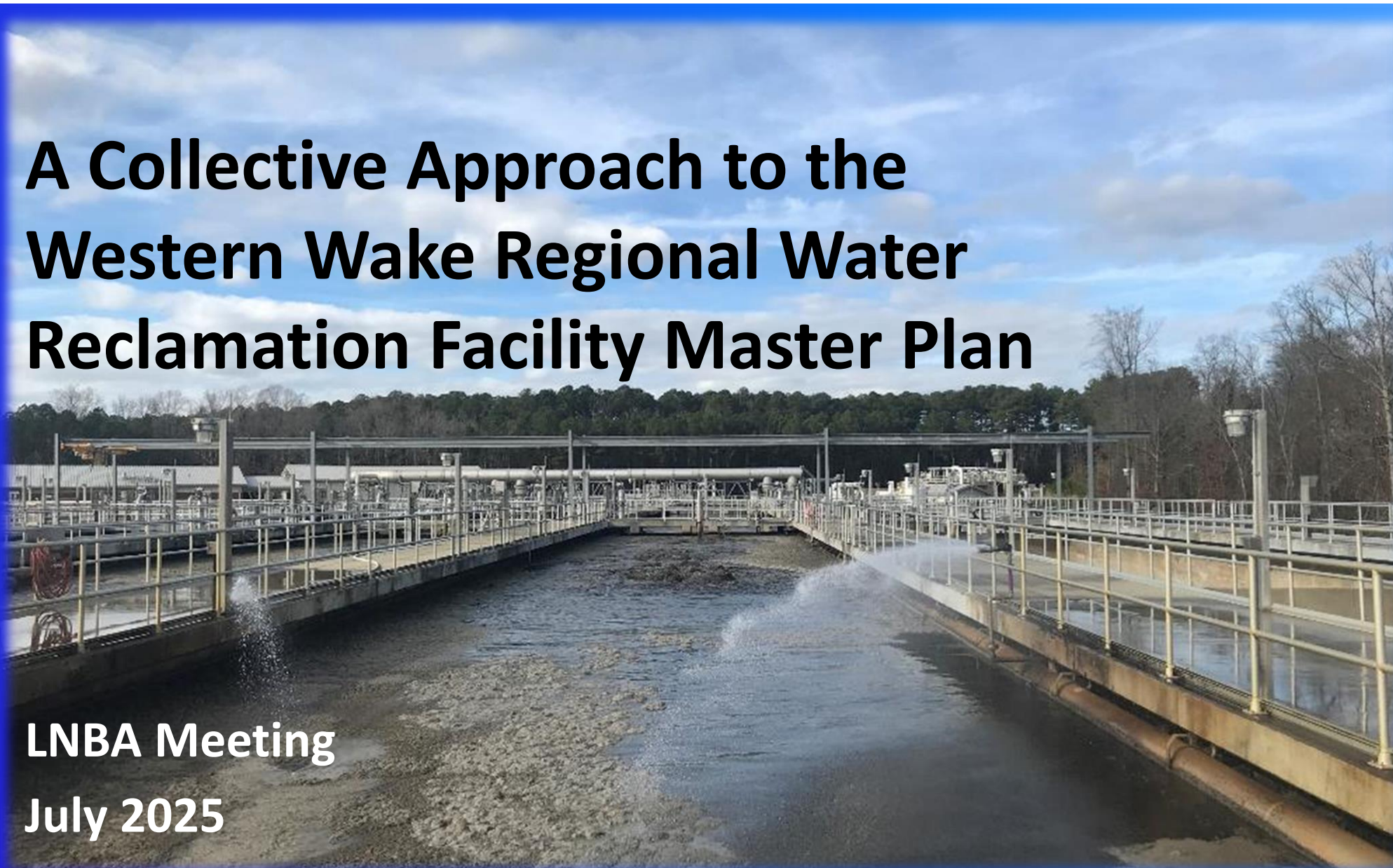


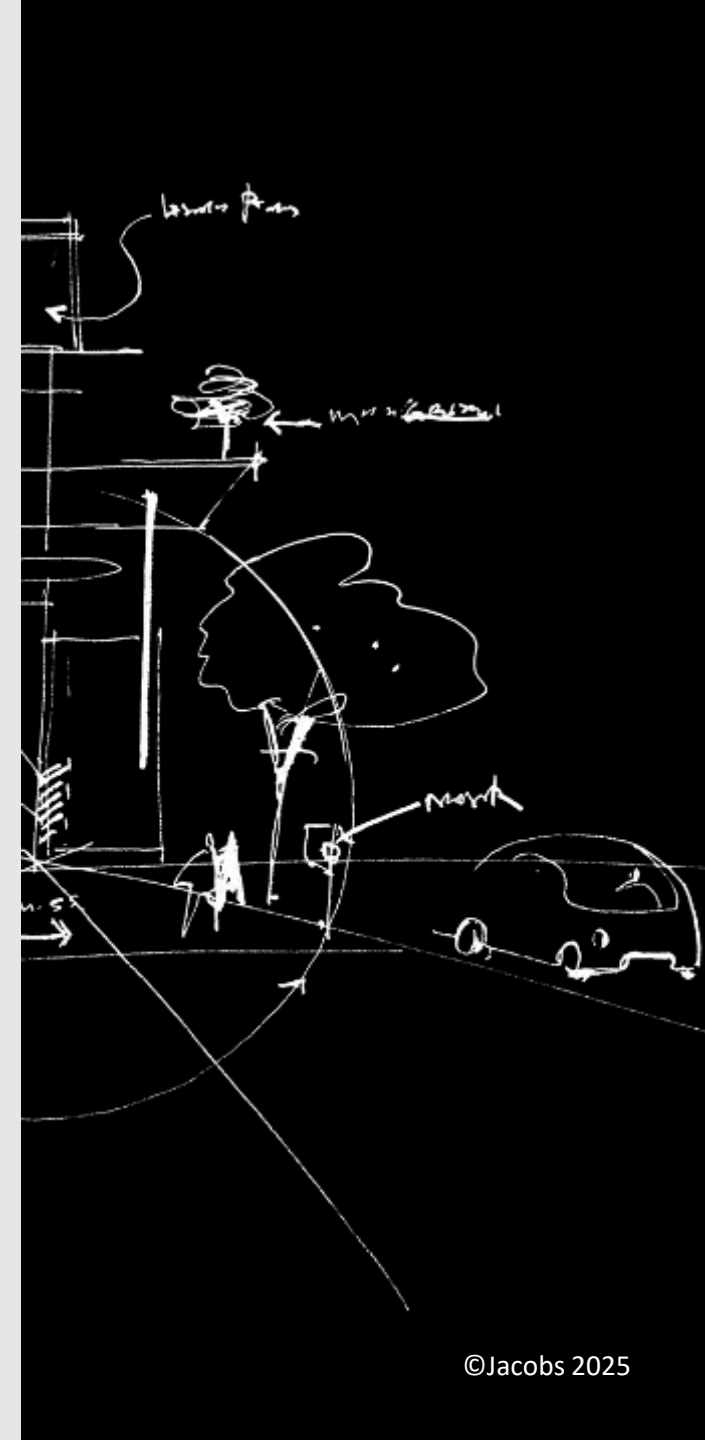
A Collective Approach to the Western Wake Regional Water Reclamation Facility Master Plan

LNBA Meeting
July 2025

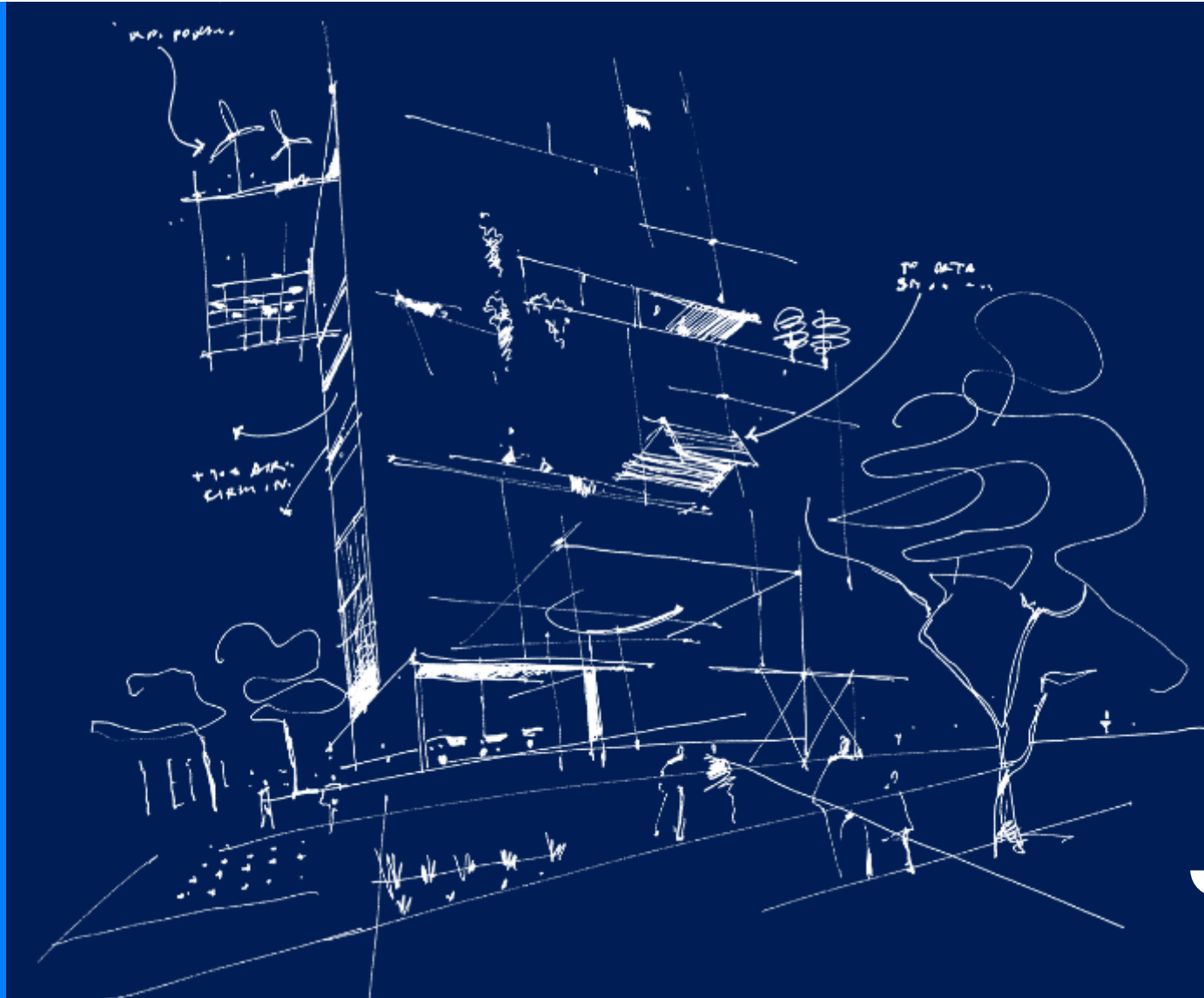


Today's Agenda

- Western Wake Regional Water Reclamation Facility
 - History and highlights
- Master Plan Objectives and Scope
- Expansion options – Screening
 - Liquids and Biosolids
- Expansion options – Detailed evaluation
 - Liquids and Biosolids
- Wrap Up Thoughts



