CITY OF
PALO ALTO

Palo Alto Regional Water Quality Control Plant (RWQCP)
Biosolids Input Workshops
Meeting Minutes

Biosolids Input Workshops Overview

City of Palo Alto staff met with community members on May 20, 2025 and on July 1,2025 to discuss proposed alternatives to the City's current biosolids processing at the Regional Water Quality Control Plant (RWQCP).

- The May 20, 2025 in-person workshop was held in the Palo Alto Room at the Mitchell Park Community Center from 6:00 PM – 7:30 PM
- The July 1, 2025 workshop was conducted virtually via Zoom from 4:00 PM – 5:00 PM

Workshop Presenters

Organization	**Name**	**Title**	**Meeting Date(s)**
City of Palo Alto	Karin North	Assistant Director, Public Works	May 20 & July 1, 2025
	Aaron Gilbert	Plant Manager	May 20 & July 1, 2025
	Tina Pham	Senior Engineer	May 20 & July 1, 2025
	Connie Li	Project Engineer	May 20 & July 1, 2025
	Daniel Shih	Intern	July 1, 2025 only
Woodard & Curran	Greg Sands	Program Manager	May 20, 2025 only
Carollo Engineers	Christine Polo	Principal Technologist – Biosolids	May 20 & July 1, 2025
	Rashi Gupta	Wastewater Practice Director	May 20 & July 1, 2025

City staff and consultants in attendance gave an overview of the RWQCP and its current biosolids management protocol. Additionally, they gave background on the on-going Biosolids Facility Plan Update and proposed alternative biosolids technologies that the City is evaluating, as well as the evaluation criteria being used to do so.

To gather public input, participants were asked to respond to the question:
"What should the Regional Water Quality Control Plant consider when evaluating biosolids technologies?"

Participants submitted words or short phrases, which were aggregated into a word cloud. In the word cloud, more frequently submitted words appeared larger and more prominently, visually highlighting the community's key concerns and priorities. The word clouds from both workshops are included in **Appendix A.**

Following the word cloud activity, participants joined facilitated small group discussions to provide more in-depth feedback on the City's draft evaluation criteria. On May 20, small group discussions were led by Tina Pham and Aaron Gilbert; on July 1, they were led by Tina Pham and Karin North.

For the in-person workshop on May 20, physical posters were displayed around the room for participants to review before the formal presentation began. These posters are included in Appendix C. The PowerPoint slides presented at both workshops were virtually identical and are included in Appendix B.

Biosolids Evaluation Criteria: Combined Community Feedback Summary

Notes from Workshops Including Small Group Discussions Sessions

The following is a consolidated summary of public feedback received during both of the Biosolids Input Workshops, capturing comments from multiple small group sessions involving residents, city staff, and project consultants. The feedback reflects resident perspectives on the *draft evaluation criteria* and broader concerns surrounding land use, technology options, and environmental priorities:

1. Environmental Impacts Should Be More Heavily Weighted

- There was a broad consensus that Environmental Impacts should carry greater weight in the evaluation criteria (currently 14%). Residents emphasized:
  - Protection of wetlands and habitat corridors
  - Minimization of trucking and vehicle emissions
  - Sea level rise vulnerability
  - Noise, odor, and air quality effects
  - Wildlife and ecological impacts, which are not currently broken out clearly in the evaluation framework

2. PFAS and Emerging Contaminants Need Explicit Attention

- PFAS (per- and polyfluoroalkyl substances) were frequently mentioned, with residents urging the city to:
  - Call out PFAS specifically under environmental criteria
  - Consider broader "contaminants of emerging concern", including pharmaceuticals and other constituents like microplastics
  - Tie these to regulatory resilience, which should reflect potential future mandates

3. Footprint Constraints and Land Use Need Transparency

- Residents asked for clarity on the use of the Measure E site, expressing concern over:
  - The loss of buffer between the park and the treatment facility
  - The original promise that unused land might be rededicated as park space
- Clarification was later provided that only 2.3 acres of the Measure E site—adjacent to the existing plant—is being considered due to landfill constraints.
- There was also support for evaluating nearby parcels, such as those on Embarcadero Way, for potential future facility expansion.

4. Community Impacts Are Undervalued

- With only 6% weighting, *community impacts* were seen as underrepresented. Residents suggested increasing this weighting and emphasized:
  - Noise, aesthetics, traffic, and public perception
  - Considering not just negative impacts, but also community benefits, such as:
    - Class A biosolids providing more reuse options
    - Potential for local application of biosolids in nearby areas (if feasible)

5. Restructure or Refine the Criteria Categories

- Residents noted that some criteria overlap or conflict, especially between environmental and community impacts, and recommended:
  - Merging or aligning adjacent categories
  - Creating clearer subcategories for air, wildlife, and noise impacts
  - Reconsidering whether "regulatory resilience" should be a scored criterion or simply a pass/fail gate
  - More balanced weights across criteria to better reflect the city's sustainability goals

6. Consider Regional Partnerships and Shared Infrastructure

- There was interest in alternatives that include partnerships with nearby cities, such as San Jose or Redwood City.
  - These were seen as having cost and operational advantages
  - Several residents asked that the evaluation explicitly reflect the benefits of regional cooperation

7. Alternative Technologies and Resource Recovery

- Some residents expressed interest in resource recovery opportunities, such as:
  - Capturing methane for biogas production
  - Using ammonia to produce fertilizers (though staff noted it may not be feasible at current concentrations)
- Interest was also shown in the potential for local biosolids reuse, though city staff noted limited available land for local application.

Suggested Framework Adjustments

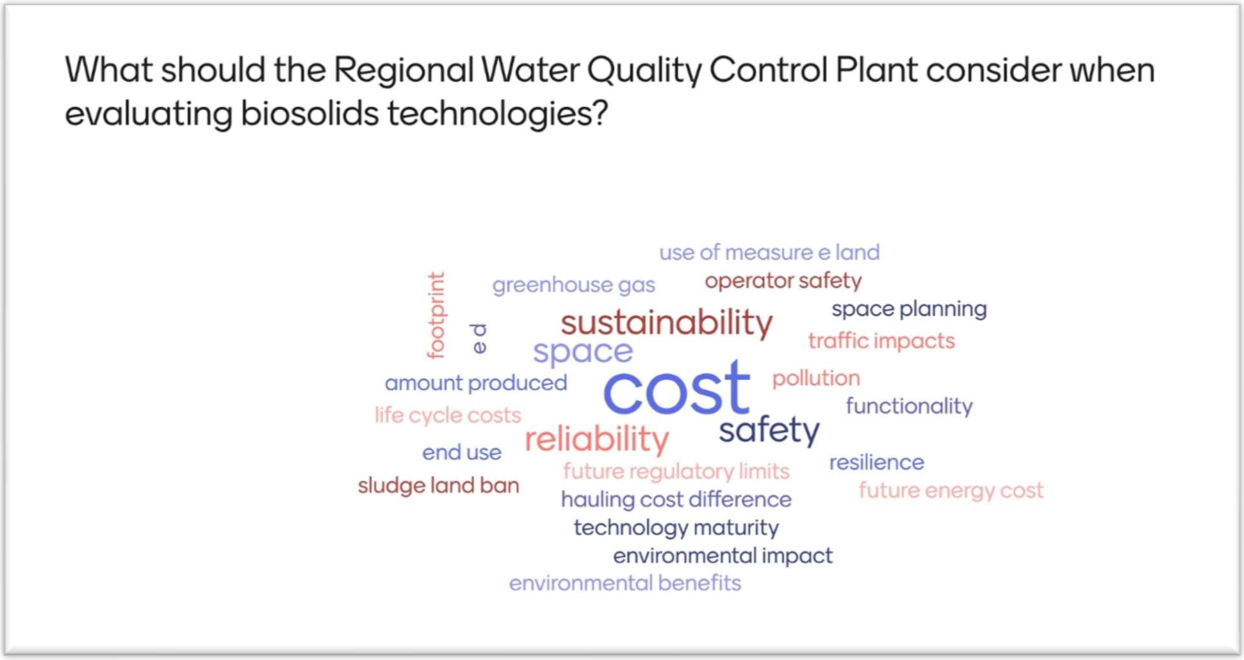
Suggested Change	Affected Category	Notes
Increase weight for environmental impacts	Environmental Impacts	Reflects community concern about emissions, habitat, water, and sea level rise
Include PFAS and CECs explicitly	Environmental/Regulatory Resilience	Name PFAS directly or group under a new “emerging contaminants” criterion
Raise weight for community impacts	Community Impacts	Capture both negative impacts and potential public benefits
Clarify or reclassify “Regulatory Resilience”	Regulatory Resilience	Consider as a threshold requirement
Add “wildlife and habitat” as a subcategory	Environmental Impacts	Impacts to non-human life currently underrepresented
Call out land use constraints more clearly	Footprint & Site Impacts	Note Measure E limits, landfill cap issues, and alternative parcels
Consider technology flexibility & resource recovery	O&M / Proven Tech	Include potential for biogas use, ammonia recovery, and biosolids reuse

Closing Remarks

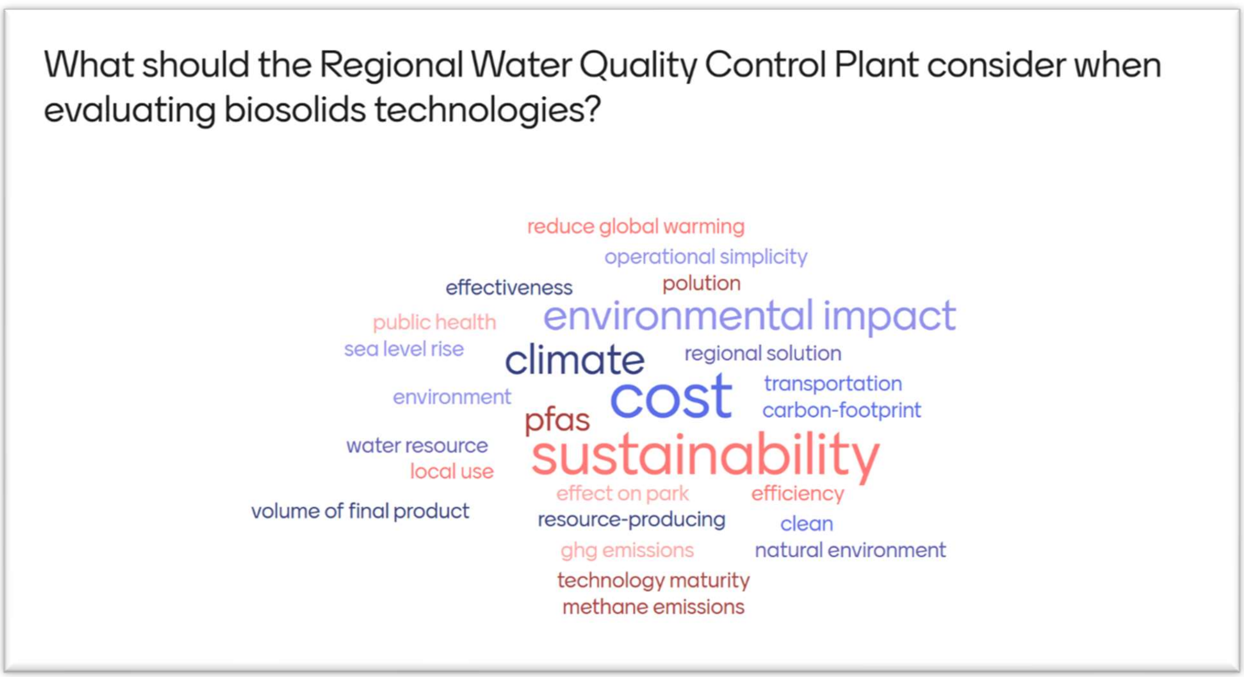
Residents expressed appreciation for the inclusive planning process and were encouraged to submit additional comments. Staff clarified that the current phase of work is focused on refining draft evaluation criteria and development of footprint sizing of the biosolids alternatives. It is anticipated that in the following months, the Biosolids Facility Plan Update will evolve further as liquid treatment upgrades recommendations are also further defined.

