A pilot-scale test pipeline was designed and currently is being constructed at Tulane University for AwwaRF Project #2686 Field-Testing of Surge Modeling Predictions to Verify Occurrence of Distribution System Intrusion. The test rig apparatus will provide a controlled environment for testing and comparing hydraulics conditions that could cause microbial intrusions in the distribution system. The test rig can be used to quantify the volume of intrusion that occurs as a result of a hydraulic transient, such as a transient associated with a pump trip.

A schematic of the test rig apparatus and photographs of the existing facilities are shown in Figures 1 and 2. The test rig includes a 10-hp pump, piping, valves, three storage tanks, two intrusion elements, pressure gages, a datalogger, scale, and other appurtenances for controlling and measuring the effects of hydraulic transients. Local tap water can be used to supply the test rig and experiments can be designed to quantify the volume of intrusion associated with a hydraulic transient. Two-inch piping is used to simulate a water transmission line. The intrusion element is located approximately 8 feet above the pump. An elevated storage tank with constant overflow provides an additional backpressure of approximately 5 feet of head.

A segment of the test rig apparatus contains a 12-inch piece of test pipe. The 12-inch test piece can be used to simulate leaks in the pipe with various size orifice diameters. Pressures can be monitored throughout the system with standard gauges. A highly sensitive pressure datalogger can be installed downstream of the 12-inch test piece to measure the magnitude and duration of low/negative pressure surges in the line.

The hydraulics laboratory at Tulane includes approximately 2,340 square feet of laboratory space plus an additional 600 square feet of floor space as a loft. The vertical clearance from the floor to the loft is approximately 7.5 feet and the total height from the floor to the ceiling of the laboratory is approximately 15 feet. The floor contains a network of sumps ranging in depth from approximately 18 inches to 3 feet. Additional facilities that are available in the hydraulics lab include 3-hp and 15-hp pumps, an air compressor, cabinets and counter space in the lab.
Figure 1. Schematic of Tulane test rig apparatus for simulating hydraulic transients and quantifying intrusion.

Figure 2. Tulane test rig apparatus for simulating hydraulic transients and quantifying intrusion. (Left) intrusion element and storage tank on mezzanine. (Right) 10-hp pump, source water tank, and graduate student Hua Wang.