Western Wake Regional Water Reclamation Facility

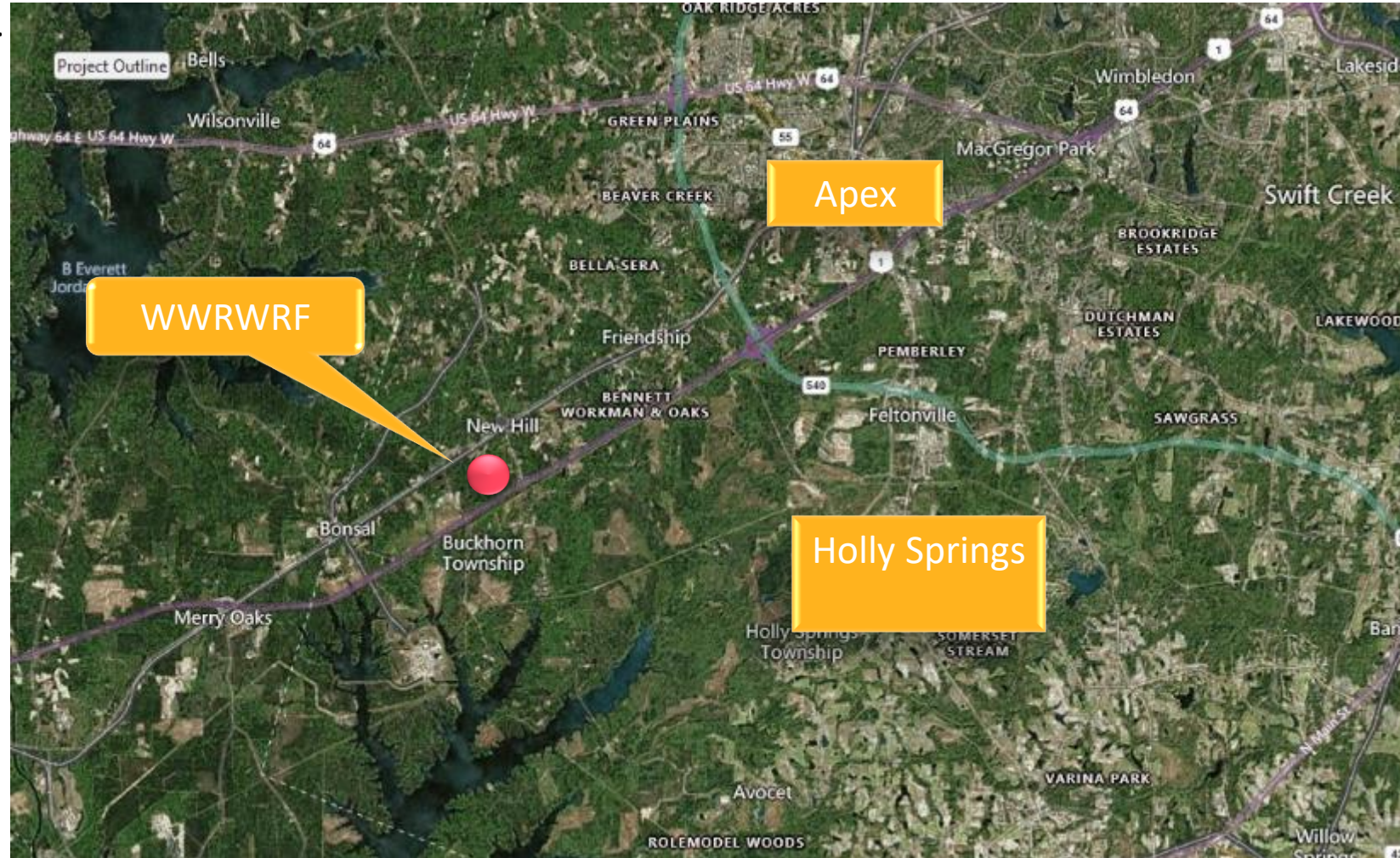


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Reinventing tomorrow.

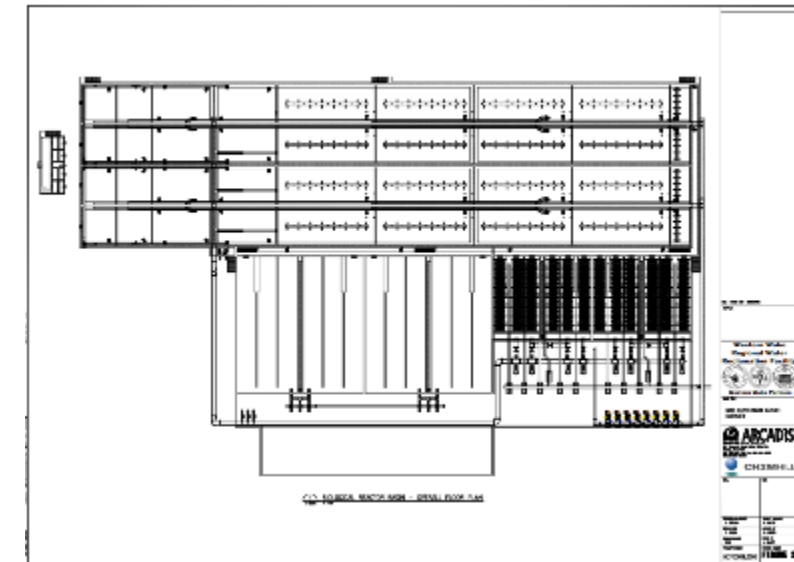
A brief history of the Western Wake Regional WRF

- Evaluation of option for long-term wastewater management
- Western Wake Partners
 - Cary
 - Morrisville
 - Apex
- Regional wastewater management facilities
- Located in New Hill, NC
 - Southwest of Apex



A brief history of the WWRWRF

- Preliminary Engineering/ Environmental permitting mid 2000s
 - Design plant for 18 MGD
 - Plan to expand to 30 MGD
- Design mid/late 2000s
 - Build for 18 MGD
 - Option to expand “conventionally”
 - Option to convert to MBR
 - Permit includes a page for 30 MGD
- Operational since 2014
 - Performing extremely well since it started