City staff will incorporate public feedback into the evaluation framework and decision-making on biosolids technology selection.

Appendix A: Word Cloud Surveys



May 20, 2025 Word Cloud



July 1, 2025 Word Cloud

Appendix B: Presentation Slides from July 1, 2025 Workshop

Attached below:

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Biosolids Input Workshop

Regional Water Quality Control Plant

July 1, 2025

www.paloalto.gov

Welcome & Introductions

City of Palo Alto
- Karin North, Assistant Director, Public Works
- Aaron Gilbert, Plant Manager
- Tina Pham, Senior Engineer
- Connie Li, Project Engineer
- Daniel Shih, Intern

Carollo Engineers
- Christine Polo, Principal Technologist - Biosolids
- Rashi Gupta, Wastewater Practice Director

Agenda

- Welcome
- Introduction to Regional Water Quality Control Plant
- Current Biosolids Management
- Overview of Biosolids Facility Plan Update
- Biosolids Technologies and Alternatives (Carollo)
- **Community Input Activities – Group Polling Exercise**
- Biosolids Alternatives Evaluation Process
- **Community Input Activities – Small Group Exercise**
- Recap/Next Steps

CITY OF PALO ALTO

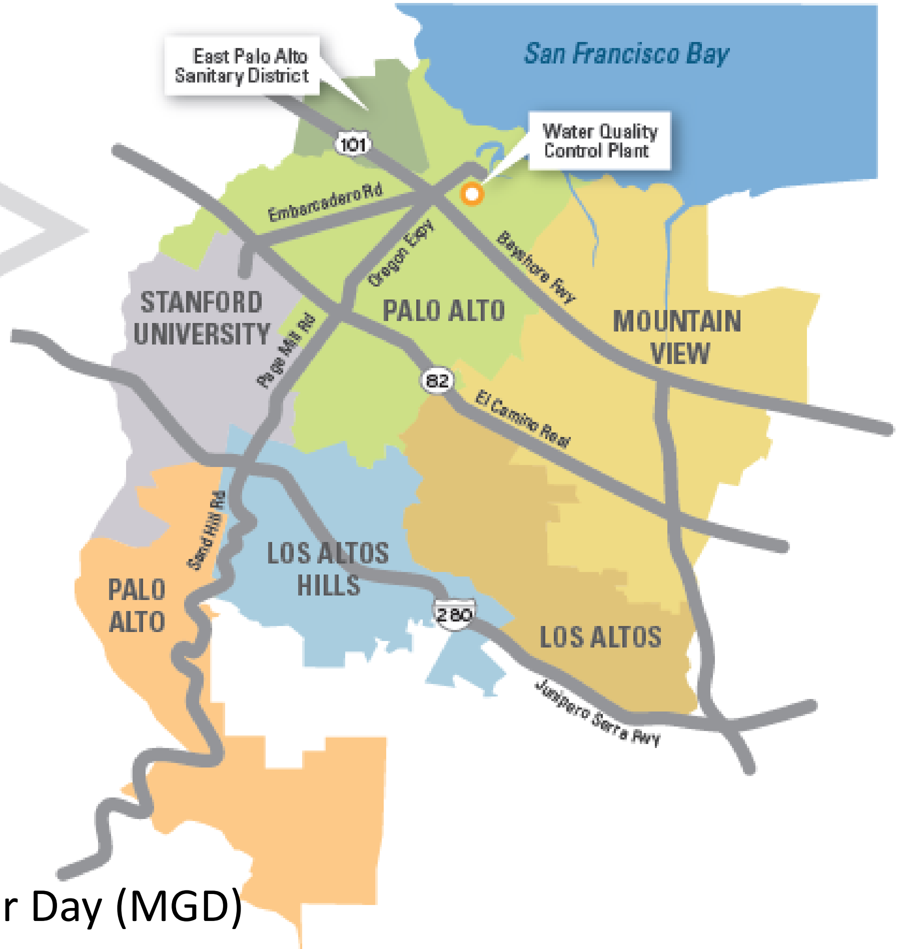
Introduction to

Regional Water Quality Control Plant

Regional Water Quality Control Plant Background Information

The Regional Water Quality Control Plant is operated by the City of Palo Alto and is a partnership among:

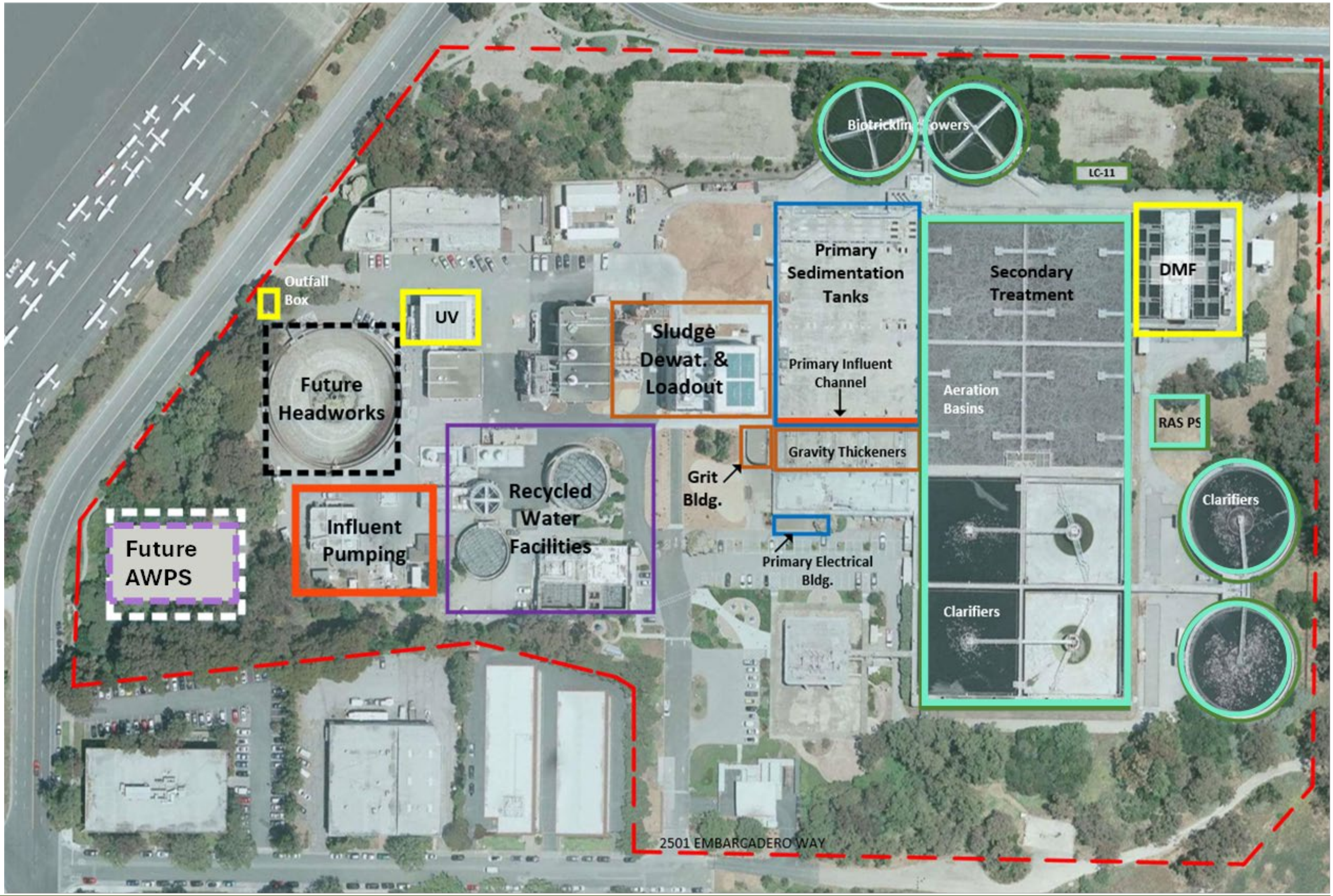
- East Palo Alto Sanitary District
- Los Altos
- Los Altos Hills
- Mountain View
- Palo Alto
- Stanford University



