

Does Composting Still Make Sense? An Evaluation of the Existing Agitated Bed Composting Facilities at the Dartmouth, MA WPCF



Presented By:

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FAY, SPOFFORD & THORNDIKE



Purpose & Scope

- Background
- Purpose of Biosolids Treatment & Disposal Evaluations
- Alternatives Considered for
 - WAS Thickening
 - Sludge Dewatering
 - Sludge Stabilization
 - Beneficial Reuse and Disposal
- Recommended Alternatives
- Project Update

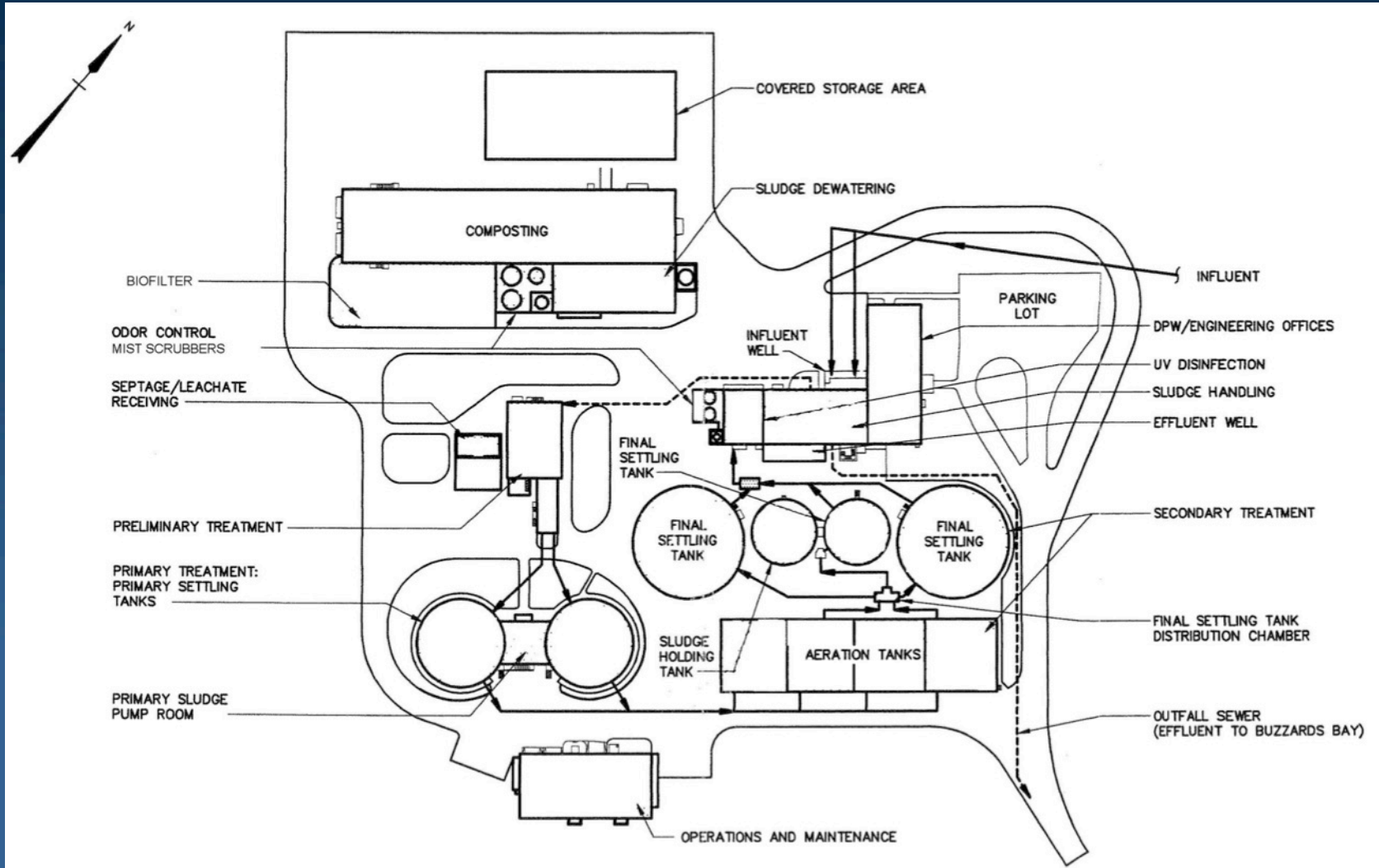
Background

- Dartmouth WPCF originally constructed in 1970
 - 2.0 MGD capacity.
 - Provides secondary treatment using conventional activated sludge & chlorination.
- \$30 million WPCF expansion & upgrade in 1992
 - 4.2 MGD average daily flow with 10.33 MGD peak hourly flow.
 - Added various liquid treatment processes, odor control and **biosolids handling, treatment and stabilization (composting)**.
- Evaluation of residual biosolid treatment & disposal (2011)
- \$8.3 million Upgrades & Improvements to the WPCF & Remote PS
 - Design completed in 2012.
 - Construction began June 2013 and to be completed by March 2015.