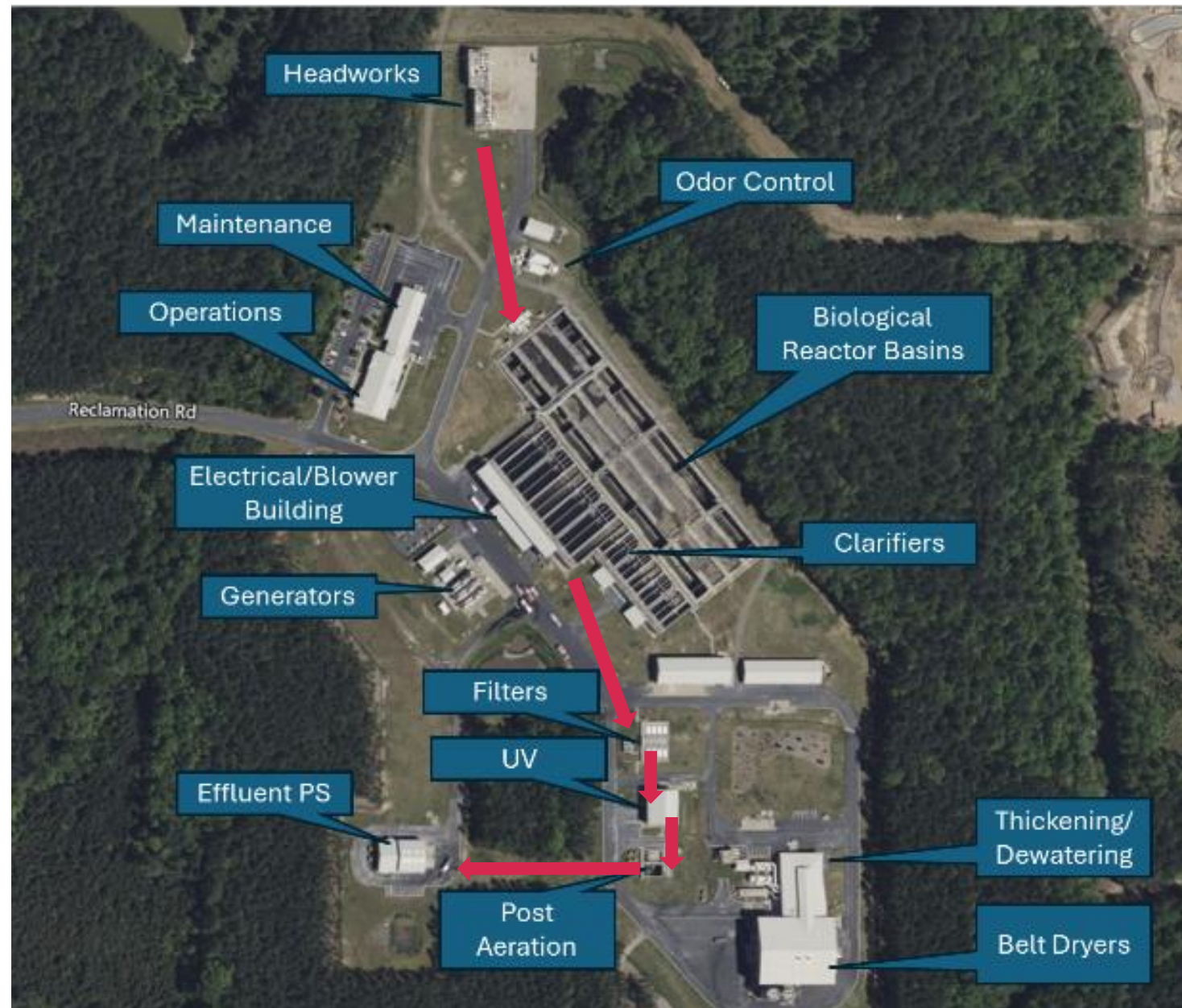
WWRWRF Highlights

■ Liquids

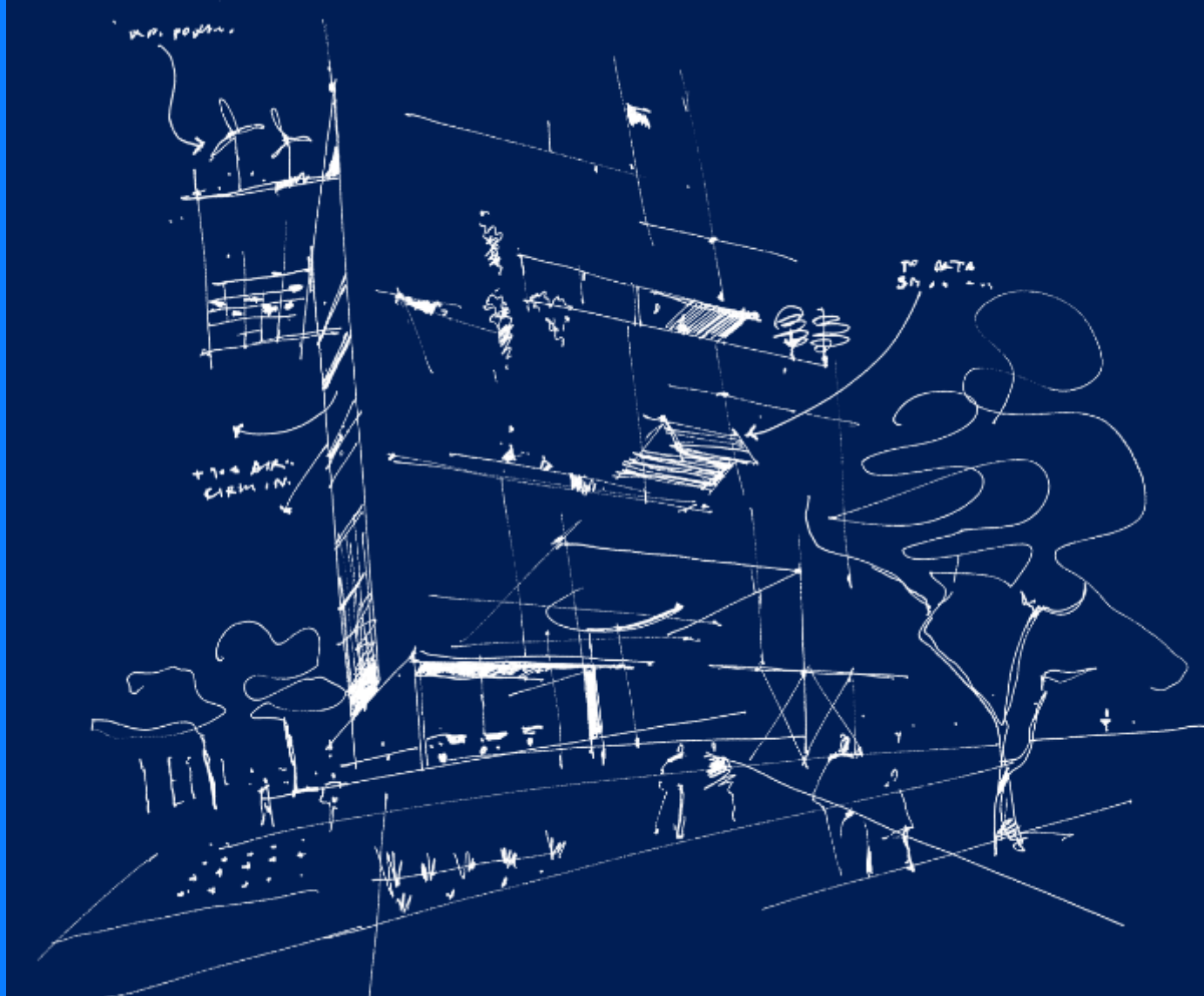
- Five-Stage, modified VIP
- 11-mile effluent pipeline to the Cape Fear River
- 8 MGD average day flow
- 15-16 MGD peak day

■ Solids

- Thickening, dewatering
- Belt dryers
- Class A, Exceptional Quality
- 1,000 wet tons per month
- 250-300 dry tons per month



Project Objectives and Scope



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Project Objectives

- Project Summary
 - Determine the most effective way to expand plant capacity to suit future needs
 - Enhance biosolids treatment
- Revisit expansion options
 - Different treatment technologies now available
 - Stepping-stone expansion:
 - 30 MGD or something else?
- Engage a Broad Group – very important!
 - Utility leadership: Cary and Apex
 - Operations staff: All three Cary plants
 - Maintenance staff
 - Engineering staff



Project Scope: Major Tasks

1. Forecast of Future Flows and Loads

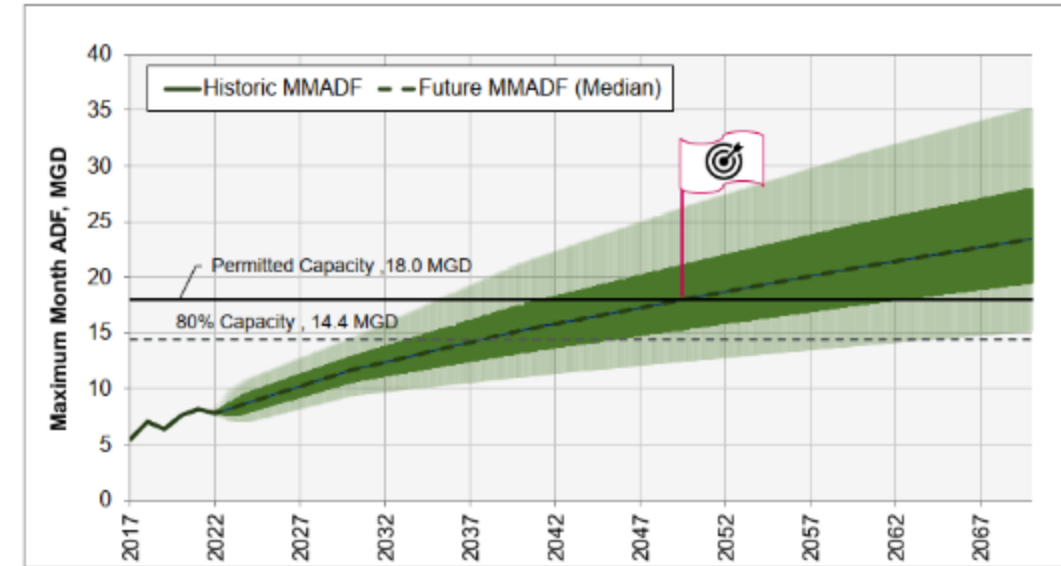
- Flow projection part of Long-Range Water Resources Plans for Cary and Apex
 - Completed by HDR
- Load projection part of Master Plan

2. Liquids Expansion Options

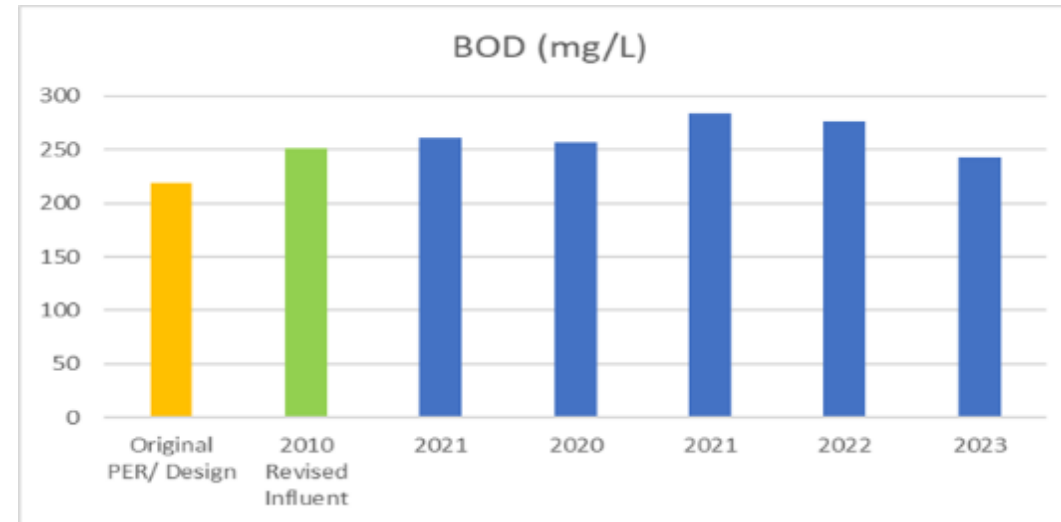
3. Biosolids Treatment and Disposal Options

4. Beaver Creek Pump Station

- Major pump station upstream of WWRWRF
- Evaluation by Freese & Nichols

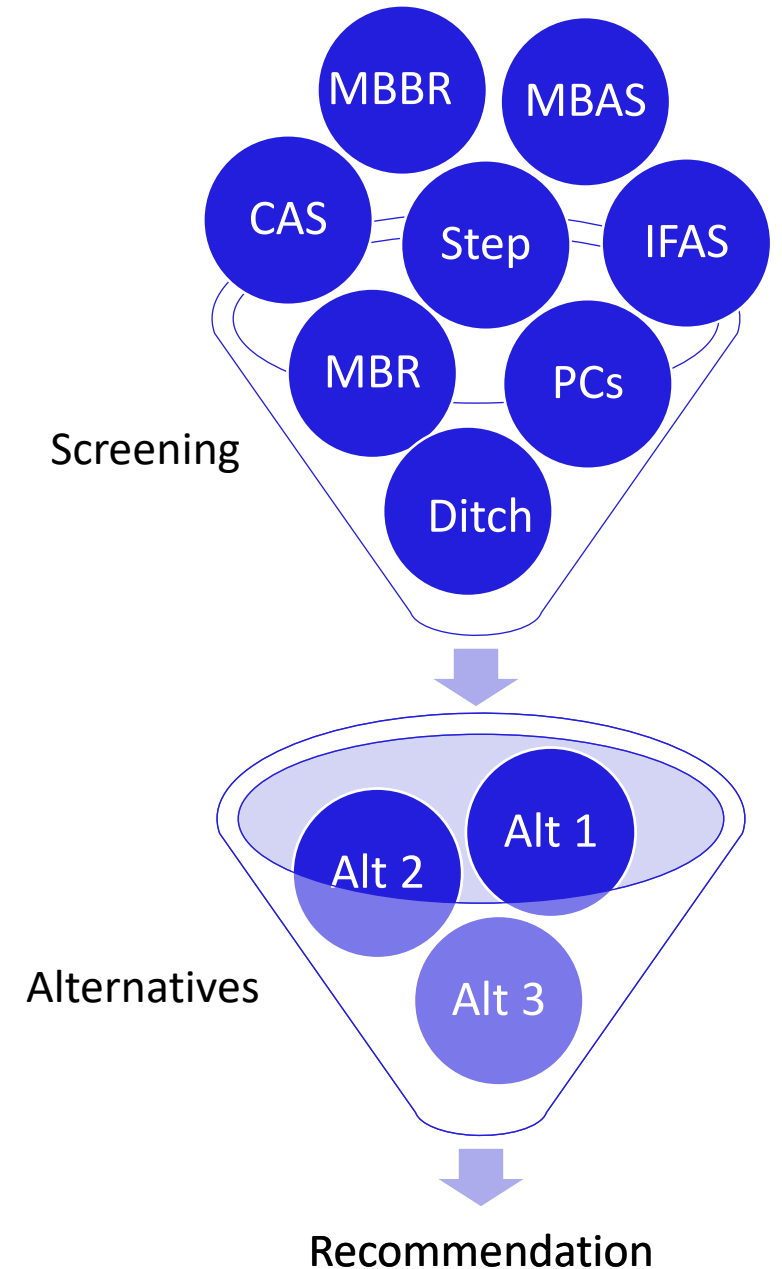


By HDR. From Forecast Review Workshop 7/22/24



Expansion Options - Approach

- Alternative Screening
 - Define universe of options for expansion
 - Screen down the list for detailed evaluation
- Alternative Evaluation
 - Detailed analysis of the options
 - Multi-Objective Decision Analysis (MODA) to account for financial and non-financial factors
 - Not just a technical or financial decision

