RHINEGEIST BREWERY WASTEWATER PRETREATMENT

SWOWEA Industrial Waste Seminar
1/27/2022

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OVERVIEW

- Brewery Wastewater pH
- pH Control Project
- Brewery Organic Solid Waste
- High Strength Waste Project

BREWERY WASTEWATER pH

Increasing Alkalinity

Neutral

Increasing Acidity

CIP Caustic

Water

Wort

CIP Peracetic

CIP Acid

pH CONTROL PROJECT – BACKGROUND

OPPORTUNITY

1. Wastewater effluent needs to remain between 5.0 – 12.5 per our Wastewater Discharge Permit

GOALS

1. Minimize equipment footprint
2. Mitigate construction & operational costs
3. Install as quickly as possible
4. Post-project implementation effluent is between 5 and 12.5

CONSTRAINTS

1. Equipment shall be installed in the basement
2. Equipment shall fit within the freight elevator (8’ x 11.5’ x 14’)

pH CONTROL PROJECT – DESIGN CONSIDERATIONS

1. **Equalization Tanks**
    1. Wastewater hold-up volume
    2. Material
    3. Size
    4. Quantity

2. **Solids Settling**
    1. Recirculation via pumping or agitation via mixer

3. **Chemical Dosing System**
    1. Gravity-fed from bulk storage tanks, one floor above
    2. Pumped from individual chemical drums in basement

4. **Control & Alarming**

5. **Data Collection & Reporting**

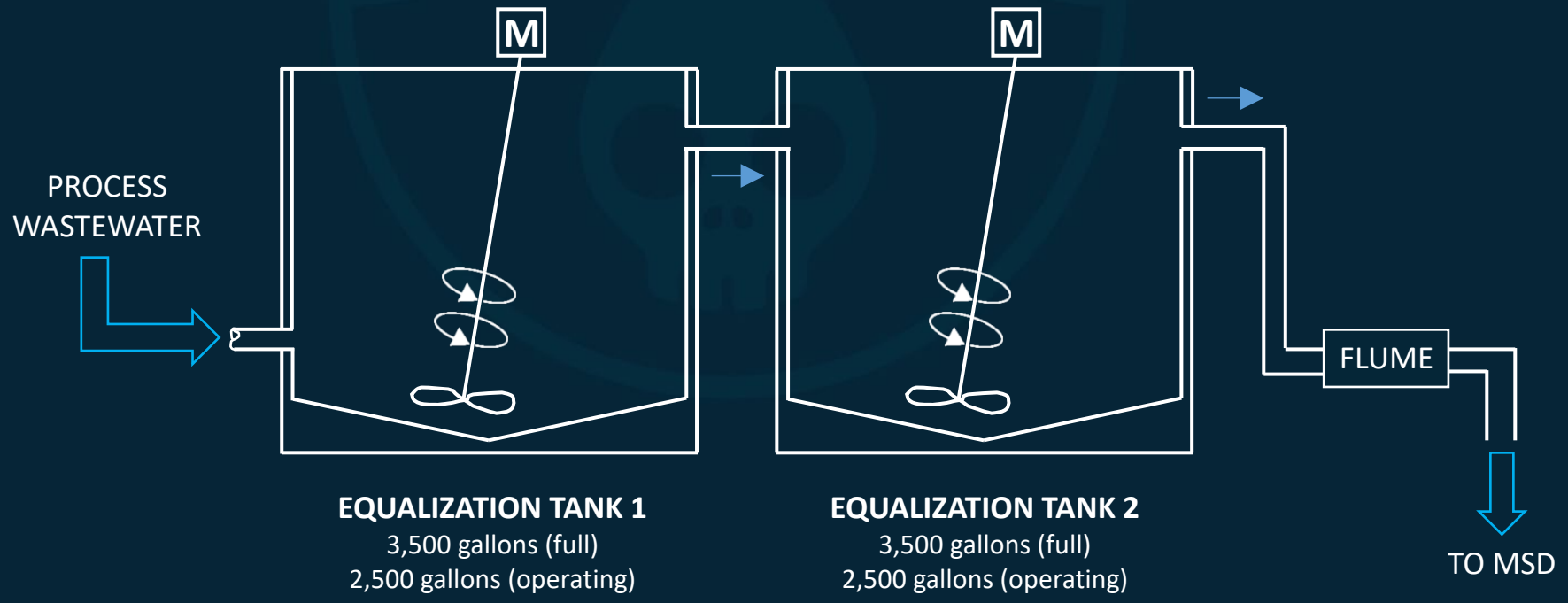
pH CONTROL PROJECT – SCOPE

1. **Equalization Tanks**
    1. Two (2) 3,500-gallon tanks
        1. Double-walled fiberglass
        2. Agitator/motor/VFD to keep solids in circulation
        3. pH probe
2. **Chemical Dosing System**
    1. Pumped via peristaltic pumps from individual drums in basement
3. **PLC**
    1. HMI Screen
    2. Trending
    3. Remote monitoring (PC, no mobile access)
4. **Motor Control Center**
    1. VFDs

pH CONTROL PROJECT - OVERVIEW

BEFORE

AFTER



EQUALIZATION TANK 1
3,500 gallons (full)
2,500 gallons (operating)

EQUALIZATION TANK 2
3,500 gallons (full)
2,500 gallons (operating)

