



PUBLIC HEALTH DIVISION
Drinking Water Services

Kate Brown, Governor



January 21, 2021

Jessica Penetar, PE
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www.healthoregon.org/DWP

Re: **Nestucca Valley Elementary School (PWS ID #90595)**
AdEdge Oxidation/Filtration Treatment for Iron and Manganese (WTP-A)
Final Approval for PR #187-2020 (originally submitted under PR# 44-2019)

Dear Ms. Penetar:

Thank you for your submittal to the Oregon Health Authority's Drinking Water Services (DWS) of the "Project Final Approval Request Form" on behalf of the [Nestucca Valley Elementary School](#) in Tillamook County. Also thank you for your letter dated January 20, 2021 addressing the remaining treatment system conditions in my Conditional Approval letter dated September 2, 2020 for the new treatment facilities ([AdEdge](#) oxidation/filtration treatment system).

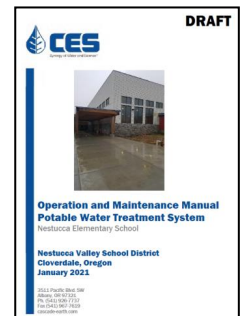
This project originally included the development of a new well #4 (new SRC-AD) and treatment system for iron, manganese, and arsenic (WTP-A/EP-A) to serve the school as shown in the system description and schematics beginning on page 12 of this letter, however, the project was subsequently split up into separate plan reviews with Well #4 containing arsenic still assigned under PR #44-2019 and the treatment system assigned to PR #187-2020. This was done so that the treatment system, which will initially treat iron and manganese from existing Well #3, could be placed into service before Well #4 was completed. Test results taken from Well #4 were over the Maximum Contaminant Level (MCL) of 0.010 mg/l for arsenic, however, [OAR 333-061-0050\(4\)\(b\)\(F\)\(xii\)](#) identifies oxidation/filtration as a "Best Available Technology" or "BAT" for arsenic V and indicates the following iron to arsenic ratio may be needed:

- (xii) Central treatment using oxidation/filtration for Arsenic V (to obtain high removals, iron to Arsenic ratio must be at least 20:1).

Final Approval is hereby granted for the treatment system in terms of removing aesthetic contaminants like iron and manganese, however, further testing will need to demonstrate the ability to remove arsenic before the AdEdge system is approved for arsenic treatment in conjunction with obtaining Final Plan Approval for Well #4 under PR #44-2019.

Pages 4-5 of the draft Operation and Maintenance Manual, dated January 2021, are very helpful and accurately reflect required monitoring under sections 5.1.2, 6.0, and 5.2, with three exceptions:

- 1) Monitoring for arsenic needs to reflect sampling done when Well #4 is in use and can begin later as part of demonstrating arsenic removal in conjunction with the further development of Well #4 to achieve Final Approval under PR #44-2019.
- 2) Because toluene was detected at low levels in Well #4, toluene will need to be sampled quarterly after treatment when Well #4 is in use for four consecutive quarters. PVC electrical tape used to secure pump cable to the drop pipe in well installations can sometimes lead to the detection of very low levels of toluene. I anticipate that quarterly testing will be non-detect for toluene, however, subsequent sampling will be dependent upon the results of this quarterly sampling.
- 3) Under OAR 333-061-0036(9), systems that carry a residual disinfectant level in the distribution system need to measure the disinfectant level twice a week as indicated in the rule language below:
OAR 333-061-0036
 - (9) Monitoring of **disinfectant residuals** in the distribution system:
 - (a) All public water systems that add a disinfectant to the water supply at any point in the treatment process, or deliver water in which a disinfectant has been added to the water supply, must maintain a detectable disinfectant residual throughout the distribution system and shall measure and record the residual:
 - (A) At one or more representative points at a frequency that is sufficient to detect variations in chlorine demand and changes in water flow but **in no case less often than twice per week; and**
 - (B) **At the same points in the distribution system and at the same times as total coliforms are sampled** as prescribed by subsections (6)(b) through (6)(f) of this rule.



On the following page, I have also shown recommended edits to *Table 1. System Monitoring Summary* in the draft Operation and Maintenance Manual.

Table 1. Water System Monitoring Summary

Component	Location	Frequency	Recommended?
Iron/Manganese	Inlet to (prior to chlorination) and outlet from AdEdge filter media	Annually after startup	Monitor for breakthrough and changeout
		After 5 years - Semiannually or quarterly and then quarterly or monthly if levels appear to be increasing	Required by Oregon Health Authority
Arsenic	Outlet	For 3 months following startup	Required by Oregon Health Authority
		Quarters following monthly sampling	
		Suggested by Oregon Health Authority sampling requirements when Well#4 is in use	
	Backwash recycle	Annually, or monthly when Well #4 is in use	Recommended to assess potential for arsenic accumulation in backwash stream
Free Chlorine	Outlet	At least one week following startup	Recommended to determine sufficient oxidation for treatment 0.5 mg/L
	Outlet	every two weeks) after startup.	
	Distribution system	Monthly	Twice a week in the distribution system (record results in an operations log) and at the same time and location as quarterly coliform quarterly sampling (record results on the coliform laboratory forms)

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Nestucca Valley Elementary School (PWS #90595)

PR #187-2020 - AdEdge Iron and Manganese Treatment System (WTP-A)

January 21, 2021

I have included in this letter the following information:

Page 5 – Conditions for approval of Well #4 and arsenic treatment (PR #44-2019).

Page 6 – Monitoring for Well #4 and arsenic treatment after plan approval is granted.

Page 7 – Recommendations for completion of arsenic treatment.

Pages 8 – 9 – Geologist evaluation of Well #4.

Pages 10 - 11 – Plan review process milestones for PR #187-2020.

Pages 12-24 – Treatment system description and process.

Any future correspondence regarding Well #4 and arsenic treatment should reference PR #44-2019 and can be e-mailed to me at evan.e.hofeld@dhsosha.state.or.us or mailed to:

Attn: Evan Hofeld
OHA-Oregon Drinking Water Services
PO BOX 14450
Portland, OR 97293-0450

Thank you for your cooperation in the plan review process. If you have any questions, please feel free to call me at 503-504-8222 (mobile) or via e-mail at evan.e.hofeld@dhsosha.state.or.us.

Sincerely,



Evan Hofeld, Regional Engineer
OHA - Drinking Water Services

ec: Misty Warton, Superintendent - Nestucca Valley School District

MistyW@nestucca.k12.or.us

Chad Holloway, Principal - Nestucca Valley Elementary

ChadH@nestucca.k12.or.us

Logan Kellow, Maintenance Specialist/Water System Operator

LoganK@nestucca.k12.or.us

Brian Hardebeck, PE. Senior Project Manager - OTAK

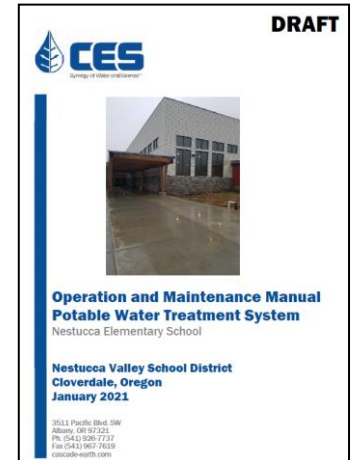
Brian.Hardebeck@otak.com

Annette Pampush, Tillamook Co. Environmental Health

apampush@co.tillamook.or.us

PR #44-2019 - Conditions remaining to be met for Well #4 and demonstration of the AdEdge system for arsenic treatment:

1. Treated water lab test results showing the completed Well #4 construction is absent of coliform bacteria to demonstrate disinfection of applicable new facilities and method of disinfection.
2. Treated water lab test results showing arsenic levels are below 0.010 mg/l when well #4 is in use.
3. The Operation and Maintenance Manual (currently in draft form) will need to be finalized and include information relevant to arsenic treatment. This can be in the form of an addendum to the current manual or other supplemental document.
4. Complete and submit the [Project Final Approval Request](https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Documents/project-update-form.pdf) form for PR #44-2019 on-line at the link below:
<https://www.oregon.gov/oha/PH/HEALTHYENVIRONMENTS/DRINKINGWATER/PLANREVIEW/Documents/project-update-form.pdf>
The form and documentation of conditions having been met may be e-mailed to me at evan.e.hofeld@dhsosha.state.or.us



Sampling following the receipt of Final Approval for PR #44-2019:

1. The new well and treatment system may be placed into service.
2. The following sampling is needed once the system is placed into service:
 - Lead and Copper Tap Sampling: Complete two 6-month demonstration rounds (e.g. 1/1/21 – 6/30/21, 7/1/21 – 12/31/21, etc.) of lead and copper tap sampling at 10 sites. This is required due to the installation of a new well (and treatment changes that may have been made to remove arsenic). Future monitoring will depend upon the results of this demonstration monitoring.
 - Disinfection Byproducts (TTHM and HAA5): Complete quarterly [DBP](#) sampling for 4 consecutive calendar quarters (e.g. 1/1/21 – 3/31/21, 4/1/21 – 6/30/21, etc.). Quarterly sampling is already in effect due to a prior MCL exceedance. Future sampling will depend upon this quarterly monitoring.
 - Well #4 Post-treatment Arsenic: Arsenic monitoring will require sampling the treated water once each month for three consecutive months and then once each quarter for three consecutive quarters. Depending upon results, monitoring may be reduced to once each year on an on-going basis. This is due to the detection of arsenic in Well #4*.
 - Well #4 Pre-treatment Coliform Bacteria: Monthly raw water (pre-treatment) source assessment sampling for coliform bacteria will need to be taken from Well #4 for 12 consecutive months due to the sensitivity of the aquifer to land use practices.
 - Well #4 Post-treatment toluene: Due to a detection of toluene* in Well #4, toluene will need to be sampled once each quarter for 4 consecutive quarters. Subsequent monitoring will depend upon the results of quarterly monitoring.

* Detections for IOC, VOC, SOC, and aesthetic sampling completed 7/23/20 (silica sampled 12/11/19):

Arsenic – 0.0102 mg/l (MRL = 0.002 mg/l, MCL = 0.010 mg/l)

Toluene – 0.00981 mg/l (MRL = 0.0005 mg/l, MCL = 1 mg/l)

Iron – 0.547 mg/l (MRL = 0.1 mg/l, Secondary MCL = 0.3 mg/l)

Manganese – 0.144 mg/l (MRL = 0.05 mg/l, Secondary MCL = 0.05 mg/l)

Fluoride – 0.556 mg/l (MRL = 0.2 mg/l, MCL = 4 mg/l)

Sodium – 618 mg/l (MRL = 1 mg/l, EPA limit = 20 mg/l (no MCL))

Silica – 5 mg/l (sampled 12/11/19, MRL = 1 mg/l, no MCL)

PR #44-2019 Arsenic Treatment Recommendations:

1. Although minimum sampling previously mentioned is required, it is recommended that additional monitoring be done as necessary to ensure arsenic levels are below 0.010 mg/l under all possible operating scenarios (e.g., sampling for arsenic when well #4 is placed into use and monthly arsenic sampling when well #4 is in use for more than a month, at least until experience has shown that the treatment is effective).
2. Provide for sample taps to be able to monitor the backwash recycle stream for signs of excessive or increasing arsenic levels.
3. Follow the System Startup procedures provided by AdEdge:

6.0 SYSTEM STARTUP

6.1 Startup Requirements

The Startup and Commissioning Plan should be reviewed to understand the requirements necessary for startup. It should be noted that the initial backwash water during startup testing will not go to the Backwash Recycle Tank and therefore temporary provisions are required. It should also be noted that initial forward flow during startup testing will not go to system distribution and therefore temporary provisions are required.

Well #4 - Geologist Well Log Evaluation Results:

The well log (TILL 52871) was submitted to our geologist, Tom Pattee, who provided the results of his evaluation to me on August 18, 2020. As shown below, Mr. Pattee found that the well was adequately constructed and sealed such that the well's construction minimized impacts from nearby land use practices, however, the shallow unconfined aquifer the well draws water from, is sensitive to nearby land use practices. Mr. Pattee noted the relative high risk associated with parking lots within 100-ft of the well, which can be mitigated with proper stormwater/runoff management.

As Built Well Construction Evaluation for Plan Review and/or Setback Waiver:

- ☒ Well/Spring meets current construction standards.
 - ☐ WRD special construction standards, see well log or Comments.
- ☐ Well/Spring construction does not meet construction standards.
 - ☐ Not sealed to appropriate depth. Recommended depth: _____
 - ☐ Not appropriate seal materials
 - ☐ Open to more than one aquifer
 - ☐ Seal info missing or unknown
 - ☐ Seal not constructed properly (☐ Insufficient sealant volume ☐ Insufficient annular space)
- ☐ Susceptible construction, but grandfathered source. Consider for reconstruction if nitrate \geq 5mg/L or confirmed *E. coli* at source.
- ☐ Susceptible well construction, not approved for use.

Comments: This well is 138 ft deep and is cased to the bottom of the hole. A casing seal was installed to a depth of 28 ft, 27 ft into a 50 ft thick clay/silt layer. Water enters the well through perforations in the casing between 125 and 135 ft below ground level. Sensitivity Analysis results suggest that well construction is not sensitive to nearby land use practices.

Nature of Aquifer Evaluation:

Aquifer Nature: ☐ Confined aquifer ☐ Semi-confined aquifer ☒ Unconfined aquifer

Comments: This well draws water from a shallow unconfined gravel aquifer. The aquifer is overlain by a 50 ft thick silt/clay layer. Sensitivity Analysis results suggest that the aquifer is highly sensitive to nearby land use practices.

Construction Setback Waiver Info:

- ☒ Facility Profiler review for additional contamination info:
 - ☒ Not applicable, Facility Profiler doesn't track releases from this type of contaminant source.
 - ☐ Facility Profiler does not indicate a spill or chemical release related to the sanitary setback violation.
 - ☐ Facility Profiler indicates that there is a spill or chemical release related to the sanitary setback violation.

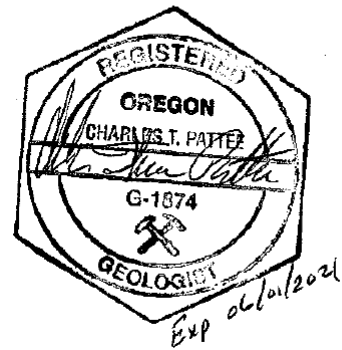
Hydrogeologist comments regarding hazards within Sanitary Setback: Due to its unconfined nature, the aquifer that this well draws water from is considered to be highly sensitive to land use practices within the 100 ft sanitary setback. Parking lots with more than 50 parking spaces are considered to represent a high risk to groundwater quality due to leaks and small spills of automotive fluids which can be transported into the aquifer by stormwater. If the stormwater collection system is designed to remove stormwater from the sanitary setback, the sanitary hazard would be minimized.

☒ Other: Qualifies for initial chemical monitoring reduction with exception of Toluene

Comments: All four wells (SRC-AA, SRC-AB, SRC-AC, & proposed SRC-AD) appear to draw water from the same aquifer and are within 2,500 ft of each other, suggesting that they capture water from the same portion of the aquifer. Land use practices are the same in the areas surrounding the wells. However, a trace amount of Toluene (~1% of the MCL) was detected suggesting that there might be a difference in water quality within the portion of the aquifer surrounding proposed SRC-AD. Therefore, it is recommended that the Toluene detection be further investigated such as follow-up sampling to determine if Toluene is persistent or a result of pump installation in SRC-AD or other similar infrastructure installations between the well and the location of the sample collection point used on 07/23/2020.

Reviewed by: Tom Pattee

Date: 11/20/2020



Plan Review Milestones:

March 12, 2019 - our office received plans showing the location of a newly constructed Well #4 and treatment system. A plan review fee of \$825 was received on March 18, 2019, submitted with the site plans for Well #4.

April 26th, 2019 - I issued a Site Plan Approval letter for well #4.

August 7, 2020 - DWS received plans for the AdEdge treatment system, fire suppression system details, and well log (TILL52871). On August 14, 2020 Jessica and I spoke about the need for wellhead details, lab results from well sampling, water rights information, and easements & well information was sent to Tom Pattee for review.

September 2, 2020 - I issued a Conditional Approval Letter for Well #4 and the AdEdge treatment system, which included the results of the well evaluation by Tom Pattee.

