PUBLIC HEALTH DIVISION
Drinking Water Services

Tina Kotek, Governor

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March 1, 2024

Scott Coleman, Public Works Director
City of Umatilla
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Letter sent via email only.

Re: Umatilla Wanapa Road Water Treatment Facility
(Wigen Skids w/Toray HFUG-2020AN UF modules)
City of Umatilla (PWS ID #00914)
Conditional Approval (PR#16-2024)

Dear Mr. Coleman:

On February 1, 2024, the Oregon Health Authority's Drinking Water Services (DWS) received 100% design plans for the City of Umatilla (PWS ID# 00914) Wanapa Road Water Treatment Facility (Woodard & Curran Project #0233937.02). The design is for a membrane plant initially using two Wigen filtration skids equipped with 30 Toray HFUG-2020AN ultrafiltration membrane modules per skid, rated at a total membrane capacity of 2.02 MGD (1.01 MGD net product per skid) to provide industrial process water.

The full build-out is projected to provide a membrane capacity of 9.6 MGD when all 6 primary skids are equipped with 48 modules each (1.61 MGD net product per skid) are added to meet potable demands for the City of Umatilla. With 1 of 6 skids in standby, the gives a firm membrane filtration capacity of 8.05 MGD, however, hydraulically, the completed plant is limited 7.8 MGD (4.7 MGD for potable use and 3.1 MGD for non-potable industrial use).

Key document shortcuts are as follows: Skip to List of Conditions Skip to List of Attachments

Documentation showing Conditional Land Use Approval granted by the City of Umatilla and a plan review fee payment in the amount of $3,300 were also received on February 2, 2024 after which the project was assigned PR# 16-2024. **This plan review encompasses the membrane filtration system only, without primary disinfection as the plant will initially be used to produce non-potable industrial process water only**. Source water is initially to be from an existing intake/pump station for the Columbia River operated by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR).

The City of Umatilla will take over the plant to serve the city as a drinking water source once a new raw water intake on the Columbia River, pump station, raw storage tank and transmission main are constructed **(under PR #23-2024) when water rights documentation will need to be submitted**. Primary disinfection & a new clearwell will also be added for potable use.

The entire project is anticipated to encompass 4 separate plan reviews as the entire potable and non-potable (industrial use) treatment system is gradually developed in 5 phases between 2023 and 2028. The 4 anticipated plan reviews are listed below and are expected to occur as facilities are gradually developed in 5 phases between 2023 and 2028. See Attachment D for an overall project description and phasing.

Plan Review	Facility	Facility ID (Online*)	Plan Review Fee***	Reviewing Engineer
16-2024	**Membrane Plant** (Wigen membrane skid w/Toray HFUG-2020AN UF modules w/out disinfection – review includes determining operator certification requirements accounting for future potable water treatment)	WTP-D**	$3,300 (paid 2/1/24)	Evan Hofeld
23-2024	**Columbia River Intake** (Raw water pump station, storage, and transmission will be informally reviewed)	SRC-DA	$3,300	Bill Goss (anticipated)
TBD	**Disinfection & Clearwell** (a tracer study will be required to demonstrate disinfection contact time)	WTP-D	$4,125	Bill Goss (anticipated)
TBD	**Finished Water Main & Pump Station**	DIST-A	$3,300	Bill Goss (anticipated)

* URL: https://yourwater.oregon.gov/inventory.php?pwsno=00914
** WTP-D will be indicated as an inactive facility and "Use Requires Disinfection" until the disinfection and clearwell have been approved.
***Plan review fees are as of February 2024 and subject to change.

The phased membrane configurations are shown in the table below:

Phase & related plan review #	# of Skids	Skid ID#	Modules per Skid	Flux* (gfd)	Net Product in GPM per Wigen (including standby skid)	Net Product in MGD per Wigen (including standby skid)	Instantaneous Feed per Wigen (including standby skid)	Calculated Feed Flow based on Flux & 969-ft^2 / module (including standby skid)
Phase 2 / 4 **PR # 16-2024**	2 Primary (including 1 standby skid)	UF110-UF120	30	40	1,398 gpm (699 gpm/skid)	2.02 MGD (1.01 MGD/skid)	1,616 gpm = 2.327 MGD (808 gpm/skid = 1.164 MGD/skid	2,584 gpm = 3.721 MGD (1,292 gpm/skid = 1.86 MGD/skid)
	1 BW Recovery skid	UF130	18	20	199 gpm	0.29 MGD	267 gpm = 0.384 MGD	242.25 gpm = 0.349 MGD
Phase 5	6 Primary (including 1 standby skid)	UF110 – UF120 UF140 – UF170	48	40	6,708 gpm (1,118 gpm/skid)	9.66 MGD (1.61 MGD/skid)	7,758 gpm = 11.172 MGD (1,293 gpm/skid = 1.862 MGD/skid)	7.752 gpm = 11.163 MGD (1,292 gpm/skid = 1.86 MGD/skid)
	1 BW Recovery skid	UF130	18	20	199 gpm	0.29 MGD	267 gpm = 0.384 MGD	242.25 gpm = 0.349 MGD
Expanded capacity (not currently planned)	6 Primary (including 1 standby skid)	UF110 – UF120 UF140 – UF170	54 (54 spaces on each skid)	40	7,584 gpm (1,258 gpm/skid)	10.869 MGD (1.81 MGD/skid)	8,730 gpm = 12.571 MGD (1,455 gpm/skid = 2.095 MGD/skid)	8,721 gpm = 12.558 MGD (1,453.5 gpm/skid = 2.093 MGD/skid)
	1 BW Recovery skid	UF130	34	20	374 gpm	0.54 MGD	500 gpm = 0.72 MGD	457.58 gpm = 0.659 MGD

* The maximum allowed flux = 120 gfd for HFUG-2020AN modules (max TMP = 29 psi).

The proposed membrane treatment plant is anticipated to be granted 4.0-log removal of *Giardia* and 4.0-log removal of *Cryptosporidium*. The potable water system must meet the 4-log inactivation of viruses and 0.5-log inactivation of *Giardia* through appropriate contact time with chlorine at the entry point (i.e., after the treatment plant, prior to the first user). 4.0-log virus inactivation can be achieved by providing the 0.5-log inactivation of *Giardia* required post-filtration. **New monthly reporting forms are required during potable water production** and include the 0.5-log *Giardia* inactivation requirement for required CT.

Operator Certification Requirements - WT2 & WD2 DRC

The new water treatment plant will require a treatment operator in direct responsible charge (Treatment DRC) with a Water Treatment 2 (WT2) license (minimum) once disinfection is added to serve as a potable water supply for the City of Umatilla. It is anticipated that the City of Umatilla will still be classified such that a Water Distribution 2 (WD2, currently required) will still be needed as the Distribution DRC. The WT2 and WD2 certification requirements are based on the points allocated in the form included at the end of this letter and are subject to change based on population growth and depending upon the final treatment system configuration. **See Attachment F for more information.**

Requirements for surface water treatment plants:

Oregon Administrative Rule (OAR) 333-061-0050(4)(c)(E) addresses construction standards for surface water treatment and states the following:

> (E) All filtration systems shall be designed and operated so as to meet the requirements prescribed in OAR 333-061-0032(4) and (5). Design of the filtration system must be in keeping with accepted standard engineering references acknowledged by the Authority such as the Great Lakes Upper Mississippi River "Recommended Standards for Water Works" technical reports by the International Reference Center for Community Water Supply and Sanitation, or publications from the World Health Organization. A list of additional references is available from the Authority upon request.

OAR 333-061-0050(4)(c)(E) is online at:
https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Documents/OAR-333-061-0050.pdf

The 2022 *Recommended Standards for Water Works* addresses membrane filtration systems under section 4.3.8 and is referenced in some of the conditions for approval identified on the following page. Some of these standards are provided in Attachment H of this letter. The entire set of standards in the 2022 *Recommended Standards for Water Works* is available online at:

https://www.health.ny.gov/environmental/water/drinking/regulations/docs/2022_recommended_standards.pdf

Although this review will conclude with the issuance of a "Final Approval" for what will initially be a non-potable water treatment plant, the review will help ensure that the design will meet the potable production needs for the City of Umatilla once primary disinfection is added.

At this stage, the plans are granted "Conditional Approval", which means construction may proceed provided the following conditions are met prior to Final Approval:

1) **A combined filter (filtrate) effluent turbidimeter and/or grab sampling tap is provided.** OAR 333-061-0036(5)(b) available online at: https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/RULES/Documents/pwsrules.pdf#page=119 requires turbidity to be sampled at least once every 4 hours at a point representative of filtered water (combined filter effluent (UF filtrate) prior to any storage. This is in addition to required continuous individual filter effluent monitoring, for which plans show individual filter effluent turbidimeters. We have typically reduced that sampling to once per day, so either a combined filter effluent turbidimeter or a combined filter effluent grab sample tap may be used. Design must ensure this sampling is possible for potable water production. Alarm set-points should also be appropriate for the turbidity requirements (e.g., 1 NTU for the combined filter effluent and 0.15 NTU for the individual filter effluent – **note the individual filer effluent set-points were identified to be set to 0.3 NTU, however, this is above a regulatory trigger of 0.15 NTU that would require a filter skid to be taken out of service and undergo a direct integrity test.**

(b) A public water system that uses a surface water source or a groundwater source under the direct influence of surface water that does provide filtration treatment must monitor water quality as specified in this subsection when filtration treatment is installed.

(A) Turbidity:

(i) Turbidity measurements as required by section OAR 333-061-0032(4) must be performed on representative samples of the system's filtered water, measured prior to any storage, every four hours (or more frequently) that the system serves water to the public. A public water system may substitute continuous turbidity monitoring for grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the Authority.

(ii) Calibration of all turbidimeters must be performed according to manufacturer's specifications, but no less frequently than quarterly.

(iii) Water systems using conventional filtration must measure settled water turbidity every day.

(iv) Water systems using conventional or direct filtration must conduct turbidity profiles for individual filters every calendar quarter.

(v) For any systems using slow sand filtration or filtration treatment other than conventional treatment, direct filtration, or diatomaceous earth filtration, the Authority may reduce the sampling frequency to once per day if it determines that less frequent monitoring is sufficient to indicate effective filtration performance.

(vi) Systems using lime softening may acidify representative samples prior to analysis using a method approved by the Authority.

2) **A plan for process monitoring of the full-scale system is submitted.** OAR 333-061-0050(4)(c)(C) –available online at: https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Documents/OAR-333-061-0050.pdf, requires a pilot study as stated below.

> (C) Pilot studies shall be conducted by the water supplier to demonstrate the effectiveness of any filtration method other than conventional filtration. Pilot study protocol shall be approved in advance by the Authority. Results of the pilot study shall be submitted to the Authority for review and approval.

It is understood that this phase of the process does not require a pilot study as the plant is to be initially used to provide non-potable industrial process water for what could be essentially a full-scale study period. This non-potable water production time can then be used as a full-scale study to provide additional water quality data to support the design and identify operational issues that may arise from variations in raw water quality for the potable plant phase. **In addition to the initial sampling required for the new intake (e.g., SOC, VOC, IOC, and radiological sampling), please consider the 2022 Recommended Standards for Water Works (see Attachment H) for additional data collection and provide a sampling plan for this full-scale study period**. This period should also include establishing a reference or baseline permeability following the first CIP (at a minimum) for all skids as well as tracking permeability before and after each subsequent CIP.

3) **Water quality data is verified.** Data provided in the submittal indicated a design using a maximum feed water turbidity of 5.5 NTU with an average turbidity of 4.5, however, it is unclear if this data was representative of the Columbia River source water as the design documentation referenced the Rogue River as shown in the text field below. **Please verify the source of the raw water quality data.**

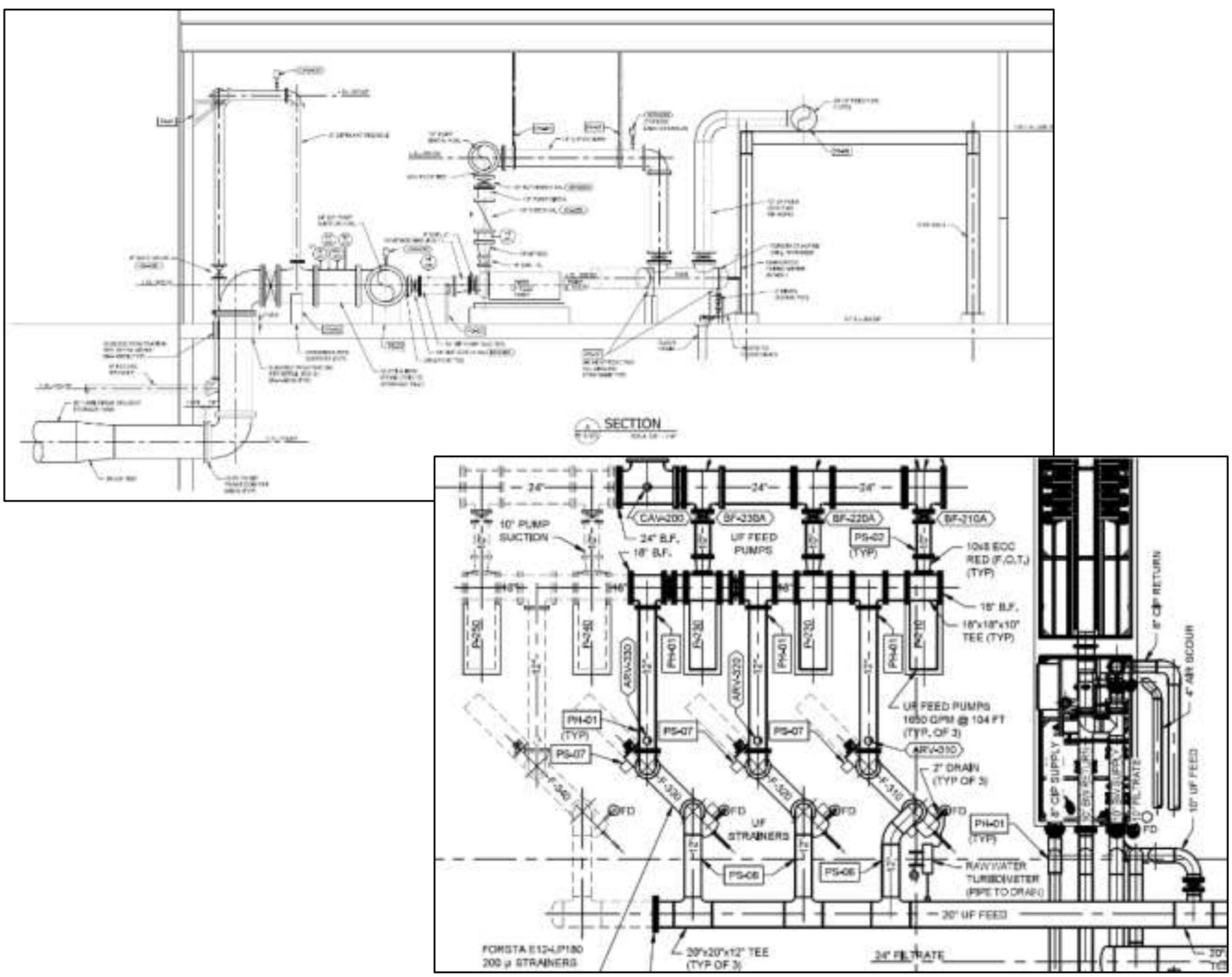
Feed Water Quality		Text field
Maximum Turbidity:	5.5 NTU	UF feedwater is Rogue River with 95% of the feed turbidity values less than 20 NTU. Up to 6 MGD of UF feedwater may be settled surface water with turbidity < 5 NTU. Values for dissolved iron and manganese have been assumed. It is assumed backwash water will have 2-4 mg/L free chlorine.
Average Turbidity:	4.5 NTU	
Maximum TSS:	12.0 mg/L	
Average TSS:	8.0 mg/L	
Color	N/A	
Dissolved Iron:	0.500 mg/L	
Dissolved Manganese:	0.022 mg/L	
Maximum TOC:	4.6 mg/L	
UV Transmittance:	N/A	
Oil & Grease:	0.0 mg/L	
Minimum Design Temperature :	5.0°C	41°F

4. More detail is provided on the coagulation system.

Coagulation is needed when maximum raw water turbidity exceeds 20 NTU according to the 2022 Recommended Standards for Water Works:

> 4.3.8.1.5 Coagulation, Flocculation, and Sedimentation
>
> Coagulation, flocculation, and sedimentation processes shall be provided on all raw water originating from rivers, streams, creeks, lakes, and/or reservoirs that have maximum raw water turbidities exceeding 20 NTUs, unless the reviewing authority allows a pilot study that can demonstrate coagulation, flocculation, and sedimentation are not necessary.

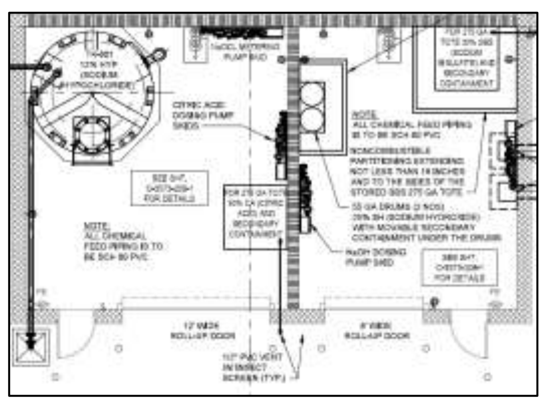
A future coagulation injection location in the distribution supply header between the suction side of UF feed pumps P220 and P230 and upstream of the 200-µm strainers is shown in the general process diagram (drawing G-3-601), however, no such provision appears in the mechanical drawings (e.g., drawing M-3-101) as shown below.



If the raw water turbidity dictates that a coagulant is needed for potable water production (also recommended to reduce membrane fouling and for organics removal to prevent formation of disinfection byproducts in the distribution system), **then the design should provide for adequate dose control and maintenance such that:**

a) Coagulant chemicals (if identified) are approved for potable use (e.g., NSF Standard 60) and compatible with the UF membranes and the Forsta E12-LP180 prescreens (if coagulant is injected upstream), which uses several O-rings and gaskets around the screens and the hydraulic piston used in the cleaning process;
b) Chemical dosing is flow paced and/or based on changes in water quality (which may require additional ports for process monitoring, streaming current meters, etc.);
c) Injection is downstream of any backwash recycle streams and upstream of the UF skids);
d) Chemical mixing (i.e., rapid mix) is adequate (e.g., static mixer, in-line blender mixer, high velocity injection quill, etc.);
e) Dosing to the individual UF skids is not subject to large variations due to uneven flow splitting (e.g., from flows through pump suction or discharge headers when one or more pumps are off-line);
f) Plans include provisions for verifying the coagulant injection pump output (e.g., calibration column or valving to allow drawdown tests).
g) Space for coagulation chemical tanks, pumps, etc. are provided that consider accessibility for operators to verify the available coagulant supply, and safety (e.g., secondary containment and adequate space to move chemical totes (using pallet jacks for example), servicing pumps and conducting sampling (without needing ladders for example), etc.);

Secondary containment example

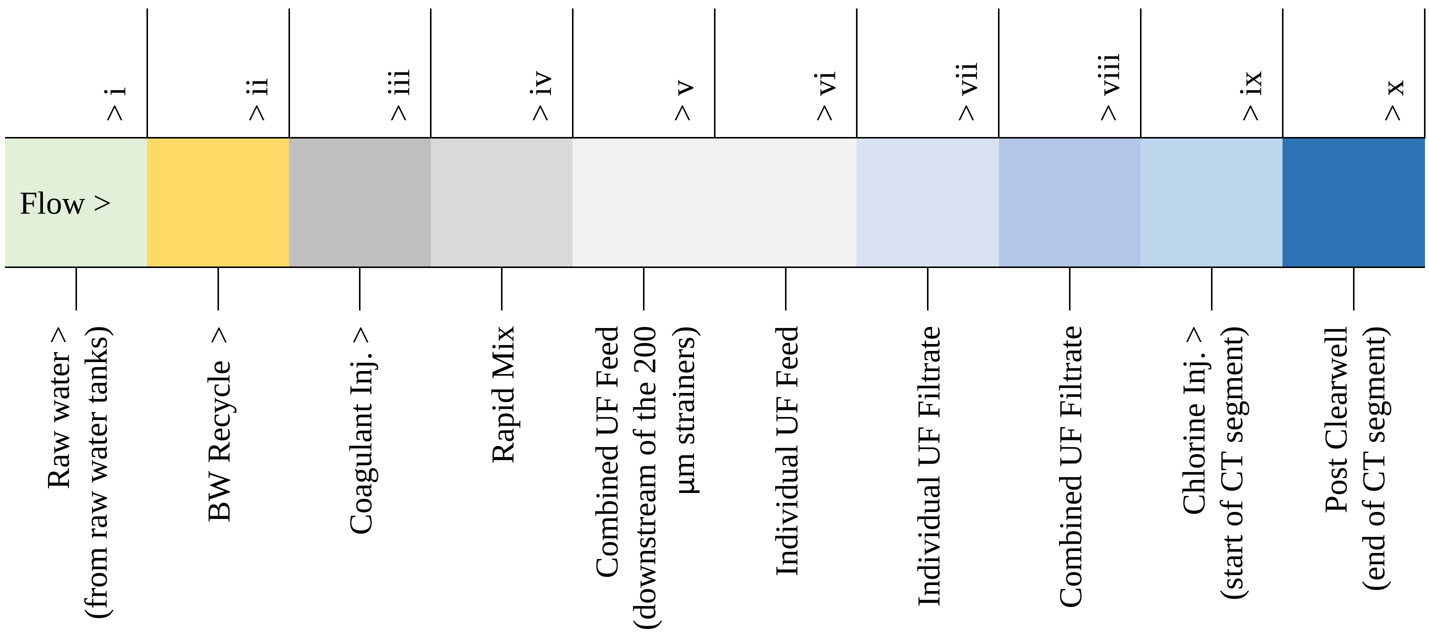


Mechanical Drawing 3-M-101

h) Sample taps are provided as described in condition #3 on the following page.

5) Grab sample taps are considered as illustrated below to facilitate:

a) Jar testing for coagulant dose.
b) Disinfection sampling to support a tracer study (required for the potable system)
c) compliance monitoring (e.g., raw water TOC for disinfection byproducts monitoring reductions, IFE and CFE turbidity to verify accuracy of continuous turbidimeters, and entry point chlorine, pH, and temperature for CT calculations).
d) Other process control determinations (e.g., TOC removal profiles, cyanotoxin removal profiles, total suspended solids for VCF determinations, etc.):



i. Raw water prior to backwash recycle streams (TOC compliance sampling).
ii. Water representative backwash recycle and of blended raw water + backwash recycle prior to coagulant addition (jar testing),
iii. Water representative of coagulant dosed water after coagulant addition but prior to rapid mix (jar testing and dose verification),
iv. Water representative of fully mixed coagulated water after rapid mix (jar testing);
v. Combined UF feed downstream of the 200 µm strainers (process control and TSS sampling for VCF determinations)
vi. Individual UF feed (process control and TSS sampling for VCF determination/validation)
vii. Individual UF filtrate (compliance monitoring and verification of continuous turbidimeter)

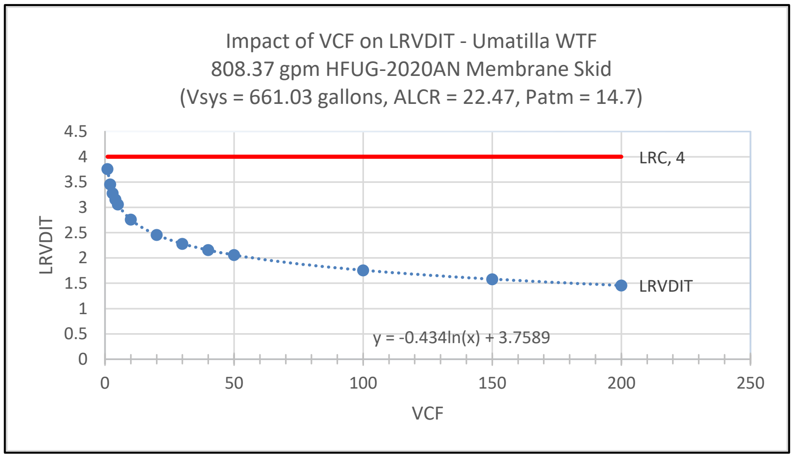
viii. Combined UF filtrate (compliance monitoring & verification of continuous turbidimeter)
ix. After chlorine injection (verification of delivered chlorine dose/residual at start of CT segment needed for tracer study for potable system)
x. After clearwell or tank/pipeline used for contact time and prior to first customer (end of CT segment needed for tracer study for potable system and compliance monitoring for CT parameters of chlorine residual, pH, and temperature)

6) A method for determining the Volumetric Concentration Factor (VCF) is provided for all the skids, taking into account the backwash recycle stream and the backwash recovery skid, which is designed to operate in cross-flow mode.

