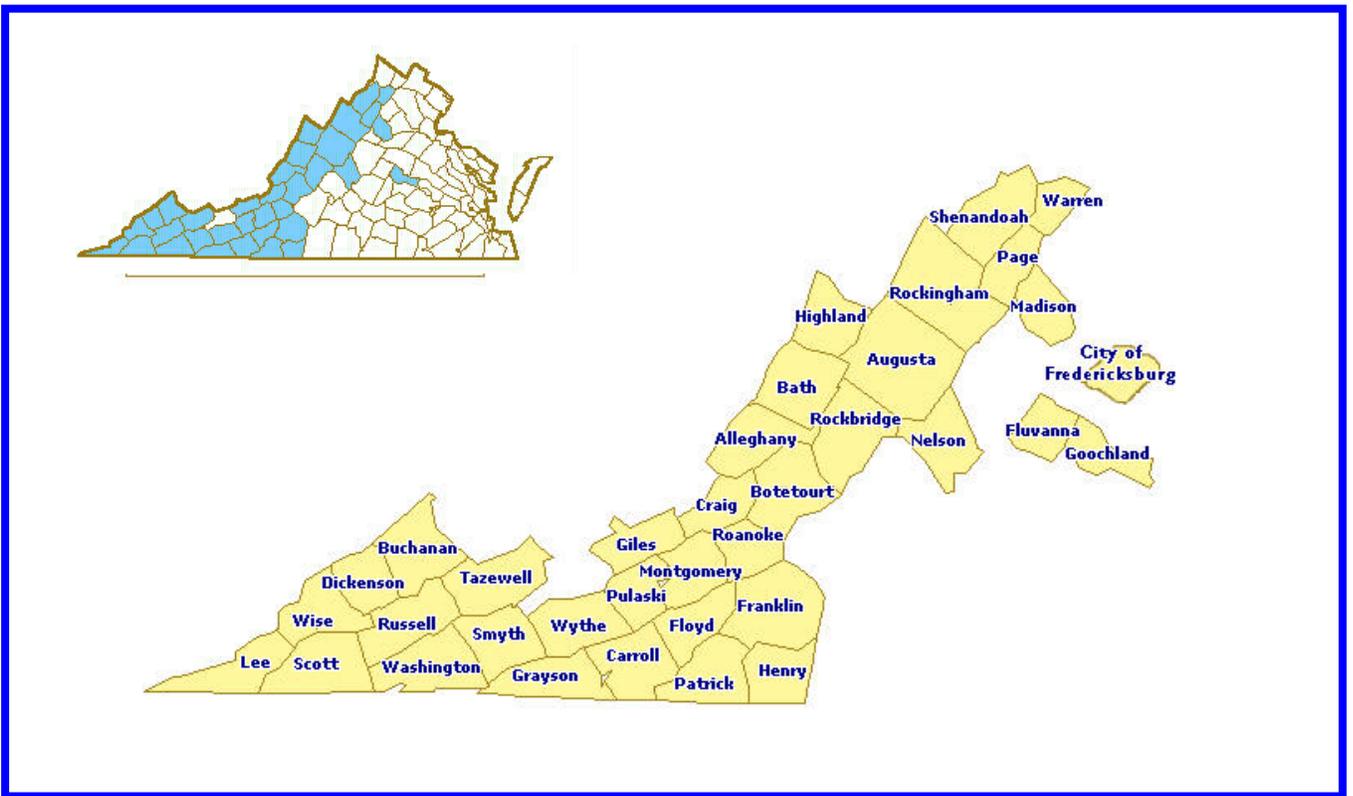


Rain Gauge Cleaning Guide

Prepared for Volunteers and Users
of the
Virginia IFLOWS Network



Virginia
Department of Emergency Management
June 2008

RAIN GAUGE CLEANING GUIDE

Introduction

Figures 1 and 2 show the main parts of a rain gauge. This type of gauge is used throughout the sensor network. Gauges report rainfall in real time (as it happens) in increments of four-hundredths of an inch. Water falls into the top of the gauge, where the *funnel* sends it into the *tipping bucket*. The tipping bucket catches the water until it is full, and then it tips. When it tips, it empties the water, resets itself, and sends a signal to the *radio transmitter*. The transmitter sends a signal to the *antenna* that tells the receiving station which gauge has sent a tip. Each tip is recorded in a computer file and used to compute the rainfall amount over a period of time. A *solar panel* keeps the battery in the transmitter recharged.



