Outline

➢ WM Organics: Mission, Role, Customers
➢ Generating Customers: Feedstocks & Challenges
➢ Product Customers: Needs & Expectations
➢ WM’s CORe® Solutions
➢ Measuring Quality & Meeting a Spec
➢ Takeaways
WM - More Than Waste Hauler

• North America’s largest provider of integrated waste management and environmental solutions

• North America’s largest recycling company - processing over 15 M tons/yr through over 100 facilities

• Industry leader in alternative energy production from solid wastes - generating enough energy to power 470,000 US Households

• WM’s Goal: To serve our Customers, by minimizing environmental impact while extracting the highest value from the materials we manage
WM Organics

➢ Dedicated Corporate Team of subject matter experts & engineers.
➢ 43 operating projects processing 3.4 M tons/yr of organics*
➢ Market high quality end products such as WM Earthcare™ and EBS®.
➢ Focus: technology scouting, field research, project development, innovation and operational excellence.
➢ Recognize that sustainability means commitment to servicing our customers on both ends of the value chain.

*See our 2018 Sustainability Report at sustainability.wm.com/waste/organics/
What’s Driving Us in CA?

• Government policies, and a growing number of customers, demand food waste recycling and/or “zero landfill” options.

• Municipal franchise agreements, big and small, increasingly include high diversion requirements (e.g. - LA City, Oakland, etc)

• CA recycles roughly 10% of food waste generated (~500,000 TPY\(^1\)). To meet 75% goal, ~ 3M+ TPY more will need to be recycled\(^2\).

• Composting simply cannot handle it all. New rules in CA, and increased GW recycled needs, will challenge composting even more.

• 80% of US population lives in urban areas (95% of CA population)\(^3\)

• Urban WRRF’s are natural partners - if we make it easy for them

2. Calrecycle. to achieve 75% reduction by 2025, 20% through source reduction of edible food.
Customers - Feedstocks & Sourcing

- CA MSW = 18% Food Waste, but what exactly is “SSO” & “High Strength Wastes”? Confusion in terms.
- Focus needs to be extracting food waste from LFs - pre & post-consumer streams (institutional, commercial & residential)
- Customer education, collection, processing - all have cost implications
- Expanding programs will enable and/or require greater participation → more physical contamination is inevitable
- Sustainably high diversion rates will require more advanced solutions
Customers - Collection Approaches

<table>
<thead>
<tr>
<th>Collection Equipment</th>
<th>SSO FW Collection</th>
<th>Wet Routing</th>
<th>MSW Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Separate containers, toters, bins</td>
<td>No separate container</td>
<td>No separate container</td>
</tr>
<tr>
<td>Routes</td>
<td>Dedicated to FW only</td>
<td>Special</td>
<td>Standard</td>
</tr>
<tr>
<td>Contamination of Food Waste</td>
<td>&lt; 20%</td>
<td>20 - 50%</td>
<td>High</td>
</tr>
</tbody>
</table>

Increased collection costs

Increased processing costs
The “low hanging fruit” clean food waste streams have already been picked . . . .
< 10% Contamination By weight
This is what large scale urban food waste really looks like from a successful program

- 75,000 TPY commercial & SF residential
- 13.8% physical inerts (72% is plastic film)
- 17% overall residue rate
- 96% organics capture for AD
Many early lessons learned from OC/LACSD Full Scale Pilot (2014-18)
Research from multiple full scale projects clearly demonstrates that WRRFs can derive tremendous energy benefits from high gas yield
Other benefits now being seen include increased digester stability, increased VSD and, in some cases, better dewatering of biosolids
However, most WRRFs customers say “make this easy for us”
WM WRRF Customers

Becoming “Utilities of the Future”

✓ Greater Lawrence SD (MA)
  • 52 MGD
  • 3.2 MW CHP (w/ ability to expand)
  • Class A biosolids pelletization

✓ Newtown Creek WWTP (NYC)
  • 300 MGD
  • Boilers for digester & plant heat
  • Biomethane Injection (Q2 2019)