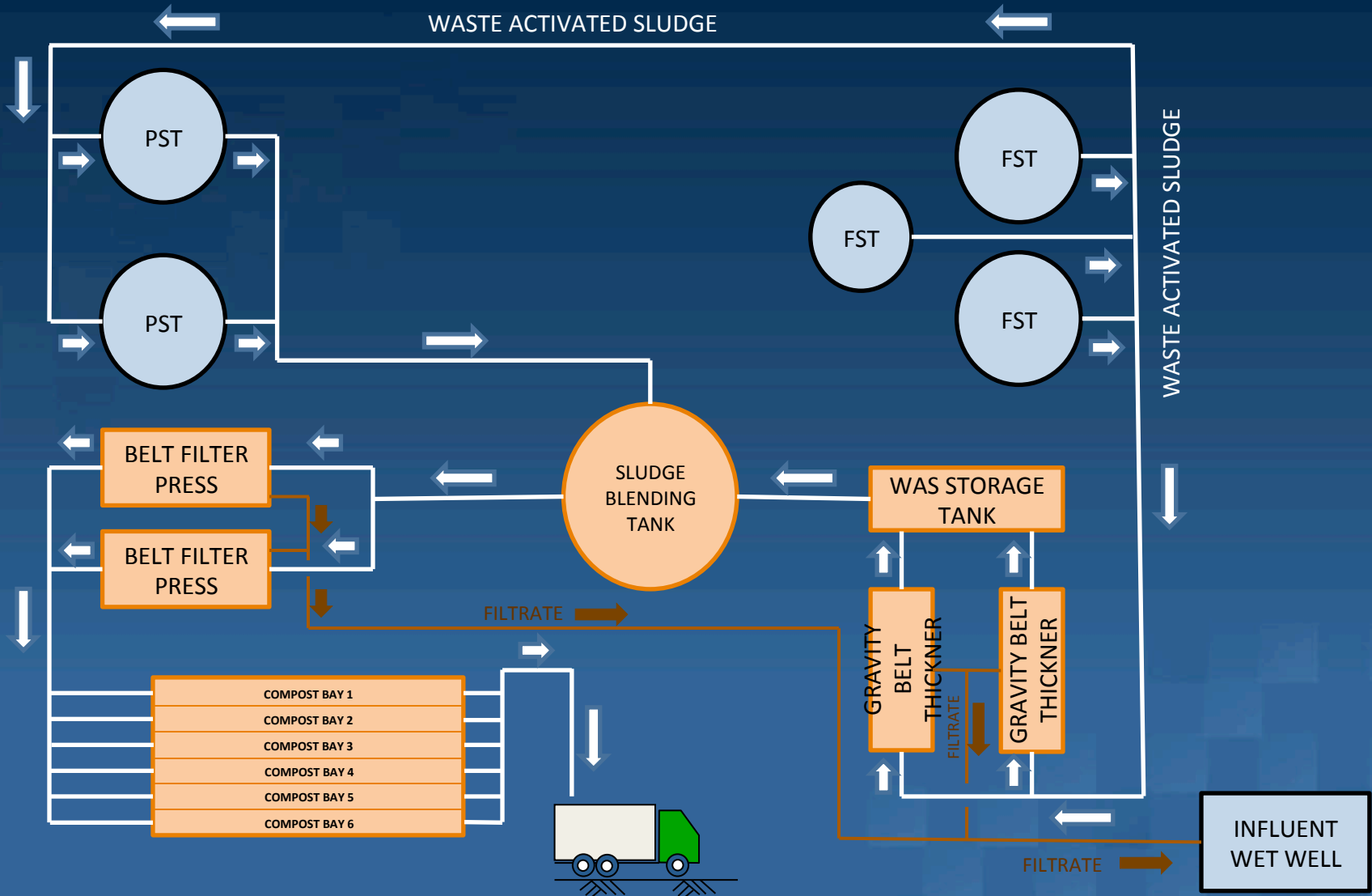


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Dartmouth WPCF



Dartmouth WPCF – Solids Treatment Train



Residuals Production

Parameters	Jan 2006 - May 2009	Design
Average Influent Daily Flow, mgd		
Municipal	3.07	4.2
Septage	0	0.005
Total	3.07	4.2
Average Influent BOD		
mg/l	226	200
lbs/day	5,164	7,000
Septage	0	200
Total	5,164	7,200
Average Influent Total Suspended Solids		
mg/l	156	177
lbs/day	3,565	6,200
Septage	0	500
Total	3,565	6,700
Average Solids Production (WAS & PS, 40:60 ratio)		
Dry lbs/day	6,600	7,500
gpd @ 4.1% solids	19,370	21,900
Total Biosolids Production		
dry tons/yr	1,205	1,370
wet tons/yr @ 22% solids	5,475	6,222
Mil. gallons/yr @ 4.1% solids	7.05	8.00

Purpose of Biosolids Treatment & Disposal Evaluation

- Existing biosolids treatment processes are over 20 years old.
- Equipment approaching remaining useful life and/or require replacement.
- Town invested in new composting equipment in 2003 & 2005.
- Investigate and consider other alternatives for treatment and disposal.

Biosolids Treatment Alternatives

- Thickening
- Dewatering
- Stabilization

Biosolids Thickening

- Concentration of Incoming Biosolids
 - WAS: 0.5 to 1% solids
- Thickening Technologies Evaluated
 - Gravity Thickening (2 to 3%)
 - Dissolved Air Flotation (3 to 5%)
