



# **A.J. Brown Wastewater Treatment Plant Condition Assessment**



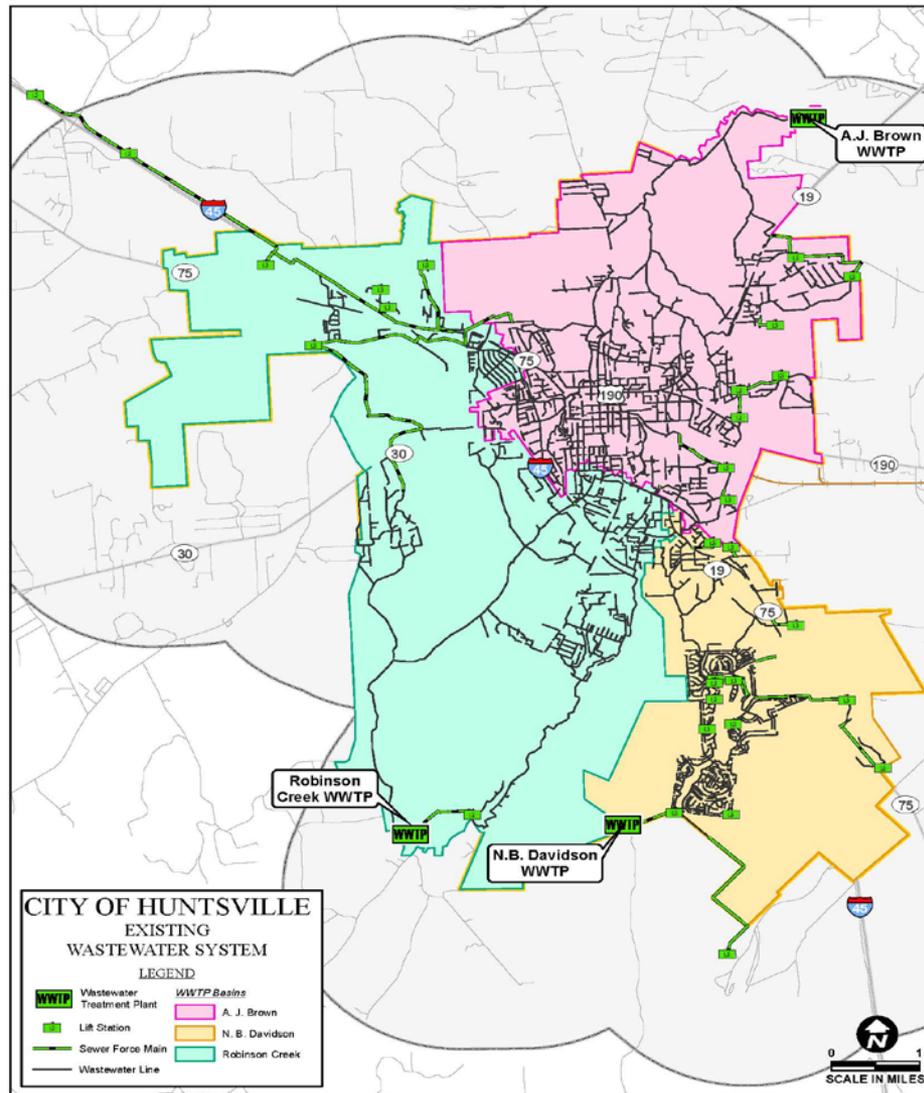
**November 16, 2015**



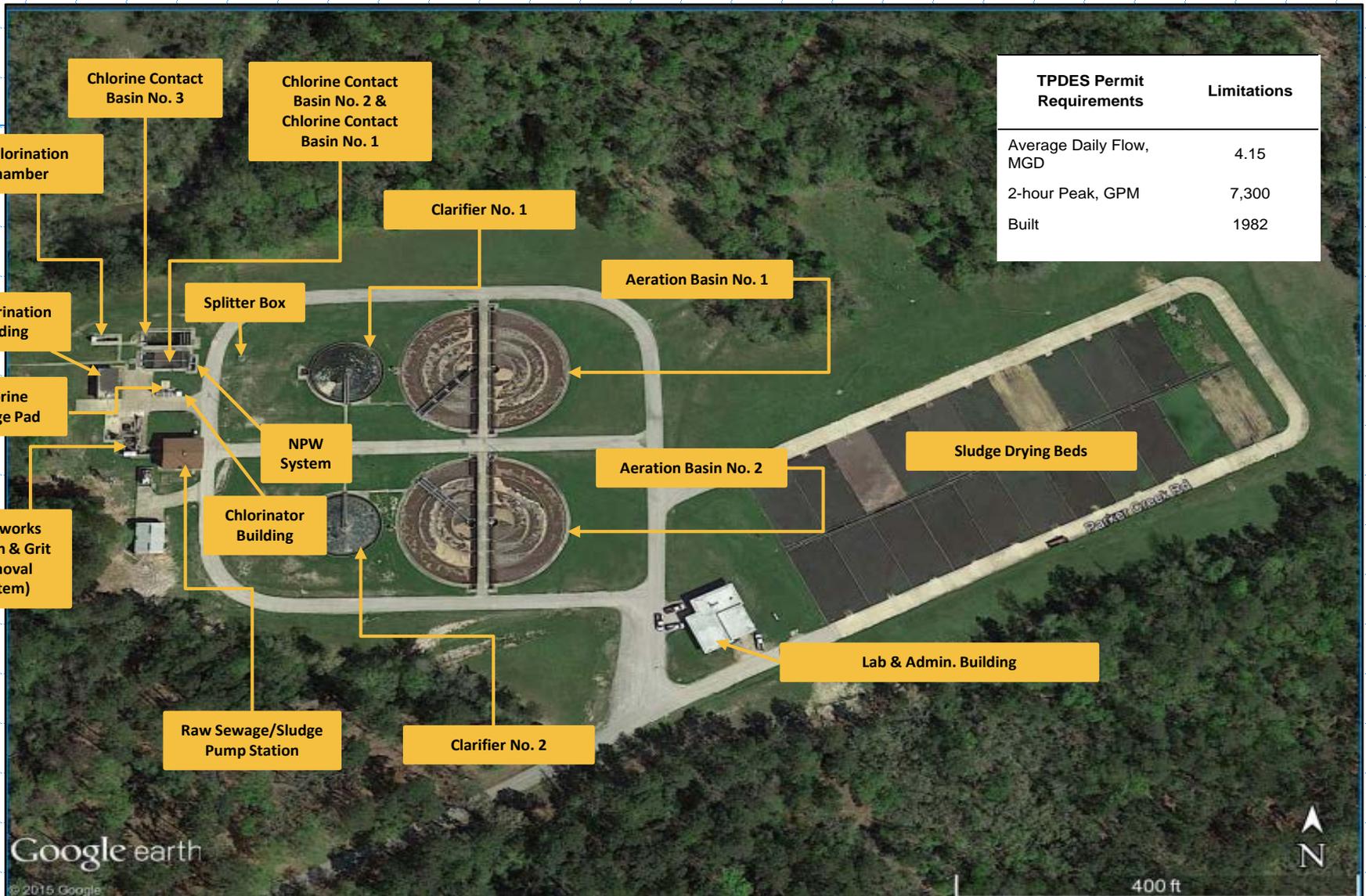
# Outline

- **A.J. Brown WWTP Overview**
- **Treatment Plant Evaluation**
  - Existing Information
  - Site Visit Observations
  - Condition and Criticality Scores
  - Improvement Alternatives
- **Risk Based Condition Assessment Methodology**
- **Risk Rating Summary**
- **Potential Phasing of Improvements**

