Lake Oswego · Tigard Water Partnership
sharing water · connecting communities

Brown AND Caldwell

Technical Memorandum

Date: March 25, 2010

BC Project No. 138564.001.003

Prepared for: Lake Oswego-Tigard Water Partnership Program

Subject: Treatment Technology Selection
Business Case Evaluation: Workshop #1

To: Joel Komarek, Program Manager
City of Lake Oswego

From: Jon Holland, Program Manager
Brown and Caldwell

Prepared by: Steffran Neff, Business Consulting Practice Managing Engineer
Brown and Caldwell

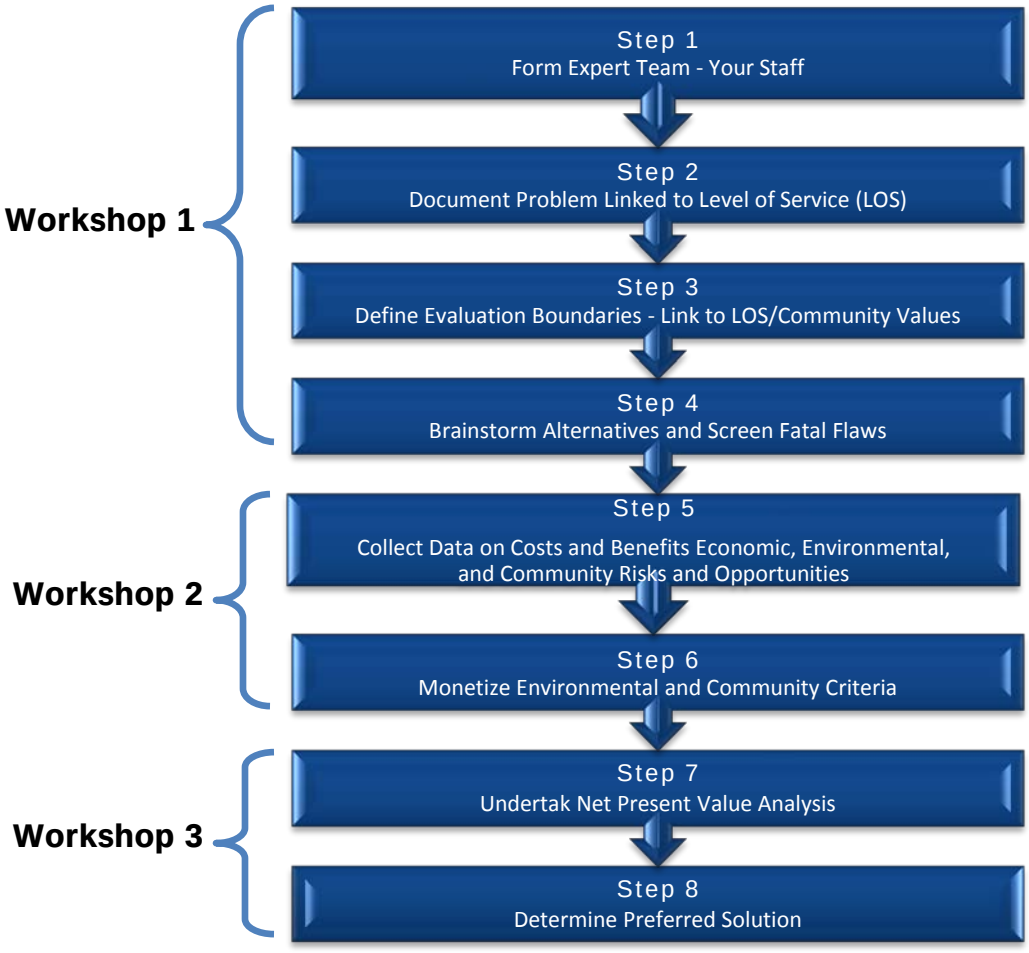
CONTENTS

Workshop Summary

This document provides an overview of the discussions and decisions from Workshop #1 of a three-workshop Business Case Evaluation (BCE) process that will determine the water quality objectives and select the treatment technologies for the upgrade and expansion of the Lake Oswego Water Treatment Plant (WTP).