Per the submitted documentation, the 12,000-gallon backwash recovery (TK-451) receives backwash wastewater from all the UF skids. The effluent of the backwash recovery tank can either be diverted to a 50,000-gallon backwash waste holding tank (TK-450) for subsequent disposal or be pumped to the feed side of the backwash recovery skid (UF430). The backwash recovery UF skid (UF430) is a copy of the primary UF skids with the additions of backwash recovery inlet, to allow recovered backwash to be fed to the train, and the UF filtrate to strainer valves, that will direct filtrate to the header ahead of the automated strainers. This backwash recovery skid is further differentiated from the primary skids in that it has the ability to deliver filtrate water to the finished water holding tanks via the UF filtrate combined header. This skid is also equipped with a recirculation system to create a crossflow to prevent packing of the solids in the modules (added March 2023 with Addendum 3-1).

The VCF is key variable that is used to calculate:

a) the sensitivity of the direct integrity test (LRV_{DIT}),
b) The actual log removal value of the operating skids ($LRV_{ambient}$), and
c) The maximum allowable pressure decay rate or "Upper Control Limit" (UCL).



$$UCL = \frac{Qp \bullet ALCR \bullet P_{atm}}{10^{LRV} \bullet V_{sys} \bullet VCF}$$

$$LRV_{DIT} = \log \bullet \left(\frac{Q_p \bullet ALCR \bullet P_{atm}}{\Delta P_{test} \bullet V_{sys} \bullet VCF} \right)$$

7) **Documentation describing the blend ratio of the recycle stream and how it will not exceeded 10% as well as documentation showing NSF-61 certification or equivalent is provided for the 12,000-gallon backwash recovery tank (TK 451).**

Per the 2022 Recommended Standards for Water Works available online at: https://www.health.ny.gov/environmental/water/drinking/regulations/docs/2022_recommended_standards.pdf and as shown below. The recycled backwash shall not exceed 10% of the total flow. Furthermore, if the filtrate from the backwash recovery rack is combined with the filtrate from the primary skids and then diverted to the UF filtrate holding tanks, the backwash recycle tank should be NSF-61 certified or equivalent for use as a potable water tank.

7.2.4 Other treatment plant storage tanks

Treatment plant storage tanks/basins such as detention basins, backwash recycle tanks, receiving basins and pump wet-wells shall be designed as finished water storage structures. Tanks are exempted from this requirement if they contain water that will receive full treatment for which the plant is designed, such as a pre-sedimentation basin at a surface water treatment plant, or water that will not be returned to the treatment process and is separated from the treatment plant by appropriate cross-connection control measures.

9.6 FILTER BACKWASH WASTEWATER

Suspended solids in the waste backwash water from surface water treatment and lime softening plants should be reduced prior to recycling the clarified water to the head of the plant.

The backwash reclaim tank must contain:

a) The anticipated volume of wastewater produced by the plant when operating at design capacity.

b) The total volume of waste wash water from both filters using 15 minutes of backwashing at a rate of 20 gallons per minute per square foot for a plant that has two filters.

c) A volume that takes into account the number of the filters and the anticipated backwash frequency and volume using 15 minutes of backwashing at a rate of 20 gallons per minute per square foot for a plant with more than two filters.

The reviewing authority may approve the recycling of the waste filter backwash water, thickener supernatant, and other liquids to the head of the plant under the following conditions:

a) Reclaimed water shall be returned at a rate of less than 10 percent of the instantaneous raw water flow rate entering the plant.

b) Reclaiming filter backwash water should be avoided if there is increased risk to treated water quality. Reclaimed water should not be recycled when the raw and/or reclaimed water contains excessive algae, algal toxins, excessive turbidity, or when finished water taste and odor are problematic. Consideration should be given to the presence of protozoans such as Giardia and Cryptosporidium concentrating in the wastewater stream.

c) Pre-treatment of filter backwash wastewater prior to recycling may be required to reduce pathogen populations and to improve coagulation.

The tank specifications in Section 13 51 00 did not address this 12,000-gallon tank:

0233937.00
Issue Date: 19JAN2024

WANAPA ROAD WTF
UMATILLA, OR

SECTION 13 51 00

BOLTED STEEL TANKS FOR BACKWASH WASTE (BWW)

PART 1 – GENERAL

1.01 SCOPE

A. This specification covers the furnishing of all labor, material, equipment, tools, services and erection of a Factory Powder Coated Bolted Steel water storage tank, as manufactured by Superior Tank Co., Inc., Rancho Cucamonga, CA, CST (TECTANK)., Kansas City, MO., Thompson Tank, Bakersfield', CA., or approved equal and as shown on the plans and specified herein.

B. One 50,000 gallon tank will be used for storage of ultrafiltration backwash waste.

8) **Programming is completed such that LRV$_{ambient}$ is calculated every 15 minutes** with the results, formulas, and variables viewable in SCADA to the operator and for regulatory inspections. LRV$_{ambient}$ uses the same equations as LRV$_{DIT}$, with the exception that the calculation uses the most recent direct integrity test and operating conditions (flows, TMP, water temperature) prior calculation. **Hold-up volumes (V$_{sys}$) for the following skid configurations are needed to establish the maximum allowable pressure decay rate (Upper Control Limit or "UCL") and validate the sensitivity (LRVDIT) of the direct integrity test for the following configurations:**

Calculations by:	Toray	E. Hofeld	E. Hofeld	E. Hofeld	E. Hofeld	E. Hofeld
Skid Function	Primary	Primary w/out recycle	Primary w/ recycle	Primary w/recycle	Secondary w/out cross-flow	Secondary with cross-flow
# of modules/skid	**30**	**30**	**30**	**48**	**18**	**18**
Vol of feed pipe/module (gal)	3.653	3.653	3.653	3.653	3.653	3.653
Feed-side hold-up vol per module (gal)	8.98	8.98	8.98	8.98	8.98	8.98
V_{sys} (gallons)	661.03	378.99	378.99	606.38	227.39	227.39
Flux (gfd)	40	40	40	40	20	20
Q_p (gpm)	808.37	807.5	807.5	1292	242.25	242.25
$ALCR_{DP}$	79.95	ALCR = 22.47 (TMP = 29 psi, Ptest = 18.21 psi, Patm = 14.7, T = 59 deg C, BPmax = 3.62, Y = 0.74)				
P_{atm} (psia)	14.7	14.7	14.7	14.7	14.7	14.7
LRC	4	4	4	4	4	4
VCF	1	1				
UCL_{DP} (psi/min) =	0.144	0.070	0.070	0.070	0.038	0.038
Check LRVDIT using UCL =>	3.999	3.972	3.972	3.972	3.967	3.967

$$LRV_{ambient} = \log_{10}\left(\frac{Q_P \bullet ALCR \bullet P_{atm}}{\Delta P_{test} \bullet V_{sys} \bullet VCF}\right)$$

9) PLC/SCADA programming accounts for the following operating conditions that are specific to the Toray HFUG-2020AN membrane module:
   - Maximum flux: 120 gpd/ft^2 @ 20 degrees C
   - Maximum flow rate per module: 80.75 gpm @ 20 degrees C
   - Minimum Static DIT pressure: 18.21 psig*
   - Maximum Trans Membrane Pressure: 29 psi @ 20 degrees C
   - Maximum allowable pressure decay rate: TBD psi/min
   - Minimum $LRV_{ambient}$: 4.0-log**
   - Filter unit is automatically taken off-line should individual filter effluent turbidity exceed 0.15 NTU for more than 15 consecutive minutes (the filter unit will need to undergo a direct integrity test prior to being returned to service).

   *Note: The 18.21 psi minimum static DIT pressure assumes a backpressure of 3.62 psi (100.28 inches of water) and establishes the required static DIT pressure (i.e., ending DIT test pressure) in order to consider the DIT valid. A higher starting DIT test pressure is needed to ensure the minimum pressure is maintained throughout the duration of the 5-minute pressure hold time of the DIT. For example, calculations submitted included a baseline decay through diffusive loss of 0.002 psi/min. Given the 5 minute hold time, a starting test pressure would have to be at least: 18.21 psi + [(0.002 psi/min) * 5 minutes)] = 18.22 psi in order to be valid, which shows that in this case diffusive loss is negligible if the PLC is programmed to begin the test at 18.9 psi for example (Toray documentation specifies not to go above a test pressure of 18.9 psi (130kPa) for the HFUG-2020AN modules, however, Toray may allow a higher starting test pressure on a case-by-case basis).

10) Pressure transmitters are verified to meet requirements of the direct integrity test and related upper control limit and sensitivity requirements and allows for field verification of measurements.

LRV calculations specified Rosemount 3051 or equal pressure transmitter with accuracy of 0.065% x 150 psi / 5 min = 0.0195 psi/min needed for DIT. The following specifications were provided as Attachment 1 – NSF 61 Certification for UF Wetted Parts:

- ***Feed Pressure*** – Rosemount TRANSMITTER-PRESS-0.50-150PSI-316-FPT-DISP-3051
  PE/PIT 411 (UF #1), 421 (UF #2), 431 (UF #3 – BW Recovery)

- ***Filtrate Pressure*** – Rosemount TRANSMITTER-PRESS-0.50-150PSI-316-FPT-DISP-2051
  PE/PIT 416 (UF#1), 426 (UF #2), 436 (UF #3 – BW Recovery)

The *Differential Pressure Measurement Specifications* Per Section 46 61 33 specified a minimum accuracy of +/- 0.25% of scale as required for the application, which does not necessarily clarify the requirement. The only other reference to pressure transmitters was on page 1,707 of the submitted plans as shown below:

0233937.00 AWS WTP & PIPELINE DB
Issue Date: SEPTEMBER 2022 UMATILLA, OR

e. Pressure switches shall be selected as follows:
1) General static pressure switches or differential pressure switches for normal static pressure ranges.
2) Low differential pressure switches for low static pressure ranges.

4. Static and Differential Pressure Measurement:
a. Static and differential pressure measurement shall be performed using pressure transmitters.
b. Sensing elements shall generally be of either the capacitance or strain gauge type.
c. In liquid services:
1) Static pressure analyzers shall be equipped with minimum two- valve manifolds.
2) Differential pressure transmitters shall be equipped with minimum three-valve manifolds.
d. Minimum Accuracy: Plus, or minus 0.25 percent full scale, and as required for the application.

0233937.00 WANAPA ROAD WTF
Issue Date: 10JAN2024 UMATILLA, OR

Woodard & Curran PRESSURE TRANSMITTERS		TAG NO	PIT 1XX, 6XXX, 4XXX [illegible]	P&ID #	[illegible]
PROJECT NUMBER	0233937	REV	REVISION DESCRIPTION	BY	DATE
DESCRIPTION	AWS Umatilla OW WTP & Pipeline DB	B	90% GMP-2	MSP	06/24/2023
		C	100% GMP-2	MBP	11/17/2023
SERVICE					
Acceptable Level of Quality Equal To:	Manufacturer	Rosemount			
	Model Number	2088G2S22A1M5B4Q4			
GENERAL	Span Range Min/Max	0-150 PSI	XMTR Body Material	Stainless Steel	
	Output Signal	4-20 mA	XMTR Element Material	316L SS	
	Accuracy	±0.075%	XMTR Fill Fluid	Silicone	
	Power Supply	24 VDC Loop	Diaphragm Seal	N/A	
	Max. Press. Rating		Seal Material (Non-Wet)	Aluminum	
	Area Classification	Unclassified	Diaf/Housing (Wet)	316L SS	
	Enclosure Rating	NEMA 4X	Fill Fluid	Silicone	
	Local Indicator/Type	Yes - LCD	Capillary Length	N/A	
	Mounting	Integral	Capillary Material	N/A	
	Connection-Process	1/2" NPT			
CALIBRATION	Process (0% / 100%)	-14.7 – 150 PSI			
	Output (4mA / 20mA)	4-20 mA			
PROCESS DATA	Proc Fluid / State	Raw/Waste Water	Flow (Min/Oper/Max)		
	Specific Gravity	Water Like	Flow Units	Choose an item.	
	Percent Solids		Pressure (Min/Oper/Max)		
	Conductivity	Water Like	Pressure Units	PSI	
	Viscosity	Water Like	Temperature (Min/Oper/Max)		

The Wigen direct integrity test protocol uses both feed and filtrate pressure transmitters to record a differential pressure at the start and at the end of the test. The difference in starting and ending differential pressures is used as the pressure decay rate.

11) New facilities are disinfected and tested per AWWA C651-654 as applicable (e.g., AWWA C652 for the 1.0 MG UF filtrate (UFF) storage tanks).

Construction may proceed, however, as-builts and verification that the conditions above have been addressed will need to be submitted prior to issuing Final Approval for the membrane filtration system. The system will not be approved to supply potable water to the City of Umatilla until primary disinfection is added and approved under a separate plan review submittal.

Upon completion of the project construction, the engineer must complete the Project Final Approval Request Form to verify in writing that construction was completed according to the submitted plans and a set of as-built drawings must be submitted. Documentation demonstrating how the above conditions were met should reference Plan Review #16-2024 and can be emailed to me at me at evan.e.hofeld@oha.oregon.gov.

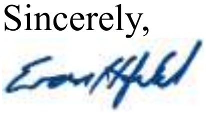
<<< Back to List of Conditions

This remainder of this letter includes the following summary tables and attachments:

1) Table 1 - Log removal credits (LRC) granted for the selected membrane modules.
2) Table 2 - Operating limits that help ensure that the log removal credits granted are met.
3) Attachment A - Explanation of operating limits and terms in Table 2.
4) Attachment B – Formulae, constants, and variables used in calculating the log removal value ($LRV_{ambient}$) of each membrane filter unit/train using current (ambient) operating conditions.
5) Attachment C – Product specifications for the selected membrane modules.
6) Attachment D – Overall project description (includes bookmarks)
7) Attachment E – Land Use Approval (City of Umatilla)
8) Attachment F – Operator Certification Requirements (WD2 + WT2 for Potable Plant)
9) Attachment G – City of Umatilla Required Details
10) Attachment H - 2022 Recommended Standards for Water Works

Thank you for your cooperation and if you have any questions, please feel free to contact me at (971) 200-0288 or e-mail me at evan.e.hofeld@oha.oregon.gov.

Sincerely,



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<<<*Go Back to List of Attachments* *Next Attachment A (Explanation of Terms)* >>>

Each membrane filter unit is granted log removal credits (LRCs) for pathogen removal as shown in Table 1. The LRCs are based on a verification of the Challenge Study Report.

Table 1 – Filter Log Removal Credit (LRC) – Toray HFUG-2020AN

Pathogen	Removal Credit ($\log_{10}$)
Giardia lamblia	4.0
Cryptosporidium sp.	4.0
Viruses	0.0

The LRCs are only valid provided operations are within the limits shown in Table 2. Ensure SCADA/PLC programming continues to account for the operating limits in Table 2 (e.g., set system alarms to ensure operating limits are met).

Table 2 – Operating Limits

Operating Parameter	Limit
Direct integrity test (DIT) frequency	Conduct at least 1 DIT each day of operation
DIT duration/hold time	5 minutes per AT7 (300 Seconds)
DIT starting test pressure	20 psi (or per manufacturer's recommendation)
Minimum allowed DIT pressure	18.21 psi throughout the 5-minute DIT duration
Maximum allowable pressure decay rate (PDR) upper control limit (UCL)	UCL = TBD $^{psi}/_{min}$ (calculated using a max flow of TBD gpm/filter unit w/TBD HFUG-2020AN modules/filter unit)
Minimum DIT pressure transducer accuracy (and span in psi) for the established UCL[1] [psi/min]	+ TBD % of span (+ TBD psi @ TBD psi) for the TBD sensor (span = TBD psi expected measurement range)
Membrane Minimum Performance ($LRV_{ambient}$)	$LRV_{ambient}$ = 4.0-log (must be ≥ 4.0-log LRC)
DIT Sensitivity (LRV_{DIT}) - depends on the pressure transducer accuracy in measuring a response due to a breach (e.g., broken fiber) in the membrane filtration units.	4.49-log. LRV_{DIT} is the maximum LRV that can be reliably demonstrated by the DIT given the use of the TBD pressure sensor @ + TBD% of span. The challenge study demonstrated 5.17-log removal value ($LRV_{C\text{-}TEST}$)
Maximum transmembrane pressure (TMP)	29 psi at 20°C
Maximum allowed filtrate flux [gfd]	120 $^{gal/SqFt}/_{day}$ @ 20°C (80.75 gpm/module x TBD modules = TBD gpm/filter unit)
Individual filter effluent (IFE) turbidity	Not to exceed 0.15 NTU for > 15 consecutive minutes
Combined filter effluent (CFE) turbidity	CFE ≤ 1 NTU in 95% of readings and always less than 5 NTU
Automatic Shutdown Conditions (i.e., shut filter unit down and conduct a DIT to demonstrate membrane integrity is intact)	○ PDR > UCL ○ $LRV_{ambient}$ < LRC ○ IFE > 0.15 NTU for > 15 min ○ CFE > 5.49 NTU (may prompt boil water notice)

[1] **Pressure transducer accuracy** is typically based on the manufacturer's stated accuracy (best fit straight line), expressed as % of span. The accuracy calculated in terms of [psi/min] must be less than or equal to the UCL in [psi/min]. Accuracy in terms of [psi/min] is calculated as follows:

Accuracy in psi/min = (% Accuracy x Max of span in psi) / DIT duration in minutes

$LRV_{ambient}$ is the best metric for demonstrating compliance with the log removal credit (LRC) granted. To remain in compliance, $LRV_{ambient}$ must be equal to or greater than the LRC for *Cryptosporidium* shown in Table 1. $LRV_{ambient}$ values displayed in SCADA should be calculated using the formulae, constants, and variables shown in Table B-1 of Attachment B.

Please ensure the following programming is maintained to ensure compliance:

1. Direct integrity testing parameters programmed into the PLC/SCADA system must include the following:
   a. A **direct integrity test pressure**, which is to be set no less than 18.21 psi.
   b. An **upper control limit (UCL)**, which is set no less than TBD psi/min as a pressure decay rate that indicates a failure of the direct integrity test and prompts an automatic shut-down of the filtration unit.
   c. A **log removal value ($LRV_{ambient}$)** reflective of particle and pathogen removal in the 3 micron (µm) or less size range that is calculated every 15 minutes based on current ambient operating conditions (a metric commonly referred to as $LRV_{ambient}$) and the most recent direct integrity test result. In summary, **$LRV_{ambient}$** is the performance indicator used to demonstrate the minimum 4.0-log (99.99%) *Cryptosporidium* removal that the membrane filters have been credited with.

2. Alarm set points should ensure the following operating limits are not exceeded and if they are exceeded, prompt an automatic shut-down of the filter unit:
   a. Maximum flux of 120 gfd, or equivalent flow setpoint.
   b. Maximum transmembrane pressure (TMP) of 29.0 psi.
   c. Minimum $LRV_{ambient}$ of 4.0-log (calculated every 15 minutes and visible in SCADA)
   d. Maximum direct integrity test pressure decay rate (UCL) of TBD psi/minute.
   e. An alarm set point established to trigger a membrane unit shut down when the combined filter effluent turbidity exceeds 0.15 NTU for more than 15 minutes so that a direct integrity test can be performed on the affected unit.

3. SCADA programming should ensure that the variables, constants, and equations used to determine the pressure decay rate and $LRV_{ambient}$ are viewable to the operator for verification purposes.

<<<Go Back to List of Attachments   Next Attachment B (LRV Formulas and Vars) >>>

Attachment A

Explanation of operating limits and terms in Table 2.

The ability of membranes to filter out pathogens (referred to as **membrane integrity**) is to be tested in two ways:

1) Continuously using a turbidimeter that monitors the effluent turbidity from each membrane unit, often called **individual filter effluent (IFE)** turbidity monitoring, and

2) Once a day using a more direct pressure decay or "air hold" test, often called a **"Direct Integrity Test" (DIT)** because the air hold test is a direct test for leaks or broken membrane fibers.

Direct Integrity Testing (DIT):

Like checking for leaks in a car tire, the membranes are pressurized with air and held for a set amount of time. Air hold times are generally 2 – 10 minutes. A pressure sensor then detects a drop in the held pressure. This pressure drop is called a pressure decay, measured in psi. How fast the pressure drops (or decays) is called the **pressure decay rate (PDR)**, measured in psi/minute. The pressure decay rate is the drop in pressure (psi) divided by the air hold time (minutes) expressed in psi/minute. In some cases, the SCADA will display only the pressure decay in psi and it is up to the operator to know the hold time and determine the decay rate in psi/minute.

Demonstrating compliance:

Should individual filter effluent turbidity exceed 0.15 NTU for more than 15 consecutive minutes, the membrane unit needs to be taken out of service and undergo a direct integrity test. Turbidity is an indirect indicator of membrane integrity and requires a direct integrity test (DIT) to directly determine membrane integrity.

In order for a DIT to be able to demonstrate that the membranes are intact (do not have holes or broken fibers), the membrane needs to be pressurized to a certain minimum pressure (the **minimum direct integrity test pressure**) and the pressure decay rate needs to be under a specified upper limit or **"Upper Control Limit" (UCL)**.

The results of the DIT can be used to calculate a pathogen removal efficiency under ambient operating conditions achieved by the membranes. This log removal value is termed **"$LRV_{ambient}$"** and can be used to demonstrate compliance by directly comparing this performance metric to the log removal credit (**LRC**) *Cryptosporidium* awarded in Table 1.

More detail on the terms introduced above and the operating limits (e.g., upper control limit, etc.) in Table 2 are further described on the following page.

- DIT Turbidity Trigger (IFE > 0.15 NTU for > 15 min): A direct integrity test (DIT) must be performed on each filter unit if the individual filter effluent (IFE) turbidity is greater than 0.15 NTU for more than 15 minutes. This must be programmed into the SCADA system. Should the IFE turbidity exceed 0.15 NTU for more than 15 minutes, the membrane unit must be taken out of service and undergo a DIT. The membrane unit must not be placed back into service unless it passes the DIT (see Upper Control Limit below). Membrane fiber repair/pinning is often needed to remedy this situation.

- DIT Daily Trigger: A DIT is also required each day of operation. If the pressure decay rate (PDR) drops below the upper control limit (UCL in $^{psi}/_{minute}$), then the DIT is considered to have failed and the unit must be automatically taken off-line & repaired and/or retested to show that it passes a DIT before being placed back into service. In other words, should the PDR of the daily PDT (or "air hold test") exceed the UCL, this should indicate a "failed" DIT and the membrane must be taken out of service and may not be placed into service until it passes a DIT. **A new DIT may be immediately run after a DIT failure, or repairs may be needed first (e.g., fibers pinned, leaks at pipe fittings repaired, etc.) followed by passing a new DIT.**

- DIT test pressure: The minimum DIT pressure (i.e., the test pressure at the end of the DIT) must not drop below the minimum DIT pressure stated in Table 2. **Should the pressure during a DIT drop below the level in Table 2, the DIT is considered invalid or "failed" and must be repeated. Starting test pressures are often established (with consultation with the membrane manufacturer) above the minimum DIT pressure to ensure that the test is valid.**

- Upper Control Limit (UCL) in $^{psi}/_{min}$
  Every membrane system has an Upper Control Limit (UCL) measured in $^{psi}/_{min}$. The UCL is the highest **p**ressure **d**ecay **r**ate (PDR) allowed during a direct integrity test (DIT). Exceeding the UCL indicates DIT failure. The failing membrane unit shall not operate until it passes a DIT. Ensure that the SCADA/PLC system is programmed to account for this UCL.