# City of Huntsville Wastewater System



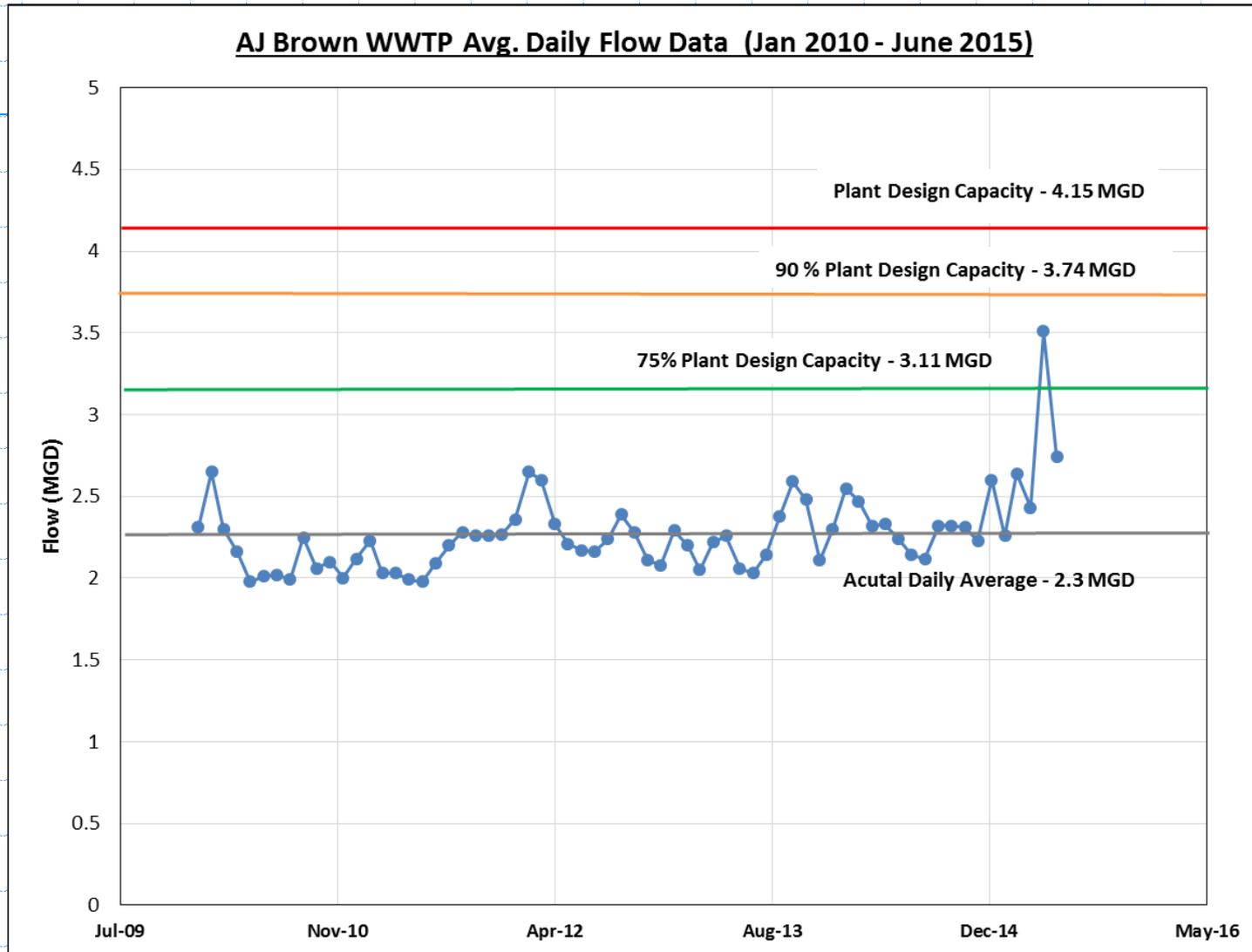
# A.J. Brown WWTP Overview



# A.J. Brown WWTP TPDES Permit

Effluent Characteristics	Discharge Limitations			
	Daily Avg mg/L	7-day Avg mg/L	Daily Max mg/L	Single Grab mg/L
Flow, MGD	4.15	N/A	N/A	N/A
Carbonaceous Biochemical Oxygen Demand (5-day)	7	11	17	25
Total Suspended Solids	15	25	40	60
Ammonia Nitrogen	2	5	10	15
E. coli, CFU or MPN/100 ml	126	N/A	394	N/A

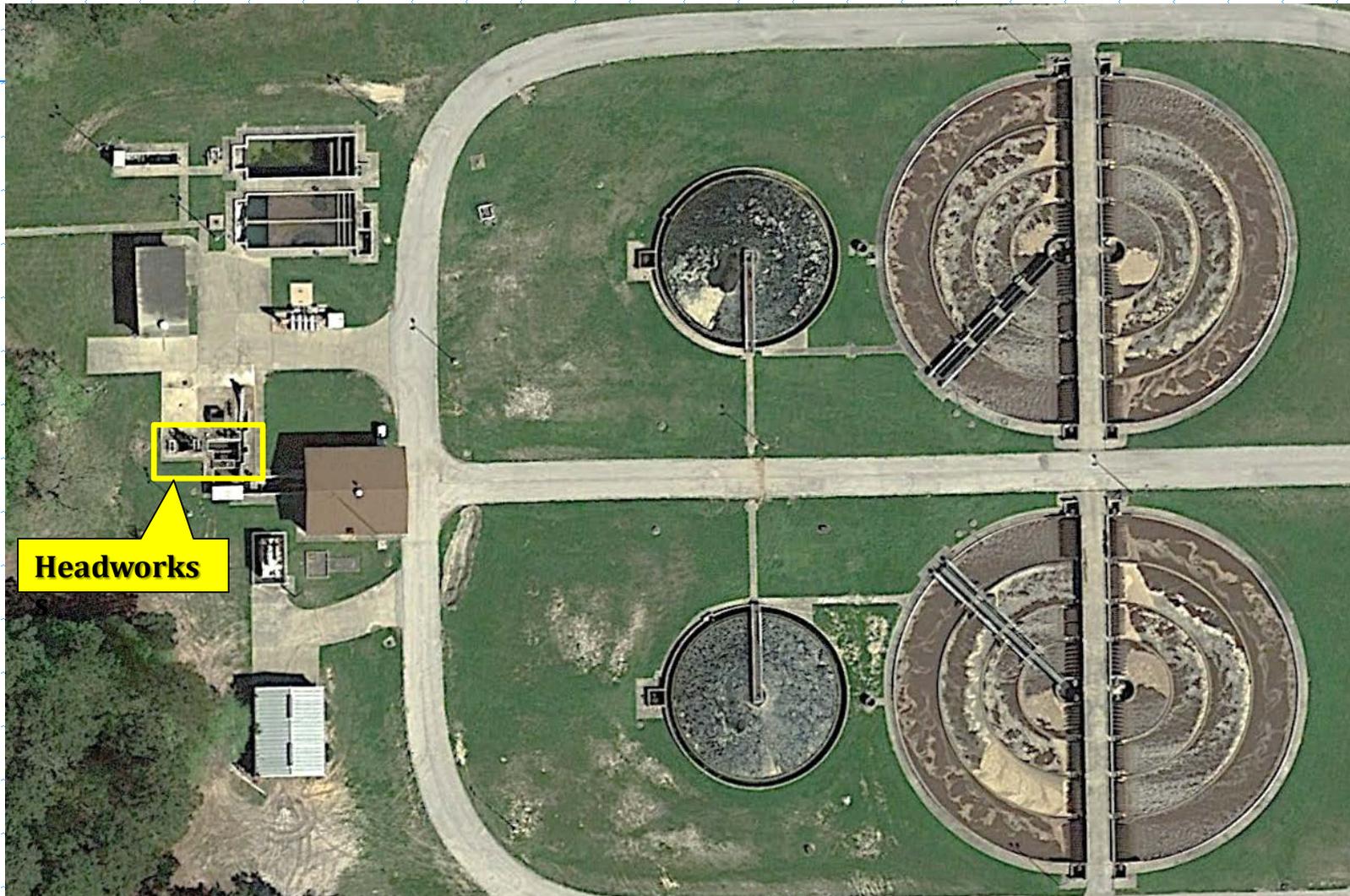
# A.J. Brown WWTP Flow Data



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# Treatment Plant Evaluation – Headworks (Bar Screens & Grit Removal System)

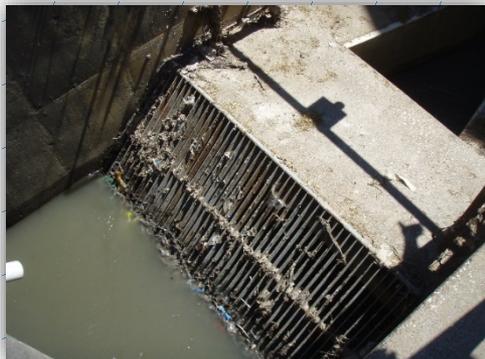


# Screens

## Mechanical Screen

- Existing Screens Information
  - One (1) Mechanical Screen
    - Manufacturer: Vulcan – Mensch Crawler Screen
    - Opening size: 1/2" inch
    - Year in Service: 1995
    - Capacity: 10 MGD
  - One (1) Manual Screen: 1-1/4" Spacing