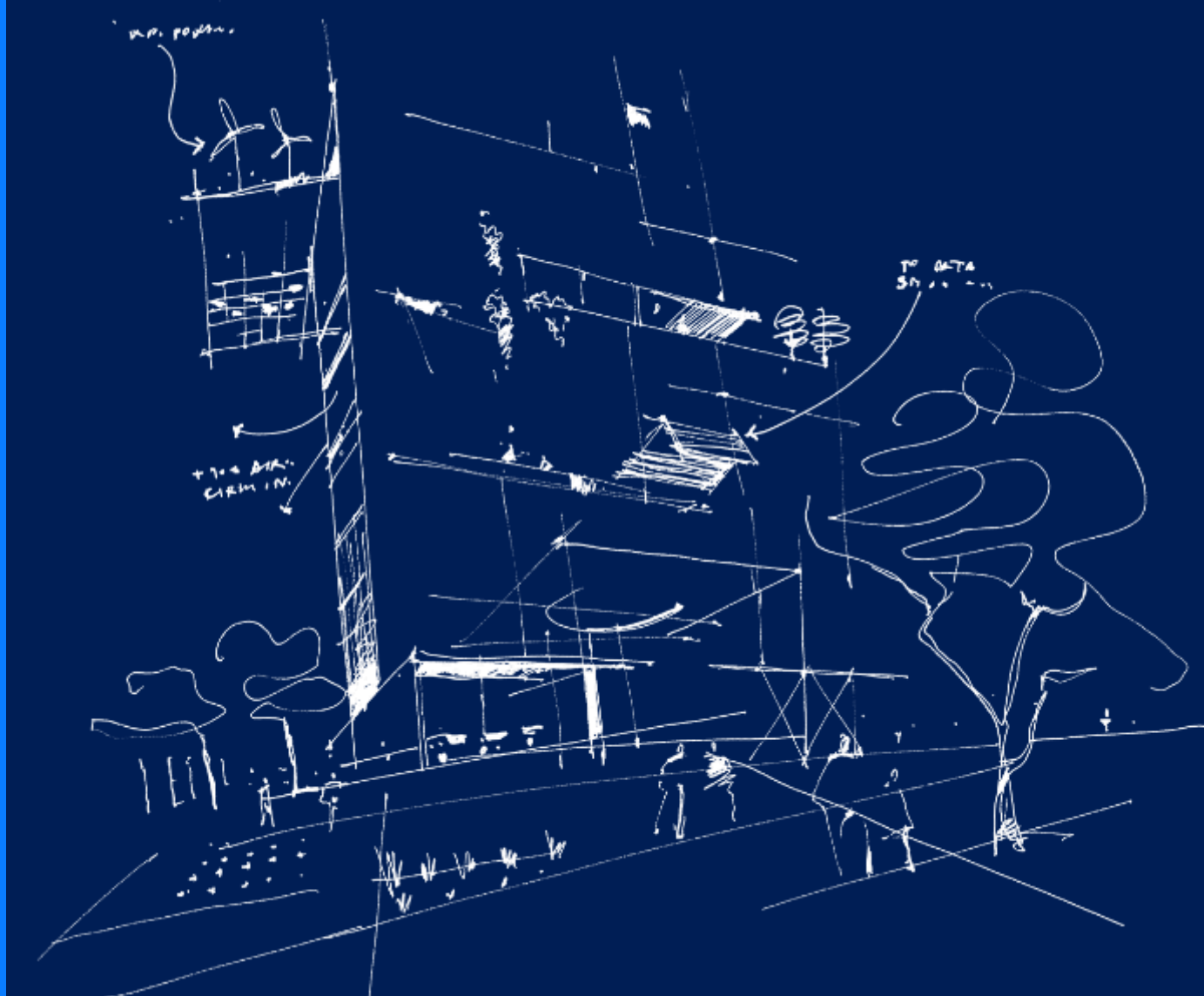


Criteria for MODA Evaluation

- Group discussion around what matters
 - Pulled relevant criteria from prior studies and Cary documents
- All voices heard – Broad group
- Selected criteria after discussion
- Weighted the criteria
 - Forced-weighting exercise
 - Which one of each pair is most important?

Selected Evaluation Criteria	
A. Beneficial use/product marketability	
B. Compatibility with Existing Systems	
C. Operational Complexity	
D. Potential Public Impacts	
E. Flexibility of solution and ability to expand	
F. Regulatory Acceptance and Adaptability	
G. Land Use	
H. Technology Maturity	

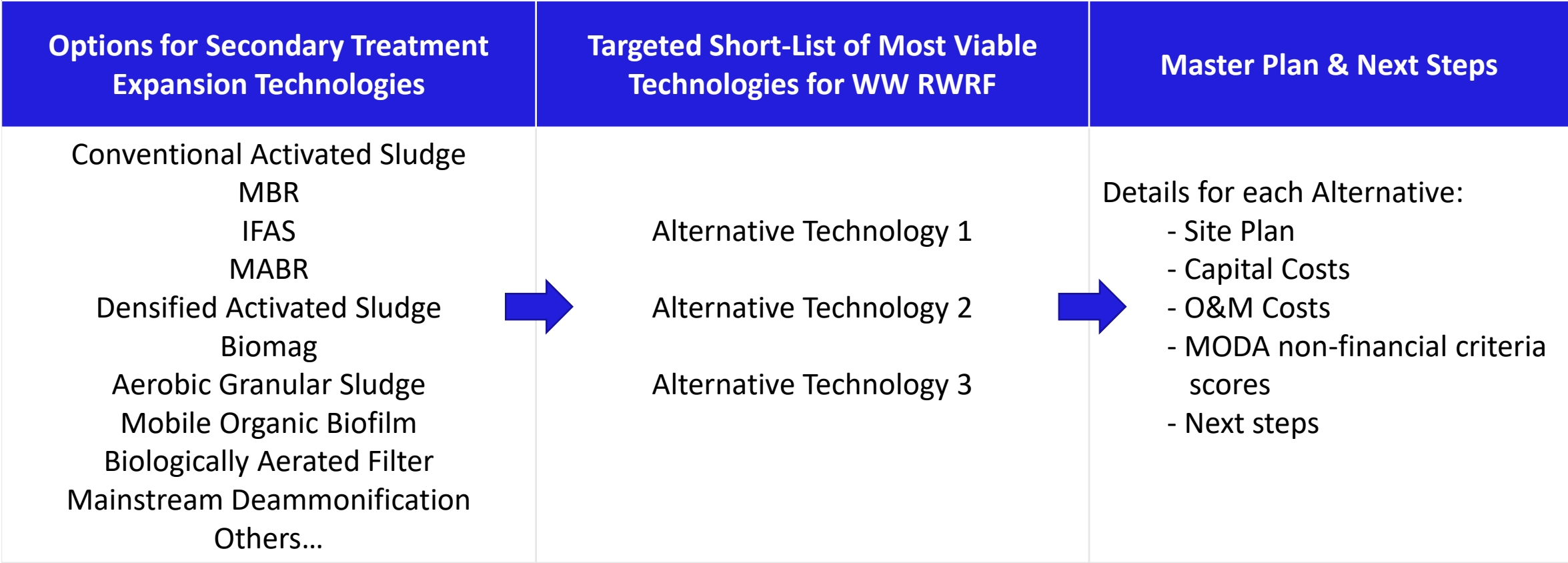
Liquids Expansion - Screening



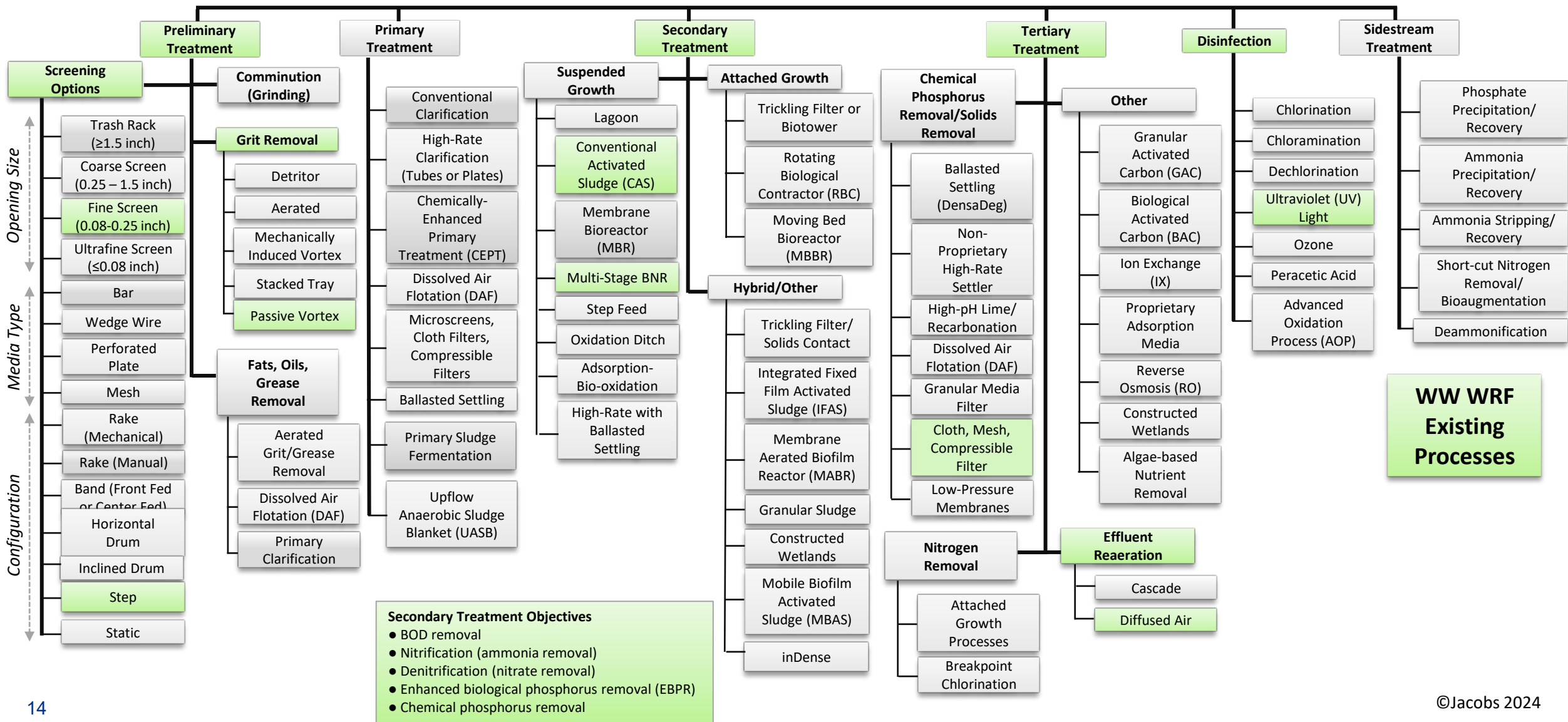
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Expansion Options - Liquids



