Bay Area Clean Water Agencies
2018 Biosolids Trends Survey Report

Photo: Anaerobic Digesters at City of Livermore Water Reclamation Plant. Source: Google Maps.

December 10, 2020

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1. Introduction

Biosolids management programs at Publicly Owned Treatment Works (POTWs) are under increasing pressure in the San Francisco Bay Region. Northern California POTWs are much more likely to use landfill Alternative Daily Cover (ADC) as a reuse strategy than their counterparts in Southern California[1]. However, legislation and regulation aimed at diverting organic material from landfills will phase out landfill burial and ADC over the next several years. The California Association of Sanitation Agencies (CASA) prepared a *Summary of SB 1383 and its Implementation*[2]*,* which outlines the regulatory challenges facing biosolids reuse and management alternatives for California agencies.

Bay Area Clean Water Agencies (BACWA) is a joint powers agency whose members own and operate POTWs and sanitary sewer systems that collectively provide sanitary services to over 7.1 million people in the nine-county San Francisco Bay Area (Bay Area). In summer 2016, BACWA distributed a survey to its member agencies to better understand the state of the biosolids treatment, disposal, and reuse in the Bay Area. In 2017, a report was published based on those survey results[3]. The survey was then updated in the summer of 2018[4]. The intent of this survey was to summarize information obtained from BACWA members in order to identify current industry trends for the following issues:

- *Biosolids production*
- *Dewatering technologies*
- *Biosolids management technologies and destination*
- *Biosolids management and transportation rates*
- *Agency challenges*
- *Long term biosolids management plans*
- *Marketing efforts*
- *Social media outlets for biosolids marketing*

The Survey includes responses from the following agencies, representing more than 95 percent of the total flow of BACWA member agencies, plus the City of Santa Rosa (which is not a BACWA member):

- Central Contra Costa Sanitary District
- Central Marin Sanitation Agency
- City of American Canyon
- City of Benicia

[1] See SCAP Biosolids Trends Survey https://bacwa.org/wp-content/uploads/2020/11/2018_SCAP_BIOSOLIDS_BIENNIAL-2020_01_14-FINALv3.pdf
[2] https://bacwa.org/wp-content/uploads/2020/11/SB-1383-and-its-Implementation-CASA-2020.pdf
[3] https://bacwa.org/wp-content/uploads/2017/08/BACWA-2016-Biosolids-survey-report-1.pdf
[4] Survey questions may be viewed by following this link: https://www.surveymonkey.com/r/7Q3PDY9

- City of Hayward
- City of Livermore
- City of Millbrae
- City of Palo Alto
- City of Petaluma
- City of San Jose
- City of San Leandro
- City of San Mateo
- City of Santa Rosa
- City of South San Francisco - San Bruno Water Quality Control Plant
- City of Sunnyvale
- Delta Diablo
- Dublin San Ramon Services District
- East Bay Municipal Utility District
- Fairfield-Suisun Sewer District
- Las Gallinas Valley Sanitary District
- Mt. View Sanitary District
- Napa Sanitation District
- Novato Sanitary District
- Oro Loma Sanitary District
- San Francisco Public Utilities Commission
- Sewer Authority Mid-Coastside
- Sewerage Agency of Southern Marin
- Silicon Valley Clean Water
- Union Sanitary District
- Vallejo Flood & Wastewater District
- West County Wastewater District

The list of respondents above is the same as a prior version of this survey conducted in 2016. The body of the report summarizes the data provided by agencies, while data on reuse and disposal destinations is presented in full in **Appendix A**. It is BACWA's intention to conduct this survey on a biennial basis. Agency responses will be used as part of a regional conversation about the future of biosolids management in Northern California, to identify regional needs, and to support efforts to identify and develop additional sustainable biosolids reuse alternatives. The survey was coordinated with the Southern California Alliance of Publicly

Owned Treatment Works (SCAP) Biosolids Trends Survey[5] and allows data comparisons between northern and southern California agencies.

BACWA wishes to thank all agencies that took the time and effort to assist with the production of this survey and report.

2. Treatment Technology

Survey respondents reported the technology used to produce and treat biosolids at each facility. Most facilities (25 out of 31 respondents) use mesophilic anaerobic digestion, as shown below in **Figure 1**. Four facilities reported using more than one method of treatment:

- Sunnyvale uses mesophilic anaerobic digestion and oxidation ponds.
- Dublin San Ramon Services District uses mesophilic anaerobic digestion and facultative sludge lagoons.
- City of San Jose uses mesophilic anaerobic digestion, lagoon stabilization, and air drying.
- City of Santa Rosa uses mesophilic anaerobic digestion and composting.

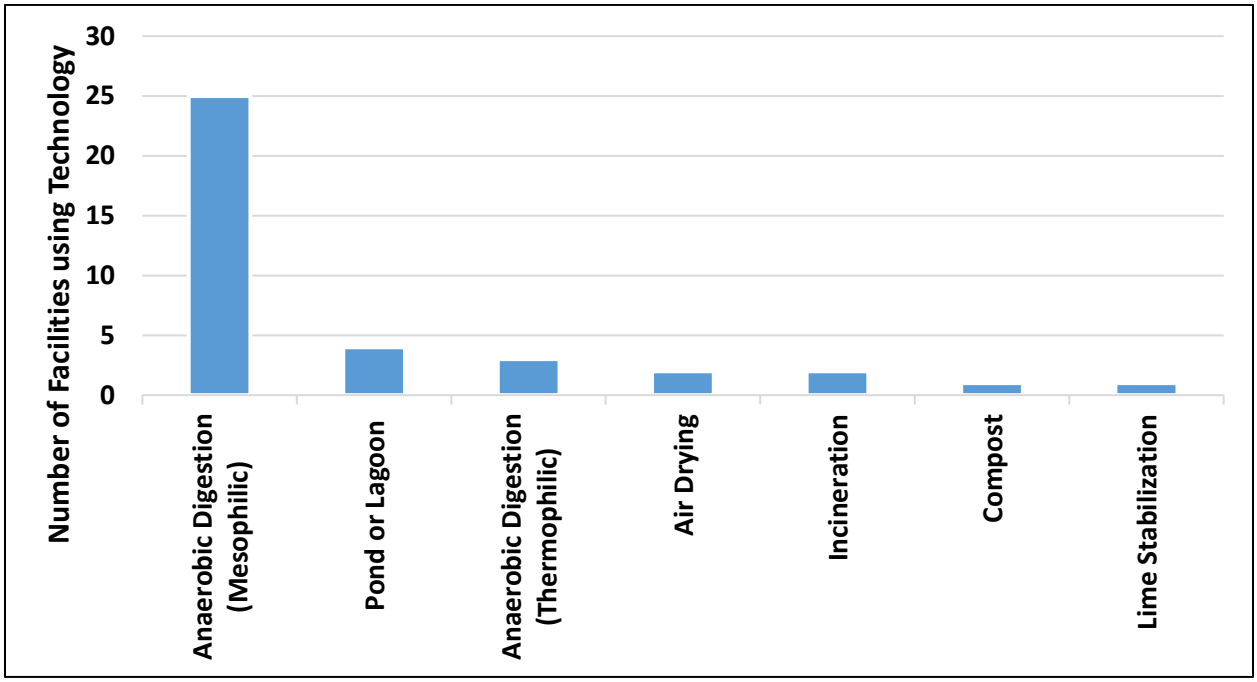

Figure 1. Technology used for biosolids production and management by survey respondents.

[5] SCAP Biosolids Trends Survey https://bacwa.org/wp-content/uploads/2020/11/2018_SCAP_BIOSOLIDS_BIENNIAL-2020_01_14-FINALv3.pdf

3. Annual Biosolids Production

Survey respondents reported their biosolids production for the 2016 and 2017 calendar years. **Table 1** lists the type of biosolids produced by each agency, based on the classifications defined by EPA Rule 503[6]. Solids designated as EQ are "Exceptional Quality" biosolids, and "Other Quality" solids do not need to meet the 503 Rules, due to their final disposition. **Figure 2** and **Figure** 3 compare the total tonnage of wet and dry tons, respectively, which were largely unchanged between the two calendar years. The dry tonnage reported in Figure 3 for 2016 assumes that percent solids were approximately the same as 2017.