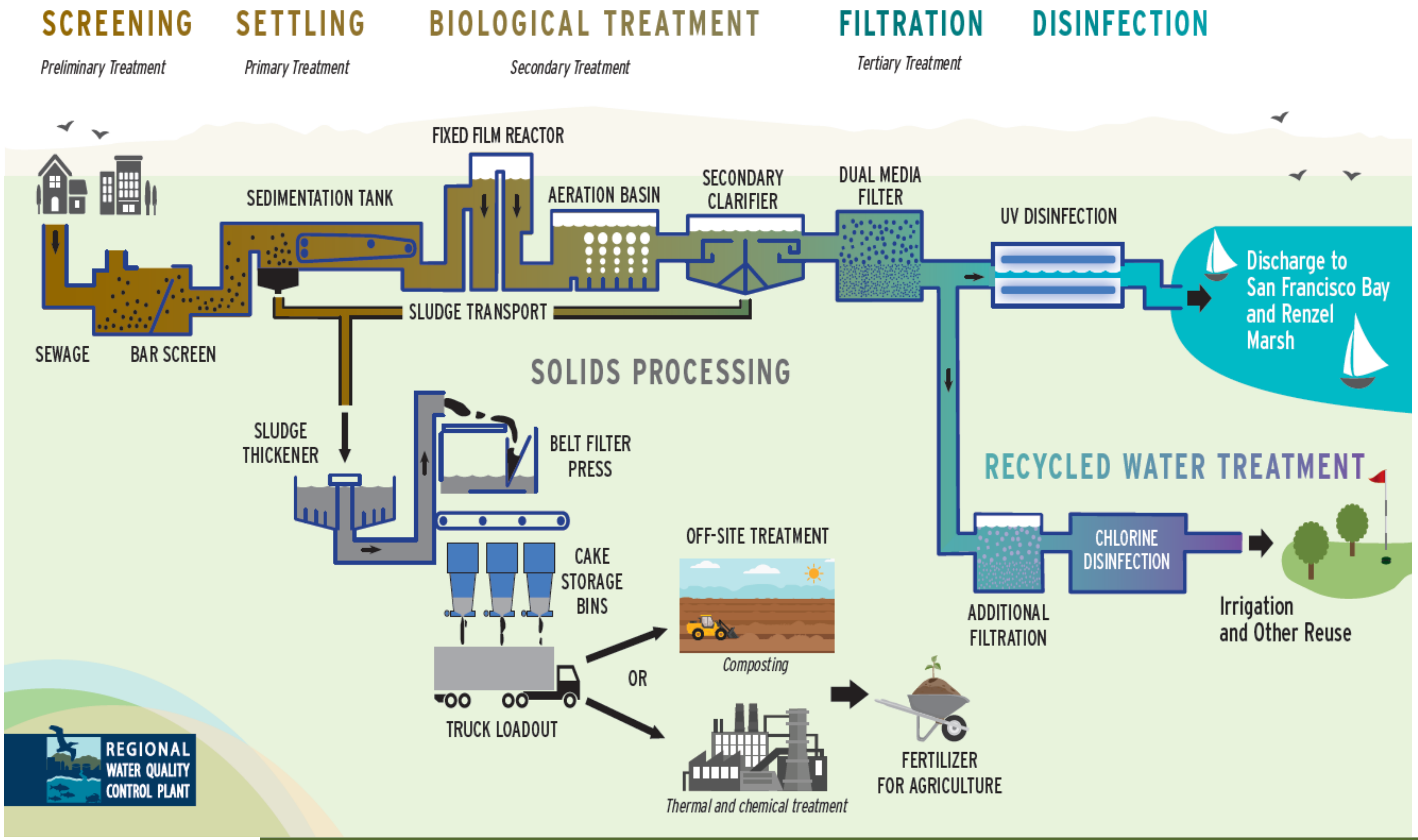
- Plant's permitted dry weather capacity: 39 Millon Gallons Per Day (MGD)
- Wet weather capacity: 80 MGD
- 2024 average dry season flow: 19 MGD (May – October)

Ongoing Capital Improvement Program

Project	Status	Cost (Mil)
Primary Sedimentation Tanks Rehabilitation	Construction Completed 2024	$16.5
Secondary Treatment Upgrades	Construction	$193.0
12 kV Loop Rehabilitation (Phase 1 + 2)	Construction	$13.5
Advanced Water Purification System	Construction	$59.9
Headworks	Pre-Design	~$100
Outfall Pipe Construction and Rehabilitation	Design	~$17.8
Joint Interceptor Sewer Rehab (Phase 1)	Construction	$8.9



Wastewater Treatment Process



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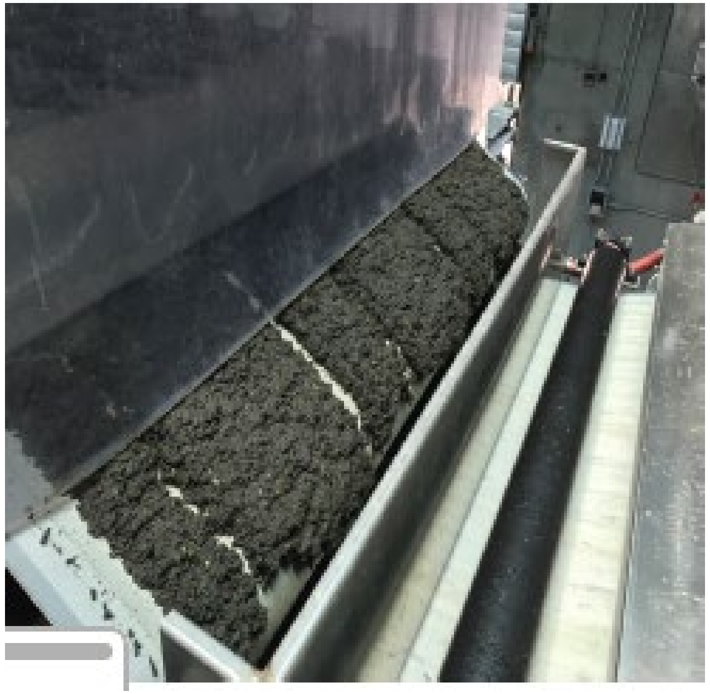
Current Biosolids Management

Regional Water Quality Control Plant

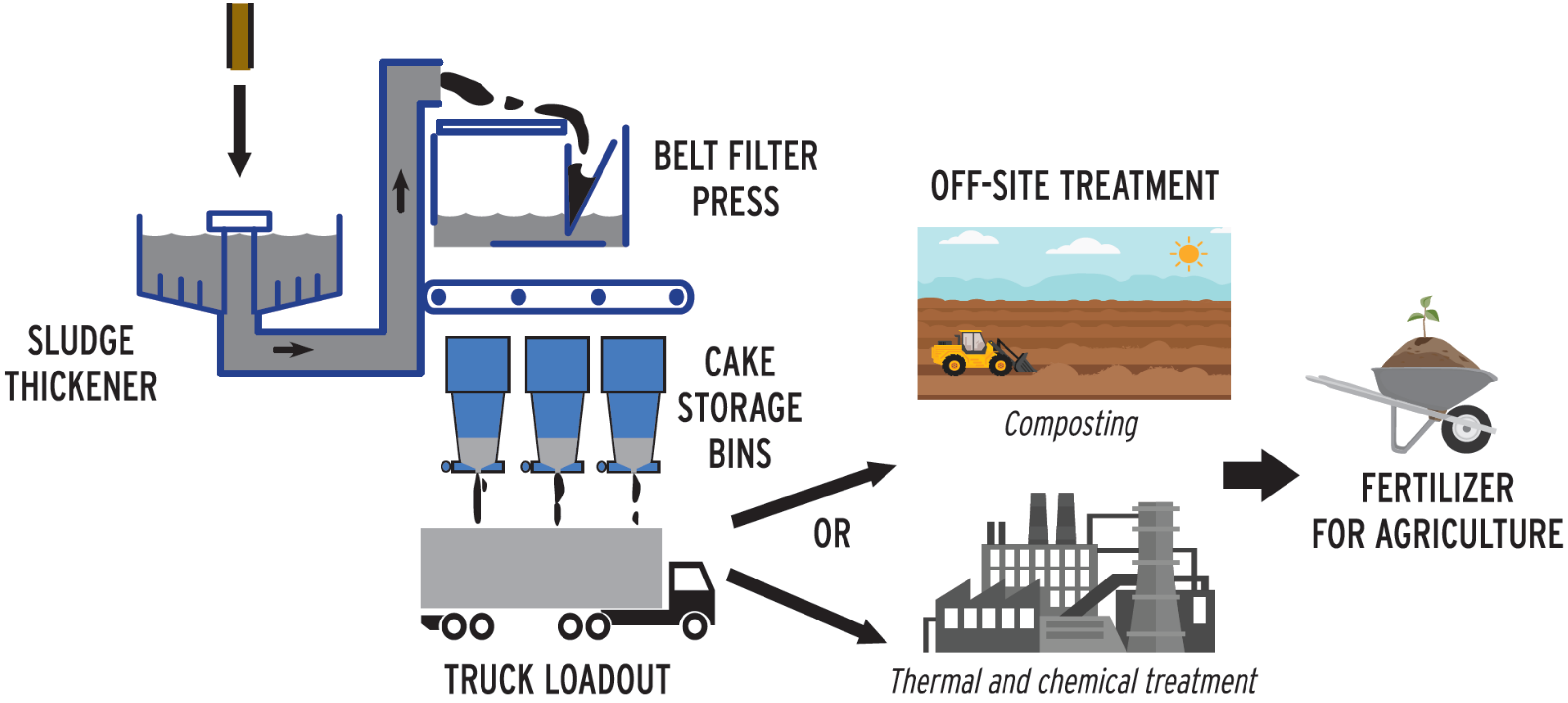
Current Solids Onsite Processes, Off-Site Hauling and Treatment



Dewatered Biosolids (Sludge Cake) from Belt Filter Press

Solids Become Compost/Fertilizer

- Solids are removed from wastewater, thickened, blended to a uniform size and dewatered on a belt filter press
- These “sludge cake” are emptied into cake storage bins for trucks to haul offsite for composting, or for thermal and chemical treatment
- All biosolids are ultimately used as an agricultural soil amendment



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Overview of Biosolids Facility Plan Update

Regional Water Quality Control Plant

Biosolids Facility Plan Update – 30-Year Strategy

Purpose of Project:

Evaluate long-term options for biosolids treatment, handling, and reuse and guide infrastructure investments through 2055

Past Studies:

- 2012 Long Range Facility Plan
- 2014 Biosolids Facility Plan
- 2019 Biosolids Facility Plan Update

Why It Matters:

- Supports future upgrades to biosolids treatment
- Ensures efficient, sustainable, and regulatory compliant operations
- Aligns with the City's infrastructure and environmental goals

Changes Since LRFP and BFP Updates

1. New Dewatering Facility and decommissioning of Incineration Facility since 2019
2. Increased off-site sludge hauling and treatment services cost
3. New and potential regulations
4. Further development of emerging technologies and availability of potential regional partnership opportunities
5. Nutrient Watershed Permit
   - Increased future waste activated sludge production after Secondary Treatment Upgrade implementation
6. Council asked staff to evaluate if part of Measure E site (former parkland) should be used for biosolids facilities

Potential Sites for Biosolids Treatment Alternatives

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Biosolids Technologies and Alternatives

Regional Water Quality Control Plant

All Biosolids Technologies Considered

	Biosolids Technology
0	Current Practice: Dewater and Haul Off-site
1	Mesophilic Anaerobic Digestion (MAD)
2	MAD with recuperative thickening
3	Thermophilic anaerobic digestion (TAD)
4	MAD with Thermal Hydrolysis Process (THP)
5	Temperature-Phased Anaerobic Digestion (TPAD)
6	Thermochemical Hydrolysis (Lystek)
7	Thermal Drying - Belt
8	Thermal Drying – Rotary Drum
9	Thermal Drying - Electric
10	Greenhouse Solar Drying
11	Greenhouse Solar Drying with Supplemental Heating
12	Composting – Covered Aerated Static Pile
13	Composting – In-vessel
14	Drying + Pyrolysis
15	Drying + Gasification

Reasons for Exclusion:

- Insufficient space on-site
- Operational complexity
- Lack of proven technology or track record
- Safety concerns for staff

**Technology highlighted in green will be considered for detailed evaluation*

Proposed On-site Alternatives for Detailed Evaluation

Mesophilic Anaerobic Digestion (MAD)

MAD with Thermal Hydrolysis Process (THP)