pH CONTROL PROJECT – EQ TANKS

EQUALIZATION TANKS
DELIVERY

EQUALIZATION TANKS
SET IN PLACE

pH CONTROL PROJECT – CHEMICAL DOSING

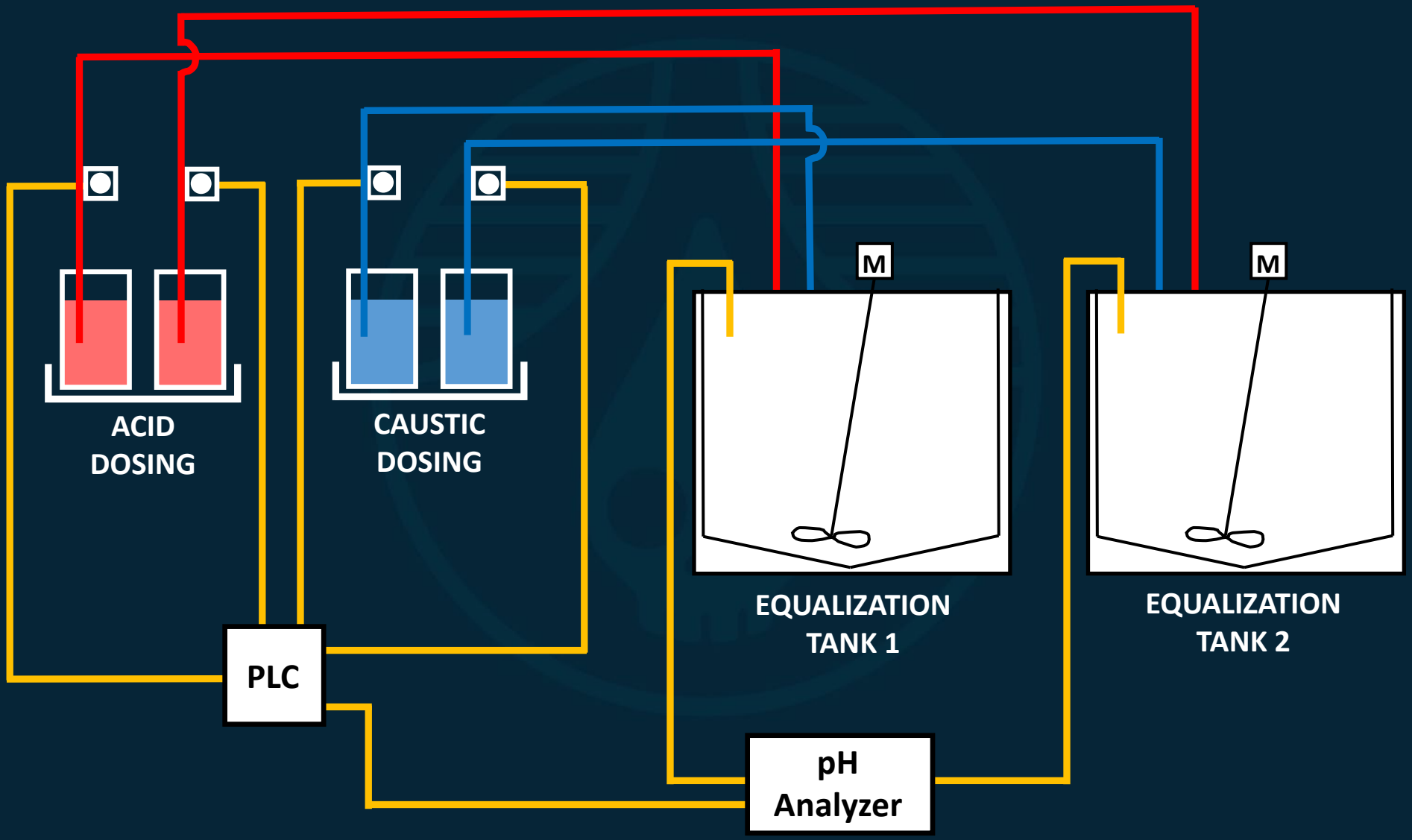
CHEMICAL DOSING PUMP
- 4 TOTAL PUMPS

CAUSTIC DRUMS
- 2 IN OPERATION
- 2 SPARES

ACID DRUMS
- 2 IN OPERATION
- 0 SPARES

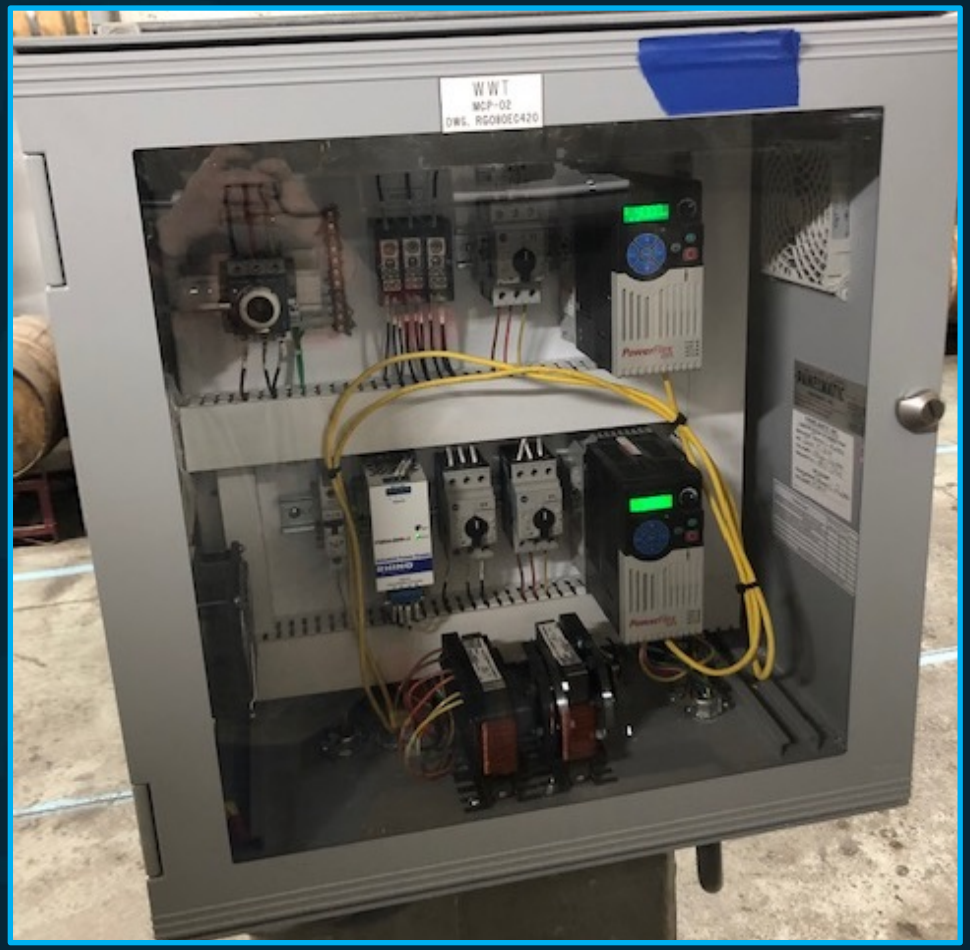
SECONDARY CONTAINMENT

pH CONTROL PROJECT - CHEMICAL DOSING



pH CONTROL PROJECT – PLC & MCC

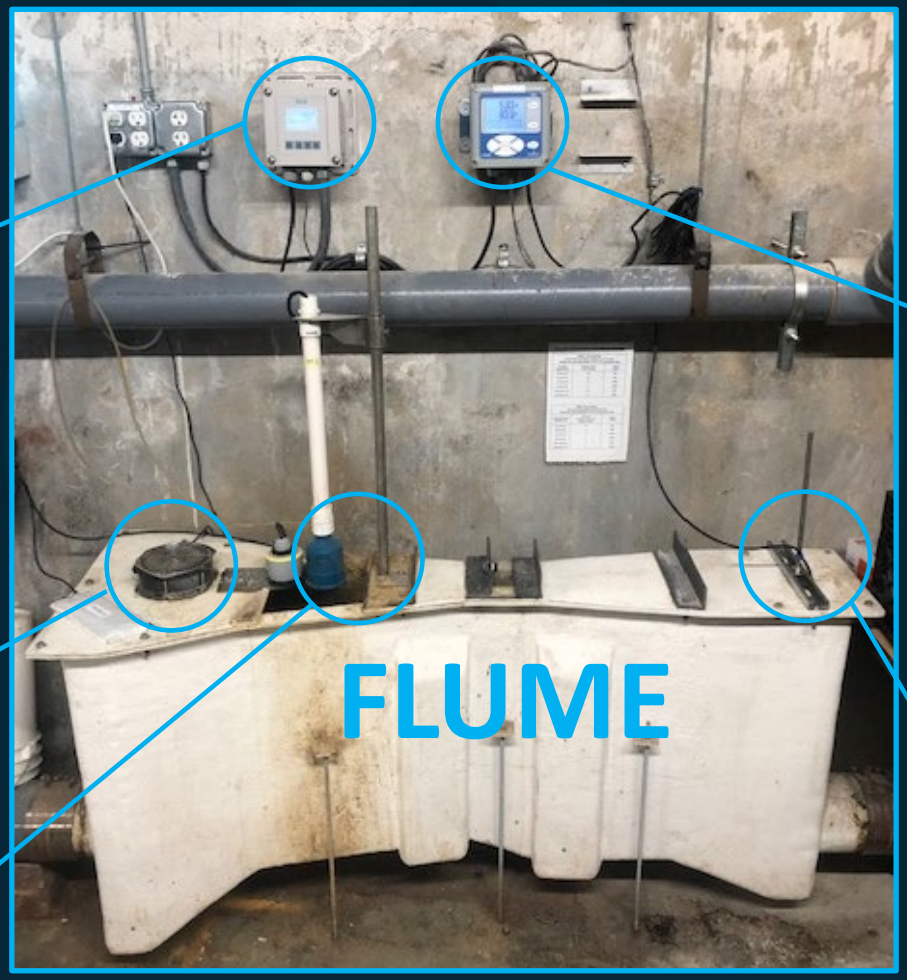
PROGRAMMABLE LOGIC CONTROLLER (PLC)