September 22, 2020 – DWS received a revised set of plans and letter demonstrating that much of the conditions in my September 2nd Conditional Approval letter had been addressed as shown below:

- A new groundwater well (#4) was installed as part the water treatment system upgrades. The well log, wellhead details (including global positioning satellite coordinates), and laboratory results are included in the Well 4 Information (Attachment 5). Also included in this attachment is the property easement information regarding the acquisition of a small parcel of land located to the north of Well #4. Nikki Hendrix of the Oregon Water Resources Department confirmed that water rights are not required and a copy of her email is also included in this attachment.
- The existing chlorination system consists of an LMI Series Milton Roy pump, model P151-398TI, which is NFS-61 approved (Attachment 6). The pump is metered and injects chlorine only when water is flowing from the well(s). The sodium hypochlorite used for chlorination is provided by Cascade Columbia Distribution (CCD) and is NSF-60, as certified by the Water Quality Association. The Safety Data Sheet for the sodium hypochlorite and CCD's certification are included in Attachment 6. The chlorinator piping is designed to prevent contamination of the potable supply because the concentrated sodium hypochlorite is not hard-piped into the injection system and a potable water line is not used to carry the chlorine into the system.
- The design basis and water treatment system overview is provided in the Water Treatment System Design Overview (Attachment 3). The process flow diagram has been updated to show an overflow on the storage tank, a check valve following the booster pumps, and a bypass around the pressure tank.

AdEdge will supply an Operation and Maintenance (O&M) manual to address how to operate the treatment system and backwash cycles. CES will provide an O&M manual to include recommendations for monitoring arsenic, sodium hypochlorite levels, iron, and manganese. A copy of this can be provided following installation, if requested.

December 29, 2020 – DWS Received a check for \$248 in order to split this project under two separate plan reviews since Well #4 was not ready to be brought on-line. Well #4 and related testing to demonstrate the AdEdge treatment system is capable of removing arsenic remains outstanding under PR #44-2019 and the AdEdge treatment system (initially granted Final Approval as iron and manganese treatment on January 21, 2021) was assigned under a new PR #187-2020.

January 20, 2021 – DWS received a letter dated January 20, 2021 and the “Project Final Approval Request” form for the treatment system under PR #187-2020. The letter included a link to 4 attachments and addressed conditions for approval as follows:

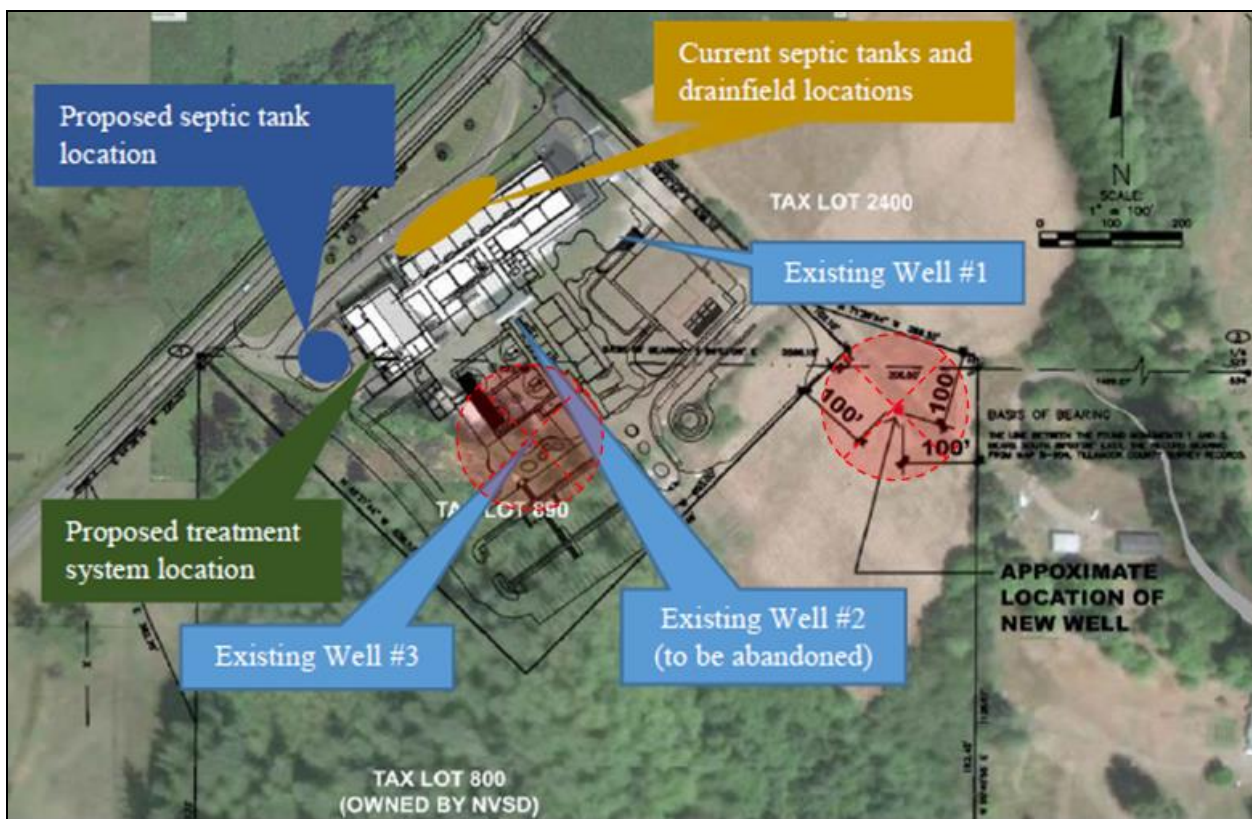
Below is a list of documentation related to the remaining conditions:

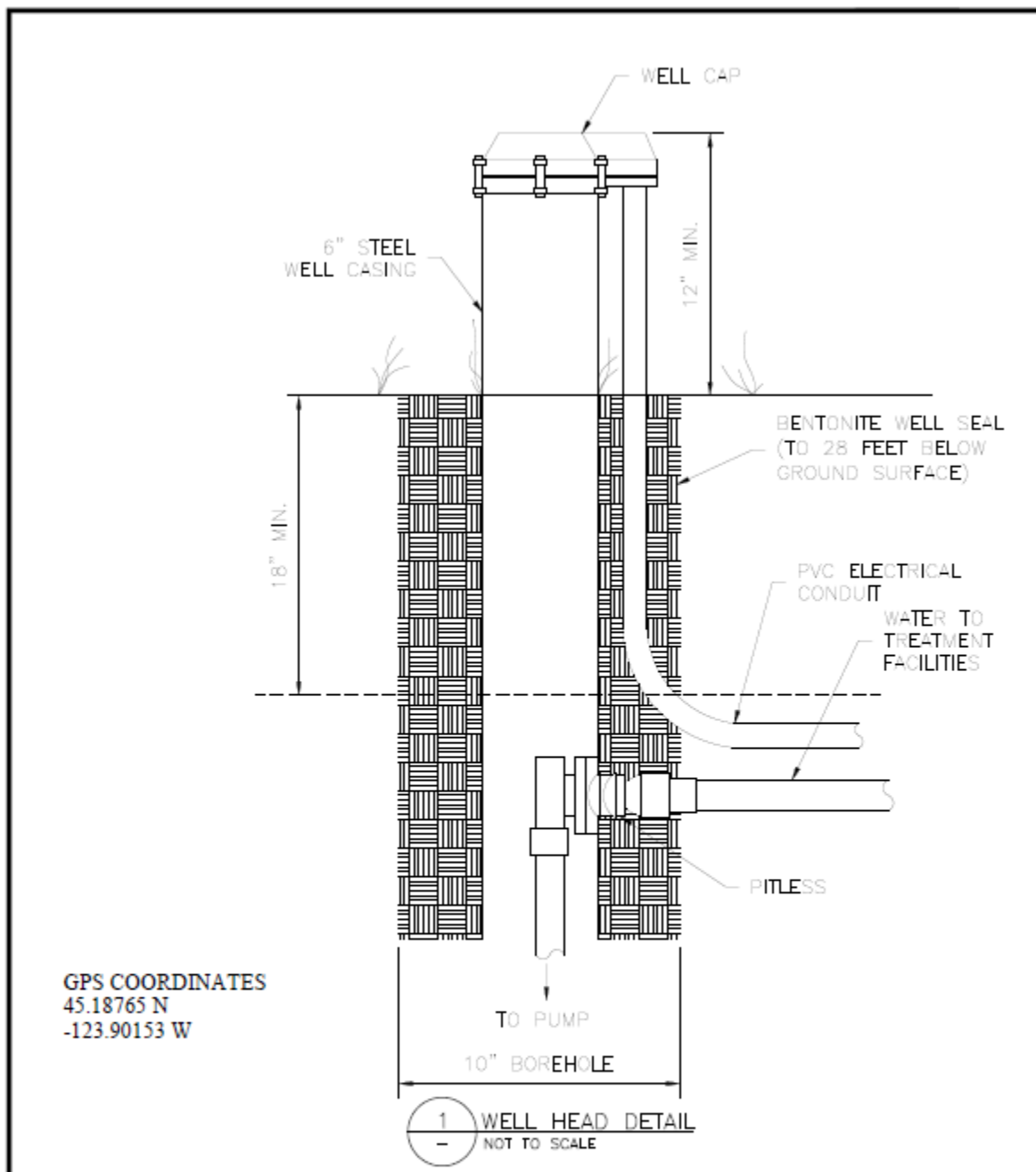
- Condition 2: During the site visit on December 31, 2020 with Annette Pampush of OHA, it was noted that the 3,000 gallon potable tank did not have an overflow pipe and that the drain line from the tank did not have a screen. Both of these items have been corrected as of January 19, 2021.
- Condition 4: An Operation and Maintenance (O&M) manual addressing the operation of the treatment system and the required monitoring has been developed (Attachment 1). The O&M manual includes information from AdEdge Water Technologies on the treatment system (iron, manganese, and arsenic), as well sodium hypochlorite monitoring. Please note there are placeholders within the O&M to insert additional equipment information as all the equipment submittals have not been received at this time. The O&M manual is therefore is marked as a draft.
- Condition 5: Treated water laboratory results for arsenic will be submitted once Well #4 becomes operational.
- Condition 6: The treatment system and associated components have been disinfected. Treated water laboratory results for coliform are attached (Attachment 2). The sample was collected from the drain valve of the pressure tank.
- Condition 7: The potable water system is adequately protected from backflow contamination. The backflow prevention schematic is detailed in the Pump House – Mechanical, Plumbing, and Fire Protection, MPF 1.0 drawing by the DLR Group (Attachment 3). A reduced pressure backflow preventer has been installed between the fire tanks and all 3 wells, per your email dated September 3, 2020.
- As-built documentation is included in the O&M manual (Attachment 1). There were no significant changes to the process flow diagram. Equipment makes and models for the booster pump, Variable Frequency Drive, and pressure tank were updated to reflect the final installation. In addition, a new chlorination system was required as the old one was deemed unusable. Cut sheets for the new equipment are included in Attachment 4.