Manual Bar Screen



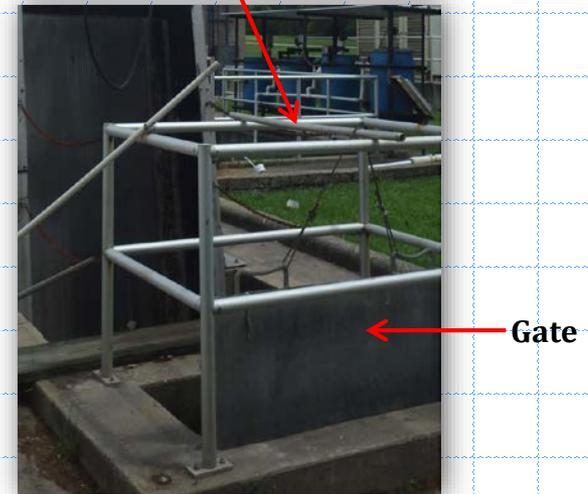
Manufacturer & Screen Data



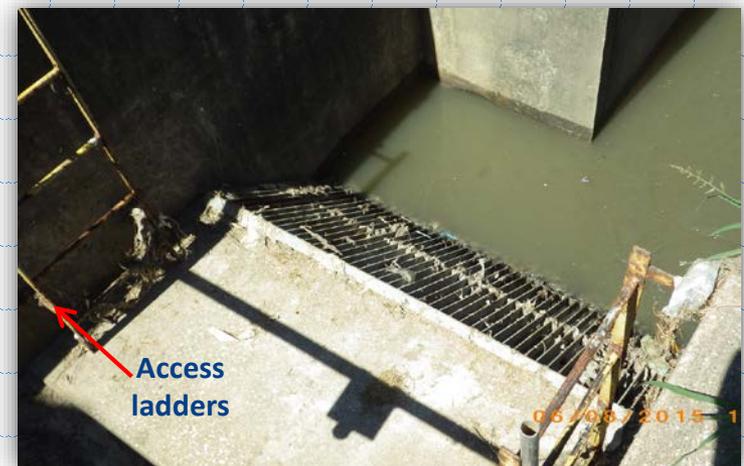
# Screens

- Existing Conditions
  - Mechanical Screen
    - Screen in good condition
    - Occasional over torquing
  - Inlet Gate
    - Gate hung on a rod supported on the handrails
    - Manually lifted with a crane
  - Manual Bypass Screen
    - Difficult to get the screenings out of the channel
    - Safety Concerns – No handrails upstream and downstream

Gate hung on rod



Manual Bypass Screen



# Screens

- Recommended Improvements

Short Term:

1. Replace existing inlet gate hung on pole with a slide gate for easier operation
2. Provide handrails at the manual bypass screen

Future:

1. Install a second mechanical screen for redundancy



# Grit Removal System

- Existing Facility Information
  - Manufacturer: Ovivo Detritor
  - No. of Units: 1
  - Year in Service: 1981
  - Screw Conveyor

Detritor



Grit Removed



Screw Conveyor



# Grit Removal System

- Existing Conditions

- Mechanical**

- System functional but reaching end of useful life
    - Corrosion of inlet baffles and screw conveyor

- Electrical**

- Flex conduits are corroding
    - Push button station aging at screw & grit motor
    - MCC past life expectancy of 30 years
    - Screw motor shows corrosion

- Structural**

- Railings damaged, safety hazard
    - Bridge/ walkway corroded
    - Some handrails broken
    - Concrete structure in good condition



# Grit Removal System

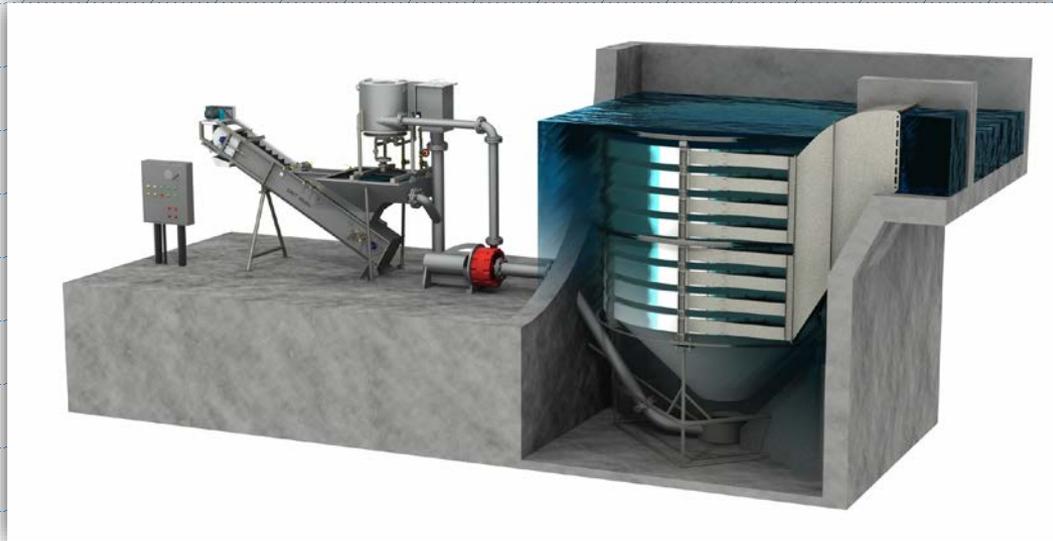
## Recommended Improvements

### Short Term:

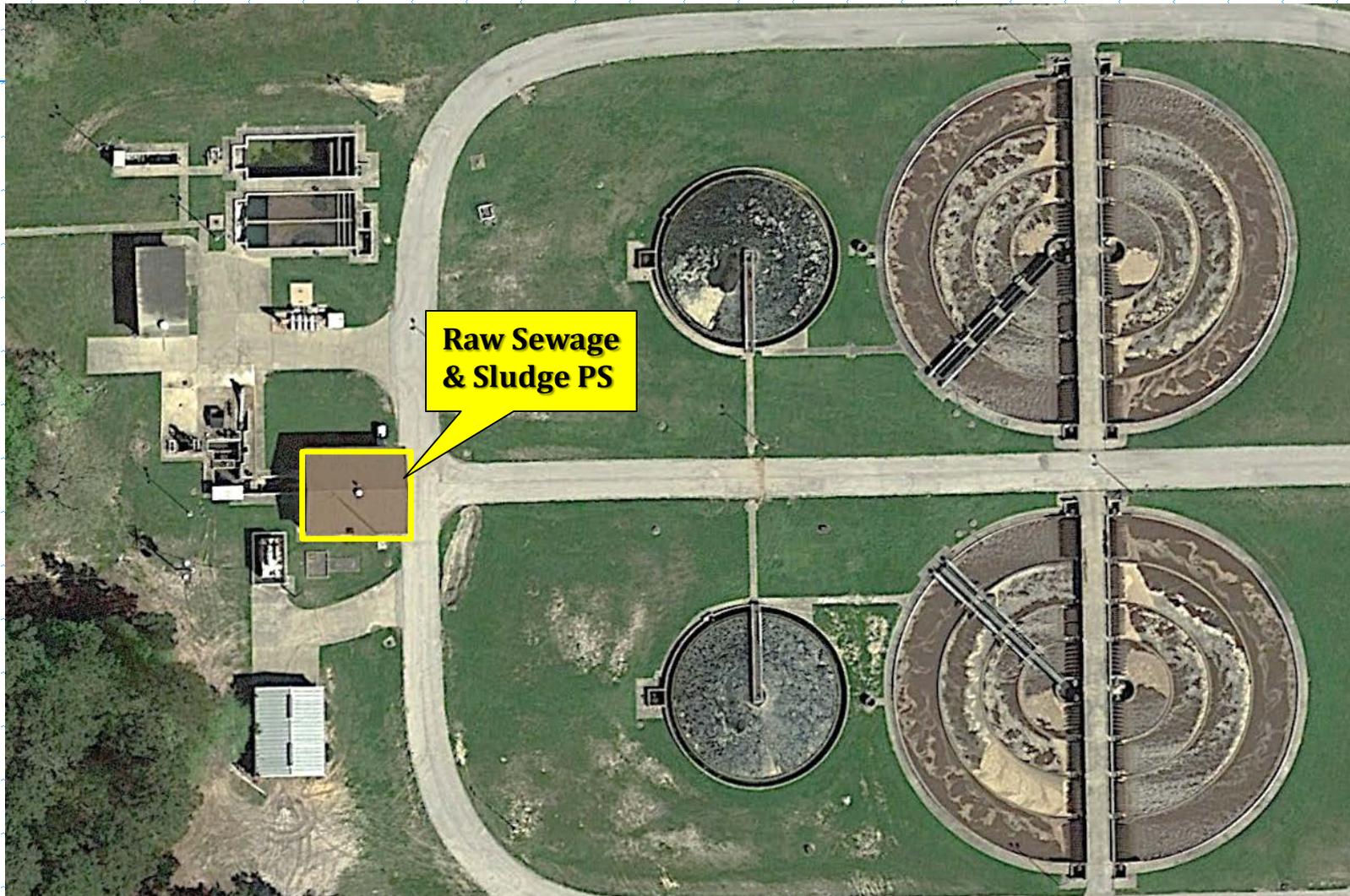
1. Replace motor access bridge/ walkway
2. Repair damaged/ broken railings
3. Replace MCC and push button at screw and grit motor

