MEMO

TO: Board of Directors

FROM: Management Staff

RE: District System Protection – Corrosion Control

DATE: February 8, 2016

As a result of the water issues in Flint, Michigan, staff has prepared this report on the Carmichael Water District's (District) system protection – corrosion control that are in place. The District takes a proactive approach to ensure the public's trust in its water supply through the following programs and processes: (a) lead and copper testing program; (b) product lead content – AB 1953; (c) new construction requirements; (d) fire hydrant permit process; (e) system flushing program; (f) annual leak detection program; and (g) mainline replacement program. The programs are described in detail below.

A. Lead and Copper Testing Program

Lead may be present in surface water or ground water sources, but more frequently it enters tap water in the distribution systems, often at the individual home. Lead pipes and solder corrode and leach lead into tap water. The District's primary tool for protecting its customers from lead is complying with the requirements of the Lead and Copper Rule (LCR). The four main functions of the LCR and how the District addresses those functions are as follows:

1. Require water suppliers to optimize their treatment system to control corrosion in customers' plumbing. A basic requirement of the lead and copper regulation is for systems to optimize corrosion control. This means that the water system is delivering water that is minimally corrosive, thereby reducing the likelihood that lead and copper will be introduced into the drinking water from the corrosion of lead and copper plumbing materials.

The Bajamont Water Treatment Plant's (BWTP) raw water source is the American River. There are several parameters that are included in measuring the corrosive potential of water such as: temperature, total dissolved solids (TDS), hardness, alkalinity and ph. The ph of American River raw water averages 7.4, when the raw water ph is measured with all of the parameters listed above, the water is considered mildly corrosive. As a result BWTP elevates the ph to a range of between 8.4 and 8.6 in order to maintain a near-balanced product. Elevating the ph is the method used at the BWTP to control corrosion. Historically (since the mid-1950s), the District treated its surface water with hydrated lime. Since 2002, the District has optimized treatment through the addition of sodium hydroxide also known as caustic soda rather than lime. At the elevated ph level the water is very close to "balanced", defined as non-scale forming and non-corrosive.

Note: All of the District's groundwater wells are near "balanced" defined as non-scale forming and non-corrosive. Hence, there is no chemical addition for corrosion control to the groundwater sources nor is chemical addition required.

2. Rule out source water as a source of significant lead levels. The District does extensive monitoring of its water supply sources and has never had detectable lead levels from any of its source samples either groundwater or surface water.

3. Determine tap water levels for customers who have lead service lines or lead-based solder in the plumbing systems. The District conducts lead and copper sampling at thirty (30) selected homes every three years as prescribed under the LCR. The results have never exceeded the "Action Level" as established by the LCR so the District is under a modified (every three years) LCR. The Action Level is a screen for optimal corrosion control as part of the treatment technique and is based on treatment feasibility.

4. If the action level is exceeded, the District would be required to educate customers about lead. The District's regulated testing program requires testing for lead and copper at thirty (30) selected homes as prescribed by the LCR. The analytical results of the samples are ranked from lowest to highest and are not to exceed the Action Level at the 90th percentile. CWD has had no known samples where the Action Level was exceeded at the 90th percentile. This testing program started with annual testing in the mid-1990s and modified to a three year cycle. In the last ten years, testing was conducted in 2005, 2008, 2011 and 2014. The next round of testing will be conducted in the summer 2017. Customers who participate are notified of the results of the lead and copper testing by mail. The results of the combined test are included in the annual Consumer Confidence Report (CCR).

B. Product Lead Content - AB 1953

Assembly Bill 1953 took effect January 1, 2010. The bill impacted plumbing fixtures in California intended to convey or dispense water for human consumption by lowering the lead content limit. As of January 1, 2010 no plumbing/waterworks products that come in contact with the wetted surface of a water system with a lead content higher than 0.25% are allowed to be installed in the District's system. In response to AB 1953, District staff took the following action:

- On December 31, 2009 District staff removed all brass plumbing fixtures containing lead from inventory resulting in an inventory adjustment of $88,298.16.
- Staff contacted manufacturers and suppliers to discuss solutions for existing inventory.
- All subsequent inventory purchases are of a low or no-lead type resulting in a 40% cost increase.