Figure 1 Rain gauge.

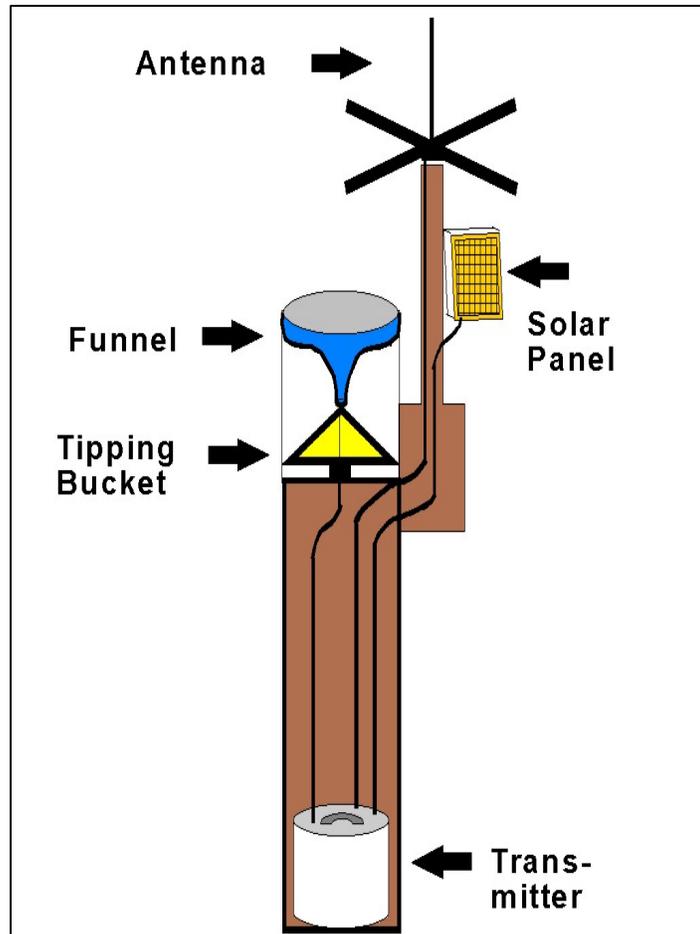


Figure 2 Parts of Rain Gauge.

A common problem with gauges is a blocked funnel. To help keep debris from clogging the funnel, the gauges have screens. *Figure 3* shows a picture looking down into the top of a gauge into the screen over the funnel. The screen is to prevent large debris and

leaves from going into the funnel. **Figure 4**, however, shows that smaller particles can get past the screen and clog the funnel.



Figure 3 Debris on screen.



Figure 4 Clogged funnel.

Another common problem is low hanging branches and trees near the gauge. Some sites that were installed a long time ago have become grown in. **Figure 5** shows a grown-in site where trees and shrubs are overtaking the gauge. Ideally a site should have no trees or branches anywhere near it. A good rule of thumb is to stand near a gauge and estimate a 45 degree angle (hold your arms straight out, and then move them about halfway up). If you see trees “above your fingertips”, they will have some effect on the gauge’s reading. The bigger or closer the tree, the worse the problem is. **Figure 6** shows a picture of a well-exposed gauge with clear line-of-sight to the surrounding sky.



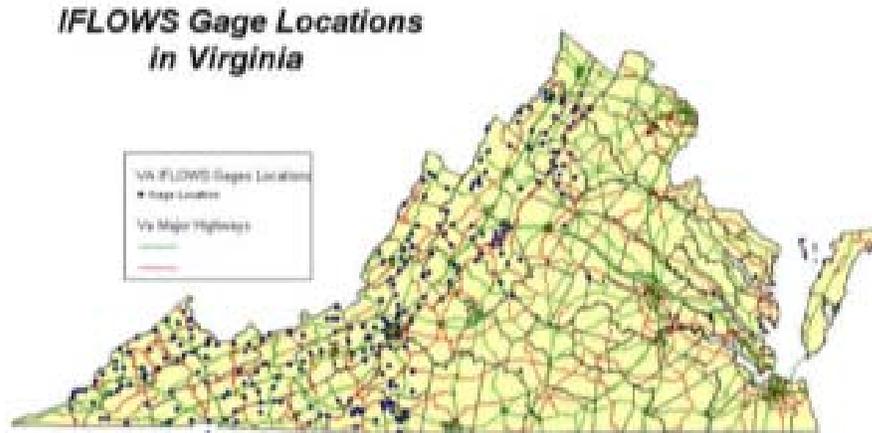
Figure 5 Poorly exposed gauge.