### Future:

1. Replace existing detritor with gravity vortex grit removal system – HeadCell™ in the future

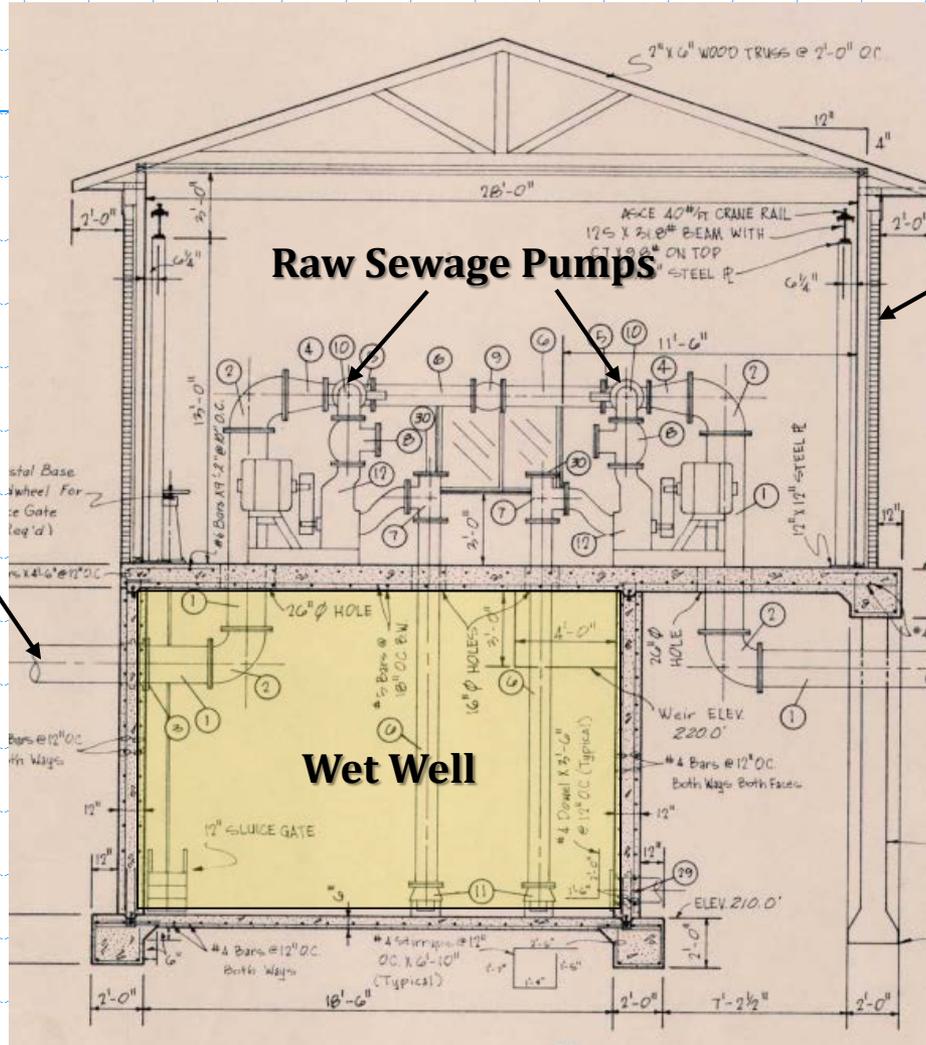


# Treatment Plant Evaluation – Raw Sewage & Sludge PS



# Raw Sewage & Sludge Pump Station

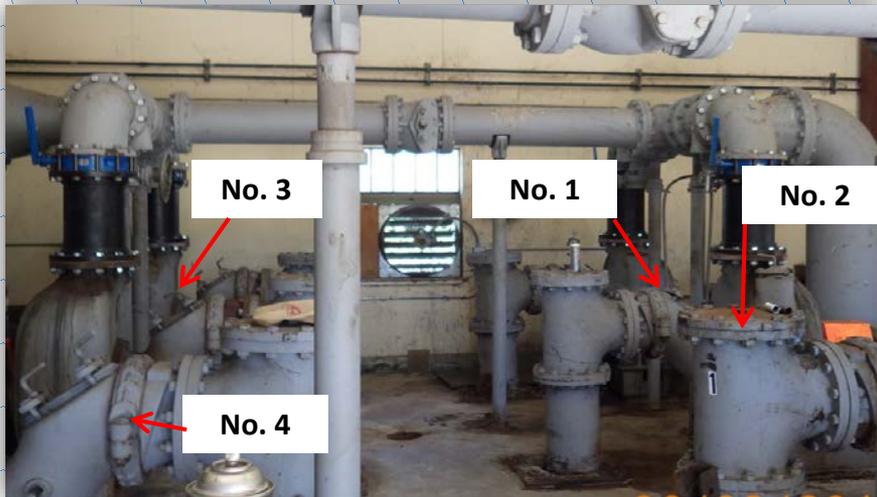
Pump Discharge to  
Aeration Basin



Raw Sewage &  
Sludge Pump Station  
Building

# Raw Sewage & Sludge Pump Station

Raw Sewage Pumps



RAS Pumps



WAS Pumps



- Existing Facility Information
  - Number of Pumps:
    - Raw Sewage - 4
    - Return Sludge - 4
    - Waste Sludge - 2
  - Year in Service: 1981
  - Pump station also houses the MCCs for the plant

# Raw Sewage Pumps

- Existing Conditions

- Pumps & Motors**

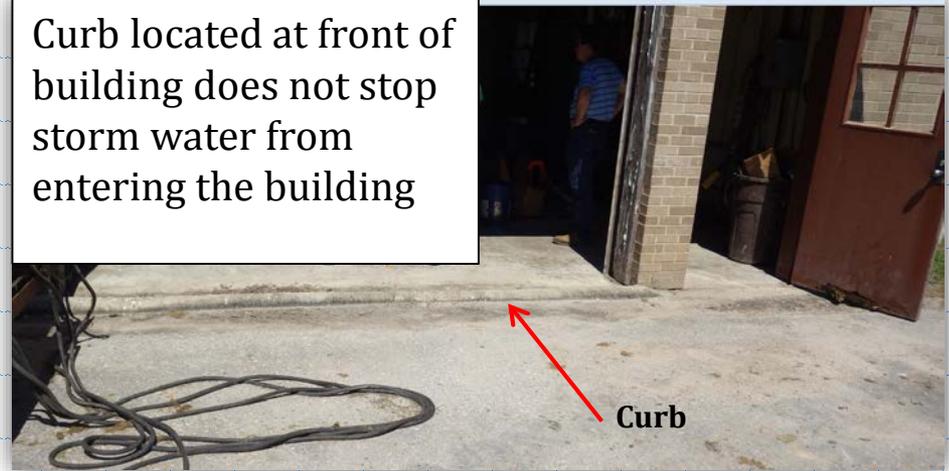
- Seals are leaking
    - Volutes show severe wear and tear and leakage
    - All motors have been (except pump no. 1) have been replaced over the years
    - Frequently have to be taken out of service for repair
    - Pumps are past their useful life

- Structural**

- No proper drainage inside the room
    - Building floods during rain



Curb located at front of building does not stop storm water from entering the building



# Raw Sewage Pumps

- Existing Conditions

- Electrical**

- Equipment past life expectancy
    - Flooding in room causes corrosion & safety hazard
    - Controllers outdated
    - Repairs cannot be made

- HVAC**

- No HVAC present to protect MCCs
    - Heaters do not work
    - Fan put in the wall for exhaust
    - Portable fan sits on floor to cool electrical equipment