World of Liquid Treatment Technologies



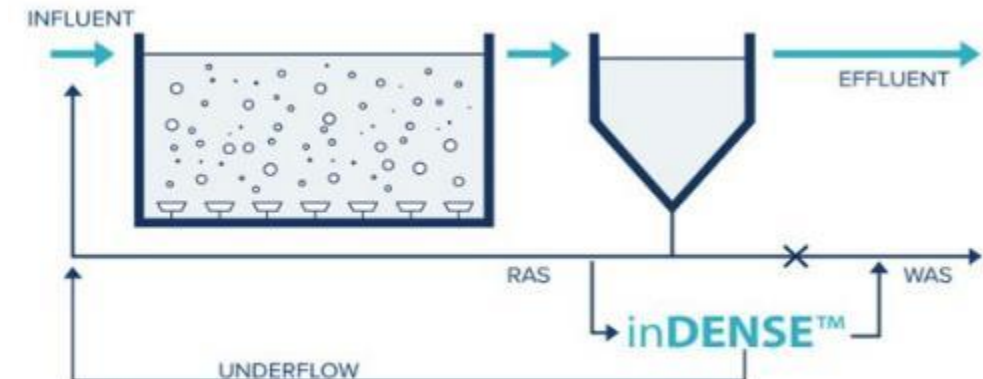
Screening Exercise - Liquids

- Pre-screen before discussion with Cary/Apex
- Primary Treatment options
- Secondary Treatment options
 - Clarification Improvements
 - Intensification/Biofilms
- Tertiary Treatment
- Sidestream Treatment

Chemically Enhanced Primary Treatment

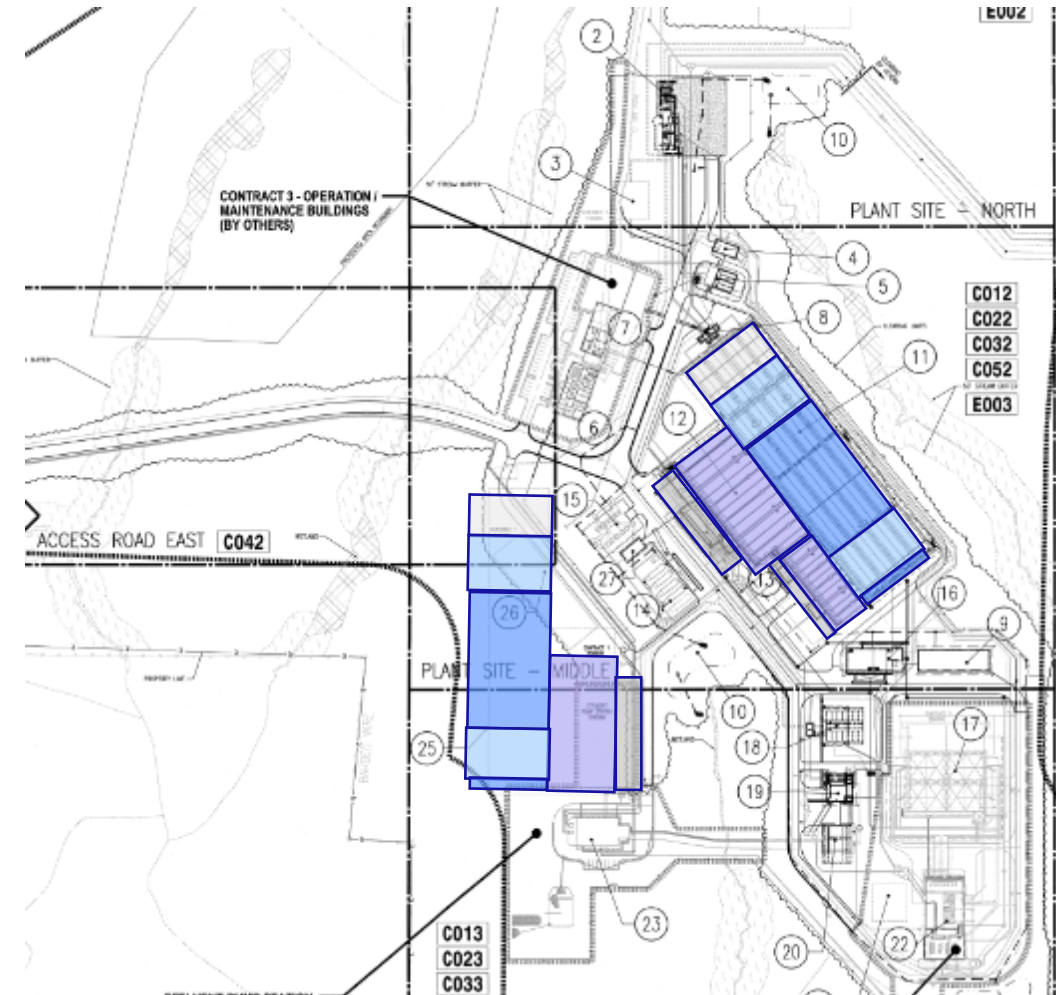


Jeyanayagam, 2016 – Carbon Redirection and its role in Energy Optimization at Water Resource Recovery Facilities

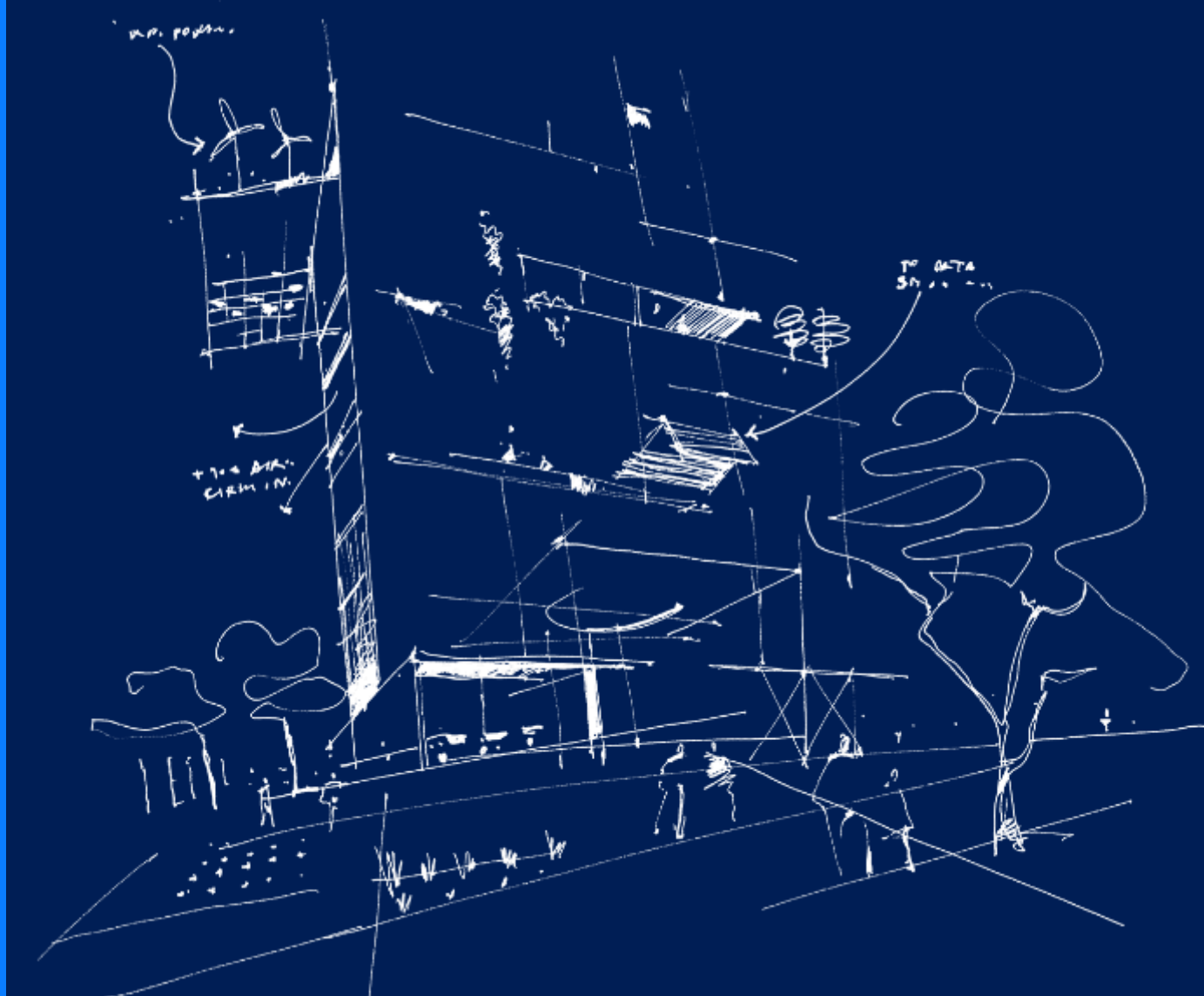


Screening Exercise - Liquids

- Four options selected for further evaluation:
- Baseline Options
 - 1. Convert to MBR
 - 2. Expand with Conventional Activated Sludge
- Clarification Improvements
 - 3. inDense/Step Feed Combination
- Intensification
 - 4. Mobile Biofilm Activated Sludge