C. New Construction Requirements

District Standards and Specifications were reviewed and updated to reflect the requirements of AB 1953. Per the District's updated specifications and procedures:

- Water services shall not be constructed of lead bearing materials and shall be compliant with AB 1953 as lead free.
- Prior to any connection to District facilities, a preconstruction meeting is held at which time the parts and appurtenances for the project are inspected for compliance by District staff.
- If no-compliant parts are identified, the contractor is not allowed to proceed until the proper non-lead parts are obtained.
- Water parts suppliers within the Sacramento area have been supplied a copy of the District's specifications and are aware of the no lead requirement.

- A final inspection is conducted by District staff to assure that District specifications have been adhered to.

D. Fire Hydrant Permit Process

A fire hydrant permit may be obtained from the District for the purposes of new construction. The following precautions are taken to maintain water quality and protect the water supply from contamination:

- Contractor or Permittee must obtain a fire hydrant permit from the District.
- The Permittee must sign an agreement ensuring that all conditions have been read and understood.
- The District shall supply an AB 1953 compliant fire hydrant meter and backflow prevention assembly for each connection to a fire hydrant.
- The District shall test the backflow assembly in accordance with the Cross Connection control program.
- The permit is valid for six (6) months from the date of issuance. In order to continue to obtain water through a fire hydrant, the permittee must schedule an inspection of the meter/backflow unit, an intermediate meter reading and apply for reissuance of the permit.
- The District may discontinue use of water and recall hydrant meters at any time if water supplies are low or for violations of the permit conditions.

E. System Flushing

District staff flushes the fire hydrants to maintain a high level of water quality in the distribution system. Over a period of time particularly at the dead end locations, stagnant water containing biofilm will build up in our distribution system. The only way to alleviate this build up is by opening the hydrants to achieve high velocity cleaning of the lines. The District's seasonal flushing program maintains system water quality.

The system flushing takes place primarily in the winter months when water demand is low. The District also flushes lines at a customer's request. During seasonal demand variations when the District operates wells and during project or emergency shutdowns the distribution lines may be affected. The District will schedule flushing in affected areas on a regular basis as well as on an as needed basis.

F. Annual Leak Detection Program

Old or poorly constructed pipelines, inadequate corrosion protection, poorly maintained valves and mechanical damage are some of the factors contributing to leakage. Leak detection has historically assumed that all, if not most, leaks rise to the surface and are visible. In fact, many leaks continue below the surface for long periods of time and remain undetected. With an aggressive annual leak detection program, the District can search for and reduce previously undetected leaks. Water lost after treatment and pressurization but before delivered for the intended use is water, money and energy wasted. Accurate location and repair of leaking water pipes in a supply system greatly reduces these losses. Once a leak is detected, the District takes corrective action to minimize water losses in the water distribution system.

Benefits of Leak Detection and Repair

Minimizing leakage in water systems has many benefits for water customers. These benefits include:

- Improved operational efficiency;
- Lowered water system operational costs;
- Reduced potential for contamination;
- Extended life of facilities;
- Reduced potential property damage and water system liability;
- Reduced water outage events; and
- Improved public relations.

Leak detection and repair programs can lead other important water system activities, such as:

- inspecting pipes, cleaning, lining, and other maintenance efforts to improve the distribution system and prevent leaks and ruptures from occurring;
- inspecting hydrants and valves in a distribution system; and
- updating distribution system maps.

Types of Leaks

There are different types of leaks (including service line leaks and valve leaks) but in most cases, the largest portion of unaccounted for water is lost through leaks in supply lines. There are many possible causes of leaks and often a combination of factors leads to their occurrence. The material, composition, age, and joining methods of the distribution system components can influence leak occurrence. Another related factor is the quality of the initial installation of distribution system components. Water conditions are also a factor, including temperature, velocity, and pressure. External conditions, such as stray electric current, contact with other structures, and stress from traffic vibrations around a pipe can also contribute to leaks.

Underground Leaks

The underground piping on either side of a water meter should be maintained. Leaks in underground plumbing can be caused by many different factors, including rusting through from age or from stray electric currents from other underground utilities that can prematurely rust metallic piping, driving over piping with heavy trucks or equipment, poor initial installation, leaking joints or valves, closing valves or starting and stopping pumps quickly.