Electrical Equipment inside Pump Station



Wall fan



# Raw Sewage & Sludge Pump Station

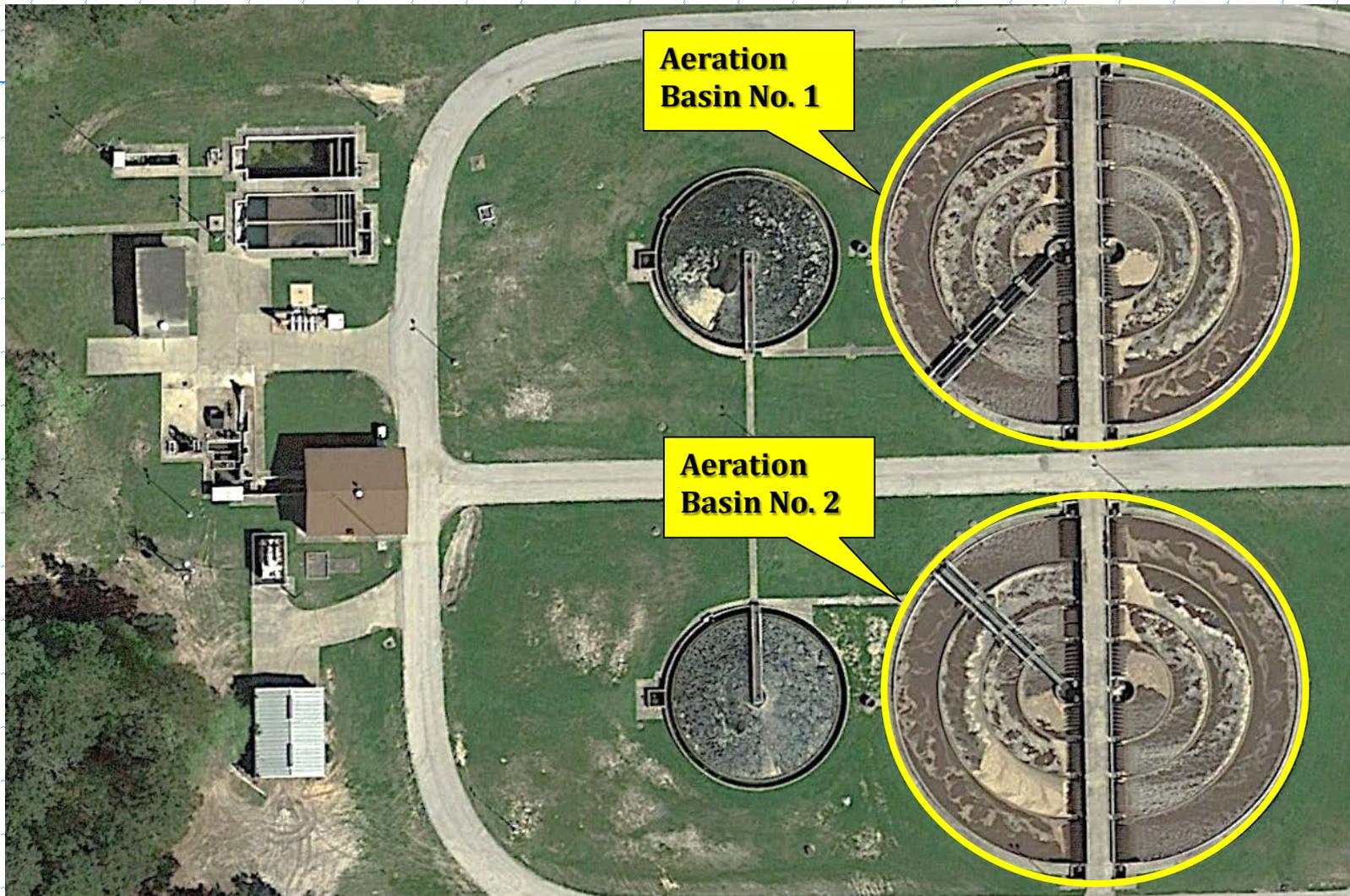
## Recommended Improvements

### ***Build a New Pump Station (Wet well & Pumps)***

1. New pump station building adjacent to existing pump station
2. New wet well and pumps (raw sewage, RAS, WAS), appurtenances and controls
3. Remove existing pumps and repurpose station building to be the main electrical building



# Treatment Plant Evaluation – Aeration Basin No. 1 and 2



# Aeration Basins No. 1 & 2

- Existing Facility Information

- Type: Orbal System
- No. of Units: 2
- Depth: 8.5 feet
- No. of Rings:
  - Three (3) inner rings for aeration
  - One (1) outer ring for digestion
- Mechanical Aerators per basin
  - Four (4) 20 HP – Outer shaft for digester ring
  - Four (4) 40 HP – Inner Shaft for aeration rings

Aeration Basin No. 1



Aeration Basin No. 2



# Aeration Basins No. 1 & 2

- Existing Conditions

- Mechanical**

- Bearings wear frequently. Replaced 2-3 months
    - Shafts break due to vibration
    - Several aerator discs replaced already
    - Difficulty/safety hazard in replacing the bearings
    - Corrosion of piping

- Structural**

- Spalled Concrete on railing posts
    - Bent railing
    - FRP Bridge is delaminating

- Electrical**

- One aerator has broken flux conduit - Basin 1
    - Motor disconnects not available - Basin 1
    - Conduit broke loose from motor box - Basin 2



# Aeration Basins No. 1 & 2

## Improvement Alternatives

***Option 1:*** Rehab existing mechanical disc aeration system

***Option 2:*** Retrofit with vertical surface aerators

***Option 3:*** New aeration basins with conventional fine bubble diffuser system

# Aeration Basins No. 1 & 2

## *Recommended Alternative*

### *Option 3: Conventional fine bubble aeration system*

- Build new conventional aeration basins
- Fine bubble diffusers
- New blowers
- New land area
- Designed for future stringent nutrient limits
- Existing mechanical aeration system will be abandoned

Conventional Aeration Basin



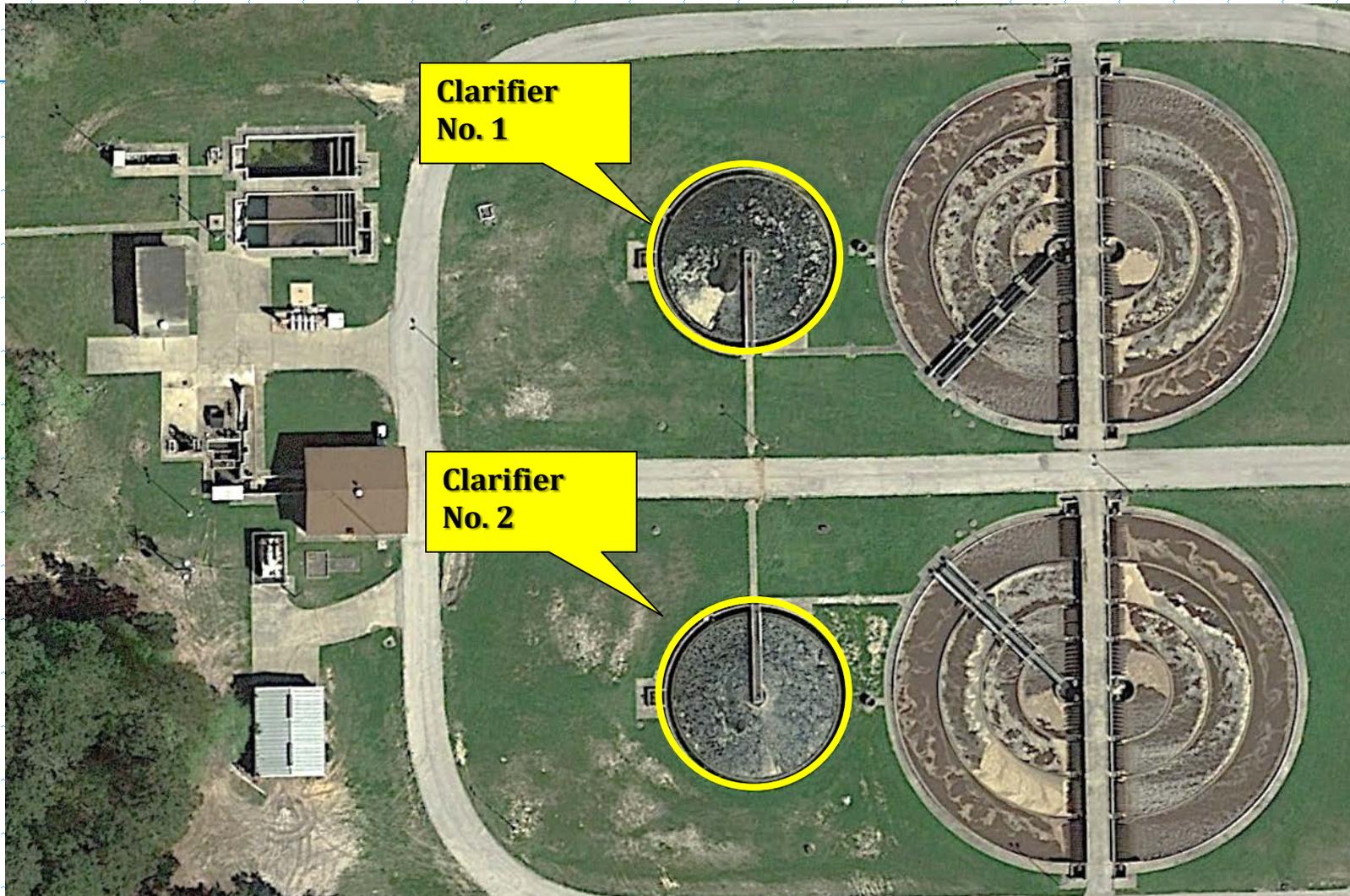
Fine Bubble Diffusers



Blowers



# Treatment Plant Evaluation – Clarifiers No. 1 and 2



# Clarifier No. 1 & 2

- Existing Facility Information
  - Year Installed: 1981
  - Size:
    - Diameter - 75'
    - Depth - 10'
  - Manufacturer: Envirex
  - Mechanism Type: Tow-Bro
  - Scum baffle and weirs recently replaced



# Clarifier No. 1 & 2

- Existing Conditions

- Clarifier Mechanism

- Periodic sludge floating issue
- Scum trough and arm are old and rusted

- Scum Baffle & Scum Scraper

- Scum scraper is old and rusted
- Scum baffle is new

- Weirs

- Weirs are new

- Electrical

- Receptacles not functional
- PVC conduit exposed to sun & supports broken

- Structural

- Clarifier No.1 bridge framing in very poor condition



# Clarifier No. 1 & 2

- Recommended Improvements
  - Add Stamford baffles
  - Replace scum scrapper arm and trough
  - Replace corroded access bridge and frame in clarifier no. 1

