# TECHNICAL MEMORANDUM

Stanislaus Regional Water Authority Water Supply Project
Treatment Performance Goals

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**To:** Stanislaus Regional Water Authority (SRWA)

**Authors:** Elaine W. Howe, P.E. (Trussell Technologies)

**Reviewers:** Andy Smith, P.E. (West Yost Associates)
Lindsay Smith, P.E. (West Yost Associates)

**Subject:** **Treatment Performance Goals**

## 1 - INTRODUCTION

The Stanislaus Regional Water Authority (SRWA) is planning to construct a new surface water treatment plant to provide a new, supplemental drinking water supply to the cities of Ceres and Turlock (Cities). On May 12, 2016 Trussell Technologies and West Yost Associates conducted a workshop with the SRWA's Technical Advisory Committee (TAC) to discuss treatment performance goals for the future SRWA water treatment plant. The workshop included an overview of surface water treatment regulations, minimum treatment process requirements, performance evaluation categories, and identification and ranking of performance goals that can be used to screen candidate treatment alternatives.

For each of the performance categories discussed by workshop participants, the TAC's goals were documented and later ranked in terms of relative importance. These performance goals will help frame process train selection for the future WTP. The purpose of this technical memorandum (TM) is to memorialize these discussions and document the resulting priorities of the various performance goals.

Some of the discussion on specific performance goals occurred during the preceding Raw Water Quality Assessment workshop (May 12th, 2016) or during a subsequent workshop on Potential Enhanced Performance Standards (May 26th, 2016). Where relevant, the notes from these workshops are recorded in the summary table.

## 2 - DISCUSSION NOTES

For each treatment performance goal category, several questions were posed to the TAC to frame the discussion and encourage the TAC to consider an even wider range of performance goals. These categories were: (1) finished water quality, (2) treatability, (3) operability, (4) financial, (5) schedule, (6) environmental, and (7) expandability. The focus questions presented to the TAC are listed below. The intent of the questions was to spark discussion, but not to limit discussion around just the questions presented.

The resulting key discussion points are summarized in Table 1. Some points are listed in relation to more than one sub-criterion, where appropriate.

Finished Water Quality

- How conservatively do you want to meet current regulatory standards? What flexibility do you want to meet future regulations?
- Do you have concerns about aesthetic considerations (e.g., tastes & odors, iron/manganese, other)? Do you have concerns over public perception of this new water supply?
- Do you have concerns about disinfection byproduct (DBP) formation in the distribution systems?
- Will each City have individual, City-specific finished water quality needs?
- Do you have concerns about integrating treated surface water into a historically groundwater-only distribution system?

Treatability

- Should the plant be designed with robustness to handle variable raw water quality conditions (e.g., seasonal variability, storm induced variability, drought related variability)?
- Is there public concern over DBPs, pharmaceuticals, or pesticides? Should the plant be able to provide treatment for all of these constituent groupings?
- Are there known occurrences of algae growth? Should the plant be able to treat for taste & odor episodes related to algae?

Operability

- Is your preference for more conventional, proven technologies, or do you prefer newer, more innovative technologies?
- Do you have staffing preferences?
- Are there issues or concerns related to solids disposal or chemical waste stream disposal?

Financial

- What are the implications of capital costs on process train selection?
- What are the implications of operation and maintenance (O&M) costs on process train selection?
- From a financial point of view, for future plant capacity do you prefer physical expansion or expansion through re-rating of the filters and possibly other unit processes?

Schedule

- Is time available for demonstration testing of innovative technologies?
- Do you have concerns over the ease of permitting the treatment facility?

Environmental

- Do you have energy usage concerns? Are there concerns or issues related to disposal of waste streams?
- Are there concerns over the number or types of chemicals stored on-site?

Expandability

- Are there known land/space restrictions for the plant?
- Is unit process re-rating (e.g., filters) preferred over physical expansion of the plant?

