Conveyance From Canales

Santa Fe, New Mexico


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Many flat roofs use “canales” to eject stormwater from the roof and allow it to fall to the ground. This is extremely inefficient when harvesting roofwater. Losses can be over 50%. These canales must be modified so that flows are directed to downspouts, gravel is kept out of the pipes, and freezing water does not back up and pool on roofs in the winter. The most efficient system used so far, is an atrium grate at the penetration of the canal (#3). The atrium grate must be sized to pass the design peak flows from the roof. The vertical pipe is connected to the horizontal plane by means of a toilet flange (#2). The flange can be sealed and screwed to the bottom of the canal for a complete seal. The installed downspouts are painted to match the stucco (#1). All of the downspouts connect to lateral conveyance pipes. In some cases the vertical pipes are not wanted by the owner, usually for visual aesthetics. In this case rain chains are a good compromise (#5). Chains are less efficient than pipes, but they are much better than spilling through the air. The chains are attached at the base in a sump box. The sump boxes are piped to lateral conveyance pipes below ground. For both chains and for downspouts, diverters are required to prevent side spillage (#4). They are constructed of angle aluminum. An opening is left so that water has a spillway to prevent backups on the roof.


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Technology and Nature

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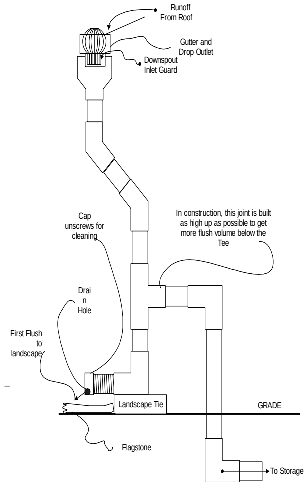

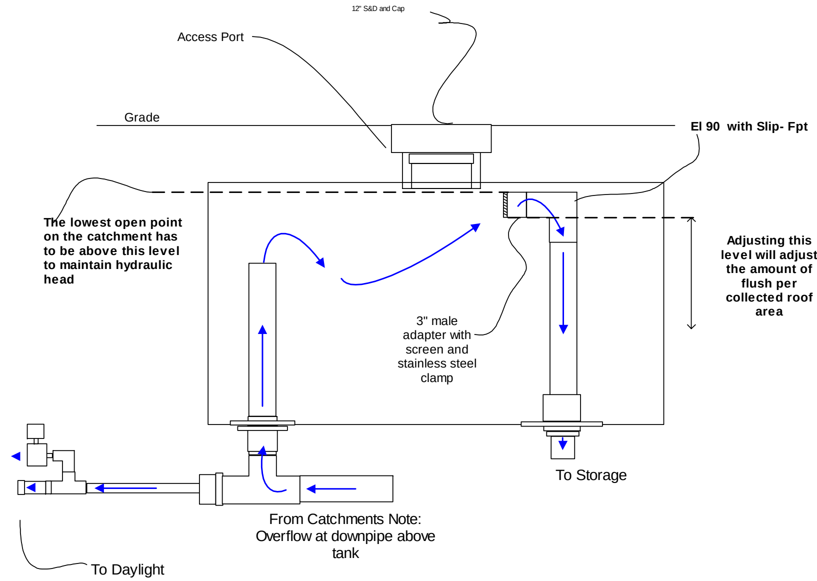

Types of First Flushes

First flushes remove the first flush of rainwater that comes off of a surface. The first flush will carry the majority of pollutants as it cleans the surface for the harvesting of the precipitation that follows. Many designs have been tried, and many have failed. The primary cause of failure is neglect. We use two designs that have minimal maintenance requirements. They are both containers that fill with the first flush and then empty between events. The upper left shows a tubular system and the upper right shows a tank system. Both can be calibrated through design to flush the appropriate volume.

There are two standards that appear in the literature. The first comes from the state of Ohio's codes which require 10 gallons flushed per 1000 square feet of harvested area (.4 liter/ square meter). The second standard comes from European writings and suggests flushing the first 2 mm of precipitation.

The drainage of the flush can be done by gravity or with a timed solenoid valve. Gravity is the simplest and will require minimal maintenance. The green cap has a hole 1/8 inch (3-4 mm) drilled in it so that it will empty the First flush between events. This hole is at 3:00 or 9:00. If set at 6:00 it will rapidly clog with sediment. The white pipe has a screw cap for manual clean out and a solenoid actuated valve to drain the pipe on a timed schedule .