Thermochemical Hydrolysis

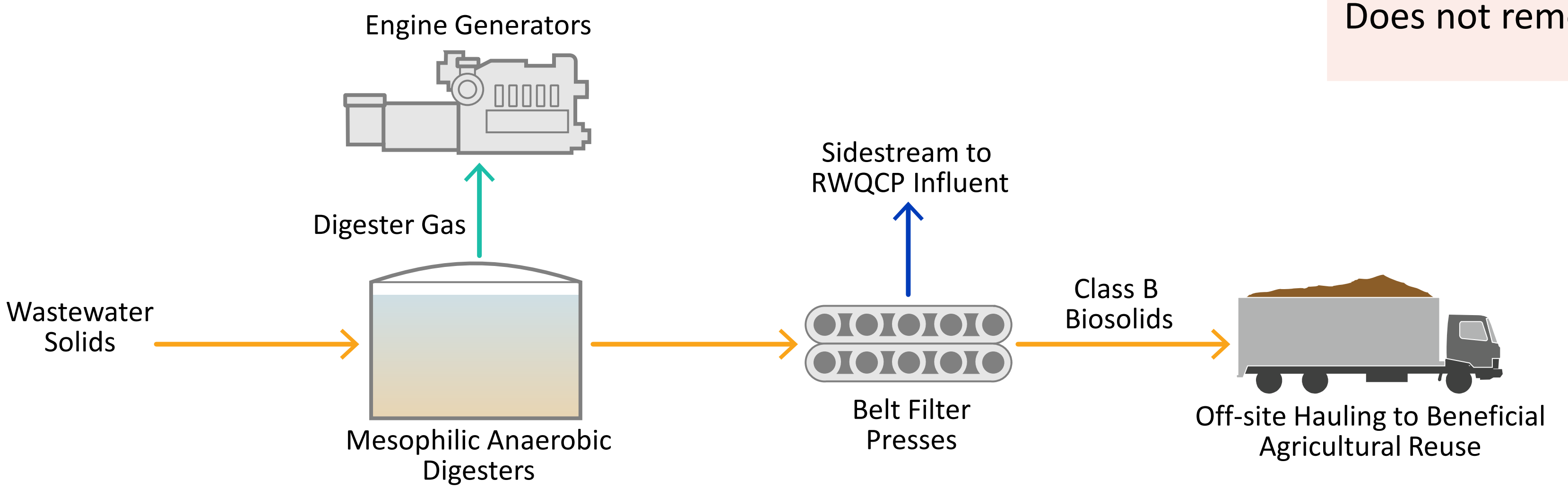
Drying + Pyrolysis

Mesophilic Anaerobic Digestion (MAD)

What is MAD?

- Similar to our digestive systems, MAD uses natural microbes, in the absence of oxygen, to break down organic waste at moderate temperatures (~35°C). The result? Digester gas and Biosolids!

Benefits	Challenges
One of the most used processes to treat wastewater solids	Higher capital cost than current operation
Relatively easy to operate and maintain	More complex to operate and maintain than current operation
Produces energy-rich digester gas and Class B biosolids	Produces ammonia-rich sidestream
	Does not remove PFAS



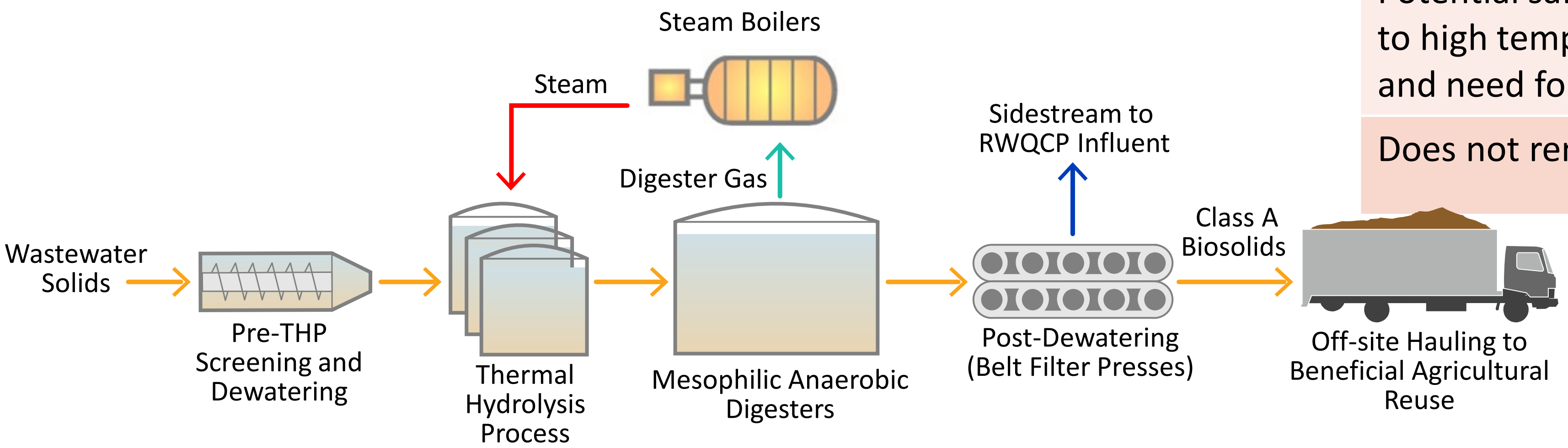
MAD with Thermal Hydrolysis Process (THP)

What's different from MAD?

- Before digestion, solids are broken down using Thermal Hydrolysis Process (THP). THP "pressure-cooks" the solids, making them easier for microbes to digest – leading to more digester gas production.

Benefits
Produces more digester gas
Produces drier biosolids, reducing hauling costs
Produces Class A biosolids, which can be used without restrictions

Challenges
Higher capital cost than current operation
Much more complex to operate and maintain than MAD
Produces more ammonia-rich sidestream than MAD
Potential safety concerns related to high temperature, pressure, and need for steam
Does not remove PFAS



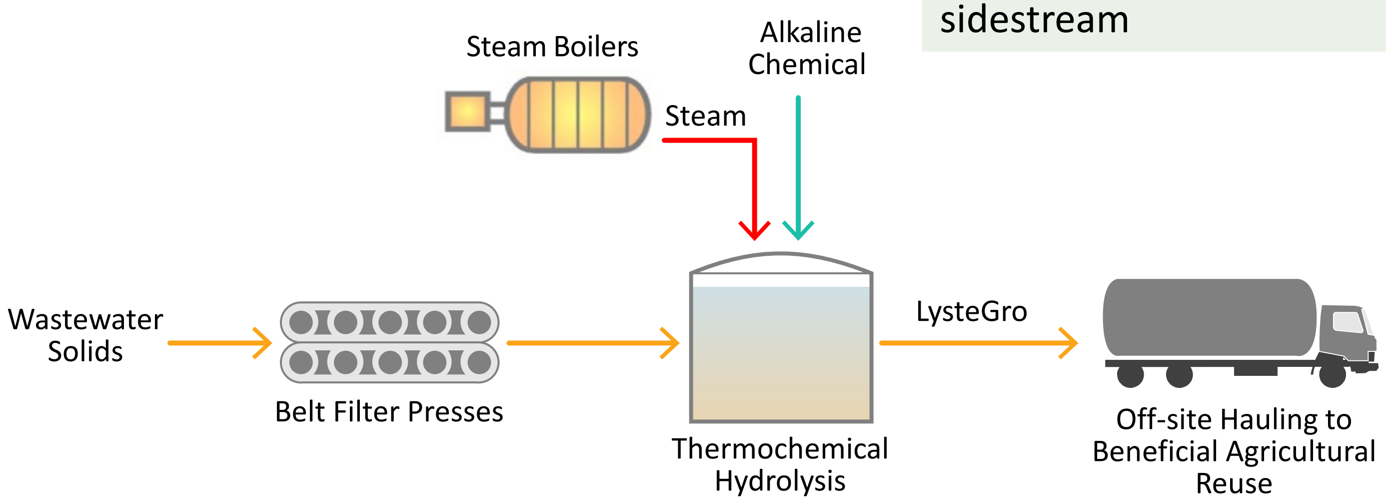
Thermochemical Hydrolysis

How does it work?

- The process breaks down solids by using alkaline chemicals, steam, and fast mixing. This cracks open microbial cells, creating a liquid Class A Biosolids product certified in California as a fertilizer.

Benefits
Relatively easy to operate and maintain
Small footprint
Produces Class A biosolids, which can be used without restrictions
Does not produce ammonia-rich sidestream

Challenges
Higher capital cost than current operation
More complex to operate and maintain than current operation
High chemical use and cost
Produces a liquid product which increases hauling costs and truck traffic
Few installations at WWTPs
Does not remove PFAS



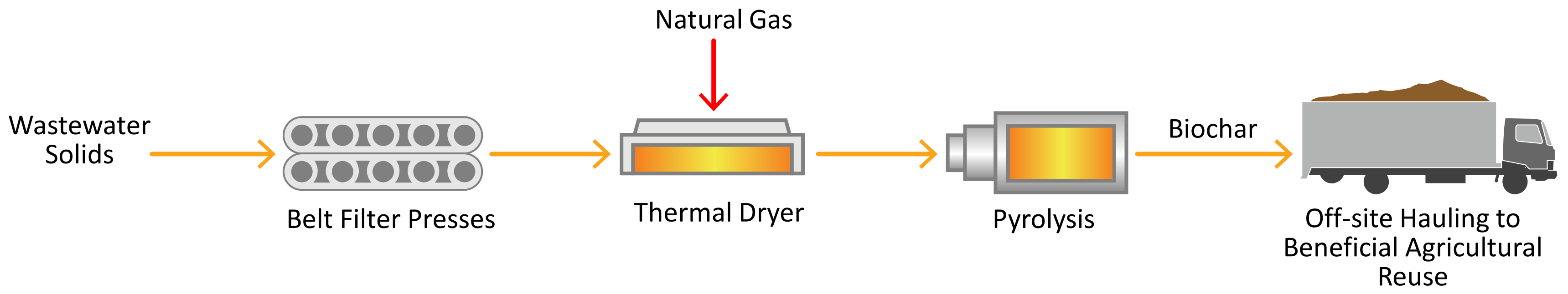
Drying + Pyrolysis

How does it work?

- Solids are first dried and then heated in a pyrolysis unit at 900-1,500°F with no oxygen. This converts the solids into biochar, a product similar to small bits of barbecue charcoal, that can be used in agriculture or other uses like concrete additive.

