Reference Document for Water Loss Stakeholder Workshop on June 7, 2019

This document focuses on the assumptions behind the economic framework for developing performance standards for water loss as per California Water Code 10608.34 for urban retail water suppliers.

Background

California Water Code section 10608.34 (Senate Bill 555, 2015) sets statutory requirements for monitoring and reducing water losses through leaks in distribution systems. The State Water Resources Control Board (State Water Board) is required to develop performance standards for water loss by July 2020 for urban retail water suppliers (URWS). One important factor the State Water Board is required to evaluate in the development of the performance standards is a life cycle cost assessment[1].

URWS's have been required to submit water loss audits since October 2017 pursuant to Water Code section 10608.34, subdivision (b) and regulations developed by Department of Water Resources. The water loss audits are required to be conducted per the M36 manual by the American Water Works Association (AWWA). The accuracy of the water loss estimates from these audits depends on the quality of entered data. The process of assessing the quality of data entered in the audit is called validation. State law requires the submitted audits to be validated as pursuant to California Water Code section 638.3, subdivision (a).

Assembly Bill 1668 and Senate Bill 606, passed in 2018, require URWS's to calculate their own individual urban water use objective beginning in 2023. The objectives will be calculated based on efficient indoor, outdoor and commercial, industrial and institutional irrigation, and an allowable water loss volume.

As part of the pre-rulemaking process for Senate Bill 555, the State Water Board has been engaging with stakeholders, including, water suppliers, industry experts, and advocacy organizations through public meetings and workshops, and correspondence received from stakeholders. The stakeholder engagement covered topics such as data accuracy and variability, focus areas, program implementation, costs, feasibility and efficiency of interventions. Four public workshops were held in Sacramento, Oakland, and Los Angeles in 2018-19.

Additionally, the State Water Board is collecting data through the Electronic Annual Report (eAR) on existing distribution system characteristics and incurred costs, and the corresponding achieved water loss reduction, to inform the development of cost-

[1] The lifecycle cost assessment will consider costs, and benefits, projected to accrue while implementing interventions over their lifetime, including planning, installation, implementation, and operation of interventions that may be used to meet the performance standards.

effective volumetric standards. Stakeholder feedback was incorporated through public meetings and comment letters to inform the data collection through the eAR.

The formal rulemaking process is expected to begin in July 2019. The regulatory package is anticipated to include appropriate environmental analyses to comply with the California Environmental Quality Act and an assessment of the state-wide fiscal and economic impacts of this regulation. The rulemaking process involves written comments and at least one public hearing in front of the Board.

Overview of proposed framework for performance standards

Leakage reduction relies in part on planning infrastructure maintenance and replacement, thus indicating a long-term approach to achieve cost-effective outcomes. The typical approach includes assessment of current leakage, selection of technologies, implementation of water loss reduction technologies, and continued operation of these technologies [1] [2].

For example, to determine a strategy to cost-effectively reduce losses for a distribution system, it is necessary to determine the nature of losses in the system and conduct trials and pilot implementations to assess different available technologies and vendors. The results of these feasibility assessments and technology selection processes can then be used to implement a system-wide strategy. Reductions in water loss are typically observed after the assessment, planning, and implementation in this multi-step process. Hence, the State Water Board proposes to follow a similar phased, progressive approach.

Initial performance standards will be adopted in 2020 by the State Water Board for all URWS through its regulations. Compliance with the regulations will be in the form of volumetric water loss reduction and performance measures. The regulations for performance standards would require compliance in each of four Phases:

1. Improved data collection and quality, as needed (2020 - 2022)
2. Initial implementation (2023 - 2027)
3. System-wide implementation (2028 - 2035)
4. Ongoing water loss control (2036 onwards)