 - Centrifuge Thickening (8 to 10%)
 - **Rotary Drum Thickeners (4 to 6%)**
 - **Gravity Belt Thickener (4 to 6%)**

Gravity Belt Thickener



Existing WAS Thickening System

No. of Units: 2

Manufacturer: Ashbrook-Simon-Hartley

Loading Rate:

- Dry weight: 3,100 dry lbs/day
- Volume @ 0.5 to 1% Solids: 37,000 to 74,000 gpd

Thickened WAS:

- Solids Concentration: 4-6% solids
- Volume: 9,000 gpd

Thickened WAS Storage Tank: 16,000 gals
(2-3 days storage)



Biosolids Dewatering

- Concentration of Incoming Biosolids
 - Blended WAS & Primary Sludge: 4% solids
- Dewatering Technologies Evaluated
 - Centrifuge Dewatering (20 to 25%)
 - Rotary Sludge Press (25%)
 - Belt Filter Press (22%)

Belt Filter Press



Existing BFP System

No. of Units: 2

Manufacturer: Ashbrook-Simon-Hartley

Loading Rate @ 4.1%: 21,900 gpd

Operating Time per Week: 26 hours

Dewatered Solids Concentration: 22%

Bulk Volume Dewatered Sludge: 28 cy/dy



Biosolids Stabilization

- Biosolids are treated to reduce volatile solids (40%) and reduce pathogens.
- Depending on degree of treatment, biosolids can be land applied, buried in landfills or incinerated.
- Stabilization treatment alternatives evaluated:
 - Chemical Process
 - Lime Stabilization
 - Biological Processes
 - Aerobic Digestion
 - Anaerobic Digestion
 - Composting

