California State Water Resources Control Board

Division of Financial Assistance

Drinking Water State Revolving Fund (DWSRF)

Bipartisan Infrastructure Law – DWSRF Lead Service Line Replacement Funding

Staff's Analysis

Comprehensive Response to Climate Change

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I. Introduction

On March 7, 2017, the State Water Resources Control Board adopted Resolution No. 2017-0012 titled *Comprehensive Response to Climate Change.*[1] The resolution directed the Division of Financial Assistance (Division) to work with the Division of Drinking Water "to provide technical assistance and financial support to protect drinking water systems that are highly vulnerable to climate change impacts, with emphasis on disadvantaged communities and vulnerable populations." Further, the resolution also directed the Division to include climate change mitigation and adaptation objectives in the Clean Water State Revolving Fund and the Drinking Water State Revolving Fund (DWSRF) Intended Use Plans (IUPs).

The "Response to Climate Change,"[2] Section VI.E of the DWSRF IUP, ensures that applications and environmental reviews for potential projects evaluate the impacts related to climate change and account for potential mitigation measures. This may include, but not be limited to, evaluating the potential effects of climate change on the viability of funded projects, and helping applicants ensure that mitigation and adaptation measures are implemented as fully as practicable. The DWSRF program has achieved this goal by including section IV. "Comprehensive Response to Climate Change" in the Technical Package for both planning and construction project applications.

The Lead Service Line (LSL) Replacement Funding Program is part of the DWSRF Program. It provides funds for LSL inventorying and replacements using funds from the Infrastructure Investment and Jobs Act (IIJA) of 2021 and awarded through United States Environmental Protection Agency.

All projects under the LSL Replacement Funding Program will be a combination of two types of projects, either inventorying LSL projects or replacing LSL. The LSL inventorying projects are primarily accomplished through historical records reviews and visual inspections at the water meter boxes. The effects of climate change on these projects and the available project opportunities for adaptation and mitigation are negligible. This leaves only the climate change analysis for the LSL replacement which, while non-negligible, is near uniform across all projects of this same type. Therefore, to reduce the administrative burden on program applicants, the Division has prepared this program wide climate change analysis for LSL replacement projects. The Division believes this analysis will be adequate for most LSL replacement projects, and the LSL application form includes a certification checkbox to indicate that the applicant has consider the climate change vulnerabilities, adaptation, and mitigation measures associated with their project and agrees that the Division's analysis is adequate. The applicant may also prepare its own, independent analysis if it believes a more thorough analysis is needed.

II. Purpose

This document serves as an analysis for the LSL Replacement Funding Program[3] based upon the uniformity of impacts across all LSL inventorying and LSL

replacement projects. The analysis will include a statement of purpose, a list of climate change vulnerabilities related to the projects typically funded by the program, a discussion of the applicability of climate change adaptation and mitigation strategies to the projects, three example studies of project level climate change impacts for reference by program applicants, and a set of concluding remarks. The intention is that this document will be a tool for program applicants in analyzing the impacts of climate change on their own projects, and the corresponding ways that they can respond to these impacts.

The analysis is modeled after section IV. of the DWSRF Technical Package.[4,5] Consistent with the Technical Package, climate considerations have been broken down into three categories: vulnerability, adaptation, and mitigation. Definitions and further discussion of the vulnerabilities, adaptation measures, and mitigation measures are included in their corresponding sections.

III. Comprehensive Response to Climate Change Analysis for LSL Replacement Funding Program

Vulnerability

A vulnerability is an effect of climate change that the facility may be susceptible to. The key vulnerabilities that are typically considered in a DWSRF application are:

- Sea level rise
- Water supply depletion
- Water supply quality
- Flooding/storm surges
- Forest fires
- Drought

Of these, only sea level rise, flooding/storm surges, and forest fires appear to be applicable to the LSL replacement projects in limited circumstances. In addition, the LSL replacement projects could be vulnerable to heavy wind created by climate change driven storms. A discussion of each of these vulnerabilities is given below.

Sea Level Rise

Per the 2020 report from the California Legislative Analyst's Office (LAO) titled *What Threat Does Sea-Level Rise Pose to California?*[6], sea level rise in California may be as great as 2 feet by 2050 and 7.1 feet by 2100. As such, LSL replacements completed in coastal regions that are within these elevation ranges risk being permanently submerged or rendered unmaintainable in the future.

Flooding/storm surges

Flooding and storm surges have the capacity to damage subsurface piping primarily through soil disturbance.[7] Shifting soil can lead to fracturing of

rigid pipe networks, causing leakages and pipe breaks. In addition, severe flooding can displace buildings leading to severance of service pipes.

Forest Fires

Climate change driven periods of prolonged drought, in combination with increased average temperature and shifting weather patterns, have been shown to contribute to a heightened frequency and intensity of forest fires throughout California. These forest fires, should they spread to regions of human inhabitation, can heat subsurface service lines to temperatures great enough to cause plastic pipes to release volatile organic compounds (VOCs) into the drinking water they carry, endangering human health. Furthermore, damage to pipes during forest fires can also allow smoke to infiltrate subsurface service lines, introducing another source of chemicals hazardous to human health to the drinking water within.

