



Keeping up with Growth: Updating the SAWS Wastewater Facilities Master Plan

September 19, 2025

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Agenda

1. SAWS Facility Overview
2. The Original WW Master Plan
 - Data Collection
 - Models
 - Needs Assessment
 - Dynamic CIP Tool
3. The 2025 WW Master Plan Update
 - Revised Models
 - Revised Condition Assessment
 - Next Steps

SAWS operates three Wastewater Recycling Centers and one decommissioned WRC that is used as an inline storage facility

Steven M. Clouse WRC
In Service Since 1987



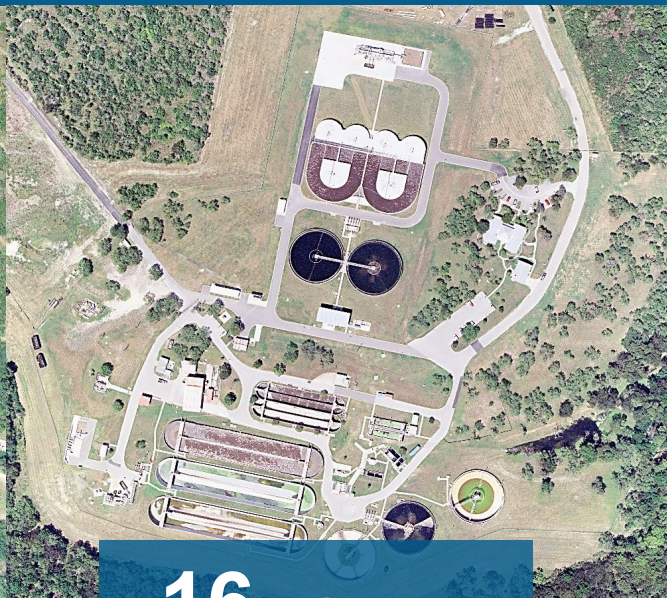
125 MGD Avg
250 MGD Peak

Leon Creek WRC
In Service Since 1965



46 MGD Avg
92 MGD Peak

Medio Creek WRC
In Service Since 1972



16 MGD Avg
40 MGD Peak

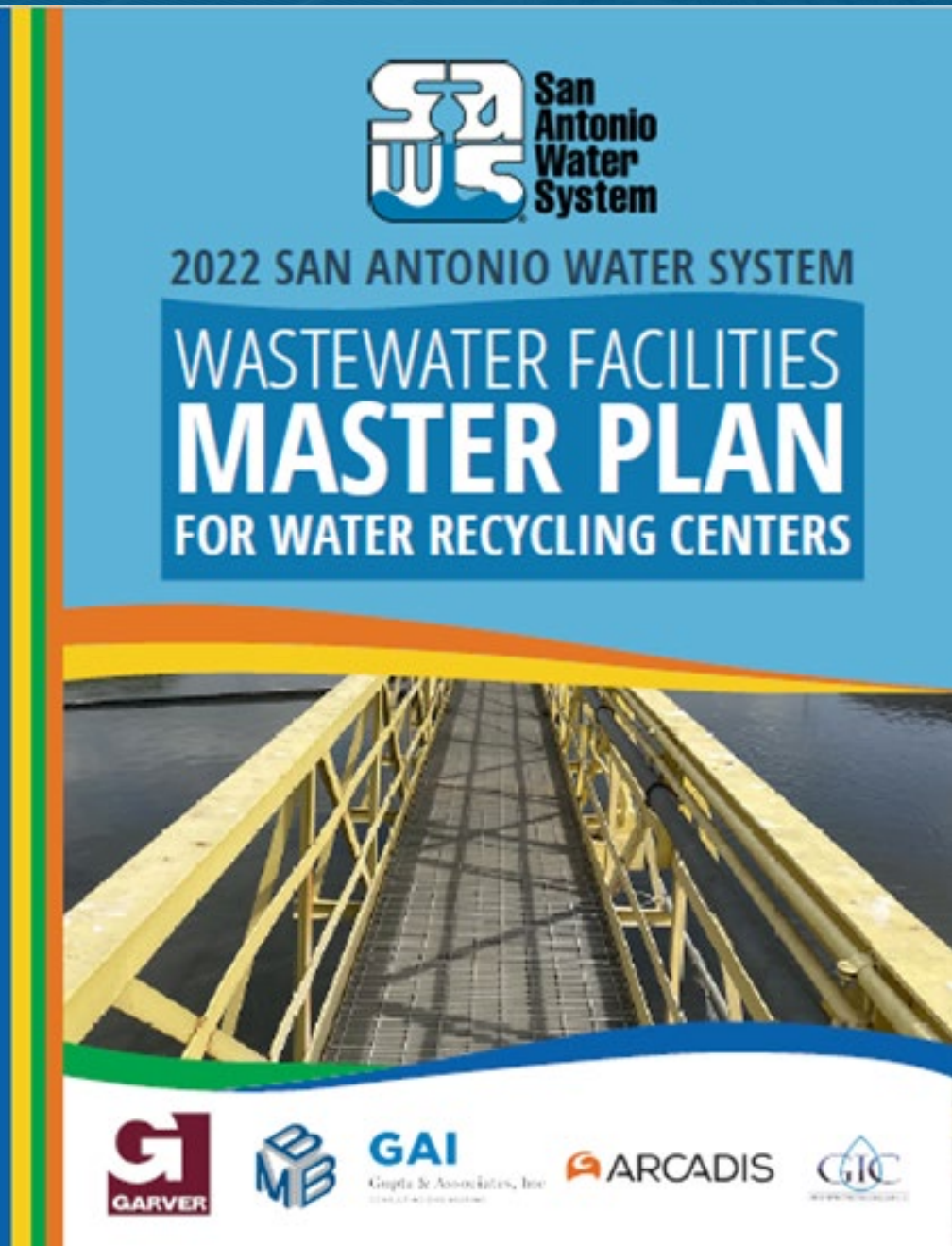
Salado Creek WRC
(Inline Storage)



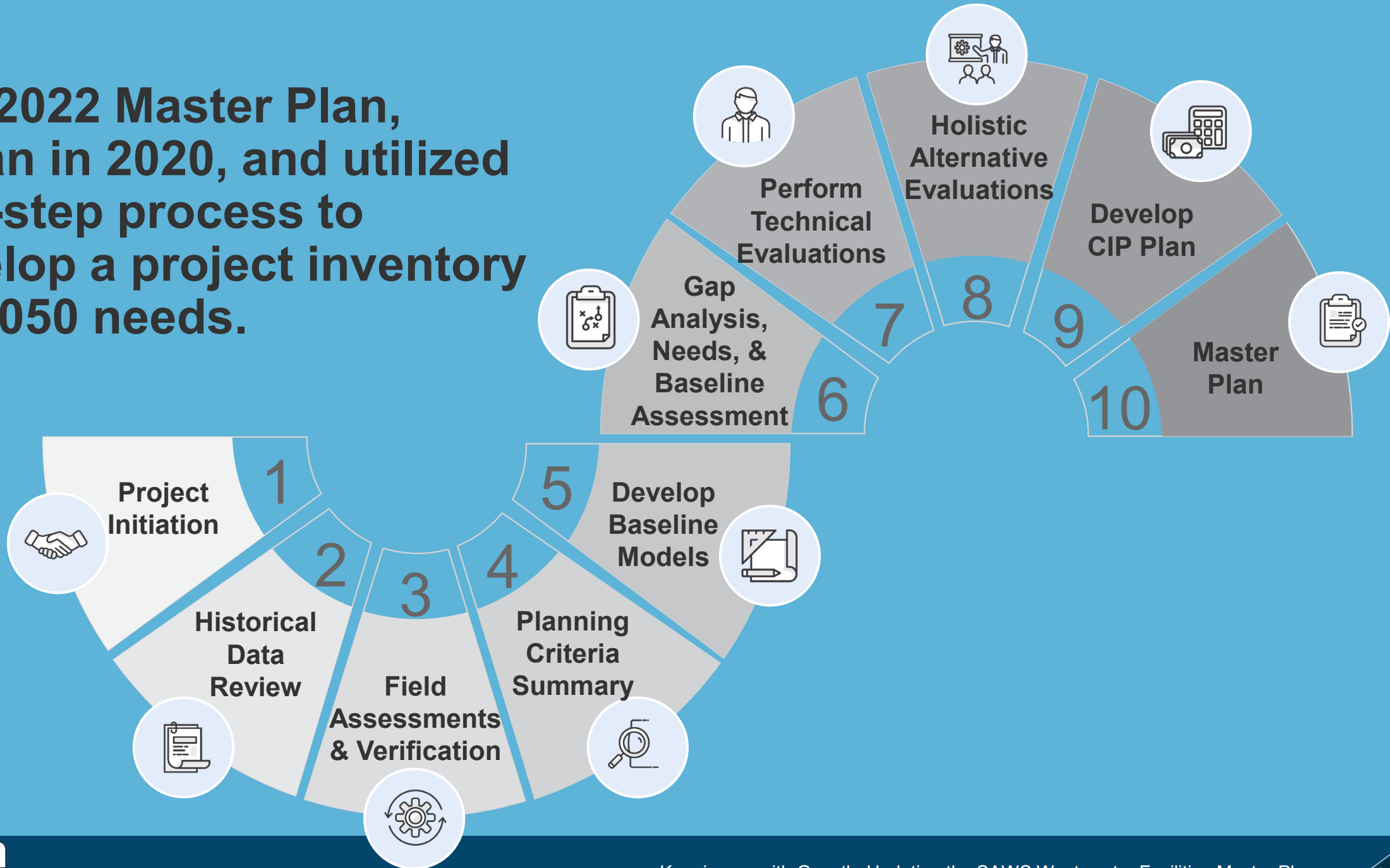
46 MGD Avg
92 MGD Peak

In 2022, SAWS published their first Master Plan for their Water Recycling Centers.

Today we will discuss the ongoing effort to update the Master Plan in 2025.



**The 2022 Master Plan,
began in 2020, and utilized
a 10-step process to
develop a project inventory
for 2050 needs.**

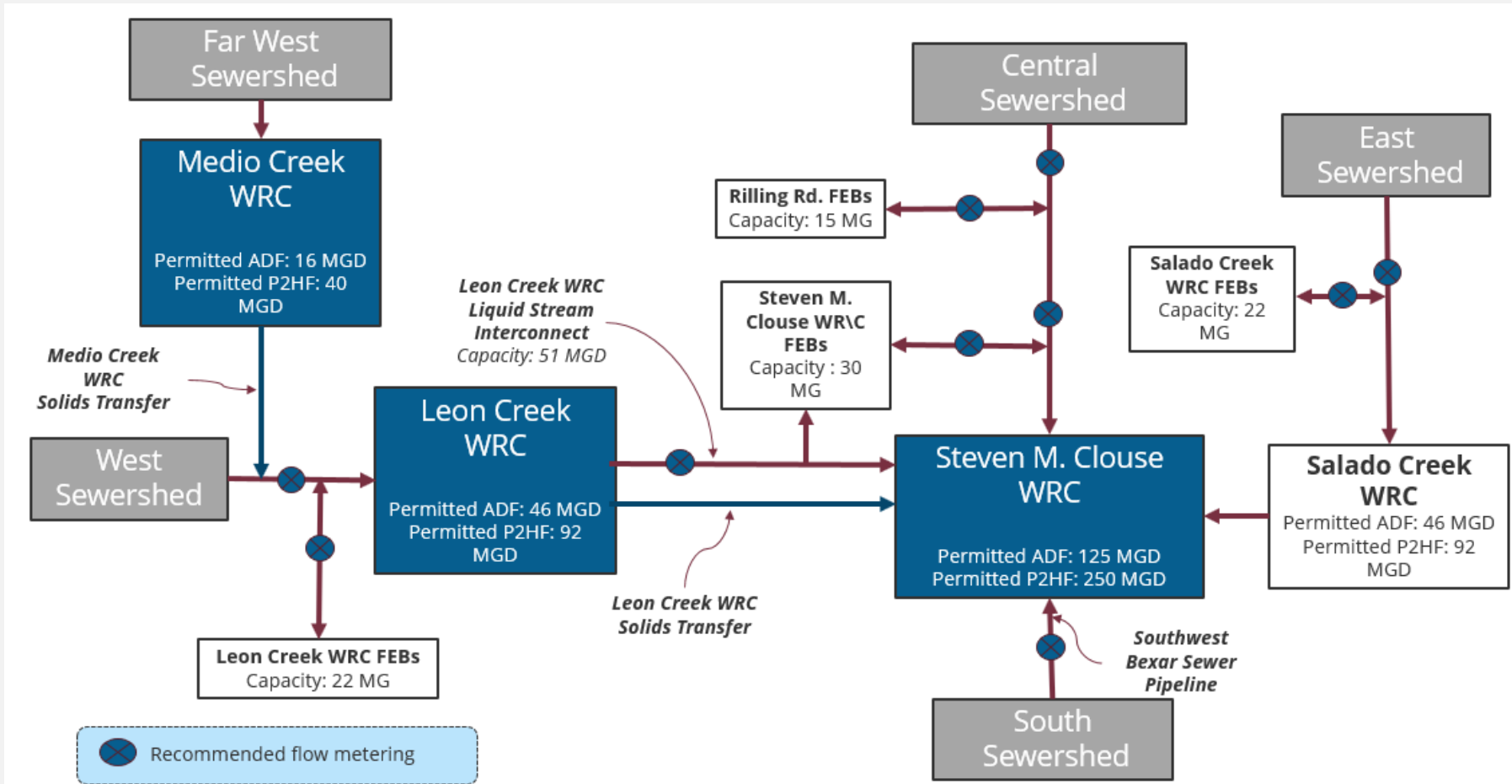


Population projections correspond to increased peak flow projections

2022 Wastewater Master Plan Projected Flows	Medio Creek WRC	Leon Creek WRC	Steven M. Clouse WRC
2020 (Current) Permitted P2HF (MGD)	40	92	250
2050 (Projected) Influent P2HF (MGD)*	42	145	396

**Flow projections are based on a five-year, six-hour duration storm*

Flow Management Improvements



Facility	Target Facility Flow (MGD)
Steven M. Clouse WRC	250
Leon Creek WRC	92
Medio Creek WRC	40

In addition to rising peak flows, the condition of the WRCs was investigated due to the age of the existing infrastructure.

- Operator shadowing
- Staff interviews
- Condition assessment site visits



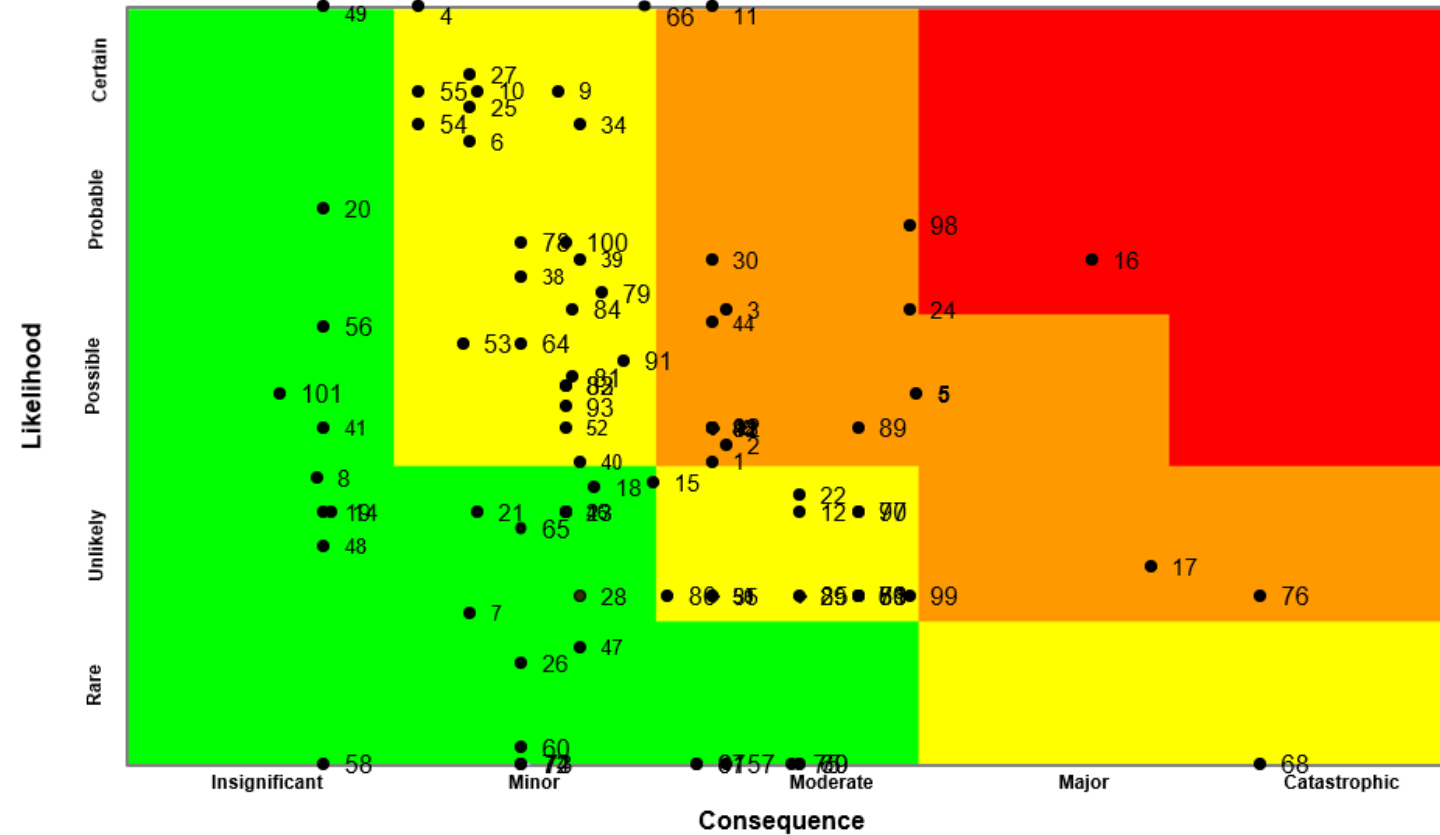
SAWS WRCs
Garver Project #19W07145
Facility Observation Form:

Name:		Discipline:		Date:	
Facility Name:			Major Equipment Group:		
Component:			Asset ID:		
Installation Date or Approximate Age:			Visual Condition Rating: (Circle one) Good Fair Poor		
Manufacturer:			Model Number:		
Size/Capacity/Type/Pressure Rating:			Horsepower/RPM/Voltage/Speed:		
Client Comments/Notes:					
Condition Comments/Notes:				Rank 1 to 10	
				Condition	
				Capacity	
				Reliability	
				Availability	
				Maintainability	

WERF Business Risk Exposure Approach

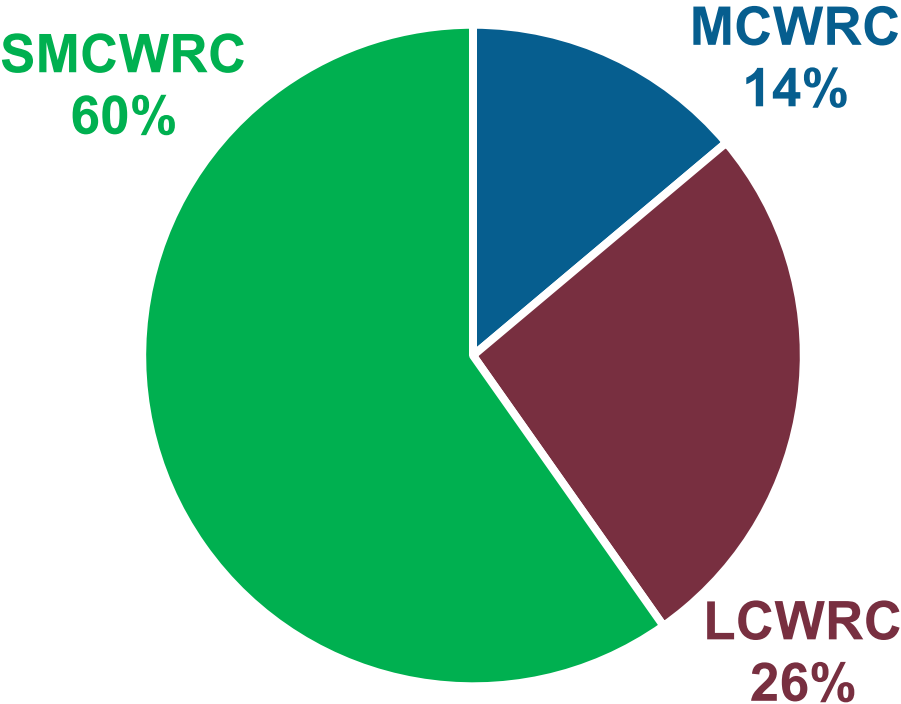
LOF & COF -

- Evaluated the likelihood and consequence of failures for major equipment

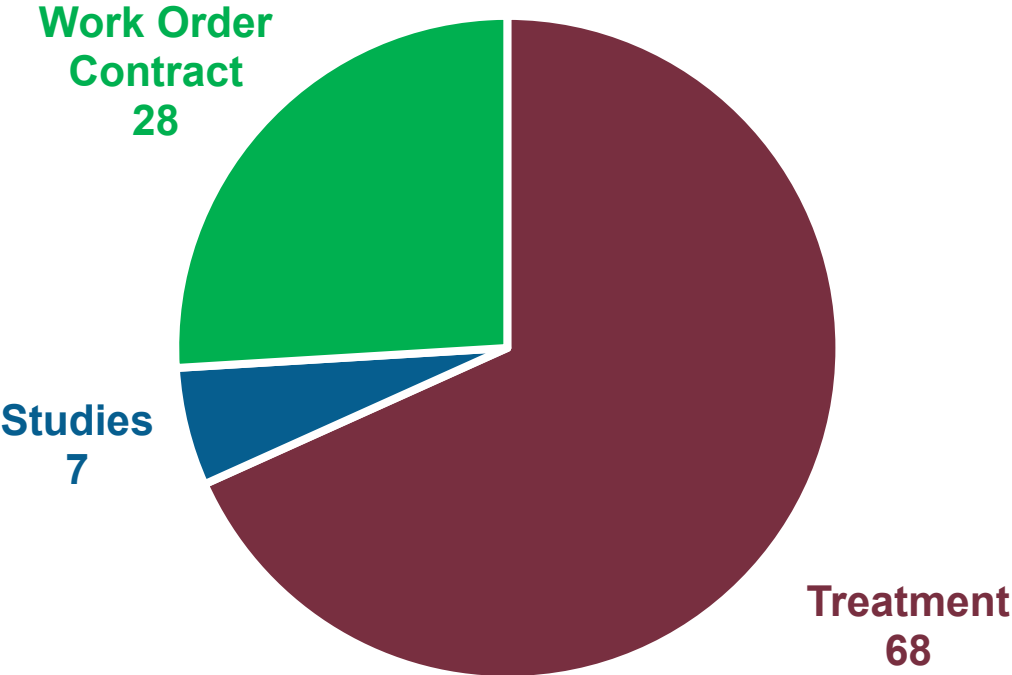


2022 Wastewater Master Plan Project List

Percentage of Projects by Cost

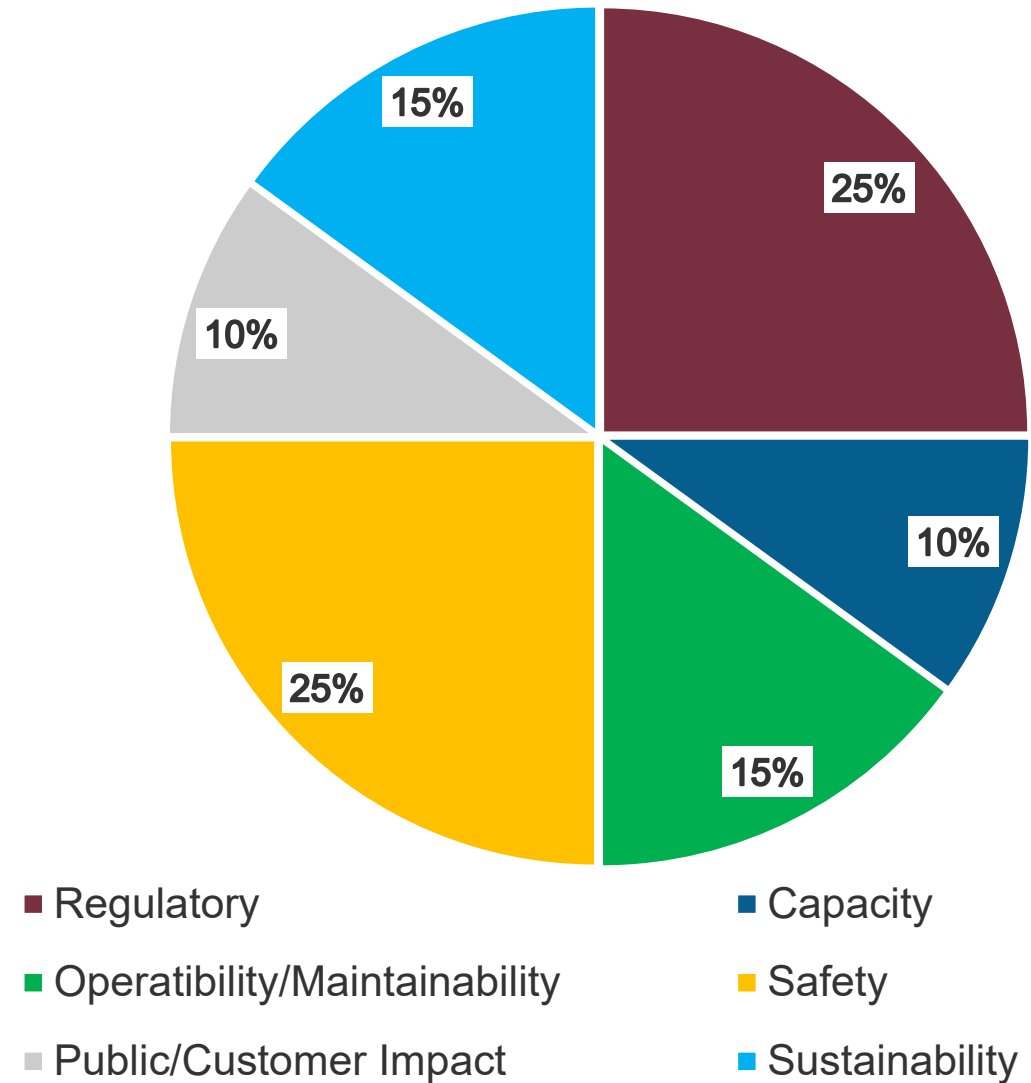


Number of Projects by Type

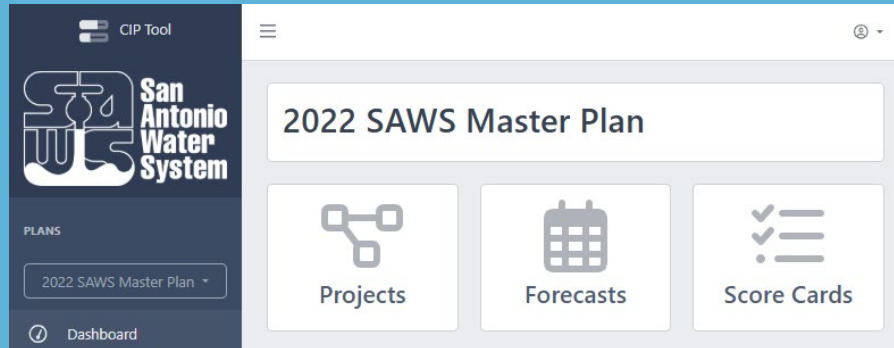


A weighted scoring of each driver was used to evaluate each CIP project and develop a *priority score* for each project

6 Final Project Drivers



Garver's DynamiCIP Tool



Number				
1				
Name				
SMCWRC - Biosolids System Upgrades				
Primary Location		Sublocation		
SMCWRC		Solids Treatment		
Budget Account	Primary Driver	Secondary Driver	Flexibility	
Select Budget Account	Capacity	Operability/Maintainability	Low	
Completed By (optional)	Start On (optional)	Start After (optional)	Score Override (optional)	
	06/01/2022			
Date the project must be completed by. The exact start date for the project. This will supercede the "Start After" date. The earliest possible start date for the project. This will override the scores from the scorecards and force a particular score.				
☐ Impact Fee Eligible				
Capital Cost	Engineering Cost Override (optional)	Capital Cost Date		
\$65,700,000				
This will override the percentage based engineering cost with a fixed amount. Assume plan start date if empty.				

