

<u>Location:</u>	Tiller Ranger Station
<u>Date:</u>	September 13 2014 - Current
<u>Time:</u>	N/A
<u>Personnel Involved:</u>	Donna Owens, Tiller District Ranger Terri Brown, District FMO Mitch Fuller, Facilities Maintenance Steve Marchi, RELM Staff Officer John Beagle, Assistant Forest Engineer Kayli Barber, Facilities Engineer Michelle Bernard, Civil Engineer John (Zeb) O'Connor, NU/DL Zone Facilities Lead Timberline Corporation, Contractor Western States Environmental, Contractor American Leak Detection, Contractor ServPro, Contractor Yeager's Plumbing, Contractor

Executive Summary

- The events that unfolded beginning Saturday, September 13, and leading up to that date, can mostly be attributed to a water infrastructure that is past its design life (45+ years old).
- Although much of the damage, disruption, and leaks can be linked to the loss of all of the Pressure Reducing Valves (PRVs), that is not the only root cause and likely only exacerbated what was already a very frail water distribution system.
- Highlights of what went well:
 - Tiller's staff kept in good spirits despite the disruptions. Mitch was particularly helpful in relaying information between Tiller and the SO.
 - John (Zeb) O'Connor's response to the site was extraordinary – it was his first day back from leave and he had to get supplies and drive over the hill from Toketee to Tiller. He should be commended for his willingness to help and respond in such a short timeframe.
 - Having Timberline on-site during these events was essential to keeping water available to the majority of the compound. The flexibility of having a contracted O&M provider paid dividends in this case; e.g. quick response, ability to make purchases after cut-off dates through the contract, etc.
 - Good documentation regarding asbestos helped prevent a potential violation of EPA and OSHA regulations that could have been caused by digging in the break room.
 - AQM was extremely helpful and did a superb job of allowing us to put the key personnel/contractors in the right place at the right time. Huge credit goes to Brad, Laurie, and their team for helping us out during their busiest part of the year.
 - The Regional Office was understanding and ultimately monetarily supportive – their contribution made us whole again and even allowed us to award the window project (which would have been cut to pay for the emergency response).
 - The contractors used in these repairs were all very professional and competent.
- As of Friday, September 26, water had been completely restored to the main office.
- Despite the obvious disruption that the loss of water caused it is important to note that the most likely and most catastrophic route to complete failure at this compound lies within the wastewater treatment system.

Next Steps

- Holes in floor will be patched by force account. Concrete mix was found and provided to Mitch Fuller on 10/1/14.
- Put together a plumbing contract that will bypass all of the galvanized lines in the building. Details to follow.
- Include electrical work to reroute power to individual on-demand water heaters.
- Restore flooring, including: replacing rubber bases, gluing down carpet and shampooing, and installing new vinyl flooring where tiles were removed
- Install new cabinetry in kitchen.



Photos and Descriptions

Office Leak Location



Figure 1 - "Ground Zero" for office leak (in hallway, opposite side of wall from break room)

Figure 1 shows the area that the leak was surfacing on Monday, September 15. The office design plans showed a potable water supply line in this general vicinity and it was believed that the line was under this wall.

Subsequent investigation by American Leak Detection showed the leak was actually on the other side of the break room wall (shown in Figure 1).

