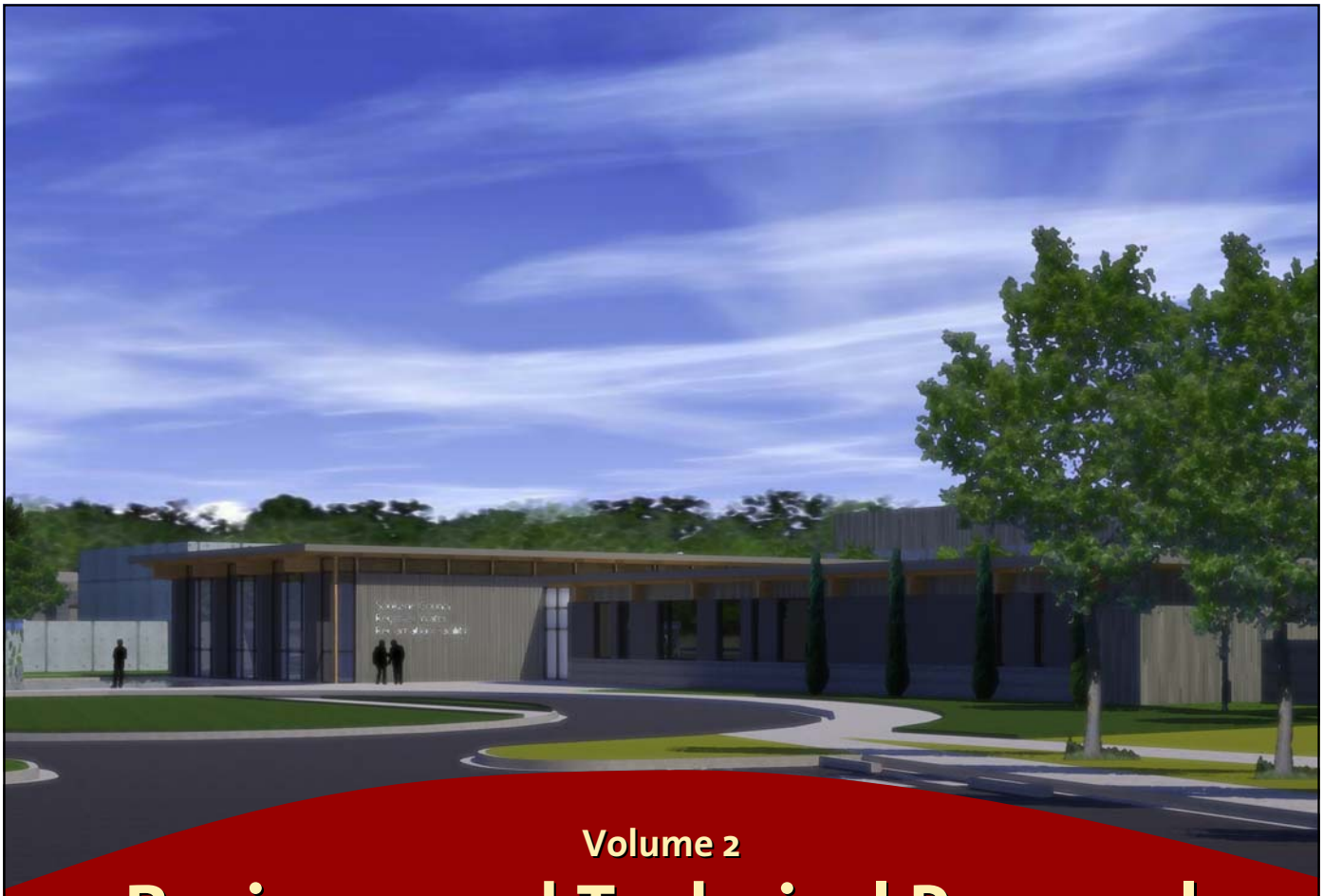

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Business and Technical Proposal