- Membrane Performance ($LRV_{ambient}$): The results of the direct integrity test will be used to determine the log removal value of *Cryptosporidium* that is based on ambient or current operating conditions ($LRV_{ambient}$). The main difference between LRV_{DIT} (see

DIT sensitivity on the following page) and $LRV_{ambient}$ is the use of the current operating flow when calculating $LRV_{ambient}$. Lower flows could yield a lower (less conservative) LRV value. Since the pathogen removal credit is in terms of a log removal value, membrane performance must be determined to demonstrate compliance with the pathogen credit awarded using the same unit of measure [log]. Formulae, constants and variables used to calculate $LRV_{ambient}$ are included in Attachment B of this letter. In summary, $LRV_{ambient}$ is the metric for demonstrating compliance. $LRV_{ambient}$ must be equal to or greater than the log removal credit for *Cryptosporidium* shown in Table 1.

- TMP: The transmembrane pressure or "TMP" is the pressure drop across the membranes and must not exceed that indicated in Table 2. The log removal credit is awarded based on this TMP as it reflects the operating conditions at the time of the challenge study conducted to demonstrate the membrane's ability to remove *Cryptosporidium*.

- Flux: The flux ($^{flow}/_{filter\ feed\ area}$) is the flow per square feet of membrane surface area on the feed or inlet side of the membranes per day [$^{gal/SqFt}/_{day}$ or "gfd"]. The flux must not exceed that indicated in Table 2. The log removal credit is awarded based on this flux as it reflects the operating conditions at the time of the challenge study conducted to demonstrate the membrane's ability to remove *Cryptosporidium*.

- Automatic Shutdown Conditions: **The filters must be taken off-line or otherwise shut down, repaired and/or re-tested if any of the following occurs:**

  1. PDR > UCL. The DIT PDR exceeds the UCL in Table 2.
  2. $LRV_{ambient}$ < LRC. The $LRV_{ambient}$ is less than the log removal credit (LRC) in Table 1
  3. IFE > 0.15 NTU for > 15 min. The individual filter effluent (CFE) turbidity exceeds 0.15 NTU for more than 15 minutes.
  4. Combined Filter Effluent (CFE) turbidity exceeds 5.49 NTU (your regulator should be contacted should CFE turbidity exceed 1 NTU. A boil notice may be required above 5.49 NTU).

- DIT Sensitivity (LRV_{DIT}): The results of the direct integrity test (pressure decay rate or "PDR") and the design flow can be used to determine the DIT sensitivity, expressed as a log removal value of *Cryptosporidium* (LRV_{DIT}). This LRV_{DIT} is calculated as shown in Attachment B and must be equal to or greater than the log removal credit (LRC) shown in Table 1.

<<<Go Back to List of Attachments *Next Attachment C (Membrane Module Specs) >>>*

Attachment B **(Go Back to Condition 8, Go Back to Condition 6)**

Formulae, constants, & variables used in calculating the log removal value ($LRV_{ambient}$) of each membrane filter unit using current ambient operating conditions.

Table B-1. Formulae and variables used in the $LRV_{ambient}$ programming

Specification	Value
$LRV_{ambient}$ equation	$LRV_{ambient} = \log_{10}\left(\frac{Q_p \bullet ALCR \bullet P_{atm}}{\Delta P_{test} \bullet V_{sys} \bullet VCF}\right)$
P_{atm}, Atmospheric pressure [psia]	Constant = 14.7 psi (same for ALCR)
VCF, Volumetric Concentration Factor [dimensionless]	Constant = 1 (deposition mode)
VCF for backwash units in which filtrate goes to clearwell	TBD
V_{sys}, Total volume of pressurized air in the unit during direct integrity testing and volume per module [gallons and liters]	TBD Toray HFUG-2020AN modules (11.88 gallons/module = 44.97 liters/module)
Q_p, filtrate flow of filter unit	Variable - for $LRV_{ambient}$ calculations
ΔP_{test}, DIT pressure decay rate [psi/min]	Variable - based on the pressure decay rate for most recent direct integrity test
Constants needed if ALCR is calculated using the Hagen-Poiseuille equation for laminar flow (Hagen-Poiseuille, MFGM[1] Eq. C.4) ☒ *Not applicable as Darcy equation is used for ALCR*	$ALCR = \frac{527 \bullet \Delta P_{eff} \bullet (175 - 2.71 \bullet T + 0.0137 \bullet T^2)}{TMP \bullet (460 + T)}$ $\Delta P_{eff} = \lvert(P_{test} - BP)\rvert \bullet \left[\frac{(P_{test} + P_{atm}) + (BP + P_{atm})}{2 \bullet (BP + P_{atm})}\right] \bullet \left[\frac{(BP + P_{atm})}{P_{atm}}\right]$
P_{atm}, Atmospheric pressure [psia]	Constant = 14.7 psi (same for $LRV_{ambient}$)
BP, Backpressure during the DIT [psi]	Constant[3] = 3.62 psi = 100.28 inches of water.
P_{Test} used for ΔP_{eff} equation [psi]	Constant[4] = 20 psi
T, Feed water temperature [°F]	Variable - used for ALCR (e.g., 68 °F)
TMP, transmembrane pressure [psi]	Variable - used for ALCR (e.g., 29 psi)
Constants needed if ALCR is calculated using the Darcy equation for turbulent flow (Darcy, MFGM[1] Eq. C.4) ☐ *Not applicable as Hagen-Poiseuille equation is used for ALCR*	$ALCR = 170 \bullet Y \bullet \sqrt{\frac{(P_{test} - BP) \bullet (P_{test} + P_{atm})}{(460 + T) \bullet TMP}}$
Y, Net Expansion Factor [dimensionless][2]	Constant = 0.74

[1] MFGM = Membrane Filtration Guidance Manual (USEPA, Nov. 2005)

[2] Crane Co. 1988. *Flow of fluids through valves, fittings, and pipe*. Technical Paper No. 410. Stamford, CT.

[3] PLC programming is using ______psi

[4] PLC programming is using the UCL of ______psi for P_{test} in the ΔP_{eff} equation, which will yield a lower and more conservative ALCR

UCL – (Back to Condition 6)

The Upper Control Limit (UCL) – To Be Verified - is the maxium pressure decay rate resulting from a pressure decay test that is allowed and that if exceeded, requires that the filter unit be shut down and repaired and/or re-tested. The UCL for Umatilla's Wigen Water UF membrane filter units containing Toray HFUG-2020AN ultrafiltration modules each was calculated using the following equations published in the Membrane Filtration Guidance Manual (USEPA, Nov. 2005), herein referred to as the "MFGM".

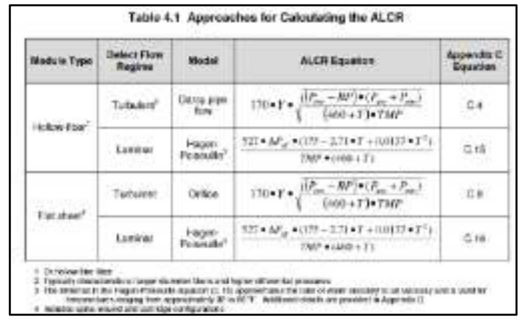


Table 4.1 Approaches for Calculating the ALCR

Module Type	Defect Flow Regime	Model	ALCR Equation	Appendix C Equation
Hollow fiber	Turbulent	Darcy pipe flow	$170 \cdot Y \cdot \sqrt{\frac{(P_{test} - BP) \cdot (P_{test} + P_{atm})}{(460 + T) \cdot TMP}}$	C.4
	Laminar	Hagen-Poiseuille	$\frac{527 \cdot \Delta P_{st} \cdot (177 - 3.71 \cdot T + 0.0137 \cdot T^2)}{TMP \cdot (460 + T)}$	C.15
Flat sheet	Turbulent	Orifice	$170 \cdot Y \cdot \sqrt{\frac{(P_{test} - BP) \cdot (P_{test} + P_{atm})}{(460 + T) \cdot TMP}}$	C.8
	Laminar	Hagen-Poiseuille	$\frac{527 \cdot \Delta P_{st} \cdot (177 - 3.71 \cdot T + 0.0137 \cdot T^2)}{TMP \cdot (460 + T)}$	C.16

The UCL is related to the minimum direct integrity test (DIT) pressure, which typically occurs at the end of the DIT air hold time. In order to achieve a resolution of 3 µm required for pressure-based direct integrity tests, the net pressure applied during the test must be great enough to overcome the capillary forces in a 3 µm hole, thus ensuring that any breach large enough to pass *Cryptosporidium* oocysts would also pass air during the test. A DIT that does not maintain at least this minimum test pressure throughout the duration of the entire air hold time is considered a failed test and may indicate either breaches or broken membrane fibers or a leak in the air hold system and should prompt immediate repair and re-testing. The minimum applied test pressure necessary to achieve the required test resolution of 3 µm was calculated using MFGM Equation 4.1 as follows:

Minimum Required DIT pressure [psi] to meet the required 3 µm resolution requirement

P_{Test} = 18.21 psi is the minumum required DIT test pressure (e.g., minimum DIT ending test pressure) in order to meet the 3 µm test resolution calculated using MFGM equation 4.1 where,

$$P_{Test} = (0.193 \cdot \kappa \cdot \sigma \cdot \cos \theta) + BP_{max}$$

0.193 = constant that includes the defect diameter (i.e., 3 µm resolution requirement) and unit conversion factors
κ = 1, dimensionless pore shape correction factor
σ = 75.6 dyne/cm, surface tension at the air-liquid interface at 0°C
θ = 0 degrees (0 radians), liquid-membrane contact angle
BP_{max} = 3.62 psi (100.28 inch of water), maximum backpressure during the direct integrity test (typically the height of water column from the bottom of the fibers to where the filtrate header is vented)
D_{base} = 0.002 psi/min, baseline decay through diffulsive losses assuming a fully intact membranes (i.e., no broken fibers, or holes in the membranes)

Because the minimum applied test pressure is specific to the make/model of membrane module and the maximum backpressure is specific to the placement of the module in the skid, regardless of the number of modules installed, this minimum 18.21 applied test pressure is valid for all configurations of installed HFUG 2020AN membrane modules within the proposed Wigen UF skids (e.g., valid for the 18 module secondary backwash recovery skid and the the 30, 48, or 54-module primary skids).

Upper Control Limit (UCL) in psi/minute (i.e., maximum allowable pressure decay rate)

Toray has established a quality control release value (QCRV) of 0.048 psi/min for pressure-based non-detructive performance test (NDPT) for production modules. The UCL should be greater than or equal to the QCRV. The calculations below show how the UCL was established for the COU WTF and account for the various module configurations in near- and far-term phases of construction.

<u>UCL for Primary UF skids:</u>

<u>To be determined</u>

<u>UCL for Secondary Backwash Recovery UF Skid:</u>

<u>To be determined</u>

<u>UCL = TBD psi/min</u> is the maximum allowable pressure decay rate for the direct integrity test as calculated using MFGM equation 4.17 where,

$$UCL = \frac{Q_p \bullet ALCR \bullet P_{atm}}{10^{LRC} \bullet V_{sys} \bullet VCF}$$

- Q_p = varies based on # of modules/skid, gpm
- P_{atm} = 14.7 psi
- LRC = 4.0 log
- V_{sys} = varies based on # of modules/skid, gallons
- VCF = TBD

(VCF for the secondary backwash recovery skid remains to be determined)

<u>ALCR = 22.47 (To Be Verified)</u> calculated using MFGM equation C.4 for turbulent flow through a breach in hollow fiber membranes where,

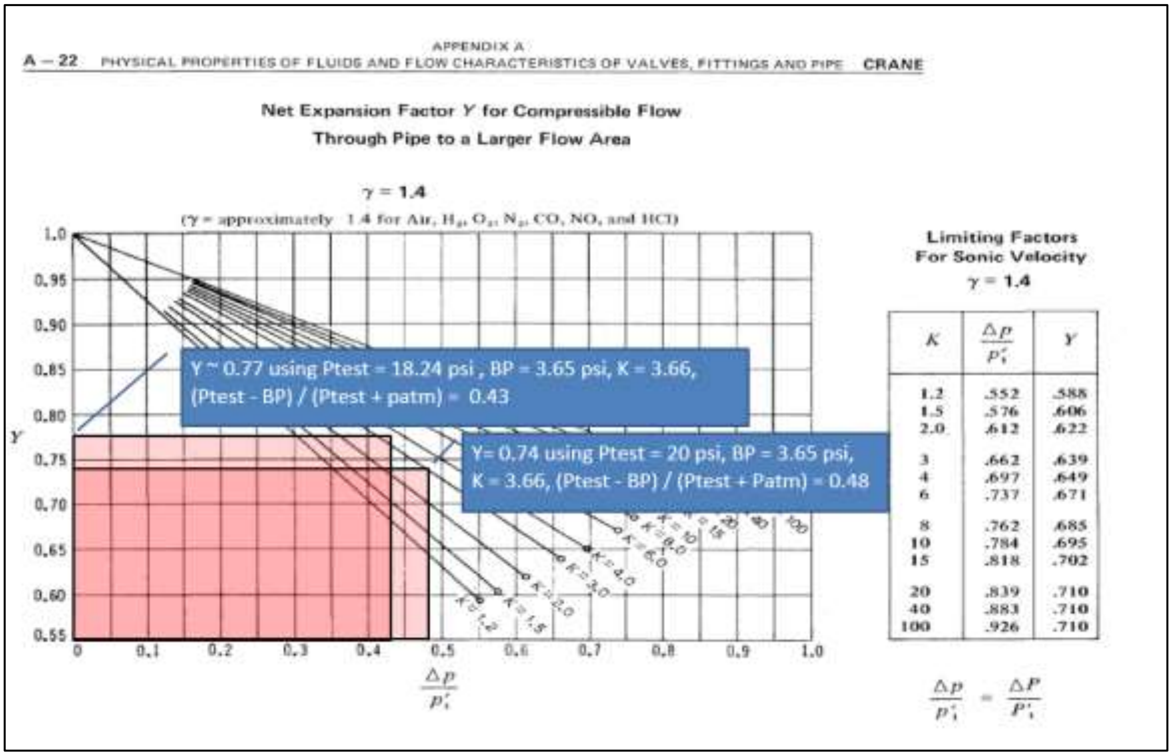
$$ALCR_{DP} = 170 \bullet Y \bullet \sqrt{\frac{(P_{test} - BP) \bullet (P_{test} + P_{atm})}{(460 + T) \bullet TMP}}$$

- P_{test} = 18.21 psi
- T = 59 °F
- TMP = 29 psi
- BP = 3.62 psi (BP_{max})
- P_{atm} = 14.7 psi
- $(P_{test}) – BP) / (P_{test} + P_{atm})$
- Y ≃ 0.77 (0.74 using P_{test} of 20 psi)

Using a lower net expansion factor yields a lower ALCR and LRV_{DIT}, therefore using Y = 74 as in the LRV calculations provided by Toray is acceptable.

$$Y \propto \left[\frac{1}{\left(\frac{P_{test} - BP}{P_{test} + P_{atm}} \right)}, K \right]$$

(Equation C.5 EPA Manual)



DIT Sensitivity (LRV_{DIT}) – To be Verified (**Back to Condition 6**)

<u>Sensitivity is defined as the maximum log removal value that can be reliably verified by the direct integrity test</u> (i.e., LRV_{DIT}). The sensitivity of the direct integrity test establishes a maximum log removal credit that a membrane filtration process is eligible to receive if it is less than or equal to that demonstrated during challenge testing (i.e., $LRV_{C\text{-}Test}$). For example, if the challenge test demonstrated a $LRV_{C\text{-}Test}$ of 5.5 log, and the direct integrity test is capable of demonstrating an LRV_{DIT} of 4.5 log, the membrane filtration process would be eligible for removal credit up to 4.5 log. <u>The sensitivity is related to the ability of the pressure sensor in terms of accuracy to measure a pressure decay rate</u>. To evaluate the sensitivity of the pressure sensors in use for the DIT measurements, LRV_{DIT} is calculated using the accuracy of the pressure sensor to ensure the DIT is capable of demonstrating the log removal credited (LRC) for the membranes. In this evaluation, <u>two conditions that needed to be met (and were met) as follows</u>:

1. The smallest pressure decay rate measurable by the pressure sensor must be $\leq$ UCL
2. The LRV_{DIT} must be $\geq$ LRC where the LRC is $\leq$ $LRV_{C\text{-}Test}$

LRC = 4.0-log (< $LRV_{C\text{-}Test}$)
$LRV_{C\text{-}Test}$ = 5.17 log (0.048 psi/min QCRV w/pressure decay test (NDPT))

LRV_{DIT} = TBD-log (> LRC) which is the sensitivity of the DIT using MFGM equation 4.9 where,

Q_p = varies, gpm (maximum design feed flow through a filter unit – depends upon # of modules installed)
ALCR = 22.47 (calculations shown above – to be verified)
P_{atm} = 14.7 psi
V_{sys} = varies based on # of modules installed, gallons
VCF = varis based on recycle – to be determined
ΔP_{test} = TBD psi/min based on the sensitivity of the Rosemount transmitter.

$$LRV_{DIT} = \log\left(\frac{Q_p \bullet ALCR \bullet P_{atm}}{\Delta P_{test} \bullet V_{sys} \bullet VCF}\right)$$

Note: TBD psi/min is the smallest pressure decay rate measurable by the Rosemount pressure trasmitter used to measure the pressure decay rate during a direct integrity test, which was determined using the pressure sensor manufacturer's stated accuracy (± TBD% of span, BFSL), expressed as a % of span x the maximum span (__ – __ psi) anticipated measurement range) divided by the DIT duration in minutes. ΔP_{test} must be less than or equal to the UCL. In this case:

Example: ΔP_{test} = [(0.5% Accuracy/100%) x 50 psi span] / 5 minute DIT duration = 0.05 psi/min, which is less than the ___ psi/min UCL. (0.05 psi/min is __% below the ___ psi/min UCL), **yielding an LRV_{DIT} of ___-log, which is still greater than the 4.0-log removal credit.**

Calculations by:	Toray	E. Hofeld	E. Hofeld	E. Hofeld	E. Hofeld	E. Hofeld
Skid Function	Primary	Primary w/out recycle	Primary w/ recycle	Primary w/recycle	Secondary w/out cross-flow	Secondary with cross-flow
# of modules/skid	**30**	**30**	**30**	**48**	**18**	**18**
Vol of feed pipe/module (gal)	3.653	3.653	3.653	3.653	3.653	3.653
Feed-side hold-up vol per module (gal)	8.98	8.98	8.98	8.98	8.98	8.98
V_{sys} (gallons)	661.03	378.99	378.99	606.38	227.39	227.39
Flux (gfd)	40	40	40	40	20	20
Q_p (gpm)	808.37	807.5	807.5	1292	242.25	242.25
$ALCR_{DP}$	79.95	ALCR = 22.47 (TMP = 29 psi, Ptest = 18.21 psi, Patm = 14.7, T = 59 deg C, BPmax = 3.62, Y = 0.74)				
P_{atm} (psia)	14.7	14.7	14.7	14.7	14.7	14.7
LRC	4	4	4	4	4	4
VCF	1	1				
UCL_{DP} (psi/min) =	0.144	0.070	0.070	0.070	0.038	0.038
Check LRVDIT using UCL =>	3.999	3.972	3.972	3.972	3.967	3.967

<<<Go Back to List of Attachments *Next Attachment D (Project Description) >>>*

Attachment C

Membrane Module product Specifications

Table C-1. Membrane Filter Module Specifications

Specification	Value
Membrane Manufacturer	Toray
Membrane Model Number	HFUG-2020AN
Challenge test standard (ANSI/NSF 419-YY, ETV, etc.)	NSF-419-18*, 40 CFR §141.719
Challenge test report date	August 15, 2019
$LRV_{C\text{-}Test}$	5.17-log (approved for 4.0-log = LRC)
OHA-DWS Challenge Study Verification Information Assumes a 2.98 psi maximum backpressure (BP_{max}) =>	Date Verified = November 12, 2019 LRC = 4.0-log (*Giardia*/*Crypto*) Max Flux = 120 GFD @ 20°C Max TMP = 29 psi Minimum DIT Pressure = 17.48 psi
ANSI/NSF Standard 61 certification (yes/no)	Yes
Membrane type (*e.g.*, hollow fiber, etc.)	Hollow fiber (14,000 fibers per module)
Number of fibers per module	14,000
Fiber inside (lumen) diameter	0.7 mm (1.1 mm outside diameter)
Fiber wall thickness	0.2 mm
Active fiber length (length of fibers not in potting)	71.5 Inches (1,816 mm) (module dimensions: 85 in x 8.5 in dia.)
Potting depth (or defect length)	95 mm potting depth
Membrane classification (*e.g.,* ultra- or micro-filtration)	Ultrafiltration
Nominal membrane pore size (*e.g.*, 0.01 µm, etc.)	150,000 Daltons (0.01 micron nominal)
Membrane material (*e.g.*, PVDF, polysulfone, etc.)	PVDF (Thermally induced phase separation - TIPS)
Roughness coefficient	N/A
Feed side membrane filtration area (ft^2)	969 ft^2 (90 m^2) per module
Filtration Flow Direction (*i.e.*, inside-out or outside-in)	Outside-in
Hydraulic configuration (*i.e.*, deposition or suspension)	Deposition
Submerged or Pressurized	Pressurized

*Testing of the Toray HFUG-2020AN Ultrafiltration (UF) membrane module was conducted in the NSF testing laboratory in 2019 to measure log removals of *Cryptosporidium*, using *Bacillus* endospores as a surrogate. The HFUG-2020AN is certified to NSF/ANSI Standard 61.


TEST REPORT

Product Datasheet

TORAY
Innovation by Chemistry

HFUG-2020AN

Pressurized Outside to In / Dead-end Filtration Ultrafiltration (UF) Membrane Module

The HFUG-2020AN module is Toray's latest UF innovation that features hollow fibers with a smaller diameter but with improved membrane durability and performance. The result is an increased surface area per module for more production output.

Membrane Characteristics	Unit	Value
Membrane Material		PVDF (Polyvinylidene fluoride)
Nominal Pore Size	µm	0.01
Outer Membrane Surface Area	m^2 (ft^2)	90 (969)
Operating Parameters	**Unit**	**Value**
Maximum Feed water / Filtrate Flow	m^3/h (gpm)	15 (66)
Maximum Backwash Flow	m^3/h (gpm)	16.8 (74)
Maximum Air Flow	Nm^3/h (scfm)	9.0 (5.3)
Maximum Inlet Pressure	kPa (psi)	300 (43.5)
Maximum Backwash Pressure	kPa (psi)	300 (43.5)
Normal Operating Trans-membrane Pressure	kPa (psi)	0–200 (0–29)
Operating Temperature Range	°C (°F)	1–40 (34–104)
pH Range – During Filtration		1–10
pH Range – During Cleaning		0–12

*Please contact Toray for operating manual and preliminary design, as capacity per module is highly dependent on feed water quality.