1 - SMCWRC - Biosolids System Upgrades

Location: SMCWRC	Sublocation: Solids Treatment
Primary Driver: Capacity	Secondary Driver: Operability/Maintainability
Priority Score: 725	Flexibility: Low
Required Completion: N/A	Start After: N/A
2022 Capital Cost: \$65,700,000	Annual O/M Change: \$0
Budget Account: CIP	Impact Fee Eligible: No
Forecasted Construction Cost: \$71,375,000	Forecasted Engineering Cost: \$14,275,000

Phase	Type	Duration	Start	End
Selection and Board Approval	Administrative	6 Months	6/1/2022	11/30/2022
Performance Evaluation	Engineering	4 Months	12/1/2022	3/31/2023
Engineering/Design	Engineering	18 Months	4/1/2023	9/30/2024
Bid Phase	Administrative	6 Months	10/1/2024	3/31/2025
Construction	Construction	36 Months	4/1/2025	3/31/2028
Start-up	Construction	3 Months	4/1/2028	6/30/2028

Project Description

The purpose of this project is to construct a new centralized solids processing facility that will replace the existing solids processing facilities. This project includes the installation of a new sludge screening, thickening centrifuges, and dewatering centrifuge building. The biosolids processing building will be located Southwest of the existing sludge drying beds. A new biosolids lab, parking lot to include approximately 15 spaces, and additional offices in the new biosolids building are also included in this project. A new road and sidewalk will be constructed to provide access for operators and visitors. All new electrical and SCADA equipment will be provided including extending duct banks to the new facility. The current BFP Pavilion should be demolished once the new building and dewatering system are in service. This project also includes the demolition of the screening facility once the new thickening and dewatering system in the new building is put into the service. (Link: Task 7 Biosolids TM Section 3.0)

Justification

There is an urgent need for additional dewatering capacity due to the limited remaining lifespan of existing BFPs. There is inadequate capacity in existing sludge screens for future flows. The additional thickening and sludge screening units will address future capacity needs. Constructing a centralized solids processing facility will decrease the operational complexity of the solids processing process. Laboratory availability and storage space are currently limited to a few areas at the SMCWRC. A new biosolids lab space will help give the operators the tools they need to execute their jobs.

Consequences

Consequences of not completing this project: Reduced dewatering performance and higher cake management costs if project is not implemented. Critical failure of existing dewatering system is possible due to age and condition of BFP equipment. Inadequate capacity to screen future sludge flows.

Special Considerations

The exact location of the new dewatering system will need to be coordinated with the location of a potential future Solar Drying and Pasteurization facility to ensure that cake transfer operations from dewatering to drying are optimized. There would need to be separate thickening of PS and WAS to coordinate with the needs of the recommended phosphate harvesting project as well as Thermal- Alkaline Hydrolysis of WAS.

The CIP tool produces a spending forecast using the following method

1. Data Insertion in the CIP Tool

Input Project Data

Score Project

2. Forecast Run in CIP Tool

Trigger Dates

Priority Score

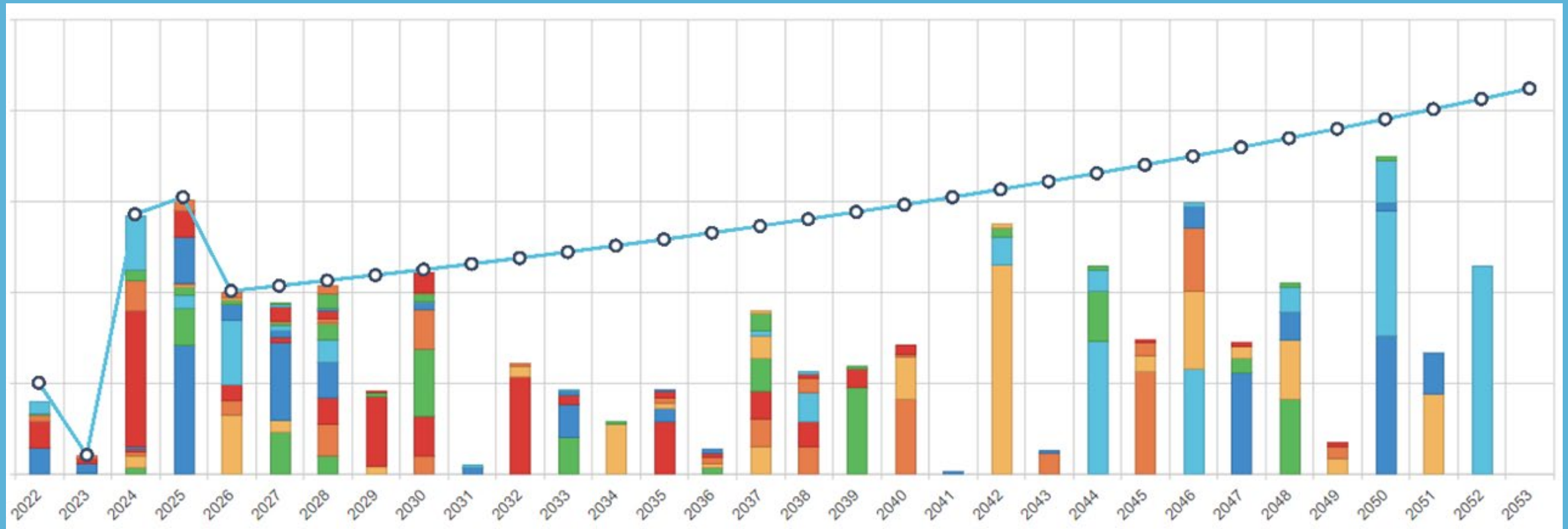
Available Funds

Project Dependencies

3. Output

Spending Forecast

The DynamiCIP Tool's final 30-year spending forecast provided SAWS a short and long term cashflow plan



2025 Wastewater Master Plan Update

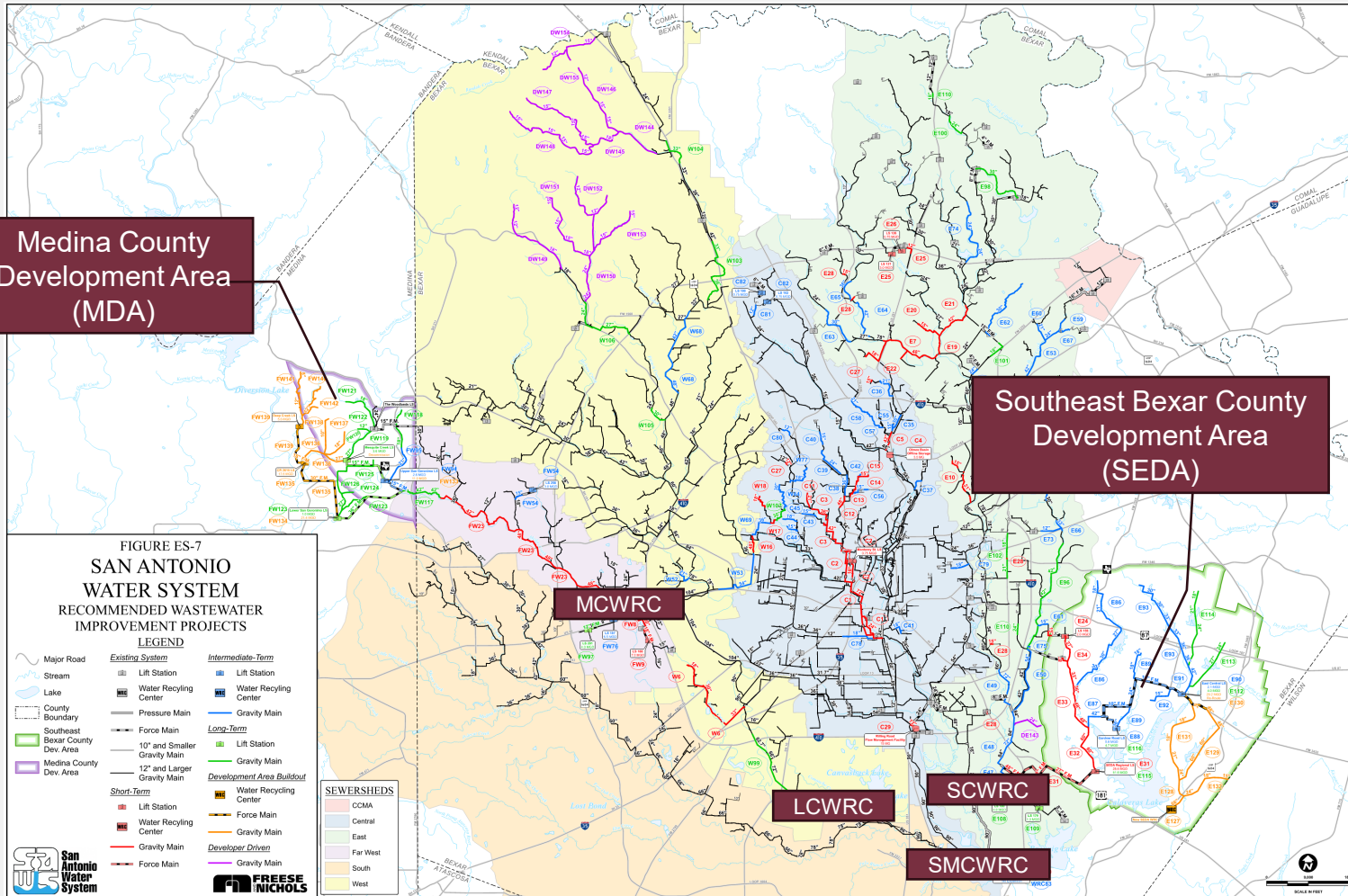


CIP Update Scope Overview

- Near-term (2026-2035) projects
- Planning Criteria
 - Revised SAWS Master Planning Group Projections (2025)
 - Operator interviews for changes to major equipment
 - On-site condition assessment updates
- Wet Weather Management
 - Flow Diversion
 - Flow Storage
- CIP Project Updates
 - Rehabilitation Projects
 - Capacity Projects
 - Electrical Projects



Revised San Antonio Population Growth



Updated New growth in the East (SMCWRC/SCWRC) and Far West (MCWRC) is driving flow increases

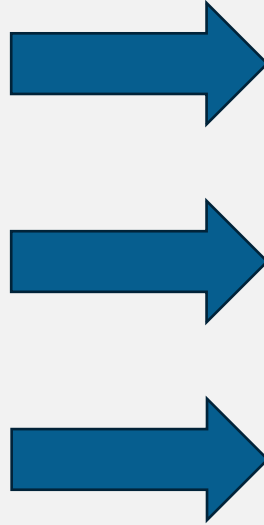
- **SMCWRC:** East w/ SEDA + Central + South Sewersheds
- **LCWRC:** West Sewershed
- **MCWRC:** Far West w/ MDA Sewershed

Collaboration with SAWS Staff to update CIP Projects

- Input from SAWS Operations, Maintenance, Asset Management, Master Planning, and Engineering Staff

- Project Element condition assessment review and classification update
- Discussions on new/ongoing operational issues
- Project review and updates for projects already in design

- Site visits to confirm project elements to understand the scope of work



- Better understanding of project needs and current market conditions
- New scope elements, costs, and quantities added
- Existing scope elements costs, and quantities updated

Near-term Major Projects Considered

- Treatment Facilities Engineering Work Order Contract Projects (2026-2030)
- Steven M. Clouse WRC Biosolids System Upgrades (**Ongoing**)
- Leon Creek WRC Hydraulic and Solids Improvements (**Ongoing**)
- Steven M. Clouse WRC Rehabilitation Improvements Phase 1 (**Ongoing**)
- Steven M. Clouse WRC Primary Treatment Expansion (Package B) (**Ongoing**)
- Leon Creek WRC Flow Management Upgrades (**Ongoing**)
- Leon Creek WRC Rehabilitation Improvements Phase 1
- Medio Creek WRC Rehabilitation Improvements Phase 1
- Steven M. Clouse WRC Rehabilitation Improvements Phase 2
- Leon Creek WRC Electrical System Improvements Phase 2
- Steven M. Clouse WRC Anaerobic Digestion Facility Expansion (Package A)
- Steven M. Clouse WRC Tertiary Hydraulic and Process Capacity Improvements (Package C)
- Steven M. Clouse WRC Space Management, Workforce Development and Roadway Maintenance
- Medio Creek WRC Hydraulic Capacity and Space Management Improvements
- Medio Creek WRC Process Capacity Improvements (Package A)
- Leon Creek WRC Aeration Process Expansion and Improvements (Package B)
- Leon Creek WRC Primary Process Capacity and Hydraulic Improvements (Package C)
- *Steven M. Clouse WRC Enhanced Energy Recovery - Biosolids Improvements Phase 1*
- *Steven M. Clouse WRC Sidestream Phosphate Harvesting*
- *Steven M. Clouse WRC Biological Nutrient Removal Upgrades*
- **Steven M. Clouse and Salado Creek WRC Flow Management Upgrades**



Key Takeaways at SMCWRC and SCWRC

- Flow projections in 2025 are higher than in the 2022 Master Plan
- Future “Central Stem” collection system project will impact flows in the Central Sewershed
- Garver is reviewing strategies to address these needs and to provide resiliency



Key Takeaways at MCWRC

- Flows and loads are higher than projected/evaluated in the 2022 Master Plan
- The change in the flows and loads are not changing the short-term projects at MCWRC
- MCWRC will be further evaluated for flow and load management



Key Takeaways at LCWRC

- Peak flows in the planning horizon are higher than projected in the 2022 Master Plan
- Updates to ongoing projects have been implemented, and additional updates are being evaluated
 - FEB diversion structure capacity that is currently considered will cover revised future growth projections

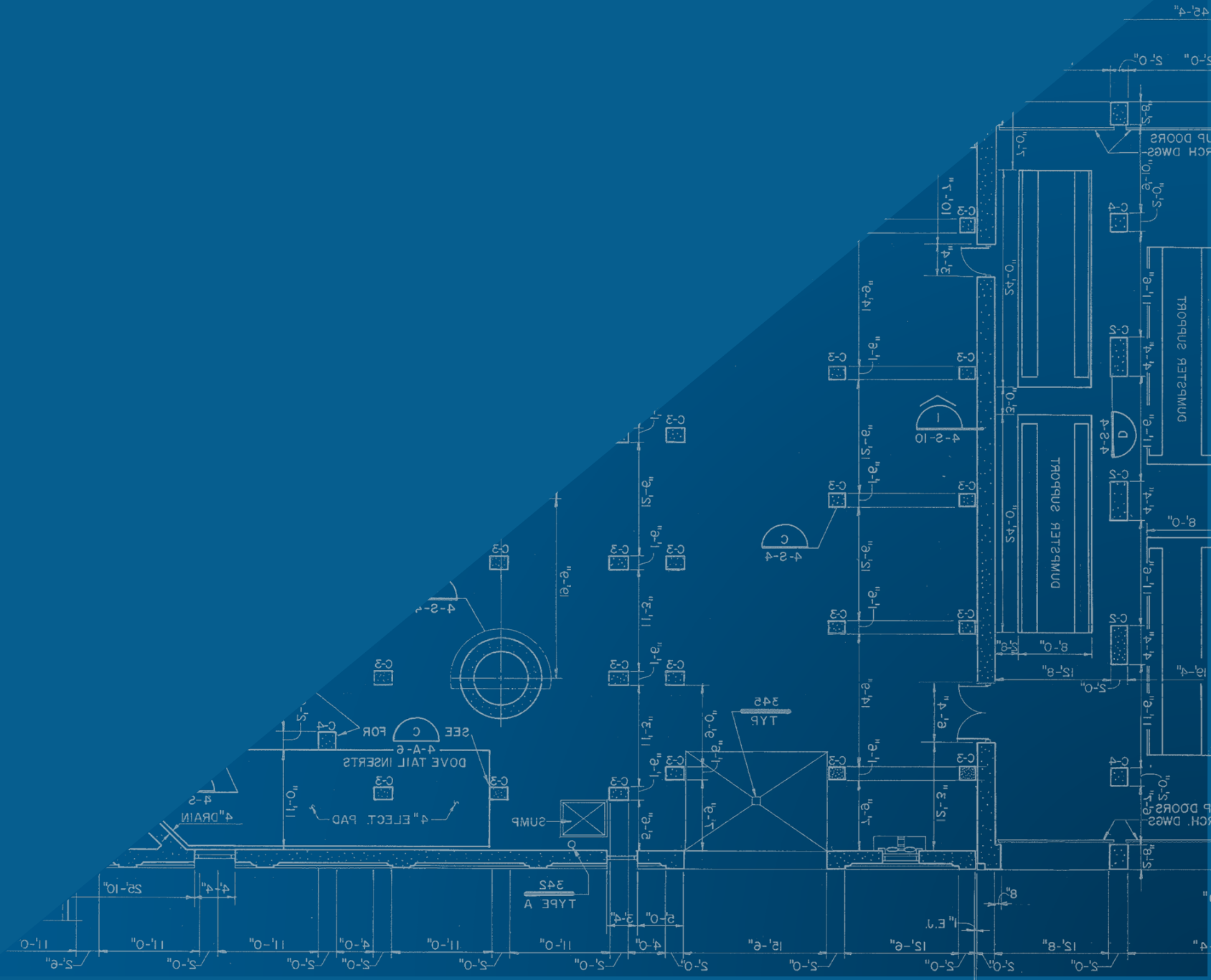


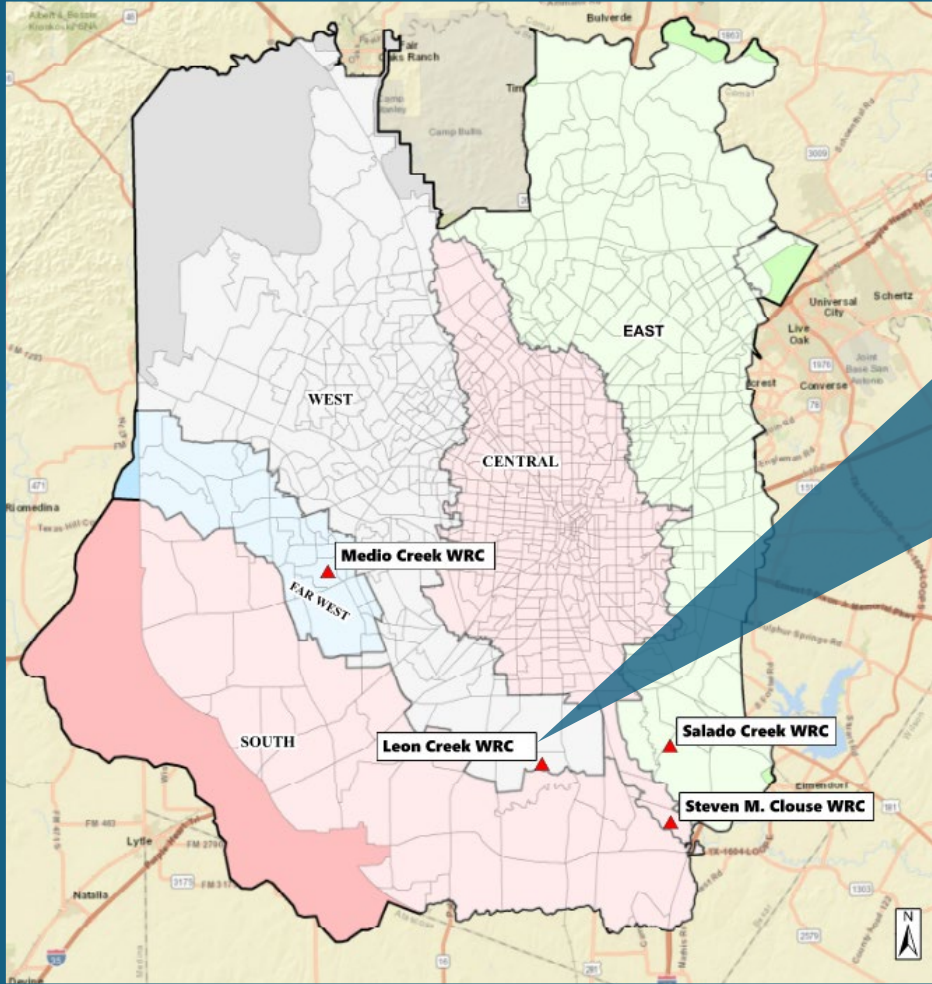
In conclusion, the 2025 CIP updates will provide SAWS with a defensible and accurate list of all critical needs for the successful operation of the SAWS WRC assets.



**San
Antonio
Water
System**

Questions?