January 21, 2021 – DWS issued a Final Approval letter dated January 21, 2021 for the AdEdge treatment system as iron and manganese treatment under PR #187-2020. Well #4 and demonstration of the AdEdge treatment for effective arsenic removal remains to be granted Final Approval under PR #44-2019.

System description:

The system is configured such that Well #1 supplies water for the fire suppression system only, while Well #3 (the well to be used the most) and newly constructed pitless adapter Well #4 supply the potable system as well as the fire suppression system. Wells #1, #3 and #4 are protected from the fire supply by a reduced pressure principal (RP) backflow prevention device and the potable supply to the treatment system (downstream of wells #3 and #4) is also protected an RP backflow prevention device.





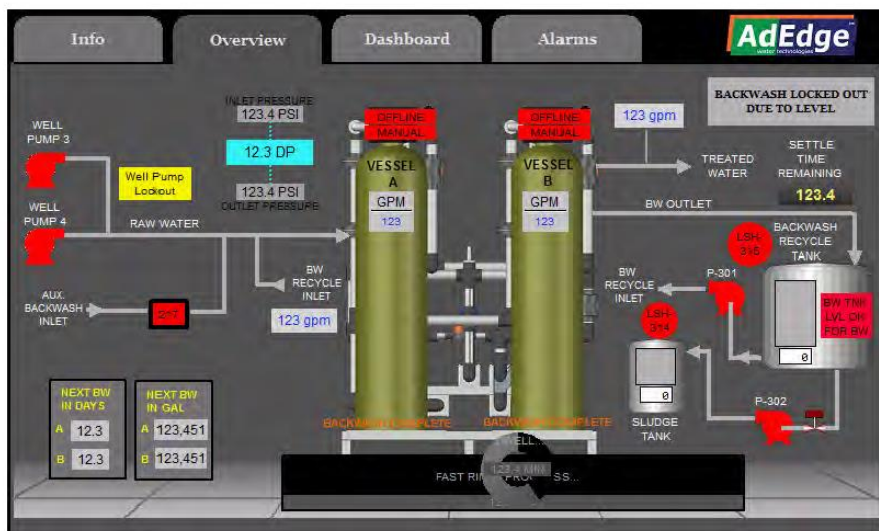
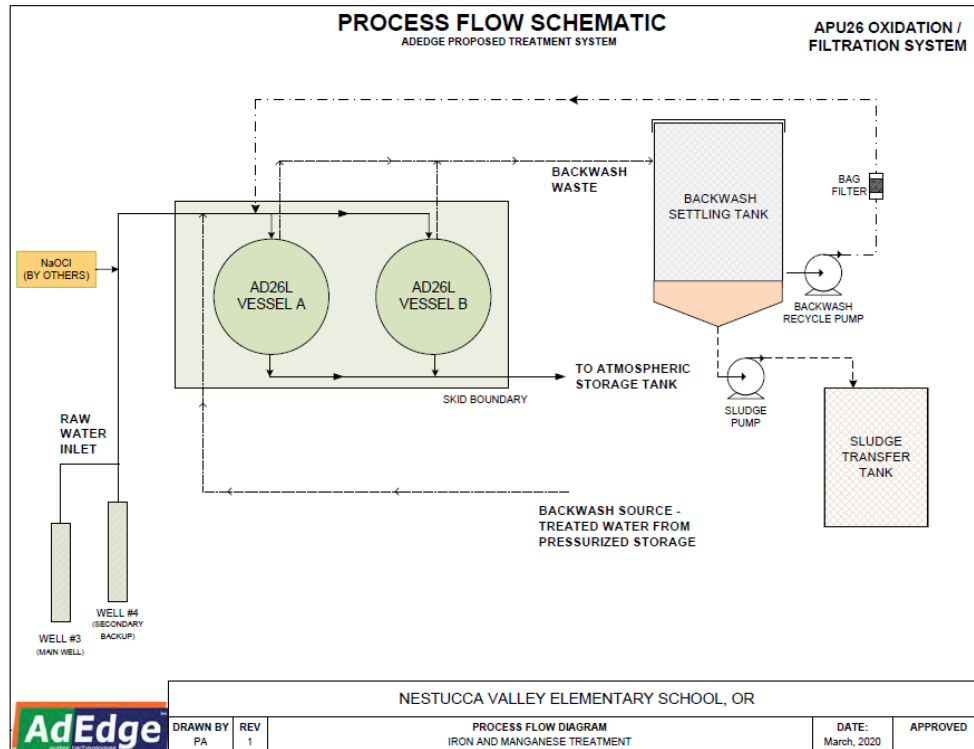
PUMP INFORMATION: FLOWISE
 S SERIES 4" STAINLESS
 STEEL SUBMERSIBLE PUMP, 2
 HORSEPOWER.

Figure G2. Wellhead Details — Well #4

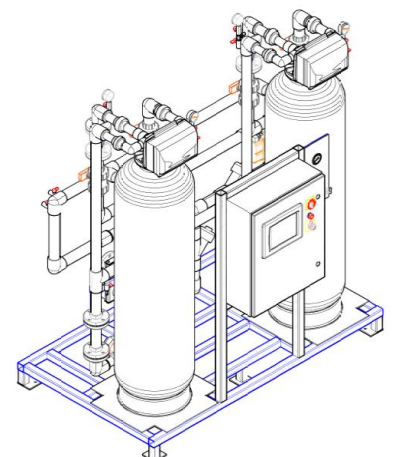
(SOURCE: "DOMESTIC WELLS, A BUYER'S AND SELLER'S GUIDE"
 FIRST AMERICAN TITLE INSURANCE COMPANY OF OREGON,
 MEDFORD, OREGON, JANUARY 2006.)

