PUBLIC HEALTH DIVISION
Drinking Water Services
Tina Kotek, Governor

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November 1, 2023

Joseph Rochon
Mapleton Water District
88151 Riverview Drive
Mapleton, OR 97453

RE: Membrane Filter (PR 2020-165)
Mapleton Water District (PWS OR4100507)
Conditional Approval

Dear Joseph Rochon:

Thank you for submitting plans for membrane filtration to replace the existing membrane filter that has multiple operational issues, and miscellaneous water treatment improvements. The Oregon Health Authority's Drinking Water Services (DWS) received plans on September 18, 2023 composed of a transmittal letter, plans and specifications from West Yost. DWS grants the project conditional approval.

The project is to replace the original WesTech filter skid equipped with Polymem modules with a Filter Tech Systems-supplied Pentair Ultraflex filter skid (housing a pair of 10 module racks) equipped with Pentair X-Flow XF40C modules. A pre-filter screen will be added as well as building modifications to remove an interior wall for the new filter skid. The existing chlorine contact basin will continue to be utilized, along with the on-site generated hypochlorite system.

A membrane module is the smallest commercial structure that acts as a filter. Multiple modules can make up a membrane "rack," "unit," "train," or "cell" which share a common header for raw water and finished water and are exposed simultaneously to a direct integrity test (DIT) on any module in the rack. A filter system may be composed of multiple racks. DITs may occur at different times for different racks. The efficiency of filtration is quantified with a log removal value

(LRV). The proposed filter system is two racks installed in parallel each having 10 modules per rack.

The membrane filter system must be operated under the following conditions to comply with the Oregon Administrative Rules (OARs):

1. Direct integrity testing parameters are programmed into the SCADA system to determine $LRV_{ambient}$ and are readily viewable by the operator, service providers, and regulators for verification purposes. These parameters include:
    a. A minimum and starting DIT pressure as well as upper limit to the pressure decay rate. The minimum pressure allowed during a DIT for the XF40C is 14.9 psi. A starting pressure is required that assures the DIT pressure does not fall below this minimum of 14.9 psi. The upper limit to a pressure decay rate must demonstrate LRV_{DIT} is meeting the awarded credit of 4.0-log.
    b. During a DIT (aka "MIT" in Filter Tech materials), a pressure decay rate (psi/min) control limit representing a 3 μm failure prompts an automatic shut-down of the filtration skid as well as alarms the operator(s). The operator subsequently evaluates the cause, resolves the cause, and reruns a DIT that must pass to restart sending filtered water to the clearwell; and
    c. A log removal value (LRV) reflective of particle and pathogen removal above 3 μm size that is calculated at least once per day (every 15 minutes is recommended) based on current ambient operating conditions and the most recent DIT result ($LRV_{ambient}$). $LRV_{ambient}$ is the metric for demonstrating 4.0-log (99.99%) removal credited (LRC) for *Giardia* and *Cryptosporidium* filtration.
2. Pressure transducers with sufficient sensitivity and accuracy are used to measure the maximum pressure decay rate to assure 4.0-log removal is achieved.

    The stated range of the proposed Dwyer model 626 transmitters is 0 to 100 psi. This product's accuracy is 0.25% of full scale, with a root sum squared of 0.20% and an absolute range of 0.5% of full scale. In confirming 4.0-log $LRV_{ambient}$ is met, a more accurate pressure

transducer may be required (i.e. accuracy of 10%, or better, of the upper decay rate).

3. Alarm set points reflect the following operating limits which, if exceeded, prompt an automatic shut-down of the filter skid:
   a. Maximum flux of 73.5 gfd and a flow total of 176 gpm per rack (i.e. 8 x 22 gpm/module).
   b. Maximum transmembrane pressure (TMP) of 43 psi.
4. Indirect integrity monitoring monitors turbidity, and a turbidimeter is on each filter rack reading turbidity every 15 minutes or less. The rule reference is OAR 333-061-0050(4)(c)(G).
5. Filtrate turbidity readings above 0.15 NTU for a period greater than 15 minutes (i.e., two consecutive 15-minute readings above 0.15 NTU) trigger a direct integrity test on that rack. The rule reference is OAR 333-061-0036(5)(d)(B)(i) through (v).
6. The operation and maintenance manual has a diagnosis and repair plan such that the ability to remove pathogens is not compromised. This would include how to test modules for failed tubules and to isolate them (e.g. plug) from the filtrate side of the module.
   - Provisions are made for periodic calibration and/or verification of the pressure sensors used in completing the pressure decay DIT. Ideally this would be quarterly.
   - A DIT is required every day of filtration. For instance, if a filter rack is used for 1 hour to generate filtrate going to the clearwell, a direct integrity test is required. The rule reference is 333-061-0032(4)(e)(B).
7. Volumetric concentration factor (VCF) - Crossflow (also referred to as “suspension mode”) was proposed within each module to reduce the rate of cake formation on the membrane surfaces. When used in conjunction with a pressure decay rate DIT, this hydraulic practice requires a volumetric concentration factor (VCF) of more than 1.0, the value used in the submitted materials. A justification for a specific value of VCF >1 is required and subject to approval by OHA DWS. (The USEPA Membrane Filtration Guidance Manual (MFGM) describes the VCF generally starting on page 2-22, crossflow use of VCF starting on page 2-

39, how VCF is applied within the LRV_{DIT} calculation [i.e. sensitivity of LRV calculations] in equation 4-3 etc., and in the calculation of $LRV_{ambient}$.) A single fixed value for VCF in $LRV_{ambient}$ calculations and the LRV_{DIT} calculation is acceptable.

In addition, I have the following comments (which are not requirements):

- Given the maximum flow for the proposed original configuration is 200 gpm, OHA recommends installing plumbing connections and allowing footprint for an additional future third rack, or at least having a plan how a third rack could be installed.
- DWS recommends calculating and monitoring permeability (or its inverse, resistivity) over time with annual, or more frequent, reviews to track system performance and probable lifetime.
- Figure 1A-1 does not show double block and bleed downstream of CIP which is a required control feature.
- It appears that raw water flow is into the top of modules, though it is unclear if backwash is thus out the top of modules. If backwash is out the top, reversing flow so that backwash is out the bottom might benefit from the effects of gravity to remove particles during backwash. If crossflow is not used, such a flow change has a potential complication in that the bottom header configuration would result in some backwash water remaining in the depressions and thus necessitating a VCF >1, even though crossflow is not used.
- The submission states "*The plant will have two operating modes – Automatic and Off*." A manual mode is stated later, which implies three operating modes. Clarifying this in the O&M Manual is recommended.

Thank you again for submitting plans and specifications. If you have questions, please contact me at (541) 650-4868 or via email at rebecca.a.templin@oha.oregon.gov.

Sincerely,

Membrane Filter (PR 2020-165) *November 1, 2023*
Mapleton Water District (PWS OR4100507)
Conditional Approval

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OHA Drinking Water Services

ec: Plan Review, DWS Portland
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