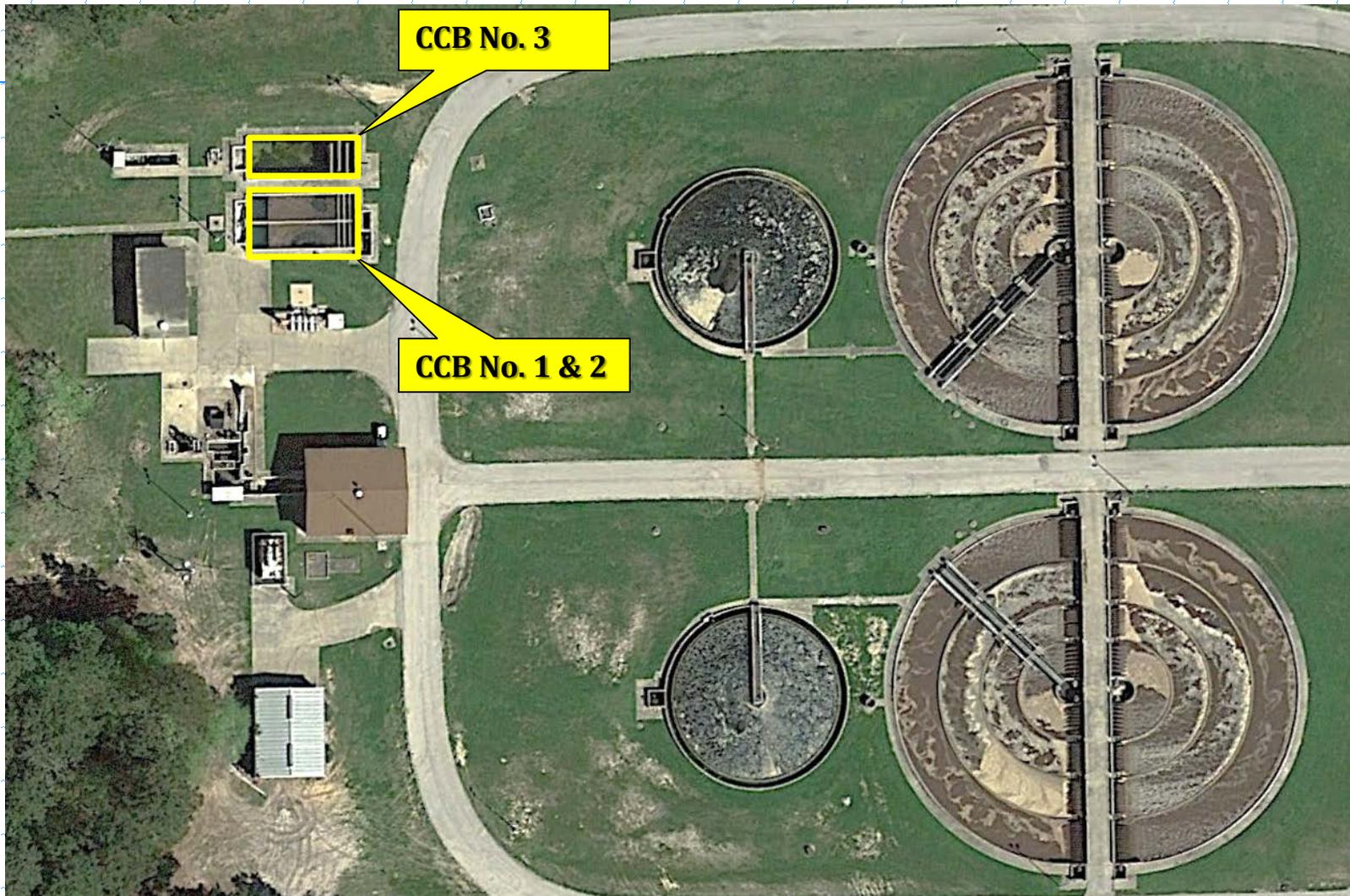


**Scum Trough**



**Stamford Baffles**

# Treatment Plant Evaluation – Chlorine Contact Basins



# Chlorine Contact Basins

- Existing Facility Information
  - Year Installed
    - 1981 - Basin 1
    - 1981 - Basin 2
    - 1994 - Basin 3



# Chlorine Contact Basins

- Existing Conditions

- Basin No. 1**

- Floors do not drain properly
    - No major issues

- Basin No. 2**

- Minor spalling of past concrete repairs

- Basin No. 3**

- Chamber is not in service
    - Flow not getting full 20 min contact time

- Gates, Piping & Weirs**

- Weir plate corroded
    - No issues noted
    - Gates operable

Basin No. 3

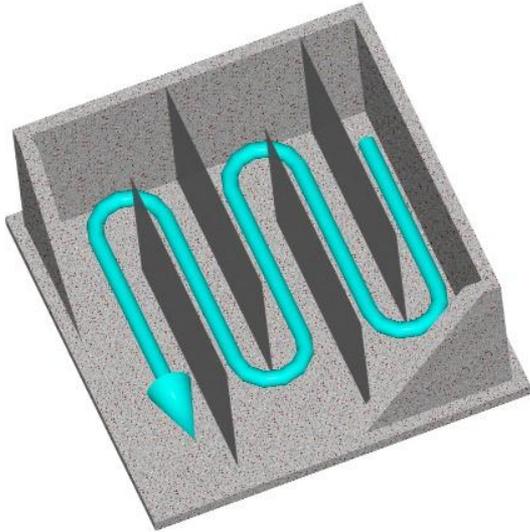


Basin No. 1 and 2

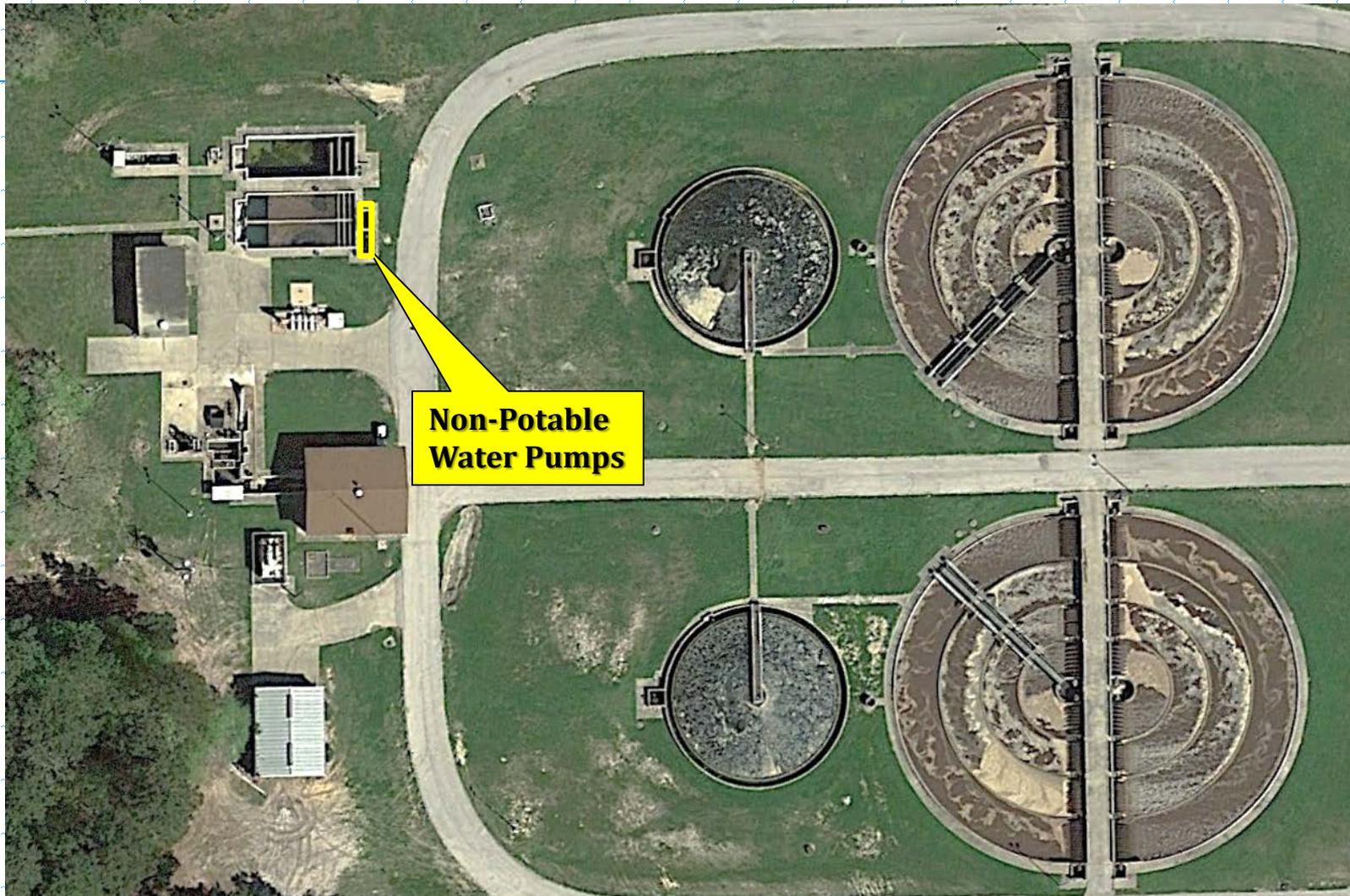


# Chlorine Contact Basins

- Recommended Improvements
  - Add curtain baffles to contact Basin No. 3 to prevent short circuiting
  - Add scum baffle to Basin No. 3 to catch the floatables