PROJECT 2017240048 DATE 8/18/2020	Nestucca Valley Elementary School Potable Water System Treatment Improvements
DWG NO: 2017240048 G2.DWG	Nestucca Valley School District 36925 US 101 Clatskanie, OR
DWG BY SNSC	PROJECT MANAGER TJAP
NOTED	CES CASCADE EARTH SCIENCES

Water from wells #3 and #4 combine prior to injection of sodium hypochlorite for oxidation and residual maintenance disinfection. The chlorinated water then flows to an AdEdge package filtration system (model #APU26-1865CO-2-2815-PLC). In order to ensure full oxidation of iron and manganese, a free chlorine residual of 0.5 mg/l (minimum) of treated water after filtration is recommended by AdEdge to ensure complete oxidation.



ADEGE TREATMENT



3.0 TREATMENT SYSTEM OVERVIEW

(Excerpt from page 2 of the DRAFT O&M Manual Dated January 2021)

An oxidation, precipitation and filtration system is an effective treatment for removing minerals such as Fe, Mn, and As. It was selected partly based on the fact that As can be removed concurrently with Fe and Mn using the same treatment steps. During the oxidation and precipitation process, arsenic will be adsorbed by the precipitating iron and manganese. This treatment process has been documented by the EPA in several studies that show that significant As removal will occur when Fe precipitates out of solution under conditions when the ratio of Fe to As is greater than 20:1 (United States Department of the Interior, 1999²; United States Environmental Protection Agency, 2006³; 2007⁴).

Oxidation

The purpose of oxidation is to oxidize soluble Fe, Mn and As into their respective insoluble forms. Liquid sodium hypochlorite (i.e., bleach) will be used as the primary oxidizer. The hypochlorite solution will be added at a rate to achieve 0.5 mg/L of free chlorine (Cl₂) in the treated water. The actual injection rate will need to be adjusted during the initial start-up stage so that the proper dosage can be determined while minimizing the residual chlorine that passes through the system.

Precipitation

After the Fe, Mn, and As have been oxidized, the constituents will begin to precipitate primarily as ferric hydroxide [Fe(OH)₃], ferric carbonate [Fe₂(CO₃)₃], and manganese oxide [MnO₂]. The oxidized As will adsorb to some of the ferric and manganite compounds.

Filtration

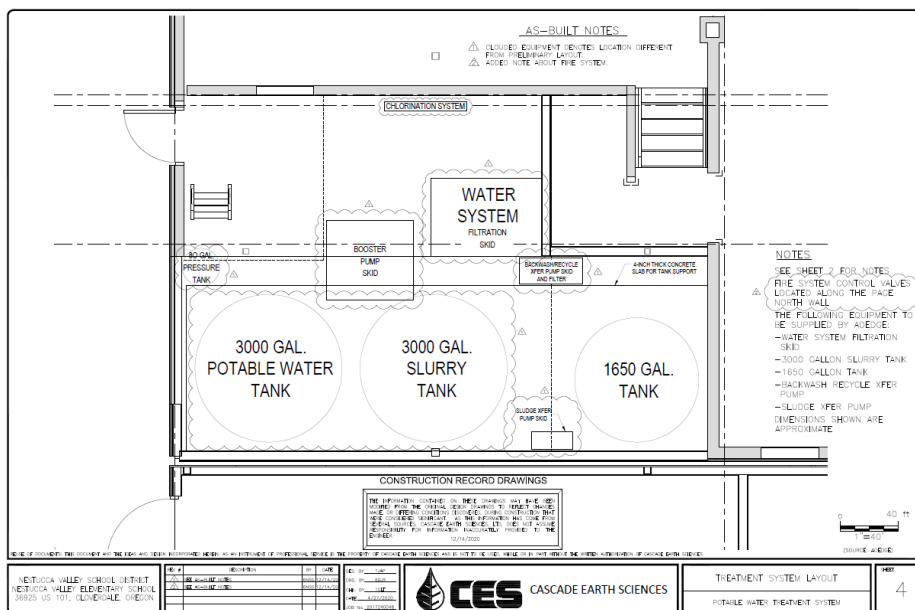
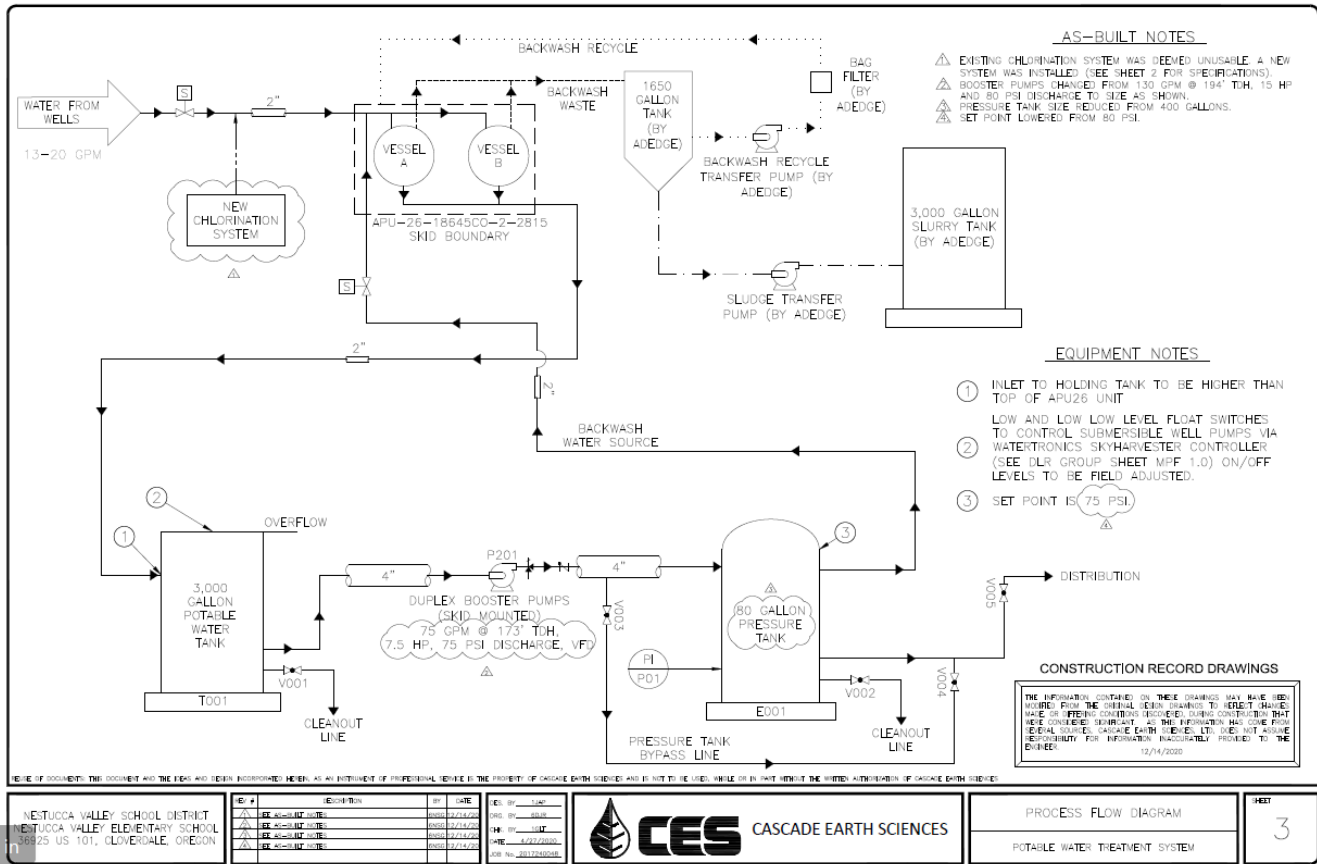
AD26L®, a form of manganese dioxide media provided by AdEdge, was selected as the filter media for this project because of its proven ability to remove Fe, Mn and As. The manganese dioxide coated surface of AD26L acts as a catalyst in the oxidation/reduction reaction of Fe and Mn to further precipitate the soluble Fe and Mn remaining after oxidation. Again, As is removed by adsorption to the precipitated ferric and manganite compounds and, to a lesser extent, onto the filter media itself. The filter media is contained within 2 vessels and will be operated in a continuously regenerated condition using the oxidation potential of injected chlorine. Based on information provided by the vendor, the filter media should last approximately 10 years under this application.

² United States Department of the Interior, 1999. *Arsenic Removal from Water Using Manganese Greensand: Laboratory Scale Batch and Column Studies*. Doc: 1425-96-FC-81-05016. Water Treatment Technology Program Report No. 41. June 1999. US Department of Interior, Bureau of Reclamation: Washington D.C.