Further Consequences of Water Leak

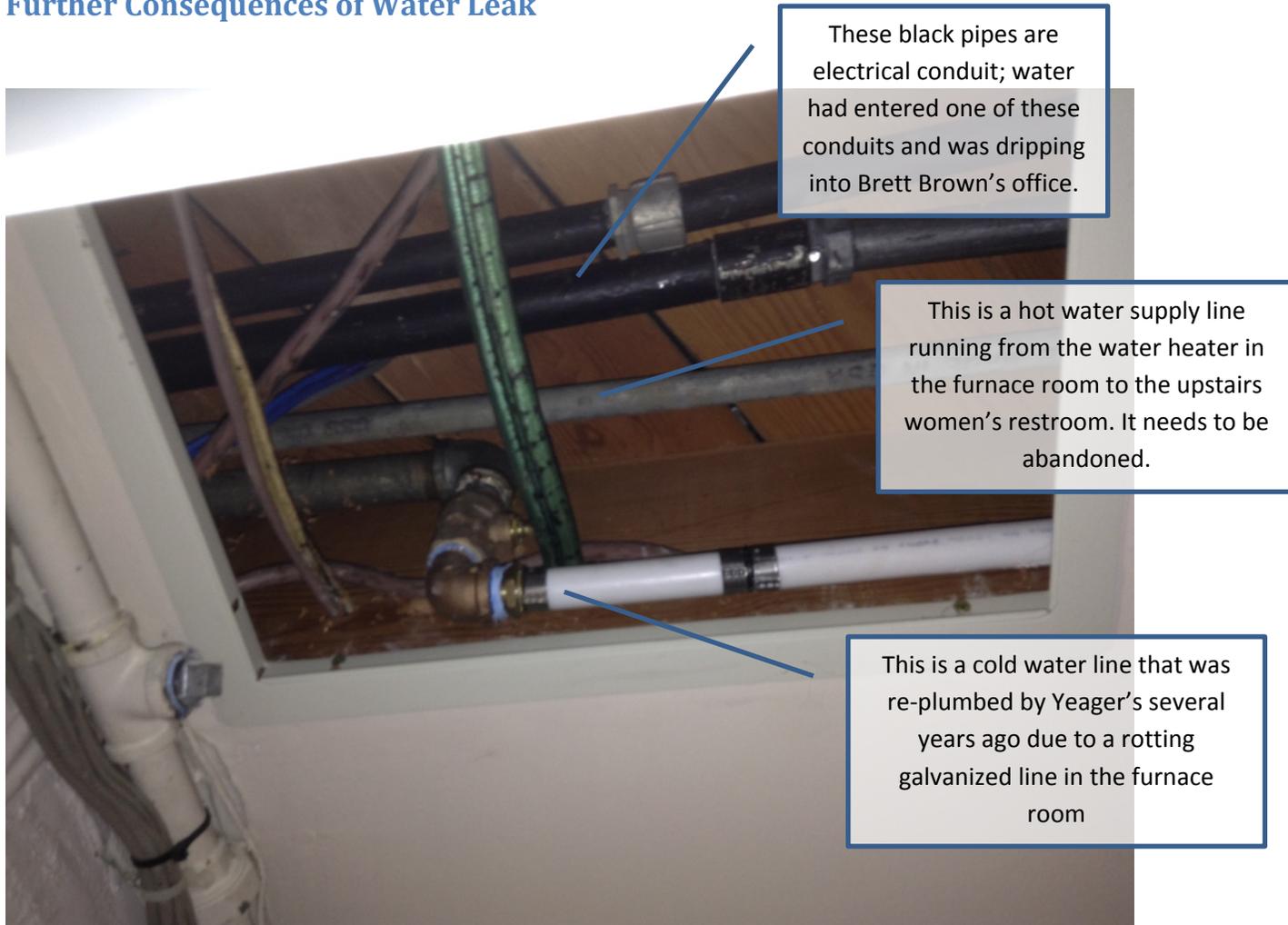


Figure 2 - Lines in hatch above Brett Brown's office

Figure 2 shows the interconnection of lines between the fire office portion of the building, and the main office. Note that water had entered the electrical conduit and was dripping into Brett's office. This probably prevented water from backing all the way up to the electrical panel, which could have been catastrophic.

Lessons Learned and Corrective Actions:

- Burying galvanized pipe within slabs was not a good practice – but it was done well before any of us inherited the building.
- After tracing out the lines, we have developed a plan to abandon all galvanized subsurface piping in the building. This plan will be developed into a contract.