MOTOR CONTROL CENTER

pH CONTROL PROJECT
MONITORING & SAMPLING LOCATION

FLOW ANALYZER
- INSTANTANEOUS FLOW RATE
- HEAD
- TOTALIZED FLOW



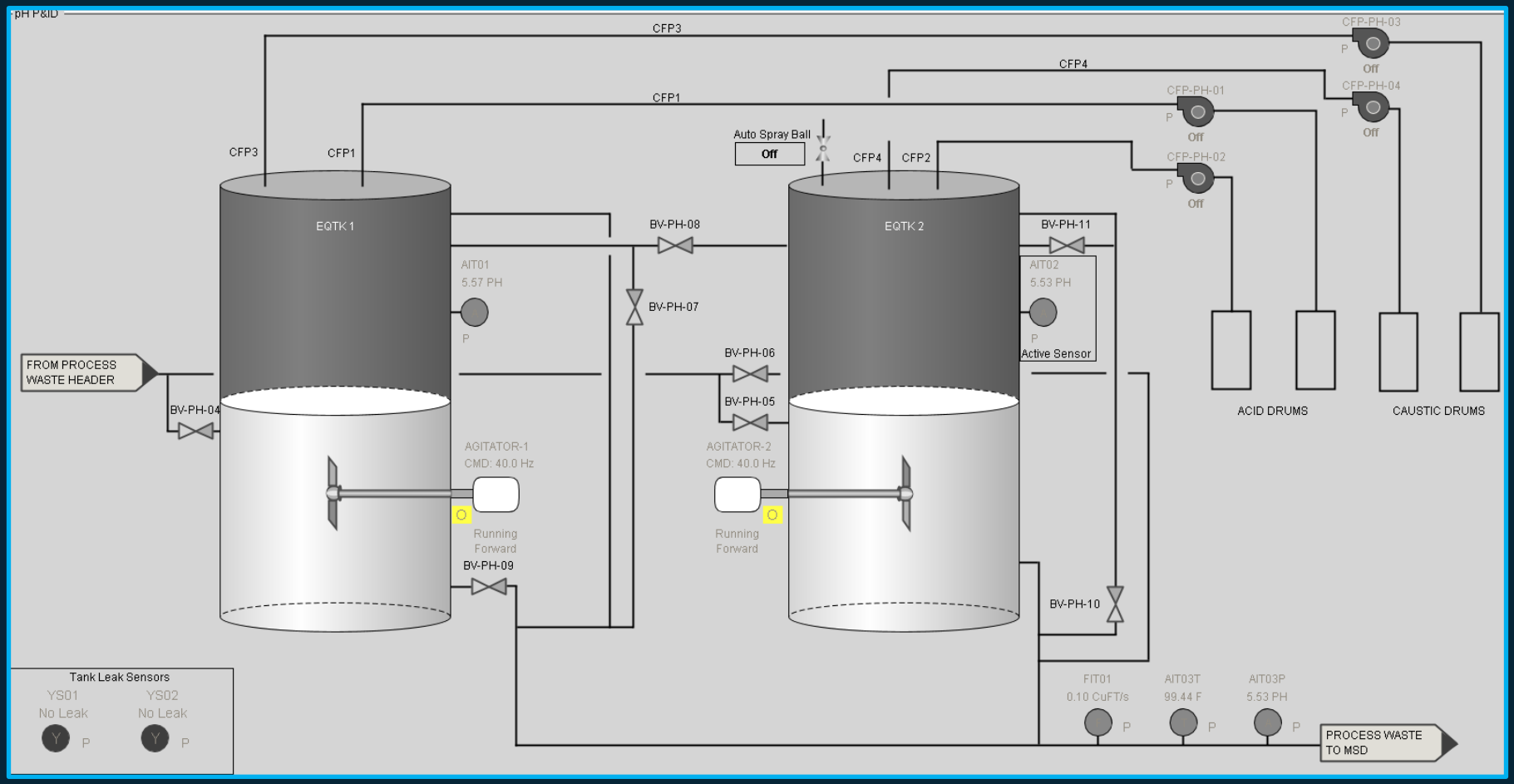
pH ANALYZER
- pH
- TEMPERATURE

FLUME FAN

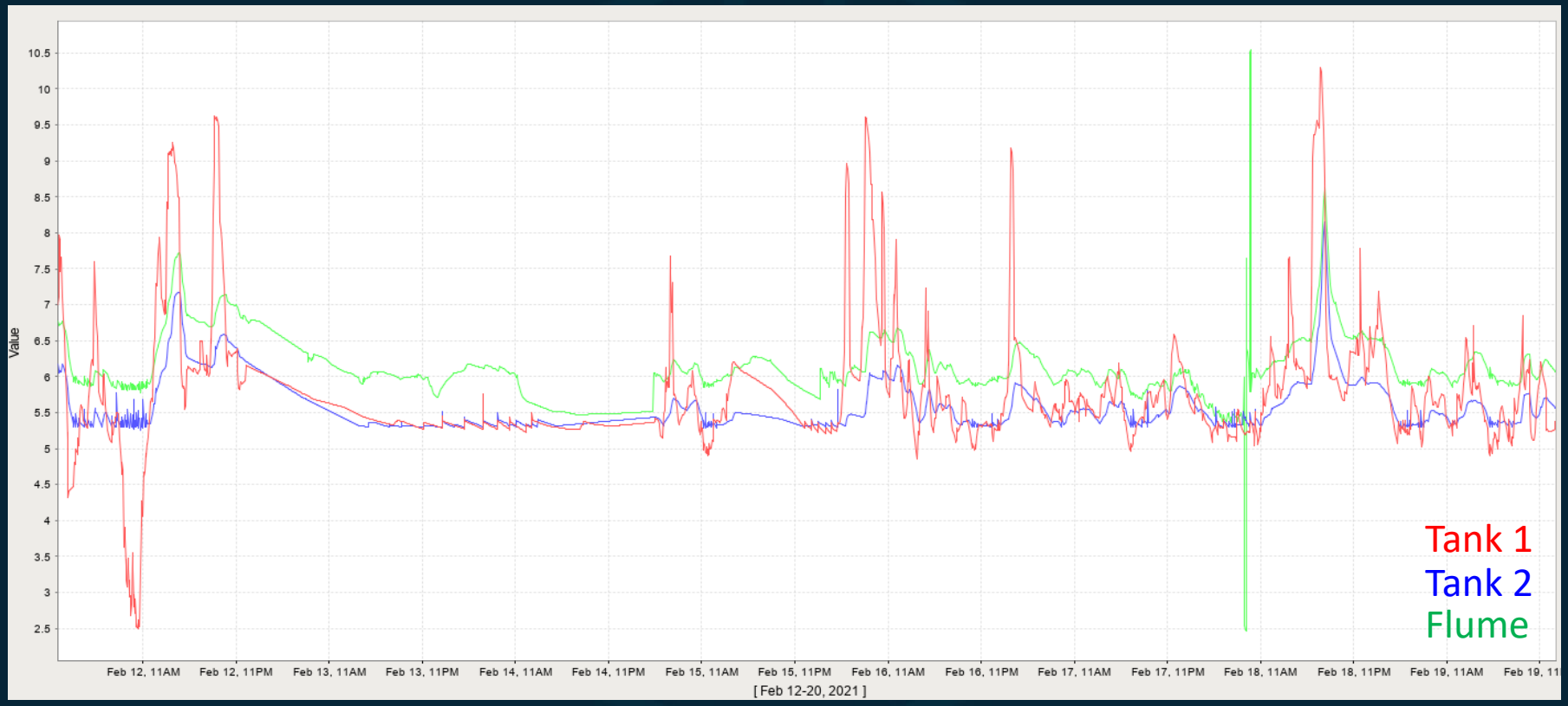
ULTRASONIC FLOW METER

pH PROBE (inside flume)