Anaerobic Digestion

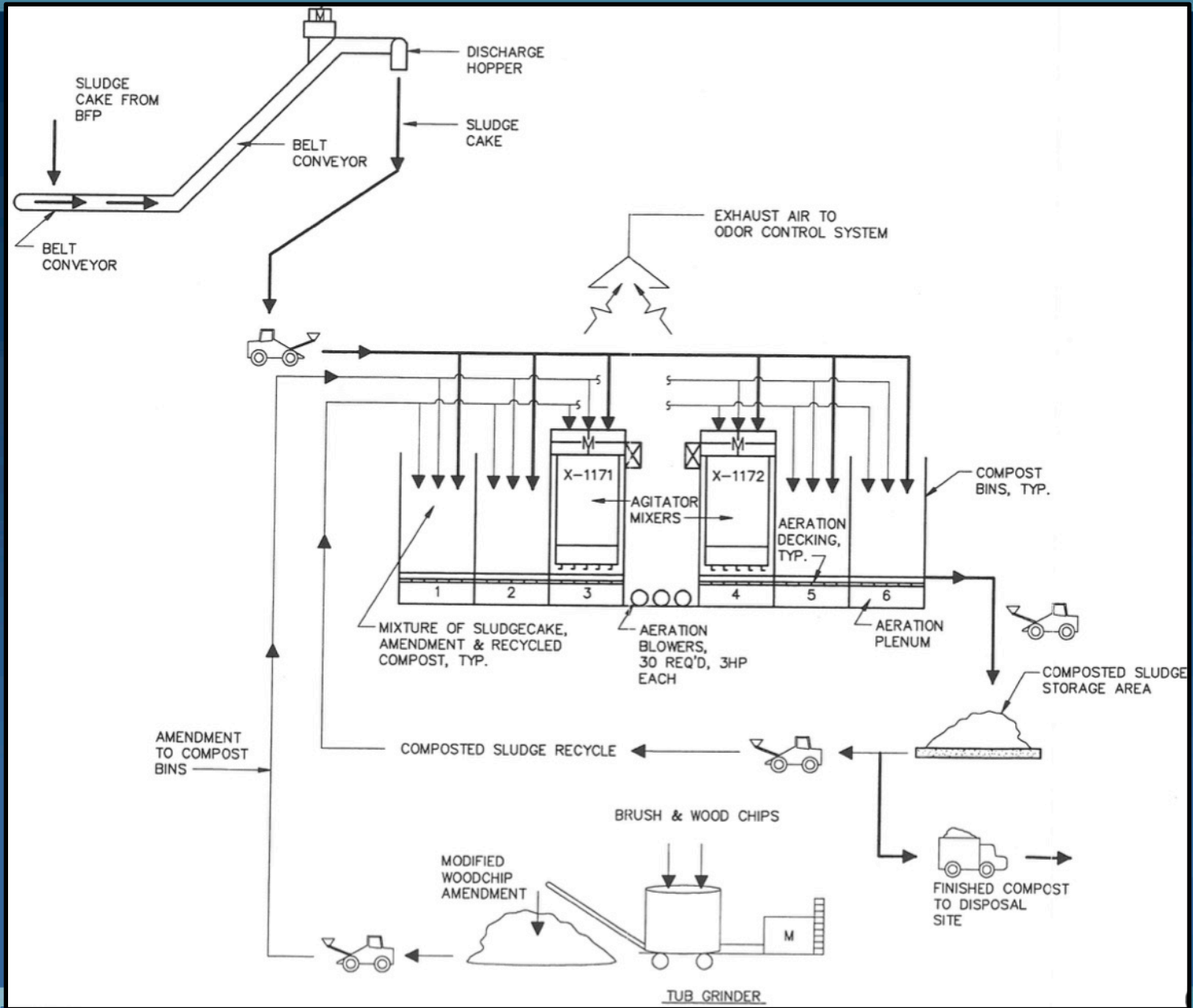
- Biological process that breakdowns biosolids in the absence of oxygen.
- Reduces volatile suspended solids.
- Reduces pathogens (mesophilic = PSRP; thermophilic = PFRP).
- Produces biogas for renewable energy.
- Requires dewatering.