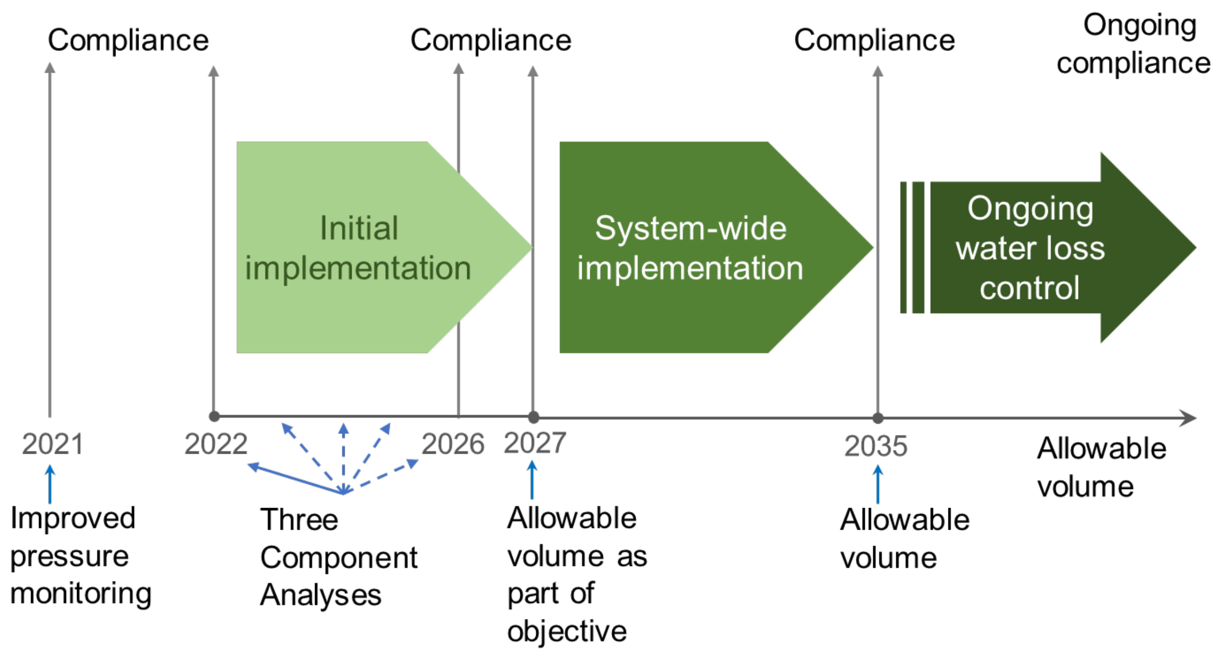

Figure. Summary of regulatory timeline and compliance requirements

The initial performance standards will include allowable water loss volumes during Phases 2, 3, and 4. The proposed approach will provide opportunities for adjustments to those volumes based on additional data in Phase 1. The allowable water loss volumes for Phases 3 and 4 could be adjusted at the end of Phase 2. Additional details are provided below in sections describing the proposed individual phases.

Adjustments: Staff proposes opportunities and processes for URWS's to request adjustments of either their allowable water loss volume based on updated, validated data or a compliance deadline in case of exceptional scenarios. Additional details on the format and provisions of these adjustments are outlined in the section titled Provision for Filing of Adjustments by UWRS's.

The standards would be based on a cost-benefit analysis for each urban retail water supplier. The document describes the basis for the economic model.

Assumptions for economic framework of water loss performance standards

Staff proposes to use the following assumptions in developing the standards. The assumptions are categorized based on topic area.

Water loss estimates and data gaps:

1. Staff has determined that it is highly improbable for water systems to have water losses lower than 20 gallons per connection per day on the basis of

analysis of the North American Water Audit Data Initiative (WADI)[2]dataset. These data have been collected over a period of seven years since 2011 from 68 systems, including several from the Western United States andCalifornia. Out of the 68 reporting systems, only 2 documented water losses consistently close to 20 gallons per connection per day. One of these systems has been implementing ongoing water loss control programs since 2004, while the other is a new system (25-30 years old), with a heavy capital improvement plan to accommodate for new development, and an apparent loss control program which verifies the low water loss estimate.

The volumetric standard will be calculated from a cost benefit analysis based on the initial water loss level and implementation of water loss control actions and associated benefits. The cost-effectiveness of recovering higher water loss recovery decreases if initial recoverable water loss is low. As all systems in California progress towards higher accuracy in water loss estimates, it is crucial to develop standards based on more probable water loss levels for water systems with low water loss. This would likely provide a standard closer to the actual economic level of leakage for that system, and thus prevents an underestimation of the possible water loss recovery.

To ensure that reasonable standards are determined for these systems with improbably low estimates of water loss, staff proposes to assign a higher initial water loss estimate to these systems to calculate volumetric standards. This initial water loss level would be equal to the median of water loss estimates for California submitted through water loss audits in 2017, which was 37 gallons per connection per day. Systems with negative water loss estimates would be included in this set of URWS for which an initial water loss estimate would be assigned by the State Water Board.

URWS may request adjustments and submit supporting documentation to demonstrate the accuracy of their water loss audits and water loss control actions that may justify the low real loss, and request to adjust the performance standard accordingly. If a UWRS can sufficiently demonstrate that the amount of real loss is a value less than 20 gallons per connection per day, the audit value would be used to calculate their standard.

2. Reported data from the Electronic Annual Reports is being used for determining costs and efficiencies for implementing these approaches for different systems. For systems that have not implemented certain or any approaches from the toolbox or have not reported on costs and efficiencies

[2]David Sayers, Will Jernigan, George Kunkel and Andrew Chastain-Howley, 2016, The Water Audit Data Initiative: Five Years and Accounting, Journal American Water Works Association

for implementing water loss control approaches in the Electronic Annual Report, the resulting data gaps would be addressed by using estimates from available data for systems with similar characteristics.