TACWA - Integrated Flow Management Solutions: Leon Creek WRC

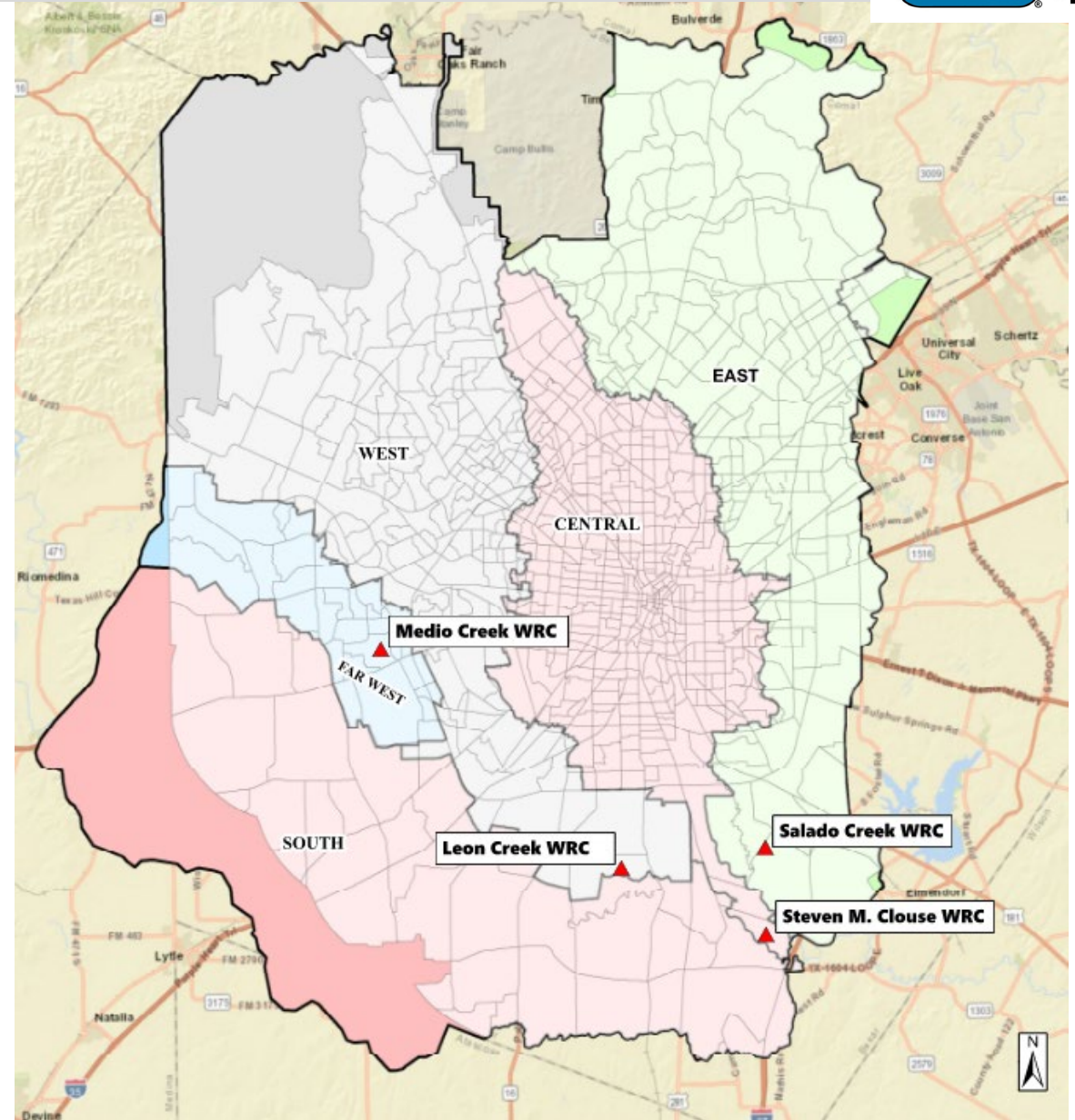


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How We Serve



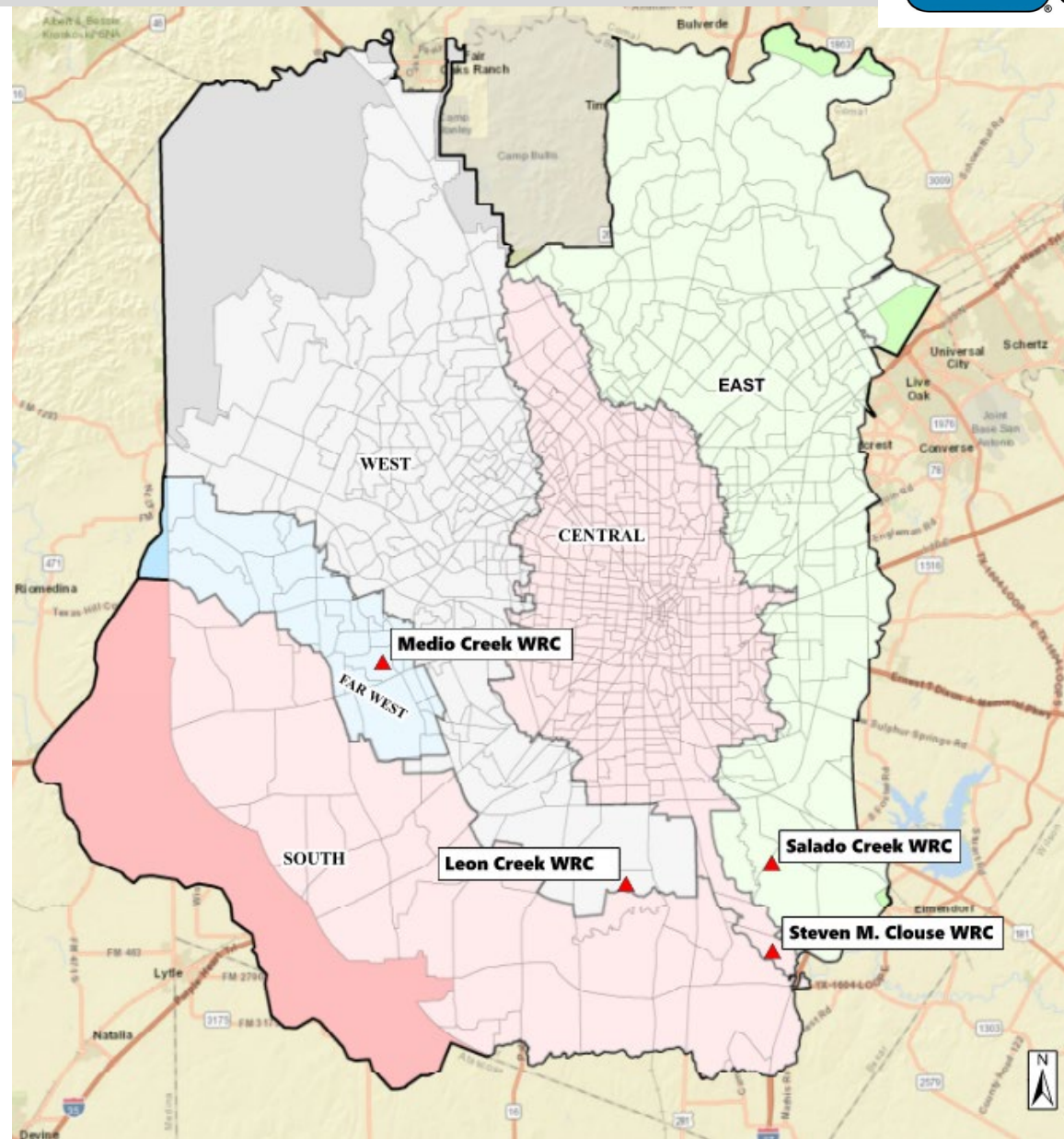
- ▶ SAWS wastewater service area spans the greater San Antonio area and comprises five sewersheds
- ▶ SAWS operates and maintains three wastewater treatment facilities:
 - Leon Creek WRC - 1965
 - Medio Creek WRC – 1972
 - Steven M. Clouse WRC – 1987
- ▶ Master Planning for systemwide treatment quality compliance, efficiency and resiliency



Who We Serve



- ▶ Serves approximately **675,000** people in the West basin
- ▶ Covers approximately **181,000** acres
- ▶ Spans approximately **8.49 million** linear feet of gravity mains



Leon Creek Water Recycling Center

▶ LC WRC Permitted Discharge

- 46 MGD ADF
- 92 MGD P2HF

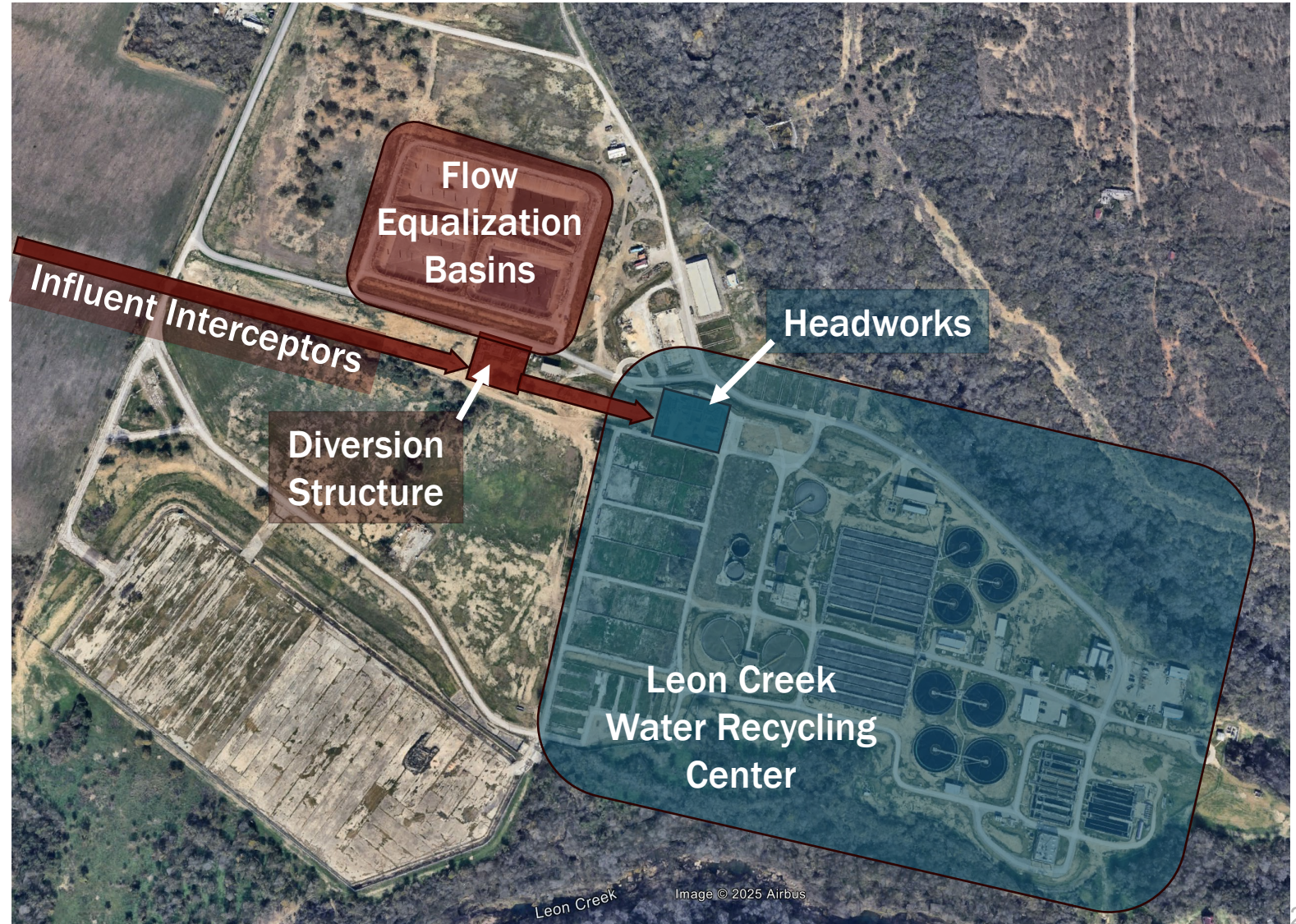
▶ Influent Interceptors

- 78-Inch
- 60-Inch

▶ Diversion Structure

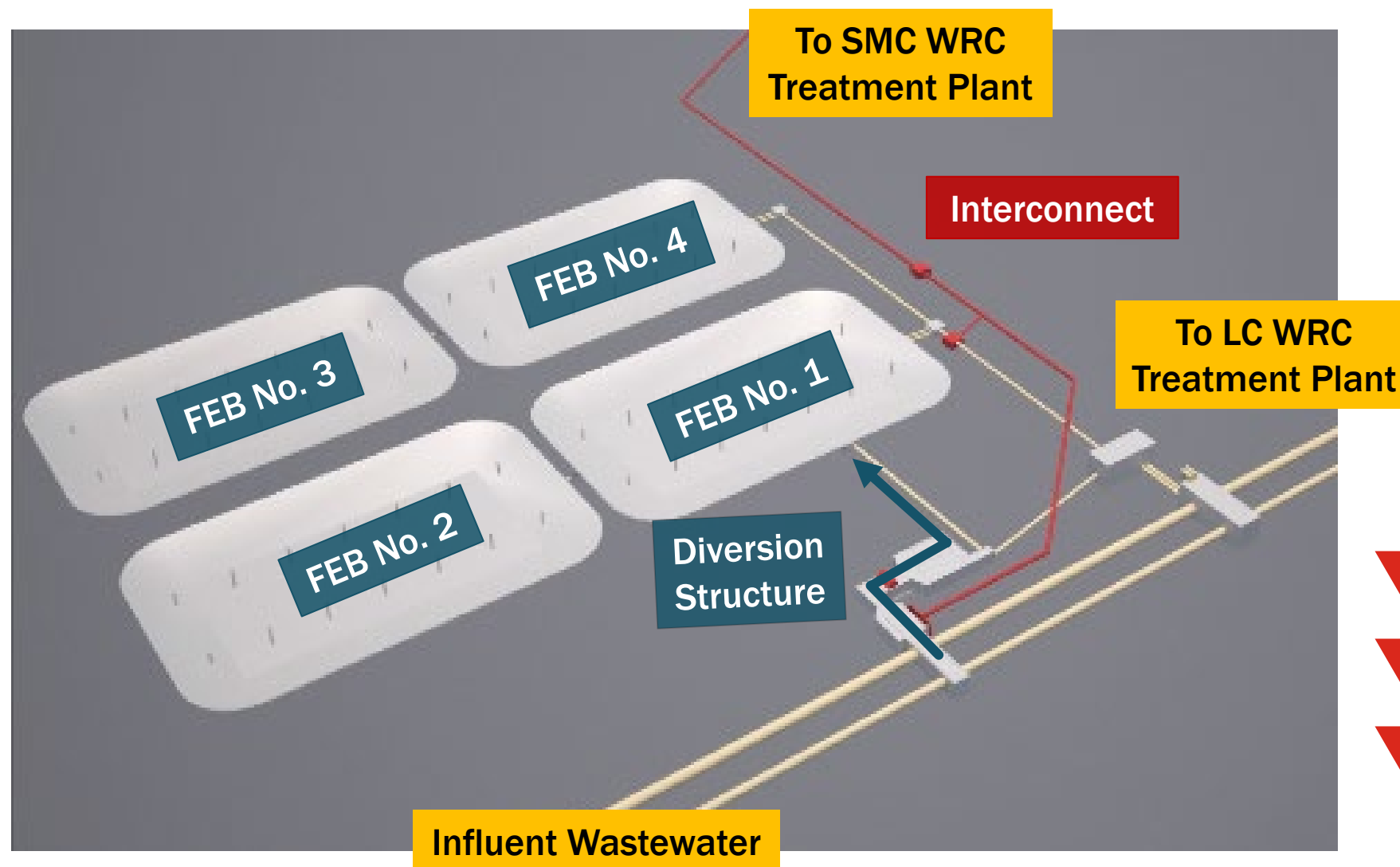
- Bar Screens
- Parshall Flume
- FEBs

▶ Wastewater Treatment



How We Are Connected

- ▶ Interconnect to SMC WRC via Southwest Bexar Sewer Pipeline (SBSP)
- ▶ Interconnect Design Flow – 60 MGD
 - Transfer of FEB Stored Flow
 - Transfer of Unscreened Diverted Flow



Planning for the Future

► 2022 SAWS Wastewater Facilities Master Plan

- 2050 Flow Projections

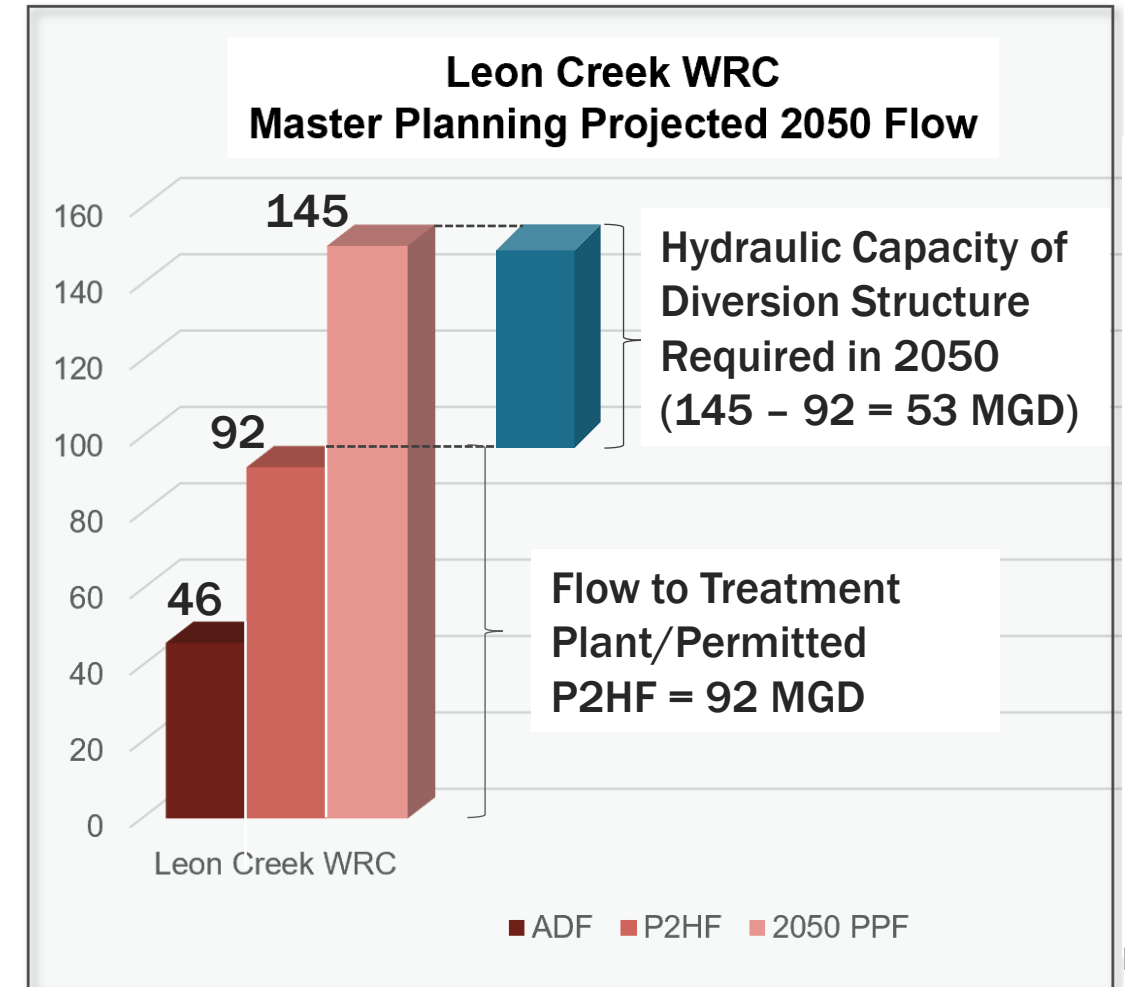
- 145 MGD P2HF

- Existing Diversion Structure

- *Hydraulically Limited through Screens & Parshall Flume*

- Leon Creek WRC Flow Management Project

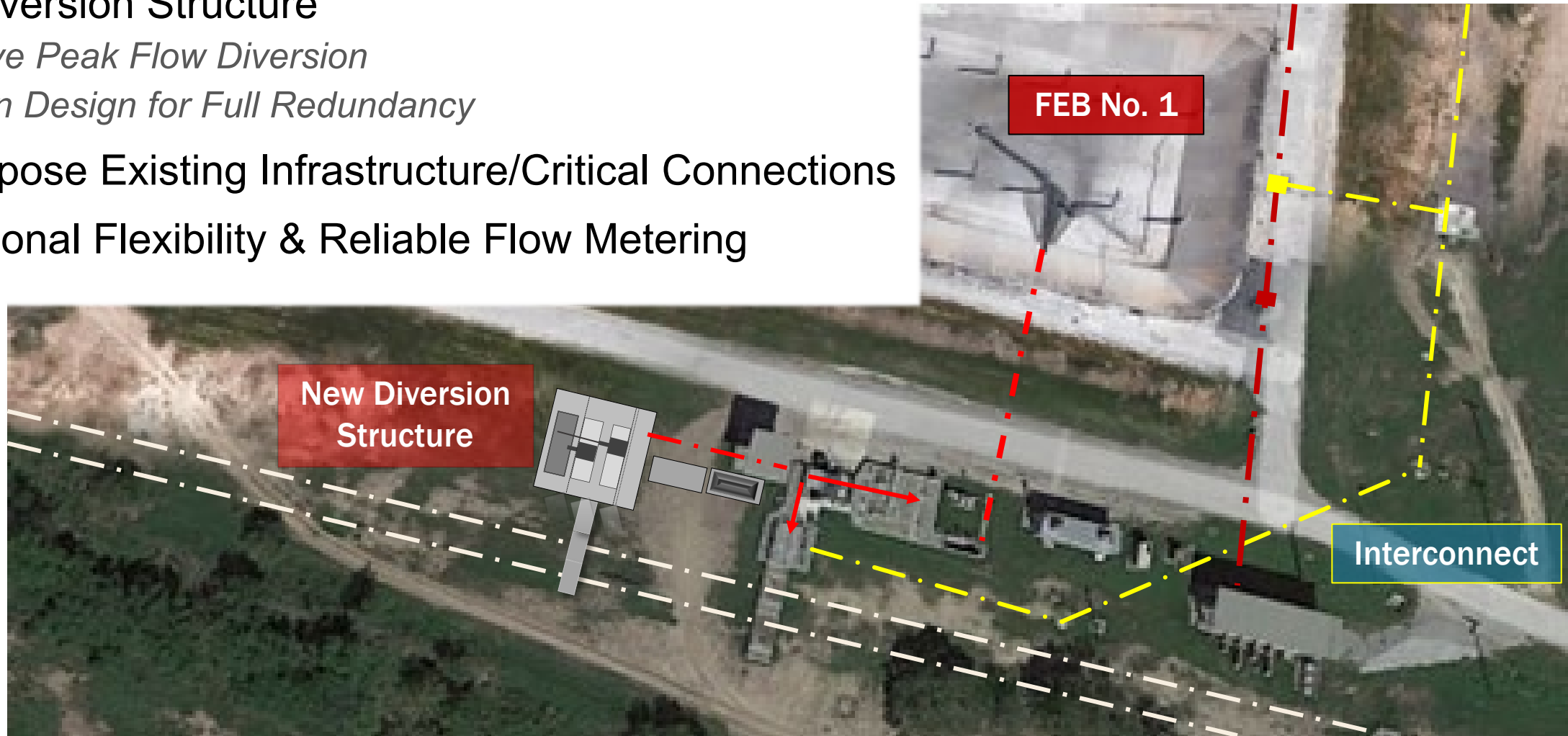
- *New FEB Flow Diversion Structure with Screens & Flow Meter; Maintain Interconnect to SMC WRC*
- *Demolish Existing FEB Flow Diversion Structure*
- *Upgrades & Repairs to Identified Flow Management Elements*
- *All associated engineering discipline support*



Peak Flow Management

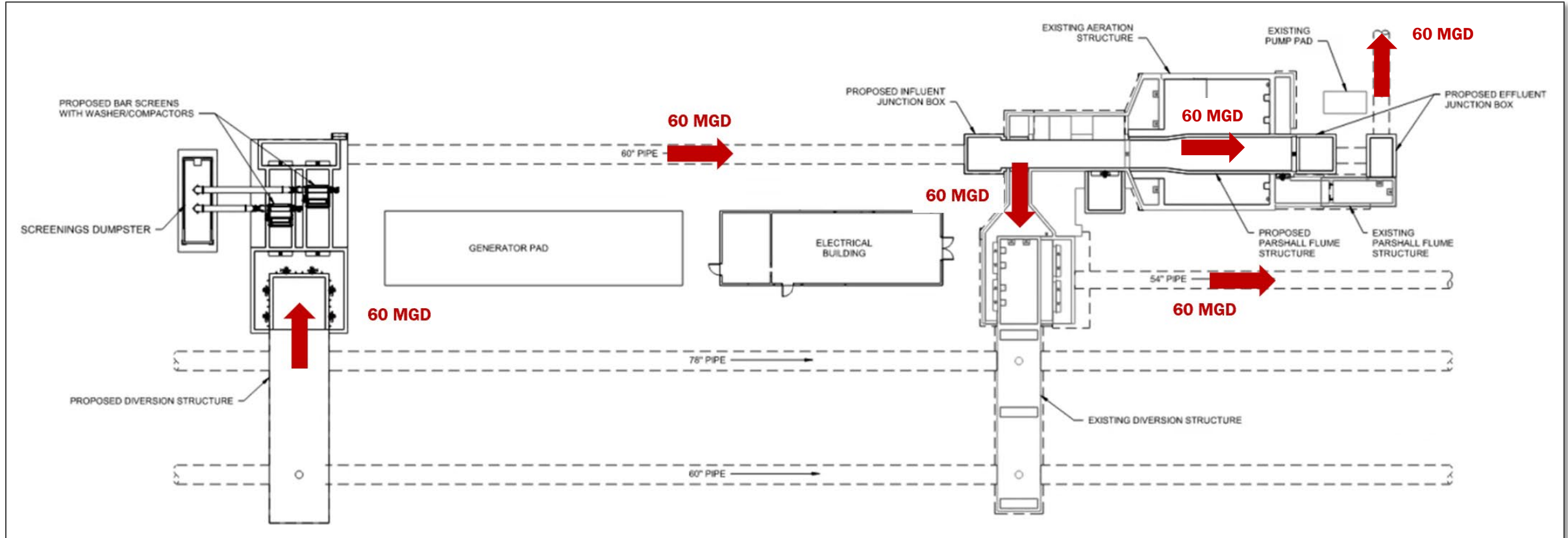
► Key Design Elements

- New Diversion Structure
 - *Passive Peak Flow Diversion*
 - *Screen Design for Full Redundancy*
- Re-Purpose Existing Infrastructure/Critical Connections
- Operational Flexibility & Reliable Flow Metering



