into the poly tank with a "first flush" filter/bypass inline prior to the tank. A first flush filter/bypass will push the first few gallons of water to a drain sending the dirtiest water from a dry rooftop and debris past your tank into a drain. All subsequent "cleaner" water is routed to a poly tank. The poly tank can be used to hold water for other uses. Poly tanks come in many sizes and shapes to fit any area. Some are narrow and very vertical and others are short and stocky. Many tanks are round and sit in the back of a yard. On the big island of Hawaii many homes use rainwater tanks for potable water as their only source of water. A great website for information on above ground tanks is www.rainharvest.com .

A good you tube view of a rainwater tank system can be found here: https://youtu.be/6lgrhViqsQw .



Example of the connections for a rainwater poly tank for capturing rainwater.

Example of a tank on the side of a house.

Example of a large round poly tank.