Figure 6 Well-exposed gauge.

Preparing for a Visit to a Gauge

Figure 7 shows roughly where gauges are in our area. We expect to give out exact location maps in the future. Until then, you will need to get directions from someone locally who knows them, or from the system administrator. If you have never been to a



particular site, try to go with someone who has been there before. The gauges are painted brown to blend in with the woods, sometimes making them hard to spot. Before you visit a gauge site, please call administrator and

Figure 7 Gauges in Virginia

the National Weather Service to let them know that you plan to work on gauges. When cleaning gauges it is likely you will have to tip the tipping bucket inside the gauge. The system users and managers need to know that these tips are not being caused by rain, or by a malfunction.

Tools

Use the checklist to take the recommended tools with you before you start out. **Figure 8** shows some useful cleaning tools.



Figure 8 Cleaning tools: paper shop cloth, Teflon mini-brush, bottle brush, water.

- ✓ **Hand tools including**
- ✓ **Screwdrivers** - An assortment of Phillips and flat blade
 - **Allen Wrenches** – 3/32, 9/64, and 1/8 inch sizes are common
 - **Pliers or vise grips**
 - **Cordless Drill** – optional, but makes screw replacement go faster
 - **Ladder** (6-8 feet) – necessary to work on gauges. Use caution when climbing
 - **Screws** – take an assortment in case you lose some, or some are missing
 - **“Skate” key** – used to quickly remove top section from High Sierra brand gauges. Check with local coordinator or system administrator to find out whether you need this key, and where you can get it
 - **Pencil** – used to mark the top section, and for taking notes
 - **Notepad** – used to take notes during your visit
- ✓ **Cleaning tools including:**
 - **Paper shop cloths or rags**
 - **Teflon and brass mini-brushes**
 - **Bottle brush**—approximately ½ inch in diameter and 12 inches long
 - **Water (1-2 gallons)** for cleaning and pouring into the gauge as a test
- ✓ **Brush clearing tools**—clippers, hand saw, machete, bush axe, or chain saw to cut brush, trees, and branches
- ✓ **Bug spray** - for killing bees and wasps that sometimes nest in gauges
- ✓ **Scanner radio** - optional but confirms site is transmitting. Set to 169.500 MHz.
- ✓ **First aid kit**

Arriving at a Site

When you get to a gauge site, follow these steps:

1. **Identify yourself.** If you are not sure whether the gauge is on private property, and there is a house or building nearby, identify yourself and explain why you are there. It is also good to thank the land owner for letting us use their land. If trees or bushes need to be trimmed, ask the land owner for permission.
2. **Look for obvious problems.** Compare what you are looking at with *Figures 1* and *2*. Ask yourself these questions;
 - a. **Are brush, trees, and shrubs making it hard to get close to the gauge?** If so, cut down the brush. In level, cleared areas, run grass over a few times with the vehicle.
 - b. **Are there overhanging trees or limbs?** You should have clear line of sight to most of the sky. If possible, trim trees and branches that are in the way.
 - c. **Do you see all the major gauge parts?** Look for major parts shown in *Figure 2*. Make sure the antenna and solar panel are there, and that no one has vandalized the gauge by shooting or driving into it.

screws at the very top that hold the funnel in place. Always use caution when climbing ladders.

3. **Mark the top section.** Before you remove the top section, make a pencil mark that will help you line up the sections that you are separating. It will make it easier to reassemble. Also, if the solar panel is mounted on the top section, mark which way it is pointing so that it can be put back correctly.
4. **Remove the top section** by lifting upward and rocking it slightly. Then, carry the top section down the ladder, or pass it to your helper on the ground. For most brands of gauges, the top section contains only the funnel. If you are comfortable with working on a ladder, you can clean the tipping bucket in place, as in *Figure 10*. If you have a top section different from those shown in *Figure 9*, or if you would prefer to work on the ground, there should be enough slack in the tipping bucket cable to reach.



Figure 10 "John Doe" works on a tipping bucket.

Cleaning the Tipping Bucket

Figures 11 and 12 show pictures of a tipping bucket and how it works. The tipping bucket is built like a seesaw with two buckets that catch water from above. When the first side fills



Figure 11 Tipping bucket.