# Treatment Plant Evaluation – Non-Potable Water System



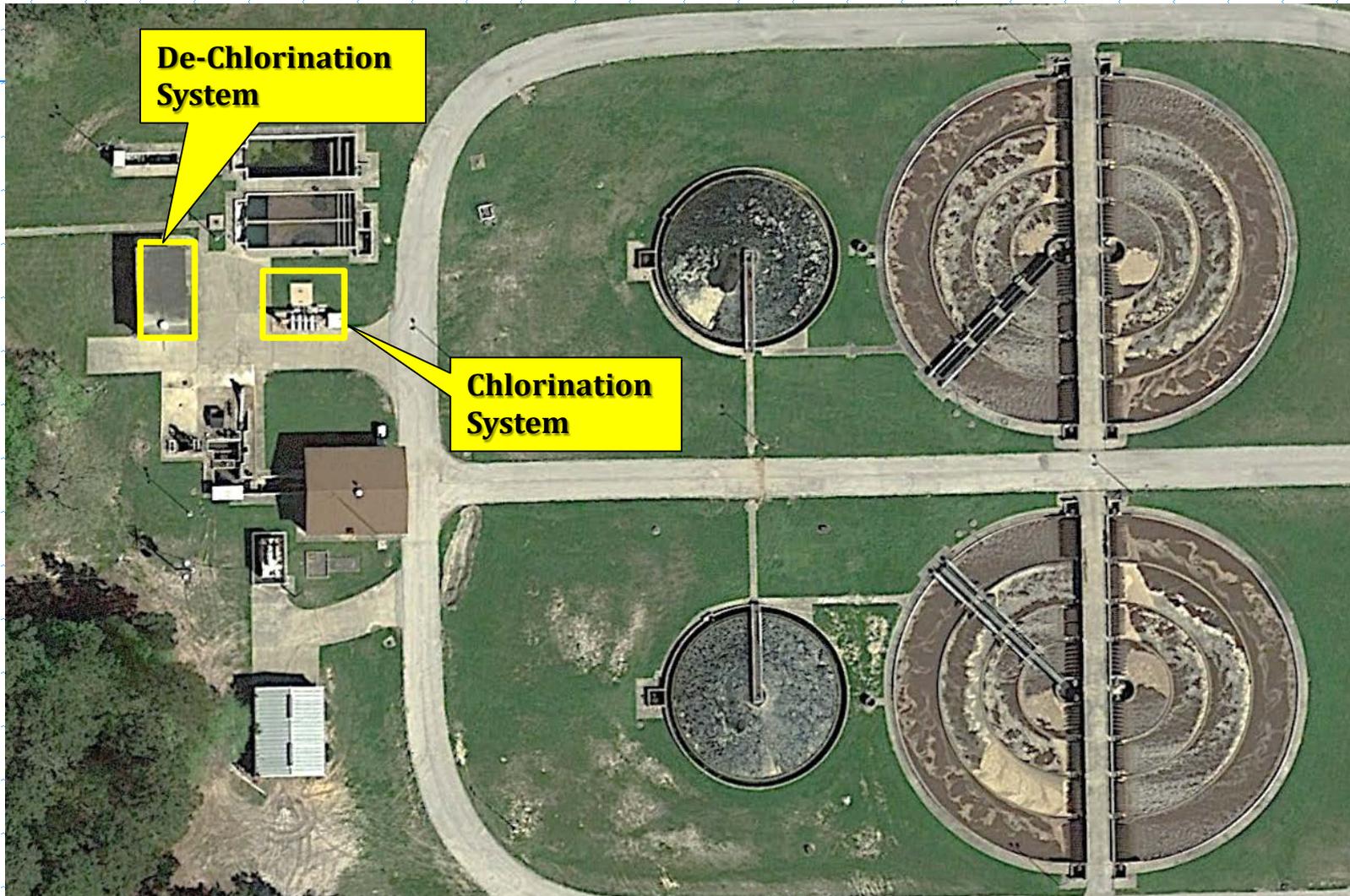
# Non-Potable Water System

- Existing Facility Information
  - Year Installed: 1981
  - No. of Pumps: 2
  - One pump replaced recently
  - Hydro-pneumatic tank not functional
- Recommended Improvements
  - Replace old NPW pump
  - Install a new hydro-pneumatic tank



# Treatment Plant Evaluation

## Chlorination & De-Chlorination System



# Chlorination System

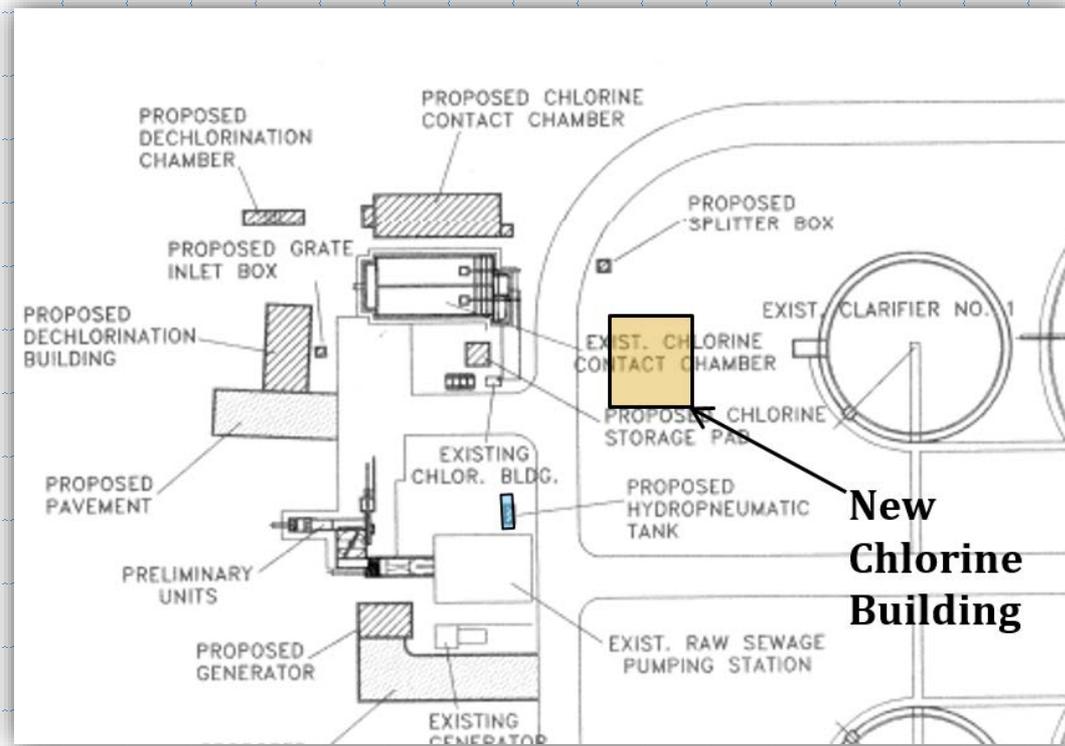
- Existing Facility Information
  - Number of Chlorinators: 2
  - Capacity: 500 lbs/day each
  - Chlorine ton cylinder stored outside
- Existing Condition
  - **Mechanical Equipment**
    - Only two scales for the ton cylinders
    - Cylinders are hard to switch with crane
  - **Electrical**
    - Push button station not reliable
  - **Structural**
    - Ton cylinder storage pad in good condition
    - 3 ton jib crane in fair condition  
needs painting

Chlorinators



# Chlorination System

- Recommended Improvements
  - Provide building for chlorine ton cylinders



# Dechlorination System

- Existing Facility Information
  - Number of Sulfonators: 2
  - Capacity: 250 lbs/day each
  - Sulfonators located inside a building
  - Exhaust fan not working
- Recommendation
  - Replace exhaust fan

Dechlorination Building



Sulfonators



Dechlorination Chamber

# Treatment Plant Evaluation – Sludge Drying Beds



# Sludge Drying Beds

- Existing Facility Information
  - Waste activated sludge pumped to sludge drying beds
  - Total of 22 beds
- Existing Condition
  - Lose sludge drying capability during wet weather
  - City had to rent belt press to dewater solids after heavy rain in May
  - Minor concrete spalling
  - Few cracks in containment wall