Biosolids Expansion - Screening

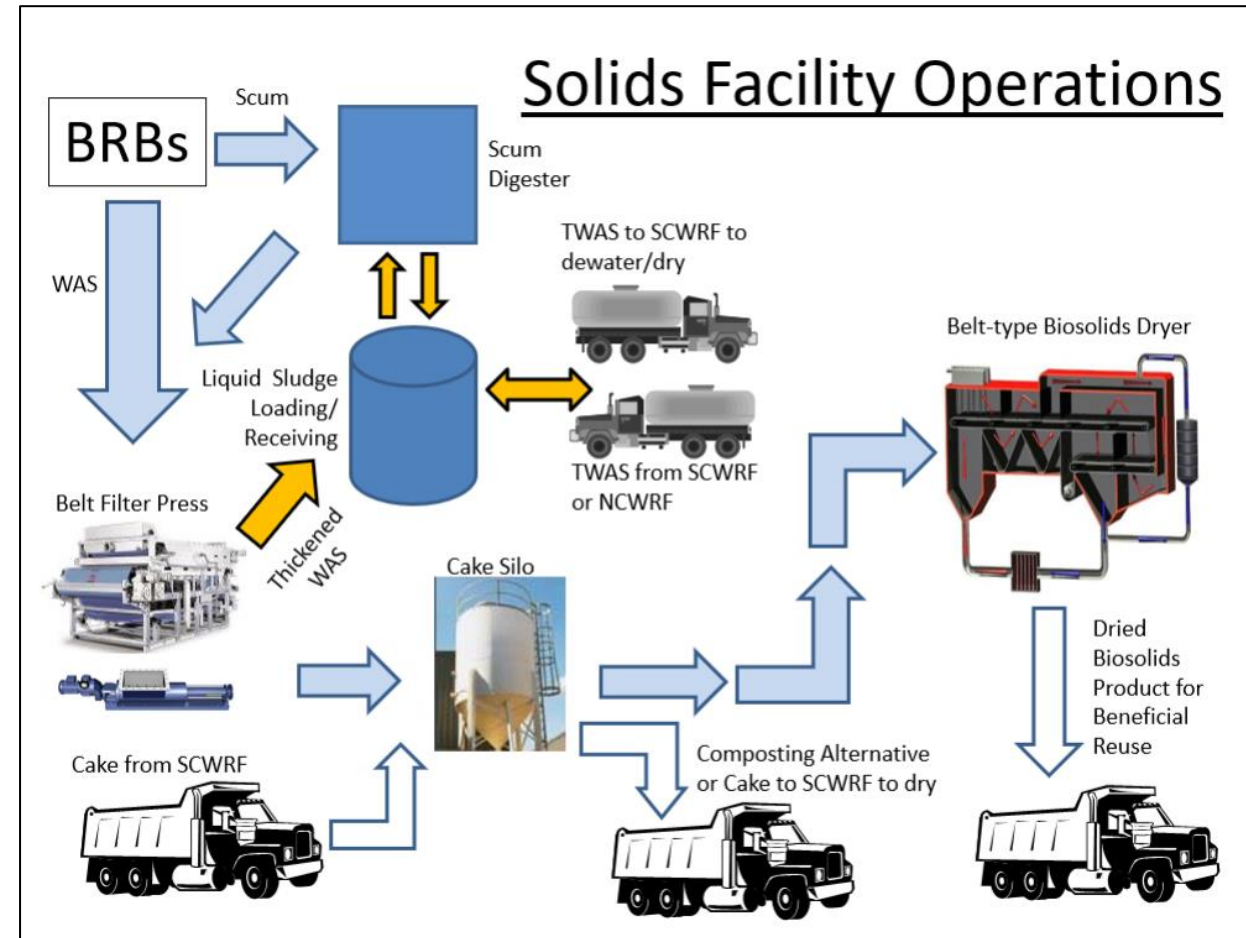


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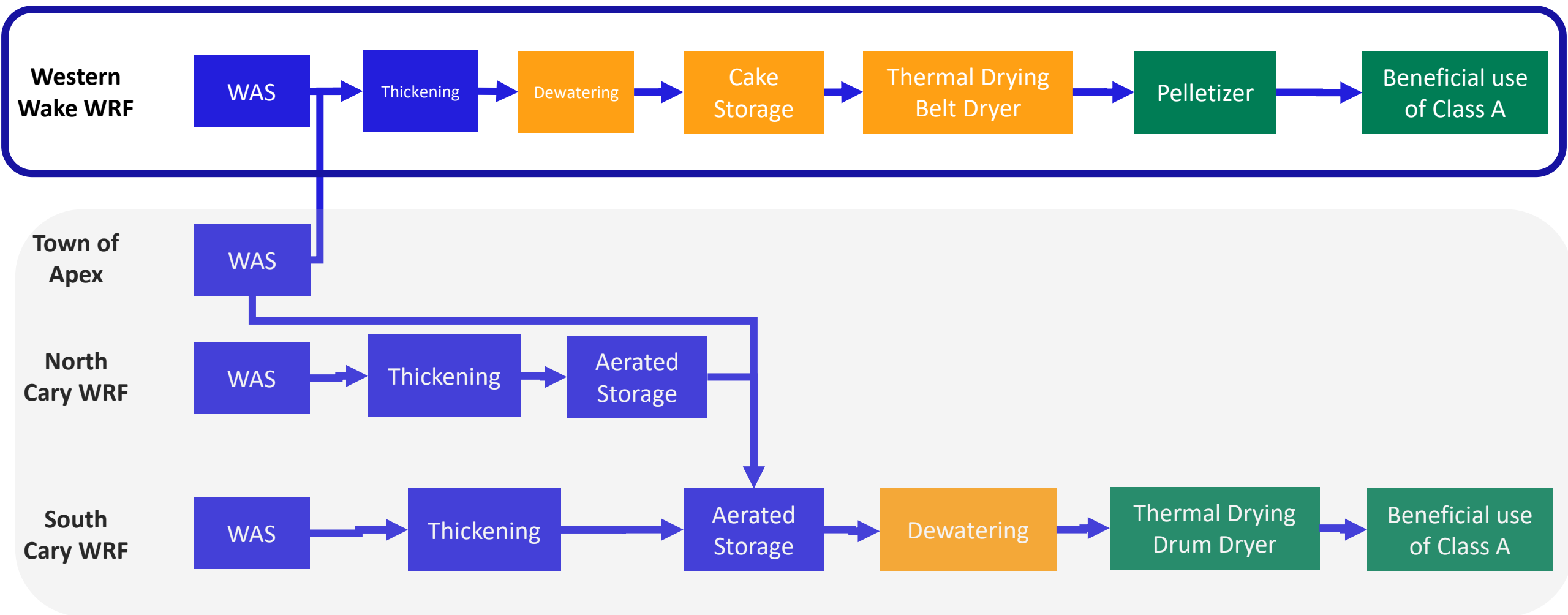
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Biosolids Treatment & Disposal Options

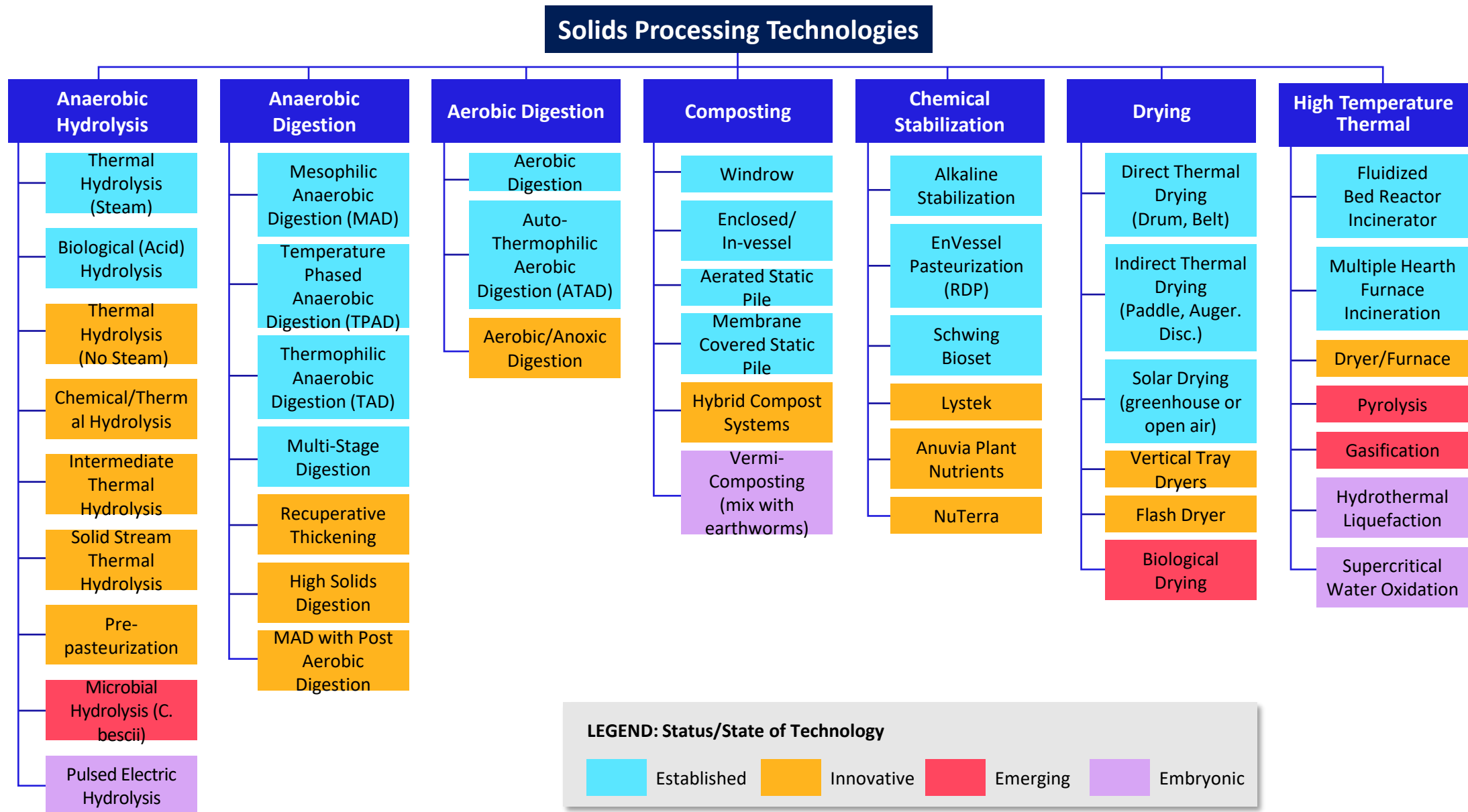
- Define expansion needs and assessment improvements to address current issues
- Establish future design capacities
- Evaluate options for disposal
 - Pelletization improvement options
 - Energy recovery options
- Solids Handling alternatives screening
- Alternatives analysis
- Preferred Alternative Development



Existing Biosolids Program

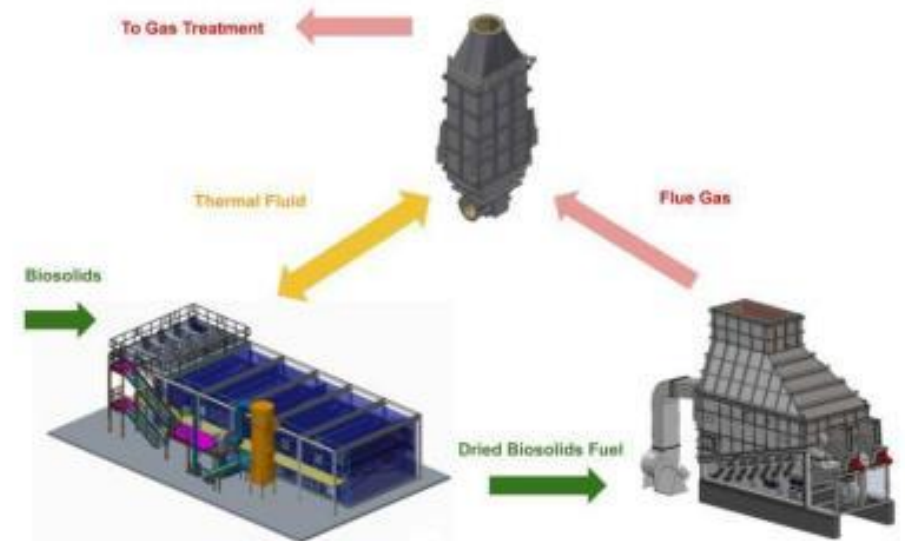
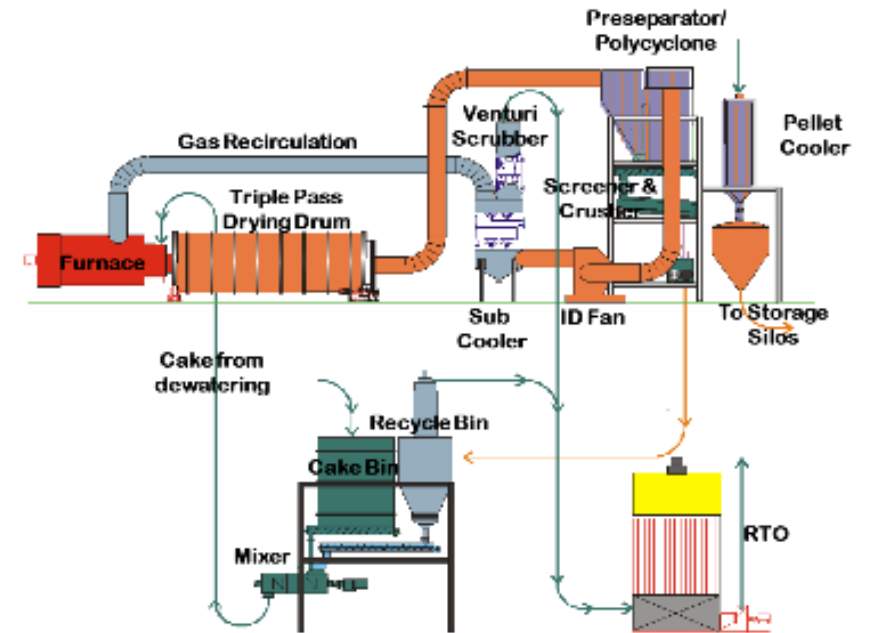