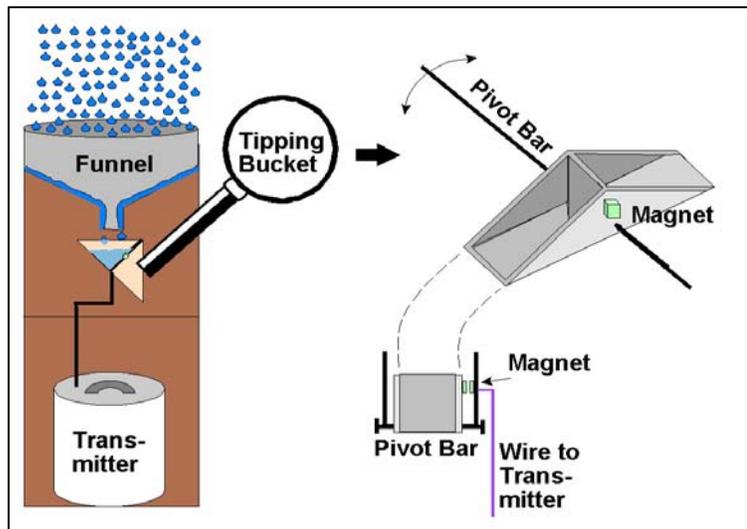


Figure 12 Tipping bucket operation.

up, the weight of the water makes the seesaw tip. The water in the first bucket dumps out and the second bucket moves into place to catch more water. When the bucket tips, a magnet on the side of the bucket passes another magnet on the stationary part of the tipping bucket assembly, making an electronic pulse. A wire carries this pulse to the transmitter. Each tip of the bucket measures 1 millimeter, equal to four-hundredths of an inch of rain.

While you have the tipping bucket apart, look for signs of obvious damage, like cracks or leaks. Some tipping buckets may distort in shape from freezing water. If you see anything you think is a problem, write it down in your notebook and let the system administrator know. *Figures 13* and *14* are examples of debris that accumulates in tipping buckets. Use the cleaning brushes to remove stuck on dirt and debris that has



Figure 13 Clogged tipping bucket, top view



Figure 14 Dirty tipping bucket.

accumulated in the buckets and in the funnel. Wipe all parts thoroughly with a shop cloth or rags, then pour some water through the funnel and bucket opening to rinse it out. Remember that each time you tip the bucket it transmits a message that shows up as rain, so try to keep the number of tips to a minimum. When you are finished cleaning, the parts should look like *Figures 15* and *16*. *Figures 17* and *18* are photos of a clean funnel and clean screen, looking down from the top.



Figure 15 Clean tipping bucket, top view.

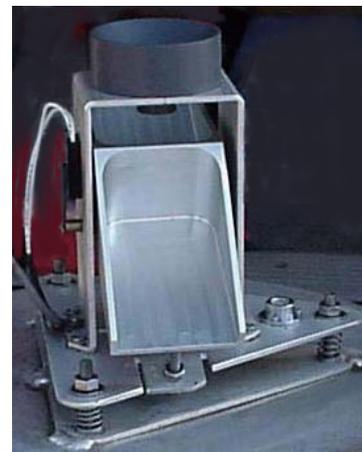


Figure 16 Clean tipping bucket.



Figure 17 Clean funnel.



Figure 18 Clean screen.

Leveling the Tipping Bucket

After you have cleaned the parts mentioned above, you must level the tipping bucket. Leveling is *very important* for rainfall reporting accuracy. The tipping bucket is carefully designed to hold four-hundredths of an inch of rain for each tip. If the tipping bucket is not level, the amount of rain in each tip is wrong, and will show up as an error in measurement. Big errors can be noticed, but the smaller errors can fool forecasters into thinking a gauge is reporting accurately when it is not.

To level the tipping bucket:

1. **Mount the base** of the tipping bucket back onto the standpipe. Check your pencil marks to line it up the same way as when you started.
2. **Set the tipping bucket on the base.** Make sure it is turned so that the bucket won't hit the vent tube or cables when it tips. Also turn it so that it is not in direct line to the four weep holes in the side of the top section. This is to prevent the wind from blowing into the hole and tipping the bucket.
3. **Check the bubble level** on the base of the tipping bucket shown in *Figure 19*.
4. **Turn the adjustment screws** so that the bubble is centered in the glass window.