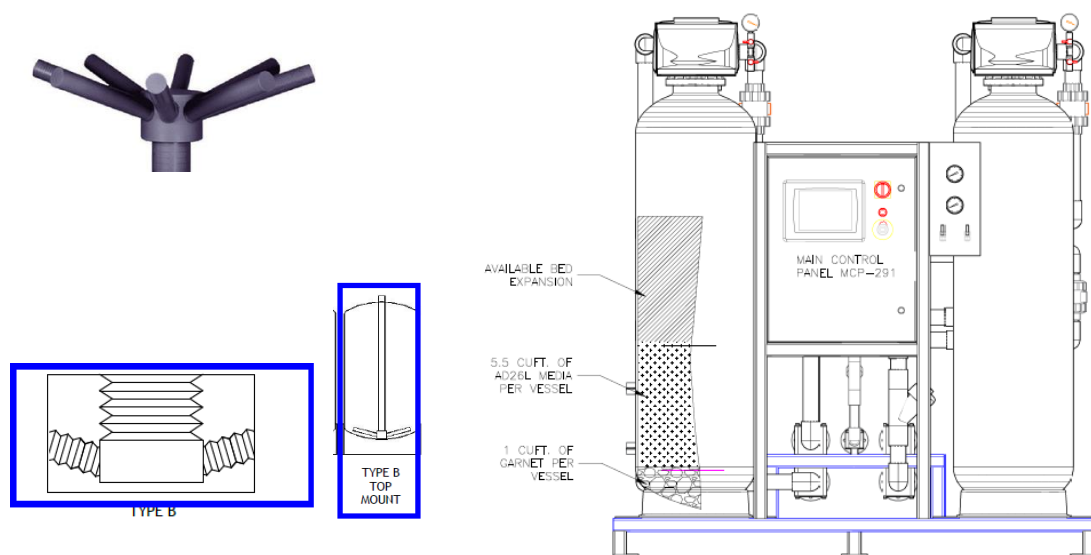
³ United States Environmental Protection Agency, 2006. *Arsenic Removal from Drinking Water by Iron Removal, USEPA Demonstration Project at Climax, MN*. Doc: EPA/600/R-06/152. December 2006. US Environmental Protection Agency: Washington D.C.

⁴ United States Environmental Protection Agency, 2007. *Arsenic Removal from Drinking Water by Iron Removal, USEPA Demonstration Project at Vintage on the Ponds in Delavan, WI – Six Month Evaluation Report*. Doc: EPA/600/R-07/083. September 2007. US Environmental Protection Agency: Washington D.C.

AdEdge APU26-1865CO-2-2815-PLC System and ancillary components – As-Built Process Flow Diagram and Layout



The AdEdge system consists of two composite pressure vessels (18" dia. X 65" tall fitted with Fleck #2815 control valves) designed to operate in parallel with a radial-type PVC underdrain system at the bottom of each vessel (suspended from the top as shown below) overlain by garnet gravel. The filters are programmed to backwash once a day and are operated in a continuously regenerative mode (the media is backwashed and rinsed sequentially [remaining filter off-line] such that the media is regenerated each day of operation).



D6336

DIS LATERAL PVC SCH80 .75" X 7" OAL .010 SLOT

The filter media in each vessel is manganese dioxide (AdEdge media product AD26L, 5.5-ft³ per vessel) over top of 1-ft³ of Carbon Enterprises, Inc. #8/12 garnet gravel ($d_{10} = 1.85$, $UC = 1.65 - 2$) covering the underdrain piping.

AD26L MEDIA SPECIFICATIONS

Removal Mechanisms.....	Rapid Oxidation /Adsorption/ Autocatalytic Adsorption
Removal Efficiency.....	>95%
H2S Capacity.....	250-300 gr/ft3
Size	20 x 40 mesh
Color.....	Black
Physical Form.....	Granular Particulate
Moisture Content.....	<0.5%
Bulk Density.....	95 lbs/cu ft
MnO2 Content.....	15%
Certifications.....	NSF 61

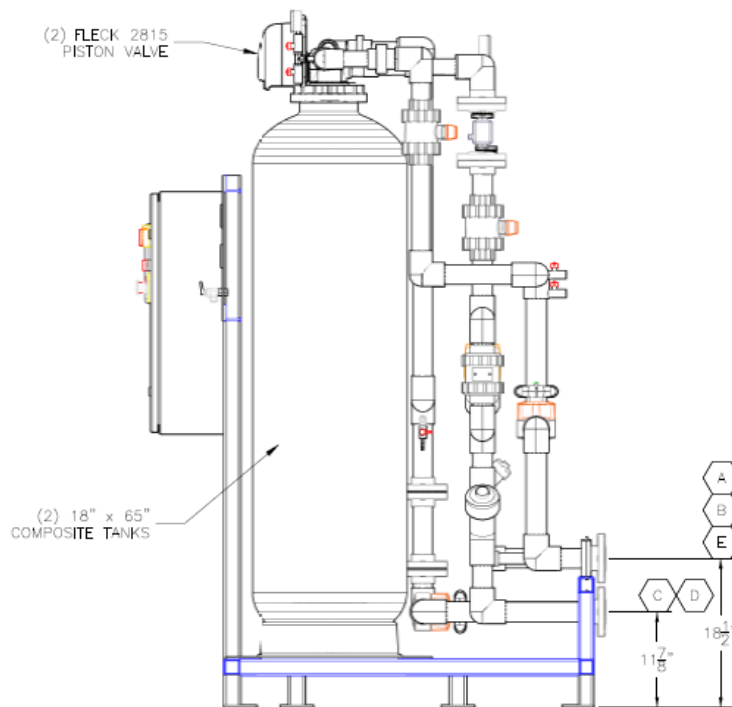
AD26L

Iron, Manganese, Sulfide & Arsenic Removal



The Fleck #2815 control valves fitted at the top of each vessel allows flow to be routed for three operating modes:

- 1) Service (forward flow to potable tank) - chlorinated water flows down through the media from the top of the vessel to the filter effluent at the bottom at 20 gpm.
- 2) Backwash (reverse flow to 1,650 Cone bottom HDPE backwash settling waste tank) - potable water supplies backwash water which flows from the bottom of the vessel (through the filter effluent valve) and up through the media to a waste line at 35 gpm. A backwash can initiate based on a set volume of water, time in operation, differential pressure exceeds 10 psig, or manually be the operator.
- 3) Rinse (forward flow to backwash waste tank) – follows the backwash by filtering (as in Service mode) to a waste valve.



2815 COMMERCIAL VALVE

1-1/2 INCH STAINLESS STEEL CONTROL VALVE



FEATURES • BENEFITS

- 316 grade stainless steel valve body for superior strength and durability
- Continuous service flow and backwash rates of 70 GPM
- Backwash capability accommodates softener tanks up to 36" in diameter and filter tanks up to 30" in diameter
- Fully adjustable 3- or 5-cycle control for efficient and reliable water treatment system operation
- Designed for single or multiple tank systems
- Corrosion resistant, UV stabilized NEMA 3R rated cover provides protection against water intrusion
- Hydraulically-balanced composite piston for durable sealing and performance
- One-piece seal and spacer cartridge simplifies service



TESTED and CERTIFIED by the WQA to NSF/ANSI Standard 61 Section 9 Material Safety Only.



TESTED and CERTIFIED by the WQA to NSF/ANSI Standard 372 for Lead Free Compliance.

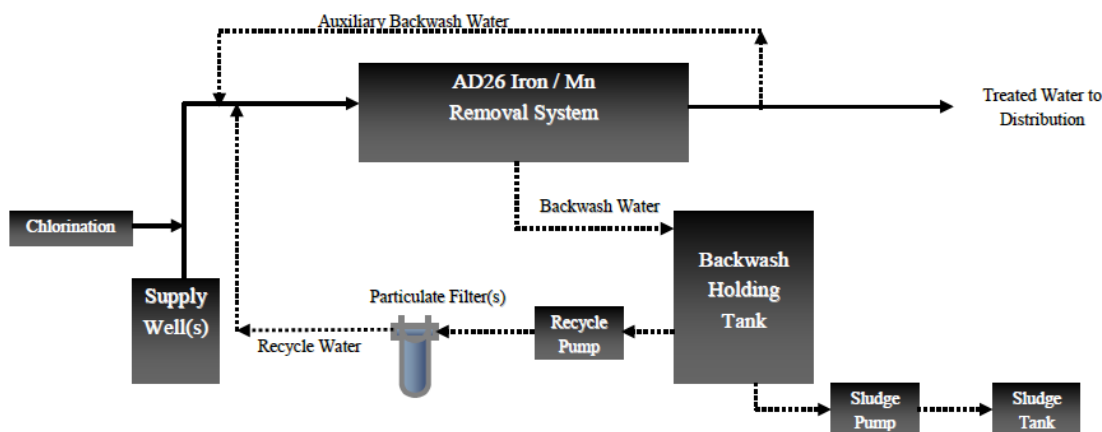


UL recognized to ETL

The AdEdge H₂Zero™ Backwash Recycle System operates such that backwash wastewater is decanted from the cone bottom backwash settling tank and sent through a 5-micron polyfelt bag filter prior to being injected at 2 gpm back into the feed side of the filtration system between chlorine injection and filtration as shown below.