**Table 1. Summary of Performance Goals Discussion**

| Primary Evaluation Category | Sub-Criterion | Discussion Notes |
|---|---|---|
| **Finished Water Quality** | Conservatism for meeting current drinking water regulations | • The TAC wants conservatism in meeting the regulations, but the design should be financially responsible. |
| | Flexibility for meeting future drinking water regulations | • The TAC does not want to limit the ability to meet future regulations but does not want to spend money now to treat unknown future regulations. |
| | Aesthetic considerations and public perception | • Public perception is important to the TAC and public outreach will be important. The TAC would like to minimize customer complaints.<br>• The TAC wants to take all reasonable precautions to prevent the occurrence of red water events in the distribution system. Manteca had red water that they associated with ferric chloride use; a corrosion inhibitor was not used.<br>• Turlock does not chlorinate their water now, but plans to start chlorine addition at their wells prior to introducing the surface water. Turlock expects many complaints just from the use of chlorine. |
| | Disinfection by-product (DBP) formation | • The TAC wants target DBP limits to be set conservatively. No specific limit was set at this time.<br>• Both cities will consider the use of chloramines for final disinfection, but only if needed for DBP control. Careful consideration must be given to blending with groundwater and the disinfectant used at the wellheads. |
| | City-specific finished water quality needs | • The TAC cannot decide now whether each will need different finished water quality for their distribution systems; will need results of West Yost distribution system modeling.<br>• Turlock does not currently add chlorine to well water. Ceres does add chlorine, and aims for a residual of 0.4 to 0.6 mg/L in distribution system. Turlock plans to start chlorine addition at their wells prior to introducing the surface water. Turlock expects many complaints just from the use of chlorine. Both cities plan to keep wells active during the winter months even with surface water available. |

| Primary Evaluation Category | Sub-Criterion | Discussion Notes |
|---|---|---|
| | Surface Water/Groundwater (SW/GW) integration | • Both cities plan to keep wells active during the winter months even with surface water available.<br>• The TAC wants to take all reasonable precautions to prevent the occurrence of red water events in the distribution system.<br>• Industrial water users may have issues with the fluctuating surface water / groundwater (SW/GW) mix. |
| **Treatability** | Robustness to handle raw water variability | • The TAC desires a robust treatment system—within reason; finances must be considered.<br>• Both Ceres and Turlock plan to maintain their groundwater system so full redundancy during storm events, etc. may not be needed |
| | Pharmaceuticals, unregulated pesticides, other contaminants of emerging concern (CECs) | • Process should consider treatment for pesticides, given the large agricultural area between La Grange Dam Reservoir and the Infiltration Gallery.<br>• Aerial application of pesticides is likely a more probable source of contamination than runoff.<br>• Ozone should be considered, particularly if it results in lower DBPs in the distribution system. |
| | Algae and related tastes and odors | • Ozone should be considered, particularly if it results in lower DBPs in the distribution system. |
| **Operability** | Proven technology | • The TAC is leaning towards more conventional, proven technologies. Membrane filtration is not excluded, but would require demonstration testing. |
| | On-line factor | • The plant should be able to shutdown in the winter when demand is lower.<br>• During winter months (lower demand), the plant can have the ability to shut down for adverse raw water conditions such as elevated turbidity.<br>• During winter months (January and February), release flows from Don Pedro reservoir cannot be halted immediately. Further communication with TID is required to fully understand these limitations. |

| Primary Evaluation Category | Sub-Criterion | Discussion Notes |
|---|---|---|
| | Staffing | • The TAC would like to consider having the plant operate unattended at night (but at least one person on call), after they demonstrate effective operating performance to DDW.<br>• The treatment plant should have the level of redundancy required to allow unmanned operation, without going overboard and considering the capacity of the Cities' groundwater wells as back-up. |
| | Waste disposal | • The TAC is considering drying beds for the solids, since space is not a significant constraint for the plant. |
| **Financial** | | • The TAC prefers to spend more now on capital costs, within reason, in order to reduce future O&M costs.<br>• The TAC wants only limited staffing of the treatment facility. Their experience is that it is hard to retain good operators.<br>• Equipment availability and lead-time should be considered with regard to redundancy. The TAC prefers to limit redundancy to just what is essential. |
| **Schedule** | | • If membranes were considered favorably for this new plant, the schedule would have to allow for demonstration testing of the membranes. The same would be true for other major equipment, if there were concerns over performance, design criteria, or proven history with similar source water. |
| **Environmental** | | • No energy concerns; TID electrical rates favorable compared to PG&E.<br>• Stanislaus landfill is not a Class 3 facility. Team will need to confirm whether the solids would have to go to a Class 3 facility.<br>• Waste streams have to be removed from the site; the WTP site is not served by a sanitary sewer system. |
| **Expandability** | Land/Space restrictions | • No, there are no space restrictions at the treatment plant site.<br>• The SRWA cannot afford to build the plant larger than it needs to be now (i.e., 30 mgd in Phase 1 and 45 mgd in Phase 2). The Master Plan for the site will address future expansion. |
| | Future process re-rating | • Where possible, unit process re-rating (e.g., filters) is desired. |

## 3 - PERFORMANCE GOAL RANKING

After discussion of all questions put forth to the TAC for each performance goal category, the identified goals were ranked by the TAC in terms of importance to both Cities, or ranked as “yes or no” for those items not amenable to numerical ranking. Results of the ranking exercise are presented in Table 2 below.