Agitated-Bed Composting

- Components:

- 6 Bins (14 cy/dy per bin)
- 30 Blowers (3 HP; 5 per bin)
- 2 Agitator/Mixers (25 HP; 125 cy/hr)
- Tub Grinder w/ grapple loader (10' dia. by 5' deep)





Biosolids Disposal Alternatives

- Offsite disposal of thickened liquid biosolids
 - Alternative 1 – Gravity Co-settle/Thicken w/Liquid Sludge Disposal
 - Alternative 2 – Gravity Belt Thicken w/Liquid Sludge Disposal
- Offsite disposal of dewatered liquid biosolids
 - Alternative 3 – Belt Filter Press w/Dewatered Biosolids Disposal
 - Alternative 4 – Rotary Press w/Dewatered Biosolids
- Beneficial Reuse/disposal of biosolids
 - Alternative 5 – Anaerobic Digestion w/Dewatering Sludge Disposal
 - Alternative 6 – Biosolids Dewatering followed by Composting & Disposal

Offsite Disposal – Thickened Biosolids

Facility	Cost Structure		Cost Per Load			Cost per Dry Ton
	Disposal	Transportation	Disposal	Transportation	Total	
Incineration	\$360 per Dry ton	\$380 per load	\$540	\$380	\$920	\$613
Incineration	\$0.06 per gallon	\$0.04 per gallon	\$540	\$360	\$900	\$600

- 4% Sludge Solids
- 9,000 gallons per average load
- 1.5 dry tons per load

Alternative 1 – Gravity Co-settle/Thicken w/Liquid Sludge Disposal

- 4% Solids Content co-settled sludge (19,800 gpd design loading).
- Sludge pumped to existing sludge holding tank (70,000 gal capacity; ~3.5 days of storage).
- **Costs: Capital = \$300,000; O&M = \$753,000; 20-yr = \$9.8 million.**

Offsite Disposal – Thickened Biosolids

Facility	Cost Structure		Cost Per Load			Cost per Dry Ton
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Incineration	\$360 per Dry ton	\$380 per load	\$540	\$380	\$920	\$613
Incineration	\$0.06 per gallon	\$0.04 per gallon	\$540	\$360	\$900	\$600

- 4% Sludge Solids
- 9,000 gallons per average load
- 1.5 dry tons per load

Facility	Cost Structure		Cost Per Load			Cost per Dry Ton
	Disposal	Transportation	Disposal	Transportation	Total	
Incineration	\$360 per Dry ton	\$380 per load	\$811	\$380	\$1,191	\$529
Incineration	\$290 per dry ton	\$0.04 per gallon	\$540	\$360	\$900	\$400

- 6% Sludge Solids
- 9,000 gallons per average load
- 2.25 dry tons per load

Alternative 2 – Gravity Belt Thicken w/Liquid Sludge Disposal

- 4% solids primary sludge (~13,000 gpd design loading) pump to existing sludge holding tank (70,000 gal capacity; ~5.4 days of storage).
- 6% solids WAS (~15,000 gpd design loading) pump to existing thickened WAS holding tank (16,000 gal capacity; ~2 days of storage).
- **Costs: Capital = \$554,000; O&M = \$568,000; 20-yr = \$7.41 million**

Offsite Disposal – Dewatered Biosolids

Facility	Cost Structure		Cost Per Load			Cost per Dry Ton
	Disposal	Transportation	Disposal	Transportation	Total	
Incineration	\$350 per dry ton	\$380 per load	\$1,247	\$380	\$1,627	\$457
Compost	\$80 per wet ton	\$20 per wet ton	\$1,296	\$324	\$1,620	\$455
Landfill	\$85 per wet ton	Included	\$1,377	Included	\$1377	\$386

- 22% solids for compost & landfill
- 3.564 dry tons per load
- 1,370 dry tons per year
- Nearly 400 loads per year (7-8 loads per week)

Alternative 3 – Belt Filter Press w/Dewatered Biosolids Disposal

- Pump blended sludge to BFP (add polymer prior to BFP) at 4.1% solids.
- Dewatered cake averages about 22% solids.
- Transfer cake to sludge holding room in Compost Building to be hauled off-site for disposal. Off-site composting was recommended.
- **Costs: Capital = \$1,177,000; O&M = \$616,000; 20-yr = \$8.61 million**