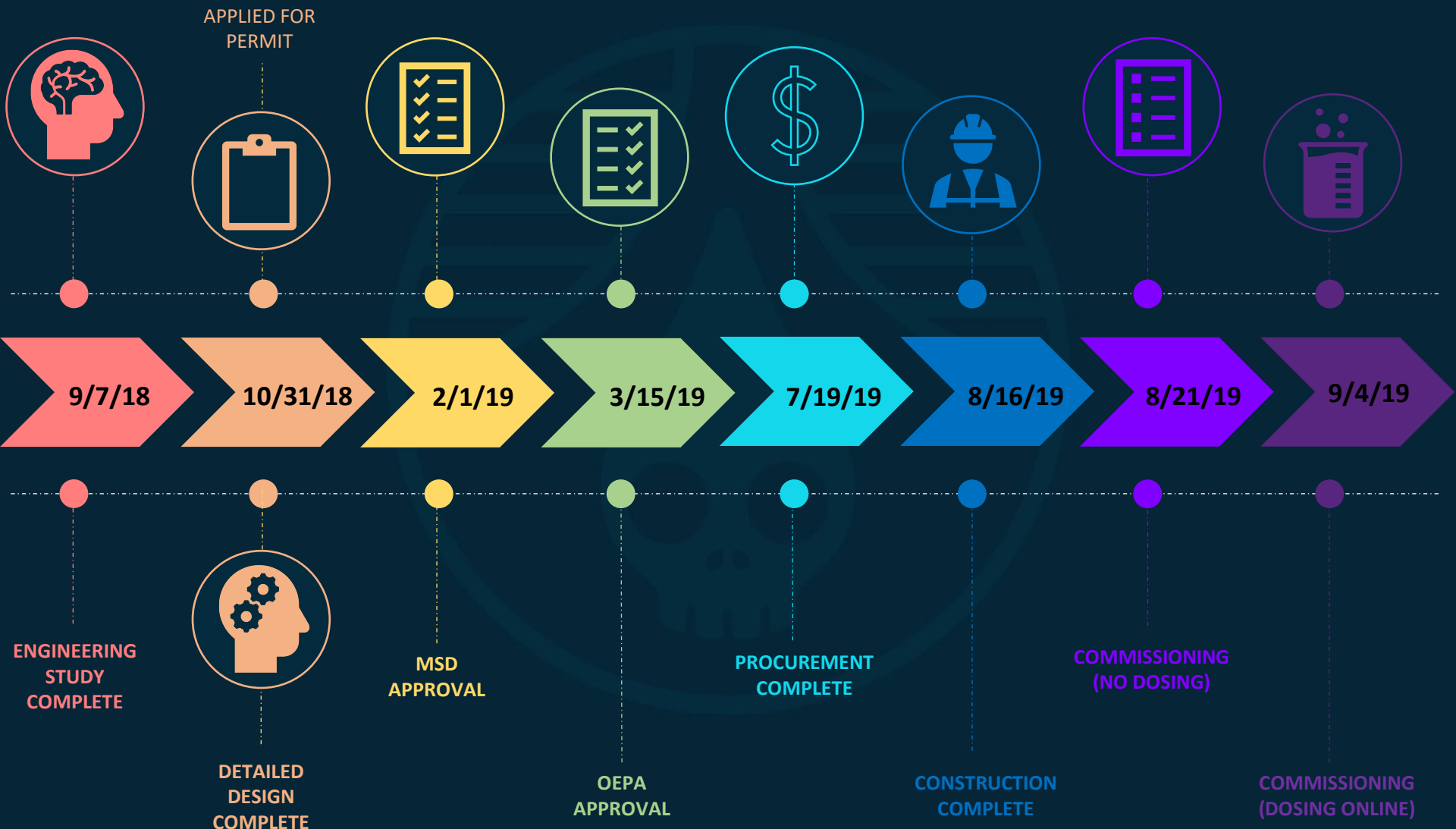
pH CONTROL PROJECT – IGNITION PROCESS SCREEN



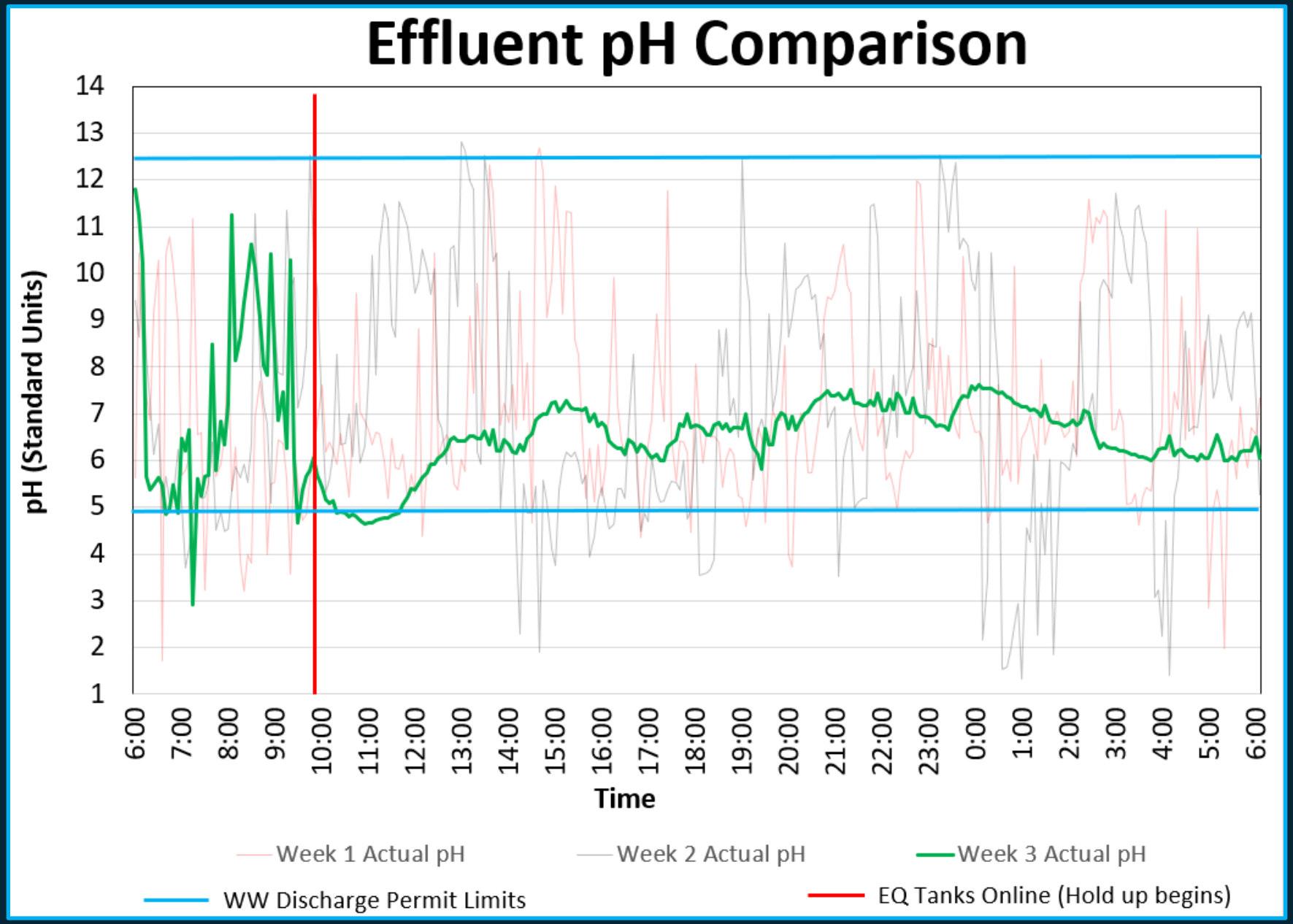
pH CONTROL PROJECT – IGNITION TRENDING



pH CONTROL PROJECT - TIMELINE



pH CONTROL PROJECT – RESULTS



pH CONTROL PROJECT – OPTIMIZATION

1. **Noise Reduction**
    1. Installed RFI suppressors, due to pH probe flickering