**Table 2. Ranking of Identified Treatment Performance Goals**

| Evaluation Category | Treatment Performance Goal | Importance (5 = most important; 0 = least important) (Yes/No) |
|---|---|---|
| Finished Water Quality | Design with safety factor in meeting regulations (e.g., DBPs) | 5 |
| | Design for ability to tailor finished water quality for each City | 3 |
| | Minimize corrosion potential and red water concerns | 5 |
| | Design for flexibility to address future regulations and/or contaminants of emerging concern (CECs) | 2 |
| | Consider the use of chloramines for final disinfection | Yes |
| | Design to include fluoride addition | No |
| Treatability | Design reasonably robust treatment train | 5 |
| | Include treatment for unregulated pesticides and/or pharmaceuticals and personal care products (PPCPs) | 3 |
| Operability | Consider proven processes | 5 |
| | Consider logistics and cost of solids disposal | 5 |
| | Consider the use of drying beds | Yes |
| | Design with processes that will accommodate unmanned facility operations at night | 4 |
| | Consider use of gaseous chlorine | No |
| | Design for the ability to shut down the treatment plant for adverse raw water quality conditions (e.g., unusual high turbidity) | 4 |
| | Consider process complexity and amount of required instrumentation | 3 |
| Financial | Build select future capacity infrastructure now to reduce future capital costs (e.g., yard piping) | 4 |
| | Willingness to invest upfront to reduce O&M costs | 5 |
| | Design facility for reduced staffing requirements | 5 |

| Evaluation Category | Treatment Performance Goal | Importance (5 = most important; 0 = least important) (Yes/No) |
|---|---|---|
| | Establish redundancy requirements at treatment facility based on criticality of equipment/process, with groundwater system providing additional redundancy | 5 |
| Schedule | Require demonstration of critical processes (e.g., membranes) | 5[(A)] |
| Environmental | (None identified) | -- |
| Expandability | Design should consider a Phase 2 expansion to 45 mgd, with ultimate expansion addressed in Master Planning | 5 |
| Flexibility | Design for treatment flexibility (e.g., coagulant addition, chemical addition points) | 5 |

[A] This goal was not included in the ranking process. The ranking shown in this table was assigned by the author, based on workshop discussions.

## 4 - INTEGRATING PERFORMANCE GOALS WITH TREATMENT PROCESS ALTERNATIVES EVALUATION

One objective for this exercise of identifying and ranking the TAC's treatment performance goals is to begin the process of treatment train selection. By aligning the array of candidate treatment alternatives with 1) these performance goals; and 2) source water quality (based on review of historical data), TID's 2007 pilot test results and input from Division of Drinking Water (DDW), the project team intends to narrow the field of candidate alternatives, identify information gaps and begin a cost evaluation of feasible alternatives, as illustrated in Figure 1.