Benefits
Drastically reduces the amount of product (biochar), resulting in minimal hauling costs and truck traffic
Produces biochar and syngas
Does not produce ammonia-rich sidestream
May remove some PFAS from the biochar

Challenges
Very few installations at WWTPs
History of operational issues that impact reliability
Highest capital cost
High natural gas use
Less nutrients in biochar relative to other biosolids products
Some PFAS may end up in exhaust or condensate



Proposed Off-Site Alternatives for Detailed Evaluation

Base Alternative:

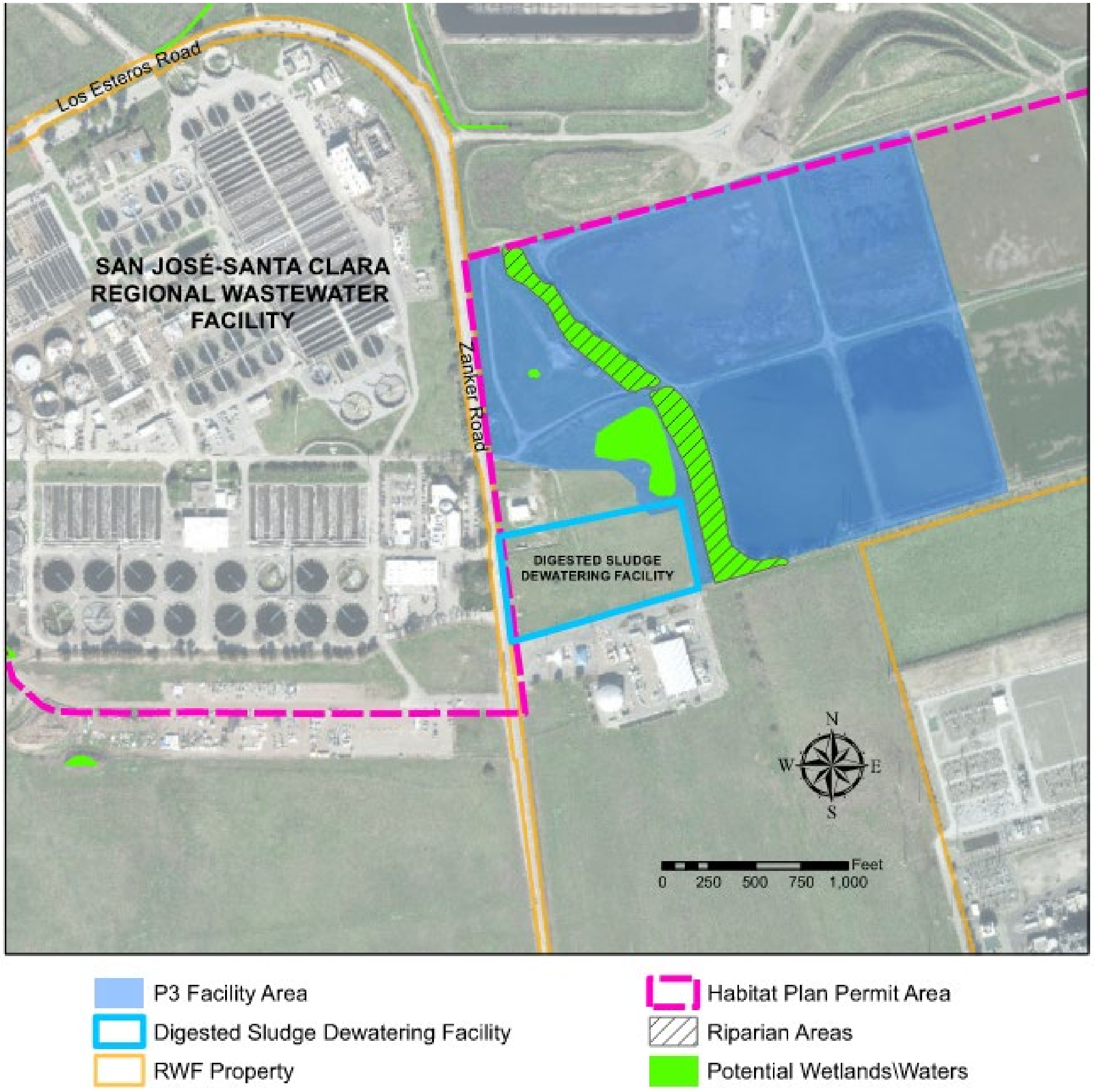
Continue with Current Practice

- Sludge hauling contract with Synagro WWT, Inc.
- Offsite treatment at 2 regional treatment facilities:
  - Synagro Central Valley Composting Facility
  - Lystek Solano County Facility

Alternative for Consideration:

Biosolids Facility at the San José-Santa Clara Regional Wastewater Facility

- To be delivered via a Public-Private Partnership (P3), which may accept biosolids from regional agencies
- Private partner to process biosolids into fertilizer product using commercially proven technology (*to be determined*)
- May require additional treatment at RWQCP to meet minimum quality requirements



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Community Input Activity

Group Polling Exercise

Group Polling Exercise – Create a Word Cloud Together!

1. Scan the QR Code or go to www.menti.com
   - If applicable, enter the code: **5329 2058**
2. Type in a word or short phrase to help us understand:

“What should the Regional Water Quality Control Plant consider when evaluating biosolids technologies?”

4. **SUBMIT!**
5. Watch the **word cloud grow** in real time!

https://www.menti.com/al2ykmqdno1n

Biosolids Alternatives Evaluation Process

Regional Water Quality Control Plant

Biosolids Alternatives Evaluation Process

We are here!

Preliminary Planning

- Population Projections
- Wastewater Modeling and Solids Projections
- Regulatory Review
- Site Spatial Analysis

Alternatives Identification

- Allows for identification of the most viable alternatives for detailed evaluation
- 4 on-site and 2 off-site alternatives identified

Evaluation Criteria and Weights Determination

- Evaluation Criteria Identification
- Weight % to Be Established Based on Relative Importance

Detailed Evaluation of Alternatives

- Layout of Planned Capital Improvement Projects
- Detailed Cost Estimates
- Score Alternatives Based on Weighted Evaluation Criteria

Recommended Alternative (s)

- Partners, Palo Alto City Council, and Stakeholder Engagement
- Planned implementation in the future

Evaluation Methodology - Example

Alternatives	Example Criteria		
	Proven Technology Performance	O&M Complexity	Community Impacts
Alternative A	3	3	3
Alternative B	3	4	4
Alternative C	1	3	3
Alternative D	5	5	2

****Example scoring – actual scoring of alternatives has not been performed yet.*

Example Final Weighted Score Calculation for Alternative C:

Tech + O&M + Comm =

1*55% + 3*30% + 3*15% = 1.9

0.55 + 0.9 + 0.45 = 1.9

Example Weights

Criteria	Weight
Proven Technology Performance	55%
O&M Complexity	30%
Community Impacts	15%

Final Weighted Scores

Alternatives	Weighted Score
Alternative A	3.00
Alternative B	3.45
Alternative C	1.90
Alternative D	4.55

**Criteria in blue font were recommended for current evaluation*

Review of Previous Evaluation Criteria

2012 Long Range Facility Plan:

1. Cost
2. Energy Use
3. GHG Emissions

2014 Biosolids Facility Plan Update:

1. Technical viability and reliability
2. Potential impacts on and benefits for the community and environment
3. Capital and O&M costs
4. Potential for revenue generation
5. Potential for other benefits and incentives

2019 Biosolids Facility Plan Update:

- Monetary (Costs)
- Quantitative:
  1. Net Energy Consumed
  2. GHG Emissions
  3. Onsite Facilities Footprint
- Qualitative:
  1. Beneficial Use of Biosolids
  2. Risk/Technology Maturity
  3. Level of O&M Complexity
  4. Local Control
  5. Community Impacts

Staff Proposed Evaluation Criteria and Weights

Evaluation Criteria		Description	Weights (%)
Financial	1) Net Present Value (NPV)	Considers capital, lifecycle, and O&M costs	25
Non-Financial	2) Proven Technology Performance	Technology maturity, track record, number of installations, vendor availability	11
	3) Environmental Impacts	GHG emissions, energy use, emerging contaminants, etc.	14
	4) Footprint, Site impacts, and Constructability	Area footprint, construction complexity, site disruption, etc.	9
	5) Treatment Plant Process Impacts	Effects on liquids process treatment due to return flows	11
	6) Operations & Maintenance Impacts	Ease of operation, maintenance effort, parts/vendor access, training requirements, etc.	14
	7) Community Impacts	Noise, odor, traffic, aesthetics, public acceptance, etc.	6
	8) Regulatory Resilience	Future flexibility to comply with upcoming regulations	10

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Community Input Activity

Small Group Exercise

Small Group Discussion Questions

1. **Review and Discuss** each of the eight evaluation criteria

2. **Questions for Discussion**:
    1. Which is the most important criteria to you?
    2. Is the relative weight percentage too high or too low?
    3. Would the group like to change or modify any of the evaluation criteria?

The GROUP FACILITATOR will take notes and summarize the group's feedback to share with the larger group during debrief

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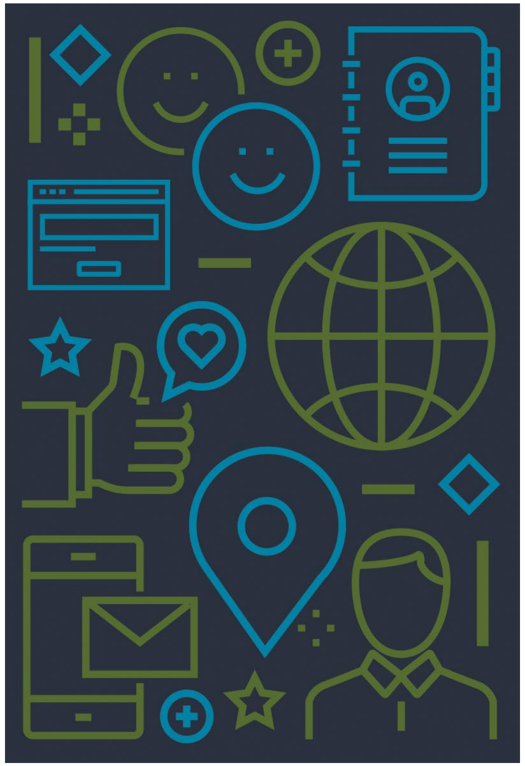
Recap/Next Steps

Regional Water Quality Control Plant

Potential Future Opportunities for Engagement

- Climate Action & Sustainability Committee (Fall 2025)
  - Present short list of top biosolids processing technologies
  - Share preliminary results of evaluation of alternatives
- City Council for Acceptance of Biosolids Facility Plan Update (2026)

CONTACT US



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Appendix C: Posters Presented at May 20, 2025 Workshop

Attached below:

Mesophilic Anaerobic Digestion

Similar to what happens in our own digestive systems, anaerobic digestion is a process where natural microbes break down wastewater solids, producing an energy-rich gas called digester gas. To promote the growth of the right microbes, the digester tanks are heated to a moderate temperature (35°C or 95°F) and have no air or oxygen (i.e., they are anaerobic).

Produces Class B Biosolids

Anaerobic Digesters.

