New Water Main Chlorination and Bacteriological Testing Protocol

Preparation:

1. An appropriate water source will be determined by the EVMWD District representative based on proximity to work location and available flow. Adequacy of flow will be confirmed by water operations staff. Typically a fire hydrant or wharf head.
2. A dedicated meter and backflow will be set at the source location prior to any source connections to the water main being tested. The District will set the meter and the contractor will set and test an RP type backflow device that is the same size as the meter, or larger than the meter. This source will only be used for water main testing and no construction purposes for the duration of water main testing.
3. A 2.5” construction meter is only suitable for up to 12” diameter water main. Larger pipe will require at least a 4” meter/backflow.
4. Clean water hose will be provided by the contractor to convey water from the water source to the water main. This hose should be at least 2.5” in diameter, NSF 61 approved for potable water use (cloth fire hose is not acceptable), and the hose should be disinfected and flushed. Care should be taken to ensure the backflow assembly is clean prior to introducing water to the new main.
5. The main being tested should not be connected hydraulically to the existing District water system except for the backflow protected source. Physical separations or test plates must be used at all future tie-in points. The presence of a physical separation or test plate will be confirmed by the inspector. Testing against a closed valve is not acceptable.
6. Sample points will be selected by the inspector. The same sample points should be used for chlorine disinfection testing as well as bacteriological samples. Sets of samples shall be collected every 1,200 ft, plus one set from the end of the line, and at least one from each branch greater than one full pipe length. Samples should not be drawn from hydrants if possible.
7. A District provided form will be used by the inspector to document a diagram of the water main being tested, location and type of all designated sample points, date and field result of chlorine confirmation tests, and date and field results of all bacteriological samples taken.

Pressure Testing:

1. Pressure testing will be performed according to the most current EVMWD design standards. It is acceptable to combine pressure testing with chlorination if preferred by the contractor.
**Chlorination:**

1. Prior to chlorinated water being introduced into the new water main, the main will be thoroughly flushed to remove any sediments, construction debris, or stagnant water.
2. The continuous feed method of chlorination, as defined in AWWA C651-14, is the only acceptable method of chlorination. Tablet chlorination and slug chlorination are not acceptable.
3. Chlorine used for the continuous feed method can be liquid sodium hypochlorite that is NSF 60 approved for use in potable water, or gas chlorine using a vacuum operated chlorinator.
4. Chlorine will be introduced downstream of the RP backflow device. This could be the #4 test port on the backflow.
5. The water main will be filled with chlorinated water dosed at 25-150 mg/L of free chlorine residual. Care shall be taken to push the water to all dead ends of the new main and through all services.
6. The inspector will confirm that 25-150 mg/L of free chlorine is present at all designated sample points on the main. This will be accomplished using a Hach high chlorine titration kit.
7. The District inspector will witness the contractor operate all isolation valves on the water main segment being tested. All valves will be closed then completely reopened. Valves will remain completely open for the remainder of the test.
8. The water main will be isolated with static pressure until the following day. The source hose should stay connected if possible.
9. At 24 hours after the chlorine dosed and tested, the inspector will test each designated sample point to ensure the water main has at least 10 mg/L free chlorine residual at all points.
10. If 10 mg/L is present at all designated points, the chlorine can be flushed to commence bacteriological testing. If 10 mg/L is not present at all designated points, the water main must be chlorinated again.

**Bacteriological Testing:**

EVMWD’s Regional Laboratory will analyze all new water main samples. The District inspector will deliver all samples to the Lab with accompanying completed chain-of-custody (COC) forms containing project and sample point IDs. Analyses for samples received at the Laboratory by 3pm will be started on the same day. Laboratory staff must be notified of any sample deliveries projected after 3pm, at the time of pick-up of sample bottles and COC’s. EVMWD WQ Lab must be notified of sampling needs via e-mail to waterquality@evmwd.net, at least one day in advance if possible, using the attached Lab order form.

1. Two consecutively passing sets of bacteriological samples are required for the water main to be accepted for tie-in to the EVMWD water system. Samples will be analyzed for coliform (presence/absence) and heterotrophic plate count (HPC). Passing samples shall be absent for coliform and have an HPC of less than 500 colony forming units (CFU) or less than 500 most probable number (MPN). If deemed applicable based on project size and conditions, it is
recommended that samples be tested for acceptable aesthetic quality (e.g., pH, alkalinity, specific conductance, turbidity).

2. During flushing, the District inspector will use a chlorine residual analyzer to confirm that all highly concentrated chlorine has been flushed from the main. The chlorine residual should be no more than 4 mg/L prior to bacteriological sampling.

3. The water main will be thoroughly flushed then shut off for a 16 hour period. During this period, the main should remain under static pressure with a valve on the source off (a backflow device valve). The inspector will read the construction meter. No water is allowed to pass through this meter prior to the arrival of the inspector for the bacteriological samples the following day.

4. After at least 16 hours have passed, the District inspector will confirm no water has passed through the meter. Bacteriological samples will be taken at each designated point. Two samples from each sample point will be taken a minimum of 15 minutes apart with the sample taps left running between samples, in accordance with “Bacteriological Tests, Option B”. The source water will only be turned on to provide pressure for samples if needed. Flushing of the water main is not permitting on the day samples are being drawn.

5. The water source will be turned on after sampling is complete to provide continuous positive pressure on the tested main. The main must remain connected to the metered and backflow protected source and pressurized until all samples have been accepted by EVMWD and the tie-in work starts. The main will be depressurized only by District Water Operations staff on the date of the scheduled tie-in.

6. Once bacteriological samples have been taken, the contractor cannot depressurize or otherwise tamper with the tested water main. Any unauthorized depressurization or tampering witnessed by District staff will require bacteriological testing to start again. After sample results are sent to the inspector from the lab, proceed based on the following table:

<table>
<thead>
<tr>
<th>Total Coliform Bacteria</th>
<th>E. Coli Bacteria</th>
<th>HPC (CFU or MPN)</th>
<th>Follow-up Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent (all samples)</td>
<td>-</td>
<td>&lt; 500 (all samples)</td>
<td>Water Main can be accepted for tie-in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=/&gt; 500</td>
<td>Flush and repeat testing at elevated HPC sites. Repeat disinfection Optional.</td>
</tr>
<tr>
<td>PRESENT (1st Round &lt; 25% samples)</td>
<td>Absent</td>
<td>Regardless</td>
<td>Flush and repeat testing of all sample sites. Repeat disinfection Optional.</td>
</tr>
<tr>
<td>PRESENT (&gt;25% samples)</td>
<td>Absent</td>
<td>Regardless</td>
<td>Flush and repeat testing of all sample sites. Repeat disinfection REQUIRED.</td>
</tr>
<tr>
<td>PRESENT (&gt;1st Round)</td>
<td>Absent</td>
<td>Regardless</td>
<td>Flush and repeat testing of all sample sites. Repeat disinfection REQUIRED.</td>
</tr>
<tr>
<td>PRESENT (any sample)</td>
<td>PRESENT</td>
<td>Regardless</td>
<td>Flush and repeat testing of all sample sites. Repeat disinfection REQUIRED.</td>
</tr>
</tbody>
</table>
Tie-In:
1. The final tie-in of the tested water main will occur no sooner than five calendar days after the passing bacteriological results, and not later than 14 calendar days after passing bacteriological results. If job progress is dependent on an immediate shutdown and tie-in, District inspectors and Operations staff will work together to complete the work in less than five days.