The key elements of the overall BCE are inclusion of an expert team as part of the evaluation process; quantification of risk; incorporation of community values into the project's Level of Service (LOS) requirements; and monetizing evaluation factors while giving full consideration to economic, environmental, and social/community factors (the Triple Bottom Line).

The key steps of the BCE process are illustrated below.



Workshop Preparation

The following describes activities conducted prior to Workshop #1.

Establishment of the BCE Expert Team

The expert team includes members from various Lake Oswego and Tigard groups including Public Works, Water Treatment, Water Distribution, Operations and Engineering, as well as outside technical experts and members of the program engineering and public involvement consultant team. The outside water treatment and water regulation technical expert team members are listed below:

- Jeff Neemann, Black & Veatch
- Matthew Marshall, Carollo
- Lee Odell, CH2M Hill
- Pete Kreft, MWH
- Eva Nieminski, Independent professor and Utah State Regulator with regulatory and water quality background

The full attendance list is included in Appendix A.

Although not in attendance at the workshop, a sounding board made up of community members was briefed on the workshop information and conclusions later the same evening.

Background Information

Background information provided to the expert panel members prior to the workshop included the following:

- Extracts from the *2006 Joint Water Supply System Analysis* report prepared by Carollo on alternative water treatment plant treatment technology upgrade, expansion alternatives, and costs
- Facility and cost information for the Lake Oswego and Tigard water distribution system, pumping, distribution, and storage systems
- Water Quality information for the following:
    - Lake Oswego Clackamas River raw water
    - Lake Oswego finished water quality at WTP
    - Lake Oswego customer-delivered water quality
    - Tigard customer-delivered water quality (Portland Bull Run water)
- Overview of water quality regulations
- Lake Oswego and Tigard Joint Project Agreements
- Other local regulations and ordinances

Workshop Overview

The main objective of Workshop #1 was to establish the limit of potential water quality regulations and their linkage to water treatment technologies, and to establish a list of water plant upgrade/ expansion treatment alternatives that will be evaluated further.

Core Project Objectives or LOS

The day started with an overview of the BCE process and a discussion of the pre-workshop background material and core project objectives (LOS).

There are four primary objectives for the project: treatment capacity of the plant, water quality, project cost, and project timing. These are summarized below.

- *Capacity*: The upgrade initially needs to provide 32 million gallons per day (mgd) of treated water with the ability to expand to 38 mgd. The current plant capacity is 16 mgd.
- *Quality*: Part of the BCE is to determine the quality of the treated water considering current and future regulatory conditions. At a minimum, the treated water will meet current regulatory requirements and remove particulates.
- *Cost*: The baseline price point of $40 Million (2006 dollars) was established in the Carollo report. The baseline price represents treating the water to meet current regulatory requirements only (particulate removal, corrosion control, and disinfection) and expanding the capacity from 16 to 32 mgd.
- *Timing*: The upgraded WTP is to be fully commissioned and online by July 1, 2016, with a stretch goal of July 1, 2015.

In addition to the core goals, the BCE will determine additional social, environmental, and economic considerations that should be included in the evaluation. Additional parameters may include the following:

- Water rate impacts
- Site footprint
- Staffing implications
- Plant operability
- Plant reliability
- Impacts during construction
- Host community impacts
- Public perception
- Energy use
- Chemical use
- Carbon footprint

Water Quality

A discussion was held on the relationships between water quality parameters, status of current regulations, potential future regulations, and public health. The U.S. Environmental Protection Agency (USEPA), in setting its regulatory Maximum Contaminant Limits (MCLs) to protect public health, considers both acute and chronic health implications. Acute issues are related to illnesses such as gastro-intestinal problems and chronic implications are based on a cancer risk of 1 in 10,000 for an individual consuming water containing the MCL concentration for 70 years. Based on the input from the expert panel, new regulations on acute issues will focus on removal of microbial protozoa such as *cryptosporidium* and for chronic issues a focus on minimizing disinfection byproducts (DBPs). It was noted that a strategy of increased chemical disinfection to address the acute issues can exacerbate the DBP issue. Regulation of contaminants related to personal care products, pharmaceuticals, and endocrine disruptors was very unlikely due to the very low concentrations when their presence is detected. It was emphasized by the panel that best practice for maximizing protection of water-related public health is through a multiple barrier approach that includes watershed-based source control, series treatment technologies, sustaining bio-stability in the storage/distribution system, and public education. It was noted that the City of Lake Oswego is already an active participant in the Clackamas River Watershed Council. Comments that link the regulatory issues to the evaluation of technologies are summarized below:

- *Microbials*
  - The system should be designed to minimize *cryptosporidium* and other microbial constituents
  - Some treatment methods of removing microbial contaminants and other organic matter increase the potential for DBP formation
- *DBPs*
  - The current MCLs are not likely to be lowered below 80 total trihalomethanes (TTHM)/60 haloacetic acids (HAA5) micrograms/liter (µg/L)
  - Currently only five HAA5 are measured, but the regulations could increase this to six in a future USEPA Stage 2 Disinfectants and Disinfection Byproducts Rule (DBP3 Rule)
  - Locational distribution system running averages currently used to compute these values for reporting purposes may be replaced in a future DBR3 Rule with a procedure to report all values found, rather than relying on averaging
- *Pharmaceuticals and Endocrine Disrupters*
  - The level at which pharmaceuticals and endocrine disrupters are detected are considered much lower than what is a risk to public health
  - Money is better spent in continued sampling and public education rather than in treatment
  - It is not anticipated that pharmaceuticals and endocrine disrupters will be regulated in the near future

- *Trace Organics*
  - Enhanced removal of trace organics directly addresses the DBP issue as well as low level watershed activity related contaminants identified in the U.S. Geological Survey study
  - Enhanced biostability in the distribution system and water customer taste and odor experience

Public Survey and Focus Group

An initial public opinion telephone survey of 300 Lake Oswego and 300 Tigard water customers was conducted by Barney & Worth. General take-aways were that drinking water is not on the public radar screen and is not mentioned as an issue facing the communities. The cost of water is a major issue for the group surveyed. Good quality and taste were given most often as the reason for customer satisfaction.

Water Treatment Technology Discussion

A list of technologies was presented that could treat a variety of constituents beyond current regulatory standards. The expert panel summarized the regulatory discussion into five water quality treatment parameters beyond current regulatory standards that should be considered in the identification and evaluation of treatment technologies. These include:

- Proactively treating for taste and odor
- Keeping treated water DBPs to a 40 TTHM/30 HAA5 μg/L limit at all locations. These values are half of the currently regulated MCLs (i.e., meet DBP goal of 40/30).
- Improving biostability of treated water
- Removing microorganisms such as *cryptosporidium*
- Removing trace organic compounds

The expert panel discussed a range of technologies that should be removed from the list for this evaluation and should be brought forward for further discussion in meeting these five parameters in addition to meeting current regulations. The technologies chosen for further discussion linked to the five parameters are listed below.

- Technologies for current regulations and particulate removal
  - Conventional treatment
  - High-rate conventional treatment
  - Membrane treatment
- Seasonal taste and odor
  - Powdered activated carbon (with clarification prior to membrane treatment)
  - Ozone plus biofiltration
  - Granular activated carbon
  - Advanced oxidation process

- Treating for DBPs
  - Ozone plus biofiltration
  - Granular activated carbon
  - Enhanced coagulation
- Biostability
  - Biofiltration
  - Ozone plus biofiltration
  - Granular activated carbon
- Microbials such as *Cryptosporidium*
  - Ozone
  - Ultraviolet (UV) disinfection plus chlorination
  - Membrane filtration (ultra filtration membranes)
- Trace organics
  - Ozone plus biofiltration
  - Granular activated carbon
  - Advanced oxidation process

There was a brief discussion on ozonated water and subsequent injection in aquifer storage and recovery (ASR) basins. The City of Tigard currently uses ASR basins to mitigate peak season demands. The potential concerns with ozonated water is the high dissolved oxygen content of the water that may gas-bind the ASR basin and injection equipment, as well as possibly exacerbate arsenic levels in the water pulled out of the ASR basins. This potential concern will be further studied to determine whether it is a fatal flaw for this application or if it can be suitably mitigated (e.g., by using deaeration towers, etc.).