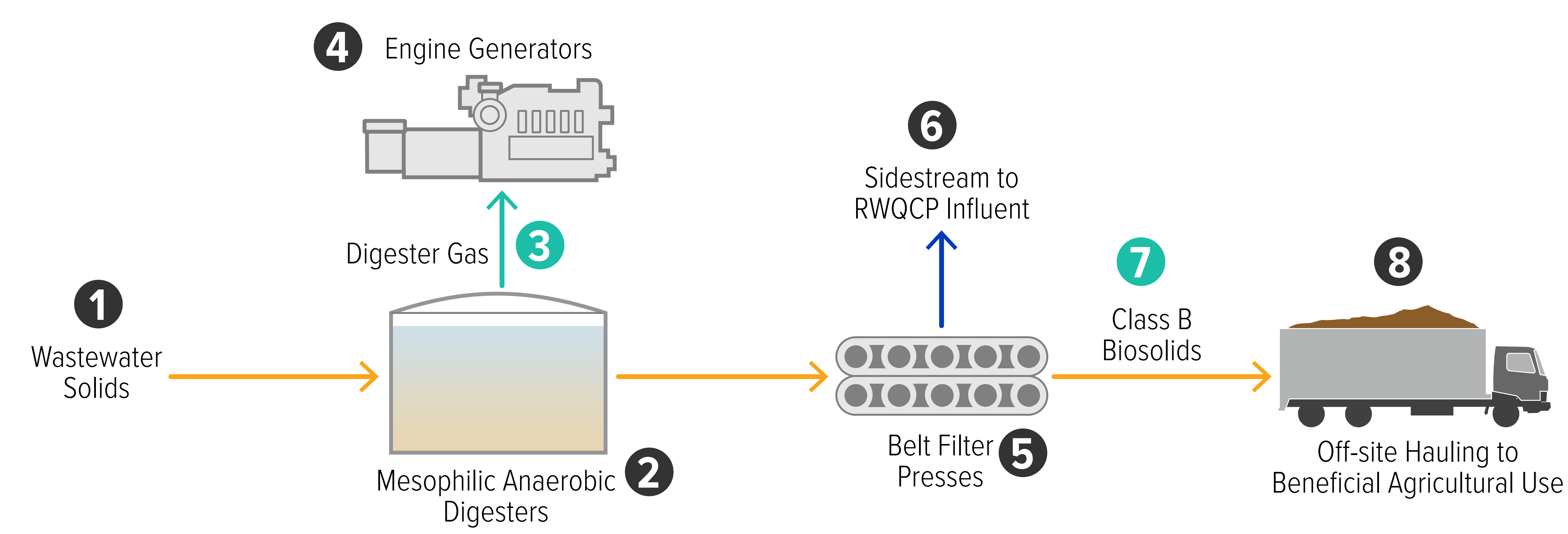
BENEFITS

- One of the most commonly used processes to treat solids from wastewater.
- Easy to operate and maintain relative to other on-site alternatives.
- Produces an energy-rich gas called digester gas that can be used to generate renewable electricity, cutting down on the RWQCP's power costs.
- Produces Class B Biosolids, a carbon and nutrient-rich agricultural amendment.

CHALLENGES

- Higher capital costs relative to current operation.
- More complex to operate and maintain relative to current operation.
- Produces an ammonia-rich sidestream that may need additional treatment.

Process Flow Diagram



❶ **Wastewater Solids** are extracted from the wastewater at various stages of the wastewater treatment process. These need to be treated so they can be beneficially used.

❷ **Mesophilic Anaerobic Digesters** are the core process for this alternative. They convert the wastewater solids into biosolids and digester gas. To promote the growth of the right microbes, the digester tanks are heated to a moderate temperature (35°C or 95°F) and have no air or oxygen (i.e., they are anaerobic).

❸ **Digester Gas** is an energy-rich gas that can be used to make electricity and heat, or it can be cleaned and added to the natural gas supply. It typically contains about 60% methane.

❹ **Engine Generators** are used to produce renewable electricity and heat. The electricity is used to reduce the RWQCP's power costs, while the heat is used to heat the digesters.

❺ The existing **Belt Filter Presses** are used to "dewater" or remove moisture from the biosolids. This reduces the hauling costs.

❻ An ammonia-rich **Sidestream** is produced that may require additional treatment.

❼ **Biosolids** are a carbon- and nutrient-rich product that can be applied at farms as an agricultural amendment. They provide numerous benefits including reducing the use of synthetic chemical fertilizers, boosting crop growth, improving water retention, and storing carbon in the soil. Unlike Class A Biosolids which are virtually free of pathogens, **Class B Biosolids** contain very low levels of pathogens so their land application is carefully managed through strict safety guidelines. Typically, Class B biosolids are applied to crops that are not for direct human consumption, like feed and fiber crops and rangelands.

❽ For **Off-site Hauling**, the City would contract with a third party to haul biosolids to be safely used in farms, composted, or treated further to produce Class A biosolids.

Mesophilic Anaerobic Digestion with Thermal Hydrolysis Process

Before digestion*, wastewater solids are broken down using Thermal Hydrolysis Process (THP). THP "pressure-cooks" the solids, making them easier for anaerobic microbes to digest and increasing digester gas production. *For more details on the digestion step, see the "Mesophilic Anaerobic Digestion" poster.

Produces Class A Biosolids

Thermal Hydrolysis Process System.

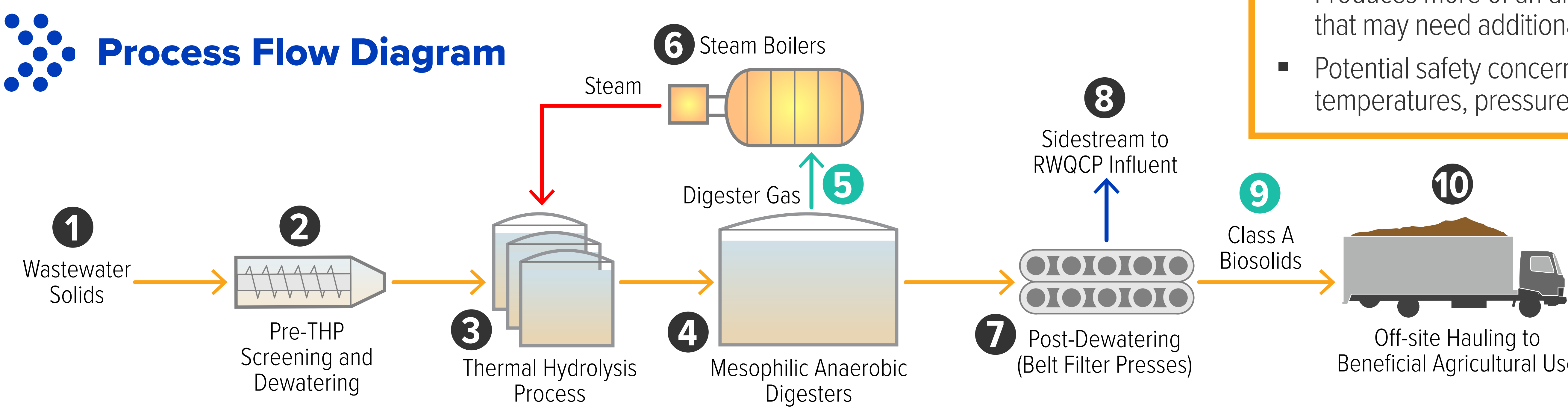
BENEFITS

- Produces more of an energy-rich gas called digester gas that can be used to generate renewable electricity, cutting down on the RWQCP's power costs.
- Improves the ability to remove moisture from the biosolids, reducing hauling costs.
- Produces Class A biosolids, a carbon and nutrient-rich agricultural amendment that can be used without restrictions.

CHALLENGES

- Higher capital costs relative to current operation.
- Significantly more complex to operate and maintain relative to Mesophilic Anaerobic Digestion alone.
- Produces more of an ammonia-rich sidestream that may need additional treatment.
- Potential safety concerns related to operating temperatures, pressure, and need for steam.

Process Flow Diagram



❶ **Wastewater Solids** are extracted from the wastewater at various stages of the wastewater treatment process. These need to be treated so they can be beneficially used.

❷ **Pre-THP Screening and Dewatering** is used to screen and "dewater" or remove moisture from the solids. This reduces clogging of mechanical equipment and the size and cost of the downstream processes.

❸ **Thermal Hydrolysis Process (THP)** is the core process of this alternative. Steam is injected to a pressurized tank raising the temperature to about 150°C or 300°F. This acts like a pressure cooker, breaking down the solids making them easier to digest, resulting in numerous benefits.

❹ **Mesophilic Anaerobic Digesters** convert the wastewater solids into biosolids and digester gas. To promote the growth of the right microbes, the digester tanks are heated to a moderate temperature (35°C or 95°F) and have no air or oxygen (i.e., they are anaerobic).

❺ **Digester Gas** is an energy-rich gas that can be used to make electricity and heat, or it can be cleaned and added to the natural gas supply. It typically contains about 60% methane. THP increases digester gas production relative to Mesophilic Anaerobic Digestion.

❻ **Steam Boilers** produce steam needed for the THP. Digester gas can be used to as the fuel for these boilers. Excess digester gas can be used for electricity generation.

❼ The existing **Belt Filter Presses** are used to "dewater" or remove moisture from the biosolids. This reduces the off-site hauling costs. By improving the ability to remove water from biosolids, THP reduces the weight of biosolids relative to Mesophilic Anaerobic Digestion, resulting in even lower hauling costs.

❽ An ammonia-rich **Sidestream** is produced that may require additional treatment. THP increases this ammonia "load" significantly compared to conventional Mesophilic Anaerobic Digestion.

❾ **Biosolids** are a carbon- and nutrient-rich product that can be used safely in farms as an agricultural amendment. They provide numerous benefits including reducing the use of synthetic chemical fertilizers, boosting crop growth, improving water retention, and storing carbon in the soil. THP produces **Class A Biosolids**, which are virtually free of pathogens and can be used without restrictions including in farms, parks, and even home gardens.

❿ For **Off-site Hauling**, the City would contract with a third party to haul biosolids to be safely used in farms or landscaping.

Thermochemical Hydrolysis

Thermochemical hydrolysis converts wastewater solids into a biosolids product that is safe to use in farms by using chemicals, steam, and fast mixing to break down the solids.

Produces LysteGro, a Class A biosolids product certified as a fertilizer

Thermochemical Hydrolysis System Reactor.