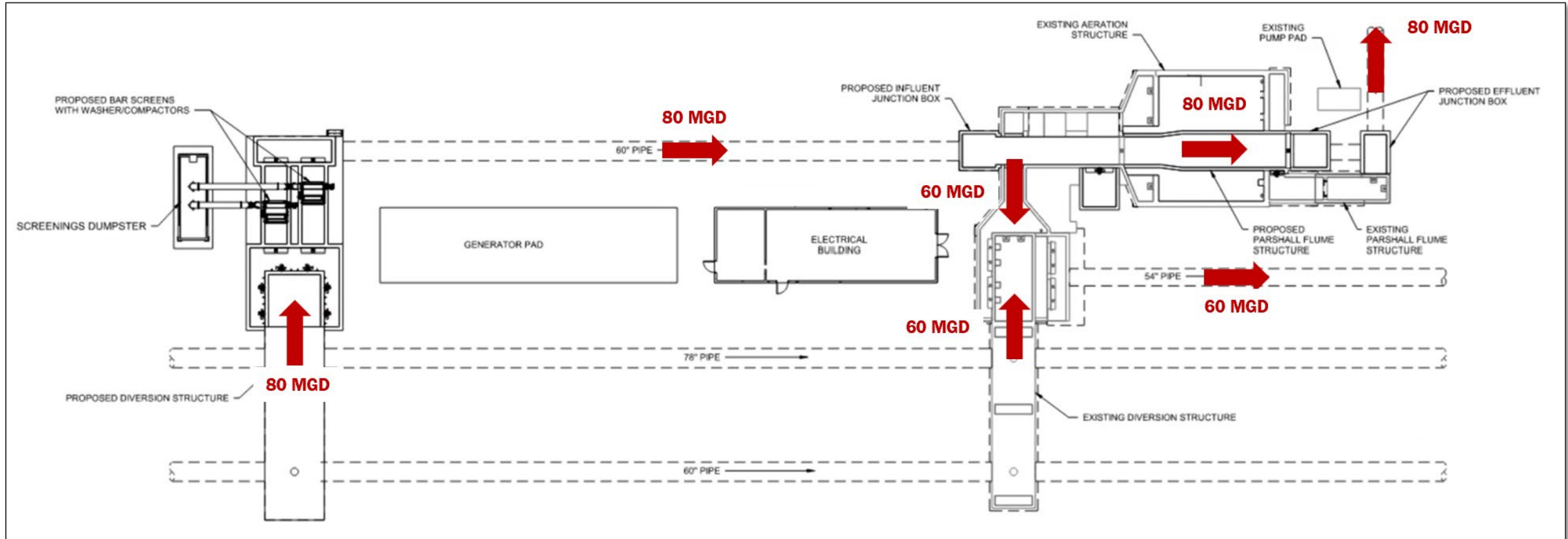
Peak Flow Management

► PER - Proposed Flow Diversion Structure Layout



Operational Resiliency

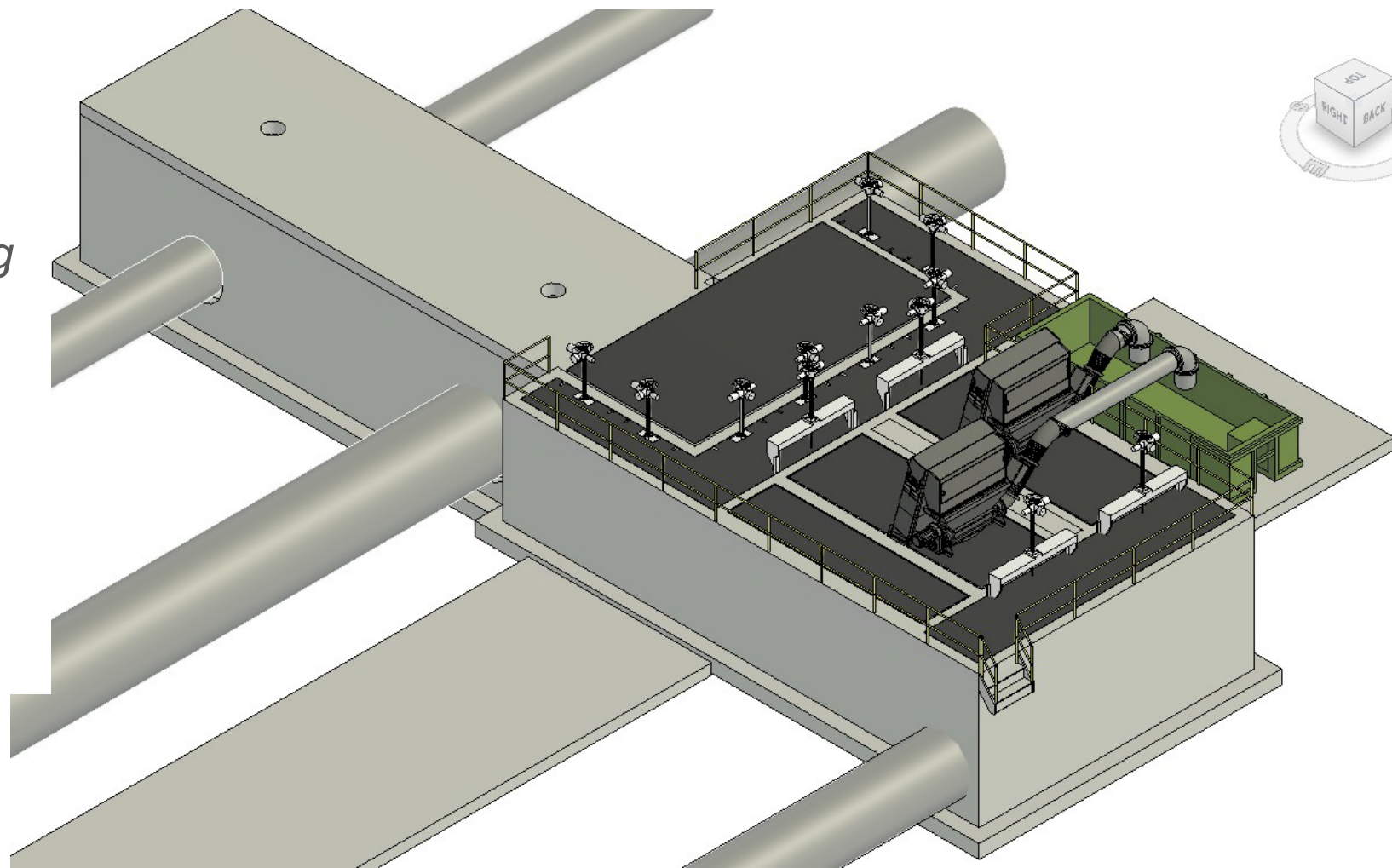
► Updated 2050 Projected Peak Flow – 168 MGD



Operational Resiliency

► Updated Proposed Flow Diversion Structure

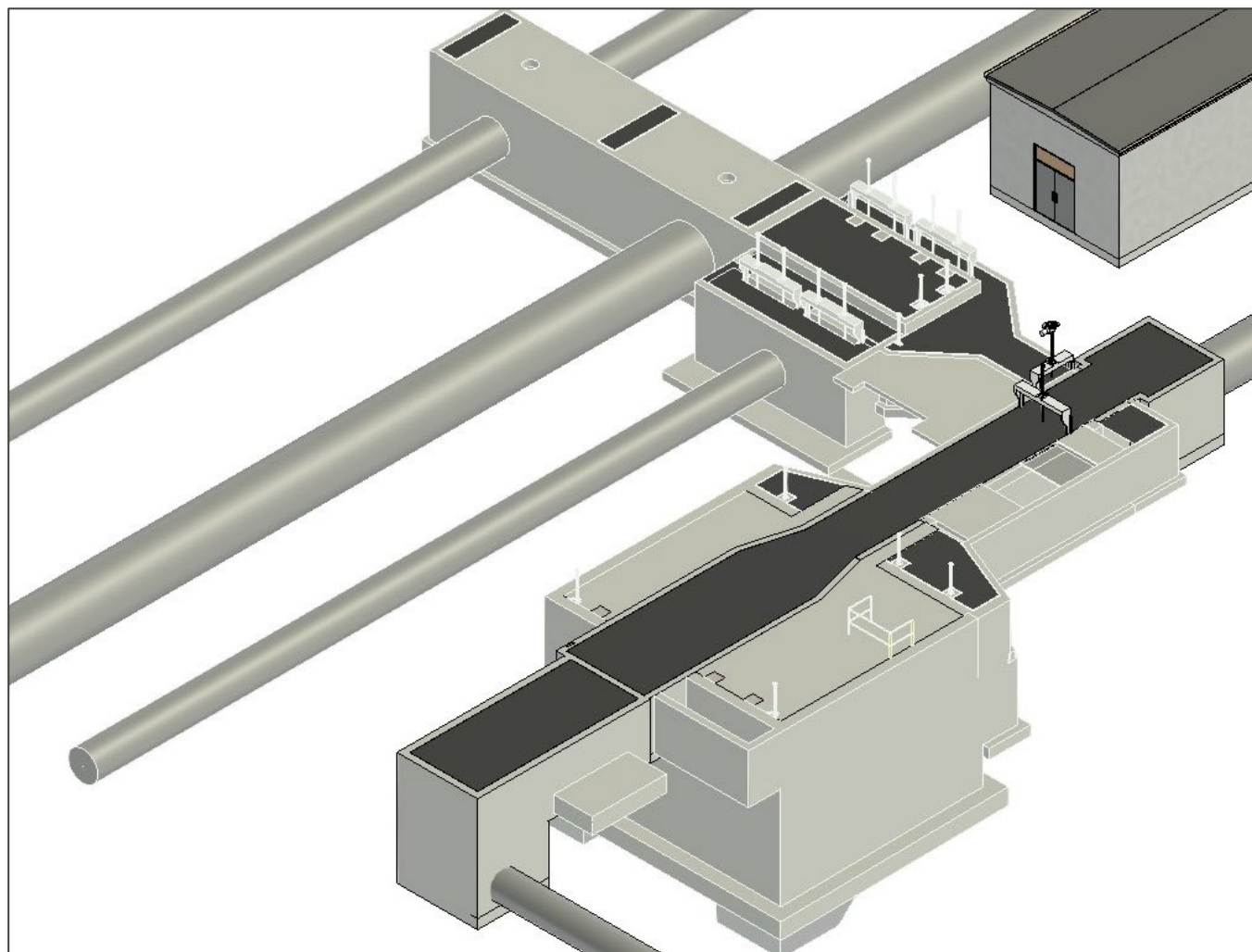
- Passive Peak Flow Diversion
- Full Screen Redundancy
- Screened Flow Path
 - To FEBs, Following Metering
 - FEBs to Treatment
 - LC WRC
 - SMC WRC
 - To SMC WRC via Interconnect



Operational Resiliency

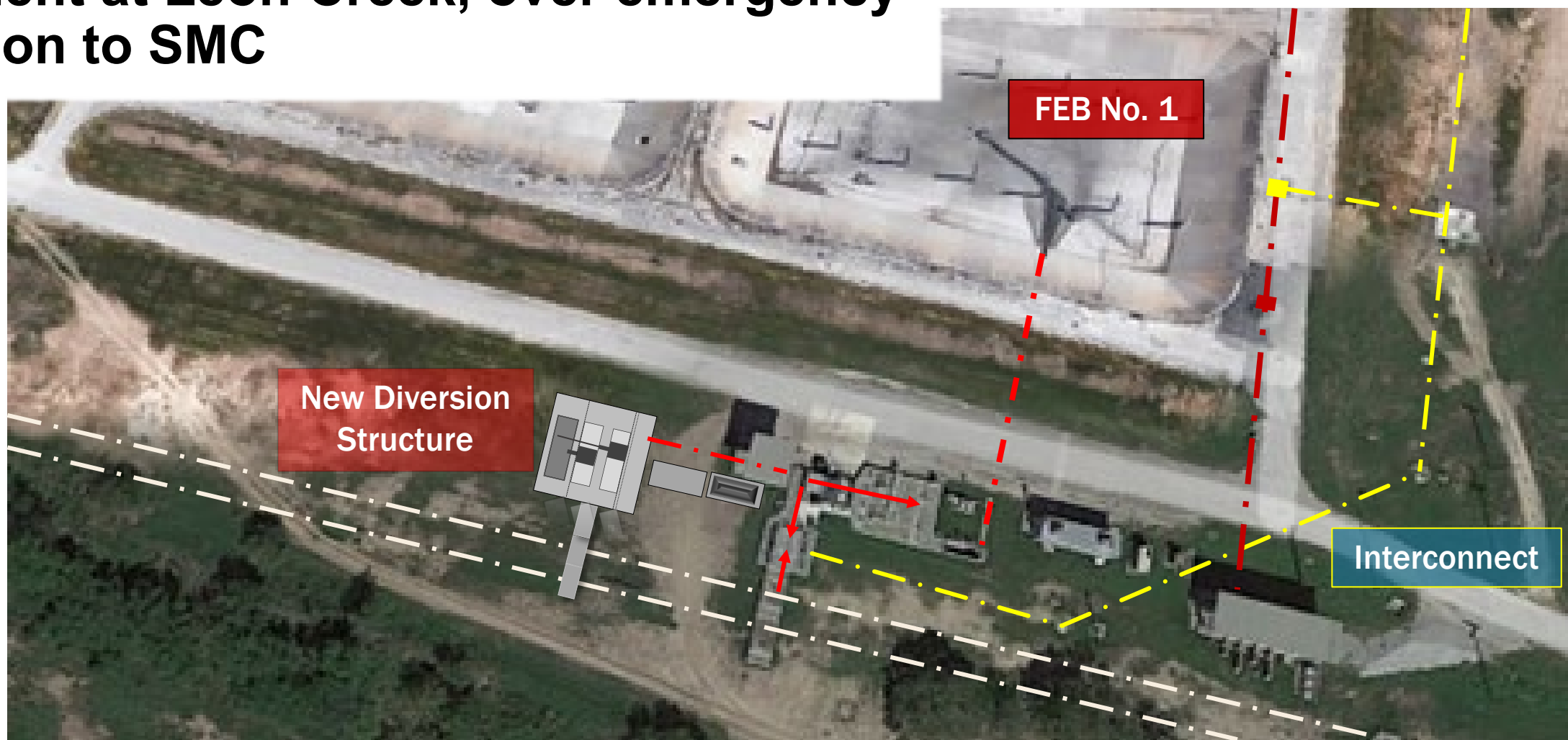
► Updated Existing Flow Diversion Structure Rehab/Modifications

- Screened Flow Path
 - *To FEBs, Following Metering*
 - *FEBs to Treatment*
 - LC WRC
 - SMC WRC
 - *To SMC WRC via Interconnect*
- Emergency Unscreened Flow to SMC WRC



Integrated Flow Management

- **Prioritizes Western Sewer Shed Peak Flow Treatment at Leon Creek, over emergency diversion to SMC**





Thank You!

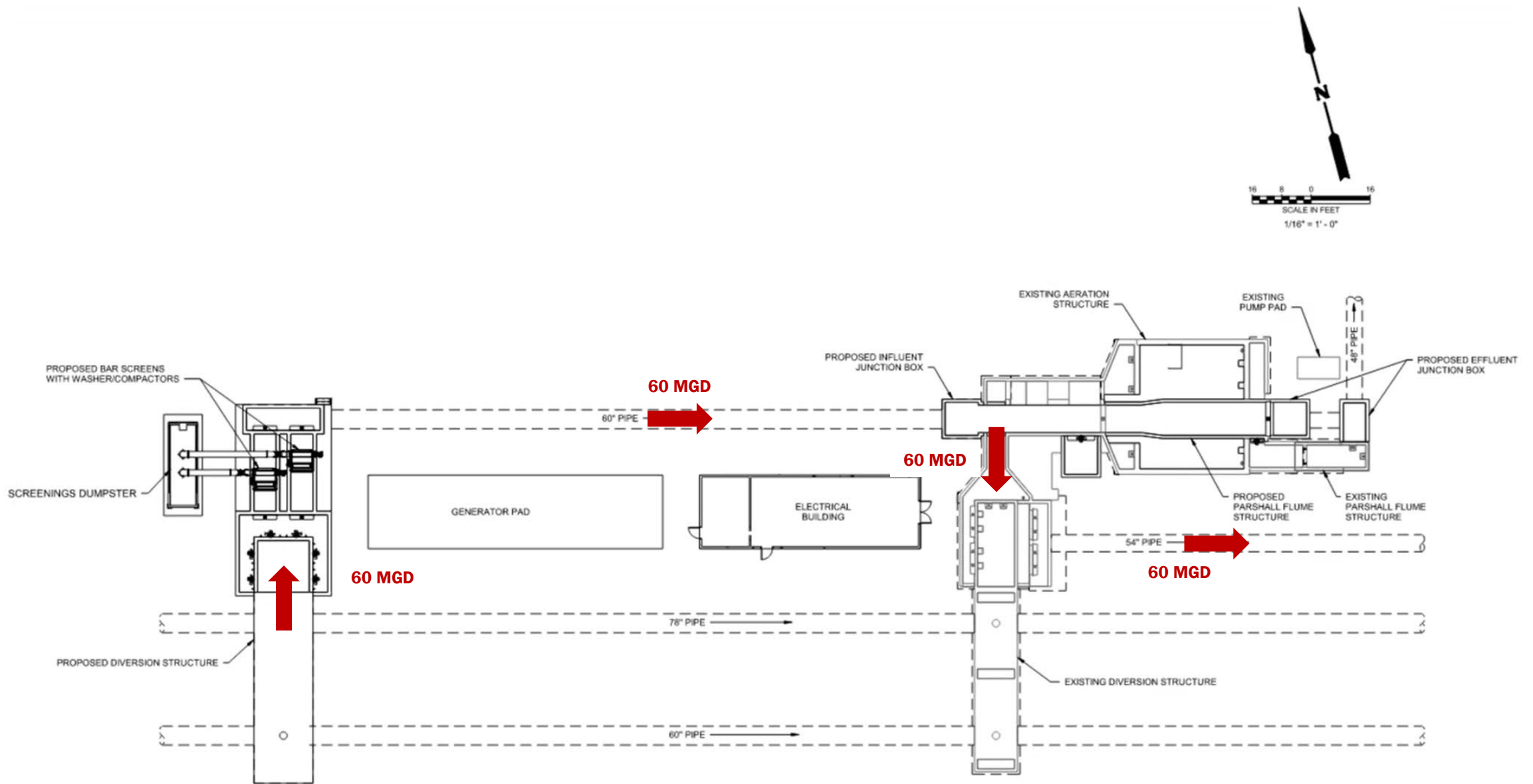
**Integrated Flow Management Solutions:
Leon Creek WRC Flow Equalization
Facilities Expansion Project**

Speakers:

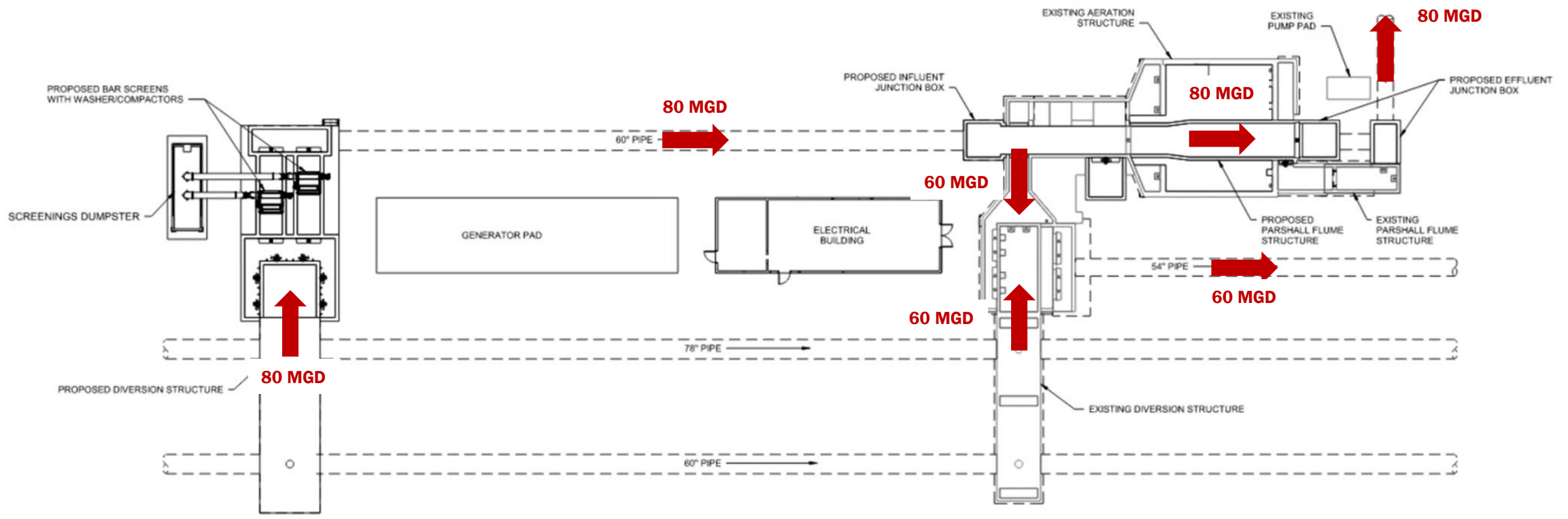
Emmanuel Villegas, P.E.
San Antonio Water System
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Daniel Smith, P.E.
San Antonio Water System
Daniel.Smith@saws.org

Dawn Anderson, P.E.
STV
Dawn.Anderson@stvinc.com

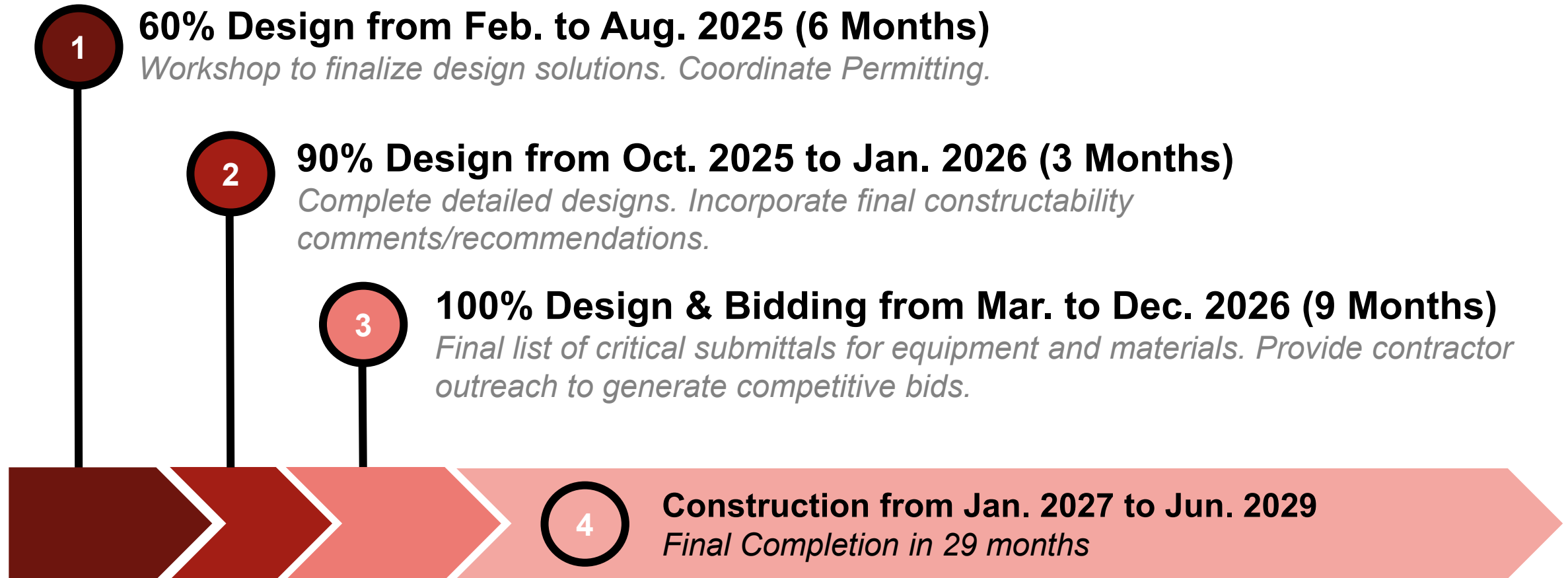


Proposed Diversion Structure – 60 MGD Screed Flow to SMC



OVERALL PLAN

Project Schedule



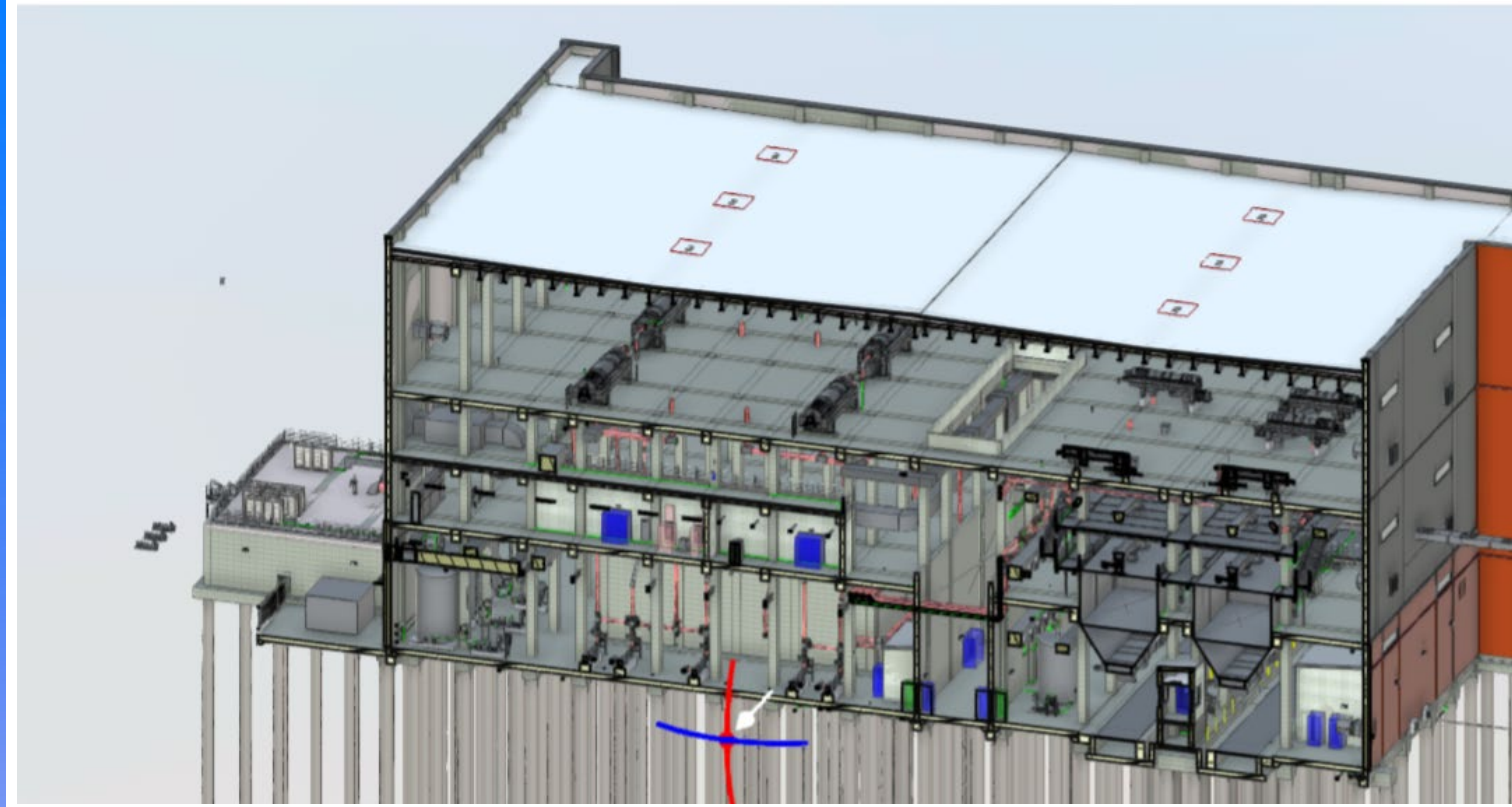


Designing SAWS' New Thickening and Dewatering Process Facility (60% Design Update)

Rebekah Ramos, P.E.
Nicolas Ulloa
Matt Berg, P.E.