Universe of Solids Processing Technologies



Screening Exercise - Solids

- Aerobic Digestion
- Composting
- Chemical Stabilization
- Thermal Drying
- High Temperature Thermal Treatment

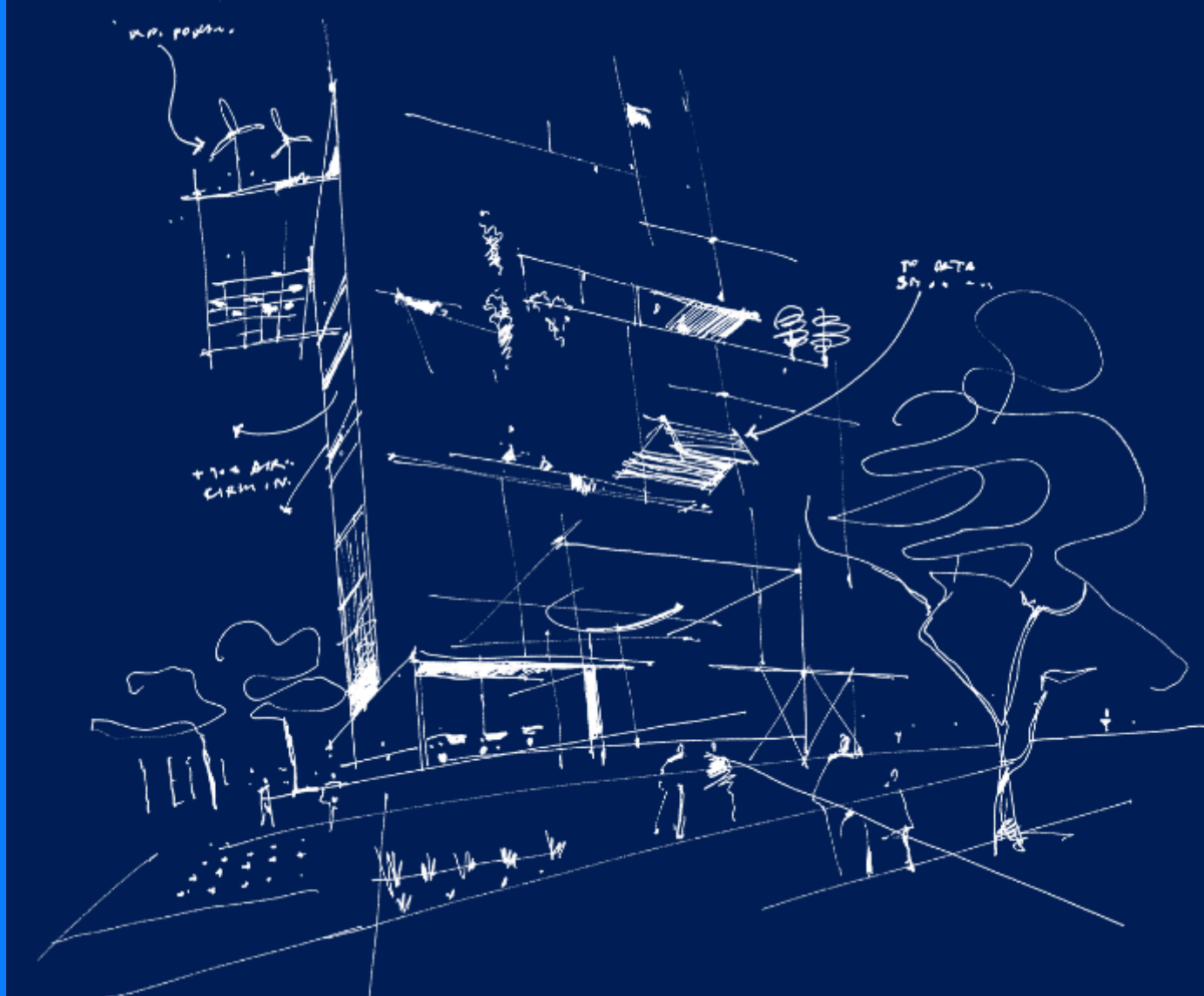


Screening Exercise - Solids

- Selected for further evaluation:
- 1. Drum Dryer
- 2. Belt Dryer with Pelletizer
- 3. Belt Dryer with Energy Recovery System
- 4. Gasification
 - Integrated Drum Dryer



Detailed Evaluation



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Detailed Evaluation - Liquids

- How far into the future does the technology get you?
 - Some 20 years
 - Some 40+ years
- Cost estimates
 - Developed to go to 40+ year horizon for comparison purposes
- Non-cost scoring/benefits
 - **Group discussion** for scoring against criteria
- Benefit/cost score to inform path forward

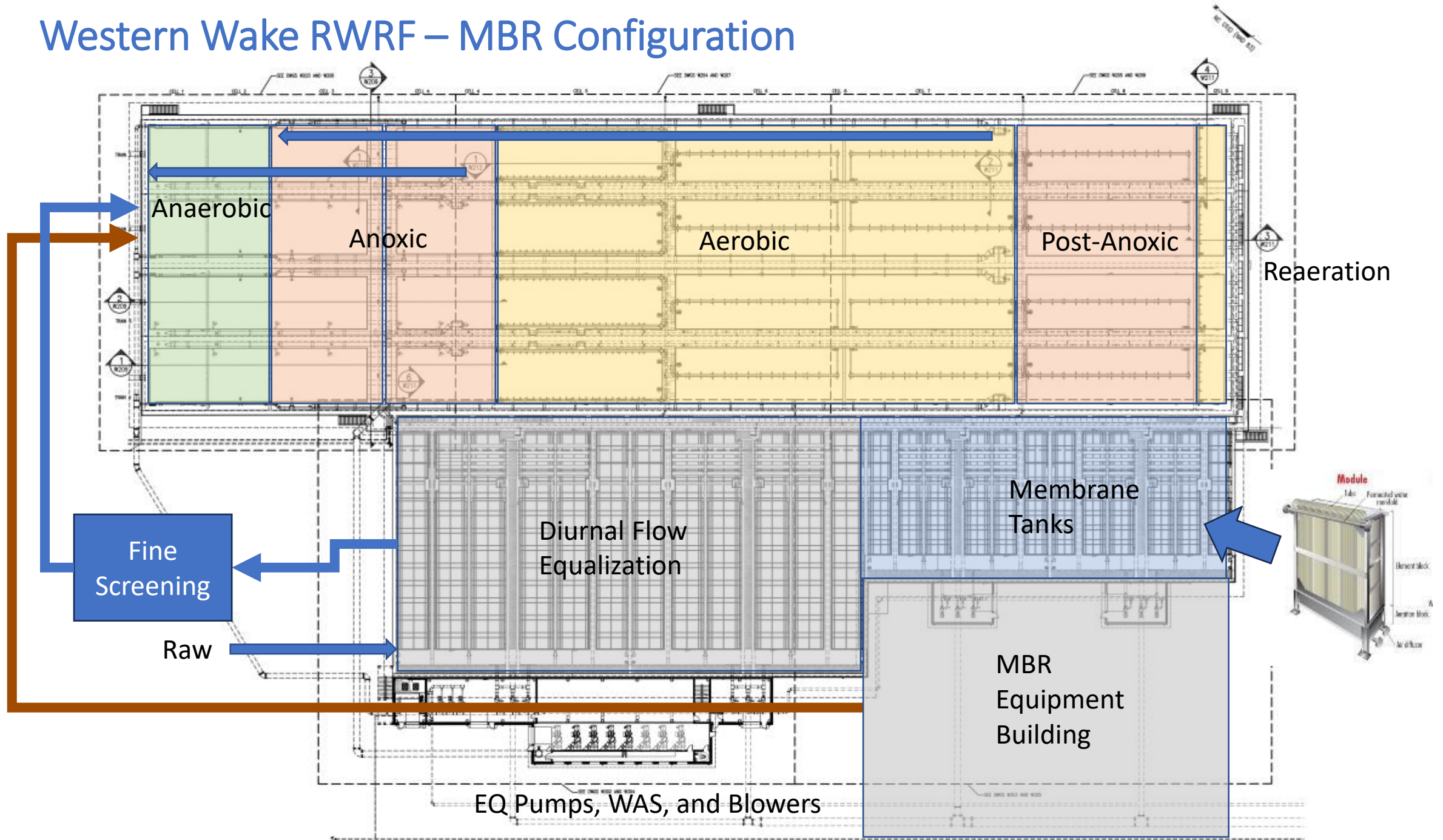
- Preferred Options
 - Mobile Biofilm Activated Sludge (MBAS)
 - Membrane Bioreactor (MBR)

Detailed Evaluation - Liquids

- Field visits to MBAS installations
 - Not doing exactly what Cary/Apex is looking to do
 - Very interesting but considered a little too new for Cary/Apex
- Current plan is for MBR expansion
 - Flexible so doesn't close the door to Conventional Activated Sludge
- Planned visits to MBR facilities, to close out the evaluation