3. Variability of annual volume for ongoing compliance after 2035 is proposed to be volumetric. For example, the highest observed variability for the two water loss systems with the lowest estimates in the North American WADI dataset is 3.9 gallons per connection per day. Staff proposes to have a maximum variability of 5 gallons per connection per day from the performance standard on a three-year average basis.

Assumptions specific to benefits estimation:

1. The additional benefit from an incremental reduction in water losses is constant across all levels of water loss recovery. In other words, we are assuming for now that the marginal benefit associated with the first acre-foot of recovery is equal to the marginal benefit associated with the last acre-foot of recovery. This assumption may change if we have reason to believe that the marginal benefits are not constant and we have data to estimate these differences for different levels of water loss recovery.

2. Benefits estimation associated with the value of water saved involves estimates for water supply costs, which may be subject to change over the time horizons considered. Thus, we require an assumption on the level of water supply costs in the future. For example, water supply costs will likely increase in the future due to climate change.

3. The value associated with reducing main breaks is challenging to quantify and requires some assumptions. We assume that the value of avoided outage can be represented by the average value of avoided supply disruptions (Buck et al. 2016). In other words, we assume this value is constant across utilities and is similar to the value of avoiding water use restrictions, such as limitations on when one can irrigate outdoor landscaping. This assumption may change based on data availability.

Assumptions specific to costs estimation:

1. Actions taken to reduce losses can be computed independently. For example, pressure management and replacement of leaky pipes to reduce water losses could happen concurrently while not impacting each other in terms of cost calculations.

2. Leaks follow a predictable distribution throughout a water distribution system. Some pipe regions are more prone to leaks and are expected to have higher leak rates than other regions. Therefore, these regions are expected to have larger water savings per leak intervention than in regions were leaks are less commonly found. We expect more loss in regions with high pressure, older pipes, and more infrastructure density.

3. Utilities will preferentially select actions that have the highest water savings first. This means, for example, that utilities will replace/repair the pipes with the largest leaks first before addressing smaller leaks.

4. Cost curves are technology specific and will change based on the technology that has already been implemented or is necessary given utility specific conditions.

Assumptions pertaining to general economic framework:

1. Future benefits and costs will need to be discounted to the present. We will consider a range of reasonable discount rates between 1-5%.

2. Short run estimates consist of a 3-5 year time horizon and medium run estimates correspond to a 15-20 year time horizon.

Information related to water loss control approaches:

<u>Reduced response to leak repair</u>

1. The action pertaining to this approach would be an incremental improvement in response time by 24 hours. Costs and benefits will be incorporated in the economic model accordingly.

2. Costs will include additional staff required to achieve this incremental improvement in response time for repairing reported leaks.

3. Pipe failures (breaks and leaks) depend on specific system characteristics, including but not limited to age of pipe, corrosivity of soils, installation practices (both current and historical), traffic loading, backfill properties and vegetative growth as well as land movement from soil saturation or seismic activity. The frequency of pipe failures for each system is indicative of the effect of these factors. Based on current modeling efforts to understand the probability of breaks, history of breaks reflects the effect of all these factors. The projected

number of breaks will likely be determined from the break history (number of breaks per mile per year) of a system.[3].

Leak detection and associated repair/replacement

1. Based on literature on water loss control methods, efficiency for water loss recovery for acoustic leak detection varies due to the following factors
    - Pipe material: Traditional acoustic leak detection can require more equipment or have lower efficiency in case of non-metallic pipes, and thus incur higher costs per mile.
      Costs for non-metallic pipes would be derived from the observed variation of implementation costs with proportion of plastic pipes in the surveyed pipes.
    - Pipe size: Acoustic leak detection equipment can have lower efficiencies in pipes with larger diameters (greater than 18 inches). Acoustic leak detection technology equipped with lower sound frequencies may need to be used for detecting leaks on plastic pipes, which may have different costs.

2. Costs will include detection equipment and staff, repair and replacement material and crew.

3. The proportion of pipes repair versus rehabilitated versus replaced may be determined from the current proportion of repair/rehabilitation/replacement needs identified during ongoing leak detection efforts. These data will be derived from Electronic Annual Reports. History of breaks and age of infrastructure will also be incorporated in determining the proportion repair versus rehabilitation versus replacement.

Pressure management

1. Costs for the following actions will be included in the costs
    a. Annual pressure monitoring survey for each pressure zone in the entire system (proposed as a compliance requirement)
    b. Pressure transient monitoring for the entire system
    c. Pressure transient mitigation for a portion of the system
    d. Pressure reduction for a portion of the system. This assumption will not be based on a certain amount of reduction in pressure, but the cost-benefit analysis for implementing pressure reduction to reduce water losses for a similar system.

[3] East Bay Municipal Utility District, 2018, Distribution System Pipeline Master Plan

2. Costs for systems with data gaps may be based on data from systems with similarly sized pressure zones (using average number of miles per pressure zone).

Asset management

Costs would include material, staff and excavation.

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