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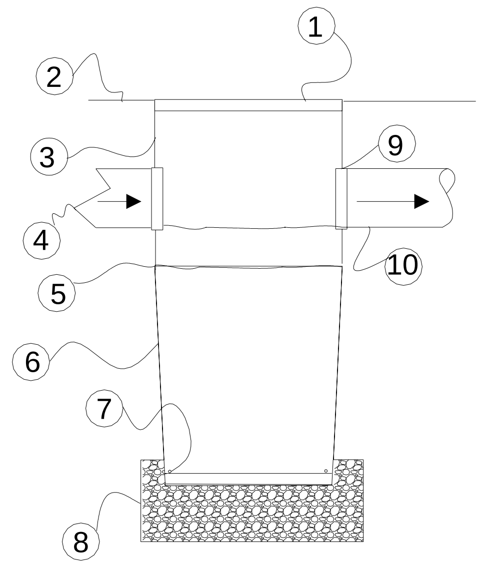
First Flush with Standard Drainage Components

This flushing system uses a sump for sediment drops. The inlet can be a downspout pipe, a rain chain, sheet flow, or a drainage channel. The design takes the first flush and allows the sediments to settle. Liquid leaches out in between events. Occasional cleaning of the sump is required

COMPONENTS

1. NDS 1220 12" solid sump box cover or equal.
2. Grade.
3. NDS 1217 12" riser or equal.
4. 4" pipe from roof drain to NDS 1242 universal outlet
5. Seal with silicone and 2" x 22 mil PVC plumbers tape
6. NDS 1225 sump box or equal.
7. 1/8" weep holes (2) at 1" above base of #12.
8. 1 cubic foot of coarse crushed gravel or rubble
9. NDS 1242 universal outlet or equal.
10. 4" pipe to conveyance laterals



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Filters and Filtration

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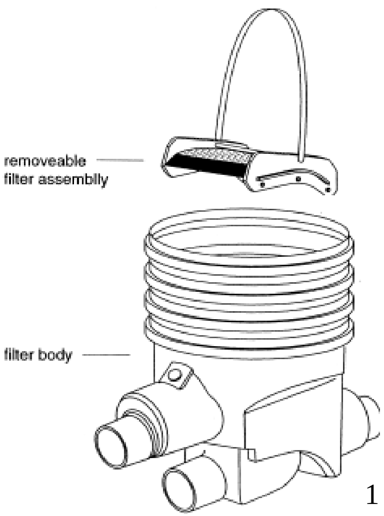
Filtration differs from flushing. Flushes remove dissolved solids as their volume permits. They also remove sediment if designed correctly. Filters remove other particulates. One useful way to remember is that the flushes get the “sinkers” and the filters get the “floaters”. Filters can be placed before the storage as inlet filters.   They can also be placed at the outlet as point of use filters. Inlet filters deal with large flows and the level of filtration is inversely proportional to the size of the flow that can be filtered. Point of use filters have much lower flow rates and are used to filter the water to the appropriate level for final use, e.g. 100 microns for drip irrigation.

Inlet filtration has several usable models from Germany manufactured by Graf and WISY. The Graf filters offer 300-500 microns of filtration. Their documentation is weak in terms of sizing,. They rate capacities by roof size. A better rating is the actual flow through the filter. This type of rating is supplied by WISY.   Graf makes two models, a self clean filter (#1) and a basket filter (#2). These can be installed in series for larger systems (#3) to get the best combination of convenience and effectiveness.   The self clean filter catches 70-90% of the flows. A basket filter will catch the remainder. The WISY filter (#4) is typical of the vortex types that use centrifugal force to push clean water through a screen and allow particulates to fall out of the bottom. A final type of inlet filter is made in the USA by Water Filtration Company. These have a flow rate of 32 gpm and in a dual cartridge unit. They have a filtration level of 60 microns and are generally reserved for systems that harvest rainwater for potable uses.



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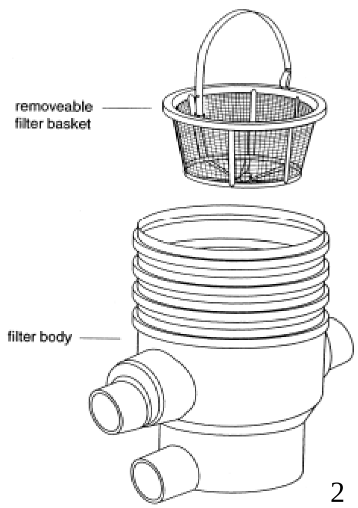

