From **Waste Treatment**

**to Resource Recovery**

How utilities are making the transition and what it means for our new workforce

This farm used biosolids to improve its soil!

Manon Fisher
Resource Recovery Specialist
San Francisco Public Utilities Commission

11/14/2018
Baywork Training Buffet
Agenda

• Introductions

• Transition to Resource Recovery
  • Opportunity
  • What role can we play as resource managers

• How does this new way of thinking change our operations?
  • Capital and programmatic

• Career implications and the need for new skills

• Questions and discussion
Wastewater Basics

**Inputs**
- Fats, oils and grease
- Influent
- Contaminants of Emerging Concern
- Stormwater

**Outputs**
- Effluent
- Biosolids
- GHG emissions

Traditionally seen as liabilities
Shifting the Balance Sheet

Liabilities
• Effluent
• Methane emissions
• Biosolids
• Nitrogen

Assets
• Recycled water
• Vehicle fuel / renewable gas
• Soil amendments / C seq.
• Fertilizers
Uniquely Suited to Address Big Issues

Water

Energy

WWRFs

Carbon
How Does This Impact Our Operations?

- Provide a Reliable, Resilient & Flexible System that Responds to Catastrophic Events
- **Recovery Resources** and Produce High Quality Products
- Maintain **Ratepayer Affordability**
- Integrate Green & Grey Infrastructure to **Manage Stormwater** and Minimize Flooding
- Provide **Benefits** to Local **Communities**
- Modify the System to **Adapt to Climate Change**
# It’s Not Just About Building New Equipment

<table>
<thead>
<tr>
<th></th>
<th>Maturity Level 0</th>
<th>Maturity Level 1</th>
<th>Maturity Level 2</th>
<th>Maturity Level 3</th>
<th>Maturity Level 4</th>
<th>Maturity Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive</td>
<td>Is undefined or person dependent</td>
<td>Is partially defined but supports compliance with current minimum standards or requirements</td>
<td>Is defined and partially deployed, but beyond the needs to meet current minimum standards or requirements</td>
<td>Is fully deployed and has assigned metrics for the measurement of goals</td>
<td>Adopts new technology, methodology, unique but workable and useful solutions, that increase capacity, efficiency/effectiveness, and reduce costs</td>
<td>Is fully integrated with long term goals</td>
</tr>
<tr>
<td>Compliance</td>
<td>Is not documented or depends on undocumented references that result in inconsistent implementation</td>
<td>Is documented, approved, and communicated</td>
<td>Is practiced in all the intended locations, processes, or subprocesses</td>
<td>Has goals set to adhere to timelines and the WWE SBP and SFPUC 2020 goals</td>
<td>Performance goals are sustained on a long term basis with a positive trend of the metrics</td>
<td>Performance goals are sustained on a long term basis with a positive trend of the metrics</td>
</tr>
<tr>
<td>Proactive</td>
<td>Is reactive, poorly controlled, and without improvement plans</td>
<td>Is occasionally reactive, but includes improvement plans that are partially implemented</td>
<td>Includes proactive measures, and is aligned with best industry practices</td>
<td>Can be automated and if so, is automated and documented</td>
<td>Is analyzed and continuously improved on a regular basis</td>
<td>Performance goals are sustained on a long term basis with a positive trend of the metrics</td>
</tr>
<tr>
<td>Performed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustained</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SFPUC Biosolids Program: *Making Soil Amendments*

Biosolids are the nutrient-rich soil amendment that we produce in San Francisco from the wastewater treatment process.
Class A Biosolids at Oceanside via TPAD

- TPAD - Temperature Phased Anaerobic Digestion
- Oceanside treatment plant transitioning to class A using TPAD
- Class A biosolids have been treated to eliminate pathogens
- Class B biosolids are treated to greatly reduce pathogens
Class A Biosolids at Southeast via THP

- THP - Thermal Hydrolysis Process (steam and high pressure)
- Increases biogas production
- Smaller footprint
- Construction beginning in 2018
- Anticipated operation in 2023
We Make Soil Amendments

- Microorganisms feed on wastewater solids, killing pathogens and breaking down pollutants
- The process takes ~ 1 month at controlled temperatures
- The result is biosolids that are rich in nutrients and organic matter
Benefit of Biosolids Applied to Soils

Portion of field without SFPUC biosolids

Portion of field amended with SFPUC biosolids
Biosolids vs. Synthetic Fertilizer

**Synthetic Nitrogen:**
- Takes 3000 ft$^3$ of natural gas to produce 1 ton of synthetic fertilizer
- Cost $490/ton and prices change every year
- Can acidify soil

**Biosolids Amendment:**
- Stable prices means stable profits for farmers
- Prevents greenhouse gas emissions by returning carbon to the ground
Value of Biosolids

Biosolids are great for the environment and save money!