The preponderance of wet tons of biosolids produced in the San Francisco Bay Region are Class B. Production of Class A biosolids dropped dramatically between the first and second surveys. The primary reason for the decline in Class A is that the City of San Jose ceased testing its biosolids to demonstrate that they meet Class A quality. Testing was ceased because their biosolids were not going to Class A re-use and the cost of the additional testing was providing no tangible benefits. The solids are the same quality, despite no longer being labeled as "Class A."

Table 1. Classes of biosolids produced by respondents

Agency	Biosolids Class
Central Contra Costa Sanitary District	Other (Incineration Ash)
Central Marin Sanitation Agency	B
City of American Canyon	B
City of Benicia	B
City of Hayward	A
City of Livermore	B
City of Millbrae	B
City of Palo Alto	Other (Incineration Ash)
City of Petaluma	B
City of San Jose	B[a]
City of San Leandro	A and B
City of San Mateo	B
City of Santa Rosa	A and B
City of South San Francisco - San Bruno Water Quality Control Plant	B
City of Sunnyvale	B
Delta Diablo	B
Dublin San Ramon Services District	Other (Surface Disposal)
East Bay Municipal Utility District	B

[6]See the "Plain English Guide to the EPA Part 503 Biosolids Rule" at https://www.epa.gov/sites/production/files/2015-05/documents/a_plain_english_guide_to_the_epa_part_503_biosolids_rule.pdf

Agency	Biosolids Class
Fairfield-Suisun Sewer District	Other (Processed at Lystek to A-EQ)
Las Gallinas Valley Sanitary District	B
Mt. View Sanitary District	B
Napa Sanitation District	B
Novato Sanitary District	B
Oro Loma SD	B
San Francisco Public Utilities Commission	A and B
Sewer Authority Mid-Coastside	B
Sewerage Agency of Southern Marin	B
Silicon Valley Clean Water	B
Union Sanitary District	B (and A after composting off-site)
Vallejo Flood & Wastewater District	B
West County Wastewater District	B

[a] In 2017, City of San Jose biosolids were reported as Class B because pathogen testing was not performed. Testing to demonstrate Class A quality resumed in 2019.

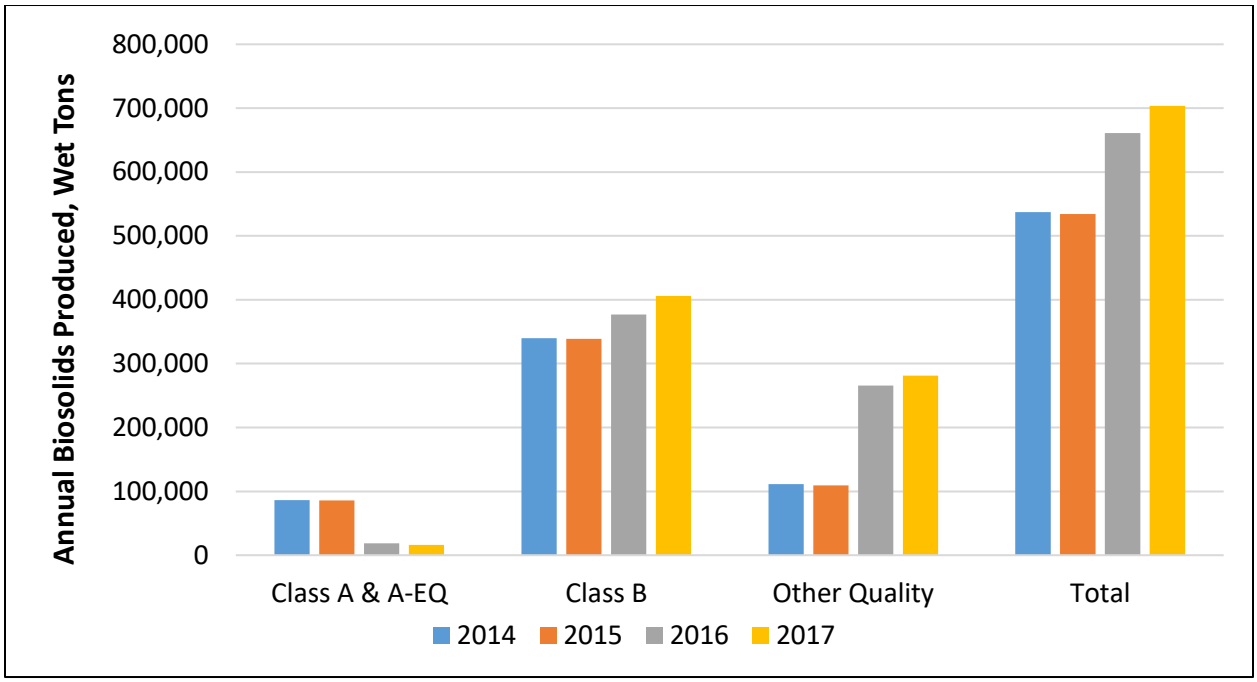

Figure 2. Aggregate wet tons of biosolids of different classes produced by survey respondents.

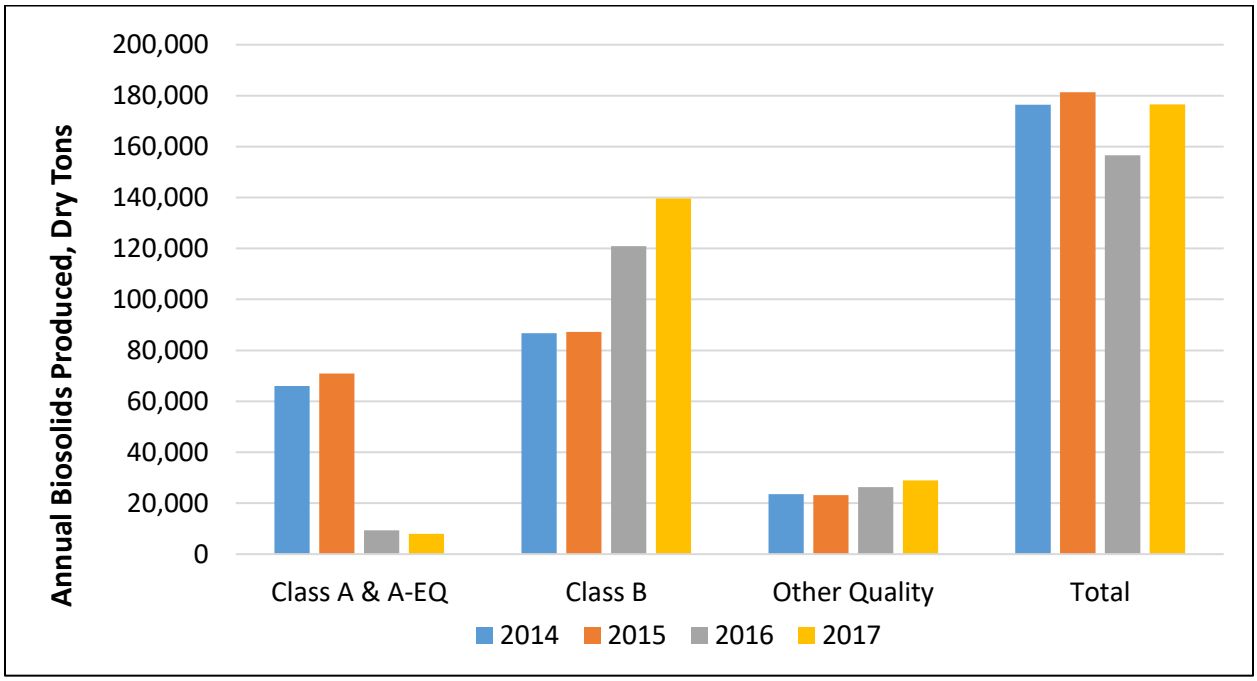

Figure 3. Aggregate dry tons of biosolids of different classes produced by survey respondents.