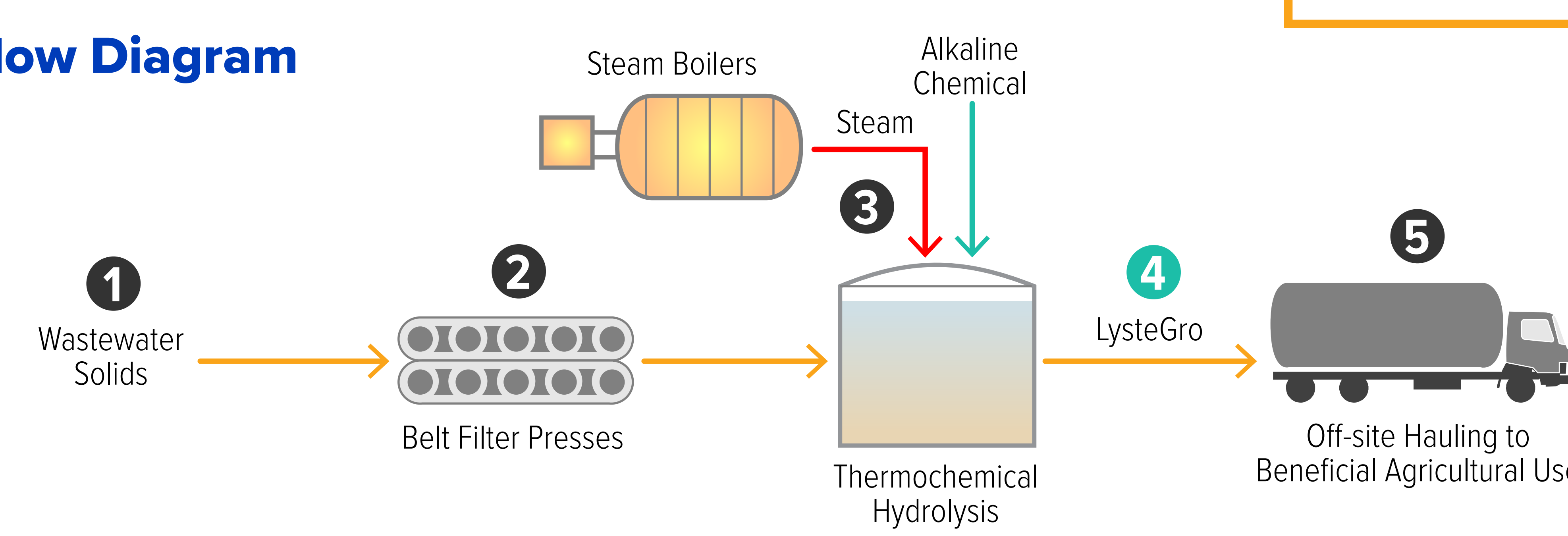
BENEFITS

- Easy to operate and maintain relative to other on-site alternatives.
- Produces Class A Biosolids, a carbon and nutrient-rich agricultural amendment that can be used without restrictions.
- Does not produce an ammonia-rich sidestream.
- Small footprint relative to other on-site alternatives.

CHALLENGES

- Higher capital costs relative to current operation.
- More complex to operate and maintain relative to current operation.
- High chemical use and cost.
- Produces a liquid product which increases hauling costs and truck traffic and requires special farm equipment to inject into the soil.
- Few installations at other wastewater treatment plants.

Process Flow Diagram



❶ **Wastewater Solids** are extracted from the wastewater at various stages of the wastewater treatment process. These need to be treated so they can be beneficially used.

❷ The existing **Belt Filter Presses** are used to "dewater" or remove moisture from the solids. This reduces the size and cost of the downstream processes.

❸ **Thermochemical Hydrolysis** is the core process of this alternative. It breaks down the solids by using chemicals, steam and fast mixing in a tank. This raises the pH and raises the temperature to 75°C or 167°F.

❹ Like other Biosolids products, **LysteGro** is a carbon- and nutrient-rich product that can be used safely in farms as an agricultural amendment. It provides numerous benefits including reducing the use of synthetic chemical fertilizers, boosting crop growth, improving water retention, and storing carbon in the soil. LysteGro qualifies as **Class A Biosolids**, virtually free of pathogens and can be used without restrictions including at farms if the farms have suitable equipment for injection into the soil. In addition, this product is certified as a fertilizer by the California Department of Food and Agriculture (CDFA).

❺ For **Off-site Hauling**, the City would contract with a third party to haul biosolids to be safely used in farms, composted, or treated further to produce Class A biosolids. Since LysteGro has a higher water content relative to other biosolids products, it increases the hauling costs and must be injected into the soil rather than tilled like other, drier biosolids products.

Thermal Drying and Pyrolysis

Dewatered solids are dried and then heated in a pyrolysis unit at high temperature and in the absence of oxygen. This converts the wastewater solids into biochar, a product similar to barbecue charcoal that can be used in farms and for other higher-value uses.

Produces Biochar

Dryers and Pyrolysis System.

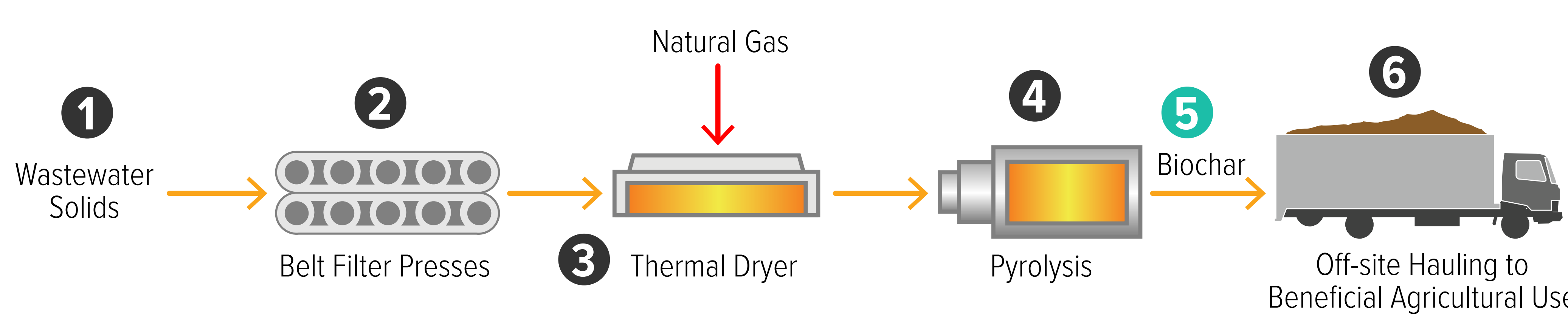
BENEFITS

- Drastically reduces the volume of biosolids product (biochar), resulting in minimal hauling costs and truck traffic.
- Produces biochar, a carbon-rich agricultural amendment that can be used without restrictions, and syngas which can be used to partially fuel the process.
- Does not produce an ammonia-rich sidestream.
- Recent research indicates pyrolysis may remove "forever chemicals" like some PFAS from the biochar.

CHALLENGES

- Very few operating installations at other wastewater treatment plants.
- History of operational issues that impact process reliability.
- Highest capital costs of the alternatives evaluated.
- High natural gas use.
- Concern about contaminants, including PFAS, in the exhaust and condensate discharges from the process.
- Reduced nutrient value in biochar compared to other biosolids products.

Process Flow Diagram



❶ **Wastewater Solids** are extracted from the wastewater at various stages of the wastewater treatment process. These need to be treated so they can be beneficially used.

❷ The existing **Belt Filter Presses** are used to "dewater" or remove moisture from the solids. This reduces the size and cost of the downstream processes.

❸ **Thermal Drying** uses natural gas and other heat sources to dry the solids. Energy from the pyrolysis process can be recovered to partially run the dryer, reducing the amount of natural gas needed.

❹ **Pyrolysis** is the core process of this alternative. It operates at high temperatures (as high as 800°C or 1500°F) in the absence of oxygen, converting the dried solids into biochar and producing a hydrogen-rich syngas that can supplement the fuel needed for the process. Recent research indicates that at high operating temperatures, pyrolysis may remove "forever chemicals" such as some PFAS from the biochar product but the PFAS may be transformed and released in the exhaust or condensate streams. Research on the full fate of PFAS through this process is ongoing.

❺ **Biochar** is a carbon-rich product similar to small bits of barbecue charcoal that can be used safely in farms as an agricultural amendment or for other purposes like concrete additives. It provides numerous benefits including reducing the use of synthetic chemical fertilizers, boosting crop growth, improving water retention, and storing carbon in the soil. Like Class A biosolids, biochar is pathogen free and can be used without restrictions including in farms, parks, and even home gardens. While biochar has some nutritional content, it is less than other biosolids products so its synthetic fertilizer offset would be less as well.

❻ For **Off-site Hauling**, the City would contract with a third party to haul biochar to be safely used in farms or for other purposes like concrete additives. This alternative drastically reduces the volume of product, resulting in minimal hauling costs and truck traffic.

Dewatering and Off-site Treatment (Current Operations)

Solids are dewatered and hauled for treatment at two off-site facilities: a composting facility and a thermochemical hydrolysis facility. These facilities produce two biosolids products: compost and liquid fertilizer, both of which are beneficially used in farms.

Existing Belt Filter Press Dewatering and Truck Loadout Facility.

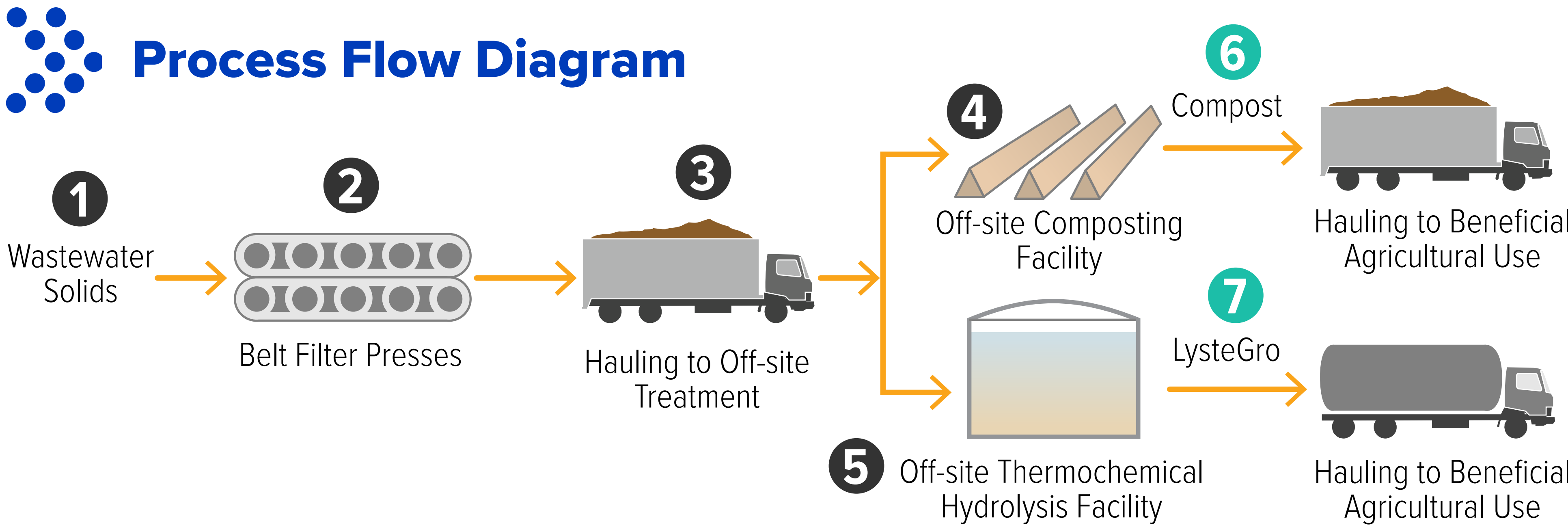
BENEFITS

- Minimal future capital costs.
- No impact to current operations and maintenance.
- Minimal use of additional space on-site.
- Does not increase ammonia-rich sidestream loads.

CHALLENGES

- Risk related to complete dependence on third parties for off-site treatment and beneficial use of biosolids and associated costs.
- Anticipated higher off-site hauling, treatment, and beneficial use costs.
- Solids produced and transported off the plant site have a lower level of treatment to reduce pathogens than other options.
- Risk of potential future regulatory requirements further limiting solids management options.