✓ Rahway Valley SD (NJ)
  • 50 MGD
  • 6.2 MW CHP
  • Includes biosolids drying
WM’s CORe® Solutions

1. FOOD WASTE
2. WM CORe® ORGANIC PROCESSING
3. EBS® CREATION AN ENGINEERED SLURRY
4. EBS® TRANSPORT TO WWTP
5. WWTP DIGESTER
6. RENEWABLE ENERGY
WM’s Full Scale CORe® Locations

- **BOSTON**
  - Permitted for 300 t/d

- **NEW YORK**
  - Permitted for 500 t/d

- **NORTHERN NEW JERSEY**
  - Permitted for 500 t/d

- **LOS ANGELES**
  - Permitted for 125 t/d
WM CORe® - Contaminant Removal

SSO Food Waste with < 10% contamination

Contaminants Removed

Contamination Detail
### WM EBS® Product Quality

- Committed to continuous improvement
- Leading the Industry to promote uniform specifications

<table>
<thead>
<tr>
<th>WM CORe® Facility</th>
<th>Operations Start Date</th>
<th>Generation</th>
<th>CalRecycle Avg. Total Manmade Inerts (% DW Basis)</th>
<th>WM Standard Avg. Total Physical Inerts (% DW Basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange County</td>
<td>Aug. 2011</td>
<td>1.0</td>
<td>0.77%</td>
<td>0.90%</td>
</tr>
<tr>
<td>NYC</td>
<td>Jun. 2016</td>
<td>2.0</td>
<td>0.21%</td>
<td>0.26%</td>
</tr>
<tr>
<td>Boston</td>
<td>Jan. 2017</td>
<td>3.0</td>
<td>0.12%</td>
<td>0.15%</td>
</tr>
<tr>
<td>NNJ</td>
<td>Apr. 2018</td>
<td>3.1</td>
<td>0.17%</td>
<td>0.17%</td>
</tr>
</tbody>
</table>

CalRecycle Limit: 0.50%

1. CalRecycle Standard includes manmade inerts consisting of film and hard plastics, glass and metal (Title 14, Section 17852. Eff 1/1/18)
2. WM Standard includes the CalRecycle manmade inerts, plus rocks, ceramics, and other hard natural or manmade objects
3. Test Method is TMECC 0306, modified for high moisture content materials
WRRF Customer - EBS® Benefits

➢ Fully Characterized Product:
  - Quality control is critical
  - Consistent & easily pumpable
  - De minimus levels of physical inerts

➢ High Energy Value (~ 3 mmbtus/ton)

➢ Minimal impact to digester operations or stability (unlike variable quality inputs from multiple sources, e.g. FOGs, etc)

➢ Delivery approach is simple & specifically tailored for ease of operation by WRRF
WM EBS® Co-digestion Research

➢ At loading rates up to ~ 30-35% additional VS loading, minimal to no impact on net dewatered biosolids production (Higgins, 2017; Aichinger, 2015)

➢ Lower foaming potential {stable & unstable foam}, higher alkalinity, greater overall digester stability (Higgins, 2017; Sharp, 2018)

➢ Greater biological diversity (Chandran, 2017); may explain higher gas yields than expected from individual feedstock components (Higgins, 2017)

Additional full scale research with EBS® in progress at partner WRRFs with leading academic institutions
Both the solid waste and waste water industries are undergoing paradigm shifts with respect to roles and organics management.

Co-Digestion of urban organics streams can play a major role in sustainable organics management in many areas.

Don’t expect clean feedstocks! Increased organics diversion will require investment in processing to create high quality products.

High quality products → demonstrated value → broader adoption: all will lead toward more sustainable programs & diversion.

The combined industries need to promote and adopt uniform product specifications - this is critical for program sustainability.
Questions?

Kevin Mattson
Organics Project Development Manager
kmattso2@wm.com
Wasted Food is Wasted Energy!