1 ton of biosolids contain:
• 5% of slow release nitrogen fertilizer
• Phosphorus, potassium, and sulfur
• Vitamins for the soil

Value of these nutrients:
• $40/ton for nitrogen (over four years)
• +$20/ton for other nutrients
• Improved soil quality: priceless!
Biosolids Return Carbon and Nutrients to Soils

- Inorganic fertilizers are elements decoupled from carbon, leading to leaching and pollution
- SFPUC Biosolids are 60% carbon compounds
- Slow release of N, P, K, S, Ca, Mg, B, Cu, Mn, Fe, Mo, Zn, etc.
- Increases water holding capacity
- Improves soil structure
- Increases water infiltration rate
- Decreases erosion
- Increases soil microbial activity
- Increases nutrient holding capacity
Biosolids Can Be Used To Repair Ecosystems Where Soils Have Been Destroyed
Biosolids Can Prepare Us For More Extreme Droughts

- Research has shown that drought in California will become more severe due to climate change (Yoon and Gillies 2015; Swain et al. 2016)

- Biosolids
  - Increase water holding capacity
  - Reduce the need for irrigation
  - Stabilize soils against erosion
Plans for Biosolids Recycling

Current

Solano County Ag  
Sacramento County Ag  
Lystegro  
Landfill ADC

Future

Green Infrastructure  
Caltrans Restoration  
Community Gardens  
Mine Reclamation  
Orchard Crops
#1 Priority - Ensuring high quality biosolids products

- Collection System Division – Permits and monitors discharges into the sewer system and conducts outreach and education on how to prevent pollution

Jobs Include:

- Water quality technician
- Facility inspector
- Field monitoring engineer
- Utility specialist
- Outreach and education coordinator
- Regulatory specialist
#1 Priority - Ensuring high quality biosolids products

- Engineering - Provides long range planning and daily support for biosolids production

Jobs Include:
- Civil engineer
- Environmental engineer
- Process engineer
- Data scientists
- Student design trainee
#1 Priority - Ensuring high quality biosolids products

- Maintenance - Performs preventative and emergency maintenance to ensure continued production of high quality biosolids

Jobs Include:

- Materials coordinator
- Asset management specialist
- Information systems engineer
- Machinists
- Electricians
- Plumbers
- Carpenters
- Maintenance planners
- Safety specialists
#1 Priority - Ensuring high quality biosolids products

- Operations - Operates the Wastewater treatment plant according to established operational procedure to produce high quality biosolids

Jobs Include:
- Treatment plant superintendent
- Chief stationary engineer
- Senior stationary engineer
- Journey stationary engineer
- Apprentice engineers
#1 Priority - Ensuring high quality biosolids products

- Laboratory – Monitors key parameters of biosolids quality

Jobs Include:

- Chemist
- Water quality technician
- Marine biologist
- Soil scientist
How do we communicate the value of our biosolids?

• Our partners help us communicate the benefits of recycling urban organics

Jobs Include:

• Outreach coordinators
• Environmental scientists
• Gardeners
• Landscapers
• Teachers
• Marketing and branding professionals

SF Environment staff tabling at Cal Academy of Sciences

Garden for the Environment hosts workshops on urban agriculture
How do we distribute our biosolids?

• Ranchers and farmers love using biosolids to substitute synthetic fertilizer and help make their pastures more fertile
Who else will use our biosolids?

- Market expansion will require biosolids program staff to have broader areas of expertise including: stakeholder engagement, business development, ecology and soil science and communications

No more is this just a field for engineers
### Maturity Levels

<table>
<thead>
<tr>
<th>Maturity Level 0</th>
<th>Maturity Level 1</th>
<th>Maturity Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is undefined or person dependent</td>
<td>Is partially defined but supports compliance with current minimum standards or requirements</td>
<td>Is defined and partially deployed, but beyond needs to meet current minimum standards or requirements</td>
</tr>
<tr>
<td>Is not documented or depends on undocumented references that result in inconsistent implementation</td>
<td>Is documented, approved, and communicated</td>
<td>Is practiced in all the intended locations, processes, or sub-processes</td>
</tr>
<tr>
<td>Is reactive, poorly controlled, and without improvement plans</td>
<td>Is occasionally reactive, but includes improvement plans that are partially implemented</td>
<td>Includes proactive measures, and is aligned with best industry practices</td>
</tr>
</tbody>
</table>

#### Business as usual

- Is reactive, poorly controlled, and without improvement plans

#### Opportunity for resource recovery

- Can be automated and if so, is automated and documented
- Is analyzed and continuously improved on a regular basis

---

**Water Resource Recovery Facility of the Future**

Energy Positive and Beyond: The Vision for Transforming Wastewater Treatment

#### Energy Efficiency and Resource Recovery

Facilities will use energy-efficient operations to recover water, energy, and nutrients as well as to produce clean water and other products.

#### Integrated Production

- Facilities will produce clean water, energy, other water grades, and a slate of products for industry, agriculture, etc.

#### Outcomes

- Healthy environment
- Renewable energy supply
- Reduced carbon emissions
- Economic growth
- Vibrant and green communities

#### Engaged & Informed Communities

- Officials, industry, and the public will manage demand and waste better, support resource recovery goals, and contribute to integrated solutions for water, energy, and food supply.
Questions?

Manon Fisher
mfisher@sfwater.org
415.215.1347