AdEdge H₂Zero Backwash Recycle System & Control

Iron and Manganese Treatment System Schematic



www.fsifilters.com
 1-800-348-3205



FILTER VESSELS

CBF-P-0012-C-0150-N-02-N-02-N-06-A-1-N

Bag Filter Housings

FSPN Vessels | FSPN E-Z Open | CBF 11, 12 Vessels | BFNP 13, 14 Vessels |
 QX4 Filter Vessel | SBF Compact Bag Vessels | FMC Drum Filters

Cartridge Filter Housings

FSMC Cartridge Filter Vessels

Plastic Filter Housings

X100 Convertible Filter Housing | XL234 Modular Filter Housings

Specialty Filter Housings

Basket Strainers

CBFP 11, 12 Vessels ~ HOW TO ORDER

CBF-P-0012-C-0150-N-02-N-02-N-06-A-1-N

CBF	P	0012	A	0150	N	02	F	02	F	06	A	1	N
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Model Number CBF	2 Bag Style P = Polyloc® (standard on CBF)	3 Number of Bags 0011 = (1) #1 bag 0012 = (1) #2 bag	4 Vessel Material A = Carbon Steel B = 304 Stainless Steel C = 316 Stainless Steel	5 Vessel Pressure Rating (PSI) 0150	6 Coating/Lining Material A = Electropolish N = None S = Special X = Passivation	7 Inlet Size Use basic pipe size with the following exceptions: 02 = 2" 03 = 3"	8 Inlet Type C = Sanitary fitting D = Flange, din E = European EN Flange F = Flange, slip-on, raised face, std. N = Female NPT P = Plain pipe S = Special T = Plain OD Tube	9 Outlet Size See Inlet Size for codes	10 Outlet Type See Inlet Type for code letter	11 Nozzle Configuration 02 = Side In/Bottom Out 06 = Side In/Side Out, Offset 08 = Side In/Side Out, Same Side See the nozzle configuration chart	12 Internal Usage A = Standard	13 Lid Opening Type 1 = Hinge, std.	14 Jacket Type N = None

BAG FILTER HOUSINGS CBFP 11, 12 Vessels

Introduction

When looking for a cost-effective single-bag filter vessel that is both durable and reliable, look to the FSI CBFP series vessels. Although the standard CBFP series vessels do not carry an ASME Code stamp, you can still realize the benefits of an economic filter vessel that is manufactured to the same high standards and engineering expertise that characterizes all of our other FSI vessels.

Features

- Offset, Side Inlet with Side Outlet (same side or opposite), or Side Inlet with Bottom Outlet configuration available
- Positive bag seating without the use of a manual hold-down device
- Single gasket cover seal
- Connections sizes available in either 2" or 3" NPT or flange



How To Order Build an ordering code as shown in the example

Example: PE - 25 - G - 2 - RPO - WE		PO - 5 - G - 2 - RPO - NSF	
MATERIALS & MICRON RATING		BAG CONSTRUCTION	
Beta (Polyester) = BB		WE = Welded Construction (Not available on POMF or PEMF)	
Polyester Felt = PE		No Symbol = Sewn (BB)	
Polypropylene Felt = PO		BAG STYLES	
Polyester Multifilament Mesh = PEM		S = Galvanized Carbon Steel Ring	
Nylon Monofilament Mesh = NMO		S-SS = 304 Stainless Steel Ring	
Polypropylene Microfiber = POMF		RPO = Molded Polypropylene Rosedale Top	
Polyester Microfiber = PEMF		RPE = Molded Polyester Rosedale Top	
Oil Removal = OA		BAG SIZES (Inches)	
		1 = 7.2 x 16	
		2 = 7.2 x 32	
		3 = 4.3 x 8	
		4 = 4.3 x 12	
		7 = 5.7 x 15	
		8 = 5.7 x 21	
		9 = 5.7 x 32	
		12 = 8.4 x 34	
		BAG FINISH	
		G = Felt - Glazed or Singed (Standard with RPO and RPE top)	
		P = Plain Finish	

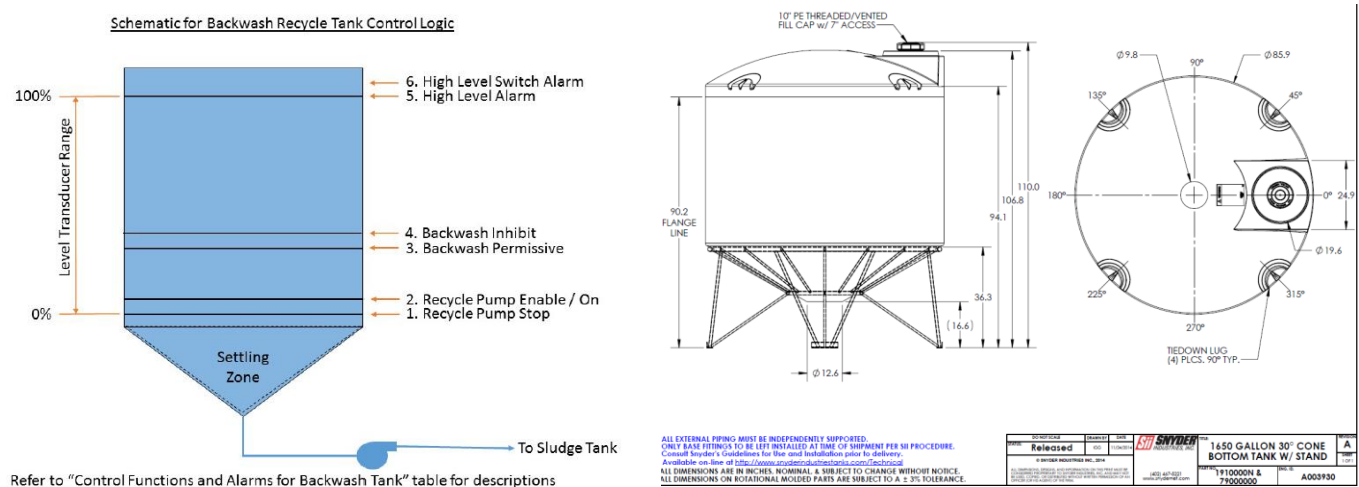
The recycle process logic is as follows:

After a backwash, the recycle pump turns ON if the following conditions are met:

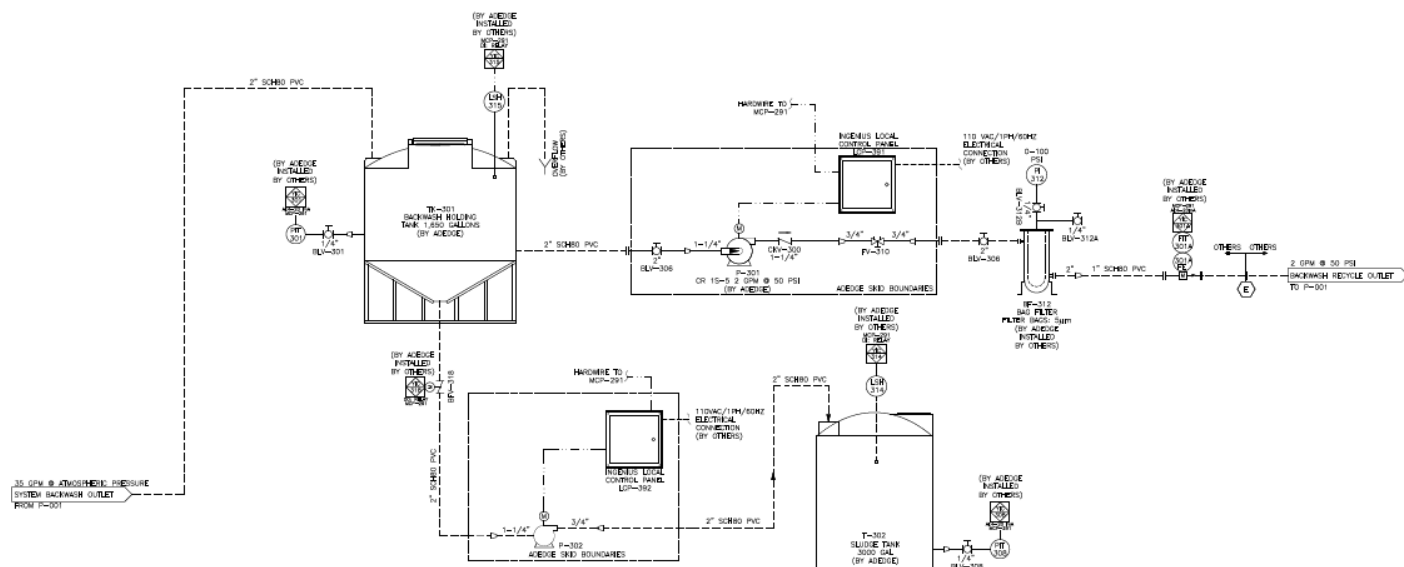
1. The established settling time has been met
2. If water level is above the Recycle Pump Enable set point (Set Point No. 2); AND
3. The well pump is running

Pumping of the recycle water from the backwash tank will STOP when one or both of the following conditions are met:

1. If water level in the backwash tank drops below Recycle Pump Stop set point (Set Point No. 1); OR
2. The well pump turns OFF and no service flow is occurring in the system to distribution



There is also a 3,000-gallon flat bottom HDPE sludge tank, which is used to contain the solids until they are eventually hauled off for disposal.



AdEdge Design Specifications

Parameter	Description
AdEdge System Model	APU26-1865CO-2-2815-PLC
Design Flow Rate	20 gpm max (22 gpm with backwash recycle)
Design Pressure	50 psi max
Pressure Vessels	Two (2) 18-inch dia. x 65-inch height
Operation	Parallel
Hydraulic Loading Rate	5.7 gpm/ft ²
Media Quantity	11 cuft AD26L
Anticipated Media Life	10 Years
Underbedding	8 x 12 Garnet / ~ 2 ft ³ (1 ft ³ per vessel)
Backwash Flow Rate	35 gpm
Wastewater Volume per Event	700 gallons (approximately)
Mounting	Composite Fiber skid-mounted, pre-piped

4/1/2020

Design Basis

System Design

20	Design flow - gpm
1.26	Design flow - liters / sec
5	Design flow - cubic meters / hr
18	inches vessel diameter
2	No vessels
17	BW design flow (gpm/sq ft)
5.66	gpm/sq foot design
11.3	gpm/sq foot design - one vessel off-line (if applicable)
35	gpm BW rate
8	total minutes of upflow BW
2	total minutes of rinse
10	total minutes of upflow BW + rinse
350	Gallons of BW water per vessel
700	Total gallons of BW water with all vessels
3	Total Cubic Meters of BW water - All vessels
5.5	media quantity (cf ft per vessel)

Backwash Frequency

31%	Percent Well Utilization
4.13	ppm, Raw water Fe
0	ppm, Coagulant as Fe
0.472	ppm, Raw water Mn

10,714	Gallons Treated before BW needed
1.2	Est. (24 hour) days between BW based on utilization

Sludge and Recycle Calculations

700	Gallons of water generated per BW event (all vessels)
25%	Reserve Capacity of BW holding tank
875	Approx. size of BW holding tank, gallons
862	Approx gals of non-dewatered sludge per month
2,586	Approx. sludge volume (6 months)

Ancillary equipment specifications:

One 80-gallon “[Elbi](#)” model WTL-300 bladder pressure tank (NSF-61)



WTS - WTL Series WELL TANKS

Designed and constructed per ASME Code Section VIII

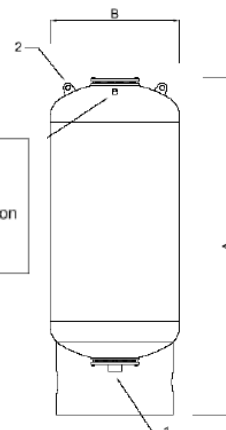
SUBMITTAL DATA SHEET

MODEL NUMBER	Capacity		B		A		NPT SYSTEM CONNECTION	APPR. WEIGHT	
	Gals	Liters	ins.	mm.	ins.	mm.		lbs.	Kg.
WTS-45	12.0	45	15.8	400	22.4	569	3/4"	52	23.6
WTS-80	21.0	80	15.8	400	34.9	886	1"	78	35.4
WTS-100	26.5	100	19.7	500	37.3	947	1"	83	37.6
WTS-140	37.0	140	19.7	500	43.3	1100	1"	114	51.7
WTL-170	44.0	170	19.7	500	48.7	1,237	1 1/4"	160	72.6
WTL-200	53.0	200	21.7	550	47.2	1,199	1 1/4"	170	77.1
WTL-300	80.0	300	25.6	650	49.0	1,245	1 1/4"	215	97.5
WTL-400	105.0	400	25.6	650	57.9	1,471	1 1/4"	248	112.5
WTL-450	120.0	450	29.5	750	55.8	1,417	1 1/2"	283	128.4

SPECIFICATIONS
 Maximum working pressure
 150 PSI (10.5 kg/cm²)
 Maximum operating temp.
 240°F (115°C)

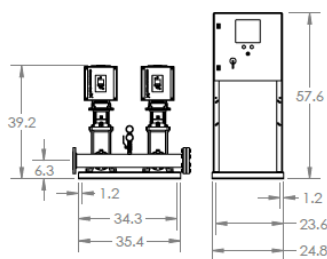
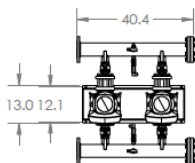
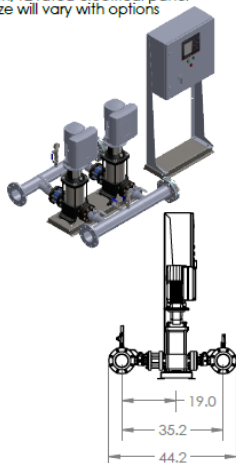
Tanks are built in accordance with ASME Section VIII, Division I, 8 thru 300 liter units are NSF61 approved. Larger units contains FDA approved compound bladders and is suitable for domestic potable water applications. Seamless one piece bladder for longer life.

- A.** Total height
B. Diameter
 1. System connection
 2. Lifting ring
 3. Precharge valve



Grundfos VFD pump skid (BoosterpaQ Model: HYDRO MPC E2CRE15-4):

1. Manifolds 4" ANSI Class 150 AISI 316SS Schedule 10s ASTM A312 or Ø114.3mm x2mm
 2. Base/Frame AISI 304SS
 3. Standard system layout : panel right facing suction
 4. Full port ball valve ASTM
 5. UL Type 3R/12 rated electrical panel
- Note: panel size will vary with options



Hydro MPC-E 2CRE
 15-4 3x208V 60Hz
 3599 rpm

Part Number N/A

Conditions of Service		Pump Data		Motor Data	
Flow Per Pump	75.00 USGpm	Material	Standard - Cast Iron / 304 Stainless Steel	Nameplate HP	7.5 HP
Head	173.3 ft			Rated Power	4.53 TEFC
Liquid	Cold Water	Max Operating Pressure	104.7 psi g	Enclosure	208-230 V
Temperature	68.00 deg F	Max Allowable Suction Pressure	145.0 psi g	Voltage	3 Phase
NPSHr	4.90 ft	Pump Efficiency	72.4 %		
Viscosity	1.00 cP	PEI (VL)	0.42		
Specific Gravity	1.000 SG	ER (VL)	58		

GRUNDFOS
 FRESNO, CALIFORNIA 93727 USA

Note:
 All dimensions are ±0.5"
 Not for Construction
 All dimensions subject to
 change without notice.

BoosterpaQ Model: HYDRO MPC E 2CRE15-4
 Power: 3x208-230 60Hz 2x7.5HP

Job: _____ Scale: 1:30
 Drawn: 0 9/18/2019 71999 Page: 1 of 1

One LMI chlorination pump



Backflow prevention (RP) devices for fire supply:

