
# Vacuum Tanker Flow Test

## Morrisvale, West Virginia
## October 23, 2011



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# Overview

- On October 22nd and 23rd, 2011, GBW Associates, LLC conducted a Rural Water Supply Operations Seminar hosted by the Morrisvale VFD located in Boone County, West Virginia.
- The seminar focused on tanker shuttle operations for rural water supply delivery.
- There were five vacuum tankers participating in the tanker shuttle drill and during the drill, a number of questions came up regarding the capabilities of a vacuum tanker.
- One question involved the ability to “push” water through large diameter hose (LDH) using the pressurized tank function.
- A flow test was conducted to examine what a vacuum tanker could do in terms of pushing water through LDH fire hose.

# The Process

- The flow test process was quite simple: attach a section of 5-inch LDH to one of the vacuum tanker's discharge ports and measure the rate of flow that could be achieved in the LDH using the pressure-mode of the vacuum tanker.
- Because a vacuum tanker pressurizes its tank in order to accelerate the offloading process, the real issue was "how far could that pressure push water through hose?"
- A 2,000-gallon vacuum tanker was filled with water and positioned to offload via a 100-ft section of 5-inch LDH into a 2,500-gallon dump tank.

# The Process

- Because there was no device available to physically measure the flow, it was decided that “time” would be used as measurement tool.
- Since a vacuum tanker will exhaust all of its water, time could be used as a reasonably accurate measurement process.
- With the tanker full, time would start when offloading began and would stop when all water was exhausted out of the tanker through the end of the 5-inch hose.
- The volume of the tanker (2,000 gallon) would then be divided by the off-load time and a “gpm” offload rate would be calculated.

# Test Site

The test site was located at the Morrisvale VFD substation in Alkol, WV.

# Test Vehicle


The test vehicle was a 1994 Firovac vacuum tanker. The tanker carries 2,000 gallons of water and has three, 6-inch dumps – one on each side and one in the rear.

# Test Set-up


A 2,500-gallon dump tank was set up as a “catch basin” for the water that was going to be offloaded. A 100-ft length of 5-inch LDH was outfitted with a supply line holder device so that the hose would be held firmly in place at the dump tank during the test.

# Test Set-up

An in-line gauge was installed in hopes of capturing a pressure reading, but that was not successful because of the large opening and no resultant back-pressure which to measure. A folding ladder was used to support the 5-inch hose and reduce kinking.

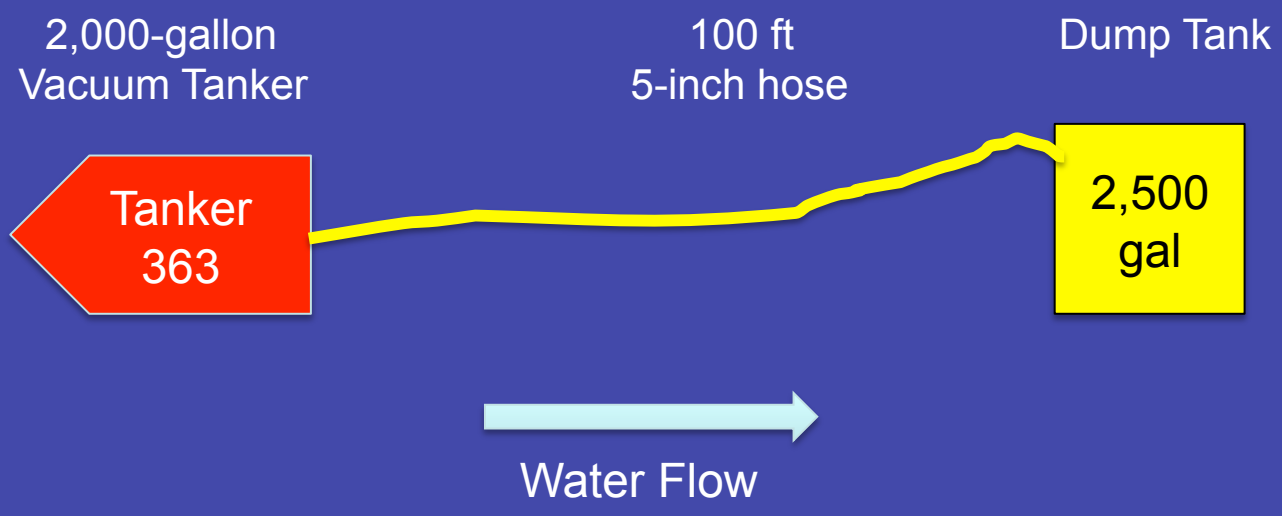
# Test Begins


On the timer's signal, the tanker operator engaged the vacuum pump and started the offloading process. Water was offloaded into the 5-inch LDH using the tanker's rear, 6-inch dump.

# Test Concludes


Water flowed through the 5-inch LDH and out into the dump tank with little effort. At the 2:10-minute mark, all of the water was exhausted and air began exiting the end of the 5-inch hose – thus the test was over and time was stopped.

# Test Layout



# The Results

- The test results showed that the 2,000 gallons were offloaded in 2:10 minutes for an offload rate of approximately 922 gpm.
- The impressive result of this test is that it shows that the vacuum tanker does not have to be positioned exactly at the dump tank in order to support a 500 or 750 gpm flow.
- A 1,000 gpm+ flow rate was not achieved because of the friction loss that occurred in the LDH – but 922 gpm through 100-feet of 5-inch LDH is still very impressive and demonstrates a good option for offloading water from a vacuum tanker using the tanker's pressure feature.

# The Results

- The results of this flow test also produced a few important points to consider:
  - The in-line pressure gauge registered 0 psi, yet water was flowing past it in excess of 900 gpm. The reason – there was no restriction – thus no back pressure to be measured.
  - The vacuum tanker is limited in its ability to generate pressure – around 15 psi is used to offload the water. Thus, only 15 psi is available to push water through hose. That is why it is so important to use LDH so that friction loss is minimized.
  - If this were a real incident, a pumper would draft out of the dump tank. If the 5-inch hose was connected directly from the vacuum tanker dump to the pumper intake, the pumper would most likely collapse the hose line and cavitate because of the low intake pressure.

# Summary

- The flow test revealed an interesting capability of a vacuum tanker.
- While there certainly are limits to the distance that water can be “pushed,” this test illustrated a realistic application – especially if tanker access is an issue on the fire scene.
- We thank the folks from Morrisvale VFD for participating in the test and we hope to do more performance tests on vacuum tankers in the near future.

# www.GotBigWater.com

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