Product Certifications & Compliances

(Please contact Toray for details on the certified modules)

- NSF/ANSI/CAN 61 for drinking water applications
- NSF/ANSI 419 to comply with the U.S. EPA's Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), which allows membrane manufacturers to prove Cryptosporidium reduction
- Association of Membrane Separation Technology of Japan
- Korea Water and Wastewater Works Association

NSF

<<<*Go Back to List of Attachments* *Next Attachment - E (Land Use Docs)* >>>

Attachment D
Overall Project Description

The City of Umatilla will take over the plant to serve the City as a drinking water source once a new raw water intake (also on the Columbia River), pump station, raw storage tank (250,000-gallon glass-fused-to-steel bolted tank by Superior Tank) and transmission main are constructed. Disinfection & a new clearwell will also be added at that time as the membrane plant will not initially have disinfection. The required operator level will be established when plans for production of potable water to be directed to the distribution system are submitted to OHA. The plant is anticipated to be rated such that an operator in direct responsible charge (DRC) with a Water Treatment 2 (minimum) will be needed. Based on the anticipated COU population to be served, a DRC with a Water Distribution 2 (minimum) certification will be needed.

OHA Safe Drinking Water System Information – SRC-DA, WTP-D, EP-D:
The membrane plant will be reviewed and added to SDWIS consistent to the COU's existing sources online at: https://yourwater.oregon.gov/inventory.php?pwsno=00914. The new WTF will be designated as follows:

1. *SRC-DA Columbia River*
2. *WTP-D TP for Columbia River* (initially listed as "inactive" until disinfection is added).
3. *EP-D EP for Columbia River WTP* (for ongoing chemical sampling for the finished potable water).

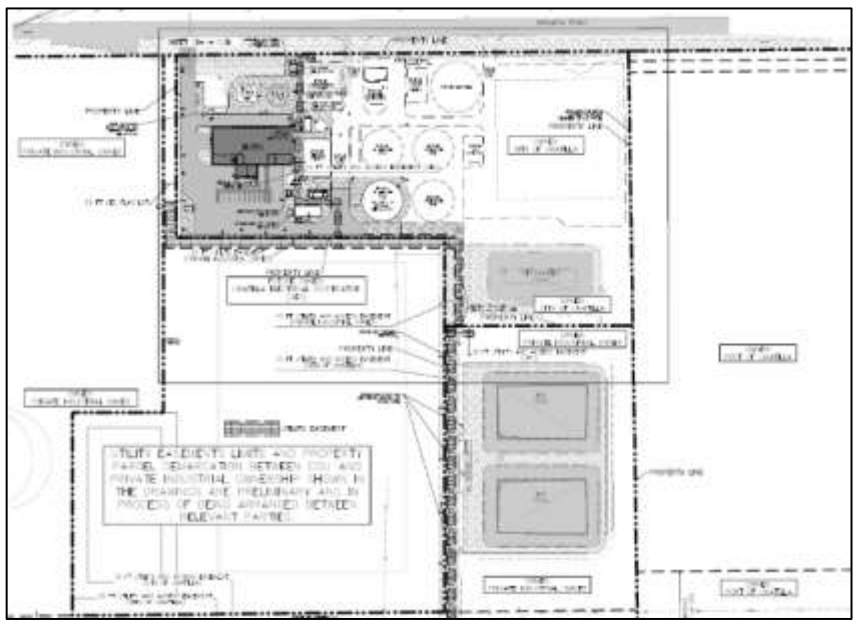
Operator certification requirements for the potable water treatment plant – WT2, WD2:

The following bookmarks are included in Attachment D to aid in navigation through this section:

Overview: ***(Go Back to List of Bookmarks)***
This project is for a water treatment facility (WTF) with a build out capacity of 7.80 mgd as ultrafiltration filtrate to supply for non-potable industrial uses as well as for future potable water City of Umatilla (COU). PCL is the prime for this WTF design-build contract with Woodard & Curran as the Engineer of Record (EOR). Once complete and in service, the plant will have the capacity to provide 4.7 MGD for potable use for the City and an additional 3.1 MGD for non-potable industrial use for a combined capacity of 7.8 MGD. The WTF is located within the City of Umatilla south of Wanapa Rd on TL1100 on Assessors Map 5N29.

Raw water flow for the UF system is based on a 24-hour average daily flow as well as a UF skid operation of 24 hours per day (and not 16 hours of production for industrial use of 3.1 mgd filtrate production at build-out as originally specified). Industrial build-out demand is 3.1 mgd of non-potable filtrate while COU build-out demand is 4.8 mgd of potable water; thus the build-out WTF demand is 7.9 mgd of filtrate from the UF skids. Seven skids are proposed at build-out with room/provisions for an 8^{th} skid (equipment pads for skids not to be installed within 3 years are not being constructed at this time, but drains are being provided and stubbed up).

One of the initial 3 skids is able to be used as a wastewater concentrator, with connections to be able to use the skid as a primary skid once permanent backwash waste handling is constructed (backwash waste pumps to waste backwash to COU sewer with pumps rated at 500 gpm (0.72 MGD) peak hour flow are included, however, flows to the COU sanitary sewer is to be limited to 50,000 gallons per day). The "backwash reuse" or recovery skid is flexible such that this skid can be used as a production skid as an operational choice by the operator. This skid is further differentiated from the primary skids in that it is equipped with a recirculation system to create a crossflow to prevent packing of the solids in the modules (added March 2023 with Addendum 3-1)



General Drawing G-1-001

Plans:

The WTF process flow diagram is shown on drawing G-3-601. The plant control narrative is provided in Attachment 5.1.A detailed description of the Ultrafiltration (UF) treatment process is provided in coordination with the membrane OEM vendor in Attachment 5.2. The ladder logic diagram is also provided in Attachment 6, which will be provided later.

Design Criteria: ***(Go Back to List of Bookmarks)***

First Stage Skids	6 (space for 48 modules)	1.55 MGD Filtrate Capacity Ea.
Backwash (BW) Reuse/recovery Skids	1 (space for 48 modules)	0.275 MGD at Build-out
Redundancy	N+1	Where N = # of skids + 1 spare
Plant Capacity (with 1 primary skid in standby)	5 first stage skids x 1.55 MGD + 1 second stage x 0.275 MGD 1.55 MGD = 1,076 gpm 0.275 MGD = 191 gpm	8.025 MGD total capacity (5,573 gpm)
Initial Installation	2 primary + 1 BW Recovery skid	8.07 MGD capacity w/30 modules in primary skids and 18 modules in BW recovery skid
Prescreens	3 = N+1 redundancy	200-micron
UF Feed Pumps	5 = N+1 redundancy	

DESIGN CRITERIA:

Raw Water Facilities	
9,205	gpm (20.51 cfs) Max. Influent Flow Rate
5,359	gpm (11.90 cfs) Initial Non-Potable Demand (UFF plus CTUIR)
24"	Influent Raw Water Meter, Electromagnetic
250,000	gal Existing Raw Water Storage Volume (1 Total Bolted Steel Tank)
500,000	gal Ultimate Raw Water Storage Volume (2 Total Bolted Steel Tanks)

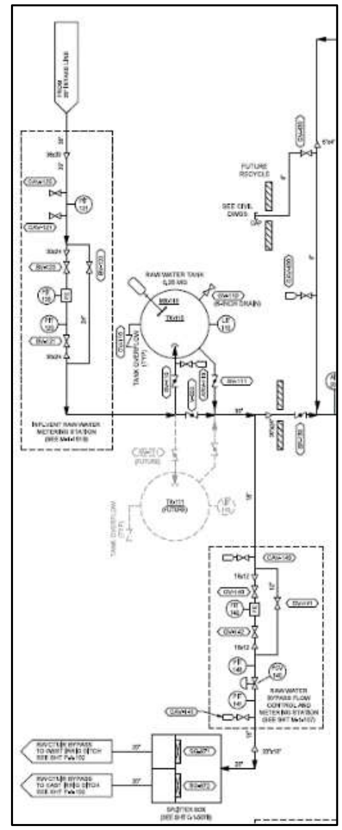
CTUIR Raw Water Bypass Facilities	
3,846	gpm (8.57 cfs) Normal Max. Flow Rate
5,278	gpm (11.76 cfs) Intermittent Max. Flow Rate
18"	Flow Control Valve with EMO
12"	Raw Water Bypass Meter, electromagnetic
2	Discharges to CTUIR Irrigation Ditches
Flow Split	Open Splitter Box with flow split to two Discharges
36"	Slide Gates, 1 each to East and West Discharges, Manual

Backwash Water System	
125	gpm Maximum Discharge to Sewer (only 10pm to 6 am)
225	gpm Maximum Return to the WTF
300	gpm Maximum Flow Rate to the Future Washwater Clarifier
315	gpm Maximum Combined Flow Rate (Assumed 90% of Maximum Flow Return to the WTF and Sewer)
1+1	Initial BWW Pumps (duty+standby, Horizontal Split Case)
2+1	Future BWW Pumps (duty+standby, Horizontal Split Case)
15	psi Nominal Delivery Pressure at Future Washwater Clarifier
1	Ultimate Bolted Steel Tank (50,000 gal.)

UFF Storage	
1	Initial Bolted Steel Tank
1,000,000	gal Initial Storage Volume
4	Ultimate Bolted Steel Tank
4,000,000	gal Ultimate Storage Volume

UFF Pump Station Conveyance	
9.51	cfs (4,268 gpm) Initial Max. Flow Rate
12.45	cfs (5,588 gpm) Ultimate Data Center Use Max. Flow Rate
2.00	cfs (898 gpm) Ultimate City Use (Non-Potable, Future Connection at Beach Access Road)
2+1	Initial UFF Pumps (duty+standby, Horizontal Split Case)
3+1	Ultimate UFF Pumps (duty+standby, Horizontal Split Case)
60	psi Minimum Delivery Pressure at Existing Wanapa Road Data Center Connection
65	psi Minimum Delivery Pressure at Existing Beach Access Road Data Center Connection

Raw Water Supply – Columbia River: (Go Back to List of Bookmarks)
<<< Go Back to Condition 3



Source water is initially to be from an existing intake/pump for the Columbia River controlled by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) until the new intake is constructed. Raw water from the river pumping facility will be conveyed through a 36" diameter intake line, through a raw water metering stations, and then be conveyed to a 0.25 MG raw water storage tank (TK-110) referred to in Specification 40 70 00 data sheets. A second 0.25 MG raw water storage tank (TK-111) will be added at a later date. The Influent raw water pipeline is provided with an electromagnetic flowmeter (FE-120) to monitor both the instantaneous flow rate (in GPM) as well as the flow volumes for operator identified time intervals (e.g., 1 day, 1 month, etc.).

The raw river water quality is provided in Table 46 61 33A.1 of the membrane specification. **Attachment 4** summarizes the feed water quality design criteria and available water quality.

Table 46 61 33A.1:

D. Water Quality:
1. Water source is the Columbia River just upstream of the McNary Dam from a proposed pump station on the Oregon side.
2. Membrane Filtration System estimated feed water quality range is shown in Table 46 61 33A.1 (Water Quality) and 46 61 33A.2 (Particle Distribution)
3. Membrane Filtration System required treated water quality is shown in Table 46 61 33B – Membrane Filtration System Treated Water Quality.
4. Membrane Filtration System shall meet design requirements shown in Table 46 61 33C – Membrane Filtration System Design Requirements

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Issue Date: SEPTEMBER 2022

AWS WTP & PIPELINE DB
UMATILLA, OR

Table 46 61 33A.1 – Membrane Filtration System Feed Water Quality Range

Design Feed Water Quality[a]		
Required Parameters	Unit	Concentration
Source	-	Columbia River Water
Total Iron	mg/L	<0.100 – 0.8
Hardness	mg/L as $CaCO_3$	50.0 – 60.0
Total Manganese	mg/L	0.014 – 0.022
pH	-	7.78 – 7.84
Temperature	°C	1.0 – 22.2, design based on 5.0°
Total Dissolved Solids	mg/L	70 - 100
Total Organic Carbon	mg/L	1.2 – 4.8
Total Suspended Solids	mg/L	1.0 – 12.0
Turbidity	NTU	3.5 – 5.5
UV 254	abs. units	NA
Alkalinity	mg/L as $CaCO_3$	52 - 80
Calcium	mg/L	14.5 – 20
Chloride	mg/L	1.3 – 4
Color	APHA	NA
True Color	APHA	NA
Sulfate	mg/L	7.4 – 9.4
Total Coliforms	CFU/100 mL	NA

Table 46 61 33A.2 – Estimated Particle Size Distribution

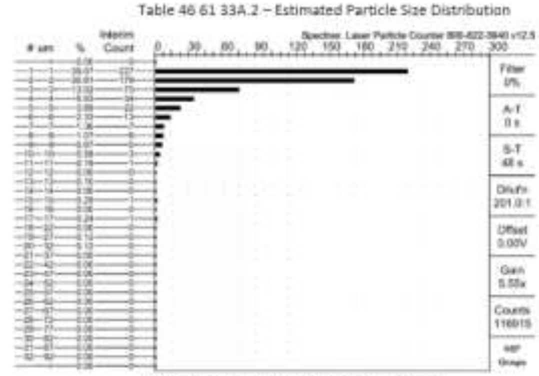


Figure 1-1: CTUIR Pump House Particle Distribution

Table 46 61 33B – Membrane Filtration System Treated Water Quality

Parameter	Filtrate Requirements	Typical Feed Water Limitation
Turbidity	≤0.10 NTU 95% of time with a maximum of 0.30 NTU	≤~~5.50 NTU~~ Maximum NTU corresponding to Observed TSS Limits & ≤4.50 NTU Average
Total Suspended Solids (mg/L=ppm)	< 1 ppm	≤12.0 mg/L Maximum & ≤8.0 mg/L NTU Average See all Addendums for overall limits
Silt Density Index (SDI)	≤ 3.0	TSS & Turbidity limits
Legionella Removal	≥ 4.0 LOG (99.99% or more)	TSS & Turbidity limits
Virus Removal	≥ 1.0 LOG (90.00% or more)	TSS & Turbidity limits
Certification Standards	NSF61, NSF419, CPDH Title 22, UL 508A Listed	ok
Other	none	0.50 maximum≤Iron≤0.25 average 4.6 maximum≤TOC≤4.0 average 0.022 maximum≤Manganese≤0.020 average 7.78≤pH≤7.84 (mg/L for all except pH)

Table 46 61 33C – Membrane Filtration System Design Requirements

Parameter	Value	Units
Net Maximum Filtrate Production Capacity	1,265	gpm
Net Average Filtrate Production Capacity	1,100	gpm
Net Minimum Filtrate Production Capacity	300	gpm
Maximum Instantaneous Filtrate Flux (under any flow scenario)	60 (Toray/Asahi) 50 (DuPont IF)	gallons/square foot/day (gfd)
Filtrate Design Flux	~~50~~ 40 (Toray / Asal 40 (DuPont IF)	gfd
Minimum Recovery	95	percent
Operational TMP (95 percent of the time)	< 10	psi
Maximum TMP	30	psi
Maximum Backwash Frequency	48	BW/module/day
Maximum CIP Frequency	1	CIP/train/month

From Toray Projections:

Feed Quality

Maximum Turbidity:	5.50	NTU
Average Turbidity:	4.50	NTU
Maximum TSS:	12.00	mg/L
Average TSS:	8.00	mg/L
Dissolved Manganese:	0.022	mg/L
Dissolved Iron:	0.5	mg/L
Maximum TOC:	4.60	mg/L
Temperature (min):	5.0	deg C

Feed (net)

3,976.92	m^3/d
165.71	m^3/h
1.05	MGD
729.66	gpm
8.00	mg/l TSS
31.82	kg/d TSS

Feed Water Quality		Text field
Maximum Turbidity:	5.5 NTU	UF feedwater is Rogue River with 95% of the feed turbidity values less than 20 NTU. Up to 6 MGD of UF feedwater may be settled surface water with turbidity < 5 NTU. Values for dissolved iron and manganese have been assumed. It is assumed backwash water will have 2-4 mg/L free chlorine.
Average Turbidity:	4.5 NTU	
Maximum TSS:	12.0 mg/L	
Average TSS:	8.0 mg/L	
Color	N/A	
Dissolved Iron:	0.500 mg/L	
Dissolved Manganese:	0.022 mg/L	
Maximum TOC:	4.6 mg/L	
UV Transmittance:	N/A	
Oil & Grease:	0.0 mg/L	
Minimum Design Temperature :	5.0°C	41°F

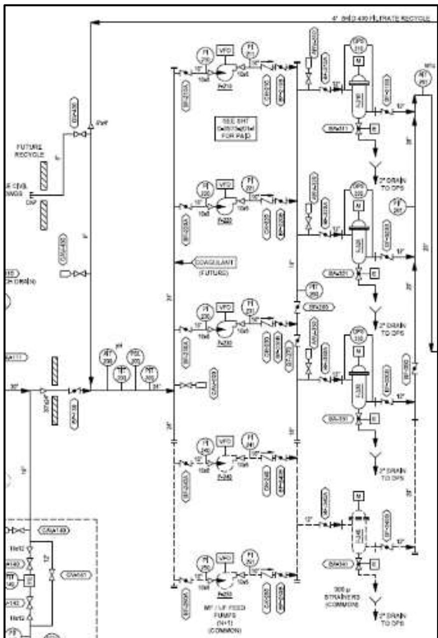
UF feedwater is Rogue River with 95% of the feed turbidity values less than 20 NTU. Up to 6 MGD of UF feedwater may be settled surface water with turbidity < 5 NTU. Values for dissolved iron and manganese have been assumed. It is assumed backwash water will have 2-4 mg/L free chlorine.

PIT 120 and PIT 121 (raw water influent):
The 30” influent raw water pipeline is provided with two pressure transducers (PIT-120 & PIT-121) for monitoring pressure within the WTF upstream and downstream of meter isolation valves between the meter vault and air valve vault on the POD side of the raw water pipeline. When the PIT-120 or PIT-121 pressure exceeds “Raw Water Influent High Pressure” set point, the SCADA System will provide a “Raw Water Influent High Pressure” alarm. When the PIT-120 or PIT-121 pressure is below the “Raw Water Influent Low Pressure” set point, the SCADA System will provide a “Raw Water Influent Low Pressure” alarm. Furthermore, PIT-121 pressure feedback and alarms will be relayed to POD via SCADA communications.

Raw water storage – Two 0.25 MG glass-fused-to-steel tanks:
At build-out, two 0.25 MG steel storage tanks will serve for raw water storage and feed to the WTF via a 30” diameter pipeline, which will also have bypass piping around the raw water tank(s) to supply to the WTF. Inlets to the raw water tanks is at the top with an air gap and outlets are at the bottom. A 24” line conveys raw water from the tanks to the membrane plant. A separate 18” diameter gravity pipeline conveys the raw river water from the raw tanks, through a raw water bypass flow control and metering station, and then splits to two 20” diameter pipelines to supply the Confederated Tribes of Umatilla Indian Reservation (CTUIR) wetlands.

***Pre-treatment:* (*Go Back to List of Bookmarks*)**

Water is conveyed from the raw water tanks via a 24” line to a distribution header. A side stream in a 4” diameter line containing recycled filtrate from a backwash recovery skid (UF430) blends with raw water prior to the distribution header.

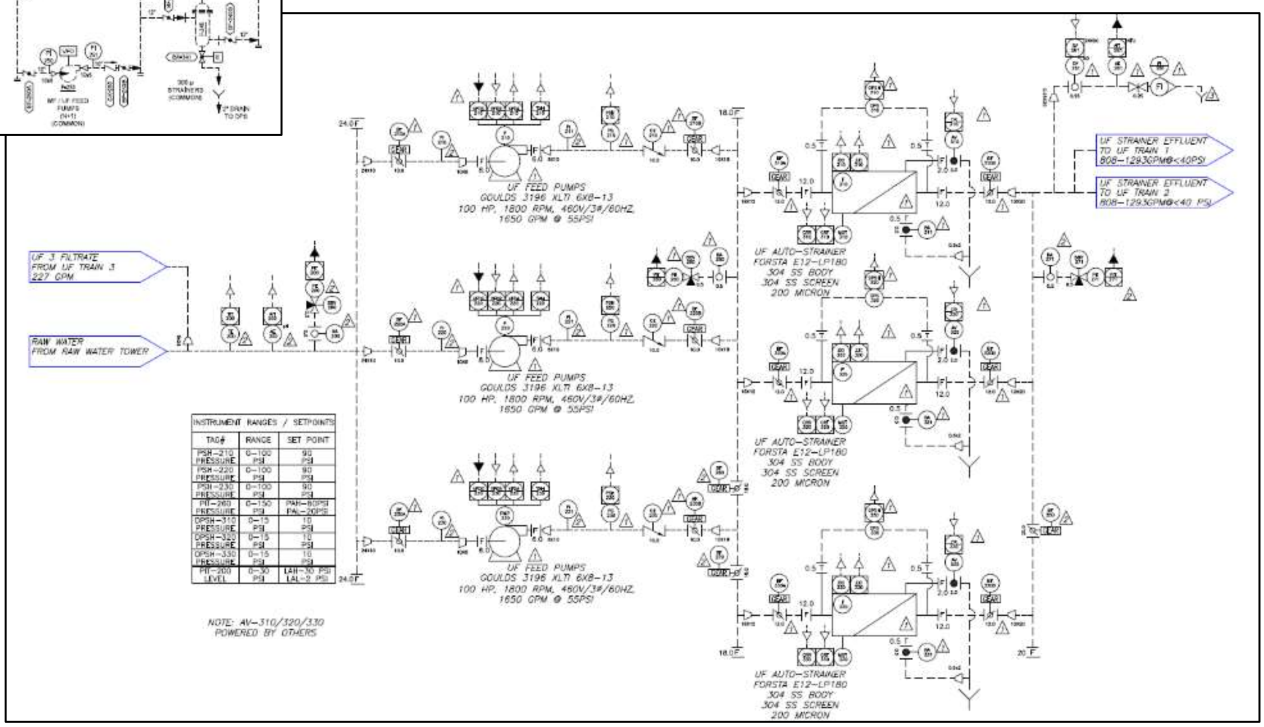


The distribution header diverts water to any one of 5 VFD UF feed pumps (P210, P220, P230, P240 and P250), followed by four 200 µm autostrainers (F310, F320, F330 and F340, just prior to the UF filtration skids (strainers are four Forsta E12-LP180 with 200-µm stainless steel screens rated at 3,100 gpm each - https://www.forstafilters.com/products/lp180-series/).

Coagulation:

<<< Go Back to Condition 4

An optional coagulation feed location is identified on the general process diagram in the distribution header between pumps P220 and P230 for future use. Mechanical plans do not show this injection location.



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Membrane Filtration – Wigen Water skids w/Toray HFUG-2020AN UF modules (969-ft^2/module): 48 modules per skid x 6 primary skids and 1 backwash recovery skid w/18 modules at full build-out – 1.61 MGD net product/skid @ 40 gfd flux (warranty limited to 40 gfd)

The membrane system will initially consist of 3 Wigen Water membrane skids with Toray HFUG-2020AN UF modules (30 modules in 2 primary skids and 18 modules in 1 backwash recovery skid). From the UF skids, filtrate will be split into two UF filtrate headers within the WTF building; one for industrial use and the other for COU's future potable water supply.

The UF Feed pumps are controlled based on signals provided from Raw Water Tank TK-110 level instruments. Normal UF Feed Pump operation is based on a permissive of operator adjustable adequate water level in Raw Water Tank TK-110. Flow is controlled by electrically actuated skid flow control valves. Feed (MIT) side piping is through a 20" HDPE combined. The pressure membrane system can operate manually at a fixed flow rate or automatically, adjusting to water levels in the 1.0 MG non-potable UFF storage tank or future potable water clearwell.

In terms of water demand and water production capacity, the Membrane Filtration System shall meet design requirements shown in Table 46 61 33C – Membrane Filtration System Design Requirements.

The Ultra Filtration System required treated water quality is shown in Table 46 61 33B – Membrane Filtration System Treated Water Quality.