Process Flow Diagram



❶ **Wastewater Solids** are extracted from the wastewater at various stages of the wastewater treatment process. These need to be treated so they can be beneficially used.

❷ **Belt Filter Presses** are used to "dewater" or remove moisture from the biosolids. This reduces the off-site hauling costs.

❸ For **Off-site Hauling**, the City contracts with a third party to haul biosolids to the two off-site treatment facilities to be safely used in farms, composted, or treated further to produce Class A biosolids.

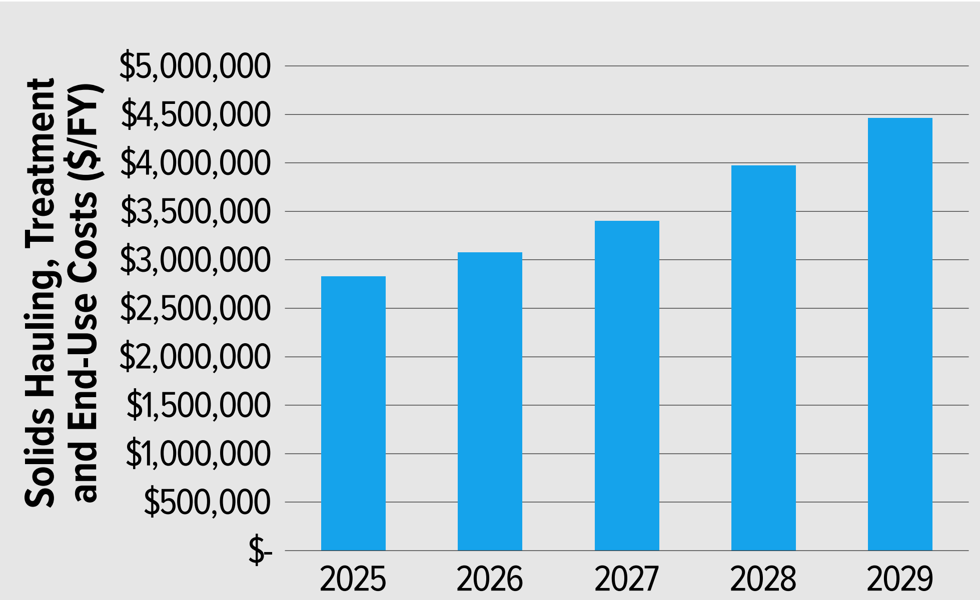
❹ At the **Off-site Composting Facility**, dewatered solids combined with yard waste or wood chips are converted by helpful microbes into compost.

❺ At the **Off-site Thermochemical Hydrolysis Facility**, dewatered solids are broken down by using chemicals, steam and fast mixing in a tank. This raises the pH and raises the temperature to 75°C or 167°F.

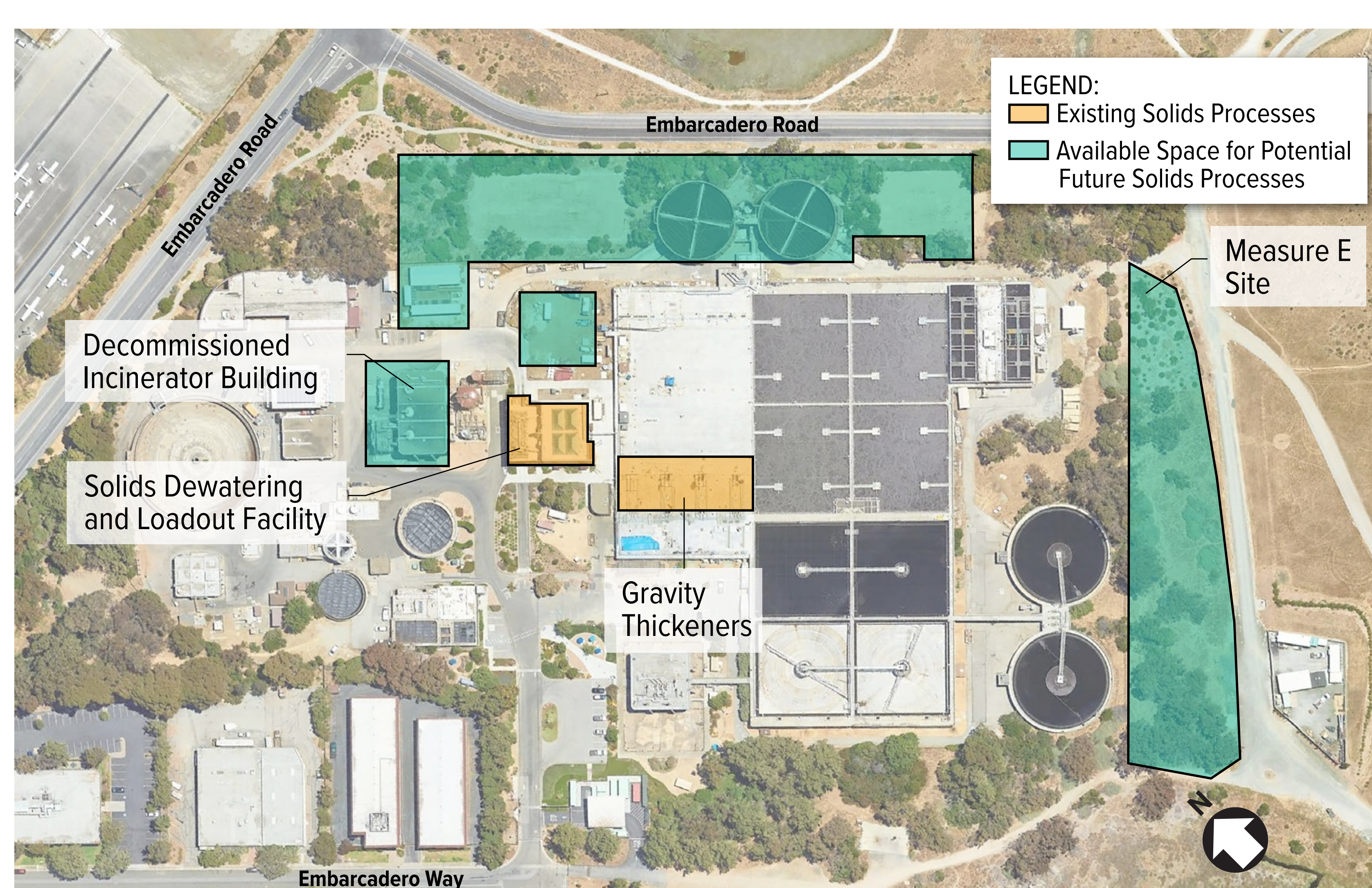
❻ Like other biosolids products, **Compost** is a carbon- and nutrient-rich product that can be used safely in farms as an agricultural amendment. It provides numerous benefits including reducing the use of synthetic chemical fertilizers, boosting crop growth, improving water retention, and storing carbon in the soil. Compost qualifies as **Class A Biosolids**, which are virtually free of pathogens and can be used without restrictions including in farms, parks, and even home gardens.

❼ Like compost, **LysteGro** provides numerous agricultural benefits and qualifies as **Class A Biosolids**. In addition, this product is certified as a fertilizer by the California Department of Food and Agriculture (CDFA).

Off-site solids hauling, treatment, and beneficial use costs are high and projected to increase further.



The RWQCP site is severely space-constrained, with limited space available for potential future solids treatment facilities.



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The RWQCP's Biosolids Planning History

The City of Palo Alto is committed to finding sustainable and cost-effective solids/biosolids management solutions for the Regional Water Quality Control Plant (RWQCP). For this reason, the City has conducted several rounds of evaluations in recent years.

Biosolids Planning Timeline

2012
Long Range Facility Plan (LRFP) Recommended:
1) Retire the existing incineration process as soon as new solids process can be implemented
2) Initiate a Biosolids Facility Plan

2014
Biosolids Facility Plan Recommended:
1) Construct a Phase I sludge dewatering and truck loadout facility
2) Decommission Aging Incinerators
3) Future Phase II design and construction of thermal hydrolysis process with mesophilic anaerobic digestion and digester gas-fueled combined heat and power

2015
Abandonment of Phase II Due to Increased Complexity and Capital Costs Discovered During Design

2018
5-Year Contracts for Off-site Biosolids Processing at Two Regional Treatment Facilities

2019
Sludge Dewatering Building Built and Aging Incinerators Decommissioned

2019
Biosolids Facility Plan Update Recommended:
Continued Off-site Hauling

April 2023
City Council Directed Staff to Determine if Measure E Site can be used to Process Biosolids

February 2024
5-Year Contracts for Off-site Biosolids Processing Renewed

June 2024
Commencement of LRFP Update Project, which includes Biosolids Facility Plan Update

Biosolids Management Alternatives the City has Evaluated

2012 LONG-RANGE FACILITY PLAN

- **On-site Alternatives**:
  - » Multiple hearth furnace incineration (MHF).
  - » Fluidized bed incineration (FBI).
  - » Plasma arc assisted oxidation.
  - » Gasification.
  - » Pyrolysis.
  - » Anaerobic digestion.
  - » Drying: pellets for fertilizer.
  - » Drying: pellets for fuel.
- **Recommendation**:
  - » Retire existing incineration process as soon as new solids process can be implemented, and initiate a Biosolids Facility Plan.

2014 BIOSOLIDS FACILITY PLAN

- **On-site Alternatives**:
  - » Mesophilic anaerobic digestion (MAD) with combined heat and power (CHP).
  - » Temperature phased anaerobic digestion (TPAD) with CHP.
  - » Thermal hydrolysis process (THP) with MAD and CHP.
  - » Dewatering and landfill gas-fueled thermal drying.
  - » Dewatering and thermal drying/gasification.
- **Recommendation**:
  - » Thermal hydrolysis process (THP) with MAD and CHP.

2019 BIOSOLIDS FACILITY PLAN UPDATE

- **On-site Alternatives**:
  - » MAD with CHP.
  - » Thermophilic anaerobic digestion (TAD) with CHP.
  - » TPAD with CHP.
  - » Low-temperature alkaline hydrolysis.
  - » MAD with Class A Drying.
  - » Drying and pyrolysis.
  - » Gasification.
- **Recommendation**:
  - » Continue off-site hauling.

Alternatives in blue font were recommended for detailed evaluation.

Alternatives Being Evaluated in Current Biosolids Facility Plan Update

- **On-site Alternatives***:
  - » Mesophilic Anaerobic Digestion (MAD).
  - » MAD with Thermal Hydrolysis Process (THP).
  - » Thermochemical Hydrolysis.
  - » Drying + Pyrolysis.
- **Off-site Alternatives**:
  - » Potential partnership with other Bay Area agencies for off-site management.

Note: This alternative is speculative. One potential partnership the City is exploring would process solids from the RWQCP at the City of San Jose's future Biosolids Public-Private Partnership Facility.

**More information about these alternatives is provided in the other posters.*

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Appendix D: Photos of May 20, 2025 Workshop