4. Management Options, Management Costs and Dewatering Statistics

Biosolids Reuse and Disposals Options

The amount of biosolids sent to each type of reuse and disposal destination by each responding agency is reported in **Table 2.** The accompanying **Figure 4** and **Figure 5** illustrate the relative importance of each reuse and disposal method for wet and dry tons, respectively. Reuse via landfill alternative daily cover (ADC) receives the largest amount of dry tonnage of biosolids in the region, followed by land application. Onsite disposal accounts for a large amount of wet tonnage, but a small amount of dry tonnage because of the low solids content.

Table 2. Wet tons of biosolids delivered by usage, 2017.

Agency	ADC	Landfill disposal	Land Application	Compost	Lystek	Biochar	Incineration	Onsite disposal	Total
American Canyon, City of	696								696
Central Contra Costa Sanitary District							75,004		75,004
Central Marin Sanitation Agency	3,406		1,120	18	1,862				6,406
Benicia, City of	2,644								2,644
Hayward, City of	6,790								6,790
Millbrae, City of			1,715						1,715
Petaluma, City of	8,100				490				8,590
Sunnyvale, City of			11,949	94					12,043
Delta Diablo		725	11,545	713					12,982
Dublin San Ramon Services District								170,482	170,482
East Bay Municipal Utility District	28,405	6,821	41,453		7,708				84,387
Fairfield-Suisun Sewer District					17,500				17,500
Las Gallinas Valley Sanitary District								7,694	7,694
Livermore, City of	4,100		4,741						8,841
Mt. View Sanitary District	721				21				742
Napa Sanitation District			6,949						6,949
Novato Sanitary District								12,945	12,945
Oro Loma Sanitary District			4,260						4,260
Palo Alto, City of							18,406		18,406
San Francisco Public Utilities Commission	35,113		24,005	23	5,496				64,637
San Jose, City of	54,874								54,874
San Leandro, City of			3,898[a]						3,898
San Mateo, City of	3,474		1,756						5,230
Santa Rosa, City of	1,758		26,187	8,578					36,523
Sewer Authority Mid-Coastside	285								285

Agency	ADC	Landfill disposal	Land Application	Compost	Lystek	Biochar	Incineration	Onsite disposal	Total
Sewerage Agency of Southern Marin	1,133								1,133
Silicon Valley Clean Water	256	659	6,956	965		266			9,101
South San Francisco - San Bruno WQCP, City of	13,199								13,199
Union Sanitary District		1,624	11,784	6,584					19,992
Vallejo Flood & Wastewater District			11,632						11,632
West County Wastewater District	27,908								27,908
Sum	192,863	9,829	169,538	16,973	33,077	266	93,410	191,121	707,490

[a] Estimated based on 1,248 dry metric tons send to direct land application, assuming 90% solids for Class A and 16% solids for Class B.

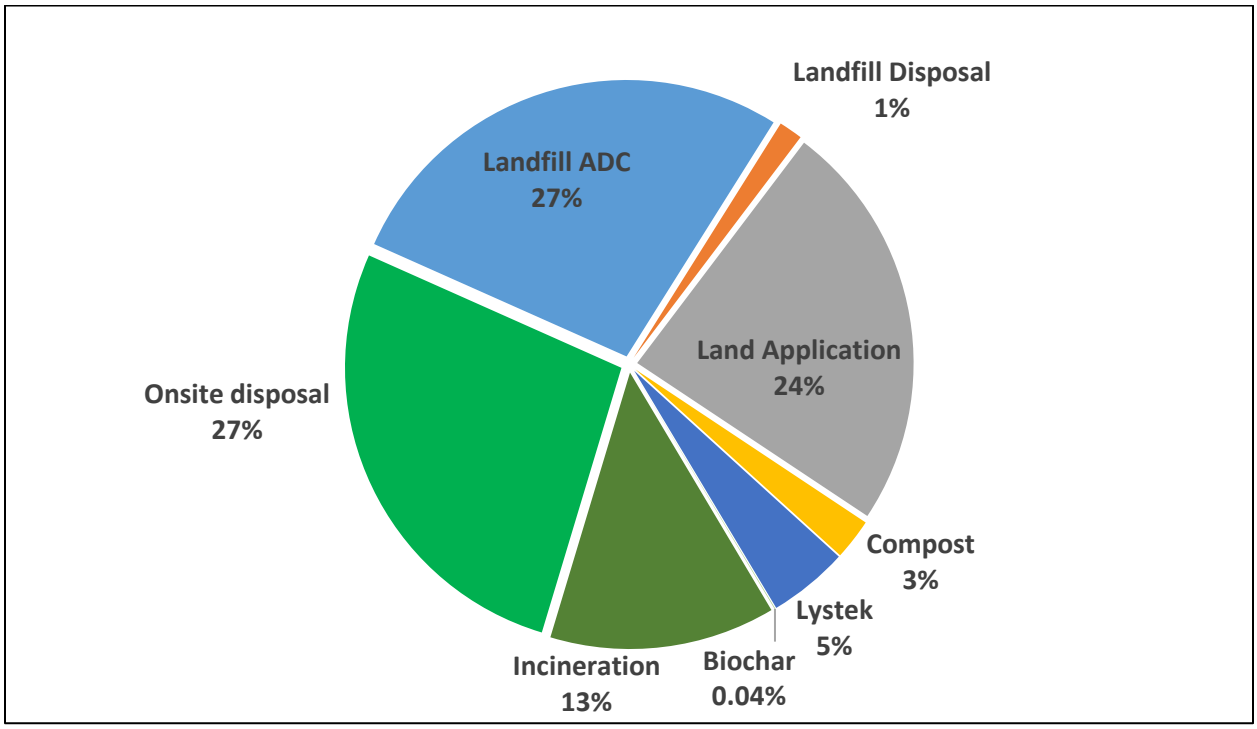

Figure 4. Relative wet tonnage of biosolids per reuse and disposal method in 2017.

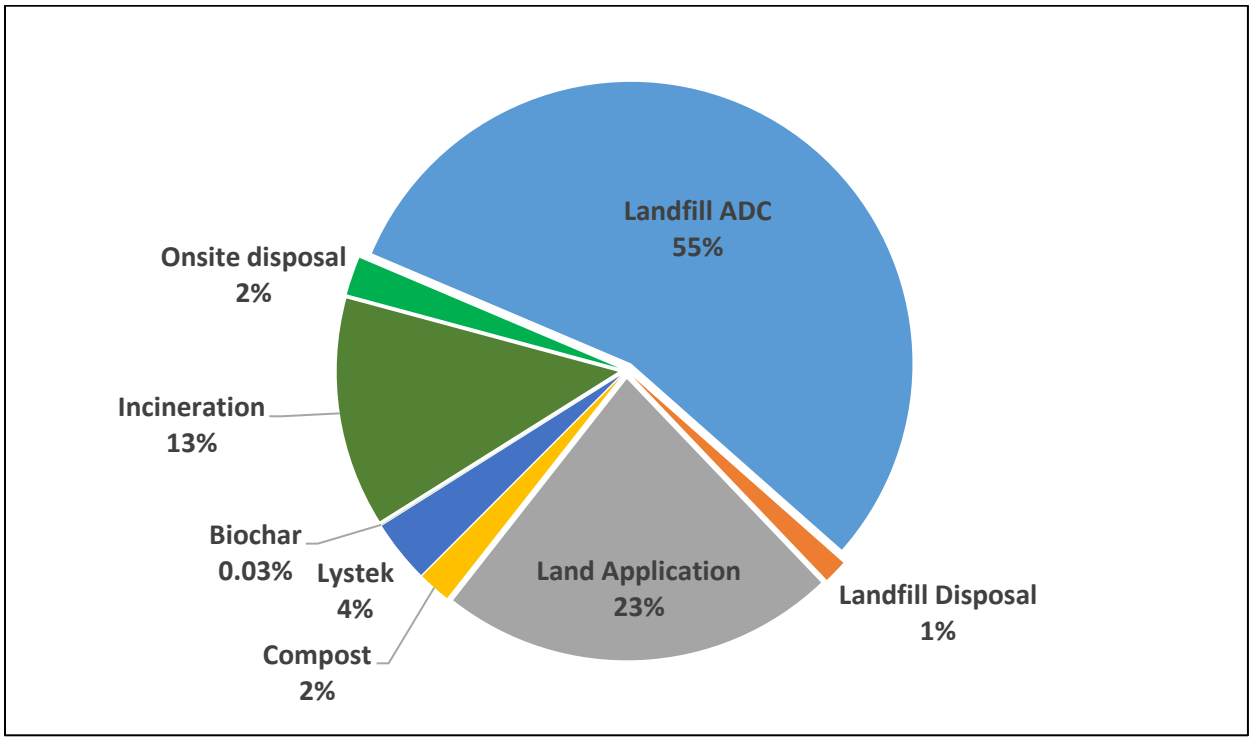

Figure 5. Relative dry tonnage of biosolids per reuse and disposal method in 2017.