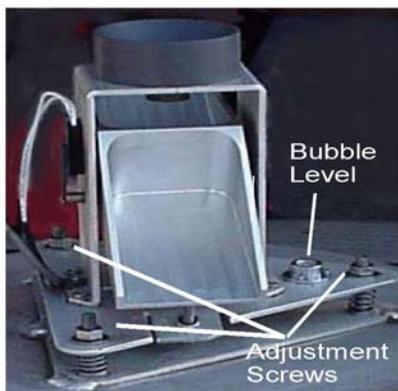


Figure 19 Tipping bucket level adjustments.

Final Steps

Before putting the funnel and screen back in place, do the following:

1. **Wipe the solar panel clean** with water and a shop cloth.
2. **Turn on your scanner** and listen to frequency 169.500 MHz. Tip the bucket and listen for a short “chirp” from the transmitter. The chirp may take up to 20 seconds after a tip, especially if you are only allowing a second or two between tips. If you do not eventually hear a chirp when you tip the bucket, something is wrong with the transmitter. Report this to the system administrator.
3. **Reinstall the funnel and screen**, replacing the screws you took out.
4. **Pour water into the top of the gauge**, slowly and steadily, to confirm the gauge is still chirping.
5. **Before leaving, write** the date and time you visited the site, what you did, and any observations you have that will help maintain the gauge.
6. **Report to the system administrator when you return**, either by web board, email, or telephone call.

Virginia IFLWS Site Contacts

<u>SITE</u>	<u>CONTACT</u>	<u>3 DIGIT</u>	<u>TELEPHONE #</u>
Augusta County	Dispatcher	351	540-245-5501
Bath County	Dispatcher	376	540-839-7291
Blacksburg Weather	Peter Corrigan	281	800-432-7070
Botetourt County	Dispatcher	374	540-473-8631
Buchanan County	Co. Administrator	253	276-935-6500
Carroll County	Dispatcher	253	276-728-4146
Clifton Forge	Dispatcher (Joy)	373	540-863-2513
Craig County	Sheriff's Office		540-864-5127
Dickenson County	Dispatcher (Mark)	231	276-926-6330
Franklin County	Dispatcher (Lucia)	347	540-483-3000
Giles County	Dispatcher	261	540-921-3842
Henry County	Dispatcher (JR)	345	276-638-8751
Highland County	Dispatcher	372	540-468-2210
VIRGINIA IFLWS	Mark Slauter	283	804-674-2405
Mobile			804-484-4204
Lee County	Dispatcher	234	276-346-1131
Madison County	Dispatcher (Terrie)	380	540-948-5161
MapTech, Inc	Maintenance Contractor		540-961-7864
Shop			540-961-7864
Mobile - Sam Utley			540-808-7200
Montgomery County	Dispatcher	344	540-382-2951
Morristown Weather	Brian Boyd	510	800-697-0075
Nelson County	Ray Uttaro	352	434-263-7045
Page County	Dispatcher	381	540-843-0911
Patrick County	Dispatcher	264	276-694-3161
Pulaski County	Dispatcher	263	540-980-7800
Roanoke City	Dispatcher	349	540-853-2411
Roanoke City EOC	Mike Guzo		540-562-3265
Roanoke County	Dispatcher	342	540-562-3265
Rockbridge EOC	Robert Foresman	362	540-463-4361
	Ron Argenbright		540-46401241
Rockbridge County	Dispatcher	361	540-261-6171
(Buena Vista)	Chief Steve		540-262-9300
Rockingham County	Dispatcher	354	540-434-4436
Russell County	Dispatcher (Naomi)	251	276-889-8033
Salem City	Dispatcher	343	540-375-3078
	Ray Bristow		540-384-6619
Scott County	Dispatcher (Melissa)	235	276-386-9111
Shenandoah County	Dispatcher	383	540-459-6101
	David Ferguson		540-459-6177
(for Strasburg)	James Tewalt		540-465-9197
Smyth County	Dispatcher	243	276-783-7204
Tazewell County	Dispatcher (David White)	252	276-988-0645
VIRGINIA IFLWS (Tri-City)	Jim Meece	285	423-323-1921
Mobil			423-335-0098
VASP Duty Tech		10	804-674-2165
Vinton City	Dispatcher	346	540-342-8135
Wakefield Weather	Keith Lynch	284	800-737-8624
Warren County	Dispatcher	282	540-635-4128
Washington Weather	Rich Hitchens	286	703-260-0909
			Ext 234
Waynesboro City	Dispatcher	353	540-942-6701

Waynesboro EOC
Wise County

Gary Critzer
Dispatcher

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540-942-6698
276-328-3756