Leak in Kitchen / Break Area



Figure 3 – Service line from main trunk to leak location (in Kitchen Area)



Figure 4 - Corroded Pipe



Figure 5 - Corroded Pipe

The decision was made not to dig at the “X” (mark on the floor showing leak location) as it was becoming clear that the “tee” was likely near the wall and in line with the “X”. Figure 3 shows the area that was dug up in the kitchen area. Very poor plumbing repair work had occurred there in the past and the pipes removed from this location were in very bad shape (see Figure 4 and Figure 5).

Lessons Learned and Corrective Actions:

- Given the state of the pipes it is imperative to develop a plan to bypass all underground galvanized pipes.
- It was only a matter of time for this failure to occur – the pressure spikes only exacerbated this situation. It is likely these pipes have been leaking underneath the slab for years.

Valve Modifications

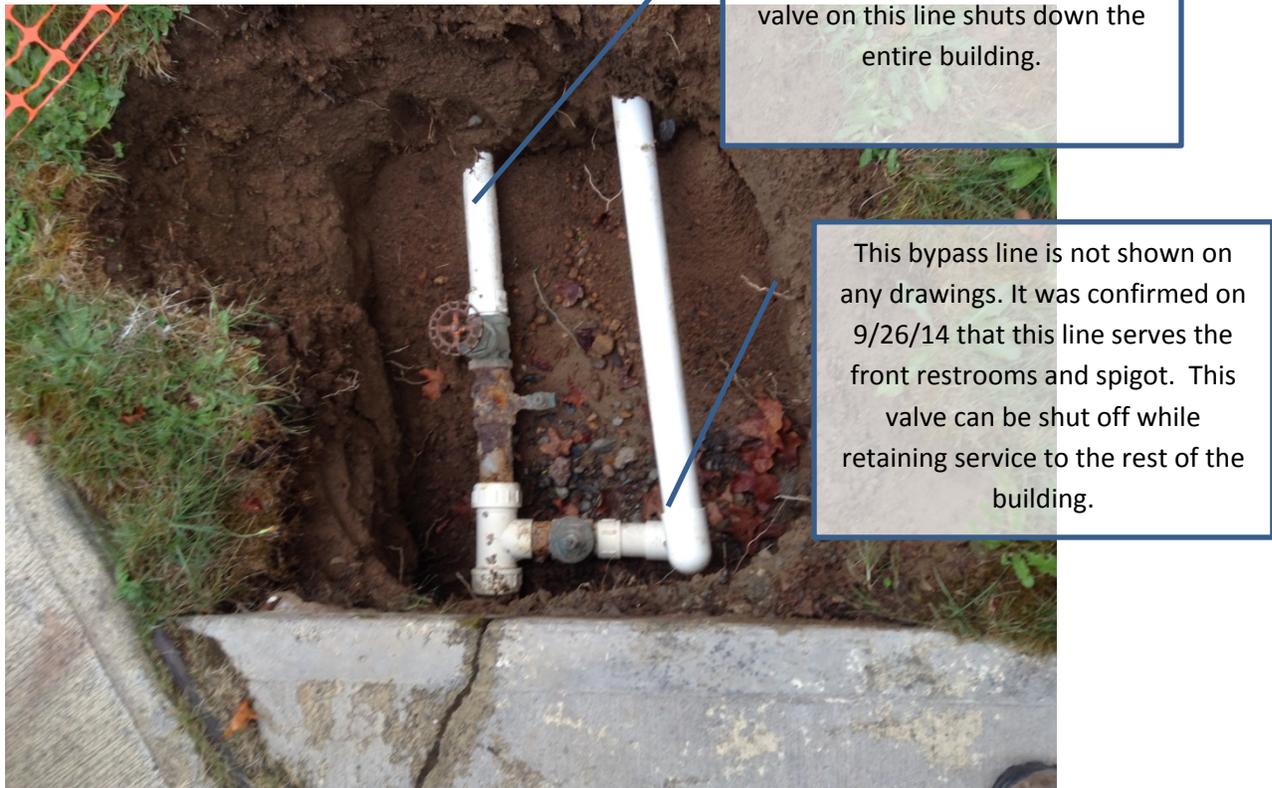


Figure 6 - Valves located near Ranger's Office

Initially, we had planned to correct the valve cluster shown in Figure 6 so that the main building and the front restrooms could be shut off independently. After discussion with the plumber, the better long-term solution will be to use this bypass line to feed the entire ranger station. There will still be an opportunity to valve the front bathrooms off separately from the rest of the building.

Also of note, Figure 6 shows a past repair that was done improperly. Threaded PVC has been threaded into galvanized fittings. Poor practices make this another weak point for failure.

Lessons Learned and Corrective Actions:

- The main line feeding the building will be capped (in conjunction with re-plumbing the Ranger Station) and this valve cluster will be re-plumbed correctly.

Proposed Long-term Solution

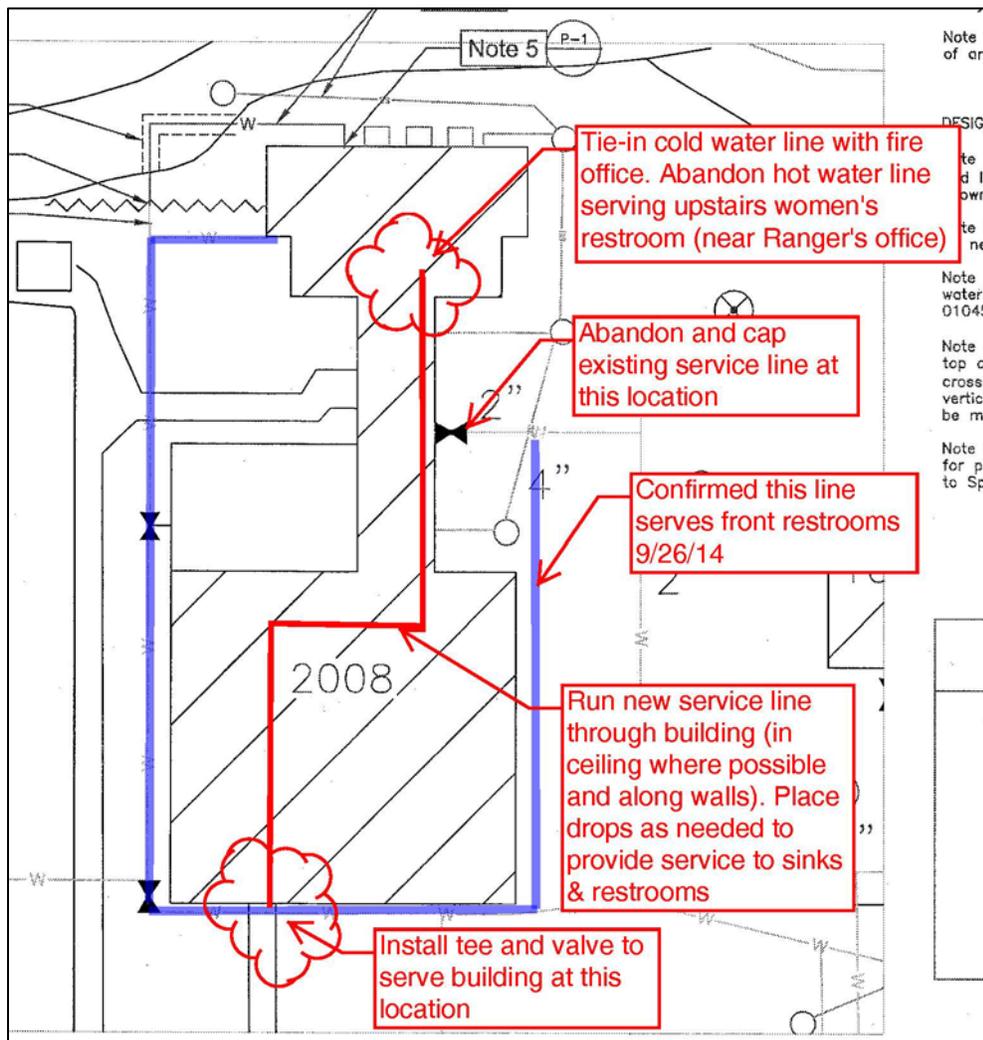


Figure 7 - Schematic of New Waterline (shown diagrammatically)

Figure 7 shows a plan to abandon all buried galvanized piping in favor of a new, overhead, PEX (cross-linked polyethylene) service that will run through the building. Pipe will run in attic/drop-ceiling spaces where possible; in some areas it will be exposed (but a decorative soffit could be built if it is objectionable).