Feed Quality

Maximum Turbidity:	5.50	NTU
Average Turbidity:	4.50	NTU
Maximum TSS:	12.00	mg/L
Average TSS:	8.00	mg/L
Dissolved Manganese:	0.022	mg/L
Dissolved Iron:	0.5	mg/L
Maximum TOC:	4.60	mg/L
Temperature (min):	5.0	deg C

Toray UF Modules with model No. HFUG-2020AN (969-ft^2 per module) are configured with trackable series number in racks with a buildout capacity (48 Modules per skid) to produce up to 1.6 MGD of ultrafiltration filtrate (UFF) per skid. 50 gsfd (gal/ft^2/day) basis for first stage flux was considered by the engineer from the city, the DB team and OEM Wigen. However, membrane manufacturer Toray reviewed the feed water analysis and recommended the flux not to exceed 40 gfd. Toray approval as membrane manufacture is required for membrane warrantee purposes. OEM Wigen reference similar sites and similar water quality for selecting 40 gfd flux for this application, which are provided in Attachment 8.

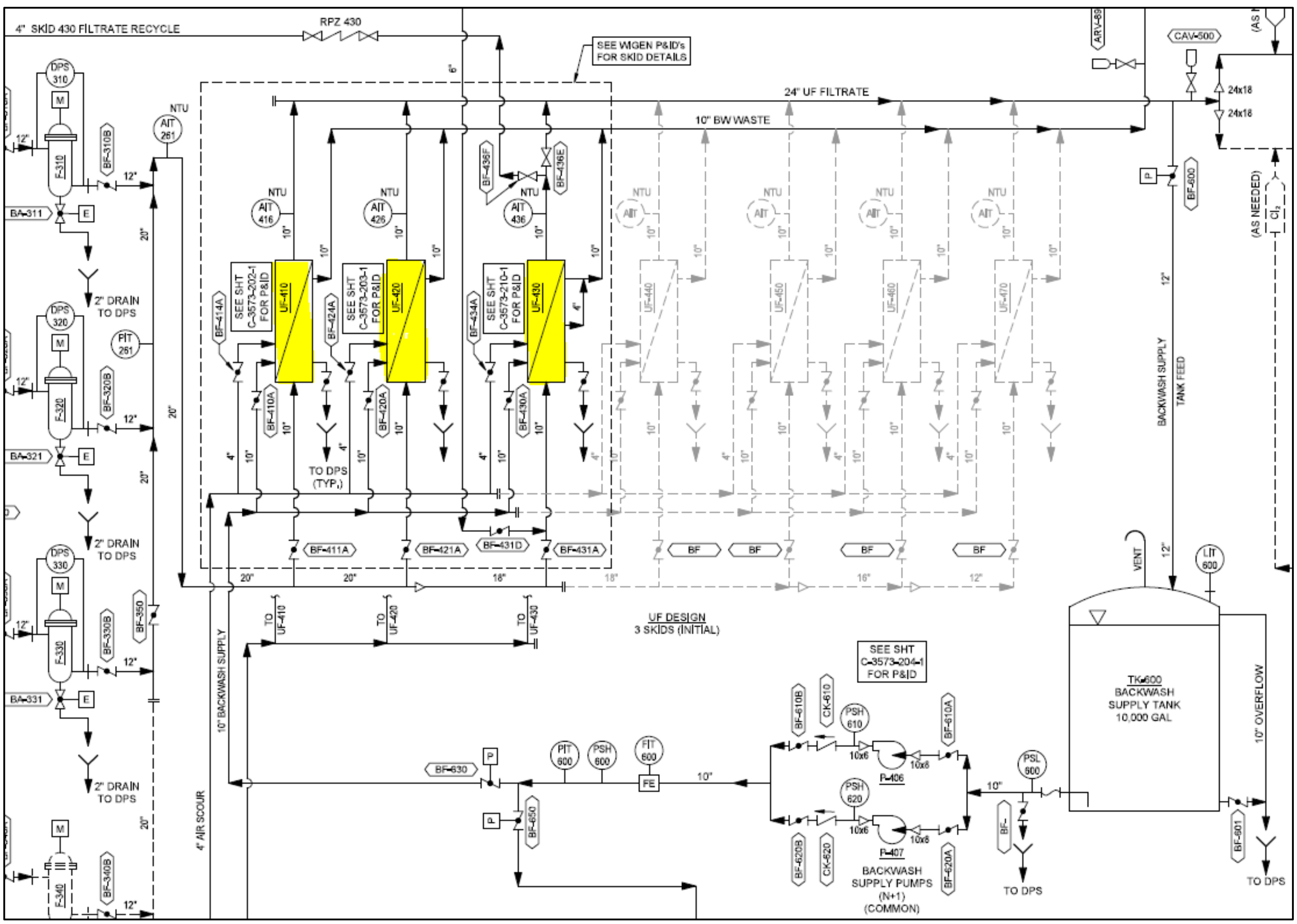
UF System: ***(*[*Go Back to List of Bookmarks*]**

The UF System is comprised of five (5) duty skids, one (1) standby. The total build-out capacity of UFF production from the WTF is as below (at 15 degrees Celsius and 40 GFD flux for 1st stage duty membranes):

An ultimate capacity of up to 9.05 MGD with five (5) duty and one standby first stage skids producing 1.81 MGD x 5 duty skids. In total 6 skids with 54 modules each. Build-out UFF demand is 7.80 MGD in 2026 at the earliest. The WTF is intended to produce at build-out 7.80 mgd UFF. No second stage skid required.

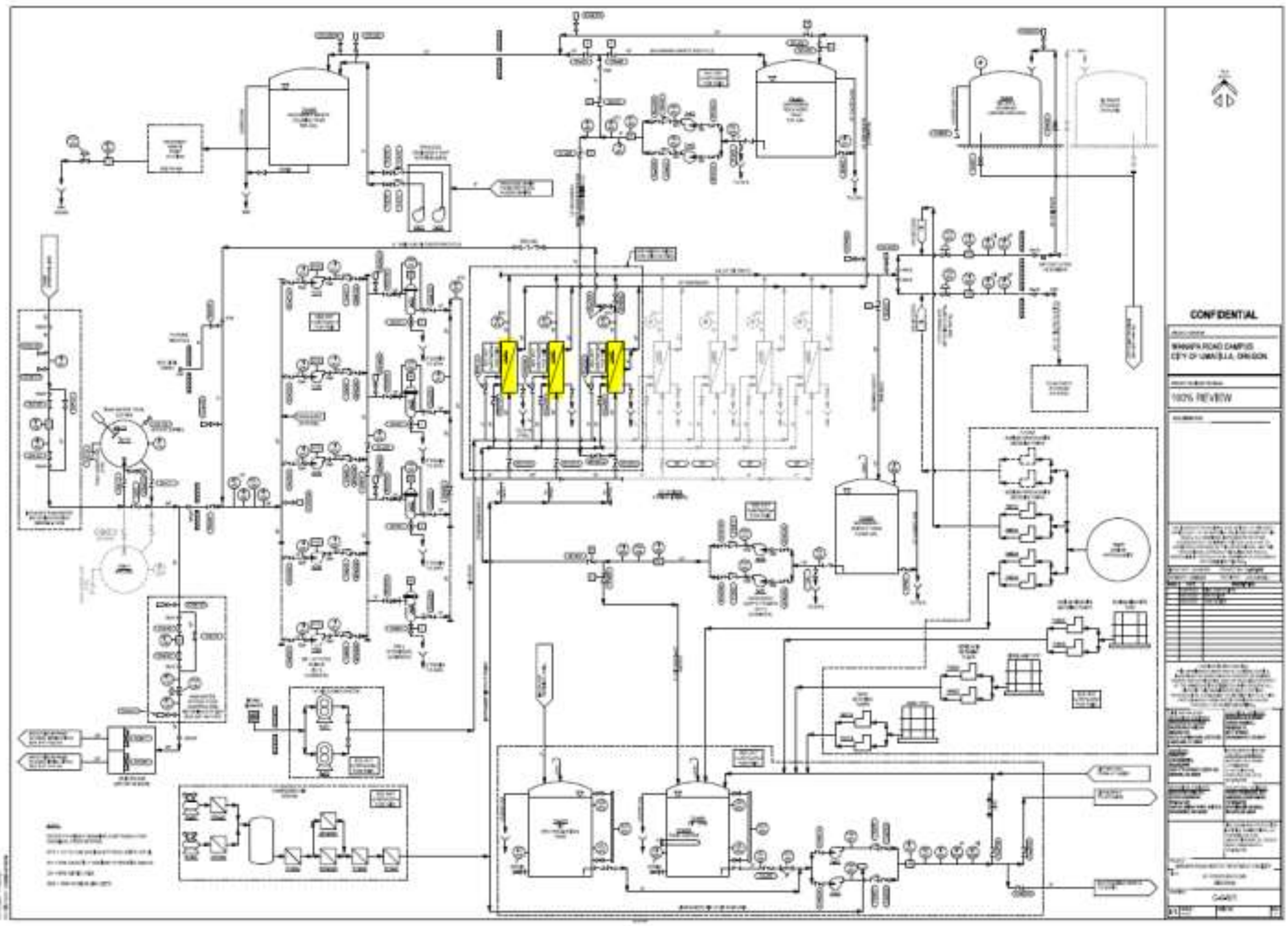
Primary Skids (6 skids w/48 Toray HFUG-2020AN modules each @ 40 gfd)
(1 skid) x (48 modules/skid) x (969-ft^2 / module) x (40 gfd flux) x (1 day/1440 min) = 1,292 gpm = 1.86 MGD

5 skids x 1,292 gpm/skid = 6,460 gpm @ 40 gfd (9.302 MGD)
6 skids x 1,292 gpm/skid = 7,752 gpm @ 40 gfd (11.163 MGD)



<<< [Go Back to List of Bookmarks]

Overall Process Diagram showing UF410, UF420, UF30 as being constructed in this phase with space for UF440, UF450, UF460, and UF470 to be added in a later phase:



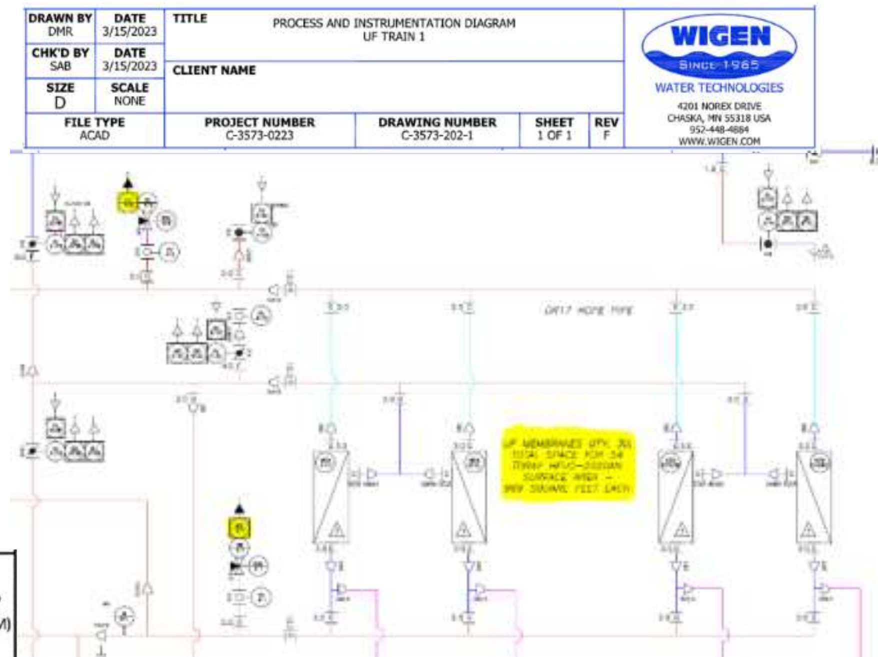
Wigen UF Diagrams: (Go Back to List of Bookmarks)

UF Filter #1 (UF410):
PIT 411 – Feed
PIT 416 - Filtrate

INSTRUMENT RANGES / SETPOINTS		
TAG#	RANGE	SET POINT
FIT–411 FLOW	0–2000 GPM	808 GPM
PIT–411 PRESSURE	0–60 PSI	40 PSI
PIT–416 PRESSURE	0–60 PSI	40 PSI
AE–416 TURBIDITY	0–1 NTU	0.3 NTU

UF 1 FEED
FROM AUTOSTRAINERS
808–1293GPM@<40PSI

SKID MODULE COUNT	INSTANTANEOUS FEED & EFFLUENT (GPM)	NET FEED (GPM)	NET FEED (MGD)	NET PRODUCT (GPM)	NET PRODUCT (MGD)	BACKWASH (GPM)	CIP (GPM)
30	808	730	1.05	699	1.01	890	475
48	1293	1167	1.68	1118	1.61	1420	760
54	1455	1313	1.89	1258	1.81	1600	855

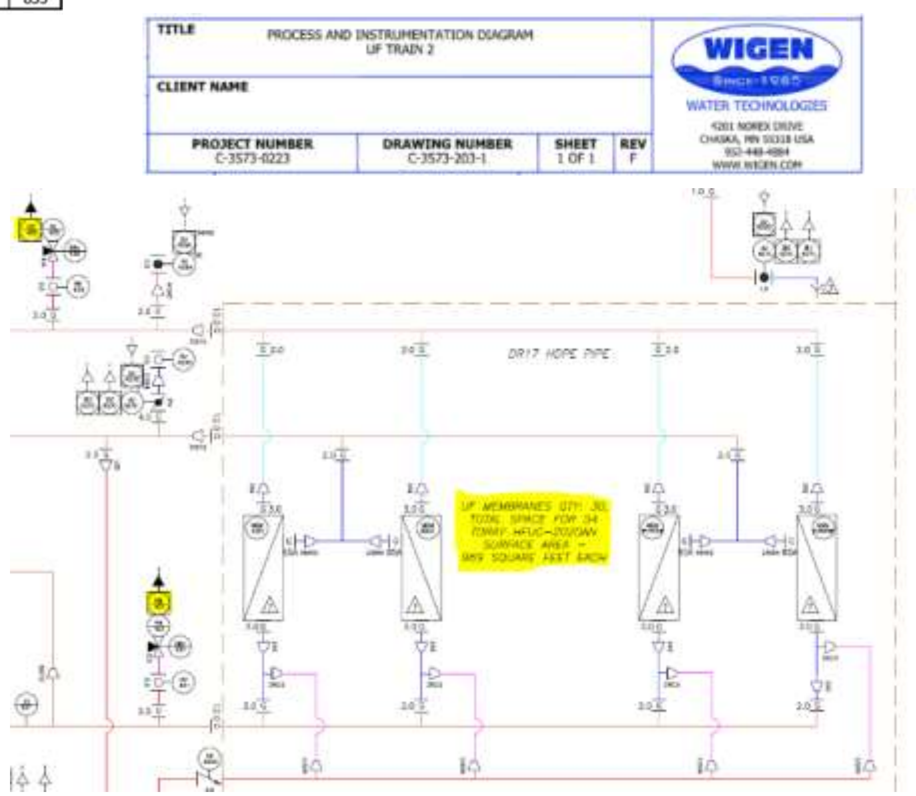


UF Filter #2 (UF420)
PIT 421 – Feed
PIT 426 - Filtrate

INSTRUMENT RANGES / SETPOINTS		
TAG#	RANGE	SET POINT
FIT–421 FLOW	0–2000 GPM	808 GPM
PIT–421 PRESSURE	0–60 PSI	40 PSI
PIT–426 PRESSURE	0–60 PSI	40 PSI
AE–426 TURBIDITY	0–1 NTU	0.3 NTU

UF 2 FEED
FROM AUTOSTRAINERS
808–1293GPM@<40PSI

SKID MODULE COUNT	INSTANTANEOUS FEED & EFFLUENT (GPM)	NET FEED (GPM)	NET FEED (MGD)	NET PRODUCT (GPM)	NET PRODUCT (MGD)	BACKWASH (GPM)	CIP (GPM)
30	808	730	1.05	699	1.01	890	475
48	1293	1167	1.68	1118	1.61	1420	760
54	1455	1313	1.89	1258	1.81	1600	855

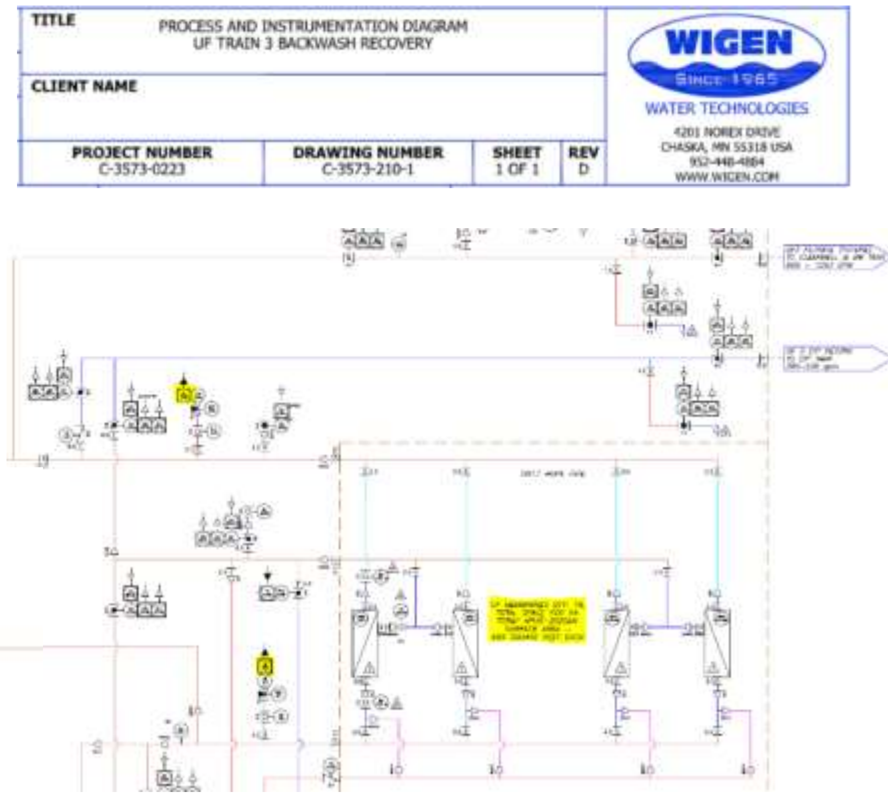


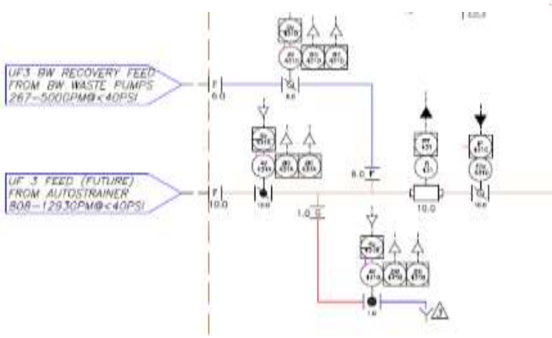
UF Filter #3 (UF430) – BW Recovery Rack

PIT 431 – Feed

PIT 436 - Filtrate

INSTRUMENT RANGES / SETPOINTS		
TAG#	RANGE	SET POINT
FIT–431 FLOW	0–2000 GPM	485 GPM
PIT–431 PRESSURE	0–60 PSI	40 PSI
PIT–436 PRESSURE	0–60 PSI	40 PSI
AE–436 TURBIDITY	0–1 NTU	0.3 NTU





SKID MODULE COUNT	INSTANTANEOUS FEED (GPM)	INSTANTANEOUS SOLIDS CROSS FLOW (GPM)	INSTANTANEOUS FEED EXCLUEDING SOLIDS CROSS FLOW (GPM)	INSTANTANEOUS EFFLUENT (GPM)	NET FEED EXCLUDING SOLIDS CROSS FLOW (GPM)	NET FEED (MGD)	NET PRODUCT (GPM)	NET PRODUCT (MGD)	BACKWASH (GPM)	CIP (GPM)
18	267	25	242	242	214	0.31	199	0.29	485	285
34	500	46	454	454	401	0.58	374	0.54	916	539

UF430 Backwash reuse/recovery skid (1 skid w/18 Toray HFUG-2020AN modules each @ 20 gfd):
(Go Back to List of Bookmarks, Go Back to Condition 7)

The 12,000-gallon backwash recovery (TK-451) receives backwash wastewater from all the UF skids. The effluent of the backwash recovery tank can either be diverted to a 50,000-gallon backwash waste holding tank (TK-450) for subsequent disposal or be pumped to the feed side of the backwash recovery skid (UF430).

The Backwash Recovery UF skid (UF430) is a copy of the primary UF skids with the additions of Backwash Recovery Inlet, to allow recovered backwash to be fed to the train, and the UF Filtrate to Strainer Valves, that will direct filtrate to the header ahead of the Automated Strainers. This skid is further differentiated from the primary skids in that it is equipped with a recirculation system to create a crossflow to prevent packing of the solids in the modules (added March 2023 with Addendum 3-1).

The Backwash Recovery UF system has the same 4 System States as the Primary UF Trains they are the Main Process, Backwash, DIT, and CIP. The Backwash, DIT and CIP Processes are sub-processes of the Main Process. Note: The UF Feed Block (AV-431A) and UF Filtrate Block (AV-436E) valves will remain closed at all times they are installed for possible use when the Backwash Recovery UF Train is Transitioned into a primary UF train in the future. When both
outer block/outlet/inlet valves are closed then the bleed valves are automatically opened.

The backwash recovery skid was designed to meet the COU requirement to limit waste to sewer, which is to remain below 50,000 gallons per day. The waste to sewer volumes are reflected between agreements between the industrial user(s) and the COU. The flux of 20 gfd for the backwash recovery skid was recommended by Toray based on feed water analysis, which is provided in **Attachment 8**. The backwash recovery flux basis and LRV verification approach are discussed in **Attachment 8** and **Attachment 7,** respectively.

per *0233937.00 AWS WTP & PIPELINE DB Issue Date: OCTOBER 2022 UMATILLA, OR WOODARD & CURRAN 100% Design – For Procurement ADDENDUM NO. 2-2,* it is anticipated that due to the proposed 96% recovery of the production UF skids, the UF backwash stream will be concentrated approximately 25 times for suspended solids and Turbidity and thus the following flux / recovery settings should not be exceeded without written concurrence from the membrane manufacturer (Toray)

a. Design flux: maximum allowable up to 20 gfd
b. Design recovery: 85% maximum with UF backwash as feed
a. Minimum number of Toray HFUG-2020AN modules installed (2023): 18
b. Approximate UF backwash volume to treat: 40,000 gal/day
c. Reduced backwash intervals (over production skids) are expected
d. Maintenance clean intervals would be expected to occur at a similar frequency to the production skids, although this is expected to be impacted if future coagulant and/or dissolved constituents are present. UF vendor to recommend cleaning frequency and procedures for this service.