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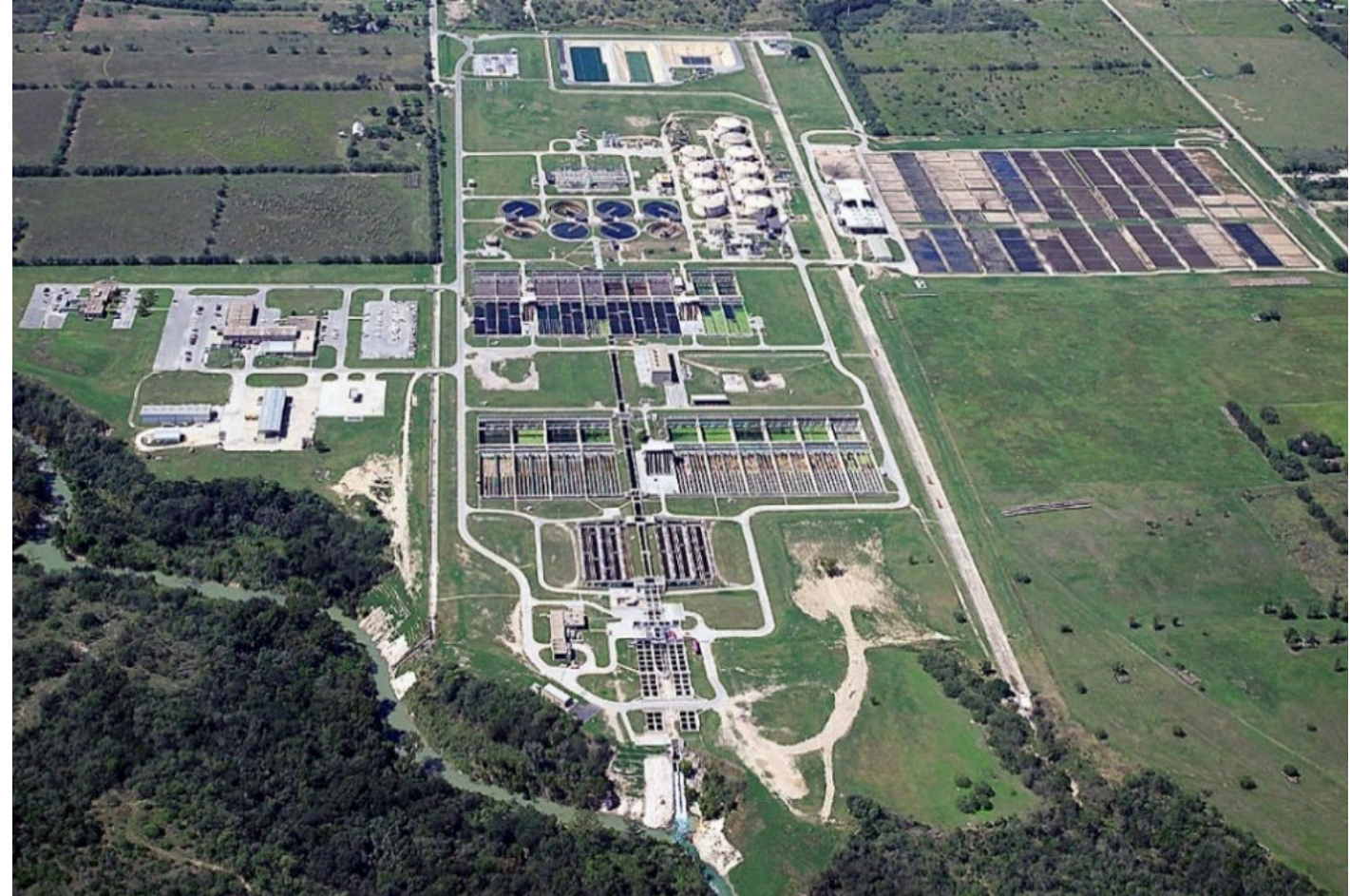
Agenda

- Project Overview
- Team Approach
- Site Tours
- Solids Separation Building
- Construction Sequencing
- Open Discussion/Questions

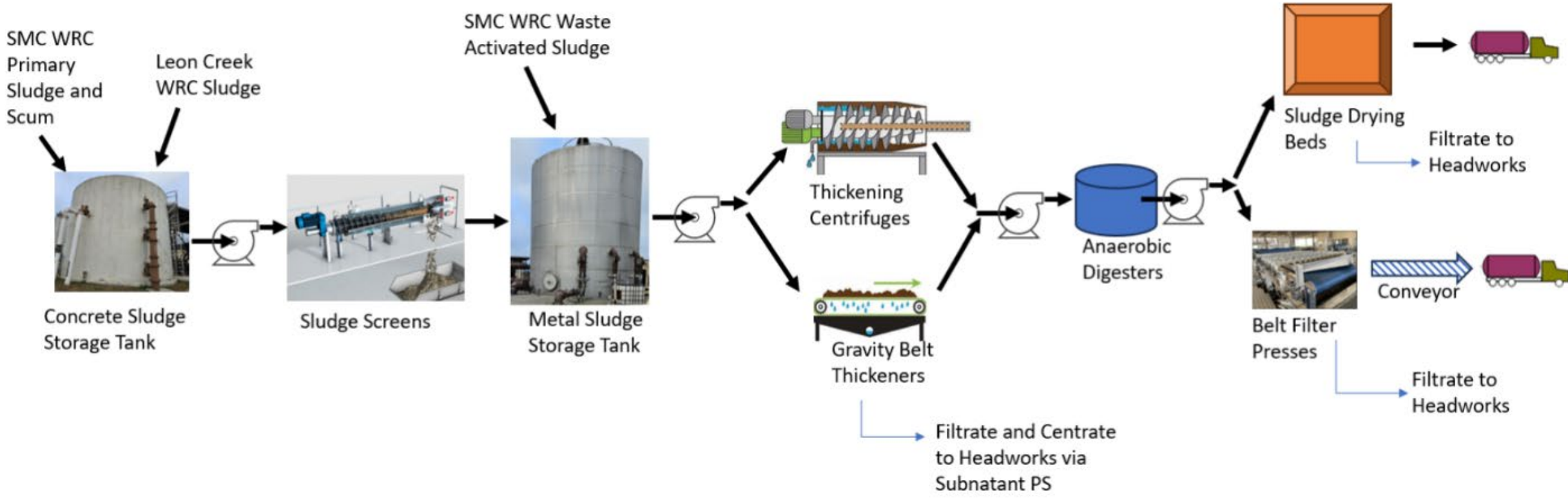
Project Overview

Project Overview

- Steven M. Clouse WRC is SAWS largest water recycling center
- All solids processing is centralized at the SMC WRC



Project Overview



Project Overview

- Address condition and capacity gaps for biosolids screening, thickening, and dewatering processes
- Project Goals
 - Replace existing equipment at the end of its useful life
 - Address future capacity needs
 - Decrease operational complexity with a single process building

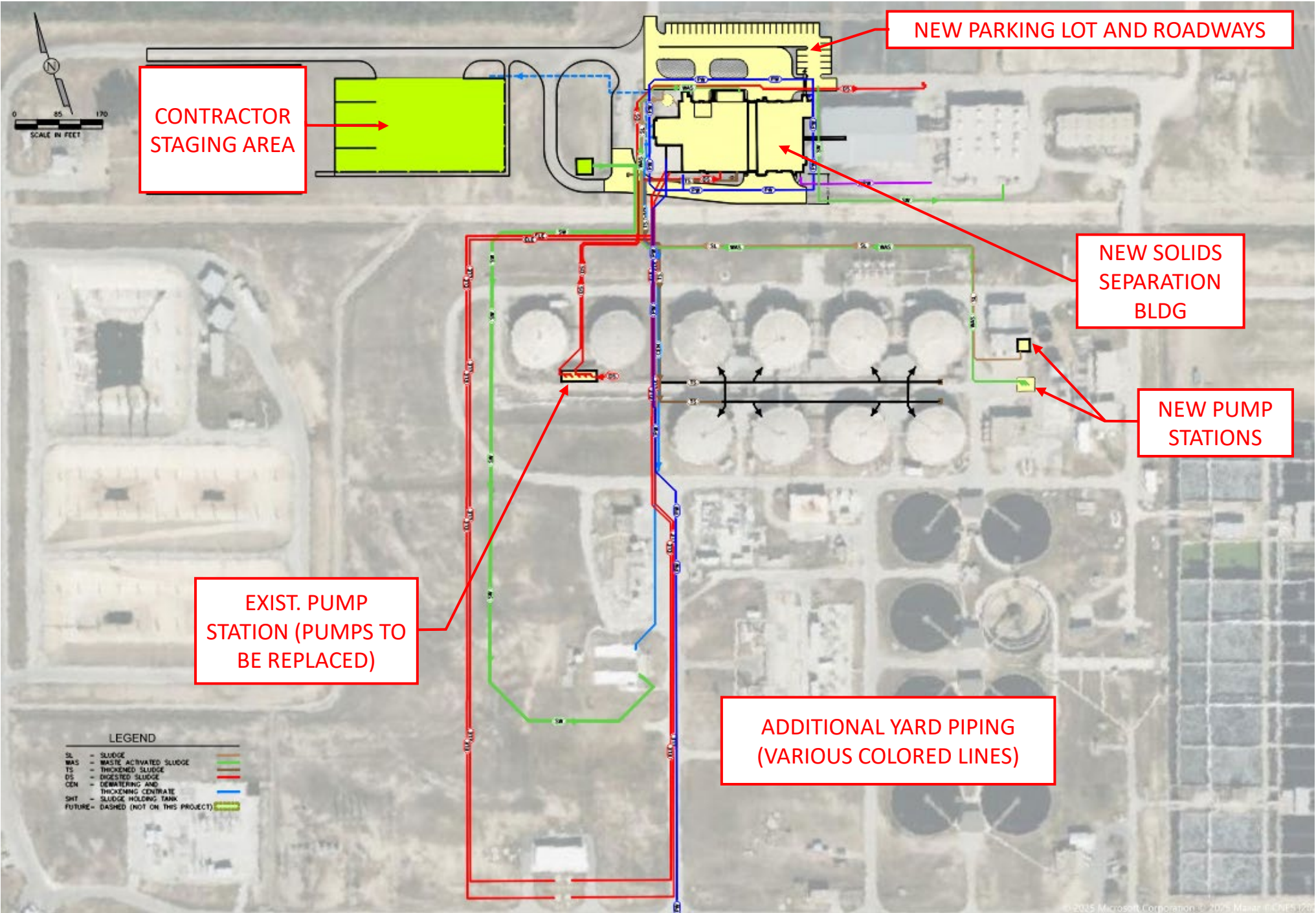


Project Overview

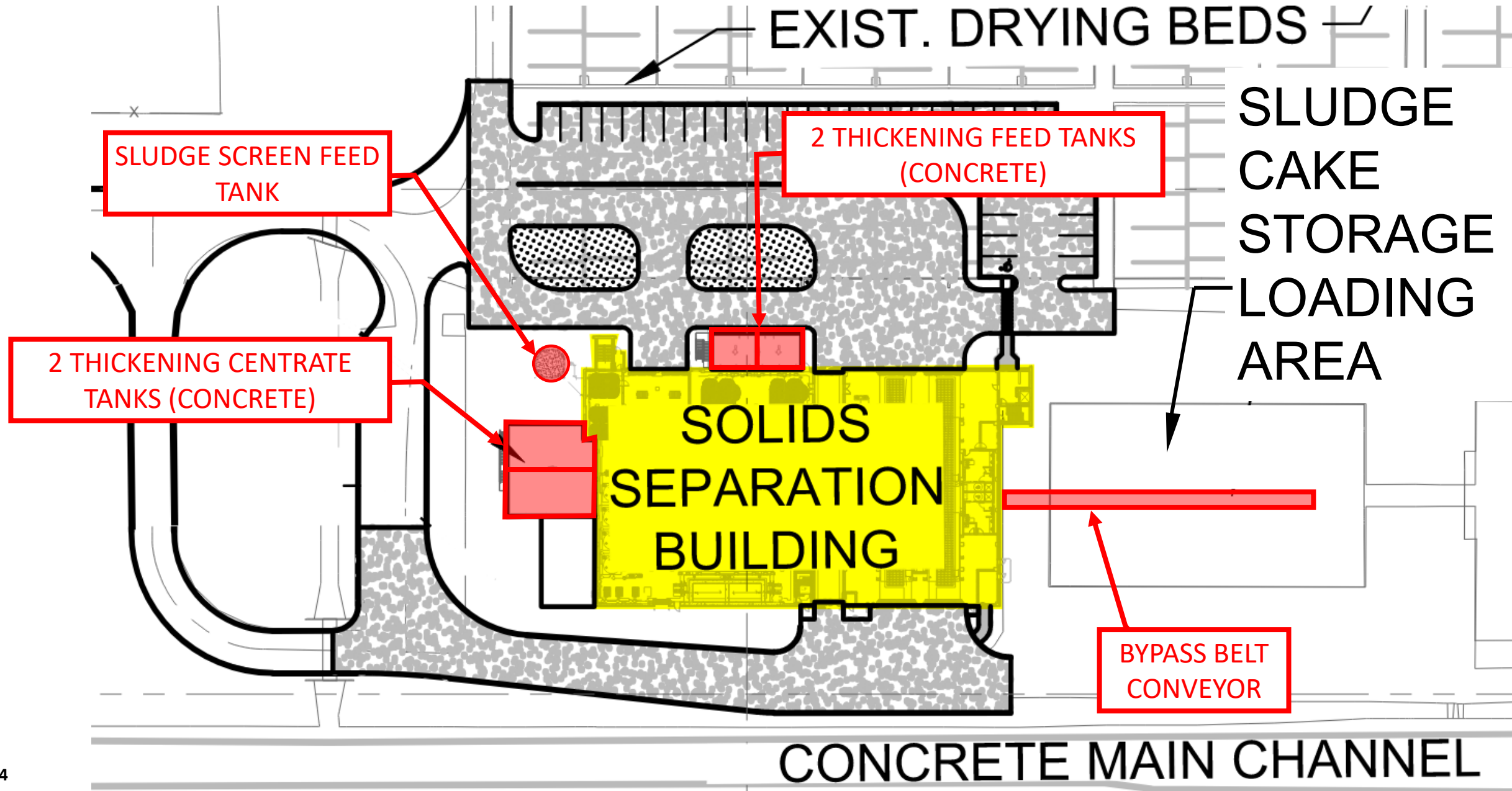
1. New construction
 - Tall 3-story building for sludge screening, thickening, dewatering
 - 2 new pump stations
 - New parking lot, access road, sidewalks
 - Additional yard piping
2. Replace pumps at 1 existing pump station
3. Demolish existing sludge screening, thickening, and dewatering facilities AFTER new building equipment is online



Site Improvements Plan



New construction outside building



Team Approach

Partnership with SAWS PMP, Treatment, Consultant, others

- Treatment Operations and Maintenance staff involvement
 - Design decisions and end-user preferences that impact operation
 - Access for maintenance (monorails, cranes, etc.)
 - Testing support
 - Operational considerations for flexibility/redundancy
 - Construction sequencing
- Site tours (with O&M staff) to facilities in other cities, including designs by other consultants to maximize lessons learned

Site Tours

SMCWRC Biosolids System Upgrades Project

Site Tours – Variety of Plants and Attendees

	Facility Size	Centrifuge Vendor	Similarity to SAWS Alts.	Building Summary	Price Date
Boulder WWTP <i>Boulder, CO</i> Tetra Tech/RTW	25 MGD; 15 dtpd	<u>Alfa Laval</u> 3 units 20-22% TS	<u>Alternative 1</u> 2-story layout, cake pumps to storage in separate building, similar feed characteristics	Building 1: 2-story; centrifuges on top, pumps on ground Building 2: 1-story; hoppers on top of truck loading bay skids	\$15M 2007
Robert W. Hite Plant, Metro Water Recovery <i>Denver, CO</i> Brown & Caldwell	185 MGD	<u>Centrisys</u> 8 units 20-22%TS	<u>Alternative 2</u> Centrifuges on top floor, silos within building, similar feed characteristics	4-story; centrifuges on top floor, piping gallery on 3 rd floor, hoppers on 2 nd floor, truck loading bays on 1 st floor	\$80M 2023
Clark County WRF <i>Clark County, NV</i> CH2M Hill (now Jacobs)	180 dtpd	<u>Andritz</u> 7 units 27-30%TS raw sludge	<u>Alternative 2</u> Centrifuges on top floor, silos within building	3-story with basement; centrifuges on top; hoppers on 2 nd floor; truck loading bays on 1 st floor	\$126M 2010

Solids Separation Building

Rendering

North side, with partial
view of east side



Rendering

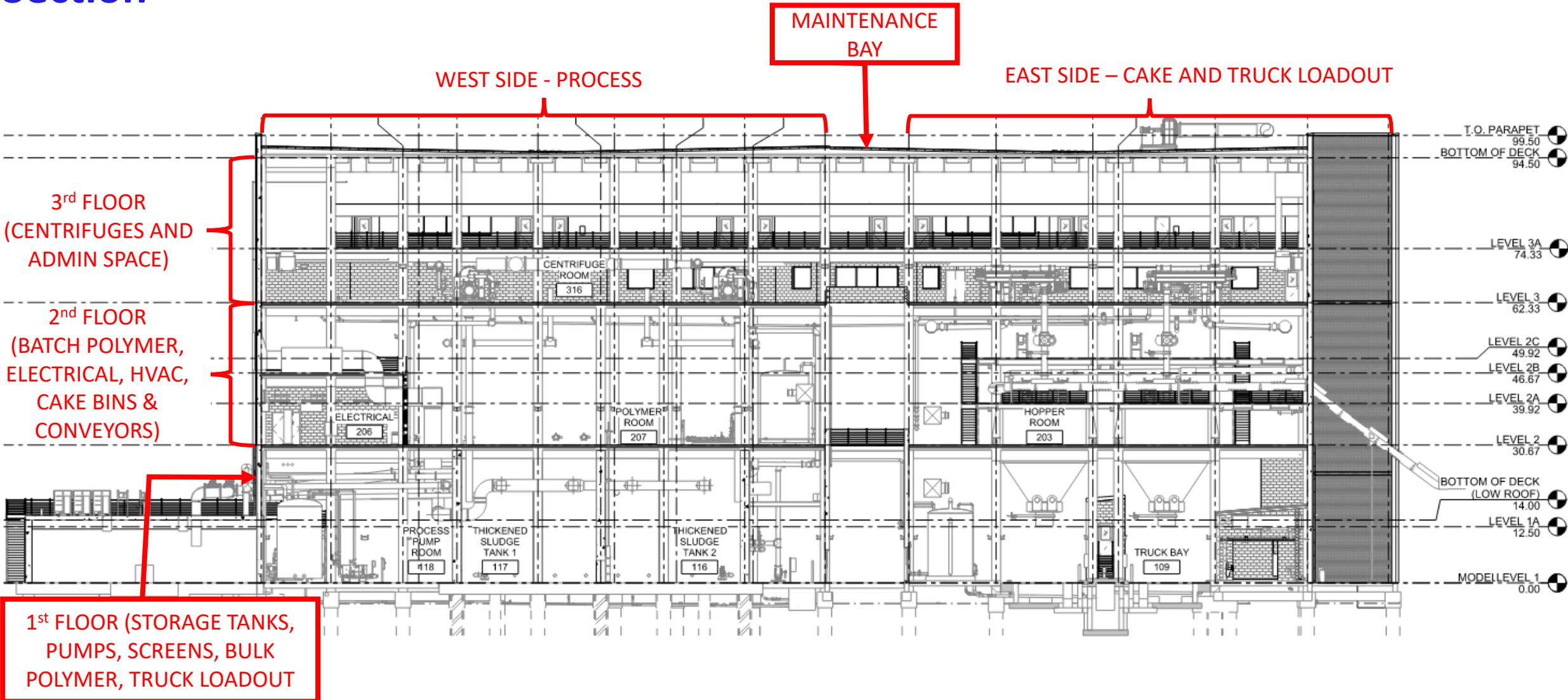
South side, with partial
view of east side



Building Overview

1. Tall 3-story building (called “Solids Separation Building”)
 - Each floor height about 30-ft
 - Mezzanine floors (Levels 1A, 2A, 2B, 2C, and 3A)
 - Length and width approximately: 250 ft x 140 ft
2. Process equipment
 - Screening
 - Thickening
 - Dewatering
 - Cake loadout with truck bays
3. Admin area (with offices, control room, etc.)
4. Also involves: HVAC, plumbing, electrical, I&C, fire suppression

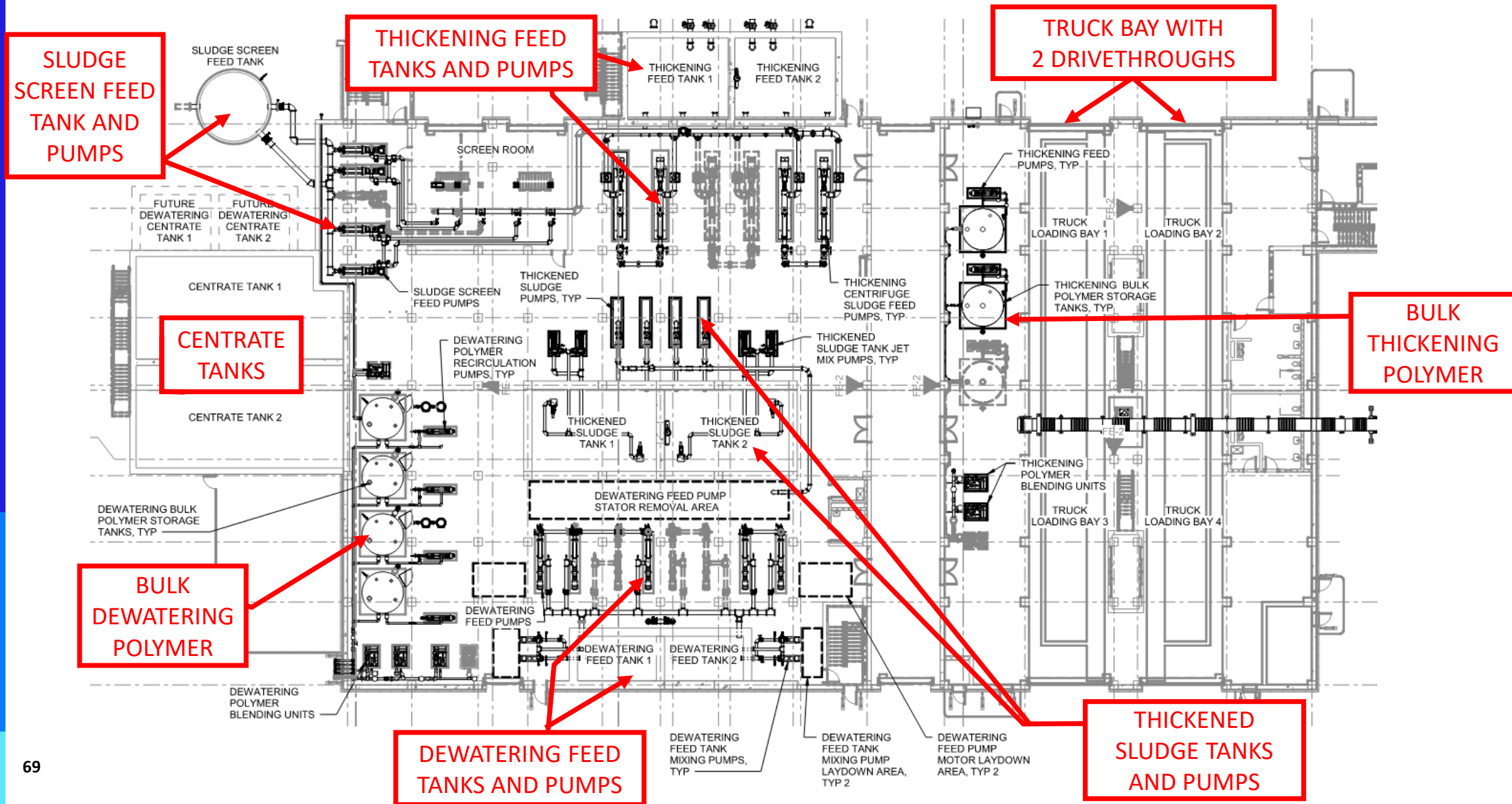
Section



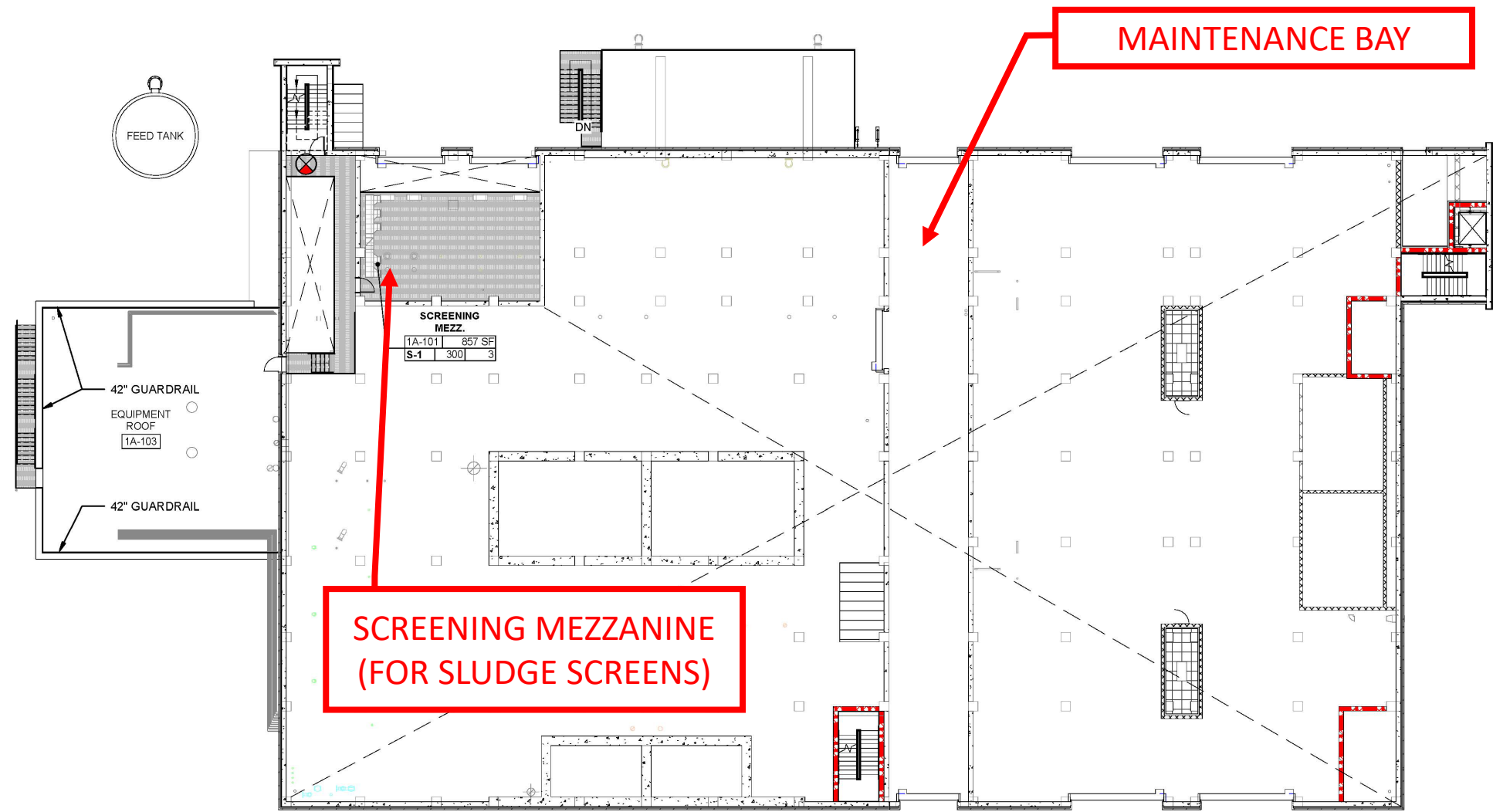
Building Overview

<https://acc.autodesk.com/docs/files/projects/73255b93-f5ba-470f-93b3-19a8e926de6c?folderUrn=urn%3Aadsk.wipprod%3Afs.folder%3Aco.sG1vkbZ4TI6sRB7eRoThSw&entityId=urn%3Aadsk.wipprod%3Adm.lineage%3AgTSzdXd2TRSwsZbtqKezNg&viewModel=detail&moduleId=folders&viewableGuid=cb8f9439-c05b-e383-8b52-def3b4217cd1>