Spokane County

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VEOLIA WATER

Introduction

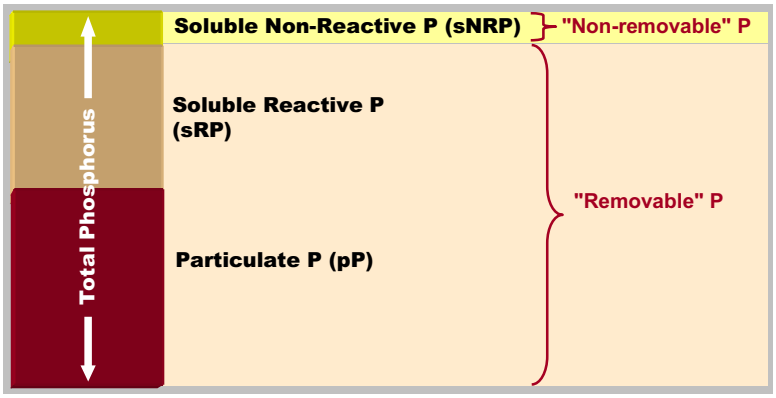
As discussed previously, the TMDL requirements of the Washington State Department of Ecology (DOE) require compliance with a 10 ug/L total phosphorous (TP) concentration for discharge to the Spokane River in the summer. Because currently available treatment technologies are not believed to be capable of producing this low of a TP level, the *Foundational Concepts for the Spokane River TMDL Managed Implementation Plan (Foundational Concepts)* allow this target to be met through a combination of treatment technology and other offset actions. The new facility is required to produce an effluent with an effluent TP concentration of 50 ug/L or less, and the difference between this and what is required to meet the TMDL requirements (10 ug/L TP) is referred to as the "delta." The *Foundational Concepts* require the County to work toward eliminating this delta through non-point source abatement strategies.

In response to this, Spokane County has prepared a delta elimination plan (Phosphorus Management Plan) for approval by the DOE, which describes several potential efforts to reduce the P loading to the river. These efforts, which include the septic tank elimination program (STEP), water conservation, water reuse, source control, and regional non-point source reduction, have a significant associated cost. For example, the cost of the STEP alone over the nine-year period from 2007-2016 is estimated at approximately $88 M (2007 Financial Plan and Rate Study). There is also some uncertainty associated with regulatory approval of the proposed delta elimination actions. For instance, environmental groups have forwarded the argument that the STEP does not constitute a legal offset, as it is already required as part of a County obligation to clean up the Spokane Aquifer. Non-approval of the delta elimination actions could have a significant impact on the TMDL phosphorus balance in the Spokane River. The target P load for Spokane County in 2017 per the TMDL is 0.67 lbs/day (based on a flow-rate of 8 MGD and an effluent TP concentration of 10 ug/L). If phosphorus reduction credits were not available because of the delta-elimination actions not being approved, at an effluent TP concentration of 50 ug/L, Spokane County would be restricted to operating the new, state-of-the-art Spokane County Regional Water Reclamation Facility (SCRWRF) at a flow-rate of as low as 1.6 MGD. If this happened, it would mean that the Spokane River would not benefit from the full level of advanced treatment achievable in the new facility.

For these reasons, there is considerable value to the County in being able to achieve lower effluent TP concentrations than the currently specified 50 ug/L. Any reduction below 50 ug/L would directly translate to a decrease in both the effort (cost) associated with the delta elimination actions, as well in the risk associated with these plans not being approved. At a 10 ug/L effluent TP concentration, in theory, no P-loading offsets would be required.

Effluent Phosphorus Speciation and Warranty

Phosphorus speciation in the effluent becomes extremely critical when dealing with such low levels of phosphorus. At the 10 ug/L - 50 ug/L level, effluent TP is typically composed of three constituents: particulate P (pP), soluble reactive P (sRP), and soluble non-reactive P (sNRP). This is shown in Figure 2.10-1.



2.10-1. Phosphorus Speciation in Advanced Reclamation Facility Effluents

While the pP and sRP components are removable to different degrees by various technologies, there is very little information on the properties and characteristics of the sNRP component. It is suspected to be organic in nature and does not appear to react with metal salts. Given that the effluent is well-oxidized, the sNRP component is also unlikely to be removed through additional biological treatment. Testing of phosphorus speciation at several

advanced water reclamation facilities suggests that the sNRP component can range between 10 ug/L and 50 ug/L. While treatment options such as advanced oxidation or adsorption might be able to affect some removal of sNRP, this is yet to be demonstrated at either pilot-scale or full-scale. Therefore, for the purposes of our discussion here, we refer to the sNRP component as the "non-removable" portion of the effluent TP. The remaining components of the effluent total P (the soluble reactive P and the particulate P) are jointly referred to as "removable" P.

Based on the inherent robustness and reliability of our six-barrier process, we are fully confident that it will reduce the "removable" phosphorus (everything but the sNRP component) to a 10 ug/L level. Accordingly, our process warranty is written around a total removable P concentration in the effluent of 10 ug/L. For example, if we assumed an effluent sNRP concentration of 15 ug/L, this would correspond to a final effluent TP concentration of 25 ug/L, significantly lower than the 50 ug/L TP specification required by the RFP.