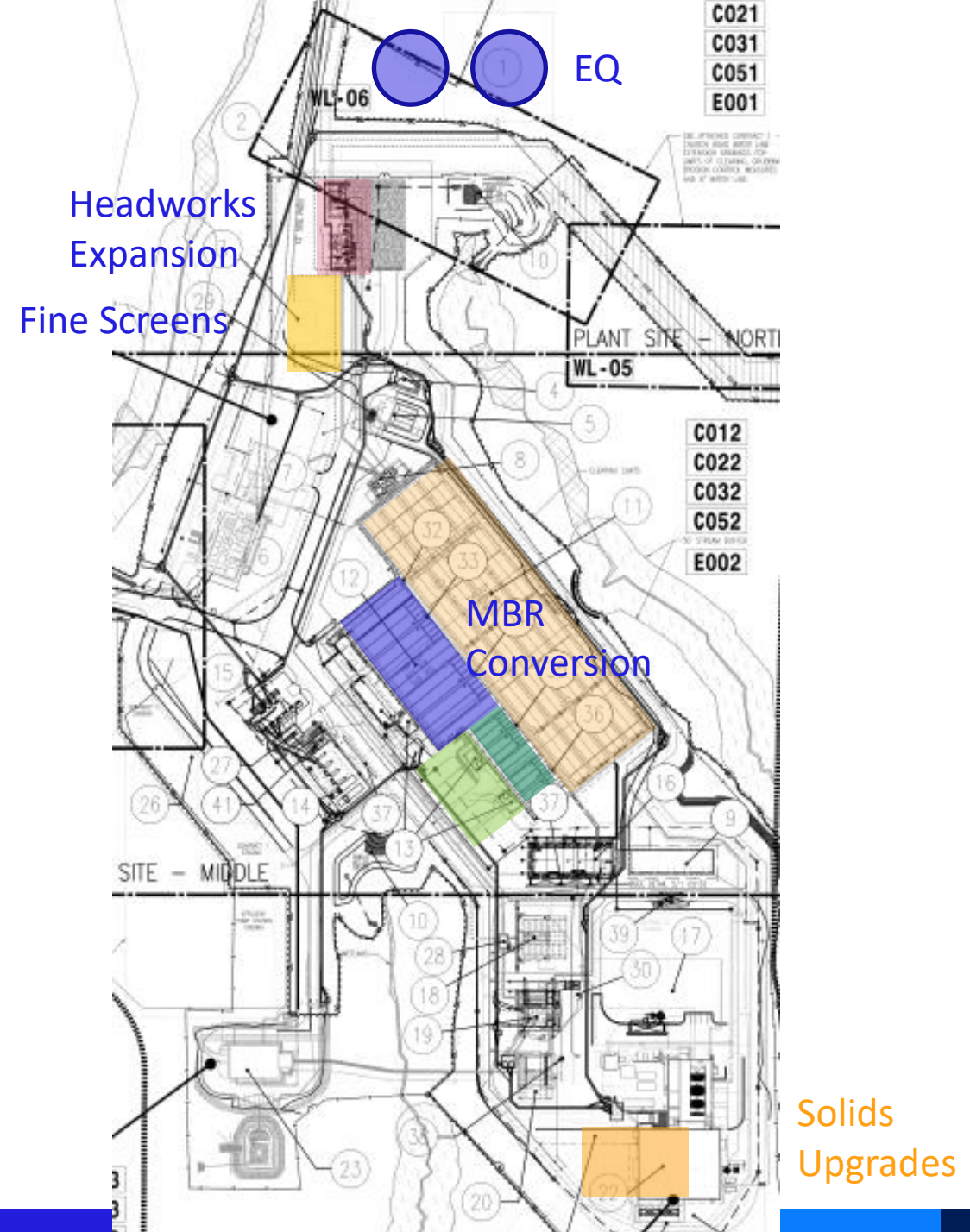


Western Wake RWRF – MBR Configuration



Overall Upgrades Proposed

- **Headworks**
 - Replace manual screen with 40mgd new mechanical screen (2 duty, 1 standby @ 40MGD)
 - Second 40 mgd grit chamber
- **Influent Flow Equalization (EQ, 9MG total)**
 - Assume 2 @ 3MG new tanks
 - Existing Large Clarifier conversion is 3MG
- **MBR Conversion**
 - Fine screening facility sized for 32 MGD
 - Installing of membrane equipment building, pumping & piping
 - Bioreactor upgrades (aeration, mixing, Internal Mixed Liquor pumping)
 - Conversion of small Clarifiers to membrane tanks
 - Conversion of large Clarifiers to Flow Equalization Basin
- **Existing Filters** – Not needed with membranes
- **Existing UV** - No upgrades, should be sufficient with EQ
- **Reaeration** – No upgrades
- **Effluent Pump Station** - No upgrades with EQ
- **Solids Upgrades** (Option 1, Option 2 or Option 3)



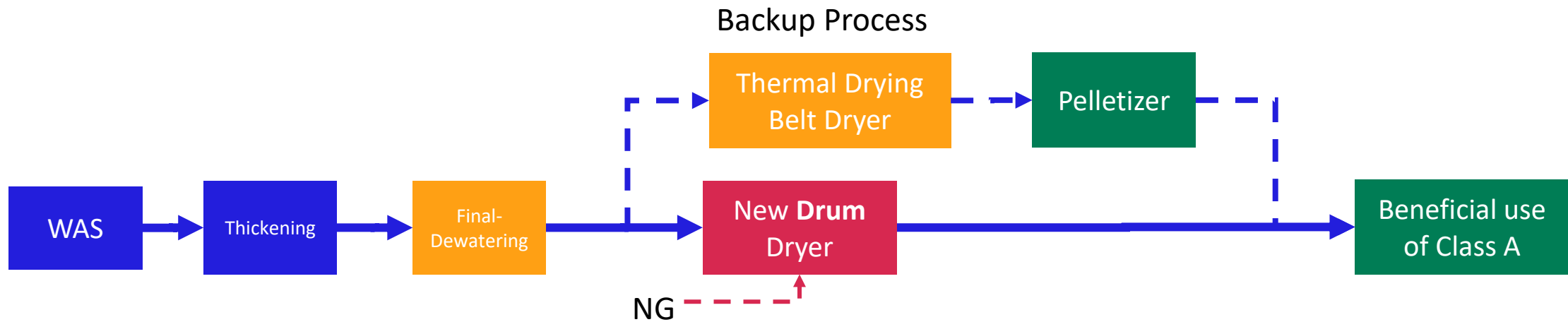
Detailed Evaluation - Solids

- All sized for 20 years
- Evaluated 24/7 and 24/5 operation
 - 24/5 allows for down-time
- Cost estimates
- Non-cost scoring/benefits
- Benefit/cost score

- Options going forward
 - 1. Drum dryer in new building
 - 2. Drum dryer in existing building
 - 3. Keep the belts and send the excess off site

Detailed Evaluation - Drum Drying

- Recycling and screening systems result in pelletized product
- Proven technology in the U.S. with over two dozen municipal installations
- Familiar to operations and maintenance staff
- Well developed market

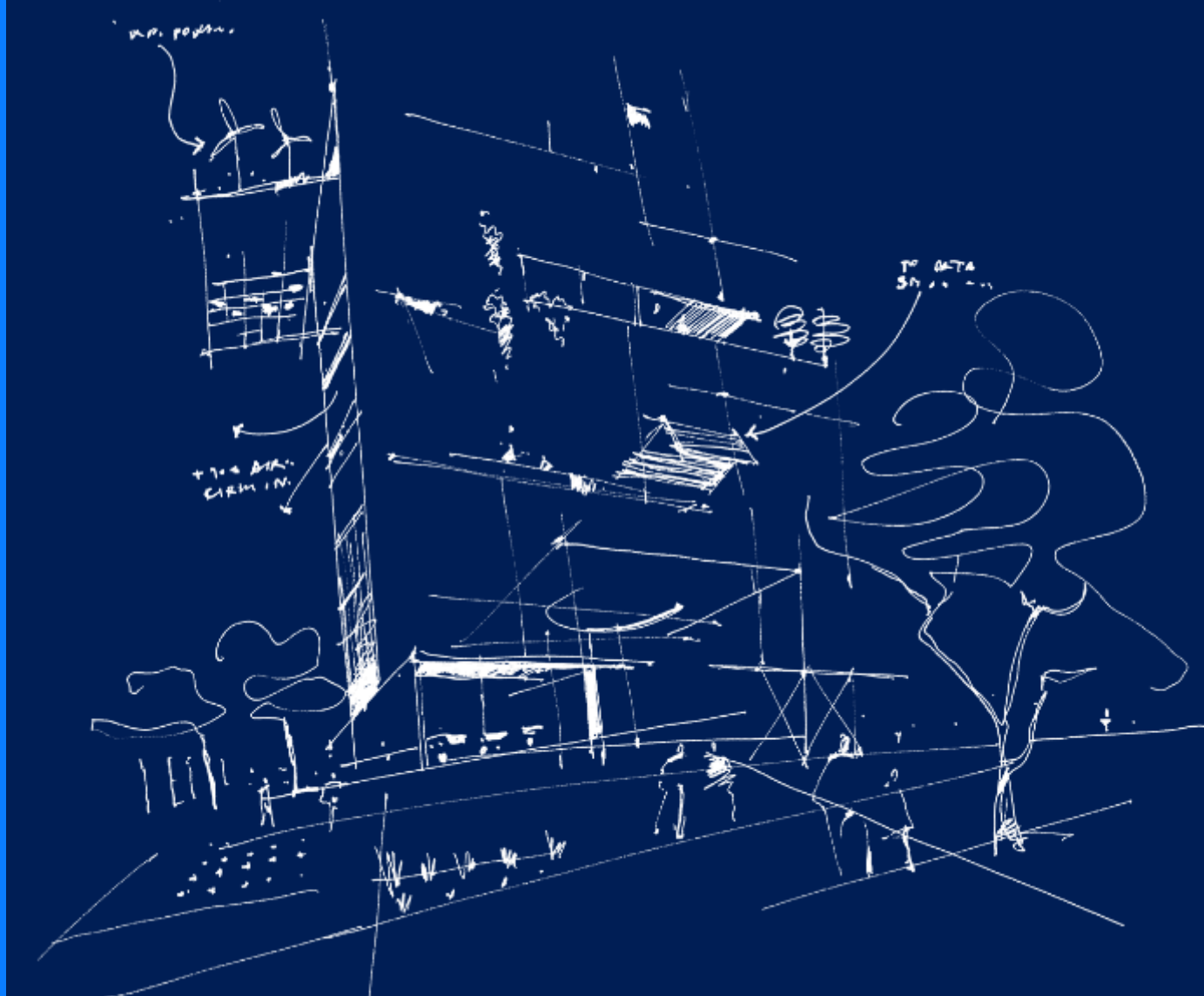


Detailed Evaluation – Solids Path Forward

- Drum dryer preferred
 - Good experience South Cary WRF
 - Potential cost savings by using existing building
 - Not necessarily easy!!
- Continue using belt dyers
 - Spread capital outlay by running existing belts for longer
 - Send excess offsite
 - Eventually replace with Drum Dryer



Wrap Up Thoughts



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Wrap Up Thoughts

- Where are we now?
 - Draft Master Plan soon
 - Trip to similar sized MBR facilities
- Project Success Factors
 - Collective Approach
 - Having many different perspectives
 - Buy-in to path forward
 - Documented Approach
 - Understand how we got here
 - Flexibility built into Master Plan
 - Not “locked in” to one technology



Thank you

Phil Ogden, PE

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