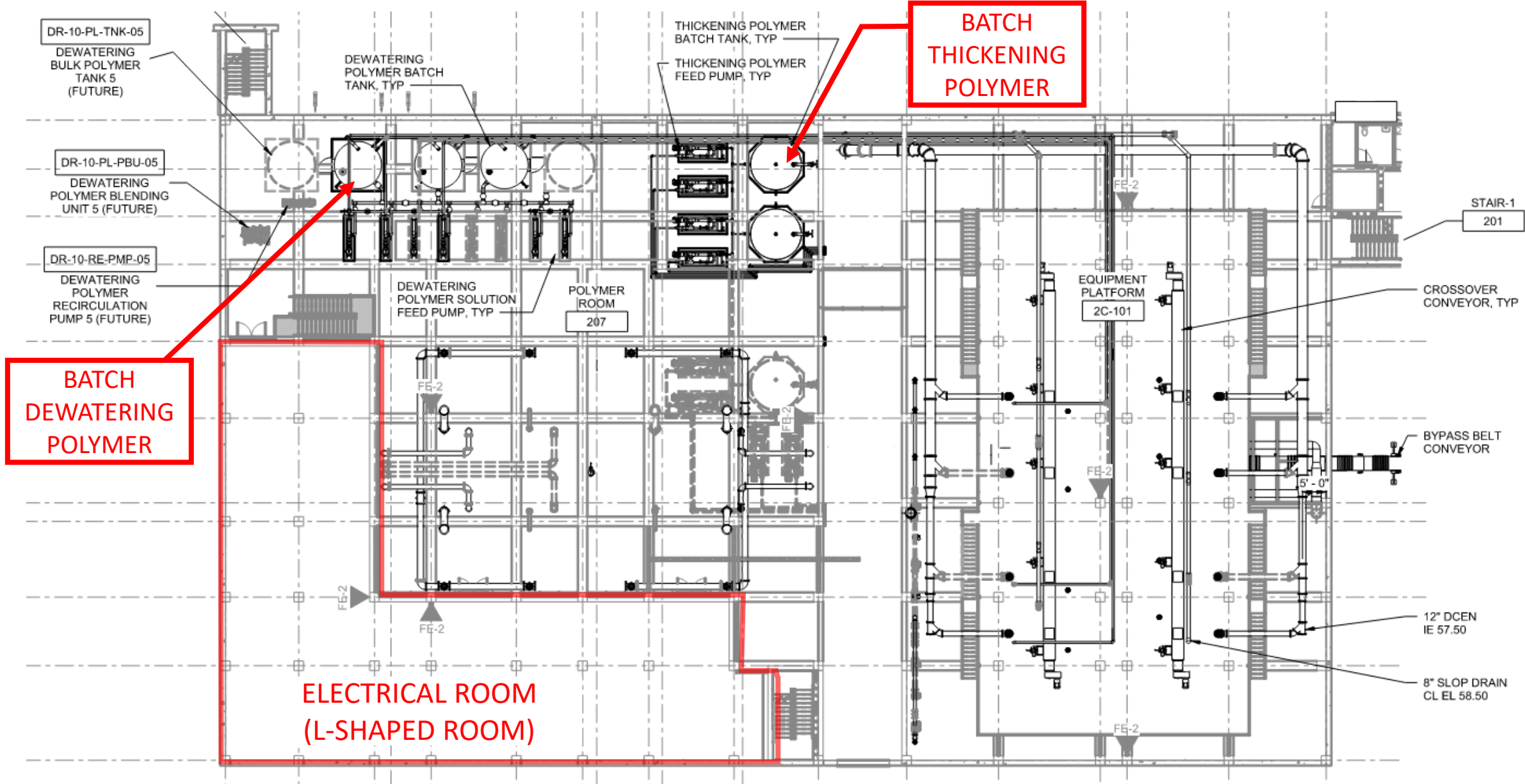
First floor – Storage tanks, bulk polymer, pumps, truck bay



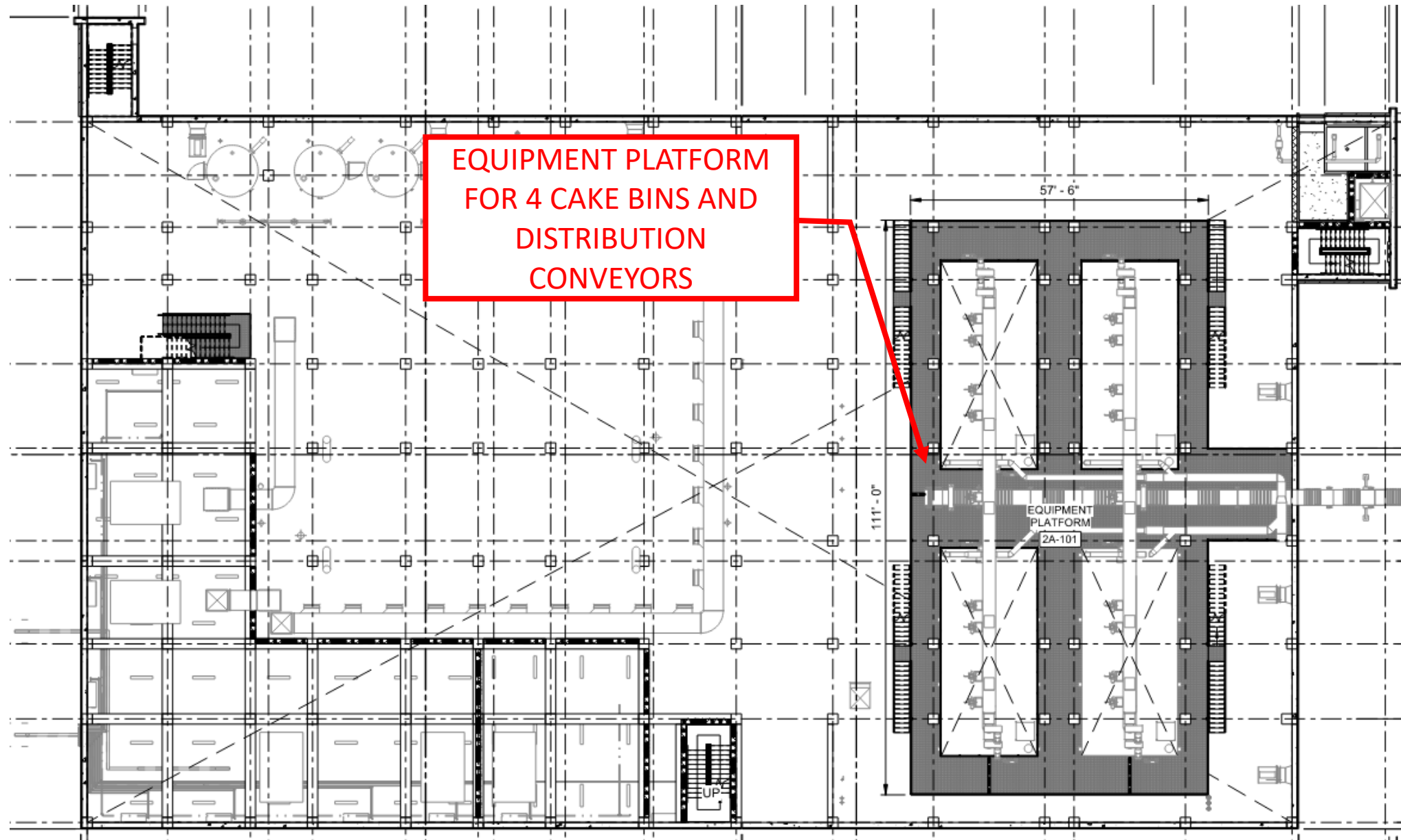
Mezzanine 1A – Sludge screens



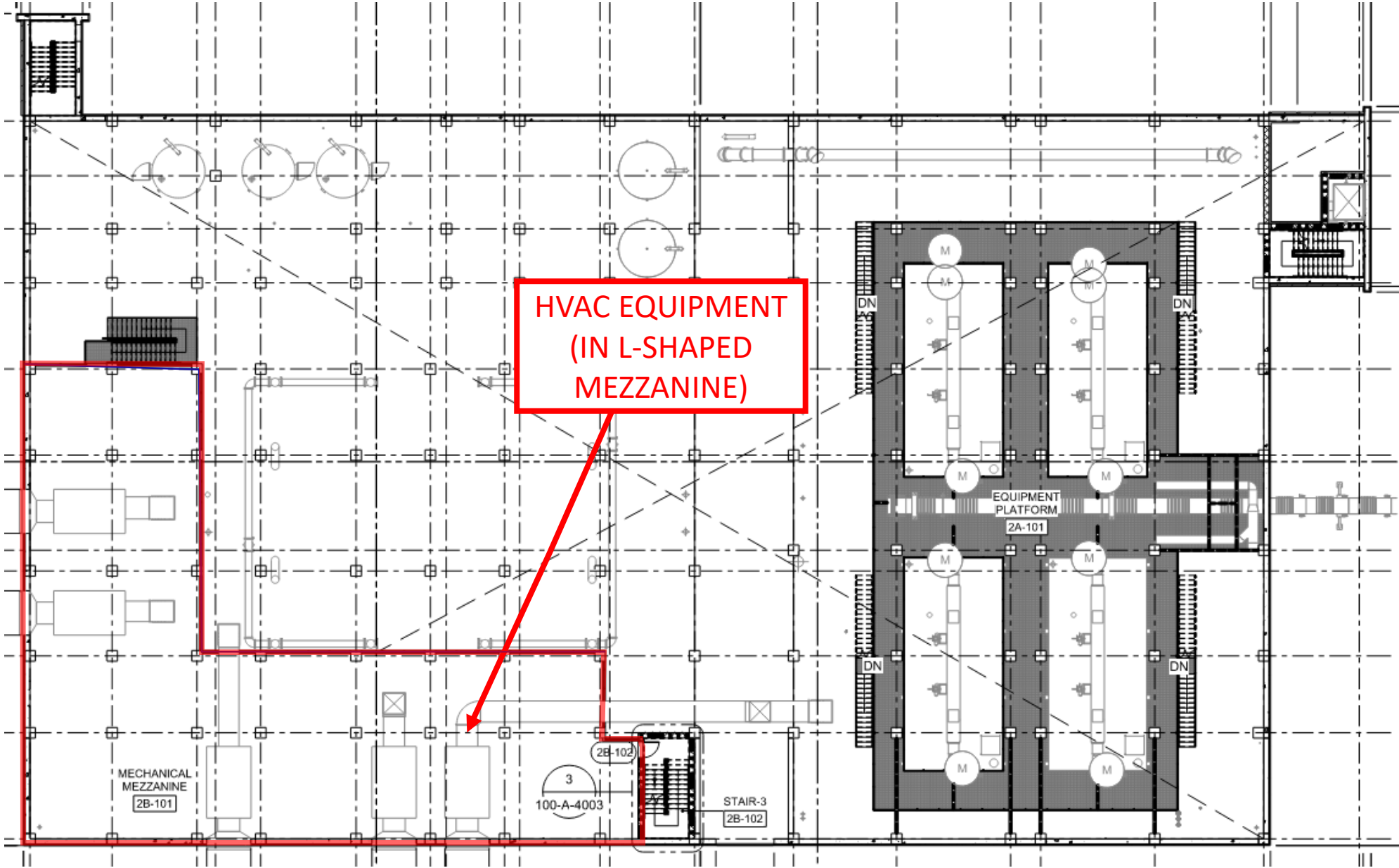
Second Floor – Electrical room, polymer feed tanks and pumps



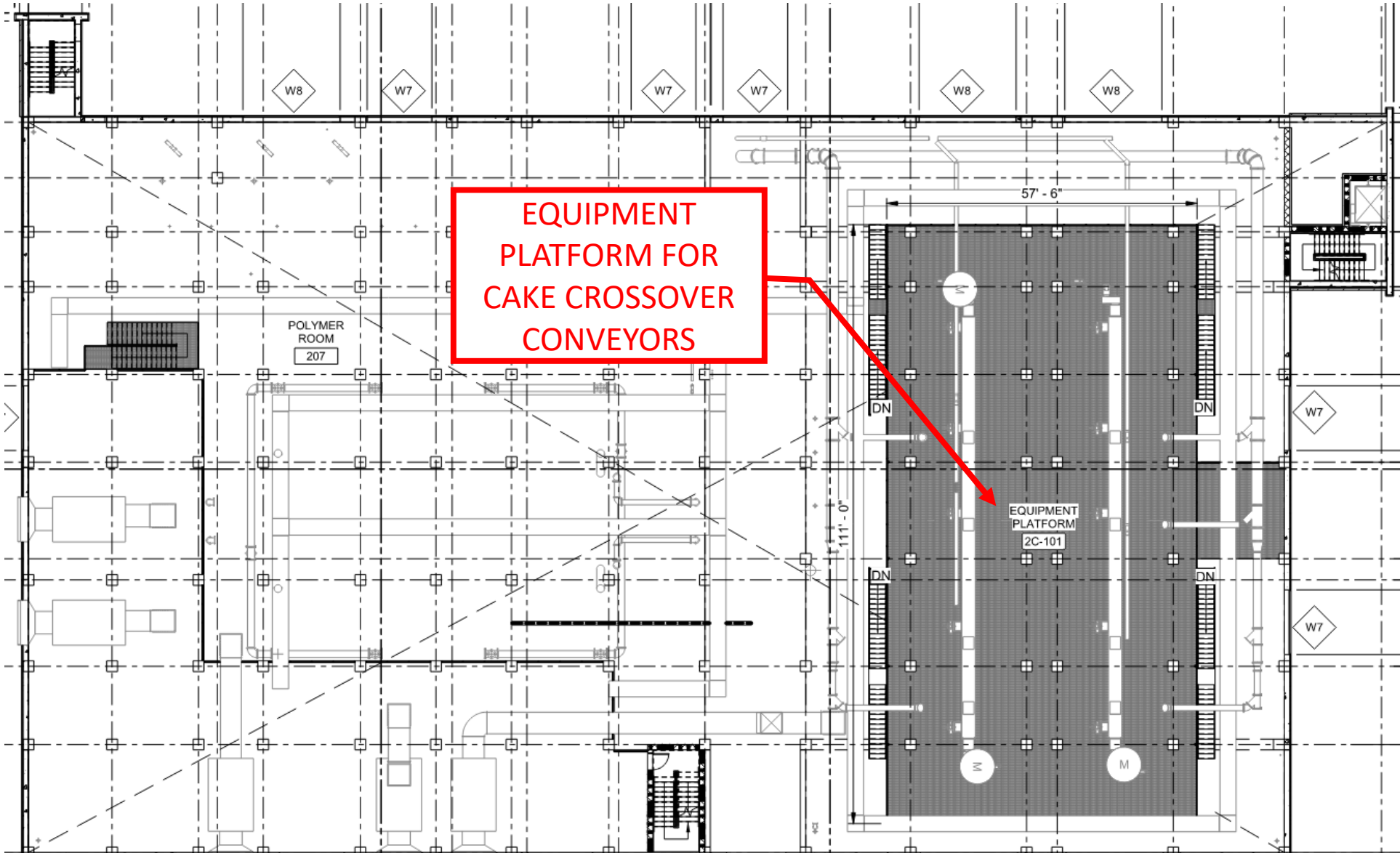
Equipment Platform 2A – Cake bins and distribution conveyors



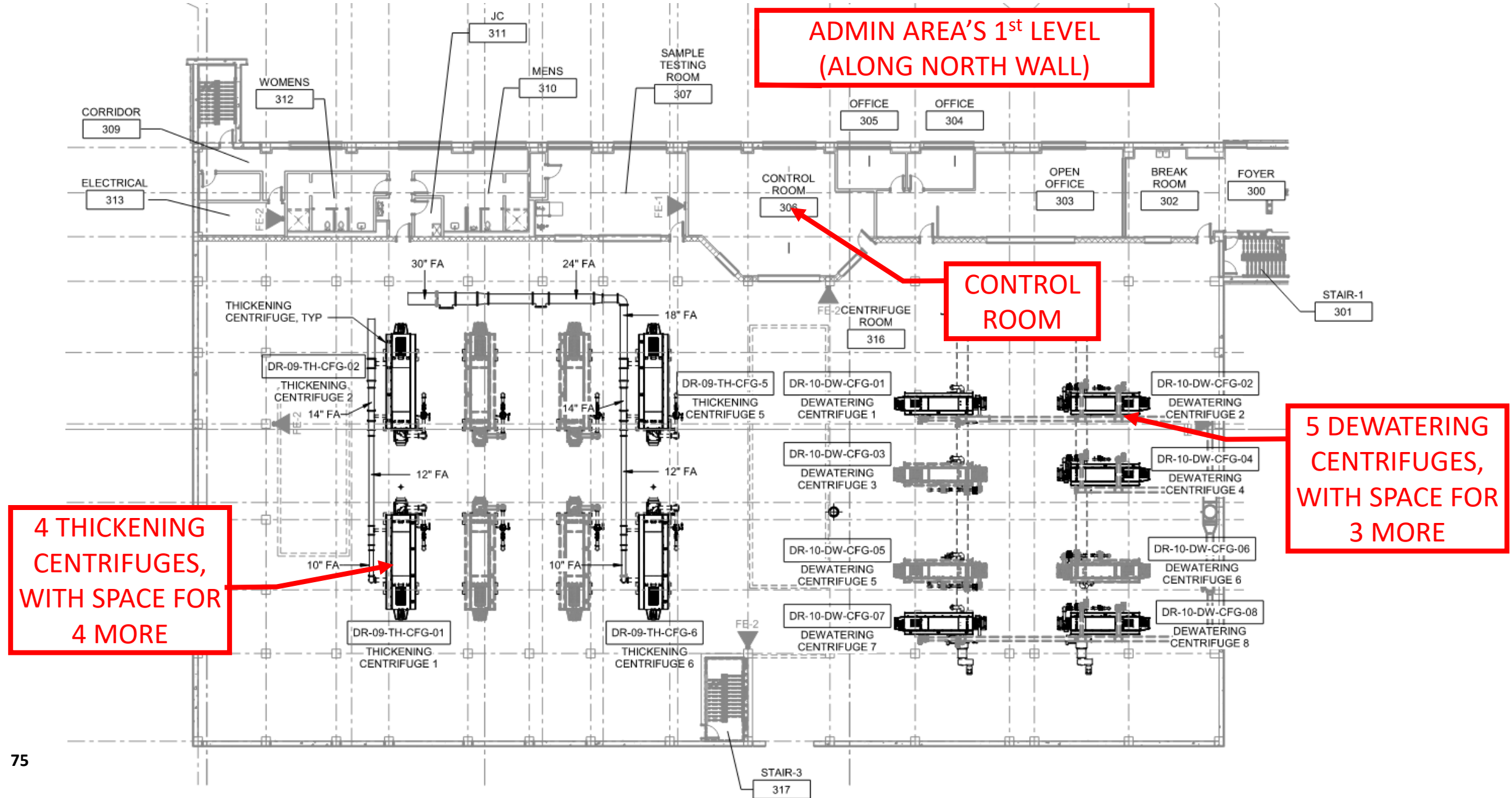
Mezzanine 2B – HVAC equipment



Equipment Platform 2C – Cake crossover conveyors



Third floor – Centrifuges, control room, sample testing, offices



Construction Sequencing

Sequencing

- Primary Construction
 - Keep existing operations running while new building is being constructed
 - Starting, testing, commissioning of all systems
 - Overall system acceptance test
- Transition and Demolition

Open Discussion / Questions

Texas Association of Clean
Water Agencies

Biosolids Master Planning in an Uncertain Regulatory Climate

Rashi Gupta, PE

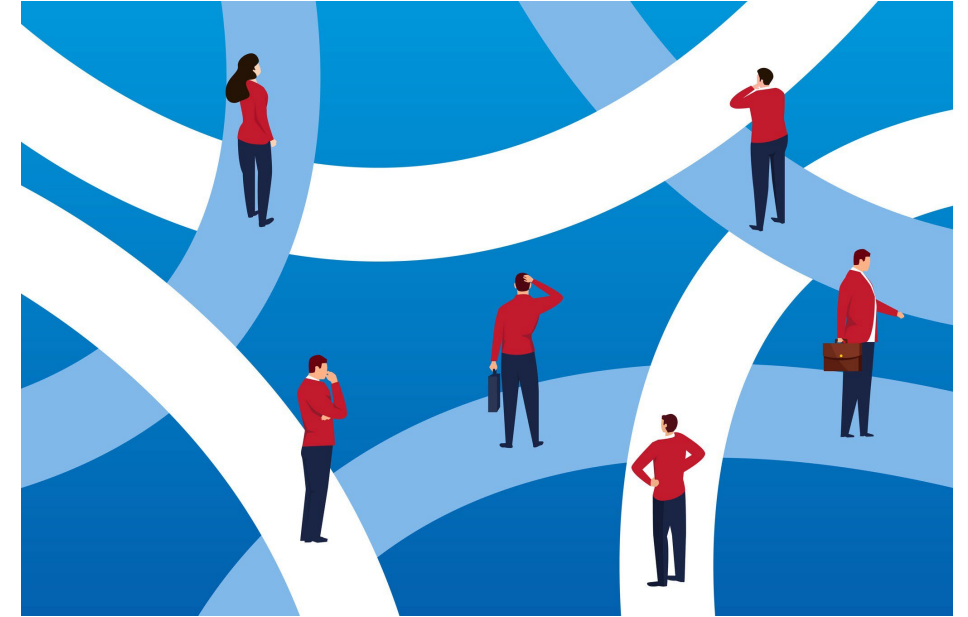
TACWA Meeting

September 19, 2025



What's on the agenda today?

- Current biosolids management in the US and Texas
- Threats to the status quo
- How biosolids master planning can help
- Case studies - A Tale of Three Utilities
- What can utilities do now relative to PFAS?