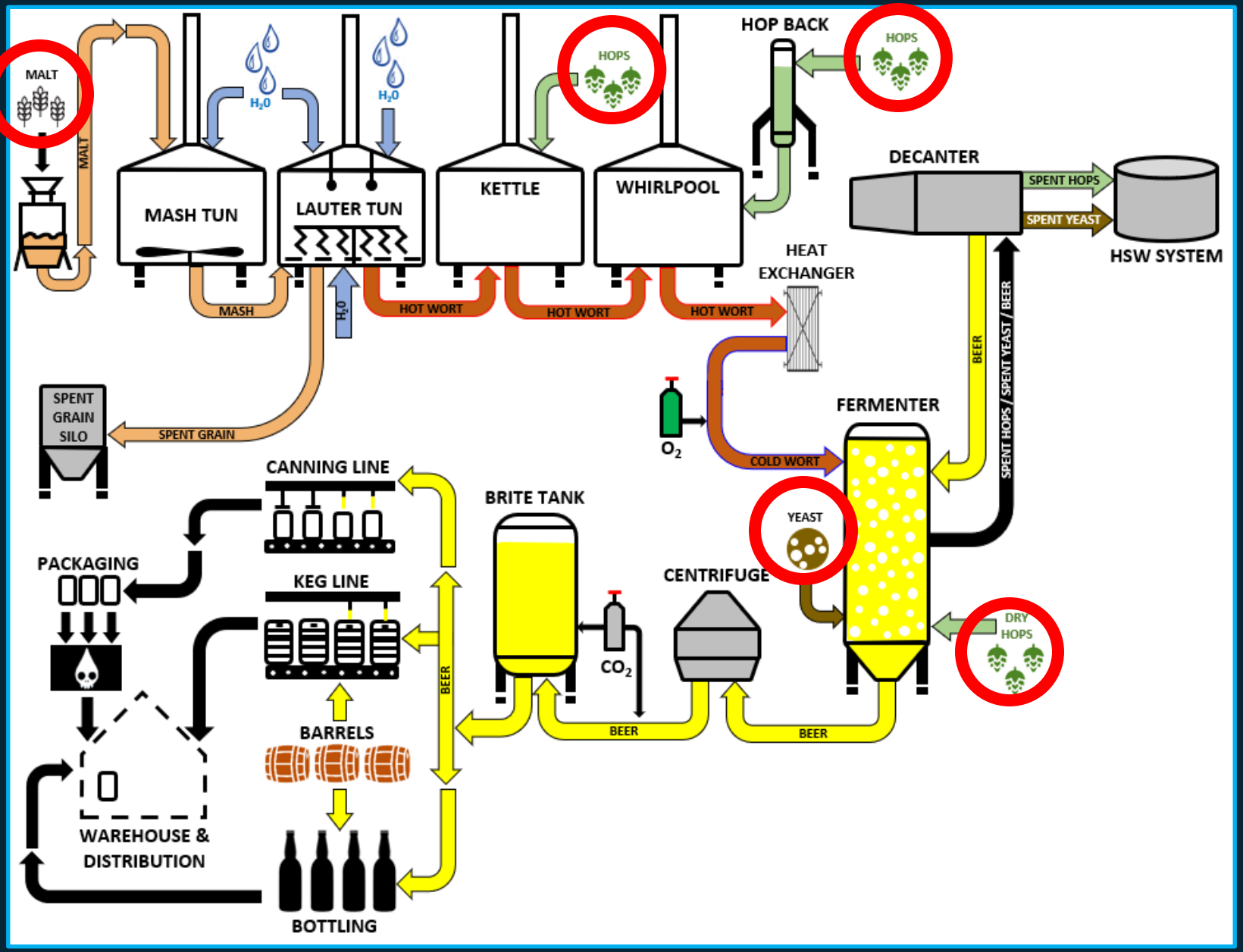
2. **pH Probe Cable**
    1. Ordered longer cable (20’ to 30’ foot) to allow calibration on floor level

3. **Chemical Dosing Drum Inventory**
    1. Incorporated physical checks of drum levels over the weekend and during shifts outside of first shift

4. **Flume Fan Installation**
    1. Installed fan on flume (upstream of ultrasonic flow meter) to blow CO_2 out of flume that was causing effluent pH to decrease during no flow timeframes over the weekend

5. **Peristaltic Pump Preventive Maintenance**
    1. Increased frequency of PMs on peristaltic (dosing) pumps. Replace internal pump tubing once every 3-6 months

BREWERY ORGANIC SOLID WASTE



WASTEWATER SURCHARGES & DISCHARGE LIMITS

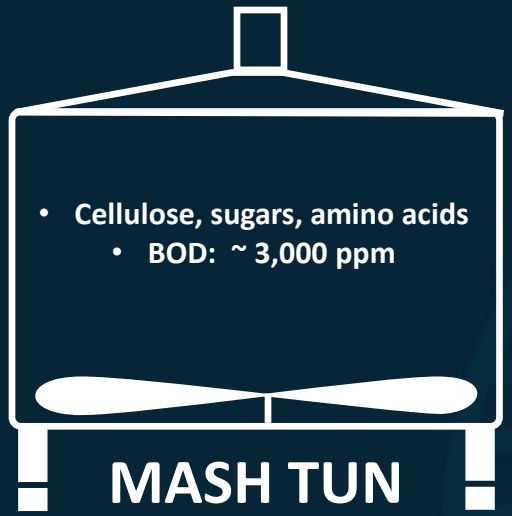
SURCHARGE CONSTITUENTS

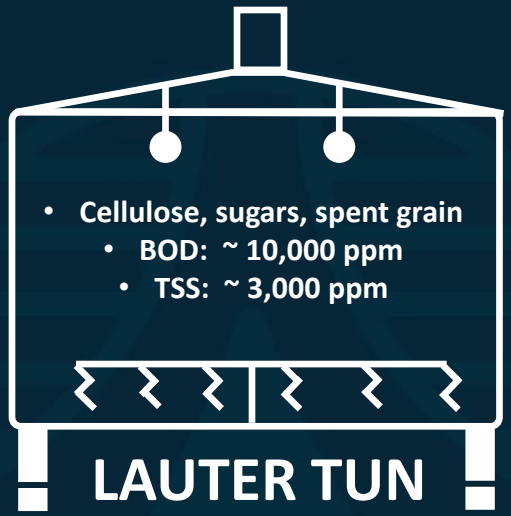
1. TSS – Total Suspended Solids
2. BOD – Biochemical Oxygen Demand
3. TKN – Total Kjeldahl Nitrogen

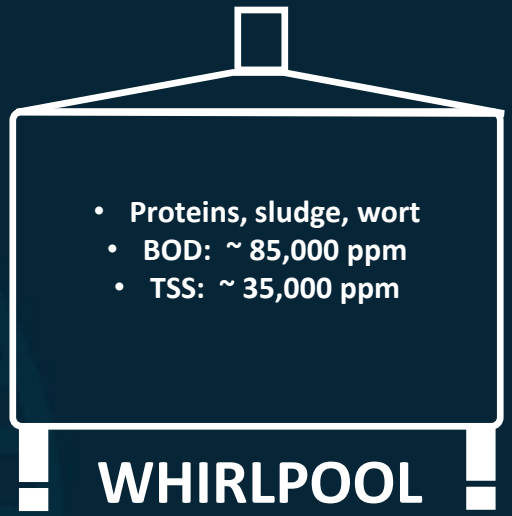
SURCHARGE RATES & THRESHOLDS

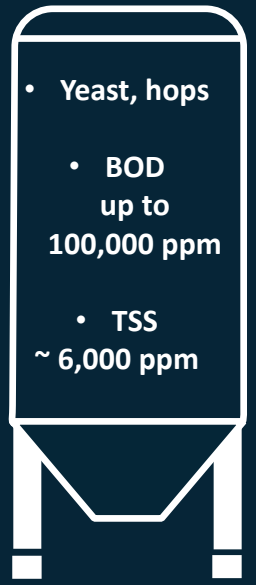
WASTEWATER CONSTITUENT	SURCHARGE RATE	THRESHOLD
TOTAL SUSPENDED SOLIDS (TSS)	$0.002756 per CCF for each mg/L above threshold	300 mg/L
BIOCHEMICAL OXYGEN DEMAND (BOD)	$0.004707 per CCF for each mg/L above threshold	240 mg/L
TOTAL KJELDAHL NITROGEN (TKN)	$0.004122 per CCF for each mg/L above threshold	25 mg/L

BREWERY HSW STUDY









CONSTITUENT	THRESHOLD
TSS	300 mg/L
BOD	240 mg/L
TKN	25 mg/L

HSW PROJECT – BACKGROUND

OPPORTUNITIES

1. Surcharges begin in January 2021

GOALS

1. Minimize wastewater surcharges
2. Minimize equipment footprint
3. Mitigate construction & operational costs
4. Install as quickly as possible

CONSTRAINTS

1. Basement equipment shall be installed directly south of pH tanks
2. Basement equipment shall fit within the freight elevator (8’ x 11.5’ x 14’)
3. No additional footprint required for storage in shipping/receiving area

HSW PROJECT – DESIGN CONSIDERATIONS

1. **Storage Tank(s)**
    1. Storage Volume
    2. Material
    3. Size(s)
    4. Quantity