Meeting the Intent and Expectations of the Foundational Concepts and the Community

The intent of the *Foundational Concepts* in specifying a 50 ug/L effluent TP concentration for the SCRWRF was to match what currently available technologies were thought to be capable of achieving. The concept of delta elimination was developed to address the difference between what technology could achieve and the TMDL specification of 10 ug/L. Put differently, if currently available technologies were believed to be capable of meeting a 10 ug/L TP concentration, then the SCRWRF effluent specification would be 10 ug/L TP, with no provisions for a delta-elimination program. Our proposed approach best meets the intent of the *Foundational Concepts* by reducing the removable P to the specified 10 ug/L level; this is the best that current available technology can achieve. This approach also squarely addresses the philosophical objections expressed by certain sections of the community relative to the delta-elimination program. By minimizing the delta, our proposed approach minimizes the need for delta elimination. More importantly, it ensures that the new plant is built to the highest performance standards, with the best available technology — consistent with the expectations of the *Foundational Concepts* and the community.

Enhanced Phosphorus Treatment Concepts

Being able to achieve a 10 ug/L total removable P concentration in the final effluent has several significant ramifications with respect to future plans for enhanced P treatment:

- **Best-case Scenario**: *Compliance with the TMDL specification, obviating the need for any delta-elimination actions*:
  - As discussed in the *Foundational Concepts*, the TMDL phosphorus requirement of 10 ug/L is driven by concerns over the DO in the Spokane River. Phosphorus can be taken up and utilized for growth by periphyton and phytoplankton, and the resulting respiration from high biomass levels can deplete the DO concentration. The current TMDL specification, written in terms of TP, assumes that all species of P are equally available for biological uptake. In reality, while the sRP and pP components are widely acknowledged to be bioavailable (or capable of being transformed into a bioavailable form), little is known about the bioavailability of the sNRP component. The *Foundational Concepts* recognizes this and allows for the NPDES permit holders to prove to the DOE that a portion of the effluent TP may not be bioavailable in the river environment. The non-bioavailable portion of the effluent TP is allowed to be excluded from the TMDL requirement.
  - The "proof" of bioavailability would very likely take the form of a bench-scale bioavailability study conducted using the SCRWRF effluent and Spokane River water. The experiment would be designed to simulate Spokane River conditions as closely as possible, with representative visible light conditions, flow recirculation and distribution, and a benthic community. The change in sNRP concentration would then be monitored over a period corresponding to the low-flow travel time in the Spokane River.

  - We have recent experience with a bioavailability study at the Truckee Meadows Water Reclamation Facility (TMWRF) in Reno, Nevada, to evaluate the bioavailability of the soluble organic nitrogen (SON) discharged in the plant effluent to the Truckee River. This test, designed based on the same protocol discussed above, was used to successfully establish the fraction of SON that was non-bioavailable.
  - If, based on this testing, all of the sNRP were found to be non-bioavailable, per the Foundational Concepts, it could potentially be excluded from the TMDL specification of 10 ug/L TP. The effluent phosphorus concentration of 10 ug/L removable P would then meet the TMDL permit. Under this scenario, no delta-elimination actions would be required.
- **Worst-case Scenario**: *Substantial reduction in effort/cost associated with the delta-elimination program, as well as in the risk associated with the program not being approved by the DOE*:
  - Even in the worst-case scenario if all of the effluent sNRP were determined to be bio-available, our guaranteed effluent TP concentration of 25 ug/L would still represent a big step down from the currently permitted 50 ug/L TP — essentially a greater than 60 percent reduction in the delta. This reduction in the delta directly translates into a reduction both in the cost of the delta-elimination actions as well as the risk associated with it not being approved by the DOE.
- **Treatment Options for Further Reduction in Effluent Phosphorus**:
  - In the event that the bioavailability testing shows that a portion of the effluent sNRP is actually bioavailable, our proposed approach offers several options for future modifications to further reduce effluent phosphorus concentrations. As discussed previously, possible methods for removing the sNRP component could include steps such as advanced oxidation or adsorption. It is also possible that additional research into the area of sNRP removal in the future might result in the identification of new treatment methods. Our process setup incorporates the flexibility for such a treatment step to be included between the tertiary clarification and membrane filtration steps.