Alternatives

Initial design criteria were discussed and documented for each technology to develop layouts and costs for Workshop #2. These technologies were incorporated into alternatives for further evaluation. The initial three alternatives developed in the Carollo report were expanded to include the technologies needed to address additional treatment parameters. This resulted in four main alternatives and a total of 15 alternative variants. These are summarized in Table 1.

Table 1. Summary of Alternatives	
Alternative #	Description
1.0	Conventional treatment as per Carollo report
1.1	Add powdered activated carbon, enhanced coagulation, and UV disinfection to Alternative 1.0 baseline to address all additional treatment parameters except trace organics
1.2	Add ozone and biofiltration to the conventional treatment to Alternative 1.0 baseline to address the five additional treatment parameters
2.0	High rate conventional treatment as per Carollo report
2.1	Add powdered activated carbon, enhanced coagulation and UV disinfection to Alternative 2.0 baseline to address all additional treatment parameters except trace organics
2.2	Add ozone and biofiltration to the high-rate conventional treatment alternatives to Alternative 2.0 baseline to address the five additional treatment parameters
3A.0	Membrane treatment as per Carollo report
3A.1	Include powdered activated carbon and clarification before Alternative 3A.0 membrane treatment baseline for seasonal taste and odor treatment
3A.2	Follow Alternative 3A.0 with ozone and granular activated carbon to address the five additional treatment parameters
3A.3	Include advanced oxidation processes after Alternative 3A.0 membrane treatment to address the five additional treatment parameters
3A.4	Include UV disinfection after Alternative 3A.0 membrane treatment to address microbial constituents
3B.2	Utilize membrane treatment plus upstream sedimentation and install sedimentation basins to offload membrane solids loading to extend membrane life and increase operating flux. Follow membranes with ozone and granular activated carbon to address the five additional treatment parameters.
3B.3	Utilize membrane treatment plus upstream sedimentation and install sedimentation basins to offload membrane solids loading to extend membrane life and increase operating flux. Include advanced oxidation processes after membrane treatment to address the five additional treatment parameters.
3B.4	Utilize membrane treatment plus upstream sedimentation and install sedimentation basins to off-load membrane solids loading to extend membrane life and increase operating flux. Include UV disinfection after membrane treatment to address microbial constituents.
4.0	Dual plant—Membrane treatment plus conventional treatment. Include additional sedimentation such that 16 mgd is treated with conventional rapid sand filtration media and 16 mgd is treated with membrane technology.

Next Steps

In preparation for Workshop #2, the costs from the 2006 Carollo report will be reviewed and updated to 2010 dollars and costs will be developed for the additional treatment technologies. Cost and benefits will be determined for the non-core LOS parameters such as operability, reliability, impacts during construction, energy use, and chemical use. In addition, risk factors for each alternative that impact scope, schedule, and performance will be developed for discussion and evaluation.

Workshop #2 is scheduled for Wednesday April 21, 2010.

APPENDIX A

WORKSHOP #1 ATTENDANCE LIST

The following people were in attendance at Workshop #1:

- **City of Lake Oswego**
  - Joel Komarek
  - David Prock
  - Kari Duncan
  - Jane Heisler
- **City of Tigard**
  - Dennis Koellermeier
  - John Goodrich
- **Brown and Caldwell**
  - Corianne Hart
  - Bill Persich
  - Steffran Neff
  - Jon Holland
  - Doug Wise
  - Jack Warburton
- **Barney & Worth**
  - Clark Worth
  - Libby Barg
- **Jossis Consulting**
  - Bob Jossis
- **Expert Panel**
  - Jeff Neemann – Black & Veatch
  - Matthew Marshall – Carollo
  - Lee Odell – CH2M Hill
  - Pete Kreft – MWH
  - Eva Nieminski – Utah Department of Environmental Quality