2. **Solids Settling**
    1. Recirculation via pumping or agitation via mixer

3. **Solids conveyance**
    1. Getting solids to storage tank
    2. Pumping from storage tank to tanker

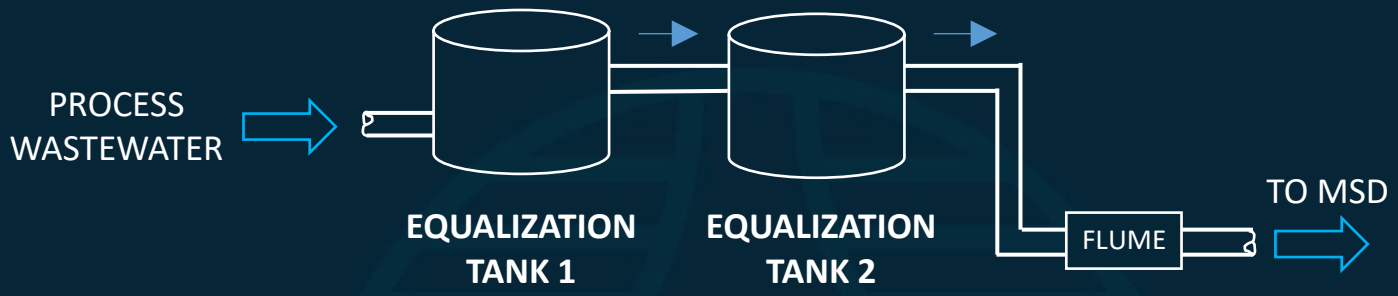
4. **Control & Alarming**

HSW PROJECT – SCOPE

1. **Storage Tanks**
    1. 3,500-gallon tank in basement
        1. Double-walled fiberglass
        2. Agitator/motor/VFD to keep solids in circulation
    2. 7,200-gallon tank outside (between brewery & boiler building)
2. **HSW Pumps**
    1. Base Mounted End Suction Centrifugal Pump
        1. Transfers HSW from Tank 1 (basement) to Tank 2 (outside)
    2. Close Coupled In-Line Centrifugal Pump
        1. Transfers HSW from Tank 2 (outside) to HSW tanker
3. **PLC**
    1. Tie into existing PLC (same one used for pH control system)
4. **HSW Hauling**
    1. Trucked to a methane digester on a Poultry Farm in Fort Recovery, OH

HSW PROJECT - OVERVIEW

BEFORE



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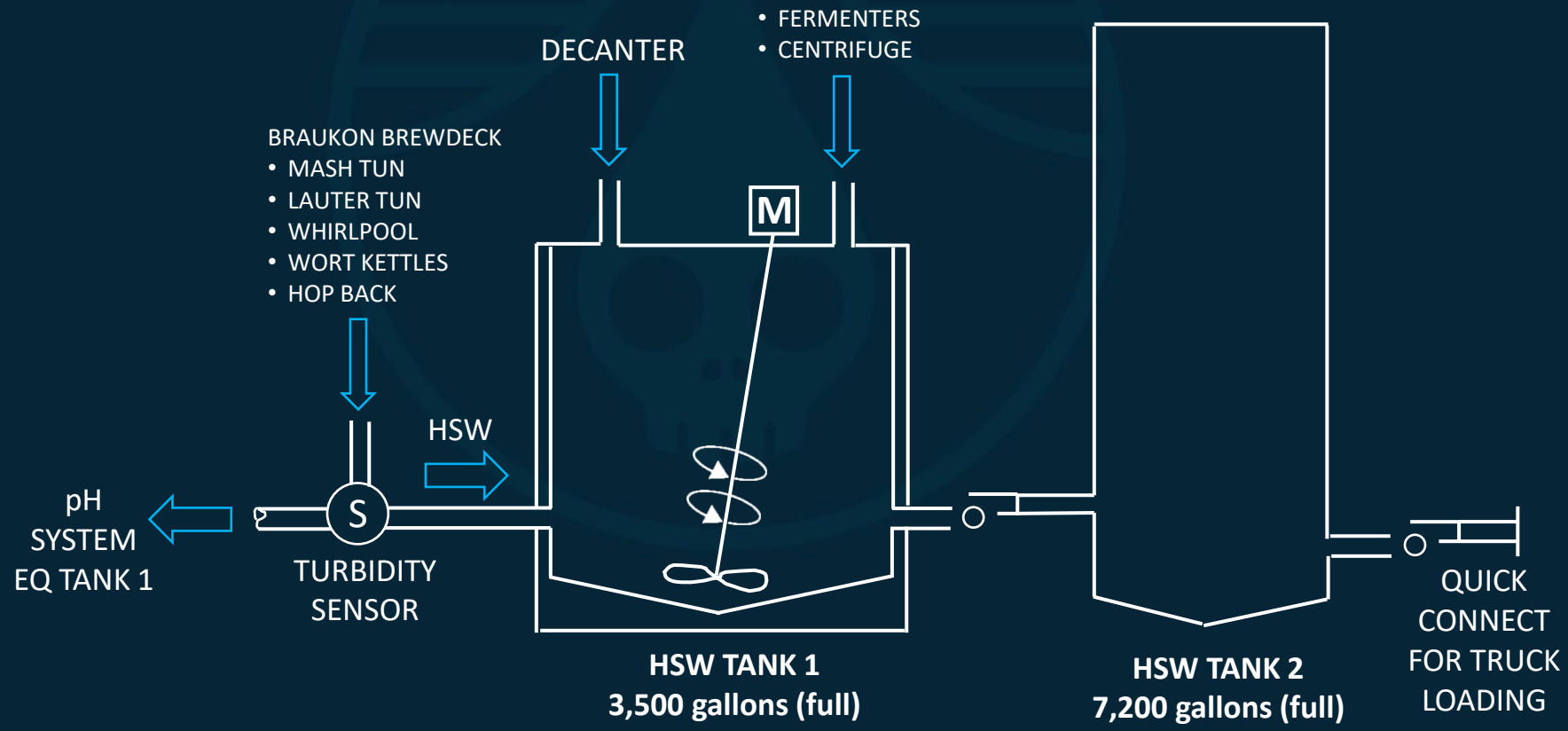
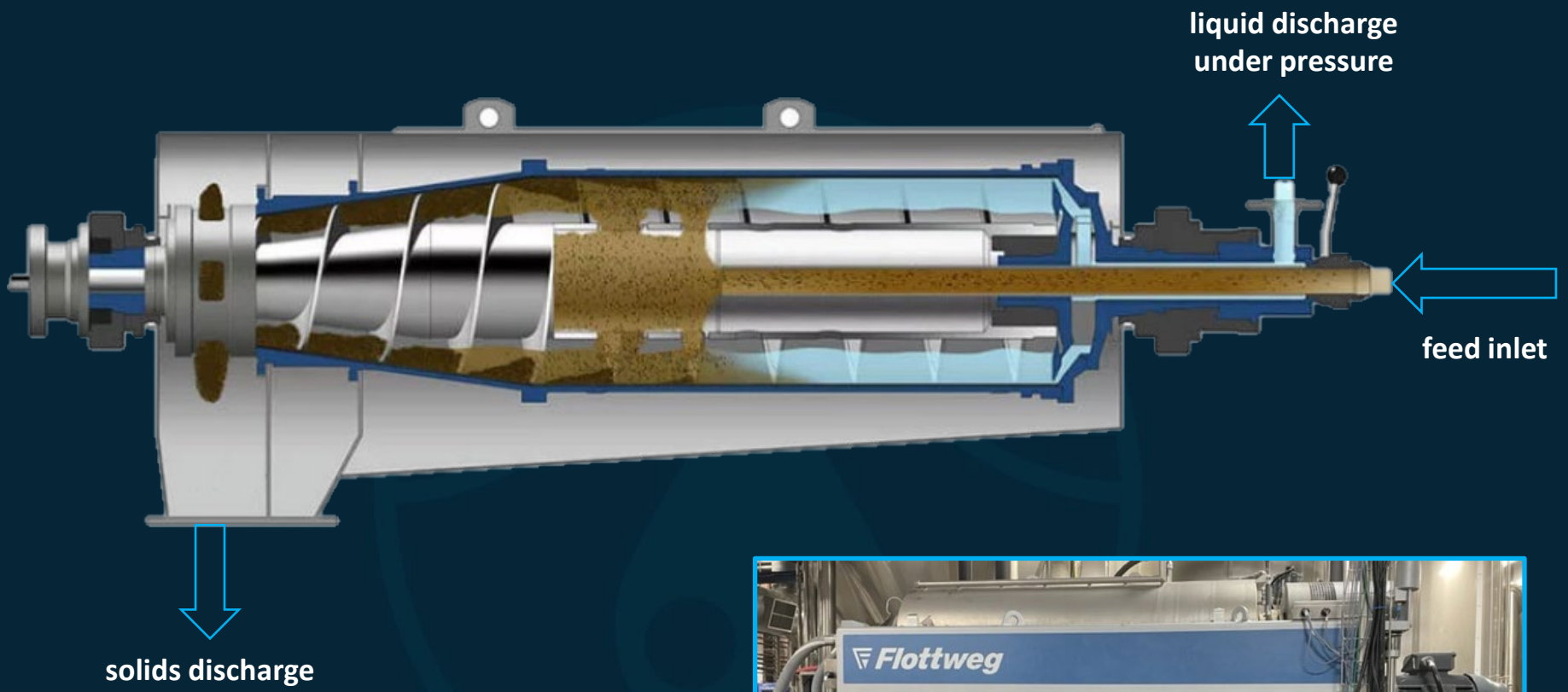
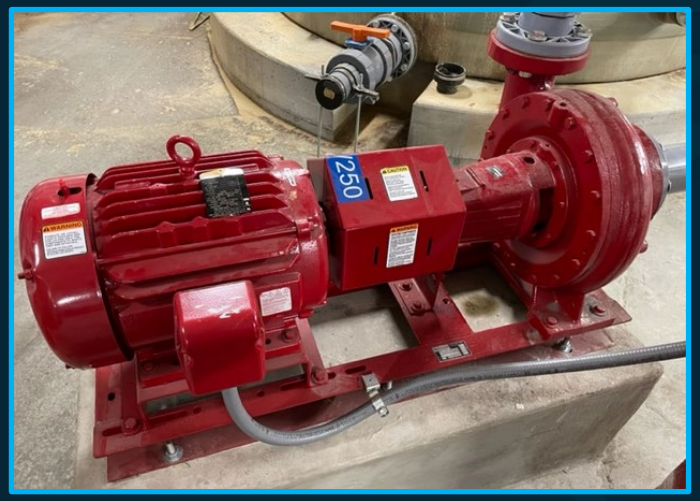


