Hysham Notes for 2/16/2023.

- Check the point of entry turbidity meter: It is reading inconsistently. Air in the sample cell is a concern.
  - We verified the meter with the handheld on Friday 2/10 and it was reading accurately.
  - We verified it again on Thursday 2/16 and cleaned the cell. It was reading accurately.
  - We installed a flow regulator on the sample discharge consistent with the operating manual to reduce bubble formation on both the Filter 1 effluent and clear well effluent turbidity meters. We opened the inlet isolation valves all the way and pinched on the discharge flow regulators to give optimum flows of 300 ml/min per the manual.
- Conduct a permanganate jar test:
  - Residence time in the CAC unit is 5.3 minutes. Residence time in the filter chamber is 11.4 minutes. We had concern that the residence time might not be enough to remove iron and manganese.
  - We prepared 6 jars with 0, 2.0, 2.5, 3.0, 3.5, and 4.0 ppm permanganate in raw water. We did not add polymer or alum. We did not allow the water to warm up before testing. We mixed the jars for 5 minutes to simulate the conditions in the CAC unit. The jars immediately turned yellow to yellow-red when the stirrers were started as shown in Figure 1. The color did not change even after considerable settling possibly indicating that residence time is adequate as shown in Figure 2.

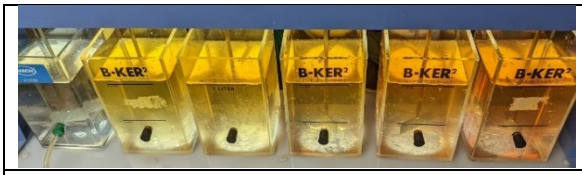

Figure 1 – Permanganate jar test immediately after mixing started.

Figure 2 – Jars after mixing for 5 minutes and settling for an additional 20 minutes.

  - We filtered about 100 ml of the 3.0 and 3.5 ppm solutions from the jar tests through 1.2 µm filter paper after settling for 10 minutes. The filtered water was clear from the 3.0 ppm permanganate jar as shown in Figure 3. The filtered water from the 3.5 ppm jar was slightly pink as shown in Figure 4 indicating there was more permanganate than could be reacted. This test indicated that the 3.0 ppm permanganate we were adding at the plant was near the optimum.

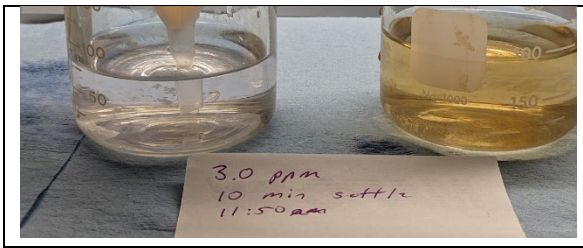

Figure 3 – Clear liquid after filtering 3.0 ppm permanganate jar after 10-minute settle.

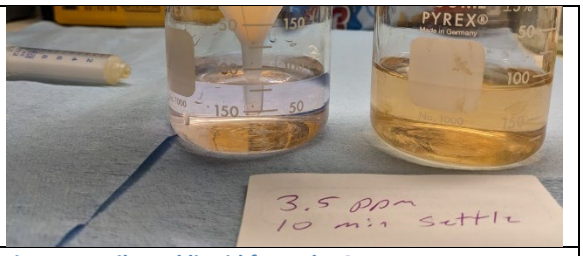

Figure 4 – Filtered liquid from the 3.5 ppm permanganate solution was a little pink. The solution faded but was still a little pink after 2 hours.

- We allowed the filtered samples to set for an extended time to see if there was additional iron or manganese that might be oxidized and turn the solution clear. The pink color did fade a little in 2 hours, but the sample was still pink indicating the bulk of the reaction happens within the 15 minutes mix/settle time we tested.
- Roy received the manganese test reagents on Friday and measured 0.3 ppm in the raw water, 0.0 in the filter effluent, and 0.4 in the clear well effluent. This supports that the CAC and filter arrangement are capable of removing the required manganese, but that we are somehow picking up manganese from the clear well. We have a brand-new sludge judge still in the box that we might use to see if there are particulates on the clear well floor that might partially explain what we are seeing.

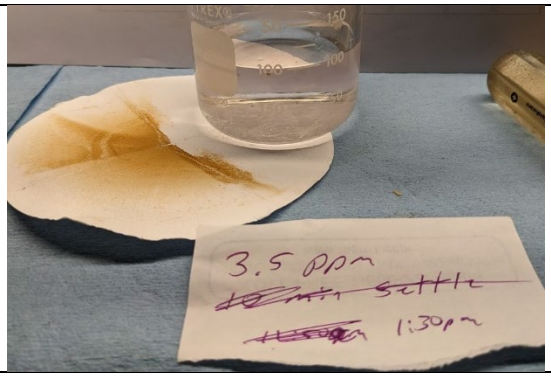

Figure 5 – Filtered 3.5 ppm permanganate sample has faded some after 2 hours, but is still pink. The filter paper shows the considerable iron and manganese removed from only 100 ml of filter water.

- The clear well effluent turbidity meter was reading 0.4 NTU with the high service pump on and off on Thursday. This is better than the 0.9-1.2 NTU it was reading before permanganate optimization, but the number is inconsistent so far and not as good as it needs to be. The clear well effluent will run in the 0.4 range for a while then jump to the 1.3 range. This is a key issue we need to understand. The filter effluent is running 0.05-0.1 NTU.

- Evaluate why the high service pumps are cycling so frequently:
  - We made a minor adjustment to the lead and lag high service pump settings to test the impact on pump cycling. We reduced the lead pump from 125 ft to 123 ft and the lag pump from 122 to 120 ft. The full set point was 128 ft and was not changed.
  - We noted alarms were not dated properly. We attempted to correct the system date and time. The only selection that seemed logical was the “config mode” button on the home screen, but this locked the system with a repeating “FactoryTalk View ME Station Shutting Down” message that wouldn’t clear. The PLC continued to run, but we lost view on the HMI (Human Machine Interface) sub-panel. The plant was shut down using the main panel and the power was cycled to the PLC to reset it. We found that the UPS system is completely dead and non-functional. The system needs to be corrected as there should be no button that locks the system on the operator panel.
  - We had to close the filter to waste valve at the PLC station after restart even though the filtered water quality was good. There may be a time delay in the program. I need to review the PLC ladder logic to understand what it is doing and what we need to improve. We are building a list of necessary enhancements.
  - Another necessary enhancement is an alarm enunciator in the plant. The clear well level is also not wired into the PLC. We cleaned the filter effluent turbidity cell without using the cleaning

program that sends a false high turbidity signal to the PLC, but the system did not route the filter to waste with needs to be followed up on.

- Understand what caused loss of system pressure to make sure it can't happen again:
  - Loss of system pressure occurred when the clear well level instrument failed. The high service pumps would not start with the malfunctioning clear well level instrument and resulted in the tank going empty. An alarm on the tank level with callout to operator using the phone dialer would help prevent a reoccurrence. Noting the tank level on the daily paperwork may also help.
  - We blew out the pressure sensor at the base of the elevated tank. The instrument was active and read 53.0 psig (122 ft) which is consistent with where the level is operating. A small amount of orange water was purged before the stream ran clear.
  - There was a pressure gauge on the system that read only 40 psig. We need to put a new gauge on so we have a way to verify the instrument. We discussed the need to verify the level instrument routinely. Weekly is probably a reasonable frequency. We will add this to the weekly paperwork.
- CAC flush frequency:
  - We observed a CAC flush and again the effluent was darker than hot chocolate even after the flush was complete. The dark material was on top of the filter. We conducted a second flush and the top of the CAC unit looked reasonable after the second flush.
  - We reduced the flush cycle time from 1200 to 600 minutes to help avoid the overly dark water from entering the filter.
  - We observed some beads on top of the CAC unit during the flush cycle. They were concentrated on the west side. The screen holding them in place appears to be aluminum and we have a concern that it may not hold up. This will be an area to monitor closely.

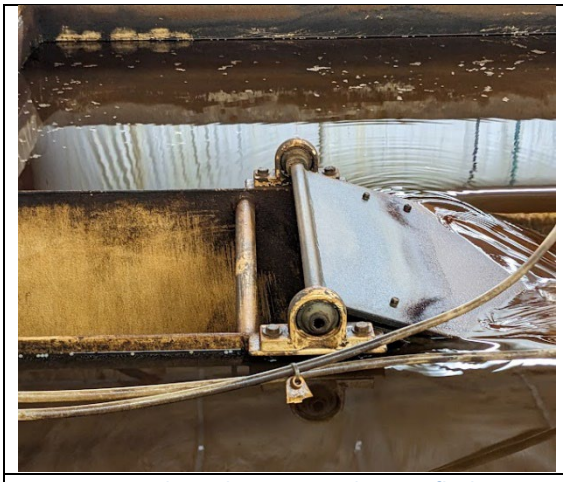

Figure 6 – Beads on the CAC unit during a flush.

- Fix leak on the LMI permanganate pump:
  - Roy and I tested a spare 20 GPH LMI pump and verified good function. The existing pump is leaking around the diaphragm. Roy has found repair kits on USA Blue Book that we can use to fix the leaking pump and repair two other pumps that have cracked heads.
- Get photos of SCADA schematics / wiring diagrams for future troubleshooting. In progress.
- Install and run in air dryer with the recommended particulate filter on discharge. In progress.
- Start troubleshooting the Bray positioners to understand their high failure rate.
  - I took one back to Forsyth for testing.

    - Roy has found that a pilot assembly inside the positioner is fouling up and causing the malfunctions. Repair kits have not been found yet. The new air dryer with discharge filter should help. Small filters at these positioners may be another option if issues continue.
- Troubleshoot ALUM pump slow pumping about 25% of pump curve. Check what we have for spare parts and what we might be able to fix. In Progress.
- Prepare Diagram with parts list for chlorine system repairs. In Progress.
- Check permanganate down-gauge:
    - We increased the pump rate from 28 to 30% on the pump. The filter effluent stayed clear.
    - 270 ml/min at 30% which equates to 3.2 ppm permanganate.
    - We tested the system at 32%, but the filter effluent started to get a little pink hue. We turned it back to 30%.
- Inspect the three Bray 5-way solenoid valves:
    - All three appeared to work as expected which may indicate the original issues were air pressure instead of the solenoids. What we found includes:
        - The first solenoid was labeled on 1/7/22 that it opens but won't close. Partial disassembly indicated the pilot piston was a little dirty but moved freely. The main armature moved freely. Appling air to port 1 routed air out of port 4 as would be expected. Energizing the solenoid would route air to port 2 as it should, but it does require a little backpressure on port 4. With no pressure in the system, there is no pressure to actuate the pilot piston.
        - The next valve was labeled as replaced in 9/18/21. It worked like the first valve.
        - The final valve had a note that it opens and closes backward. It worked like the other two. It appears the solenoids could be mounted to reverse the direction of the valve, but we will have to check the gasket when one is dissembled to know for sure.