Note: in the above scenario, all water heaters will be replaced with on-demand, tankless heaters. This will eliminate both the cold and hot galvanized lines that are buried beneath the slab.

Pressure Reducing Valves



Figure 8 - Pressure Reducing Valves

There are two sets of Pressure Reducing Valves (PRVs), with two PRVs per station. We therefore have a total of four PRVs that work in conjunction to reduce water pressure from over 200 psi to approximately 60 psi at most services. The PRVs shown in Figure 7 had been damaged due to a “homemade” manhole and lid that does not fit properly. This lid was accidentally dropped into the manhole and caused damage to the last working PRV.

When the service technician examined the PRVs he found that they had never been serviced. A diaphragm that he removed had a date stamp on it from 1967. Those diaphragms should be changed out every five years.

Lessons Learned and Corrective Actions:

- Our O&M Contractor will build annual inspection and maintenance of these PRVs into their standard procedures.
- A new manhole/lid system will be designed that is more appropriate for this installation; and will be designed so the lid cannot fall into the hole.

Water Valves



Figure 9 - Unknown Water Valves

In the process of fixing the PRVs, it was discovered that a valve cluster had been installed just outside the PRVs but had long since been buried. As such, the valves had never been exercised and were unknown to operators. These valves are important to operators as it allows them to isolate sections of line for repair.

Lessons Learned and Corrective Actions:

- Valve boxes will be installed so that valves can be actuated from the surface
- These valves will be added to the O&M contractor's standard valve exercising procedures to ensure the longevity of the valves.

Background and Timeline of Events

- On the morning of September 13, 2014 I received a call from Steve Marchi on my work and personal cells indicating that water pressure may have been lost in the distribution system at the Tiller Compound. This was an immediate concern to both of us as depressurized distribution lines can cause contamination of the waterlines.
 - I immediately notified Michelle Bernard, COR for the contract with Timberline.
 - Within a few minutes I had received a call from John Woody, operator for Timberline. He said that water pressure had not been lost in the distribution systems, but that water to Mill Hill and other select areas were being turned on and off intermittently to allow water use at those locations during portions of the day; the rest of the compound was unaffected.
 - It was also discussed that some of the PRVs may have failed and pressure spikes were being noted. Causes of the failures are multiple; one PRV was damaged due to ill-fitting, heavy lids that were deemed inappropriate for the application. One of these lids fell into the hole damaging a PRV.
 - The operator explained their plan to keep water in service and to minimize pressure spikes as much as possible, there was no other way at that time to reduce pressure – the PRV technician was notified that we had an emergency, but the soonest he could get to our site was the following Tuesday (September 16).
 - I briefed the Ranger and her staff after discussion with the contractor – since pressure had not been lost in the distribution system (at that time) there was no need for concern from a contamination standpoint.
- I received multiple phone calls from the operator for the remainder of the weekend. Some of the repairs were damaged when the line was pressurized (such as the line at Mill Hill) due to insufficient thrust blocking.
- By Sunday night (September 14th) it appeared most of the system had been patched back together and was limping along – but some pressures were on the high side (~100 psi). The PRVs are a highly specialized piece of equipment and we were at the mercy of when the technician could arrive to make repairs.
- I received a phone call around 0730 Monday, September 15 from the Ranger stating that the main office had flooded over the weekend.
 - AQM was immediately notified of the situation as it would likely require emergency spending (we were past year-end cutoffs)
 - John (Zeb) O'Connor was notified and agreed to mobilize to the site to assist.
 - The following contractors were called and mobilized: (Yeager's Plumbing – for repairs and ServPro – for cleanup).
 - Once the above was complete, Michelle Bernard and I drove to Tiller
 - Through a joint effort between Timberline, Yeager's Plumbing and John O'Connor, we were able to track the leak down to the vicinity of the break room.
 - We discussed methods of cutting into the slab: utilizing a concrete saw would create a lot of dust – John O'Connor has a concrete saw, but did not bring it with him. Yeager's