HSW PROJECT - DECANTER



HSW PROJECT – PUMPS & TRUCK LOADING



PUMP 1 - BASEMENT

- FLOW: 200 GPM
- HEAD: 60 FT
- HP: 7.5
- RPM: 1200

TRUCK LOADING PUSHBUTTON STATION

PUMP 2 BOILER BUILDING

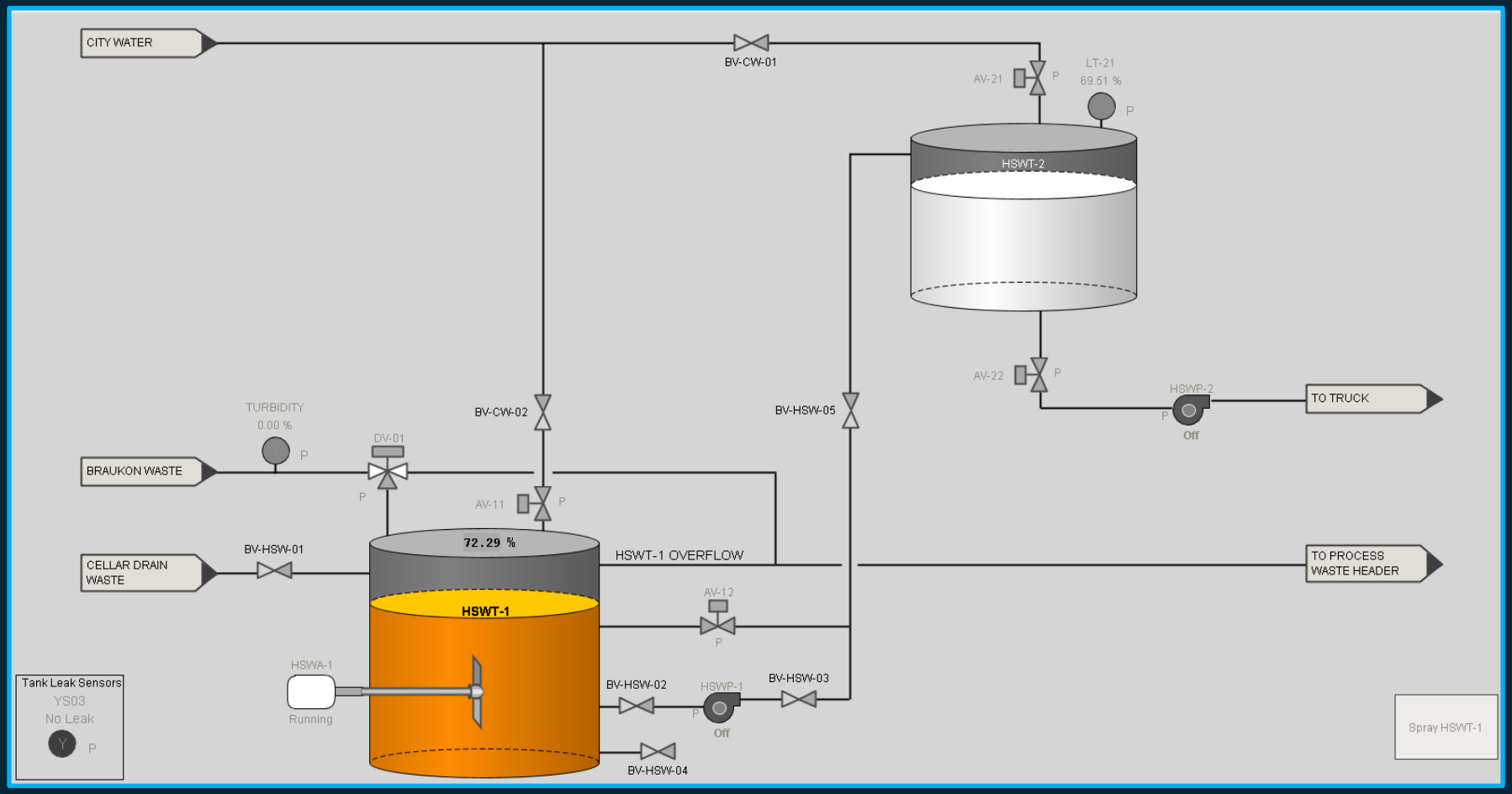
- FLOW: 300 GPM
- HEAD: 20 FT
- HP: 5
- RPM: 1800