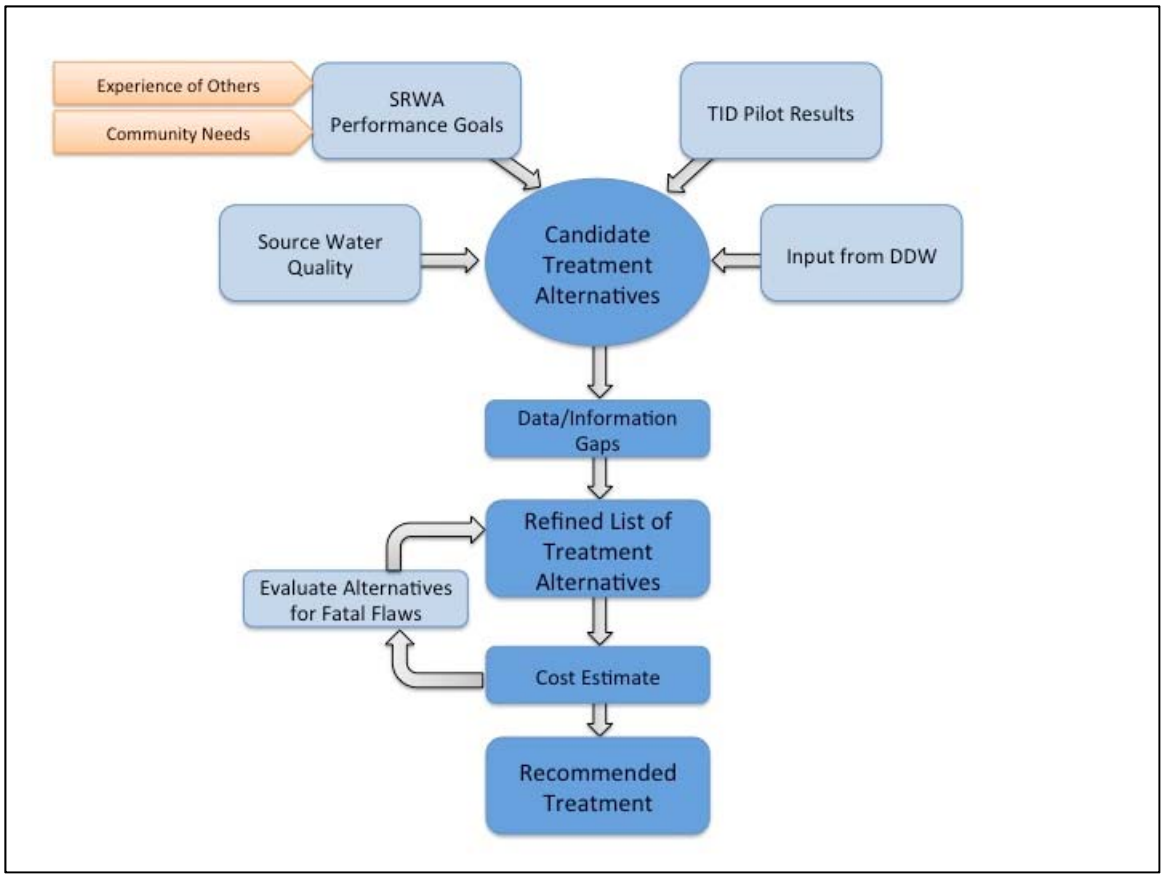


**Figure 1. Flow Chart for Identifying a Recommended Treatment Train**

Some of the treatment goals discussed during the workshop are broad goals (e.g., consider proven processes) and will help frame process train selection, while others are more specific (e.g., no gaseous chlorine) and will be incorporated into the facility design. For the purposes of assessing and comparing treatment process alternatives, as well as simplifying communication between the TAC, SRWA Board and the respective communities, a consolidated set of goals is helpful. To that end, Trussell Technologies has distilled the larger list of treatment goals into the following summary. (Note that the goal of meeting all State and Federal drinking water regulations is not included, as this is understood to be a condition for obtaining a drinking water permit).

**Employ Reasonably Robust Treatment Train**: The treatment train should be robust to accommodate "normal" raw water quality variability, and to accommodate night-time unmanned facility operations. Plant shutdown is acceptable under extreme water quality conditions, since groundwater will remain available.

**Use Proven Processes**: Choose processes that are successfully operating at other plants. Demonstration testing will be required for membrane filtration, if selected.

**Minimize DBP Formation**: Choose disinfection and total organic carbon (TOC) removal options that result in lower DBP concentrations. Chloramines will be considered for final disinfection, but only if upstream processes are not expected to sufficiently reduce DBP formation potential.

**Design for Unmanned Night Operations**: Treatment process complexity and instrumentation and monitoring should be considered in meeting the goal of unmanned facility night operations.

Over the coming months, the TAC will participate in workshops on treatment process alternatives. Alternative treatment processes will be analyzed with respect to source water quality, experience of others and TAC goals. Some alternatives are expected to be quickly eliminated from the list of candidates, and some critical data/information gaps may be identified. At present, known data gaps include: (1) water quality needs of the large industrial water users in Turlock and Ceres, (2) the effectiveness of the infiltration gallery for improving raw water quality (e.g., turbidity) and (3) the representativeness of the historical TOC concentrations at the infiltration gallery location. Missing data/information will be gathered as quickly as possible—some requiring more time than others—and will be presented during one of the upcoming workshops to further refine the list of candidate treatment processes, and ultimately to identify one or more recommended treatment trains.