Another way to measure the relative importance of reuse and disposal methods is by counting the number of agencies that employ each, as illustrated in **Figure 6**. As can be seen in **Table 2**, many agencies use more than one reuse or disposal management strategies. Out of the thirty-one responding agencies, seventeen used landfill ADC as one of their management strategies. Land application was the next most popular, followed by composting and treatment at Lystek. Landfill disposal was used by just four agencies. Incineration was used by two agencies in 2017, although one of these agencies, the City of Palo Alto, was planning a transition away from incineration.

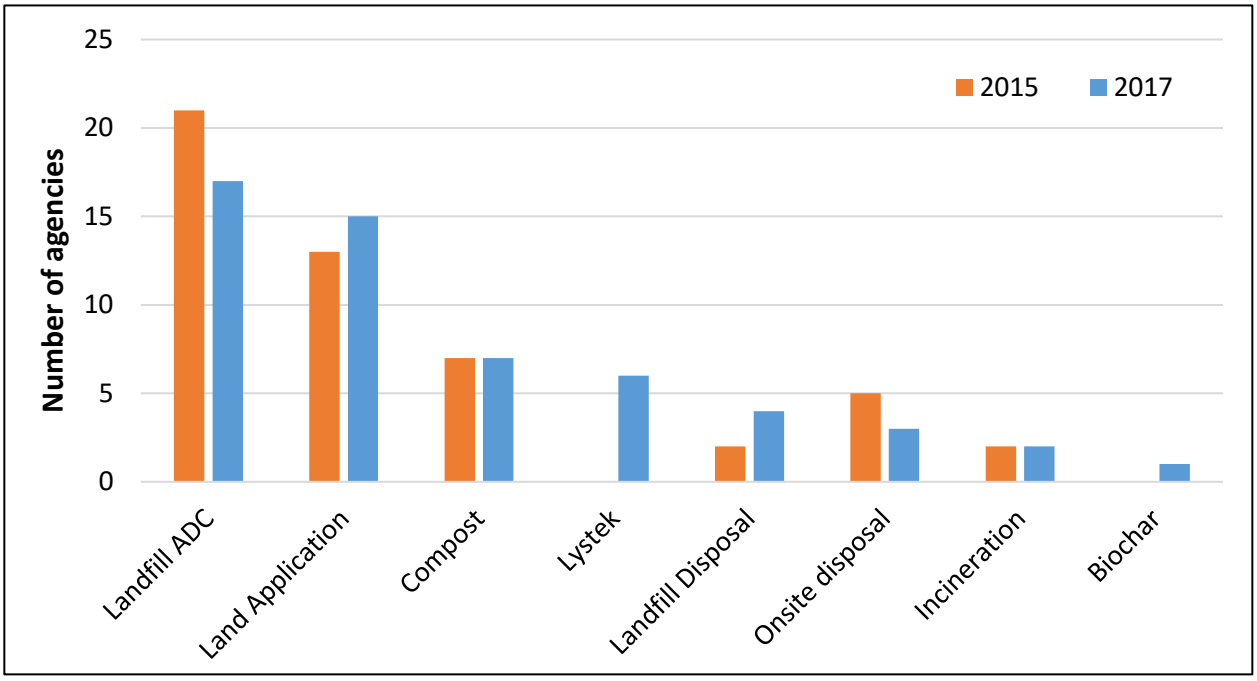

Figure 6. Changes in biosolids management practices for 31 survey respondents, 2015 to 2017.

As of 2017, six agencies were sending biosolids to the Lystek Organic Materials Recovery Center (OMRC) located in Fairfield. The OMRC began processing biosolids to produce Class A-EQ liquid fertilizer in 2016, and in 2017 it accounted for 5% of total wet tonnage produced by survey respondents (3% of total dry tonnage).

While Lystek grew in popularity as a biosolids reuse option, landfill ADC became less popular: In 2015, 21 agencies sent biosolids to landfill ADC, while in 2017, 17 agencies sent biosolids to landfill ADC. Fairfield-Suisun Sewer District, City of Millbrae, Oro Loma Sanitary District, and Union Sanitary District used biosolids for Landfill ADC in 2015, but not in 2017. More agencies are expected to move away from Landfill ADC in the future due to SB 1383 (see **Table 6**).

Management Costs

Agencies that send biosolids to multiple destinations report a range of costs per ton. Minimum and maximum reported hauling and tipping costs for each agency are reported in Table 3. Where costs were provided by the respondent as a range, the mean of the range was used for that destination. Total costs per agency are calculated by multiplying tons of solids by cost per ton for each destination and summing the destinations. Average costs for each agency are calculated by dividing total cost by tons of biosolids.

Table 3. Hauling and tipping costs for agencies

Agency	Minimum Cost ($/Ton)	Maximum Cost ($/Ton)	Average Cost ($/Ton)	Total Cost ($/Yr)
American Canyon, City of	Solids hauled as part of agency's franchise agreement.			
Central Contra Costa Sanitary District	Onsite incineration. Cost information not provided.			
Central Marin Sanitation Agency	$29	$96	$61	$393,200
Benicia, City of	$87	$87	$87	$230,100
Hayward, City of	Cost information not provided			
Millbrae, City of	$59	$59	$59	$101,000
Petaluma, City of	$49	$90	$51	$441,000
Sunnyvale, City of	$108[a]	$117[a]	$108[a]	$1,302,100[b]
Delta Diablo	$33	$55	$34	$447,700
Dublin San Ramon Services District	Onsite disposal. Cost information not provided.			
East Bay Municipal Utility District	$29	$77	$39	$3,280,400
Fairfield-Suisun Sewer District	$55	$55	$55	$970,400
Las Gallinas Valley Sanitary District	$9	$9	$9	$67,500
Livermore, City of	$40	$40	$40	$353,600
Mt. View Sanitary District	$52	$99	$75	$55,700
Napa Sanitation District	$43	$43	$43	$298,800
Novato Sanitary District	$15	$15	$15	$188,500
Oro Loma Sanitary District	$42	$42	$42	$178,900
Palo Alto, City of	$71[b]	$71[b]	$71[b]	$1,305,300[a]
San Francisco Public Utilities Commission	$58	$98	$65	$4,169,200
San Jose, City of	$30	$30	$30	$1,646,200
San Leandro, City of	$37	$37	$37	$144,200
San Mateo, City of	$37	$37	$37	$192,600
Santa Rosa, City of	$4	$85	$8	$309,800
Sewer Authority Mid-Coastside	$62	$62	$62	$17,700
Sewerage Agency of Southern Marin	$96	$96	$96	$108,800

Agency	Minimum Cost ($/Ton)	Maximum Cost ($/Ton)	Average Cost ($/Ton)	Total Cost ($/Yr)
Silicon Valley Clean Water	$41	$53	$43	$392,200
South San Francisco – San Bruno WQCP, City of	$58	$58	$58	$765,500
Union Sanitary District	$32	$56	$40	$798,000
Vallejo Flood & Wastewater District	Land application on District-owned land (Tubbs Island). Cost information not provided.			
West County Wastewater District	Solids hauled as part of agency's franchise agreement.			
Subtotal (25 of 31 agencies reporting)				$18,158,000

[a] Cost has been converted to equivalent for wet biosolids, although City pays based on dry weight basis. Dewatering is included in cost.

