Highlights of Investigation of Sodium and Chloride in the Water Supply, John Read Middle School, prepared by WSP USA

Investigation undertaken to

- Attempt to identify the source of excessive sodium and chloride concentrations in Well 1 at John Read Middle School
- Provide potential options to improve the quality of the water supplied to the school

Existing System:

- The existing water-supply system consists of one bedrock water-supply well (Well 1), a 10,000-gallon atmospheric storage tank and two re-pressurization transfer pumps. In addition, two other bedrock wells were drilled on the property (Well A and Well B).
- The school currently uses bottled water to meet the consumptive demand for the school (drinking and food preparation) and utilizes the onsite bedrock water-supply system for sanitary purposes.
- The water quality concerns that were evaluated as part of this investigation include sodium, chloride, lead, and copper.
- The sodium and chloride were investigated because elevated concentrations were detected in Well 1. Elevated concentrations of sodium and chloride in a water supply can result in corrosion of the plumbing system.
- Lead and copper were investigated to determine if the sodium and chloride in the water supply have had a corrosive effect on the plumbing system within the school.

Water Quality

- Water-quality samples have been collected from Well 1 and from sampling points within the school, and then analyzed for sodium, chloride, lead and copper:

TABLE 1

JOHN READ MIDDLE SCHOOL
REDDING, CT

Summary of Groundwater Quality Results – Well 1

Sample Date	Sodium (mg/l)	Chloride (mg/l)	Copper (mg/l)	Lead (mg/l)
5/8/2007	**34.3**	135	0	0
5/17/2010	**39.5**	109	0.02	0.001
5/1/2013	**130**	1	0.03	0
2/1/2016	**189**	**781**	0.03	0
9/26/2016	NS	**807**	NS	NS
11/1/2016	NS	**895**	NS	NS
2/14/2017	NS	**953**	NS	NS
5/18/2017	NS	**943**	NS	NS
9/11/2017	NS	**692**	NS	NS
11/28/2017	NS	**675**	NS	NS
US EPA MCL	NE	250	0.015	1.30
CTDPH Notification Level	28	NE	NE	NE
CTDPH Guidance Level	100	NE	NE	NE

mg/l	Milligrams per liter
US EPA	United States Environmental Protection Agency
MCL	Maximum Contaminant Level
NS	Not Sampled
NE	Not regulated under this criteria.

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- The sodium concentration in Well 1 has been increasing since 2007 from a low of 34.3 mg/l to a high of 189 mg/l, with the highest concentration being collected on February 1, 2016. The Connecticut Department of Public Health (CTDPH) Guidance level for sodium is 100 mg/l and a Notification Level of 28 mg/l. Therefore, the sodium concentrations that have been detected in Well 1 are greater than the CTDPH Guidance Level and the Notification Level.
- The chloride concentration has been gradually increasing since 2010 from a low of 109 mg/l to 943 mg/l, which was collected on February 14, 2017. The maximum contaminant level (MCL) for chloride is 250 mg/l; therefore, the chloride concentration has exceeded the MCL.
- Lead and copper have been sampled between 2007 and 2016. The laboratory results indicate that the lead concentration ranged from a low of 0 mg/l in 2007 to 0.001 mg/l in 2010 and the MCL for lead is 0.015 mg/l.

- With regard to copper the laboratory results indicate that the copper concentration ranged from a low of 0 mg/l in 2007 to a high of 0.03 mg/l in 2016. The MCL for copper is 1.3 mg/l.
- The laboratory results indicate that neither lead nor copper have been detected at concentrations that exceed regulatory criteria.
- MCLs relate to potential adverse health effects. SMCLs relate to aesthetic issues (such as color and odor).

Potential Sources of Sodium and Chloride

- Sodium and chloride occur naturally in groundwater.
- Sources of elevated concentrations can include salt storage, road salting, and backwash water from water softeners
- There is a DPW salt storage facility approximately 3,800 feet to the east of JRMS, and up gradient from JRMS.
- Road salt is applied to parking areas surrounding Well 1, and to Redding Road, which is adjacent to Well 1.
- No awareness of water softeners in the area but it cannot be ruled out
- Based on the site inspection and review of the available data, it is not possible to conclusively identify any of the sources as the primary source
- However, because of the proximity of Well 1 to Redding Road and the DPW salt storage facility being located up gradient from JRMS, road salting along Redding Road and the DPW salt storage facility may be contributing factors.