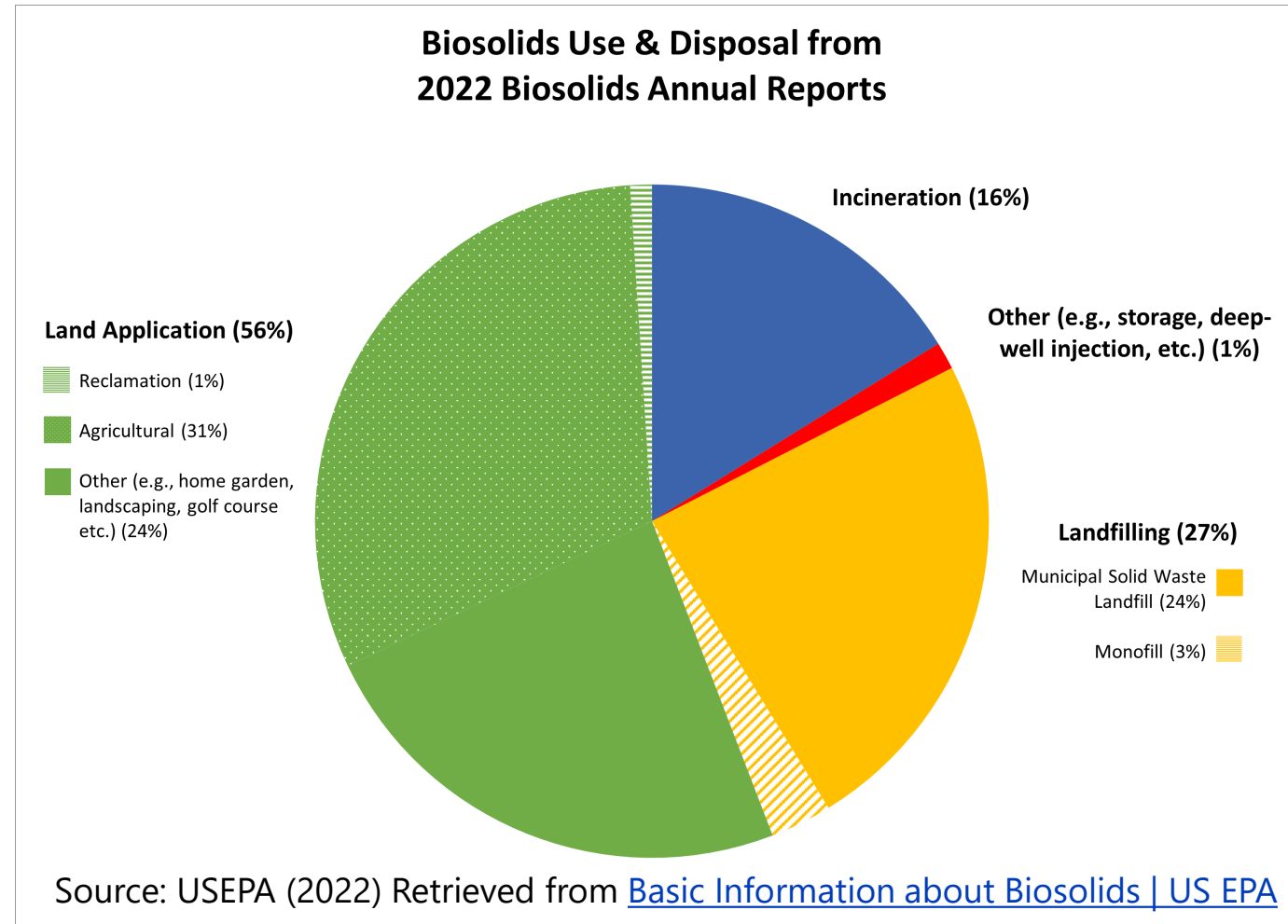
01

Current Biosolids Management in the US and Texas

Land application, incineration, and landfiling comprise 99% of recent biosolids management in US

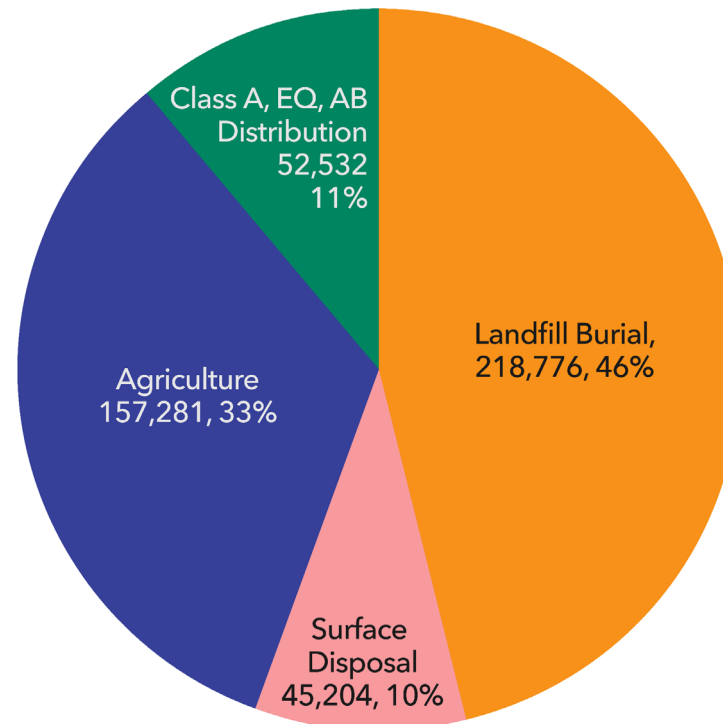
Land Application Benefits:

- Soil health (available nutrients, available carbon)
- Reduced fertilizer and pesticide use
- Low-cost fertilizer for farmers
- Carbon sequestration
- Water retention
- Revitalize degraded lands



Texas agencies landfill more than national average but beneficial use remains significant

Texas Biosolids Use & Disposal 2018
(dry metric tons, %)
Total: 473,800



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02

Threats to the status quo

—
A confluence of factors are creating
uncertainty about management options

Concerns about
contaminants
(PFAS, etc)

Concerns about
liability

Potential
regulatory
changes,
restrictions

Increasing costs

Fewer, reliable
management
providers

Perception

Johnson County lawsuit, emergency declaration, legislative bills illustrate risks

- Lawsuit ongoing; motion to dismiss filed
- Synagro retained Parsons and Dr. Linda Lee (Purdue University) to assess PFAS in biosolids and soils
 - » Per Synagro, work showed that biosolids could not have caused the damages claimed

Synagro seeks to dismiss lawsuit over PFAS in its biosolids, citing new research

The company, backed by a Goldman Sachs fund, argues its treated sludge from the Fort Worth, Texas, wastewater system could not have caused harmful contamination on farmland.

Published March 19, 2025



Jacob Wallace
Reporter



The Fort Worth Water Gardens, a public space in the Texas city's downtown. Fort Worth recently sued the U.S. Department of Defense and chemical manufacturers like 3M and DuPont over PFAS contamination in its water. Thompson, Jeremy. (2021). "Fort

EPA Draft Risk Assessment created additional uncertainty

- A few initial points:
 - » NOT a regulation
 - » DOES NOT reflect risks for the average person or general population
 - » NOT Final
 - » Found risks from ALL management practices considered
 - » DOES NOT recommend best disposal/management option
 - » Did not include risk management

No timeline given for next steps in the regulatory process





Draft PFAS Sewage Sludge Risk Assessment

What does the EPA's draft risk assessment mean for utilities?

EPA released its Draft Sewage Sludge Risk Assessment for PFOA and PFOS on January 14, 2025, evaluating potential human health risks to a "farm family" from land-applied or surface disposed biosolids. This risk assessment precedes potential future regulations and encourages risk reduction through PFAS source control and biosolids land application in areas less susceptible to potential impacts.

Key Findings of the Risk Assessment

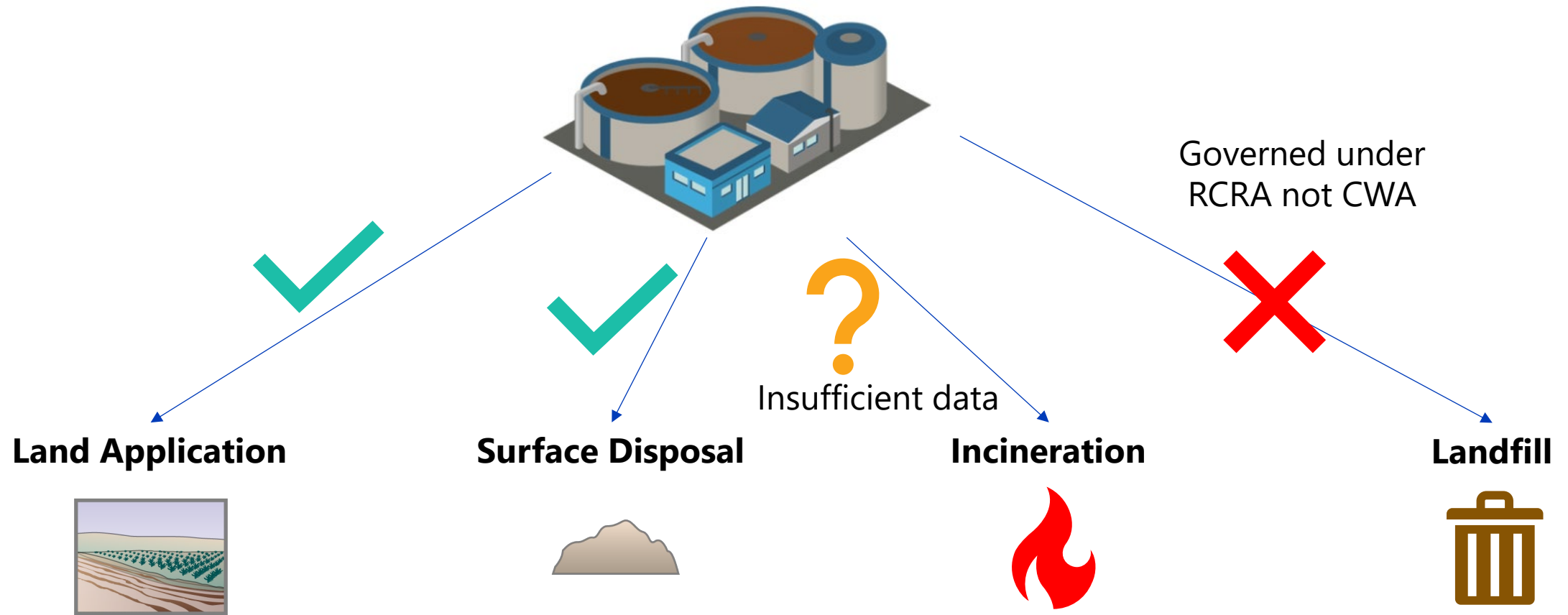
The draft risk assessment quantitatively evaluated potential human health risks through 18 potential exposure pathways from two common biosolids management practices: land application and surface disposal in a monofill. Risks associated with sludge incineration were described only qualitatively due to a lack of data.

The quantitative assessment focused on a hypothetical "farm family" that lives on or near a site where biosolids are disposed of in a monofill or land-applied annually at a rate of 10 metric tons (dry) per hectare for 40 years. The assessment assumes that the farm family sustains itself primarily on the crops, milk, meat, eggs, and drinking water from the impacted land for 10 years.

Key findings include:

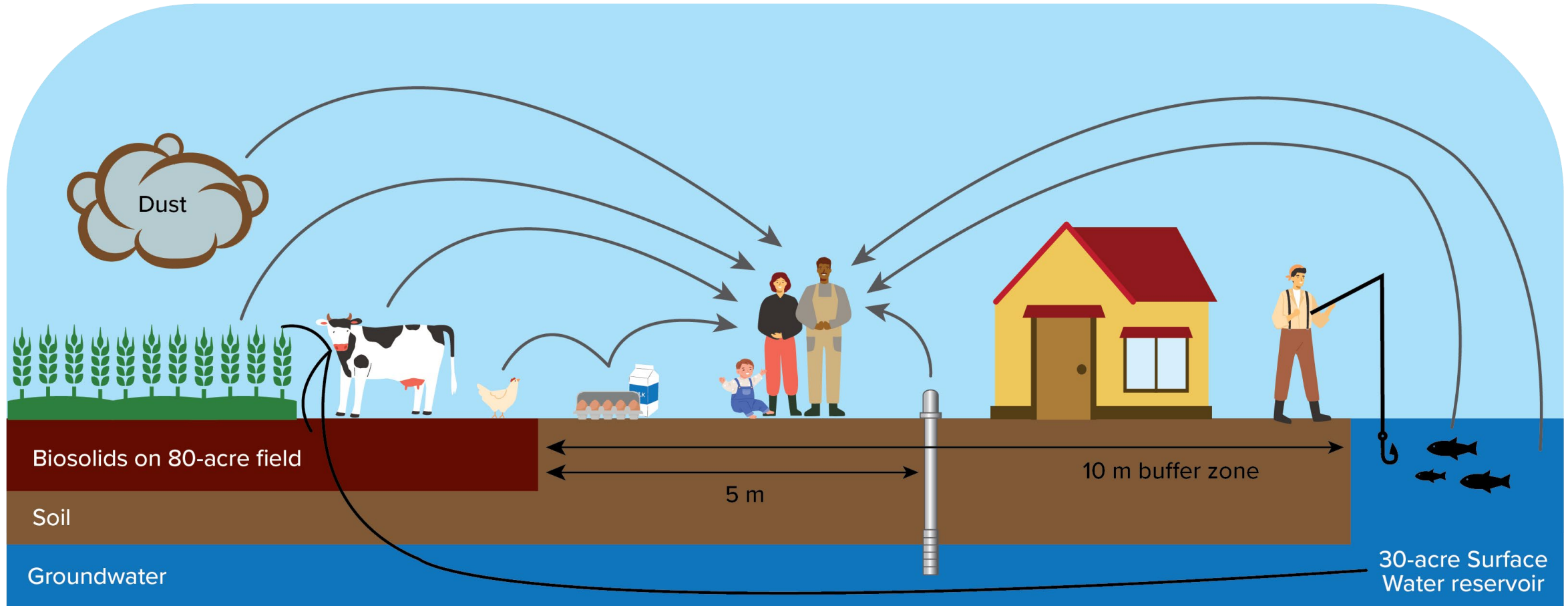
- ❖ EPA's acceptable risk thresholds may be exceeded for the farm family under some modeled scenarios when biosolids containing 1 part per billion (ppb) of PFOA or PFOS is land-applied.
- ❖ Human health risks may occur from drinking contaminated groundwater near inadequately lined surface monofills with sewage sludge containing 1 ppb PFOA or 4-5 ppb PFOS.
- ❖ While incinerating sewage sludge might affect nearby communities, EPA needs more data to quantify the risks.
- ❖ The draft risk assessment focused on the hypothetical farm family and did not assess risks to the general population who typically have a diverse diet and are not in close contact with land-applied biosolids.

Quantitatively considered only land application and monofills (surface disposal)



Assessment intended to model a farm family subsisting on their land/products – not the general population

❖ **Land Application: Pasture or Crop Farm Scenario**



Select takeaways from the Draft Risk Assessment for land app... and a few concerns

- **Key Takeaways**

- » 18 exposure pathways considered
- » 1 ppb PFOS and 1 ppb PFOA (separately) assumed
- » Cancer and/or non-cancer risks exceeded EPA targets under some modeled scenarios
- » Comment period ended August 14, 2025 and >20,000 comments filed
- » Finalization would occur after comments are reviewed and addressed

- **Concerns**

- » Unrealistic assumptions for agricultural practices and land application
- » Research/cases used to formulate basis for risks
- » Lack on inclusion of recent/ongoing work regarding fate/transport, plant uptake, etc.
- » Issuance without risk management element
- » **Perception and potential reactions**

Biosolids Legislative Chaos

- Voluntary Testing
- Required Monitoring
- Source Control Screening Level(s)
- Proposed Land Application Limits
- Biosolids Land Application Ban
- Proposed Biosolids Land Application Ban

**Anything hashed was proposed and did not pass.*

Washington – Requires biosolids quarterly sampling starting 2027.

Colorado - PFAS monitoring in biosolids req'd; PFOS > 50 ppb requires source investigation.

California - Sampling and reporting required. Local agencies take lead.

Minnesota – Tiered approach. PFOA or PFOS
> 125 ppb – no land app
51-124 ppb: source ID + limited land app
21-50 ppb: track cumulative app rates
<20 ppb: no restrictions

Wisconsin – PFOA+PFOS
> 150 ppb - land application not allowed
>50 ppb - source control required + limited land application
> 20 ppb – implement source investigation and reduction efforts
< 20 ppb – no restrictions

Michigan – Tiered approach. PFOA or PFOS:
> 100 ppb - land application not allowed
>20 ppb - source control required and limited land application
< 20 ppb – no restrictions
PFOA+PFOS < 20 ppb “Exceptional Quality” eligible

Vermont - land application requires soil and biosolids be below:< 3.4 ppb PFOS, < 1.6 ppb PFOA, < 0.84 ppb PFHpA, < 0.44 ppb PFNA, < 0.38 ppb PFHxS

Maine – Ban on land app/biosolids due to PFAS concern.

New Hampshire - Solids monitoring required. General interim best management practices guidance for solids developed.

New York – Tiered approach. PFOA or PFOS
> 50 ppb: land application not allowed until < 20 ppb
> 20 ppb: 1 year to reduce to <20 ppb
< 20 ppb: land app allowed

Massachusetts– PFAS testing required for solids in permit renewal process.

Rhode Island– Bill moving to Senate to require testing for land app permits.

Connecticut – Ban on biosolids that contain PFAS.

New Jersey – ground water PFAS monitoring for all regulated entities land applying Class B biosolids.

Virginia – publicly owned treatment works shall monitor PFAS in biosolids at least quarterly

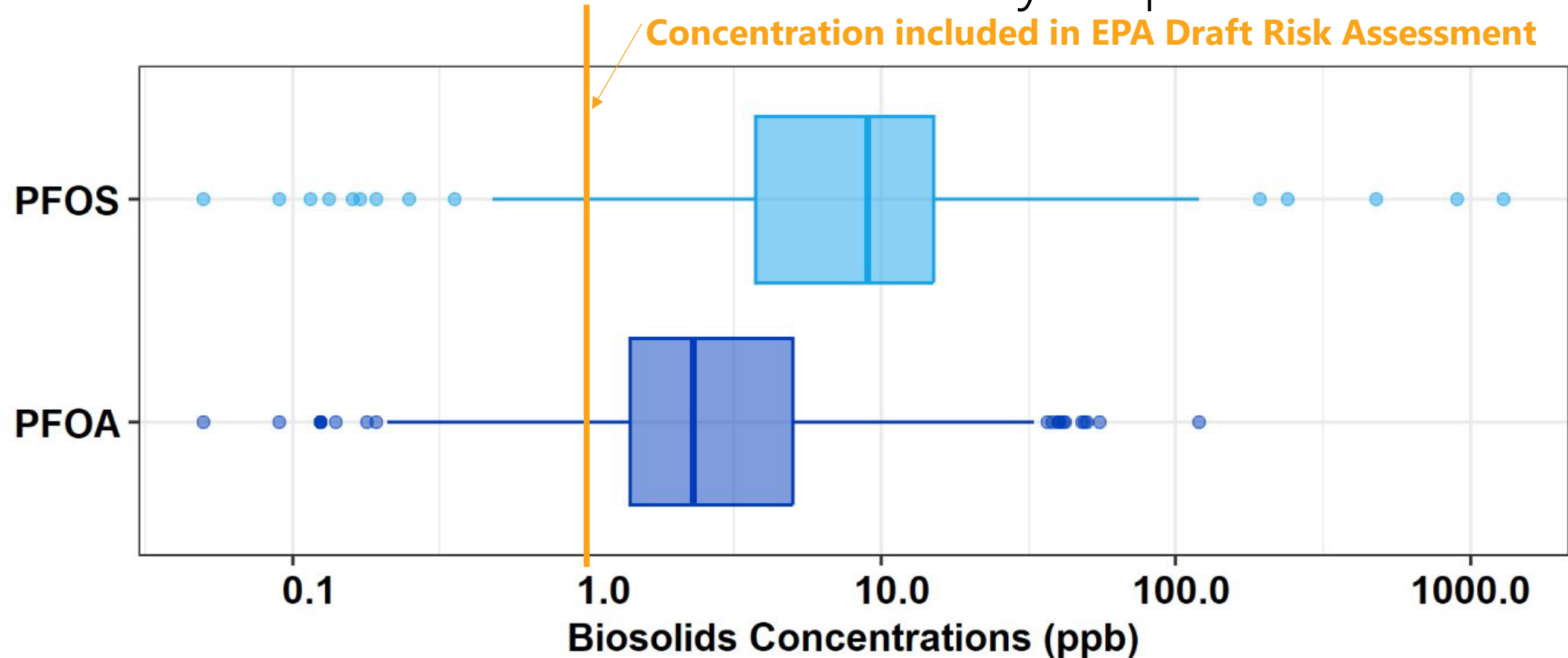
Indiana- Proposed land application limit of 100ppb of one or more PFAS chemicals.

Hawaii – Prohibit permits for sludge with detectable PFAS

ppb = µg PFAS/kg biosolid

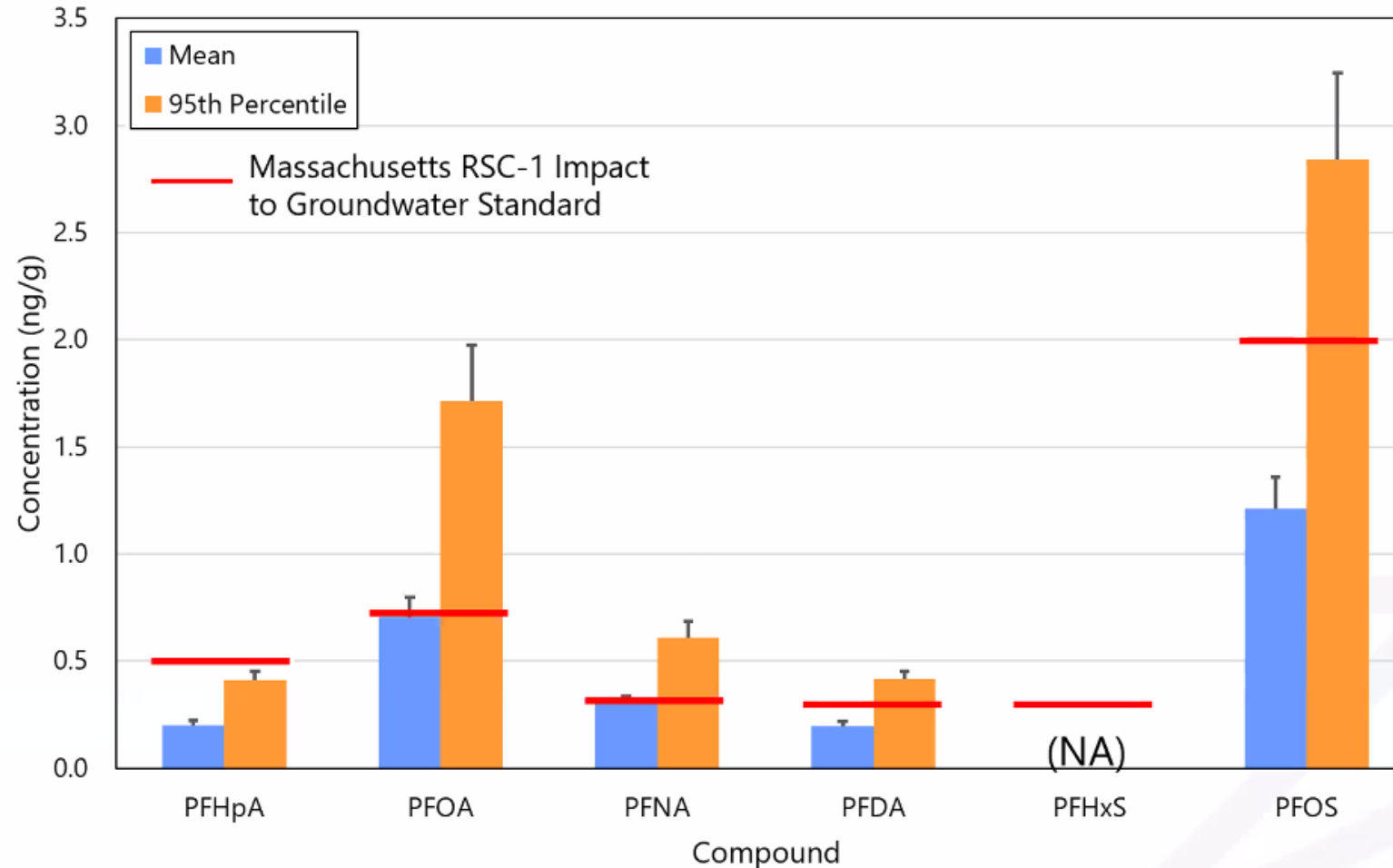
Updated August 20, 2025.
Not intended to be comprehensive due to ongoing changes.