Heavy winds

Shifts in weather patterns caused by the change in global climate have the potential to lead to more frequent and intense storm events over much of California. One component of these storms is heavy winds, which with sufficient wind speed can topple trees. If their roots are close to subsurface service lines, the toppling of trees can lead to service line damage or ruptures.

Adaptation

An adaptation measure is a measure taken as a direct response to the effects of climate change. The key adaptation measures typically considered in a DWSRF application are:

- Alternative energy sources
- Drought resiliency and flood contingency
- Permeable pavements
- Elevated construction, sea wall, and levees
- Green roofing
- Fire-resistant water connections and hydrants
- Additional storage

Of these, only elevated construction, sea wall, and levees and fire-resistant water connections and hydrants seem to be an applicable adaptation measure for LSL replacement projects. All the other adaptation measures usually considered are either ineffective for addressing the climate change vulnerabilities faced by LSL replacement projects or are too far out of the scope of an LSL replacement project to feasibly be incorporated. In addition to the typical adaptation measures covered by DWSRF applications, the benefits of proper tree pruning and maintenance to prevent damage from heavy winds were also considered. A discussion of this as well as of elevated

construction, sea wall, and levees, and fire-resistant water connections and hydrants are given below.

Elevated construction, sea wall, and levees

While elevated construction is not an option for service lines, sea walls and levees can both serve to reduce the impact of flooding and sea level rise. Limiting flood water and sea water intrusion in service areas will prevent soil disruption and building displacement, both of which can lead to service line breaks. While this adaptation method is likely too costly to include within the scope of a LSL replacement project itself, funding applicants should consider potentially constructing sea walls or levees as is appropriate and financially feasible.

Fire-Resistant Water Connections and Hydrants

As exemplified by the wildfires in Paradise, California, the increasing number and intensity of forest fires can pose a threat to service lines. In *How Do Wildfires Affect Water Systems?*[8] two possible methods of increasing fire resistance in service lines are considered. The first is to bury the replacement service lines deeper in regions most at risk of forest fires. This would increase the effective insulation of the soil above, thereby decreasing the damage caused by a given fire. The second option is to introduce isolation valves throughout the distribution system, as well as backflow preventers. This will not reduce the damage individual lengths of pipe receive from a given fire; however, the isolation valves will enable contamination to be isolated after the forest fire has ended, and the backflow preventers will prevent contamination from entering the system from buildings damaged in the fire.

Proper tree pruning and maintenance

As discussed by Chisolm and Matthews in the article *Impact of Hurricanes and Flooding on Buried Infrastructure*[7] the toppling of trees due to heavy winds can damage nearby buried service lines. To combat wind damage to trees, the Arbor Day Foundation suggests in *How to Make Trees Storm Resistant*[9] that proper pruning and maintenance of trees can reduce the risk and severity of storm related wind damage to trees.

Mitigation

A mitigation measure is a measure taken to slow or stop changes caused by greenhouse gas emissions in the atmosphere. The key mitigation measures that are typically considered in a DWSRF application are:

- Renewable energy sources
- Energy conservation
- Water conservation

Firstly, LSL replacement projects do not deal directly with energy sources, so renewable energy sources are not applicable. Secondly, there are no significant methods for improving energy efficiency within the scope of LSL replacement projects. Lastly, while some incidental water conservation may be achieved by installing new service lines securely and thus preventing future leaks, the opportunities for water conservation in LSL replacement projects are generally negligible. In summary, all three mitigation measures were considered and were found to be inapplicable to the work completed in the LSL replacement funding program.

IV. Sample Vulnerability Scenarios

Scenario 1 – Sea Level Rise Vulnerability

Consider the hypothetical case of a service line replacement in a Bay Area town. In this hypothetical, the town has identified during previous inventorying that all the service lines between 1st Street and 3rd Street use lead piping. Therefore, the town has developed a project plan to replace the existing LSLs with non-lead piping. However, according to the National Oceanic and Atmospheric Administration's *Sea Level Rise Viewer,*[10] most of the project area will be submerged with 2 feet of sea level rise, and the entire project area will be submerged with 4 feet of sea level rise. As previously mentioned, the 2020 report from the LAO suggests that we may see as much as 2 feet of sea level rise by as early as 2050, and likely much more by 2100. As such, without additional infrastructure preventing the region from being submerged, any replacement service lines installed could become unmaintainable and unusable in as little as 27 years. In this hypothetical, the town should consider what additional infrastructure, such as a sea wall or levees, would be necessary to protect the long-term usability of the project, and if the accompanying costs required substantially affect the original project's viability.