Signs of underground leaks include:

- Unusually wet spots in landscaped areas and/or water pooling on the ground surface;
- An area that is green, moldy, soft, or mossy surrounded by drier conditions;
- A notable drop in water pressure/flow volume;
- A sudden problem with rusty water or dirt or air in the water supply (there are other causes for this besides a leak);
- A portion of an irrigated area is suddenly brown/dead/dying when it used to be thriving (water pressure is too low to enable distant heads to pop up properly);
- Heaving or cracking of paved areas;
- Sink holes or potholes;
- Uneven floor grade or leaning of a structure; and
- Unexplained sudden increase in water use, consistently high water use, or water use that has been climbing at a fairly steady rate for several billing cycles.

Leak Detection and Repair Strategies

There are various methods for detecting water distribution system leaks. These methods usually involve using sonic leak-detection equipment, which identifies the sound of water escaping a pipe. These devices can include pinpoint listening devices that make contact with valves and hydrants, and geophones that listen directly on the ground. In addition, correlator devices can listen at two points simultaneously to pinpoint the exact location of a leak.

Large leaks do not necessarily constitute the greatest volume of lost water, particularly if water reaches the surface where they are usually found quickly, isolated, and repaired. However, undetected leaks, even small ones, can lead to large quantities of lost water since these leaks might exist for a long time. Ironically, many small leaks are easier to detect because they are noisier and easier to hear using hydrophones.

Active leak detection is crucial in identifying unreported water leakage and losses in the distribution system. Finding and repairing water losses through an active leak detection program will reduce water loss and, in many cases, save substantial money. Without a leak detection program, leaks may only be found when they become visible at the surface, or when major infrastructure collapses. Active leak control will reduce expensive emergency overtime repairs and the associated liability costs. The impact on customers is also greater in emergency repair situations as is the possible impact on other infrastructure (roads, sewers, utilities) and on the environment due to possible discharges of chlorinated water.

Detecting leaks is only the first step in eliminating leakage. Leak repair is the more costly step in the process. On average, the savings in water no longer lost to leakage outweigh the cost of leak detection and repair. In most systems, assuming detection is followed by repair, it is usually cost effective to completely survey the system every one to three years. Selecting a strategy depends upon the frequency of leaks in a given pipe and the relative costs to replace and repair them. For example, instead of repairing older, leaking mains, some argue it is preferable to replace leak-prone older pipes. Deciding whether to emphasize detection and repair over replacement depends upon site-specific leakage rates and costs.

In general, leak detection and repair result in an immediate reduction in lost water, whereas replacement will have a longer-lasting impact to the extent that it eliminates the root cause of leaks. The most important factor in a leak detection and repair program is the need for accurate, detailed records that are consistent over time and easy to analyze. Records concerning water production and sales, and leak and break costs and benefits, will become increasingly important as water costs and leak and break damage costs increase and as leak detection and rehabilitation programs become more important.

G. Water Main Replacement Program

The District owns and maintains approximately 154 miles of 4" to 24" water mains. Many miles of these water mains were constructed in the 1940's and 1950's and have outlived their useful life and are in need of replacement. The initial 5 to 10 year replacement program will address old pipelines installed prior to 1950. District staff has identified seventy-nine projects throughout the service area that need immediate attention due to undersized piping and/or water quality issues

The PSM program sets forth a strategy to replace aging, deteriorating, and undersized water mains throughout the District with an emphasis on the next 5 to 10 years. The program is based

on information identified in the District's Master Plan to define areas in most need of main replacement. The criteria used to develop the program included the age of the main, pipeline material, location of the pipe, leak history, hydraulic factors (including fire hydrant spacing, percentage of hydrants that are wharf type and fire flow capability), and risk factors.

The individual Planned System Maintenance (PSM) projects have been bundled into groups to allow for annual scheduling and funding. The PSM program is used as a planning tool during annual capital improvement program (CIP) budget discussions with the Board.

Future Treatment

District staff continues to monitor regulatory requirements for upcoming changes. In the foreseeable future, there is nothing new for corrosion control and the District has no plans to change chemicals or processes.

Summary

The District's takes its mission to provide its customers with a safe and reliable water supply very seriously. Staff will continue to keep the public informed on water issues that are concerning. Customers are encouraged to continue to read updates on the District's website, agenda packets, newsletters, bill inserts, and other outreach materials and attend District Board Meetings for all the latest Carmichael Water District news and information.