1 ppb PFOS and/or PFOA would likely be lower than values found in most non-industrially impacted biosolids



Source: California Geotracker, 2024
Values < MDL assumed MDL/2

Meanwhile... >1 ppb PFOS found in soil without biosolids applied



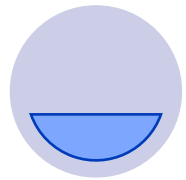
Source: PFAS Concentrations in Surface Soil in Northern New England: Regional and Global Source Patterns and Regulatory Relevance (Woodard Curran)



03

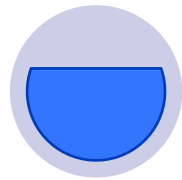
How Biosolids Master Planning Can Help

—
Biosolids master plans (BMPs) help utilities lay out how to get “there” from here



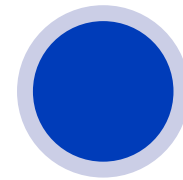
Biosolids Master Planning

- Evaluate options
- Define projects, triggers, risks
- Estimate capital investments and operating costs
- Develop schedules and roadmaps
- Document in dynamic CIP



Financing and Partnering

- Rate studies
- Loan/grant applications
- Bonds
- Public/private partnerships
- Regional partnerships
- Other financing mechanisms



Project Implementation

- Design
- Construct
- Operate

Utilities seek vision-aligned solutions that address multiple needs within their constraints

Near-term
Mid-term
Long-term

Financially
responsible
(capital and
operating costs)

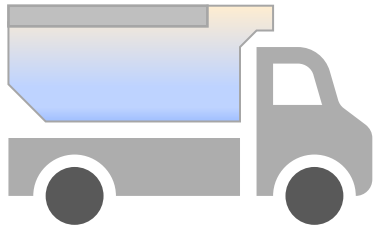
Fit on site/in
community

Proven
operability,
reliability, and
safety

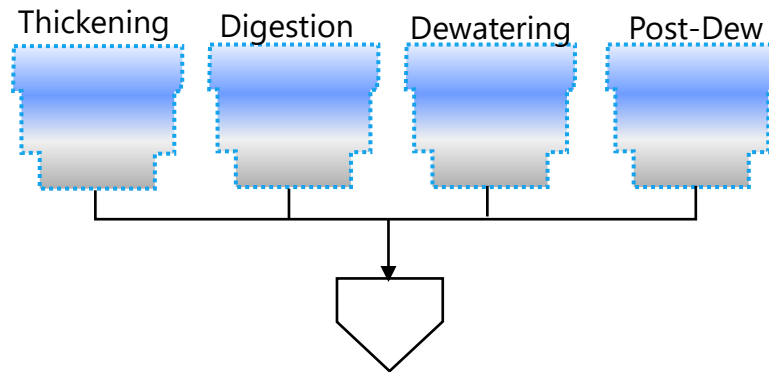
Meet current and
potential
regulations

Environmentally
responsible

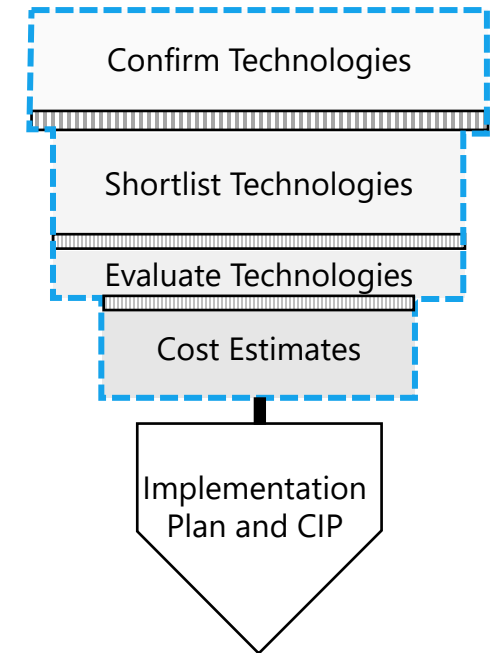
Assess end uses and current processes, identify technologies and evaluation criteria/weights, and then evaluate to select best options



End Use Market/
Disposal Options
Assessment



Process Assessment and
Technology Identification



Stepwise Evaluation and
Technology Selection

For example, post-dewatering technologies being considered for risk mitigation relative to PFAS

Incineration (700-900°C)



Courtesy of Suez

Gasification (700-1000 °C+)



Courtesy of Aries

Pyrolysis (300-950 °C)



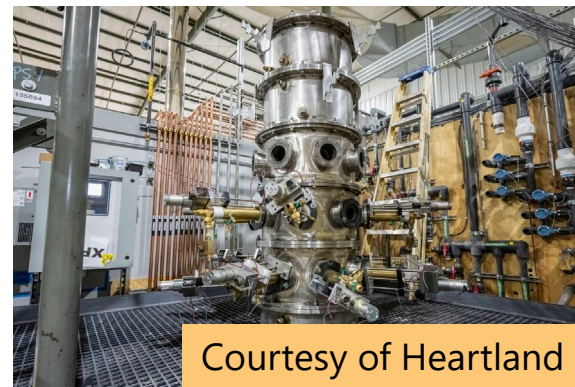
Courtesy of Bioforcetech

Supercritical Water Oxidation
(374 °C; 221.1 bar)



Courtesy of 374Water

Ultra-high Temp Ionic Gasification
(3,000-10,000 °C)



Courtesy of Heartland

Cheat Sheet:

- 300 deg C ~ 570 deg F
- 374 deg C ~ 705 deg F
- 700 deg C ~ 1,300 deg F
- 1,000 deg C ~ 1,800 deg F
- 3,000 deg C ~ 5,400 deg F
- 10,000 deg C ~ 18,000 deg F
- 221 bar ~ 3207 psi

Considerations beyond PFAS destruction...

Scalability

Safety/Reliability/
Longevity

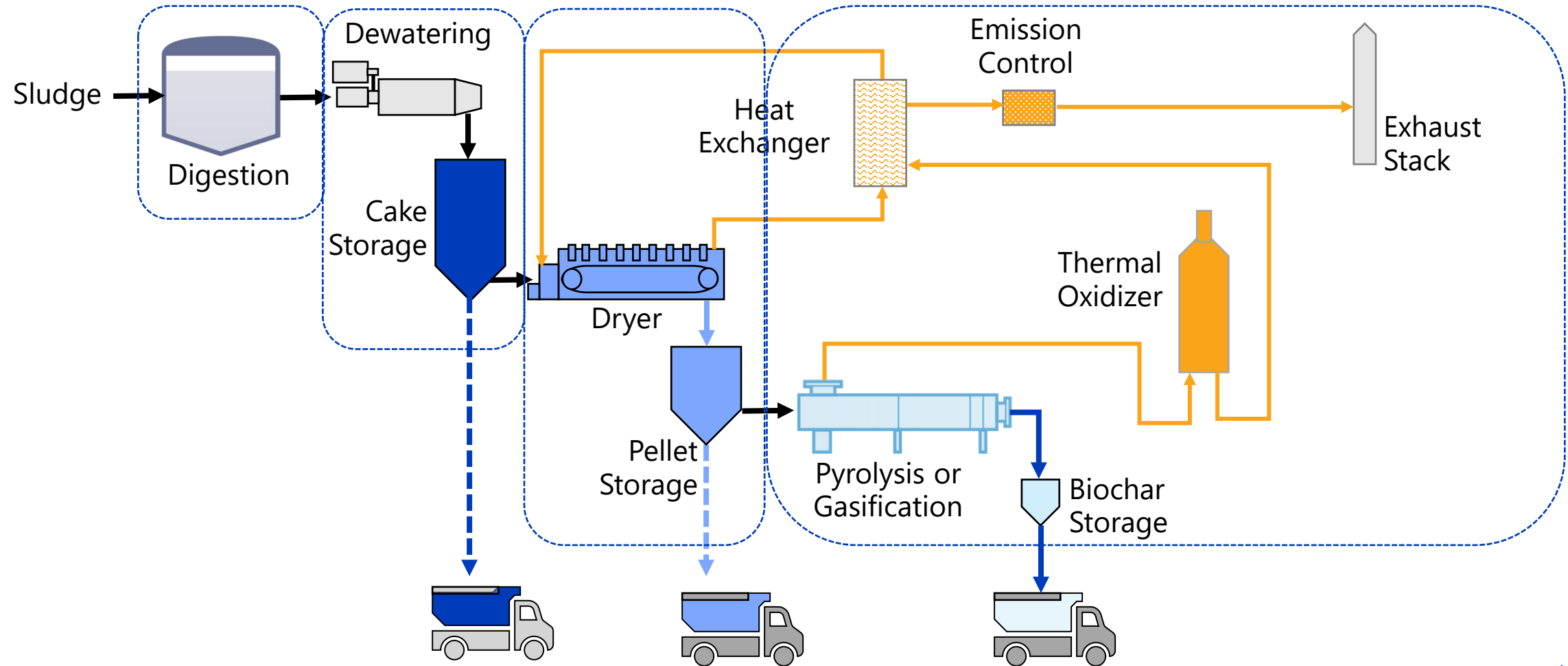
Capital and
Operating Costs

Permitting

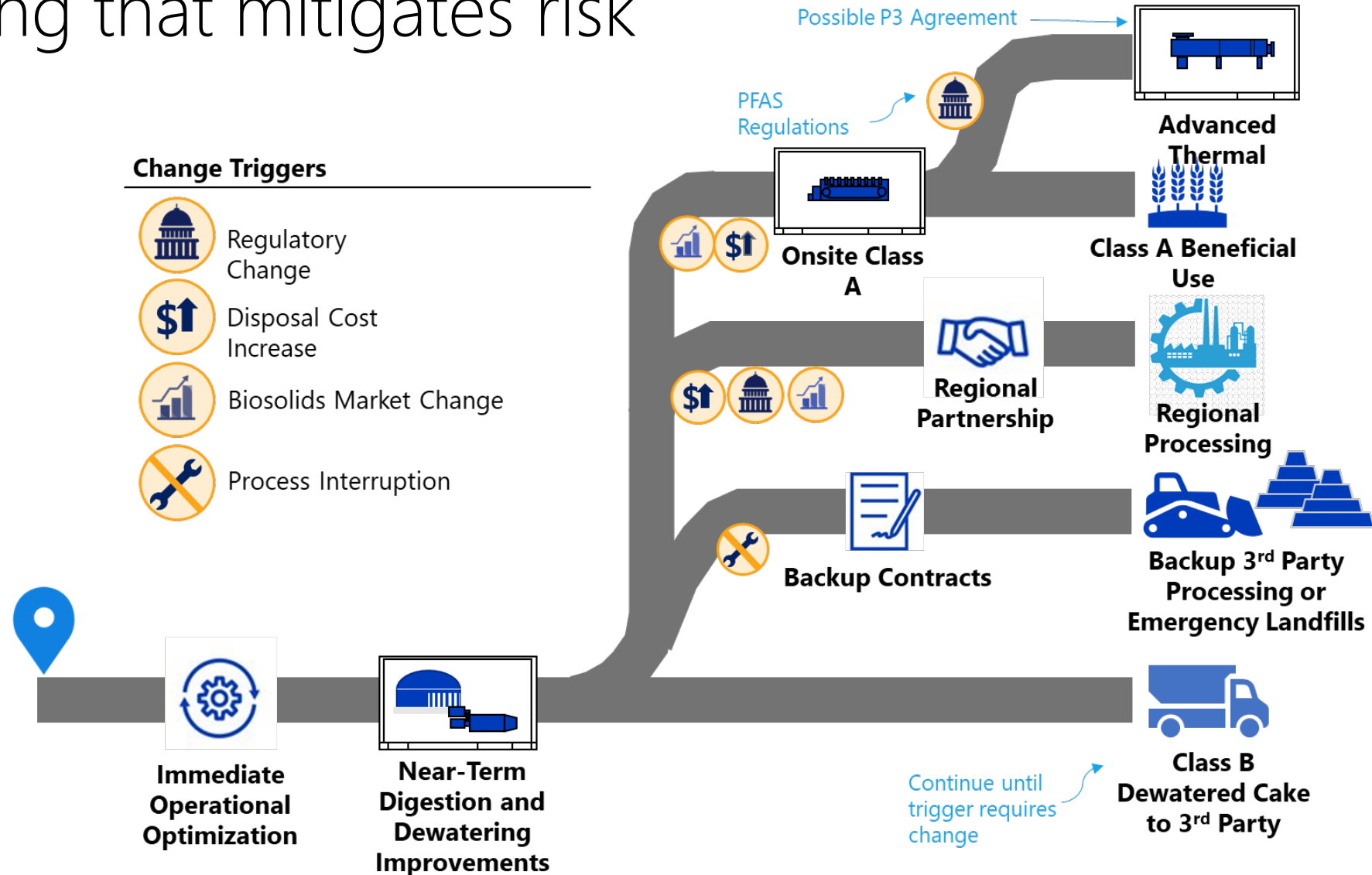
Broader
Environmental
Impacts

Long-term
Impacts of Source
Control/Bans

Phasing can address near-term needs and reduce quantities while setting utilities up for the future

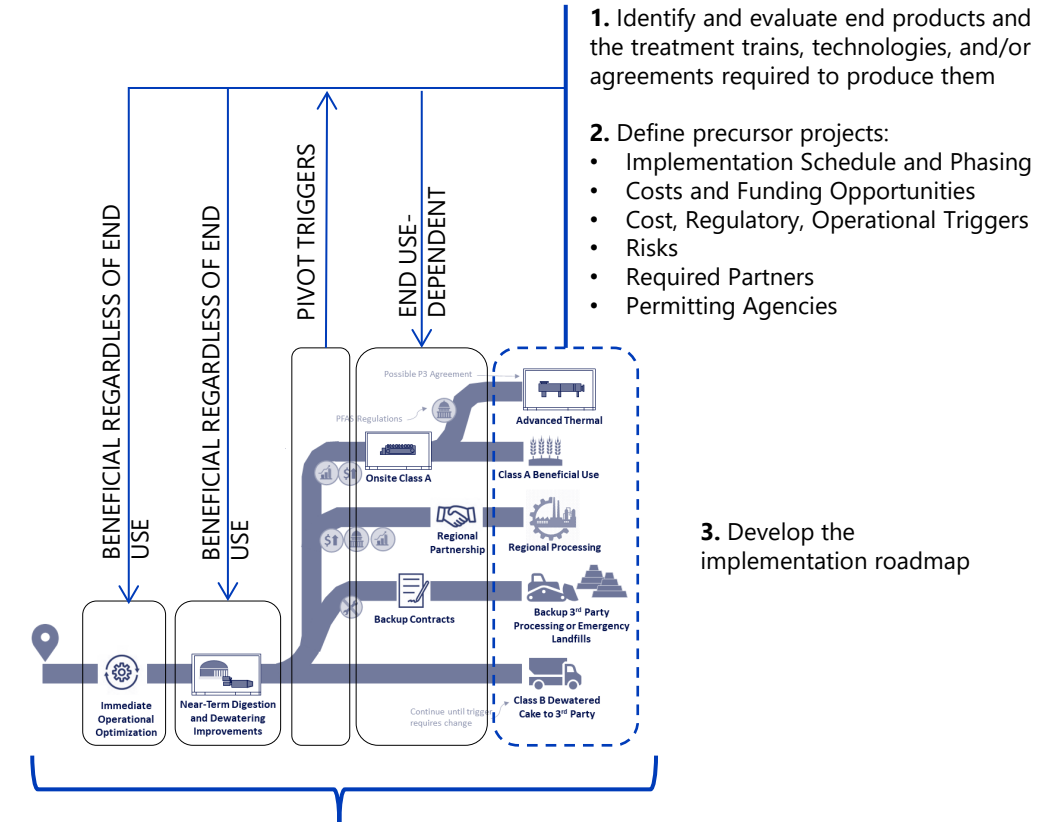


Develop flexible roadmap with phasing that mitigates risk



Develop dynamic capital improvement plan (CIP)

1. Complete process and technology evaluation
2. Define projects, triggers, costs, schedule, partnerships, and permits
3. Develop implementation plan
4. Document in dynamic CIP with cost allocation by year, sensitivity parameters, toggle switches



4. Document CIP with cost allocation by year

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04

Case Studies

A Tale of Three Utilities

A decorative background pattern consisting of numerous small, light gray dots arranged in a series of wavy, horizontal lines that create a sense of depth and movement across the bottom half of the slide.

Three utilities in different situations relative to backgrounds and drivers

Utility A - Background

- Capacity constraints
- Site constraints
- Local Class B land app and supportive farmers
- Very low management costs
- Operate multiple plants

Utility B - Background

- Not capacity limited
- Aging infrastructure and site constraints
- Little local Class B land app
- Organics diversion limits landfilling
- Doubling of management costs
- Operate single plant but many in region

Utility C - Background

- Capacity constraints
- Aging infrastructure
- Land application restricted across state
- Operate multiple plants with varying solids processes
- Familiar with drying

BMP recommendations for the three utilities offer examples for others – Utility A

» Near term:

- Add digestion capacity and concentrate conventional processing at 2/4 plants
- Send sludge from 2 small plants to largest one via pipeline
- Continue Class B land app until trigger
- Secure emergency offtakes for plant upsets, weather interruptions

» Longer term:

- Centralized post-dewatering at one of the smaller plants (more space)
- Truck in cake from other facilities
- Phase in drying for quantity reduction upon reg/market trigger
- Phase in advanced thermal processing upon reg trigger/additional experience
- Consider finance/own/operate option with 3rd party for cost/risk

BMP recommendations for the three utilities offer examples for others – Utility B

» Near term:

- Minimize new onsite solids processing (continue producing unstabilized, dewatered cake for 3rd party management)
- Maintain diversity in management contracts (3rd party fertilizer, compost)
- Focus on regional solutions with other utility partners

» Longer term:

- Regional offsite post-dewatering processing at site offered by neighboring agency
 - Similar regional sustainability initiatives and focus on quantity reduction
- Work with neighboring agency to select 3rd party technology/systems and offer capital to support
- Risk if 3rd party requires stabilized solids
- Maintain diversity in management contracts (3rd party fertilizer, compost)

BMP recommendations for the three utilities offer examples for others – Utility C

» Near term:

- Address capacity/condition constraints and upgrade current thickening, digestion, dewatering, and drying systems at largest facility
- Centralize biosolids processing for all agency plants at facility
- Upsize drying and incorporate receiving facility for solids delivery

» Longer term:

- Maintain space onsite for advanced thermal processing facility
- Incorporate future digestion advancements to maximize performance
- Incorporate future phosphorous recovery/sequestration to reduce struvite issues and maximize resource recovery

—
Different situations, drivers, goals, and constraints
require different solutions and roadmaps



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05

What can utilities do now
relative to PFAS?

A decorative background pattern on the right side of the slide, consisting of numerous small dots arranged in a series of wavy, horizontal lines that create a textured, water-like effect.

Utilities can take proactive steps while awaiting regulatory guidance on biosolids.



Know your data



Reduce significant sources



Master plan strategically



Talk to your neighbors

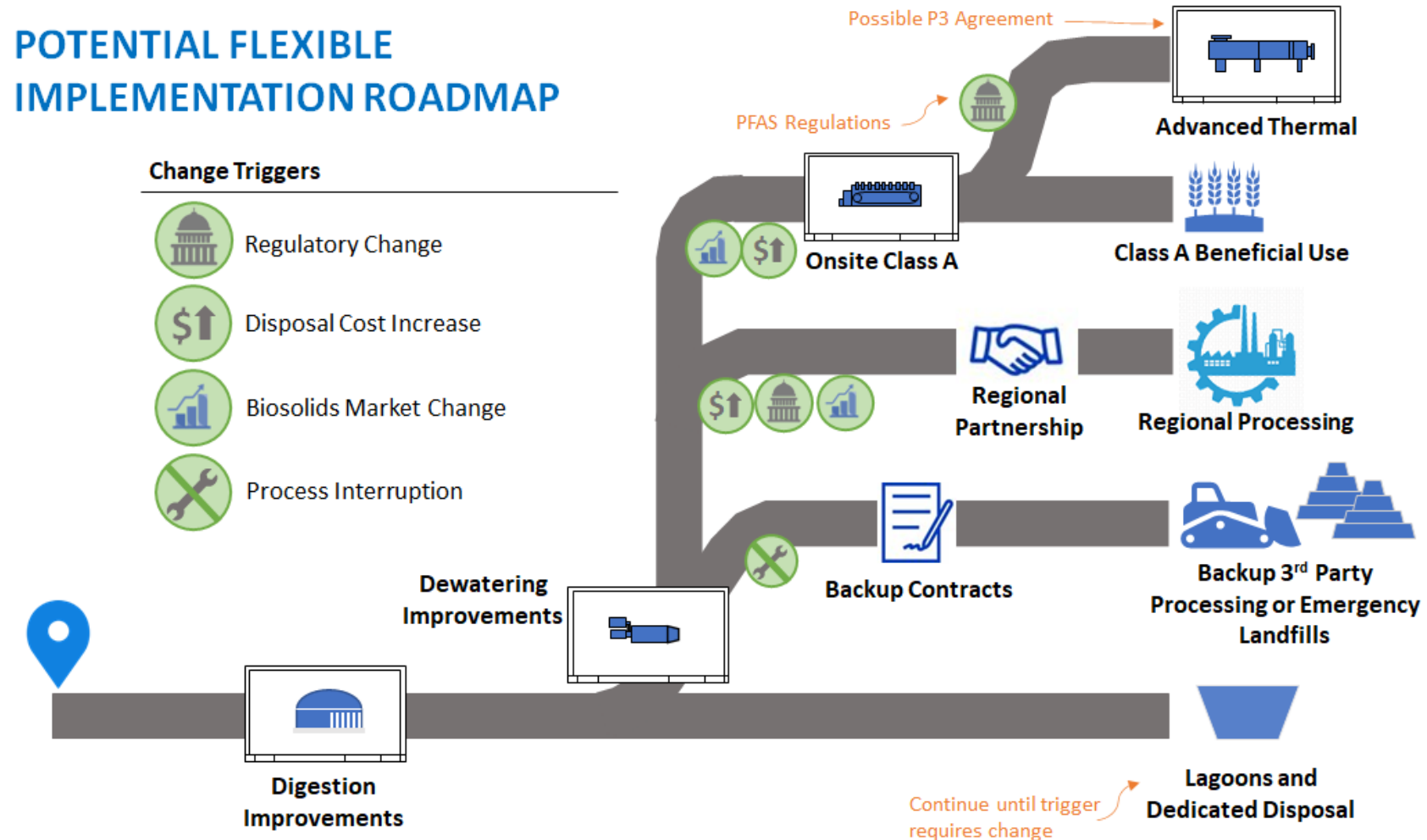


Communicate proactively



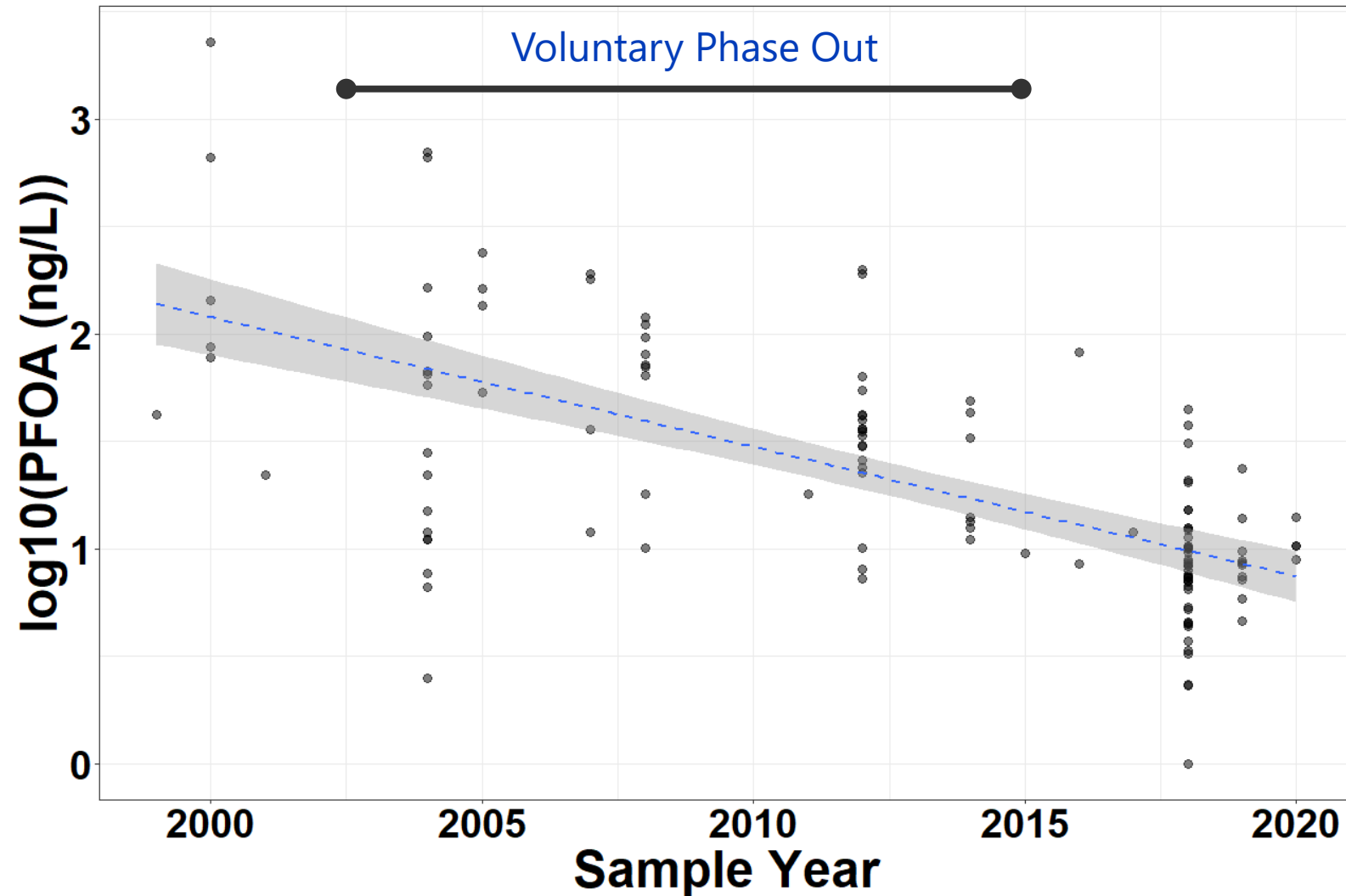
Track/research/
test technologies

Plan for flexibility with offramps for different trigger points – invest in improvements along the path



—

Source control and phase outs have led to decreased PFAS concentration in effluent and biosolids



Source: Thompson, K. A. et al. 2022. ACS ES&T Water, 2(5), 690–700.

Source control and phase outs have led to decreased PFAS concentration in effluent and biosolids

Mean and Median Values of Biosolids/Sludge Concentrations Since 2018



Year	PFOS (ppb)		PFOA (ppb)	
	Mean	Median	Mean	Median
2018*	184	13	25	7
2021	21	9	8	4
2022	16	10	7	3
2023	11	7	6	3
2024**	8	5	5	2

*Includes data from industrially impacted facilities as part of a statewide study
**Calculations based on 170 results received as of 12/05/2024
All values listed are in parts per billion (ppb[μg/kg])

Source: EGLE, "Michigan's Interim Strategy for Land Application of Biosolids Containing PFAS", Conference Presentation 2024.

Thank you!



Rashi Gupta, PE
Wastewater Practice Director
rgupta@carollo.com



*Point your camera at the QR
code for contact information.*