[b] Cost has been converted to equivalent for wet biosolids, although dry ash is hauled.

For the 24 agencies that reported costs in both 2015 and 2017, total costs rose about 12%, from about $16M in 2015 to $18M in 2017. This represents at 12% increase in costs over two years; by comparison, the U.S. inflation rate from 2015-2017 totaled 3%.

The range of hauling and tipping costs associated with each reuse and disposal alternative are plotted in **Figure 7**. City of Sunnyvale costs for land application, landfill ADC, and compost included dewatering and were therefore omitted from Figure 7. For agencies with available land, onsite disposal is by far the lowest-cost option. As in the previous survey, unit costs for landfill ADC and land application showed a very large range, with landfill ADC (median cost: $48/ton) proving to be more expensive than land application (median cost: $33/ton). This is true even if Santa Rosa is excluded (median land application cost excluding Santa Rosa: $43/ton); Santa Rosa operates its own land application program and reported significantly lower unit costs than any other agency. The median unit cost for land application stayed about the same from 2015 to 2017, while the median unit cost for landfill ADC increased from $43/ton to $48/ton (12% increase over 2 years).

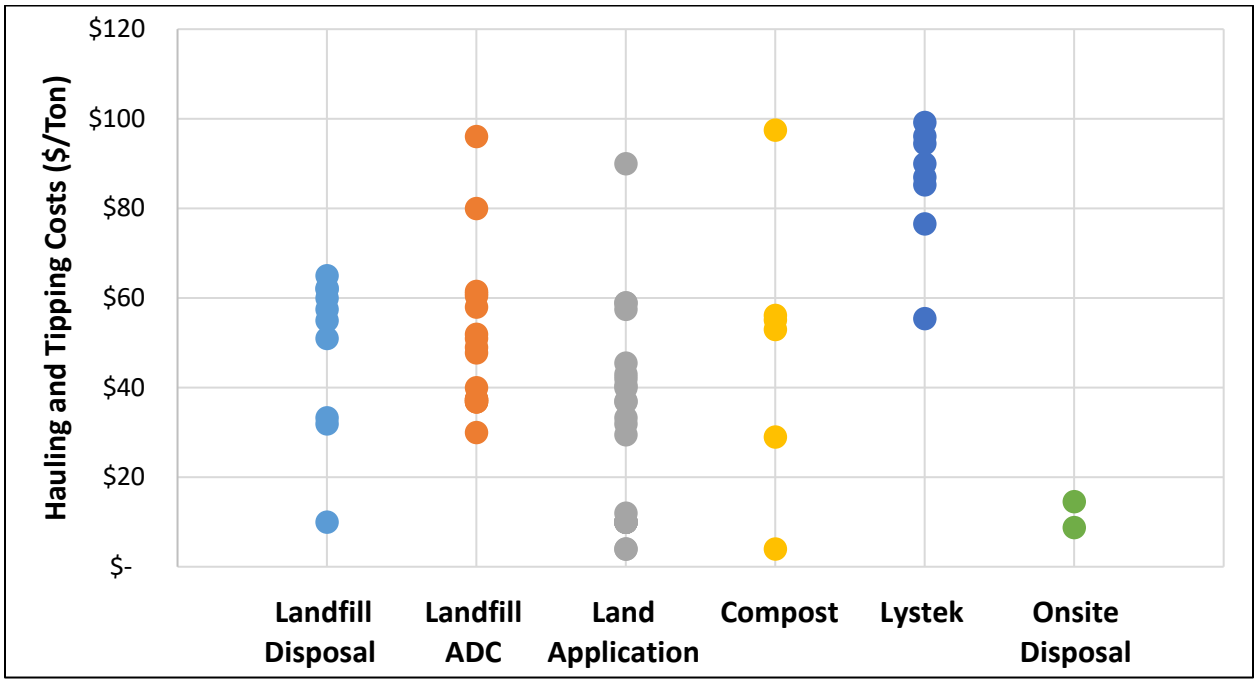

Figure 7. Tipping and Hauling Costs for each reuse/disposal alternative.

Hauling Distance

The range of round-trip hauling distances for each agency, as well as total ton-miles, are listed in **Table 4.** The ton-miles provides a metric for the total hauling burden for each agency.

Table 4. Round-trip Distance Hauled

Agency	Minimum Distance Hauled (Round Trip, miles)	Maximum Distance Hauled (Round Trip, miles)	Total Ton-Miles
American Canyon, City of	62	62	43,200
Central Contra Costa Sanitary District	Not avail.	Not Avail.	Not Avail.
Central Marin Sanitation Agency	35	296	415,300
Benicia, City of	70	70	185,100
Hayward, City of	70	70	475,300
Millbrae, City of	200	264	344,700
Petaluma, City of	75	108	911,600
Sunnyvale, City of	130	250	1,582,000
Delta Diablo	150	240	2,047,700
Dublin San Ramon Services District	0	0	0
East Bay Municipal Utility District	76	262	14,734,600
Fairfield-Suisun Sewer District	0	0	0
Las Gallinas Valley Sanitary District	0.3	0.3	2,600
Livermore, City of	19	175	907,600
Mt. View Sanitary District	42	74	51,600

Agency	Minimum Distance Hauled (Round Trip, miles)	Maximum Distance Hauled (Round Trip, miles)	Total Ton-Miles
Napa Sanitation District	6	6	41,700
Novato Sanitary District	0	0	0
Oro Loma Sanitary District	120	120	511,200
Palo Alto, City of	372	372	2,464,900[a]
San Francisco Public Utilities Commission	100	290	8,132,300
San Jose, City of	2	2	109,700
San Leandro, City of	240[b]	240[b]	935,600
San Mateo, City of	116	870	2,084,900
Santa Rosa, City of	1	229	1,416,800
Sewer Authority Mid-Coastside	8	8	2,300
Sewerage Agency of Southern Marin	43	43	48,800
Silicon Valley Clean Water	0	250	2,183,200
South San Francisco – San Bruno WQCP, City of	123	123	1,623,500
Union Sanitary District	128	242	3,468,600
Vallejo Flood & Wastewater District	24	24	279,200
West County Wastewater District	57	57	1,590,800
Total (31 of 31 agencies reporting)			**46,595,000**

[a] Total for hauling of dry ash.

[b] Estimated distance of Merced County.

The combined hauling burden for all survey respondents (46,595,000 ton-miles) represents a 14% increase compared to the total 2015 value of 41,011,000 ton-miles.