- suggested coming back with a jack hammer – less dust. We agreed that was the best plan.
- ServPro began setting up their equipment for the water remediation during this time and gave us an estimate of 5 to 7 days of drying time.
 - On 9/16/14 Yeager’s Plumbing returned to the site – they dug into the floor where we had seen the water surfacing, but could not locate the pipe. When the water was turned back on, it appeared to be surfacing at a different location (in the break room).
 - At first, it was decided that removing the floor in the break room while the plumber was on site would be a good course of action. A quick look at the asbestos files, however, showed that the adhesive beneath the 12x12 tiles contained asbestos. I advised the plumber to cease all work and pull off until the floor could be abated.
 - It now made sense to call in American Leak Detection to locate the leak more precisely while simultaneously getting an asbestos abatement contractor to remove the flooring. American Leak Detection was scheduled at their earliest opening, Wednesday September 24. Western States Environmental was also contacted and scheduled for the next day, September 25. Yeager’s Plumbing was then contacted and set up for the 26th.
 - The Mill Hill line was repaired by Wednesday September 17 and new thrust blocks were placed, but required the line to remain depressurized a bit longer until the concrete cured.
 - On September 23 we got a positive coliform result at Mill Hill – this was likely due to soil getting into the line during repair; the test was a non-detect for E.coli, however. A precautionary “boil water” notice was issued.
 - A subsequent test on the 24th showed a non-detect for coliforms and the boil water notice was lifted.
 - Water remained shut off at the Ranger Station during this time. Bottled water was purchased, porta-potties / washing stations were ordered, and a nearby vacant house served as a makeshift break room.
 - The water remediation was completed by ServPro on September 22.
 - Michelle Bernard returned to Tiller on September 24 to monitor American Leak Detection’s Progress. The leak was found and located in the break room at a location that did not make sense based on record drawings of the facility. No further leaks were found in the office or in the distribution system on this day.
 - Western States Environmental mobilized on the 25th and removed all asbestos containing mastic. We were given the “all-clear” to reoccupy this room on the same day. The “X” that American Leak Detection had put on the floor to indicate the leak location was transferred to the concrete by Mitch Fuller.
 - On September 26th I arrived at the Ranger Station just prior to 0800. Yeager’s Plumbing was already on site. Based on the location of the “X” we began to piece the puzzle together – we believed the tee was directly perpendicular from the “X” to the wall. There was even evidence of a prior patch in this location. We decided to dig there, which required removing the cabinet and water heater. The Ranger was consulted and agreed to allow removal of the cabinet.

- There was evidence of a prior fix once the pipe was exposed – it was not installed properly, but appeared to be holding. The plumber cut the pipe back to the tee and installed a plug. Some of the fittings and pipes that were removed had large holes in them – it is likely they have been leaking for a long time.
- The result of capping the tee at this location is all downstream fixtures are now cut off. This includes the janitor’s closet and a hose bib near the southern corner of the building (closest to the visitor parking lot).
- Once the line was capped we pressurized the system and monitored for leaks. None were apparent. We also flushed the system for a long period of time and took a “special” coliform test to the lab for analysis. The results came back as a “non-detect” on Monday, September 29.
- Total costs to fix leaks and the damage caused by the leaks are still being accrued and the current estimate of costs to-date is around \$45,000. Restorative costs to fix floors, drywall, cabinets, plumbing, and electrical have not yet been estimated, but budget numbers are expected to be around \$40k to \$50k.

John Beagle, PE
Assistant Forest Engineer
Umpqua National Forest

