

August 21, 2012

Rob Henry
HBH Consulting Engineers
2316 Portland Road, Suite H
Newberg, OR 97132

**Re: Jewell School District #8 (PWS #90531)
Slow Sand Filtration and Disinfection System Expansion
Final Approval - PR #192-2010**

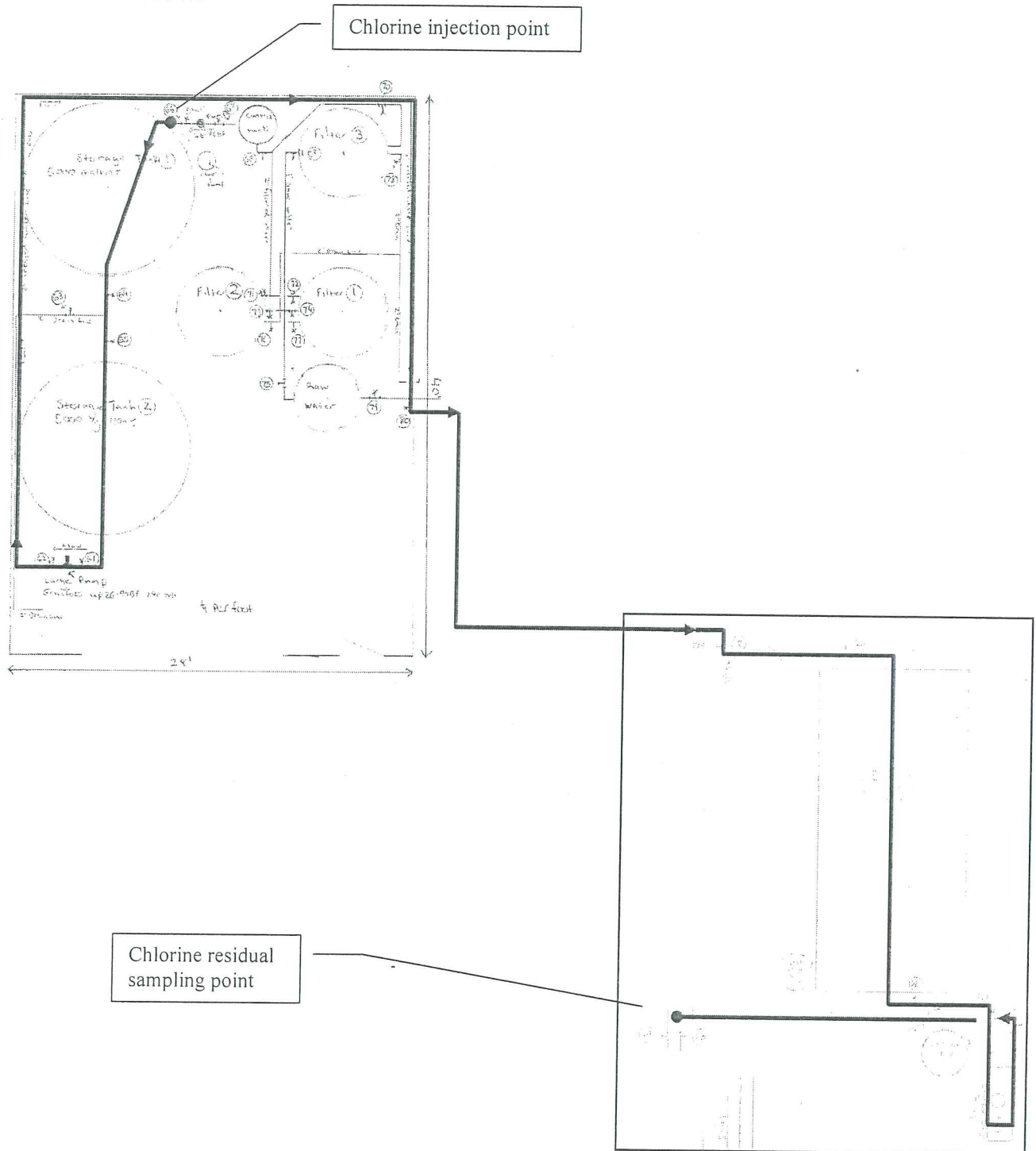
Dear Mr. Henry:

On December 7, 2010, our office received plans for the slow sand filtration and disinfection system expansion for the Jewell School District #8 (Plan Review #192-2010). On August 6, 2012 we received the results of a tracer study conducted on May 30, 2012 demonstrating a **contact time of 161 minutes at 30-gpm** through two new 5,000 gallon poly tanks and a pre-existing 15,000 gallon steel tank. **The project is Granted Final Approval.**

The project involved the installation of a third 6-gpm Blue Future Filter slow sand filter (SSF-6), two new Norwesco 141”D x 87” H tanks (product code #0005-050) with NFS-61 Certification, chlorination system, and related piping incorporated into a new filtration building, which also houses the two original SSF-6 Blue Future filters, control tank, pump, Hach 1720E turbidimeter and related piping previously approved under PR#72-2008.

This system serves to augment the existing corrosion control system, 15,000 gallon clearwell, pressure tank, and related piping located in the original treatment room.

The tracer study was conducted through the treatment process as shown in the schematic below:



Conditions and results of the tracer study are tabulated below:

Plant (WTP-A)	Slow Sand Filter Plant
Measured Contact Time	161 min
Flow rate	30 gpm (range was 32-33gpm)
Storage facilities included in study	1) 2 Norwesco Tanks (4,526 gallons each @ 141" diameter & 67" depth) 2) ~200-ft of 2" pipe (~33 gallons) 3) 15,000 gallon tank
Initial & final 5,000 gal tank levels	Initial = 12" below tank max liquid level (plant starts at this level) Final = 24" below tank max liquid level
Initial & final 15,000 gal tank levels	Initial = 90% of tank max liquid volume (3" below full) Final = 90% of tank max liquid volume (12" below full)
Initial (C ₀) & final (C ₁₀) chlorine residual measured at the effluent of the 15,000 gallon tank.	C ₀ = 1.54 mg/l C ₁₀ = 1.64 mg/l (based on 0.98 mg/l increase in plant dose)
Theoretical Contact Time @ 30 gpm	1) 5000-gal tanks = 26 min (7,836 gallons total @ 18" below max level, 10% baffling factor) 2) ~200-ft of 2" pipe = 1 min (33 gallons, 100% baffling factor) 3) 15,000 gal tank = 45 min (13,500 gal @ 90% full, 10% baffling factor) Total theoretical contact time = 72 min
Baffling Factor Estimate	~ 23% for the three tanks plumbed in series @ 30 gpm The total volume of 21,369 gallons (7,836 gal + 33 gal + 13,500 gal) could provide 712 minutes of contact time provided perfect plug flow conditions existed allowing use of a 100% baffling factor. Due to short circuiting, only 161 minutes is provided through this same total volume. The baffling factor for the three tanks in series is roughly 23% (161 min / 712 min = 22.6%).

Thank you for your assistance in this process and if you have any questions, or would like this in an alternate format, please feel free to call me at (971) 673-0419 or via e-mail at evan.e.hofeld@state.or.us.

Sincerely,



Evan Hofeld
Regional Engineer
OHA - Drinking Water Services

CC: Ryan Sunnell, Jewell SD #8