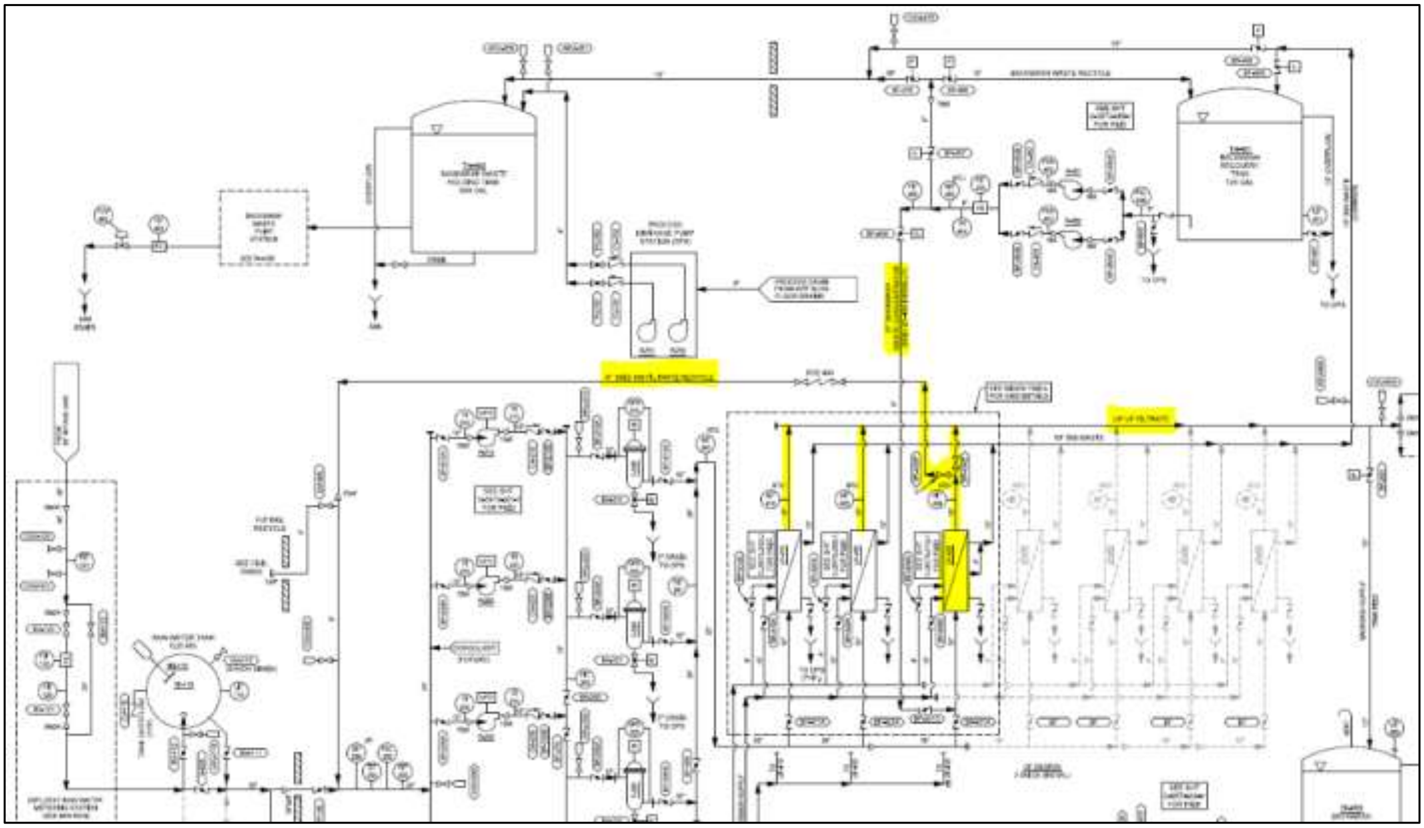
A March 2023 Addendum 3-1 added the following criteria:

- Approximate backwash reuse volume to treat: 40,000 gal/day per 1.0 MGD feed
- capacity to overall UF system.
- Maximum TSS in feed to backwash reuse skid: 300 mg/L.
- Reduced backwash intervals (over production skids) are expected
- Maintenance clean intervals would be expected to occur at a greater frequency than the production skids, but no more than once every 24 hours. This is expected to be impacted if future coagulant and/or dissolved constituents are present.
- UF vendor to recommend cleaning frequency and procedures for this service.
- Based on projected flows and expansion, a backwash waste holding tank of
- approximately 14,000 gallons was provided, sized to handle a minimum of one backwash cycle for flow storage for this backwash tank.
- Performance Testing of Service UF Skids and Backwash Reuse Skid for a period of up to 180 days (or a complete cooling season), with operation at or as close as possible to the design flux as possible (40-gfd for the primary skids and 20-gfd for the backwash recovery skid).

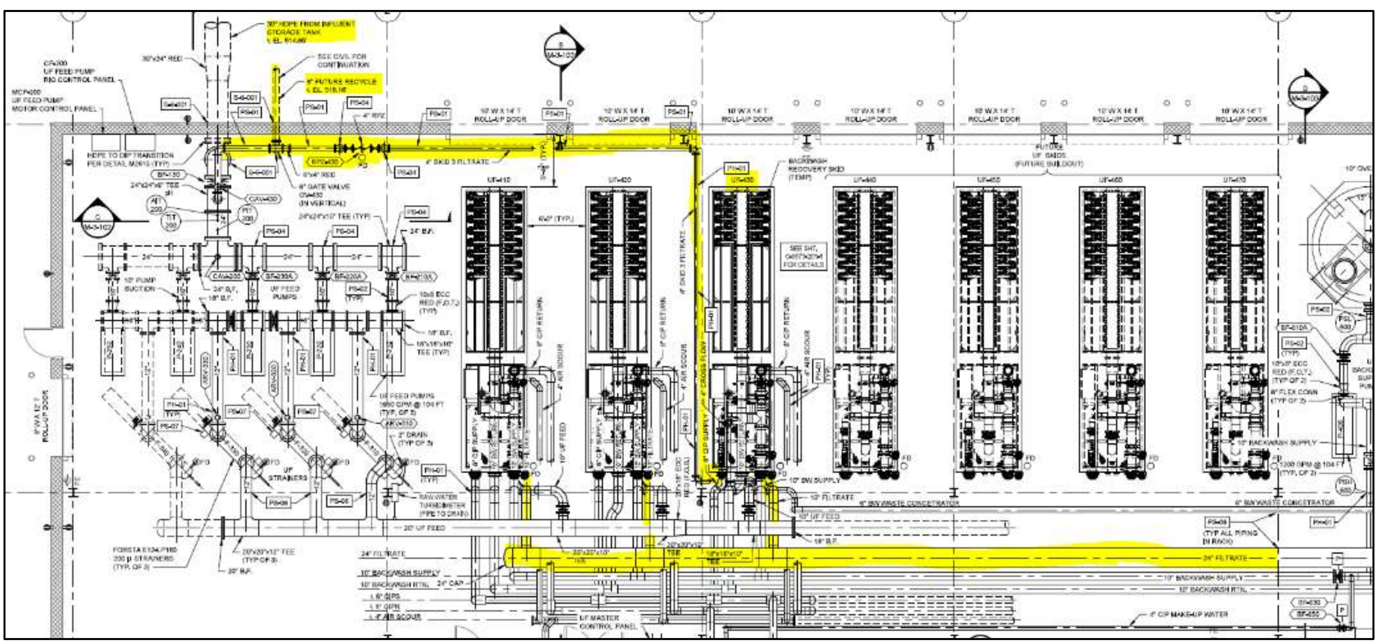
(1 skid) x (18 modules/skid) x (969-ft^2 / module) x (20 gfd flux) x (1 day / 1440 min) = 242 gpm = 0.35 MGD

Phase 1 firm capacity with one first stage skid and one backwash reuse skid is 1.043 MGD. Phase 1 maximum capacity of 2.38 MGD (30 modules installed per first stage skid) with 2 duty skids and one backwash reuse (second stage) skid producing 2.38 MGD (1.01 MGD x 2 duty skids + 0.36 MGD for 2nd stage). Phase 1 skid may be used for temporary water supply.

The recycle blend is anticipated to be 4-10% (recycle blended with 90 – 96% of raw water).



Process Flow Diagram G-3-601



Mechanical Drawing M-3-101
(Note: RPZ-430 Cross Connection Device Separating UF430 Filtrate from Raw Water Supply)

Direct Integrity Test: ***(****Go Back to List of Bookmarks**, **Go Back to Condition 10****)***

The following is an example configuration and general steps that closely matches the COU WTF when undergoing a direct integrity test (pressure decay test or "PDT").

Below figure indicates a flow diagram for the PDT.

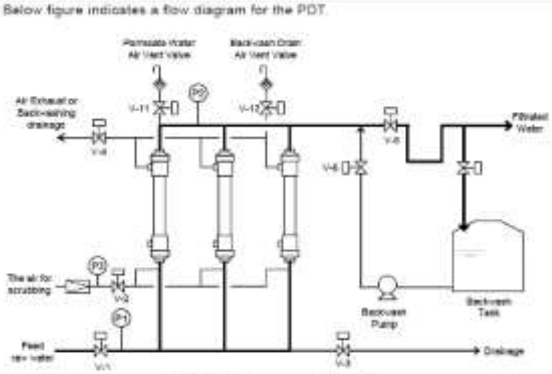


Fig. 1 Flow diagram for the PDT

2. PDT Method

(1) Stop filtration to be tested. Close all valves.
(2) Relieve pressure in the feed side of the membrane module by opening the backwash drain air vent valve (V-12) and the drain valve (V-3).
(3) Relieve pressure in the permeate side of the membrane module by opening the permeate water air vent valve (V-11).
(4) After the permeate side has relieved and the feed side has drained, close the V-3 and the V-12.
(5) Introduce oil free air to the feed side by opening the air-scrubbing valve (V-2).
(6) Close the V-2 after setting air pressure to set value (100kPa) by using regulator.
(7) Monitor the pressure decay (Δp) of the feed air pressure for 5 to 10 minutes, dependent on the number of modules. See Fig. 2 or Table 1 for examples of pressure decay due to one broken membrane fiber. If pressure decay is excessive, a visual inspection of the decay will be required (see step 9).
(8) Diffusion of air through the water filled pores of the membrane fiber leads to a pressure decay of approximately 0.3 kPa in 5 minutes (dependent on the volume of the pipework manifolds, etc.). A single broken membrane fiber in 20 2020 type modules gives a pressure decay of 3 kPa in 5 minutes, so a decay of 3 kPa in 5 minutes is normally used to indicate the presence of a single broken membrane fiber for this size of unit.

The top-side module connections are clear PVC to help operations staff identify air bubbles during the pressure-based direct integrity test. The Direct Integrity Test for the COU WTF has AUTO and OFF Control. Per the Wigen process control documentation, the control should always remain in AUTO. This is unless operations require it to be OFF or if a shutdown alarm were to occur on the system during a DIT process. The AUTO control will allow the DIT to run at a pre-set time. The DIT process can also be Manually Initiated by an Operator.

At a set time of day, the UF Trains will perform an Integrity test. This system will perform an integrity test on all the available UF skids in order (if they are not offline for Maintenance or cleanings), to confirm that there are no broken fibers in the membranes. Each skid will be tested separately, so that all the available active skids are confirmed as passing integrity.

The system uses the Feed Pressure Transmitter (PIT-4X1 where "X" denotes the skid #) as well as the Filtrate Pressure Transmitter (PIT-4X6) to monitor the change in differential pressure over time after filling the skid with compressed air to the set differential required for the test. The pressure drop of air through the membrane will increase drastically if there is a breach in the membrane integrity. The test sequence will follow the process steps outlined below.

1. ***Initiate test, filter, backwash, then complete extended drain:***
   Once the Integrity test system on a UF Train is initiated, it will operate in Filtering mode for a set time, which is needed to generate the operating parameters of the system before entering a standard backwash sequence. After the Backwash Step, the Train will perform an extended Drain step prior to pressurizing the modules.
2. ***Filtrate is vented and air applied to feed side:***
   Once the test begins, the filtrate side is vented through the UF Train Filtrate Outlet Valve until the differential pressures reaches the test vent pressure set point. There is a pressure delay, which is a timed valve transitional step before pressurizing the membranes. During this transitional step, all

valves connected to the feed process will be closed. The Filtrate and Filtrate Outlet Bleed valves will be opened to allow for the filtrate header to remain unpressurized. Once the process steps are done and the timer is done then the system will advance to the next step where the feed side of the membrane is filled with compressed air. Any leftover water in the Feed side of the membrane easily permeates the membrane, while the air does not.

3. ***Reach DIT test pressure and stabilize:***
   Once the differential pressure reaches the Integrity Test Pressure set point from the previous timed step, a timer will start and the system will wait for the Integrity Test Delay Time set point (suggested at 60 Seconds) to allow the pressure to stabilize, and then the test will start.
4. ***Start of air hold – dP is read at the start:***
   The test will take a reading of the Pressure Differential at the start of the Integrity Test Time.
5. ***End of air hold (5 minutes) – dP is read at the end:***
   The test will take a reading of the Pressure Differential at the end of the Integrity Test Time.
6. ***Determine pressure drop (dP start – dP end) for use in LRV calculation.***
   Subtracting the final pressure from the starting pressure will get the pressure drop over the time of the test. This is then divided by the Minutes of the test to get an average Delta PSI/Min value. This value is then input into the EPA accepted calculation for Log removal credits available at those operating parameters and membrane characteristics to determine a Log removal value for that test. If the value is below 4 Log an alarm is sounded, and the skid is taken out of service to be investigated.
7. ***Return to service:***
   Before the system can be brought online however, the modules must be vented and then refilled with water, which is accomplished by opening the vent valve until the Pressure Differential reaches the Vent Setpoint, and then entering the Post DIT Filling step, where feed water is used to fill the Feed side of the membranes. The entire Integrity test sequence should take around 20 minutes per UF Skid test. After a Train has completed the DIT, it is returned to Standby or Filtering. The process steps along with the exact valve positioning of each step are provided in the Control Matrix.

Pressure sensors for DIT and TMP:
LRV calculations specified Rosemount 3051 or equal pressure transmitter with accuracy of 0.065% x 150 psi / 5 min = 0.0195 psi/min needed for DIT. The following specifications were provided as Attachment 1 – NSF 61 Certification for UF Wetted Parts:

- ***Feed Pressure*** – Rosemount TRANSMITTER-PRESS-0.50-150PSI-316-FPT-DISP-3051
  PE/PIT 411 (UF #1), 421 (UF #2), 431 (UF #3 – BW Recovery)

- ***Filtrate Pressure*** – Rosemount TRANSMITTER-PRESS-0.50-150PSI-316-FPT-DISP-2051
  PE/PIT 416 (UF#1), 426 (UF #2), 436 (UF #3 – BW Recovery)

Differential Pressure Measurement Specifications Per Section 46 61 33:

0233937.00
Issue Date: SEPTEMBER 2022

AWS WTP & PIPELINE DB
UMATILLA, OR

e. Pressure switches shall be selected as follows:
   1) General static pressure switches or differential pressure switches for normal static pressure ranges.
   2) Low differential pressure switches for low static pressure ranges.

4. Static and Differential Pressure Measurement:
   a. Static and differential pressure measurement shall be performed using pressure transmitters.
   b. Sensing elements shall generally be of either the capacitance or strain gauge type.
   c. In liquid services:
      1) Static pressure analyzers shall be equipped with minimum two- valve manifolds.
      2) Differential pressure transmitters shall be equipped with minimum three-valve manifolds.
   d. Minimum Accuracy: Plus, or minus 0.25 percent full scale, and as required for the application.

Turbidimeter Specifications Per Section 46 61 33:

Turbidimeters:

F. Turbidity Analyzer:
   1. Local digital indication type transmitter with local display.
   2. Continuous turbidity monitors.
   3. Utilizes USEPA Method 180.1 compliant sensors.
   4. Accuracy: Plus, or minus 2.0 percent of reading, over the range of measurement designated.
   5. Includes internal diagnostics.

Individual filter effluent (IFE): (Go Back to List of Bookmarks)

Individual filter effluent (filtrate) lines are equipped with IFE turbidimeters. The current set point is 0.3 NTU, but should be reduced to 0.15 NTU.

Backwash, EFM, and CIP: (Go Back to List of Bookmarks)

Design criteria – General Drawing G-1-001:

Backwash Water System	
125	gpm Maximum Discharge to Sewer (only 10pm to 6 am)
225	gpm Maximum Return to the WTF
300	gpm Maximum Flow Rate to the Future Washwater Clarifier
315	gpm Maximum Combined Flow Rate (Assumed 90% of Maximum Flow Return to the WTF and Sewer)
1+1	Initial BWW Pumps (duty+standby, Horizontal Split Case)
2+1	Future BWW Pumps (duty+standby, Horizontal Split Case)
15	psi Nominal Delivery Pressure at Future Washwater Clarifier
1	Ultimate Bolted Steel Tank (50,000 gal.)

Backwash and CIP capabilities are designed to maintain flux and TMP recovery using air scour and with access to only four types of chemicals. The onsite treatment chemicals are NSF 60 certified and include:

a) 50 % Citric Acid solution (CA) only for membrane cleaning (clean in place- CIP)
b) 25 % Sodium Hydroxide solution only for pH neutralization of membrane CIP
c) 12 % Sodium Hypochlorite solution (HYP) for controlling excessive microbial growth in UFF and flux maintenance (FM) membrane backwashes
d) 30 % Sodium bisulfite solution (SBS) only for pH neutralization of membrane CIP.

Skid Isolation valves:
The various bleed valves throughout the system will be called to open whenever their respective lock/outlet/inlet valves are both closed. In other words, once both outer block/outlet/inlet valves are closed then the bleed valve will open.

Startup of a backwash or CIP will call for some valve transition as the UF Main process is moving from Filtrate to a cleaning process. This is a timed process in which the following valves will open: AV-4X1A, FCV-4X1C, AV-4X6B, SV-4X6C, AV-4X6E.

Start Backwash calls for another valve transition. The inlet and the filtrate outlet valves will close, isolating the UF from inlet flow and filtrate. The backwash inlet and the backwash outlet valves will open (opens: AV-4X0A, AV-4X0C, AV-4X3B)

Backwash:
The UF Trains will all totalize their flow individually. They will compare their total Filtrate flow to a throughput setpoint, subtracting the totalized flow to the setpoint. Once the totalized flow meets or exceeds the throughput setting then the system will call for a backwash.

The Backwash water is drawn from the Backwash Supply Tank. The Backwash Pumps (P-406/407) will draw UF Filtrate out of this tank to backwash each UF Train. The setpoint to trigger a backwash is based off the total volume of each train treated.

The Backwash process uses backwash, air scour, and drain steps to dislodge as much of the accumulated particulate as possible from the membrane surface before returning those membranes back into service. Each UF has a Manual Backwash Initiation button on the control screen to allow for backwashing of the trains outside of their normal automated backwash cycle, which can be run as long as there is sufficient backwash water in the Backwash Supply Tank. In Backwash the lead Backwash Pump (PMP-406/407) will startup and maintain the Backwash flow setpoint for the backwash time setpoint. Backwash will be pumped in through the module permeate port, out through the inlet port and off the skid through the backwash waste connection to drain.

Clean-in-place (CIP) – Recovery Clean and Enhanced Flux Maintenance (EFM) or "maintenance clean":
In addition to routine backwashing, each module is taken offline for more intensive cleaning (clean in place CIP) after set volumes have been filtered. This cleaning process takes the entire module offline for approximately 2 to 2.5 hours.

Before the start of any CIP process the desired type of cleaning must first be selected. This selection can happen automatically or manually selected by an operator. Only one CIP Process can operate at a time as common piping is utilized in the CIP system. The following CIP types are available for the UF Cleanings:

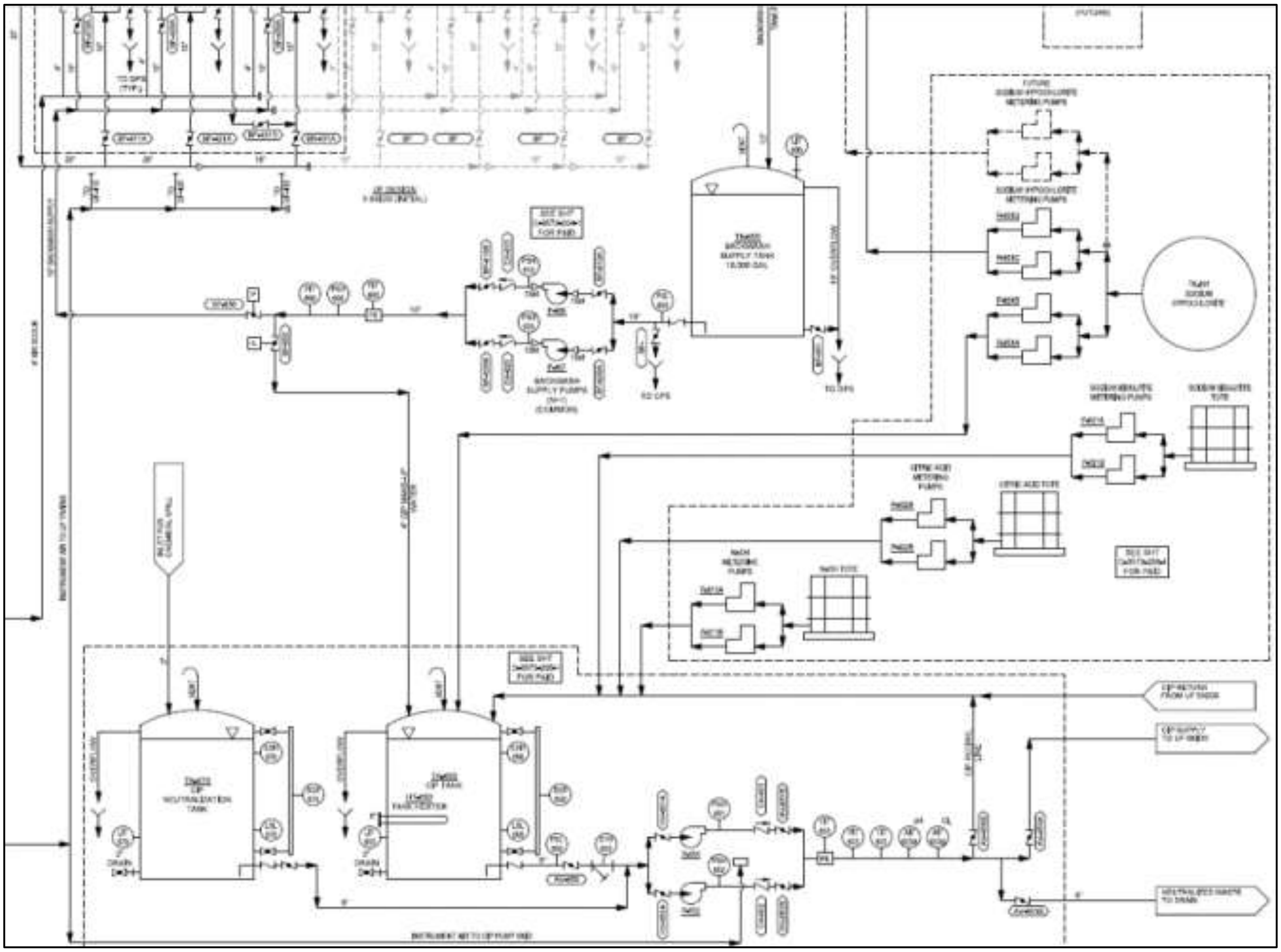
- Low pH Mini/Maintenance Clean (Citric Acid)
- Low pH Full/Recovery Clean (Citric Acid)
- Chlorine Mini/Maintenance Clean (Chlorine)
- Chlorine Full/Recovery Clean (Chlorine)

CIP Tank Prep:
The CIP Tank Prep Process will start after the CIP Type is selected. This process uses utility water for filling the tanks along with the individual tanks' valves, pumps, and heaters to prepare a cleaning solution for the UF train to be cleaned. The CIP Tank (TK-650) will be filled to a target level with UF filtrate, via the CIP Outlet and CIP Outlet Block valves. Water in the CIP tank will be heated and recirculated prior to adding the CIP chemical (depending upon the type of clean is requested.

Pre-Cleaning Backwash:
After the CIP Tank prep is done for the selected CIP Type the UF Calling the CIP will be taken out of service. At the start of the CIP Process the UF will first run a backwash process.