Scenario 2 – Forest Fires Vulnerability

Consider the hypothetical case of a service line replacement in a Southern California town. In this hypothetical, the town has identified during previous inventorying that there are multiple LSLs in need of replacement along Oak Drive, Elm Lane, and Walnut Place. Therefore, the town has developed a project plan to replace these LSLs with HDPE piping. However, in reviewing the *Fire Hazard Severity Zones Maps*[11] provided by the State of California Office of the State Fire Marshall, the project area lies entirely within either very high or high hazard zone areas. In this hypothetical, the town should consider revisiting its project plans to potentially increase the depth of the replacement service lines to increase the insulation provided by the soil in the event of a wildfire, as well as the possible benefits provided by adding isolation valves to the replacement service line to enable the town to contain any post-fire contamination, and backflow preventers to ensure that burnt homes do not contaminate the distribution systems.

Scenario 3 – Heavy Winds Vulnerability

Consider the hypothetical case of a service line replacement in a Northern California town. In this hypothetical, the town has identified during previous inventorying that some of the services lines along Vanderbilt Street are LSLs. Therefore, the town has developed a project plan to replace these LSLs with non-lead piping. However, there is substantial tree cover along Vanderbilt Street that, in the event of heavy winds caused by climate change driven storms, may damage buried service lines if toppled. In this hypothetical, the town should now consider additional maintenance requirements for the trees along Vanderbilt Street to mitigate any future damage to the replacement service lines.

V. Conclusion

The Division urges all program applicants to consider the impact of climate change on their LSL replacement projects. This Staff's Analysis regarding a Comprehensive Response to Climate Change provides a general overview and an analysis of the potential impacts of climate change on LSL replacement projects. The details in this document are provided for program applicants to use as they consider the effects that climate change has on their prospective LSL replacement projects. The Division believes this analysis will be adequate for most LSL replacement projects, and applicants may fulfill the Response to Climate Change requirement in their LSL application by self-certifying their agreement with the adequacy of the analysis for their projects. Additional concerns or considerations may arise on a case-by-case basis. Applicants may perform their own, independent climate change analysis if they choose.

VIII. References

1. California State Water Resources Control Board (2017) *STATE WATER RESOURCES CONTROL BOARD RESOLUTION NO. 2017-0012 COMPREHENSIVE RESPONSE TO CLIMATE CHANGE* <https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2017/rs2017_0012.pdf> (accessed 23 March 2023)

2. California State Water Resources Control Board Division of Financial Assistance (2022) *DRINKING WATER STATE REVOLVING FUND INTENDED USE PLAN STATE FISCAL YEAR 2022-23* <https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/2022/dwsrf-iup-sfy2022-23-final.pdf> (accessed 23 March 2023)

3. California State Water Resources Control Board Division of Financial Assistance (2022) *DWSRF Lead Service Line Replacement Funding SUPPLEMENTAL INTENDED USE PLAN STATE FISCAL YEAR 2022-23* <https://www.waterboards.ca.gov/water_issues/programs/grants_loans/docs/2022/2022-23-supp-iup-lslr-final.pdf> (accessed 23 March 2023)

4. California State Water Resources Control Board Division of Financial Assistance (2020) *Technical Application Instructions (Construction)* <https://www.waterboards.ca.gov/drinking_water/services/funding/documents/srf/dwsrf_policy/h3_dwsrf_application_const_technical.pdf> (accessed 23 March 2023)

5. California State Water Resources Control Board Division of Financial Assistance (2020) *Technical Application Instructions (Planning)* <https://www.waterboards.ca.gov/drinking_water/services/funding/documents/srf/dwsrf_policy/f3_dwsrf_application_plan_technical.pdf> (accessed 23 March 2023)

6. Legislative Analyst's Office (2020) *What Threat Does Sea-Level Rise Pose to California?* <https://lao.ca.gov/Publications/Report/4261> (accessed 23 March 2023)

7. Chisholm, E. I.; Matthews, J. C. (2012) *Impact of Hurricanes and Flooding on Buried Infrastructure*, Leadership and Management in Engineering, 12, 3 <https://ascelibrary.org/doi/full/10.1061/(ASCE)LM.1943-5630.0000182> (accessed 23 March 2023)

8. Meadows, R. (2022) *How Do Wildfires Affect Water Systems?*, ACS Cent. Sci. 8, 5, 504–506 <https://pubs.acs.org/doi/10.1021/acscentsci.2c00511> (accessed 23 March 2023)

9. Fazio, J. R. (2014) *How to Make Trees Storm Resistant*, Tree City USA Bulletin, 75 <https://www.arborday.org/trees/bulletins/coordinators/resources/pdfs/075.pdf> (accessed 23 March 2023)

10. National Oceanic and Atmospheric Administration Office for Coastal Management (2023) *Sea Level Rise Viewer* <https://coast.noaa.gov/digitalcoast/tools/slr.html> (accessed 23 March 2023)

11. California Department of Forestry & Fire Protection Office of the State Fire Marshal (2023) Fire Hazard Severity Zones Maps <https://osfm.fire.ca.gov/fire-hazard-severity-zones-maps-2022/> (accessed 23 March 2023)