Options to Improve Water Quality

- Install water treatment equipment to reduce the sodium and chloride
    - Estimated cost to install: minimum of $50,000
    - Estimated operational costs: $1,250 to $2,500 daily for offsite disposal
- Install water treatment equipment to mitigate potential corrosive effects to the distribution system from the groundwater
    - Intended to prevent leaks and potential leaching of lead and copper
    - Estimated cost to install: $10,000 to $20,000
- Evaluate Well A and/or Well B as an alternative source(s) of supply
    - Perform testing to determine sustainable yield and drawdown in both wells, as well as sampling to determine the concentration of sodium and chloride. Estimated cost: $3,800
    - Estimated cost to install and connect each well: $66,500 to $97,500
    - 2X if both wells are required for sufficient yield: $133,000 to $195,000
    - Caveat: water quality may degrade over time.
- Locate and drill a new water-supply well

    - Estimated cost to install and connect new well: $57,500+ to $85,000+
    - Caveats: new well may not have sufficient yield or acceptable water quality. Water quality may also degrade over time.
    - Minimum cost to assess yield and quality: $17,500 to $25,000
- Connect to a public water supply system
    - Construction costs estimated at $1,320,000 to $2,640,000 per mile to connect
- Reduce the level of salt application to the parking lots, walkways, and Redding Road

Conclusions

1. JRMS currently provides bottled water for consumptive purposes. This action is warranted.
2. The water supplied from Well 1 exceeds the MCL for chloride and the CTDPH Guidance Level and CTDPH Notification Level for sodium.
3. Water samples collected from the distribution system within the school indicate that lead and copper have not been detected at concentration that exceed the applicable MCL.
4. Installation of a water treatment system to reduce sodium and chloride is feasible; however, additional evaluation would be needed to determine if it is practical.
5. Extension of the water main from a public water supplier is considered less desirable because of the cost associated with extending a water main.
6. Two potential water supply wells exist on school property (Well A and Well B). The wells should be evaluated to determine if there is adequate yield and water quality for connection to the existing water supply system.
7. The drilling of a new bedrock water-supply well is a potential option to improve the quality of the water supplied to the school. However, there are uncertainties associated with this approach. It cannot be determined without drilling and testing the water supply well if this option is feasible relative to obtaining the desired yield and quality. In addition, it cannot be determined if operating the new water-supply well over time would induce groundwater with larger concentrations of sodium and chloride to the new well. The cost associated with connecting a new bedrock water-supply well would need to be further evaluated to develop a precise estimate.
8. The installation of a corrosion control system could be considered as a protective measure against the future potential for corrosion of the existing distribution system.

Recommendations

1. Well A and Well B should be evaluated for yield and water quality.
2. Consideration should be given toward the drilling and testing of a new bedrock water-supply well.
3. A corrosion control system should be installed on the existing water-supply system.

4. Additional water samples to evaluate corrosive potential of the water supplied to the school should be collected.
5. Consideration should be given toward the use of a treatment system to reduce sodium and chloride in the water supply.

Facilities Committee Input:

- Remediation activities should be considered against the cost/benefits of continuing the existing usage of bottle water for consumptive purposes (~$7,000 annual cost).
- Evaluation of Well A and/or Well B as an alternative source(s) of supply should not be pursued:
    - Spending $3,800 will provide information on whether 1 or 2 additional wells would be needed to obtain sufficient yield and whether there is acceptable water quality.
    - Estimated cost to install and connect each well: $66,500 to $97,500
    - 2X if both wells are required for sufficient yield: $133,000 to $195,000
    - Caveat: water quality may degrade over time, with no guarantee of long-term resolution.
- Drilling a new well costs a minimum of $17,500 to $25,000 to evaluate the well, and another $40,000+ to $60,000+ to connect, with no guarantee of long-term resolution. This should not be pursued.
- Water treatment equipment to reduce sodium and chloride, and connection to a water main, are cost–prohibitive and should not be pursued.
- Have professional firm evaluate building water distribution system to provide recommendations related to possible corrosion of the distribution system.
- Subject to the results of the evaluation, water treatment equipment to control corrosion should be pursued to protect the distribution system since the well water will continue to be used for sanitary purposes