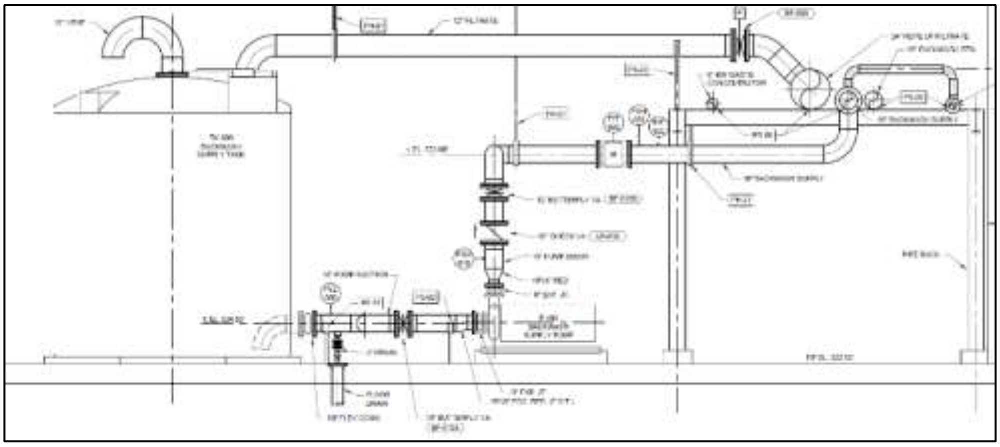
Cleaning, second backwash, and return to service:
After the backwash is complete then the water from the UF membranes will be drained back through the CIP feed. Then the system will be ready for the CIP solution to be recirculated through the UF back to the CIP System. After the initial recirculation, the chemical will have time to Soak on the membrane, and then the system will run a second recirc. After the recirculation and soak processes are complete then the system will go through a flushing process to remove the chemical solution from the membranes and all piping involved in the CIP Process.

CIP Facilities are shown in the following process diagram:

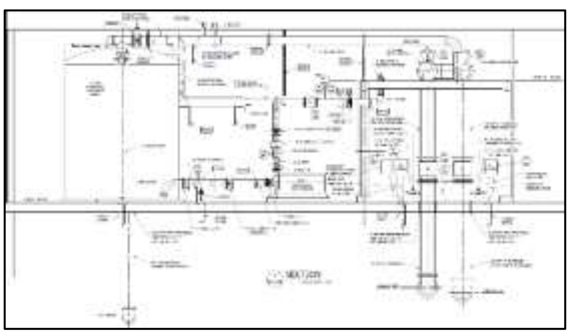


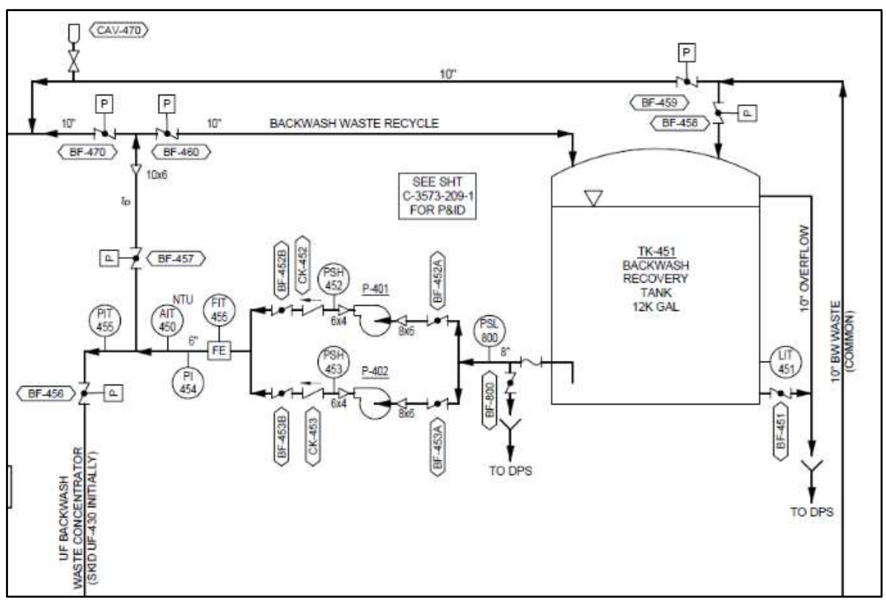
10,000-gal Backwash Supply Tank (TK-600): (Go Back to List of Bookmarks)

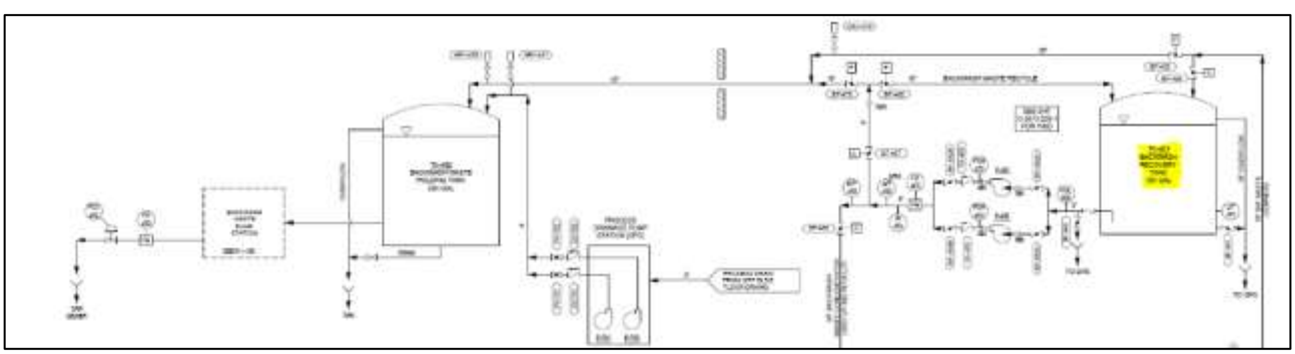
The NSF-61 backwash supply tank holds 10,000 gallons (A series RPVs are applied for separation/backflow prevention. Appropriate block and bleed assemblies will be provided with membrane racks (3 per rack).



12,000-gallons HDPE backwash recovery tank (TK-451) ***(Go Back to Condition 7)***







50,000-gallon Backwash Waste Tank (TK-450) and pump station.

The 50,000-gallon NSF-61 bolted steel backwash waste (BWW) tank holds influent UF backwash waste, and waste from WTF, BWW storage, and BWW pumping with provision to discharge to sanitary sewer at a rate of up to 125 gpm between 10 pm to 8 am,. The UF BWW and WTF waste enter the BWW tank (TK-450) via the Drainage Pump Station (DPS). The Backwash Waste Tank TK-450 will provide an operational buffer volume to help regulate the WTF UF Backwash Waste generated by the UF Membrane cleaning process and BWW pumping to disposal or future recirculation or solids processing. Future disposal to a future solids concentrator and drying beds will be constructed by COU with its future potable treatment plant. In the interim, when neither of the future connections are constructed, the only disposal route for water stored in TK-450 is via a sewer discharge at the BWW Pump Station. Tank specification indicated an estimated TSS of 320 – 2,000 mg/l, a TDS of 100 – 300 mg/l, and pH ranging from 6.5 to 8.9.

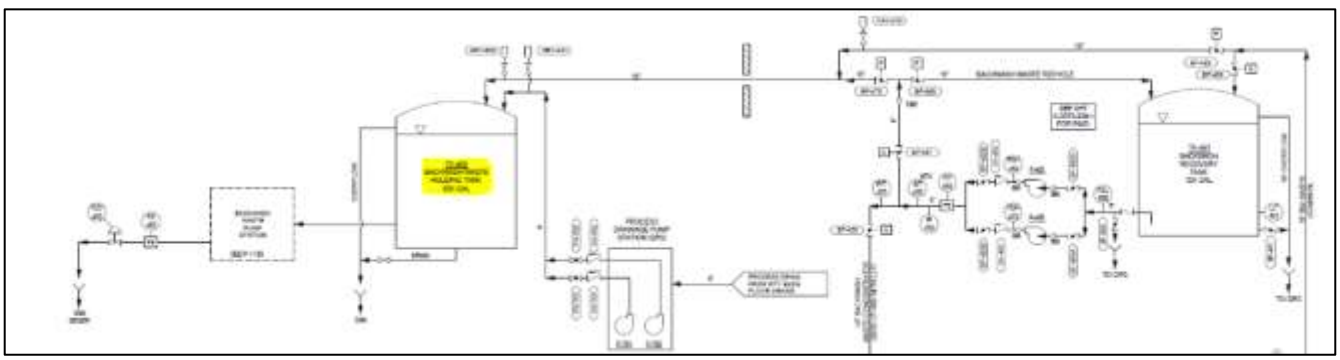
a. Backwash waste from membranes with raw river water feed, TSS range estimated 320 mg/L to 2,000 mg/L, TDS between 100 to 300 mg/L, pH between 6.5 to 8.9

6. Allowable Soil Bearing Pressure *3,500 psi*

2.03 MATERIALS

A. Plates and Sheets. Plates and sheets shall conform to appropriate ASTM designation as set forth in Section 4.4, AWWA D103-19, and shall have a minimum yield strength of 30,000 psi.

WOODARD & CURRAN **BOLTED STEEL TANK FOR BWW**
100% Design – NOT FOR CONSTRUCTION **13 51 00-4**

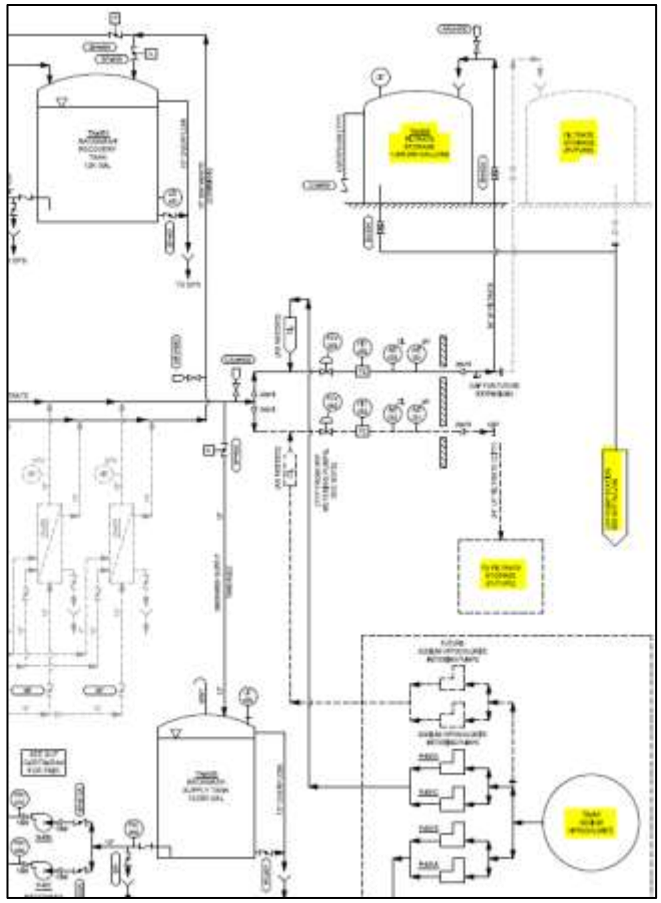


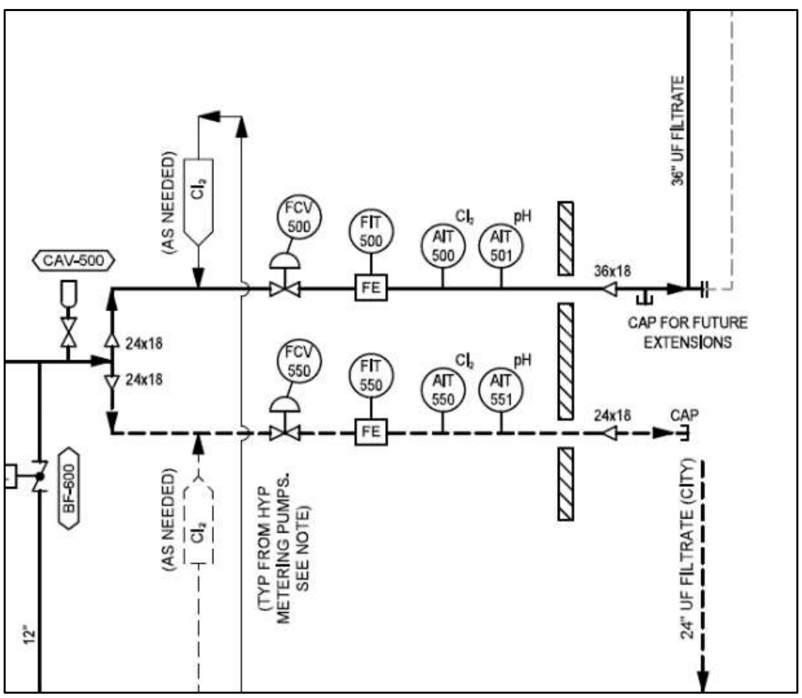
Combined Filter Effluent: ***(Go Back to List of Bookmarks)***
<<< Back to Condition 1

UF filtrate from each membrane skid combine into a single 24" filtrate header. A 12" line tees into this header to fill the backwash tank. The submitted plans do include a combined filter effluent turbidimeter (only individual filter effluent turbidimeters).

Following the 12" backwash supply line, the 24" splits into two filtrate streams, each equipped with their own chlorine injection, flow control valve and flow meter, as well as chlorine and pH analyzers:

1) A 36" diameter pipeline conveying non-contact non-potable industrial cooling water to what will ultimately be two 1.0 MG storage tanks, after which water will be pumped from the on-site UFF storage tank(s) and UFF pump station (PS) into the pipeline to supply industrial water purposes.
2) A 24" diameter pipeline conveying what will be future City of Umatilla (COU) processes expected to be on-site to produce potable water from WTF UFF and conveyed into the COU water distribution system.





Disinfection – sodium hypochlorite: ***(Go Back to List of Bookmarks)***

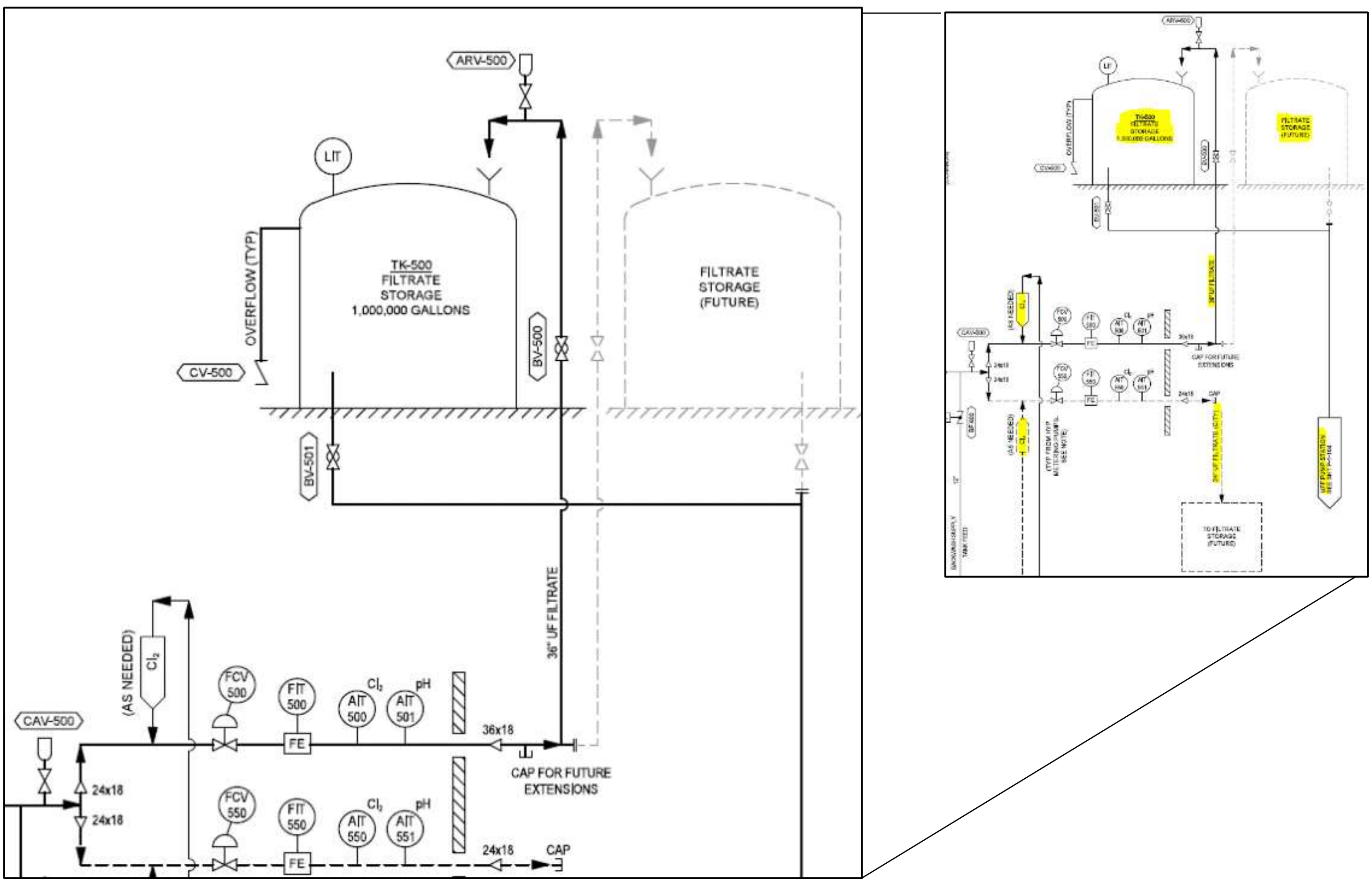
On start-up and commissioning COU WTF will only produce ultrafiltration filtrate (UFF) for non-contact cooling purposes and not potable water. Hence, disinfection not required or provided for the WTF. A provision is made to dose 12% hypochlorite within filtrate piping, to control microbial growth potential as shown on plans and specified in project specifications.

Residual disinfection (not for primary disinfection):
Liquid sodium hypochlorite can be injected to control microbial growth using metering pumps into each of the two filtrate streams listed above to provide a residual disinfectant (not primary disinfection) prior to being either diverted to what will ultimately two 1.0 MG filtered water storage tanks for industrial process water or future COU on-site potable water treatment.

Primary disinfection for 0.5-log Giardia and 4.0-log viral inactivation:
Primary disinfection will be added later downstream of the two streams listed above under "Combined Filter Effluent" as part of the remaining COU potable treatment system, although the chlorine injection shown in the plans for the potable stream may be the only additional point of disinfection prior to storage needed for disinfection contact time.

UF Filtrate (UFF) water storage: ***(Go Back to List of Bookmarks)***
Up to four 1-MG finished water storage tanks will ultimately be constructed to hold finished water prior to pumping to supplying process water for industrial use and potable water to the COU.

UFF Storage	
1	Initial Bolted Steel Tank
1,000,000	gal Initial Storage Volume
4	Ultimate Bolted Steel Tank
4,000,000	gal Ultimate Storage Volume



UFF Pump Station Conveyance	
9.51	cfs (4,268 gpm) Initial Max. Flow Rate
12.45	cfs (5,588 gpm) Ultimate Data Center Use Max. Flow Rate
2.00	cfs (898 gpm) Ultimate City Use (Non-Potable, Future Connection at Beach Access Road)
2+1	Initial UFF Pumps (duty+standby, Horizontal Split Case)
3+1	Ultimate UFF Pumps (duty+standby, Horizontal Split Case)
60	psi Minimum Delivery Pressure at Existing Wanapa Road Data Center Connection
65	psi Minimum Delivery Pressure at Existing Beach Access Road Data Center Connection

Seismic Design Criteria: ***(<u>Go Back to List of Bookmarks</u>)***

Seismic design criteria were provided by Shannon and Wilson based on Site Class B (bedrock)

Exhibit 5-1: Parameters for Seismic Design of Structures

Symbol	Description	Value
S_S	Spectral Response Acceleration for Short Periods	0.39g
S_1	Spectral Response Acceleration at 1-second Period	0.15g
F_a	Site Coefficient	0.9
F_v	Site Coefficient	0.8
S_{MS}	MCE_R Spectral Response Acceleration for Short Periods	0.36g
S_{M1}	MCE_R Spectral Response Acceleration at 1 second Period	0.12g
S_{DS}	Design Spectral Response Acceleration for Short Periods	0.24g
S_{D1}	Design Spectral Response Acceleration at 1-second Period	0.08g

NOTES:

g = standard acceleration of gravity

MCE_R = Risk-targeted Maximum Considered Earthquake

MCE_G = Maximum Considered Earthquake Geometric Mean

5.2 Shallow Foundations

The proposed WTF and tank structures may be supported on conventional shallow foundations (i.e., spread and continuous footings) bearing entirely on: 1) directly on bedrock or 2) a minimum 3-foot-thick structural fill pad extending to bedrock, as described above. Structural fill should extend horizontally a minimum 12 inches on all footing sides. We anticipate the structural fill beneath the structures may consist of imported gravel with sand and/or gravel processed from over-excavation of the basalt bedrock at the site.

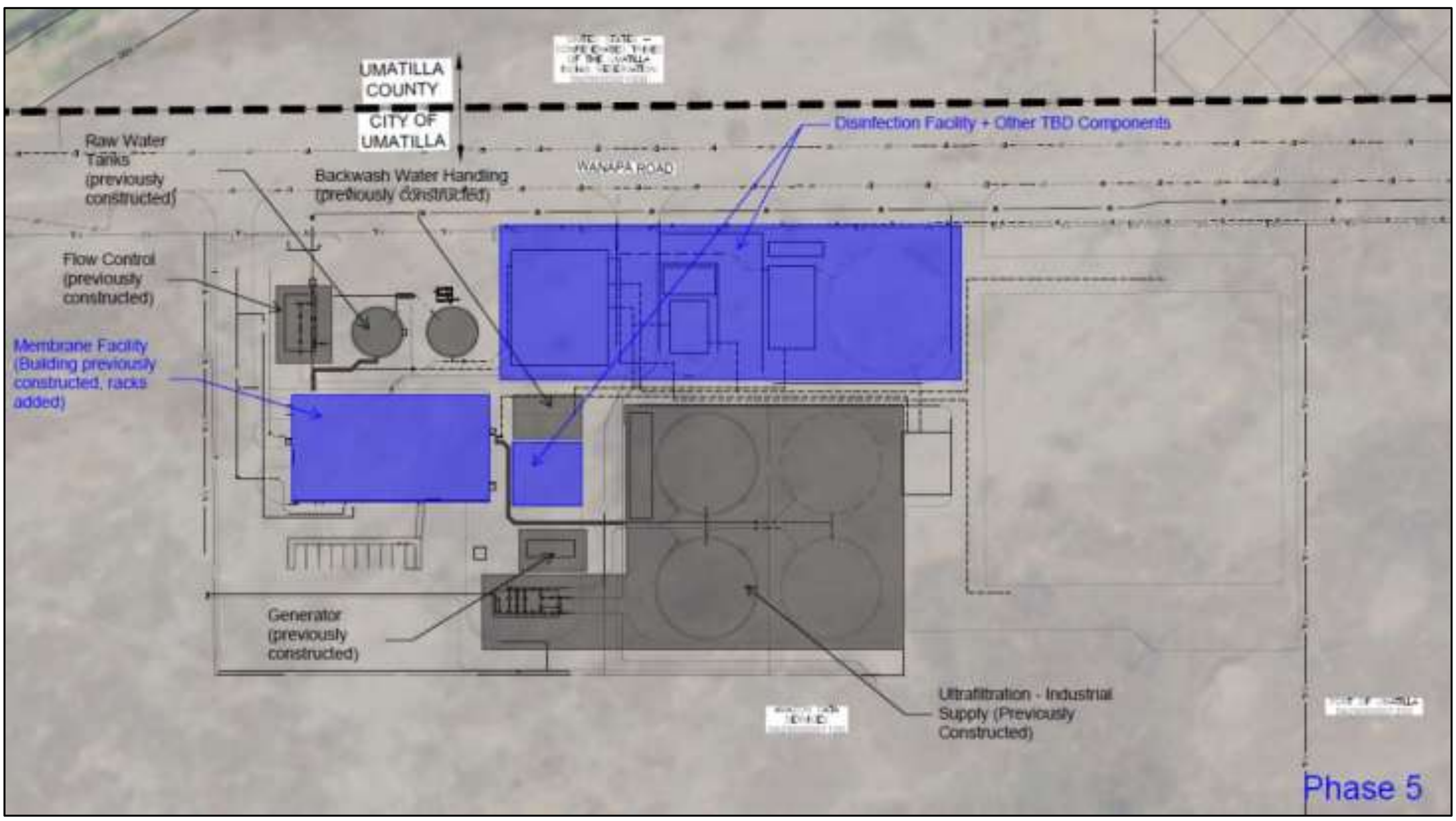
5.2.1 Bearing Capacity

We recommend embedding continuous strip and isolated footings a minimum 2 feet below adjacent (interior and exterior) grades for frost protection, bearing, and settlement considerations. Continuous footings should be a minimum 18 inches wide, and a minimum 24 inches wide for square or rectangular footings. We recommend a maximum allowable bearing capacity of 12 kips per square foot (psf) for footings bearing directly on bedrock or 6 ksf for footings bearing on compacted structural fill placed on bedrock. The allowable bearing capacity may be increased by one-third for short-term, transient loading conditions (i.e., seismic and/or wind loads).