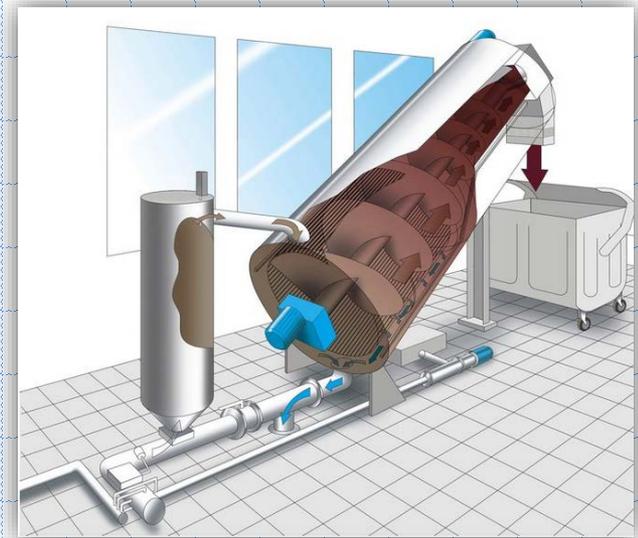
# Sludge Drying Beds

- Improvement Alternatives
  - Install new mechanical dewatering equipment.
  - Two options for mechanical dewatering:

**Belt Filter Press**



**Screw Press**



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# Risk Based Condition Assessment Methodology Overview

- **Condition Rating**

Condition Rating	Scoring Guidelines
1.00 – 2.00	<b>Good</b> condition; minor improvements recommended to enhance performance
2.01 – 3.50	<b>Fair</b> condition; improvements recommended to improve performance or efficiency
3.51 – 5.00	<b>Poor</b> condition; improvements recommended to maintain operation reliability

# Condition Scoring

- Example Condition Rating Component Groups & Weightings**

Component Group	Condition Rating (1-5)	Weight Factor*	Weighted Component Rating
Electrical		15%	
Mechanical Equipment		40%	
Structure		30%	
Piping Valves		15%	
<b>Total Weighting</b>		<b>100%</b>	

\*Example weight factors which change per unit investigated.

# Criticality Scoring

- **Example Criticality Rating Component Parameters & Weightings**

Criticality Parameters	Component Criticality Rating (1-5)	Weight Factor *	Weighted Component Rating
Capacity Affected		20%	
Process & Regulatory Impact		40%	
Safety		20%	
Outage Duration		20%	
<b>Overall Criticality Rating</b>		<b>100%</b>	

\*Weight factors are consistent for all units.

# Risk Assessment

- Risk Assessment Score Ranges & Matrix

		Condition		
		Good	Fair	Poor
Criticality	Low	Low Risk		Moderate Risk
	Moderate	Moderate Risk	High Risk	High Risk
	High	High Risk	High Risk	High Risk

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# Risk Based Assessment Summary

Facility	Condition Score	Condition Rating	Criticality Score	Criticality Rating	Risk Scoring	Risk Category
Raw Sewage PS	4.25	Poor	4.20	High	8.45	Very High
RAS-WAS PS	4.15	Poor	4.20	High	8.35	Very High
Aeration Basin #1	3.65	Poor	4.40	High	8.05	High
Aeration Basin #2	3.65	Poor	4.40	High	8.05	High
Clarifier #1	2.85	Fair	4.20	High	7.05	High
Clarifier #2	2.60	Fair	3.80	High	6.40	High
NPW System	3.80	Poor	2.40	Low	6.20	Moderate
Sludge Drying Beds	2.40	Good	3.60	High	6.00	Moderate
Screens	2.70	Fair	3.00	Moderate	5.70	Low
Grit Removal	2.70	Fair	3.00	Moderate	5.70	Low
Chlorination System	1.90	Good	3.40	Moderate	5.30	Low
Chlorine Contact Basins	1.70	Good	2.80	Moderate	4.50	Low
De-chlorination System	1.65	Good	2.60	Moderate	4.25	Low

# Opinion of Probable Construction Cost (OPCC)

Treatment Unit	Risk Category	Improvements	Opinion of Probable Construction Cost
Raw Sewage & Sludge PS	Very High	New PS + New MCCs	\$3,438,000
Aeration Basins	High	New Conventional Aeration Basins	\$7,330,000
Clarifiers	High	New Clarifiers	\$2,824,000
NPW System	Moderate	New NPW pumps & Hydropneumatic tank	\$211,000
Sludge Drying Beds	Moderate	New Screw Press	\$1,827,000
Screens	Low	Install slide gate; hand rails are manual bypass screen	\$24,000
		New second mechanical screen, Slide gates	\$845,000
Grit Removal	Low	Install new handrails & access bridge at existing grit system	\$28,000
		New gravity vortex grit removal system	\$1,331,000
Chlorination System	Low	New chlorine building	\$667,000
Chlorine Contact Basins	Low	Curtain baffles & scum baffles	\$59,000
Dechlorination System	Low	New exhaust fan	\$7,000

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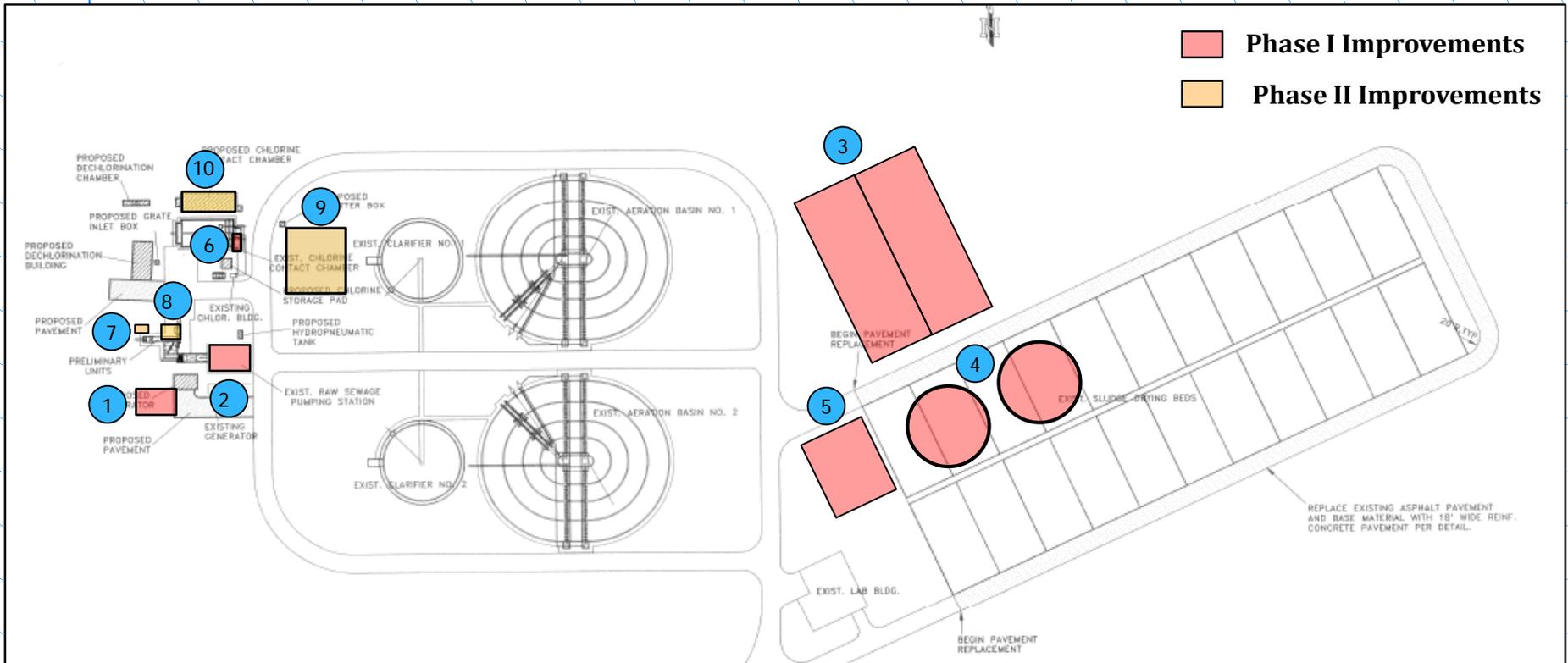
# Potential Phasing of Improvements

## Phase I Improvements:

1. New Raw Sewage & Sludge PS
2. New MCCs
3. New Aeration Basins
4. New Clarifiers
5. New mechanical sludge dewatering
6. New NPW pump & hydrotank

## Phase II Improvements:

7. Second Mechanical Screen
8. New Grit Removal System
9. New chlorine building
10. Baffles in chlorine contact basin no. 3



# Potential Phasing of Improvements

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Dechlorination System	Low	New exhaust fan	\$7,000

Phase 1:  
\$15,630,000

Phase 2:  
\$2,909,000

# Questions?