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WFF 150 vortex filter with extension tube
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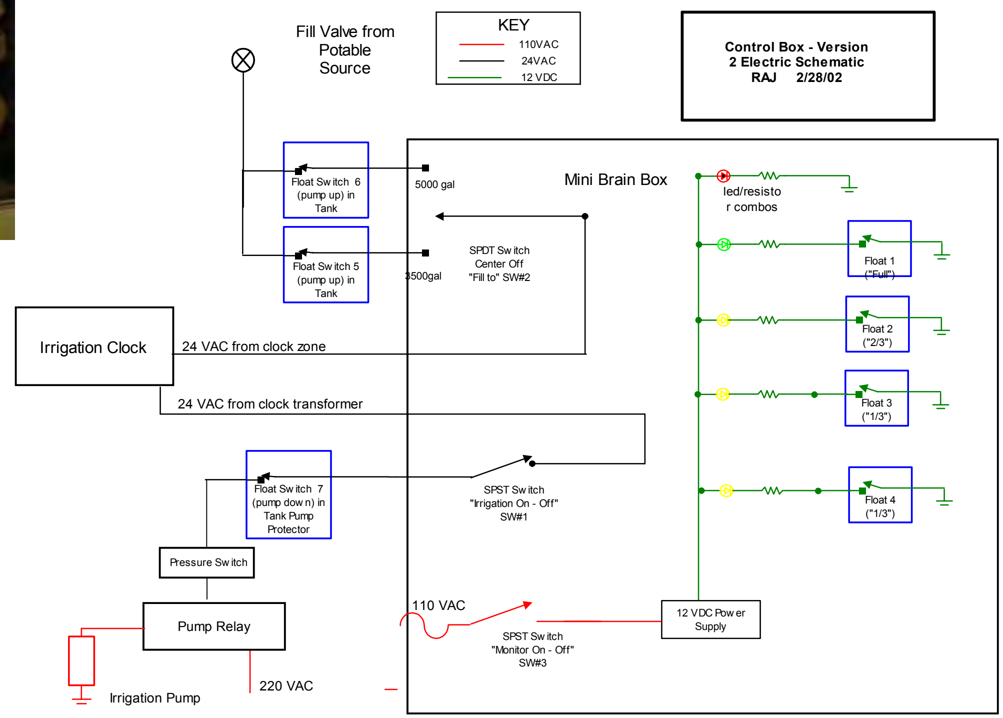
System Controls

Individual systems serve individual needs. Part of the designer's job is to determine the level of involvement that the owner will take. This determines the level of automation needed. Automation can be as simple as three switches. The top switch shuts down the entire distribution system. The middle switch turns the irrigation system on and off. The makes it unnecessary for the owner to change individual controls ion the irrigation controller. The bottom switch controls an off season fill valve that is timed to provide makeup water when there is less demand on the community system or well. This system can be set to a generic operating sequence or it can be controlled by the owner. The LED's on the right are controlled by float switches and show the level of water in the tank. The level in the tank controls irrigation decisions. The latest irrigation clocks feature Evapotranspiration settings that increase irrigation efficiency by as much as 100%.



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System Controls

The SP6R control by SJE Rhombus is used with a pressure/level transducer from KPSI (#700 series). This system has both graphic and digital readouts for water level. The combination of the two elements creates a system with a minimal amount of external cables and connections. In fact there are only three connections for the readout system. This has been shown to increase reliability and to decrease O&M costs over time. In comparison with the prior system, there are 75% less external wiring connections.

The SP6R also includes a programmable logic controller for pumps and level adjustments. The increased resolution of 1% allows for sophisticated system management. The addition of a range gauge also allows for the generation of data for storm event intensity/duration vs volume of harvested water. A network of these systems would also provide information on the efficiencies of various roof types, conveyance systems, and seasonal factors.

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Water harvesting is an ancient art. From Mohenjo Daro in the Indus Valley, to the Negev Desert in the Middle East, to sites in the Americas, humans have been catching and storing water for millennia. While water was precious for the ancients, the amount of water available globally per capita was not a problem. Now it is. The purpose of our R&D is to further the state of the art. We seek to capture rainwater more efficiently with lower energy inputs. We also seek to use that water in the best way, mindful of the other millions of species that also depend on it. The photos show some of the projects . Photo 1 is a demonstration unit with different piping and measurement facilities. Photos 2a & 2b show an inexpensive filter for distributed conveyance. Photo 3 is an in ground source selector for testing different pump suction lines. Photo 4 is a prototype above ground pump station that was sized to use exact amount of American construction materials with no waste. Photo 5 is an underground tank system made with culvert and plastic liners. The goal of all of this research is to find better ways to store and distribute our precious rainfall, and to make these systems as widely available as possible.

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Research and Development

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