Dewatering Statistics

The on-site methods employed by agencies to dewater biosolids prior to final use included drying beds, centrifuges, presses, and dryers. Dewatering equipment employed by each agency, as well as the resulting percentage of solids, is listed in **Table 5.**

Table 5. Percentage Solids, Dewatering technology type and manufacturer for each agency

Agency	Percent Solids	Dewatering Technology	Equipment Manufacturer
American Canyon, City of	15%	Screw Press	OR-TEC
Central Contra Costa Sanitary District	Not avail.	Centrifuge	Sharples
Central Marin Sanitation Agency	25%	Centrifuge	Centrisys CS 18-4

Agency	Percent Solids	Dewatering Technology	Equipment Manufacturer
Benicia, City of	16%	Belt Filter Press	Ashbrook
Hayward, City of	85%	Drying Bed	-
Millbrae, City of	19%	Belt Filter Press	Andriz/Pilgram
Petaluma, City of	16%	Screw Press	FKC Screw Press
Sunnyvale, City of	24 to 26%	Centrifuge, Belt Filter Press	Andritz (centrifuge) and FRC (belt press)
Delta Diablo	25%	Centrifuge	Flottweg centrifuges
Dublin San Ramon Services District	<2%	No dewatering	N/A
East Bay Municipal Utility District	23%	Centrifuge	Flottweg and Humboldt centrifuges
Fairfield-Suisun Sewer District	16%	Screw Press	FKC
Las Gallinas Valley Sanitary District	5%	Sludge lagoons	N/A
Livermore, City of	17%	Belt Filter Press	Ashbrooks
Mt. View Sanitary District	27 to 42%	Centrifuge, Drying Bed	Centritech centrifuge
Napa Sanitation District	18%	Belt Filter Press	Ashcroft
Novato Sanitary District	6%	Sludge lagoons	Not Applicable
Oro Loma Sanitary District	80%	Belt Filter Press	BDP Belt Press
Palo Alto, City of	25-36%	Belt Filter Press	Ashbrook Simon-Hartley, Model WP (i.e., Bellmer Winklepress)
San Francisco Public Utilities Commission	23%	Centrifuge, Screw Press	Screw Press – FKC, Centrifuges – Humboldt/Sharpels
San Jose, City of	87%	Drying Bed	The City does not have a mechanical dewatering process in place yet but is in on track to construct a mechanical dewatering facility that will use centrifuges.
San Leandro, City of	Not avail.	Belt Filter Press, Drying Bed	BDP 3dp belt filter press
San Mateo, City of	25%	Centrifuge	Westfalia
Santa Rosa, City of	16%	Belt Filter Press	Ashbrook
Sewer Authority Mid-Coastside	18%	Belt Filter Press	Ashbrook 2 meter press
Sewerage Agency of Southern Marin	25%	Belt Filter Press	BDP Industries
Silicon Valley Clean Water	Not avail.	1st stage Fournier Press, 2nd stage Drying beds & Bioforce Tech	Fournier Press

Agency	Percent Solids	Dewatering Technology	Equipment Manufacturer
South San Francisco – San Bruno WQCP, City of	15%	Belt Filter Press	Komline-Sanderson
Union Sanitary District	24%	Centrifuge	Andritz D5LL Decanter Centrifuge
Vallejo Flood & Wastewater District	31%	Belt Filter Press	Ashbrook
West County Wastewater District	83%	Drying Bed	-

5. Challenges and Future Planning

Challenges

Agencies were asked to rank the challenges facing their biosolids program. The following challenges are ranked from the aggregate responses from most to least important:

1. Rising costs
2. Securing sustainable reuse options
3. Regulatory Restrictions on using Biosolids for Alternative Daily Cover
4. Hauling distance
5. Public perception/relations
6. Local restrictions on land application
7. Wet weather impeding drying operations
8. Space for drying operations
9. Other

Reasons listed as "other" included:

- Uncertainty regarding the future viability of on-site disposal
- Loss of drying beds due to space constraints
- Sea level rise
- Restrictions on land application due to organic farming

As in the 2016 survey, rising costs were the top concern overall. On an individual agency basis, rising costs were listed as the top concern for about half of the agencies that responded.

Future Biosolids Management Plans

The survey asked respondents about their plans for biosolids management in 2019. 25 of 31 respondents selected the response "Same plan/strategy as 2017." The remaining 6 agencies had the following responses:

- City of Benicia: *"Hauling to Lystek where biosolids are converted to Class A EQ for fertilizer."*

- City of Petaluma: *"City to issue Biosolids RFP in 2019".*
- Dublin San Ramon Services District: *"Our Wastewater Treatment and Biosolids Facilities Master Plan in September 2017 identified future solids storage concerns. Due to the concern of solids accumulation and FSL/DLD capacity we are presently evaluating dewatering as an option to address the issue."*
- East Bay Municipal Utility District: *"In 2018 and 2019 we are increasing our diversion from ADC to compost and wet weather storage."*
- City of Palo Alto: "*Decommission sewage sludge incinerators and use new Sludge Dewater & Haul Facility to two other facilities for ultimate treatment and disposal."*
- Sewer Authority Mid-Coastside: *"Investigating creating soil amendments with Class A biosolids."*

The survey also specifically asked about agency's responses to SB 1383, which mandates diversion of organics from landfills in order to reduce short-lived climate pollutants (i.e., methane). SB 1383 will require a 75% reduction in organics from landfills compared to 2014 levels. This new legislation is expected to have two main impacts on biosolids disposal:

- Biosolids used as landfill ADC will be considered disposal instead of beneficial reuse, which will sharply limit ADC use of biosolids;
- Municipalities will need to divert organic materials (green waste, food waste, etc.) from landfills. If wastewater agencies provide opportunities for co-digestion of these diverted materials, there will be an increase in the production of digested biosolids and of biogas at POTWs.

Complete responses to the survey question about SB 1383 are shown below in **Table 6**. Three or more agencies mentioned each of the following strategies:

- Increase the amount of material sent to Lystek to produce Class A-EQ fertilizer.
- Increase reliance on land application.
- Install treatment facilities (e.g., pyrolysis) to reduce the amount of sludge requiring disposal.

Table 6. Agency Plans to Respond to SB 1383 as of 2018

Agency	How does your agency plan to respond to the likely limits on landfill reuse or disposal resulting from SB 1383?
American Canyon, City of	We are testing the Blue Frog technology in our sludge pond, with the hope that our need to off-haul biosolids will be significantly reduced.
Central Contra Costa Sanitary District	Continue to incinerate sludge, recycle ash

Agency	How does your agency plan to respond to the likely limits on landfill reuse or disposal resulting from SB 1383?
Central Marin Sanitation Agency	CMSA is in the process of securing a five years biosolids disposal contract with Redwood Landfill, starting in Jan 2019.
City of Benicia	Hauling to Lystek where biosolids are converted to Class A EQ for fertilizer.
City of Hayward WPCF	We are evaluating our options.
City of Millbrae	-
City of Petaluma	The City plans to review submittals from 2019 RFP and make a selection at that time.
City of Sunnyvale	Our current disposal portfolio consists primarily of land application. We plan to work with our current and any future contractors to ensure that this option, or an equivalent that complies with AB 1383, is available and prioritized.
Delta Diablo	Increase quantity of biosolids to composting
Dublin San Ramon Services District	Currently we use the Dedicated Land Disposal site (DLD) and as the DLD approaches capacity, DSRSD will start developing strategies that do not rely on landfill disposal.
East Bay Municipal Utility District	We plan to have alternatives in place prior to the deadlines. We are still waiting on the final regulations to determine the necessary timing to divert all material from ADC.
Fairfield-Suisun Sewer District	We will continue to send all biosolids to Lystek for further processing
Las Gallinas Valley Sanitary District	-
Livermore, City of	No solid plans yet
Mt. View Sanitary District	The District is evaluating the feasibility of using Bioforcetech dryers and pyrolyzer. And also negotiating an MOU with Lystek.
Napa Sanitation District	-
Novato Sanitary District	There is currently no plan beyond continuing to use the DLD and supporting industry efforts regarding Biosolids use and reuse.
Oro Loma Sanitary District	We can store on site until dry weather. Land application.
Palo Alto, City of	Undetermined
San Francisco Public Utilities Commission	Increased use of more expensive all weather agricultural options.
San Jose, City of	The City is constructing a mechanical dewatering facility that will allow more reuse options (composting, land application, soil amendment etc.) for future biosolids.
San Leandro, City of	We still land apply so no change as of yet
San Mateo, City of	No plan has been specifically addressed.
Santa Rosa, City of	Increase land application and increase amount going to Lystek. Continue to research other treatment options.

Agency	How does your agency plan to respond to the likely limits on landfill reuse or disposal resulting from SB 1383?
Sewer Authority Mid-Coastside	We are looking into technology to concentrate the digested sludge and hopefully decrease our solids disposal
Sewerage Agency of Southern Marin	Based on Waste Management, the manager for Redwood Landfill notified SASM staff that the landfill is working on a plan on behalf of its clients on how to fulfill the AB 1383 requirement.
Silicon Valley Clean Water	With BioForce Tech operating onsite the impact is not known at this point.
South San Francisco – San Bruno WQCP, City of	Dryer / Pyrolysis technologies
Union Sanitary District	Still exploring options.
Vallejo Flood & Wastewater District	Studying if we can accept biosolids from other agencies for land application on existing fields and/or storage
West County Wastewater District	Still studying options

6. Public Outreach

Marketing

The survey asked whether agencies directly market their biosolids products, or whether another entity markets biosolids products on their behalf.