Offsite Disposal – Dewatered Biosolids

Facility	Cost Structure		Cost Per Load			Cost per Dry Ton
	Disposal	Transportation	Disposal	Transportation	Total	
Incineration	\$350 per dry ton	\$380 per load	\$1,247	\$380	\$1,627	\$457
Compost	\$80 per wet ton	\$20 per wet ton	\$1,296	\$324	\$1,620	\$455
Landfill	\$85 per wet ton	Included	\$1,377	Included	\$1377	\$386

- 22% solids for compost & landfill
- 3.564 dry tons per load
- 1,370 dry tons per year
- Nearly 400 loads per year (7-8 loads per week)

Alternative 4 – Rotary Press w/Dewatered Biosolids Disposal

- Pump blended sludge to Rotary Press (add polymer prior to Rotary Press) at 4.1% solids.
- Dewatered cake averages about 25% solids.
- Transfer cake to sludge holding room in Compost Building to be hauled off-site for disposal. Off-site composting was recommended.
- **Costs: Capital = \$2,116,000; O&M = \$638,000; 20-yr = \$9.82 million**

Anaerobic Digestion of Biosolids

Alternative 5 – Anaerobic Digestion w/Dewatering Sludge Disposal

- Pump blended sludge to Anaerobic Digesters.
- Stabilized sludge is pumped to existing BFP for dewatering.
- Dewatered cake averages about 22% solids.
- Reduces volume of biosolids to 40% or greater.
- Anaerobic Digestion (mesophilic) is a PSRP = Class B Biosolids
- Anaerobic Digestion (thermophilic) is a PFRP = Class A Biosolids
- Requires installation of new Anaerobic Digester system.
- **Costs: Capital = \$9,930,000; O&M = \$641,000; 20-yr = \$19.80 million**

Composting of Biosolids

Alternative 6 – Biosolids Dewatering followed by Composting

- High Temperature Composting is a PFRP = Class A biosolids
- ~14 cy per day of finished compost.
- Plant sells finished compost for ~\$7 to 8 per cy to Agresource, Inc.
- Plant also collects revenue for accepting trees and brush.
- Revenue offsets costs for biofilter media replacement & fuel to maintain biofilter for Compost Building.
- Some of the equipment employed in the process such as the compost agitator/mixer has been replaced within 5 years of the evaluation period.
- **Costs: Capital = \$3,168,000; O&M = \$342,000; 20-yr = \$7.29 million**

Comparison of Biosolids Treatment & Disposal Options

Alternative Number	Description	Cost		
		Capital	O&M	Present Worth
1	Gravity Co-Settle/Thicken With Liquid Sludge Disposal	\$300,000	\$753,000	\$9,383,000
2	Gravity Belt Thicken With Liquid Sludge Disposal	\$554,000	\$568,000	\$7,406,000
3	Belt Filter Press With Dewatered Sludge Disposal	\$1,177,000	\$616,000	\$8,608,000
4	Rotary Press With Dewatered Sludge Disposal	\$2,116,000	\$638,000	\$9,820,000
5	Anaerobic Digestion With Dewatered Sludge Disposal	\$9,932,000	\$642,000	\$19,797,000
6	Sludge Dewatering followed by Composting and Disposal	\$3,168,000	\$342,000	\$7,291,000

- Alternative 6 was recommended for the next 8-10 years.
- Biosolids treatment will need to be re-evaluated after that period.

Project Team

- Owner: Town of Dartmouth, Massachusetts
 - David Hickox, P.E., DPW Director
 - Carlos Cardoso, WPCF Manager
- Consultant: Fay, Spofford & Thorndike
 - Parviz Amirhor, Ph.D., P.E.
 - Dave Graham, P.E.
 - Peter DeFronzo, P.E.
 - Ron Porter
 - Kenneth Scully, P.E.
 - Tony Veltri
- Contractor: Methuen Construction
 - Jay Spooner, Project Manager

QUESTIONS????