HSW PROJECT – STORAGE TANKS

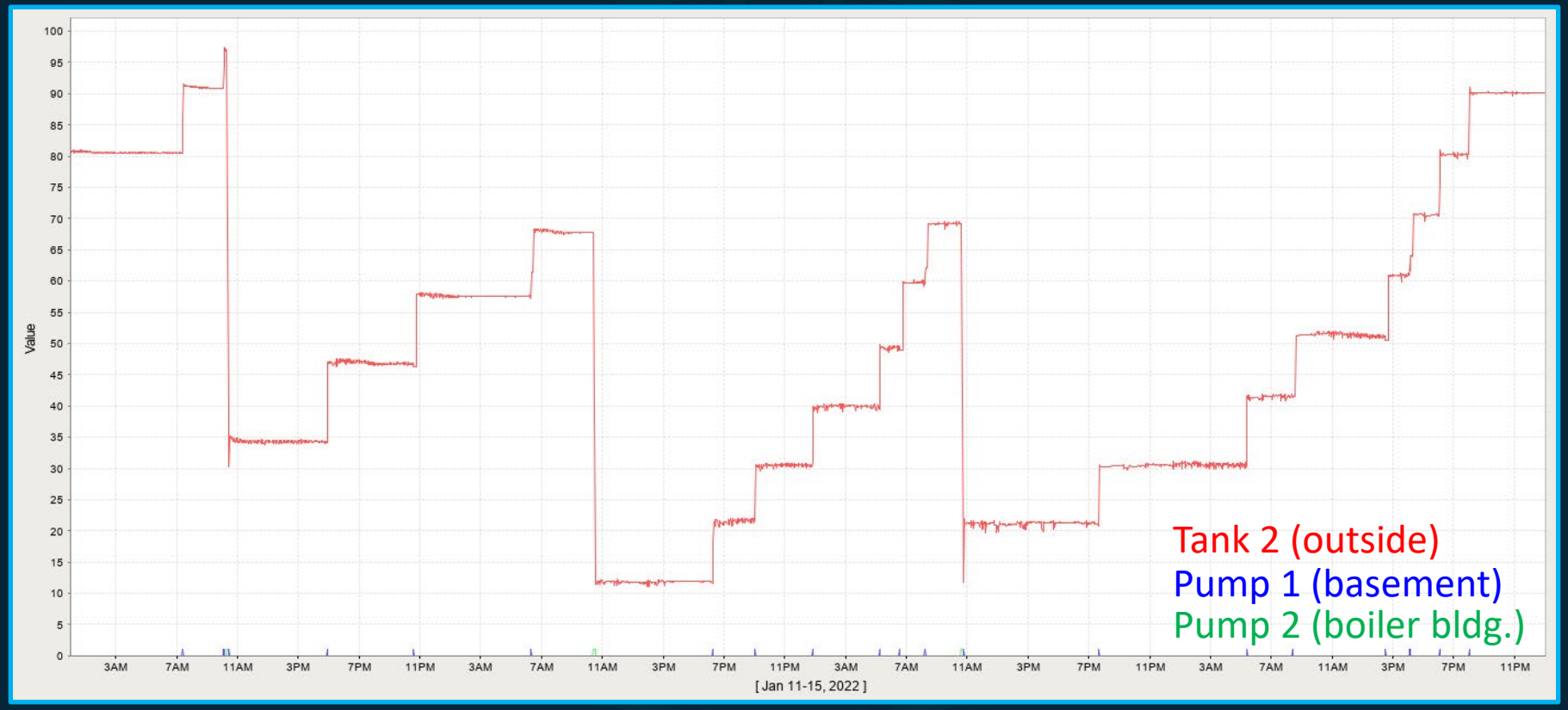
TANK 1 - BASEMENT

TANK 2 - OUTSIDE

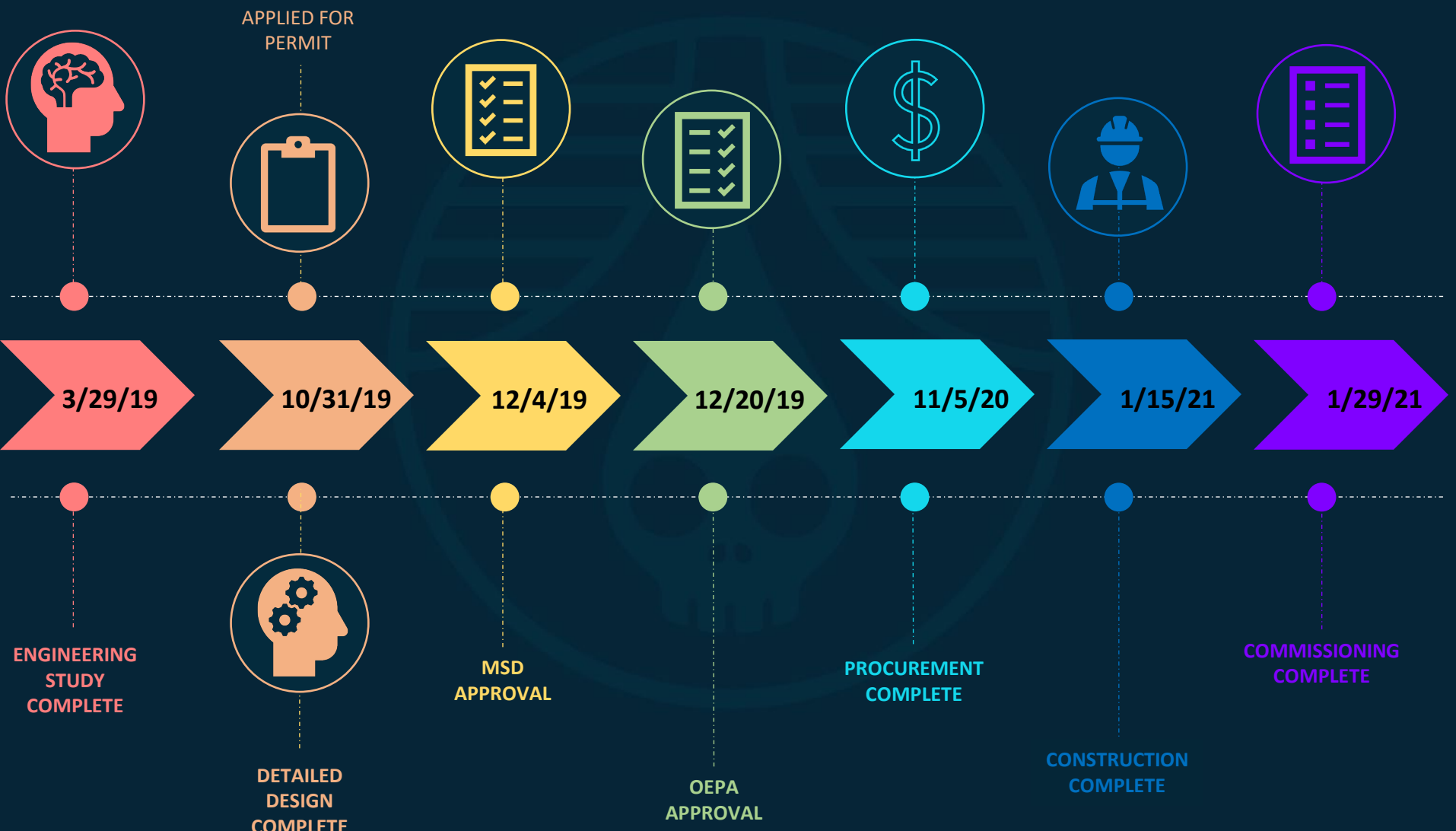
HSW PROJECT – IGNITION PROCESS SCREEN



HSW PROJECT – IGNITION TRENDING



HSW PROJECT - TIMELINE



HSW PROJECT – RESULTS

1. **SURCHARGE MITIGATION**
   - a) **Pre-HSW Project**
     1. July 2020 sampling:
        1. Surcharge Rate: Serves as a baseline, pre-project implementation
        2. Estimated annual surcharge costs: over $1,000,000
   - b) **Post-HSW Project**
     1. March 2021 sampling:
        1. Reduction in baseline surcharge rate: 56%
        2. Estimated annual surcharge savings: over $600,000
     2. Dec 2021 sampling:
        1. Reduction in baseline surcharge rate: 61%
        2. Reduction from March 2021 rate: 12%
        3. Estimated annual surcharge savings: over $650,000

2. **SIDESTREAMED HSW (spent hops/yeast slurry)**
   - a) Over 850,000 gallons in 2021

HSW PROJECT – OPTIMIZATION

1. **Tank 1 (basement) level measurement**
    1. Issue with only knowing when tank was at high and low levels, nothing in between.
    2. Replaced level sensor (floats) with radar level sensor

2. **Tank 1 (basement) manual pump to Tank 2 (outside)**
    1. Issues with moving volume from Tank 1 to Tank 2 (highly manual process)
    2. Added a button to the HMI that enables us to move liquid from Tank 1 to Tank 2, to ensure we get a full HSW truck every time.

3. **HSW Pump 2 (in boiler building)**
    1. Issues with solids settling in the cone of the tank, causing longer truck pump outs or durations that the trucker is onsite
    2. Swapped out the 3hp motor to a 5hp; increased the impeller size

WASTEWATER SYSTEMS - BASEMENT

PRE-PROJECT INSTALLATIONS

POST-PROJECT INSTALLATIONS


THANK YOU