- 1 agency (Santa Rosa) directly markets their own biosolids products.
- 5 agencies (Benicia, Petaluma, East Bay Municipal Utility District, and San Francisco Public Utilities Commission) reported that Lystek markets Lystegro on their behalf.
- 4 agencies (Sunnyvale, East Bay Municipal Utility District, Silicon Valley Clean Water, and Union Sanitary District) reported that another entity markets other finished products on their behalf, such as compost or biochar.
- Two agencies (San Francisco Public Utilities Commission and City of San Jose) reported that they have plans in the future to brand their biosolids product(s).

Outreach and Education

Agencies were asked whether they conduct any outreach or publicity pertaining to their biosolids programs, and via what venue. Seven agencies replied that they conduct outreach pertaining to biosolids, using a combination of YouTube videos, agency websites, print media, and social media, as illustrated in **Figure 8**. By comparison, in the 2016 survey, six agencies responded that they conducted this type of outreach. Sixteen agencies in this survey replied that they conduct outreach, but not for biosolids in particular. Eight agencies replied that they do not conduct outreach at all.

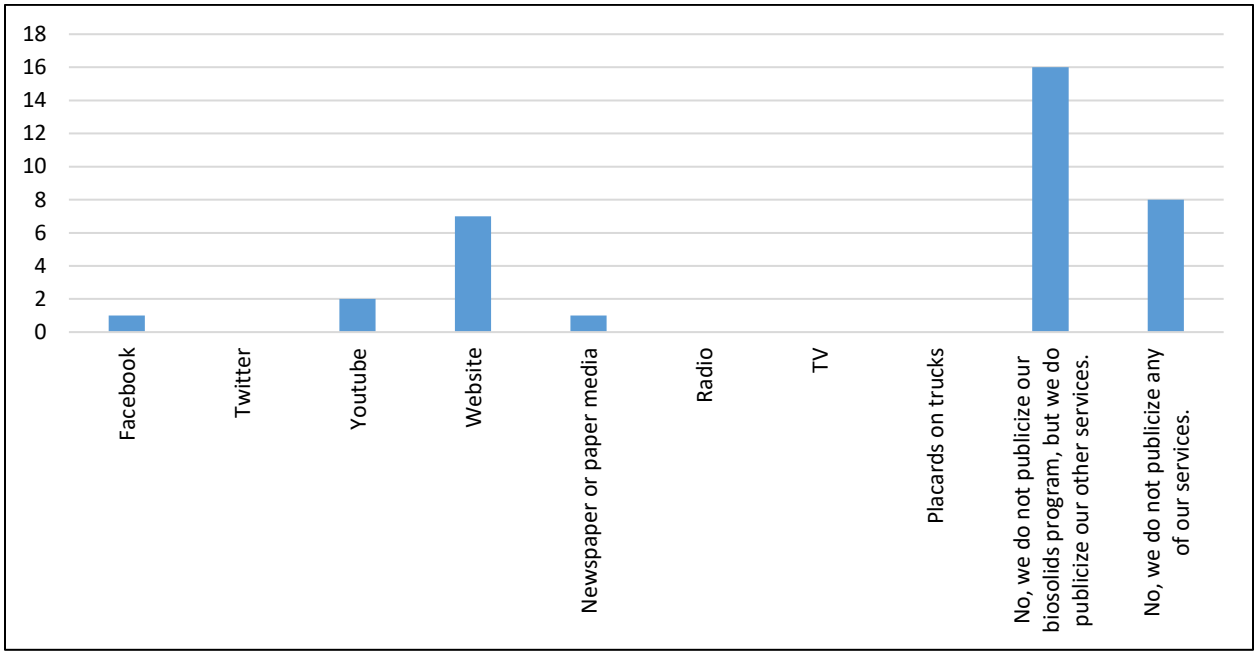

Figure 8. Number of agencies doing biosolids outreach via traditional and social media.

7. Biosolids Staffing

The final survey question asked respondents to describe how their agency manages biosolids staffing. 30 out of 31 agencies responded that they use their own staff, while 1 agency (Sunnyvale) uses contractors. Complete responses are shown below in **Table 7.** The two agencies with the largest dedicated staff are Santa Rosa (9 Full Time Equivalent positions) and the City of San Jose (>11 Full Time Equivalent positions). Adding up the 29 agencies that provided estimating staffing levels, the total is more than 40 Full Time Equivalent positions.

Table 7. Agency Staffing for Biosolids

Agency	Please explain below how your agency manages biosolids staffing		
	How many staff are involved with biosolids?	What % of their time is spent on biosolids?	Please describe their roles
American Canyon, City of	3 operators, 1 operations manager	1% when not operating screw press, 4% when operating screw press	
Central Contra Costa Sanitary District	N/A	N/A	N/A
Central Marin Sanitation Agency	2	5-10%	Typically, one operation staff would setup, operate the centrifuge.
Benicia, City of	1/2 per day	4 – 6 hours per day	pressing sludge to biosolids
Hayward, City of	4	10%	Operator, Maintenance, Laborer, Lab Tech
Millbrae, City of	four operators	5 % of 160 hrs or 8 hrs	Belt press operations
Petaluma, City of	5	0.85 FTE	Management for disposal and laboratory staff for compliance sampling
Sunnyvale, City of	2 contractors		
Delta Diablo	17	15%	Operators – produce and process the biosolids; Ops Supervisor and Manager – reporting & regulatory oversight of biosolids
Dublin San Ramon Services District	3 full time; 5 part time (seasonal)	3 full time (15%, 2%, 2%) part-time seasonal 100%	oversee operation, training, tractor/dredge operation
East Bay Municipal Utility District	Varied but there are no dedicated employees for just biosolids activities	5-50% depending on work area and task	Operations, field inspections, engineering, sampling, testing
Fairfield-Suisun Sewer District	0.5 FTE of total operator time, 0.25 FTE engineering	see above	see above

Agency	Please explain below how your agency manages biosolids staffing		
	How many staff are involved with biosolids?	What % of their time is spent on biosolids?	Please describe their roles
Las Gallinas Valley Sanitary District	1 operator, 1 lab staff	Operator ~18% FTE; lab staff ~20% FTE	Operator time is primarily for management of sludge pumping and anaerobic digesters. Lab staff for collection and analysis of digester and biosolids samples.
Livermore, City of	one operator daily, mostly 7 day operation	90% of shift for one operator	Filter Belt pressing, mechanically loading trucks & cleanup
Mt. View Sanitary District	7	15%	1 Lab Analyst performs weekly process control monitoring. 5 Operators and 1 Supervisor maintain and operate sludge pumps, grit removal, sludge thickening, sludge digestion, scum handling, sludge dewatering and disposal.
Napa Sanitation District	3 FTE	40%	The Reclamation Department is overseen by a manager. The department encompasses biosolids management and the required land practices. Mowing, preparing fields, spreading, discing, and working with growers. They perform ranch maintenance such as pesticide control, fence mending, road repair. They are also responsible for the ever-expanding distribution of recycled water, customer connections, meter reading, connection testing, system leaks.
Novato Sanitary District	All of the Operations staff (12) are involved with biosolids	(Very roughly – this is hard to estimate) 5%	Operators manage sludge transfer, return and balance of biosolids and all issues relating to the flare and the BAAQMD. Lab (and also Operations) monitor the health of the digester, %TS, %VS and manage the EPA reporting.
Oro Loma Sanitary District	5	varies (.01 to .5)	Two staff work half time to manage drying facility. Two staff manage annual testing and hauling operation (.05). One staff member manages EPA reporting (8 hours/year).
Palo Alto, City of	~10-20	5-25%	Operators, Maintenance, Lab staff, Engineers & Managers involved in regulatory compliance
San Francisco Public Utilities Commission	5	From 10%-100%	Biosolids Coordinator, Process Engineer, Resource Recovery Specialist, Soil Science Specialist, Business Services Manager