Project Phasing: ***(**Go Back to List of Bookmarks**)***

The overall project is to be completed in 5 phases with potable water being produced at the end of phase 5 (water for industrial use will be produced in earlier phases):

- Phase 1 (2023) – primarily temporary facilities to be able to start producing industrial process water (125-ft dia. glass fused to steel bolted tank, portable PALL membrane plant, and other facilities needed to produce water for industrial use)
- Phase 2 (2024) – More permanent facilities that will be put to potable use after phase 5 (raw water tank at the plant, generator, backwash handling facilities)
- Phase 3 (2025/2026) – Permanent raw water pump station and raw water transmission line membrane racks.
- Phase 4 (~2026, to be determined) – Membrane racks and modules.
- Phase 5 (2028) – More membrane racks and modules and production of potable water.



Project Contacts: (***Go Back to List of Bookmarks***)

Membrane plant design/construction:

- Industry Representative: Rupeet Malhotra
- Owners Advisor: Salas O' Brien: Donald Young, Donald.Young@salasobrien.com
- PCL Construction: Project Manager, Cameron Goss, CTGoss@pcl.com

  Project Engineer, Will Gendusa, Wgendusa@pcl.com
- Design Engineer: Woodard & Curran: Project Manager, Paul Brandt, PBrandt@woodardcurran.com

Membrane skid and module suppliers:

- Wigen Water (skids)
  - VP of Sales - Michael Bourke, D(303) 350-3086, T(800) 240-3330, michael.bourke@wigen.com
  - Tim Seibert, tim.seibert@wigen.com
- Toray (membrane modules)
  - UF/MBR Technical Support Leader – Sue Guibert, O(289) 635-6083, C(858) 382-2813, sue.guibert.h4@mail.toray

City of Umatilla (COU) potable water system:

- City of Umatilla:
  - Public Works Director: Scott Coleman (541) 922-3226 ext 1010, scott@umatilla-city.org
  - Water System Operators:
    - Leon Scheel (541) 922-3226, leon@umatilla-city.org
    - Bryan Cutchen (541) 922-3226, bryan@umatilla-city.org
- Carollo Engineers (treatment):
  - Chief Technologist/VP: Dan Hugaboom, P(208) 376-2288, M(208)-866-3402, dhugaboom@carollo.com
  - Project engineer: Ali Leeds, P(206) 538-5169, M(206) 661-6324, aleeds@carollo.com
- J.U.B Engineers (raw water pipeline):
  - Lisa Siefkin, lls@jub.com
  - Bret Converse
- Kleinschmidt Group (pump station)
  - Bill Cutting, Bill.Cutting@kleinschmidtgroup.com

Oregon Health Authority – Drinking Water Services:

- Membrane plan review – Evan Hofeld, (971) 200-0288, evan.e.hofeld@oha.oregon.gov
- Intake, pump station, pipeline plan review – Bill Goss, (541) 966-0900, William.H.GOSS@oha.oregon.gov

<<<*Go Back* *to List of Attachments*   *Next Attachment - F (Operator Cert)* >>>

Attachment E

Conditional Use Approval

CITY OF UMATILLA PLANNING COMMISSION
REPORT AND DECISION
FOR
CONDITIONAL USE (CU-3-22) & SITE PLAN REVIEW

DATE OF HEARING: November 22, 2022

REPORT PREPARED BY: Jacob Foutz, Senior Planner

I. GENERAL INFORMATION AND FACTS

Applicant: City of Umatilla, 700 sixth street, PO box 130, Umatilla, OR 97882

Property Owners: Amazon Data Services, 410 Terry Avenue North, Seattle, Washington 98109

Land Use Review: Conditional use and site plan review to establish new water system structures.

Property Description: Tax lot 1100 on Assessors Map 5N29

Location: The subject property is south of Wanapa Road in the City of Umatilla

Existing Development: The property currently has temporary water solutions.

Proposed Development: The applicant requests approval to develop municipal potable and non-potable water, stormwater, and industrial waste water facilities.

Zone Heavy Industrial (M2).

Adjacent Land Use(s):

Adjacent Property	Zoning	Use
North	Tribal-not subject to local land use.	Vacant land
South	County EFU	Vacant Land and Wetlands
East	Heavy Industrial	Data center campus under construction
West	Heavy Industrial	Empty M-2 lots.

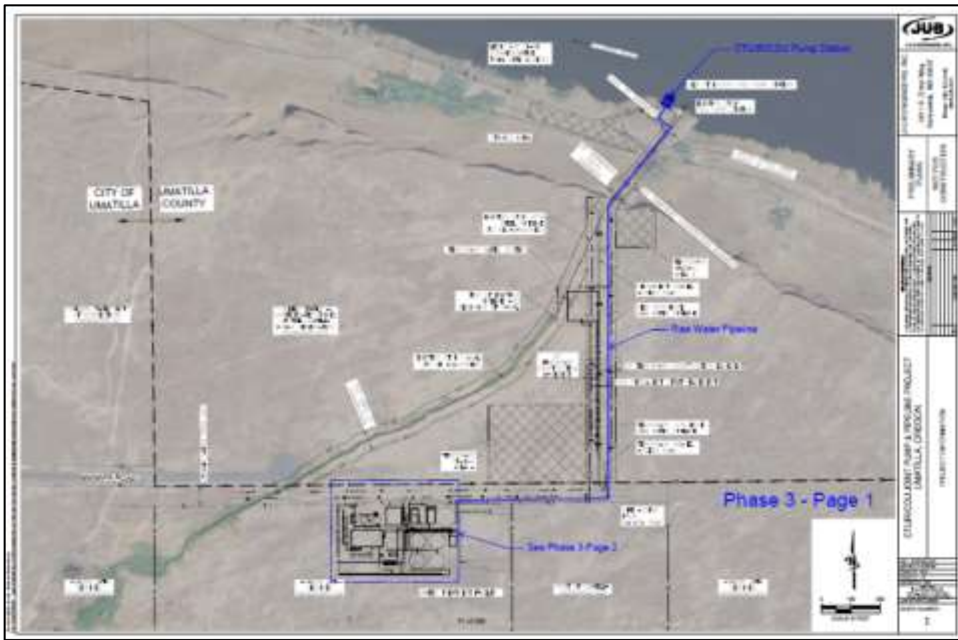
Conditions for land use approval are as follows:

IV. SUMMARY AND PLANNING COMMISSION DECISION

The applicant is proposing to develop the site with a new municipal potable and non-potable water, stormwater, and industrial waste water facility. The submitted materials meet or are capable of meeting the standards and criteria of approval as addressed in this report. Therefore, based on the information in Sections I and II of this report, and the above criteria, findings of fact and conclusions addressed in Section III, the City of Umatilla Planning Commission **APPROVES** Conditional Use, CU-3-22 & SP subject to the conditions of approval contained in Section V.

V. CONDITIONS OF APPROVAL

1. The applicant must obtain all federal, state and local permits or licenses prior to starting construction activities.
2. Landscaping shall be located along street frontages and building fronts to enhance the street appearance of a development. Landscaped areas shall be provided with automatic irrigation unless a landscape architect certifies that plants will survive without irrigation.
3. If any historic, cultural or other archaeological artifacts, or human remains are discovered during construction the applicant shall immediately cease construction activity, secure the site, and notify appropriate agencies including but not limited to the City of Umatilla, Oregon State Historic Preservation Office and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Cultural Resources Protection Program.
4. The applicant must establish the proposed use within one year of the date of the final approval unless the applicant applies for and receives and extension prior to the expiration of the approval.
5. Failure to comply with the conditions of approval established herein may result in revocation of this approval.



<<<Go Back to List of Attachments   *Next Attachment - G (COE Requirements) >>>*

Attachment F

Operator Certification Requirements (WT2 & WD2 DRC)

(rev. 2/9/24)

The new water treatment plant will require a treatment operator in direct responsible charge (Treatment DRC) with a Water Treatment 2 (WT2) license (minimum) once disinfection is added to serve as a potable water supply for the City of Umatilla. It is anticipated that the City of Umatilla will still be classified such that a Water Distribution 2 (WD2, currently required) will still be needed as the Distribution DRC. The WT2 and WD2 certification requirements are based on the points allocated in the form below and are subject to change based on population growth and depending upon the final treatment system configuration.

The Umatilla membrane plant treatment scored a total of 51 points, requiring a WT2 DRC. The WT2 designation is assigned for treatment totaling from 32 – 55 points. This score assumes the full 7.8 MGD buildout (8 points), 1 coagulant added using a static mixer (3 points) & on-site generated sodium hypochlorite (7 points) among other considerations (see the *Water System Treatment and Distribution Classification Worksheet* on the following page). **Corrosion control treatment was not factored in**, although pH/alkalinity adjust could be added for 4 points, which would still require a WT2 treatment operator.

The WD2 DRC designation is assigned for population served in the range of 1,501 – 15,000 people. The population used for this rating was 7,605 as shown below from the population shown on our website on 8/29/23.

OR41 00914	UMATILLA, CITY OF		Classification: COMMUNITY
Contact:	LEON SCHEEL	**Phone:** 541-922-3226	
	PO BOX 130	**County:** UMATILLA	
	UMATILLA, OR 97882	**Activity Status:** ACTIVE – History	
Population: 7,605		**Number of Connections:** 2,120	
Operating Period: January 1 to December 31		**Regulating Agency:** REGION 1	
Certified Operator(s)		**Owner Type:** LOCAL GOVERNMENT	
	Required: Y	**Licensed By:** N/A	
	Distribution class: 2	**Approved Drinking Water Protection Plan:** No	
	Treatment class: None	**Source Water Assessment:** Yes	
	Filtration Endorsement Required: No	**Last Survey Date:** Apr 14, 2021	

The current population can be viewed online at:
https://yourwater.oregon.gov/inventory.php?pwsno=00914

Water System Treatment & Distribution Classification Worksheet

Water System Treatment and Distribution Classification Worksheet *(not for small PWS classification)* Page 1 of 2

PWS Name:	City of Umatilla			Date:	8/29/2023
PWS ID#: 41	00914	PWS Type: C	(C,NTNC,TNC,NP/SR)	Pop:	7,605
WTP Name:	TP for Colummbia River	WTP ID: D		DWP Staff:	Evan Hofeld
Classification:	WT = 2 WD = 2 FE =	↑ *put "N/A" if no treatment*			

Item - *Use this section only if system treats for contaminants in OAR 333-061-0030(1) through (5) and (7)*		**Points**	
Treatment system size - use population served or flow whichever is greater and round to lowest whole number			
Population Srvd	1 pt per 10,000 (max 30), 1 if < 10,000 Pop = 7,605	*1 to 30*	
Avg Day Demand	1 pt per 1 mgd of flow (max 30), 1 if < 1 mgd ADD = 7.800	*1 to 30*	8
Treatment system water source			
Groundwater	GW	*3*	
Surface water or Groundwater Under the Influence of Surface Water	SW/GU	*5*	5
Chemical Treatment/Addition Process			
	Fluoridation	*5*	
	Disinfection:		
	Ultraviolet	*2*	
	UV with Chlorine Residual	*5*	
	Ammonia/Chloramination	*3*	
	Chlorine	*5*	
	Mixed Oxidants/On-site Gen. Sodium Hypochlorite	*7*	7
	Ozonation (on-site generation)	*10*	
	Residual Maintenance	*N/A*	
pH Adjustment			
	Slaked-Quicklime (Calcium Oxide)	*5*	
	Hydrated Lime (Calcium Hydroxide)	*4*	
	All others (hydrochloric acid, sodium hydroxide, sulfuric acid, sodium carbonate)	*1*	
Coagulation & Flocculation Process			
	Chemical addition (1 point for each type of chemical coagulant or polymer added, maximum 5 points)	*1 to 5*	1
Rapid Mix Units			
	Mechanical Mixers	*3*	
	Injection Mixers	*2*	
	In-line blender mixers (static mixers, etc.)	*2*	2
Flocculation Units			
	Hydraulic flocculators	*2*	
	Mechanical flocculators	*3*	
Clarification and Sedimentation Process			
	Adsorption clarifier	*10*	
	Horizontal-flow (rectangular basins)	*5*	
	Horizontal-flow (round basins)	*7*	
	Up-flow solid contact sedimentation	*15*	
	Inclined-plate sedimentation	*10*	
	Tube sedimentation	*10*	
	Dissolved air flotation	*10*	
Filtration Process			
	Single media filtration	*3*	
	Dual or mixed media filtration	*5*	
	Microscreens/Membrane filtration	*5*	5
	Direct filtration	*5*	
	Diatomaceous earth filtration	*12*	
	Slow sand filtration	*5*	
	Cartridge/bag filters	*5*	
	Pressure or greensand filtration	*10*	

Water System Treatment and Distribution Classification Worksheet 8/29/2023 Page 2 of 2

PWS Name: City of Umatilla PWS ID#: 41 00914

WTP ID: D

Item	Points	
Stability or Corrosion Control		
Slaked-Quicklime (calcium oxide)	*10*	
Hydrated Lime (calcium hydroxide)	*8*	
Caustic soda (sodium hydroxide)	*6*	
Orthophosphate	*5*	
Soda ash (sodium carbonate)	*4*	
Aeration: Packed tower, Diffusers	*3*	
Calcite	*2*	
Others: sodium bicarbonate, silicates	*4*	
Other Treatment Processes		
Aeration	*3*	
Packed tower aeration	*5*	
Ion exchange/softening	*5*	
Lime-soda ash softening	*20*	
Copper sulfate treatment	*5*	
Powdered activated carbon	*5*	
Potassium permanganate	*5*	
Special processes	*15*	
Sequestering (polyphosphates)	*3*	
Residuals Disposal		
Discharge to lagoons	*5*	
Discharge to lagoons and then raw water source	*8*	8
Discharge to raw water	*10*	
Disposal to sanitary sewer	*3*	
Mechanical dewatering	*5*	
On-site disposal	*5*	
Land application	*5*	5
Solids composting	*5*	
Facility Characteristics		
Instrumentation		
The use of SCADA or similar instrumentation systems to provide data with no process control	*1*	
The use of SCADA or similar instrumentation systems to provide data with partial process control	*3*	
The use of SCADA or similar instrumentation systems to provide data with complete process control	*5*	5
Clearwell size less than average day design flow **CW size (MG) =**	*5*	5

Total Points =>		**51**
Water Treatment Classification =>	WT-	**2**
Water Distribution Classification =>	WD-	**2**
Filtration Endorsement Required (Yes/No) =>	FE Req-	

Classification of water treatment plants and distribution systems: ***Population = 7,605***

WT Class		Points	WD Class	Population
Water Treatment 1		1 to 30	Water Distribution 1	1 to 1,500
Water Treatment 2	*<=== WT-2 ===>*	31 to 55	Water Distribution 2	1,501 to 15,000
Water Treatment 3		56 to 75	Water Distribution 3	15,001 to 50,000
Water Treatment 4		76 or more	Water Distribution 4	50,001 or more

Filtration Endorsement (FE) is an additional classification that applies when a water treatment plant is classified as a Water Treatment 2 (WT2) and uses conventional or direct filtration treatment to treat surface water or groundwater under the influence of surface water (i.e., FE endorsement required for WT2 operators, but not WT3 or higher).

<<<Go Back to List of Attachments *Next Attachment - H (Ten States Standards) >>>*

Attachment G

City of Umatilla Required Details

UF Membrane Vendor and Membrane Selection: COU Required Details

The PCL / W&C team were directed to incorporate the following COU required details for the UF package (aka LLE#2) :

1. In accordance with COU provided direction the raw water flow for the UF system is based ‹_ _ 24 hour average daily flow as well as a UF skid operation of 24 hours per day (and not 16 hours of production for . 3.1 mgd filtrate production at build-out as originally specified). . build-out demand is 3.1 mgd of non-potable filtrate while COU build-out demand is 4.8 mgd of potable water; thus the build-out WTF demand is 7.9 mgd of filtrate from the UF skids.
2. Kinetrol / K-Tork clamshell pneumatic valve actuators vs. proposed Bray rack and pinion actuators.
3. Electrically actuated skid flow control valves vs pneumatic.
4. Utilizing HDPE instead of schedule 80 PVC for all "MIT-side" piping since PVC is not desired for compressed air service.
5. Use of slightly more conservative membrane flux based on description in WesTech's proposal which took into account membrane down-time.
6. Use of 200-micron vs 300-micron UF strainers.
7. Provide slightly different UF feed pump that is not close coupled for potential ease in future maintenance.
8. Provide alternate chemical "dosing pump" for feeding chemical into the membrane CIP tank. Original proposal was an air-diaphragm dosing pump by Wilden.
9. Confirm that UPS will be provided in the control panels to keep computer/PLC on during power failure. [confirmed]
10. Confirm that the material of the CIP is Hastelloy or Inconel and not 316 ss. [Inconel confirmed]

In addition to the proposed "adders" above, the team agreed to get deductive pricing on a couple of items to help off-set potential cost increases above.

11. The use of Forsta (200 micron) versus Amiad strainers.
12. The use of the recently developed larger Toray membranes (HFUG-2020AN) which has significantly more membrane surface area (969 SF) than the originally proposed Toray (HFU-2020AN) membranes (775 SF).
    OR
13. The use of the DuPont Integraflux 2880 modules – similar to those used at PDX-63 and PDX-80.

After further discussion with the City team and PCL/W&C, it was discussed that this summary document will formalize the proposed membrane equipment selections for this project as follows:

1. Proposed UF OEM Vendor: Wigen Water Technologies
2. Membrane: Toray HFUG -2020AN
3. Membrane skids each with 44 spaces to house the Toray HFUG membranes (42,636 SF per skid). Number of spare module locations on each skid to be confirmed but should be 4 or more for a minimum of 48-50 per skid.
4. MIT-side module connections: HDPE
5. Top-side module connections: PVC (clear to see bubbles for testing)
6. UF Feed Pumps: Non-close-coupled horizontal pumps (end suction). Likely Goulds
7. UF Strainers: Forsta E12-LP180 – 200-micron strainers
8. Pneumatic actuators: Kinetrol or K-Tork rotary vane

9. Skid flow control valves: Bray electric actuators (note that Wigen still recommends pneumatic for better control)
10. CIP Tank Heater Material: Incoloy
11. Integration of the UF skids into the building:
    a. Seven skids proposed at build-out – with room/provisions for 8 skids. Equipment pads for skids not to be installed within 3 years should not be constructed – but drains would be provided and stubbed up when constructed.
    b. Skid drain located in the center of the equipment pad so not to impede the spacing between the skids so that City's equipment could be used.
    c. Backwash supply tanks (to provide filtrate for backwashing) and backwash waste tank (to provide controlled backwash waste pumping) to be located inside with pumps.
        i. Discussion with City on ultimate sludge handling / backwash waste recycling be discussed soon so that the size/head requirements of the backwash waste pumps can be verified / adjusted as necessary.
    d. All skids to have the ability to be removed/replaced through proposed garage doors to the west or the south.
    e. Larger building (approx. 14k SF) is being developed for 60% presentation.
    f. The use of one of the UF skid for backwash reuse. Enable one of the initial skids (likely initially 3 skids) COULD be used as a wastewater concentrator – and then utilized as an in-service skid once permanent backwash waste minimization processes are determined.
    g. Add backwash pumps to route UF backwash to backwash waste holding tank and then route to the backwash reuse skid
    h. Add backwash waste pumps to waste backwash to COU sewer with pumps rated at 200gpm peak hour flow

END OF SECTION 46 61 33

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<<< Go Back to Condition 2

Attachment H

Select standards from the 2022 Recommended Standards for Water Works

The 2022 *Recommended Standards for Water Works* addresses membrane filtration systems under section 4.3.8 and is referenced in some of the conditions for approval identified on the following page. The 2022 *Recommended Standards for Water Works* is available online at:

https://www.health.ny.gov/environmental/water/drinking/regulations/docs/2022_recommended_standards.pdf

Some of the relevant sections of the 2022 Recommended Standards for Water Works include:

Section 4.1 Microscreening – pg. 34
Section 4.3.8 Membrane Filtration – pg. 60

3. Direct integrity testing information, including method specifications, LRV calculations (include sample calculations), and instrumentation specifications. The following information shall be provided to describe the direct integrity test:

    1) Minimum direct integrity test starting pressure (P_{test}).

    2) Pressure decay test result (ΔP_{test}).

    3) Minimum applicable log removal value (LRV).

    4) Air-to-liquid conversion ratio (ALCR).

    5) Volume of pressurized air in the membrane system during a pressure decay test (V_{sys}).

    6) Volumetric concentration factor (VCF).

    7) Maximum backpressure during pressure decay test (BP).

    8) Liquid-membrane contact angle (θ).

    9) Pore shape factor (K).

    10) Surface tension (σ).

    11) Transmembrane pressure (TMP).

    12) Water temperature (T).

    13) Time/Length of direct integrity test.

4.3.8.1.3 Raw Water Quality

1) Weekly source water quality monitoring should be conducted to include different seasons, to capture seasonal variations, with a minimum of four (4) samples per season. Monitoring shall be conducted for:

   a) Turbidity.

   b) Total Organic Carbon (TOC).

   c) Temperature.

   d) pH.

2) In addition to any new source sampling requirements, sample results for the following shall be submitted:

   a) Alkalinity.

   b) Total Hardness.

   c) Calcium Hardness.

   d) Ammonia.

   e) Iron.

   f) Silica.

   g) Sulfate.

   h) Total Dissolved Solids (TDS).

   i) Color.

   j) Manganese.

   k) Dissolved Oxygen (DO).

   l) Algae.

   m) Silt Density Index (SDI).

4.3.8.1.5 Coagulation, Flocculation, and Sedimentation

Coagulation, flocculation, and sedimentation processes shall be provided on all raw water originating from rivers, streams, creeks, lakes, and/or reservoirs that have maximum raw water turbidities exceeding 20 NTUs, unless the reviewing authority allows a pilot study that can demonstrate coagulation, flocculation, and sedimentation are not necessary.

4.3.8.1.10 Direct Integrity Testing

Each filter unit shall be equipped with a direct integrity testing system that is consistent with Chapter 4, Direct Integrity Testing in the EPA's Membrane Filtration Guidance Manual (MFGM). Operational parameters and critical control limits must ultimately be based upon the direct integrity test performed to achieve a minimum resolution of 3 microns. System-specific calculations shall be provided with the permit application and address: minimum test pressure, effective pressure, pressure decay rates, air-liquid conversion ratio (ALCR), and Log Reduction Value (LRV).

c) At each location of a pressure transducer, a 1/4-inch diameter NPT pressure gauge connection shall be provided to facilitate the connection of a portable, pocket type test gauge.

d) A calibrated, portable pocket type pressure gauge of the correct range and accuracy for the application shall be provided to check each pressure transducer installed on the membrane filter unit.

e) The time for direct integrity test to determine the decay rate shall be at least five (5) minutes during any direct integrity test.

f) Each filter unit shall be equipped with alarms and shutdowns that will be triggered by exceedance of operational control limits. Failure to comply with the following limits shall cause the programmable logic controller (PLC) to initiate immediate shutdown of the affected filter unit:

Etc.