Agency	Please explain below how your agency manages biosolids staffing		
	How many staff are involved with biosolids?	What % of their time is spent on biosolids?	Please describe their roles
San Jose, City of	10 Residual Sludge Management , 1 program manager, 3 CIP engineers	(100 %) for sludge management and program manager; 10-20% for CIP	7 Heavy Equipment Operators, 2 Wastewater Attendants,1 Superintendent, 1 program manager, 3 senior/associate/sanitary engineers
San Leandro, City of	11 ops, 2 maint, 3 lab	5%ops, 25% maint, 1% lab	ops dewaters, maint manages drying beds and runs in bed equipment, lab testing
San Mateo, City of	5	20%	One operator is always scheduled to handle the solid-side process, along with some management associated with hauling contracts and report writing. Most future planning has been left to consultants.
Santa Rosa, City of	8	100%	Maintenance/operations
Sewer Authority Mid-Coastside	4	20 hrs	pump cleaning, process operation and optimization
Sewerage Agency of Southern Marin	3	25%	Operations, management, sample collection and data analysis of biosolids
Silicon Valley Clean Water	3	1-30%, 1-50%, 1-25%	Drying bed worker. This worker operates equipment to spread the biosolids and loads trucks. One operator who manages running the solids handling building operations. One supervisor.
South San Francisco – San Bruno WQCP, City of	8	20	Dewatering equipment operation and maintenance
Union Sanitary District	5	10%	Chief Plant Operator, Operations Supervisors, and Process Engineer.
Vallejo Flood & Wastewater District	2	30	Staff monitor amounts of solids transported, daily production, prepare reports, coordinate sample collection and work with contract farmer.
West County Wastewater District	11	not very much apiece, so hard to estimate	turning valves, collecting samples

8. Future Surveys

BACWA intends to repeat this survey in 2021, and every two years thereafter. This will give the region the ability to track changes in biosolids trends over time. Additionally, the Biosolids Committee may choose to expand the scope of this survey to a greater geographical area.

BACWA member agencies are all permitted by the San Francisco Regional Water Quality Control Board. Although the Regional Water Board's jurisdiction does not have a direct bearing on biosolids regulation or management, regulatory requirements within NPDES permits indirectly affect biosolids management. Within the next few years, new regulations from the State and from the Bay Area Air Quality Management District regarding climate pollutants (e.g., methane) are expected to impact biosolids management to a greater extent than NPDES permit requirements.

As SB 1383 Regulations are implemented, and the next two years bring clarity to approaches for biosolids reuse and disposal in California, future survey questions may be refined to better understand how agencies are responding to this shifting landscape.

APPENDIX A – AGENCY DATA: 2017 Biosolids Management

American Canyon, City of	
type	ADC
location	Recology Landfill – Hay Rd, Vacaville
wet tons	696
cost ($/ton)	$62
round trip distance (miles)	0 – Recology hauls free as part of our franchise agreement. We expect this won't always be the case.

Central Contra Costa Sanitary District	
type	incineration
location	onsite
wet tons	75,004
cost ($/ton)	$0
round trip distance (miles)	0

Central Marin Sanitation Agency				
	Destination 1	**Destination 2**	**Destination 3**	**Destination 4**
type	ADC	Lystek	Land App	Compost
location	Redwood Landfill, Novato	Lystek A-EQ Land App	Synagro's Solano County land application site	Synagro's Central Valley Compost Facility
wet tons	3,406	1,862	1,120	18
cost ($/ton)	$47.78	$96.12	$45.50	$29.00
round trip distance (miles)	35	84	120	296

Benicia, City of	
type	landfill liner
location	Hay Road Landfill
wet tons	2,644
cost ($/ton)	$87
round trip distance (miles)	70

Hayward, City of	
type	ADC
location	Altamont Landfill
wet tons	6,790
cost ($/ton)	Not reported
round trip distance (miles)	70

Millbrae, City of		
	Destination 1	**Destination 2**
type	land application	land application
location	Sacramento	Merced
wet tons	1,691	25
cost ($/ton)	$58.90	$58.90
round trip distance (miles)	200	264

Petaluma, City of		
	Destination 1	**Destination 2**
type	ADC	Lystek A-EQ
location	Hayroad Landfill	Lystek
wet tons	8,100	490
cost ($/ton)	$49.00	$90.00
round trip distance (miles)	108	75

Delta Diablo			
	Destination 1	**Destination 2**	**Destination 3**
type	land application	ADC	compost
location	Solano, Sacramento, and Merced Counties	Hwy 59 landfill	Synagro Central Valley Compost Facility
wet tons	11,545	725	713
cost ($/ton)	$33.29	$33.29	$52.10
round trip distance (miles)	150	200	240

Dublin San Ramon Services District	
type	onsite
location	DSRSD owned land
wet tons	2,786
cost ($/ton)	-
round trip distance (miles)	0

East Bay Municipal Utility District					
	Destination 1	**Destination 2**	**Destination 3**	**Destination 4**	**Destination 5**
type	ADC	ADC	ADC	disposal	land app.
location	Potrero Hills Landfill	Vasco Road Landfill	Altamont Landfill	Altamont Landfill	Merced County
wet tons	18,760	9,551	94	3,315	41,453
cost ($/ton)	$37.40	$37.40	$37.40	$62.00	$29.49
round trip distance (miles)	88	82	82	82	262

East Bay Municipal Utility District (Continued)					
	Destination 6	**Destination 7**	**Destination 8**	**Destination 9**	**Destination 10**
type	Lystek	disposal	disposal	disposal	disposal
location	Lystek OMRC	Forward Landfill	Ox Mountain Landfill	John Smith Landfill	Keller Landfill
wet tons	7,708	2,519	71	867	49
cost ($/ton)	$76.55	$55.00	$65.00	$60.00	$57.50
round trip distance (miles)	76	158	88	192	62

Fairfield-Suisun Sewer District	
type	Lystek
location	Lystek Organic Materials Recovery Center (OMRC)
wet tons	17,500
cost ($/ton)	$55.45
round trip distance (miles)	-

Las Gallinas Valley Sanitary District	
type	land application
location	onsite
wet tons	7,694 wet tons (ang 4.7 % TS)
cost ($/ton)	-
round trip distance (miles)	-

Livermore, City of		
	Destination 1	**Destination 2**
Type	ADC	Land Application
Location	Vasco Road Landfill	Denali Water Solutions site
wet tons	4,100	4,741
cost ($/ton)	$40	$40
round trip distance (miles)	19	175

Mt. View Sanitary District			
	Destination 1	**Destination 2**	**Destination 3**
type	ADC	ADC	Lystek
location	Recology Hay Road Landfill	Potrero Hill Landfill	Lystek Organic Materials Recovery Center
wet tons	575	146	21
cost ($/ton)	$80	$51.91	$99.18
round trip distance (miles)	74	56	42

Napa Sanitation District	
type	onsite
location	onsite
wet tons	6,949
cost ($/ton)	$43
round trip distance (miles)	6

Novato Sanitary District	
type	onsite
location	Designated Land Disposal site
wet tons	12,945 wet tons
cost ($/ton)	$188,500 flat fee
round trip distance (miles)	0

Oro Loma Sanitary District	
Type	land application
Location	Silva Ranch (Synagro - Ione, CA)
wet tons	4,260
cost ($/ton)	$42
round trip distance (miles)	120

Palo Alto, City of	
Type	incineration
Location	Hazardous waste landfill, Kettleman City CA
wet tons	18,406 (in reality sent 6,626 dry tons of ash)
cost ($/ton)	197 (per dry ton of ash)
round trip distance (miles)	372

San Francisco Public Utilities Commission (Continues next page)				
	Destination 1	**Destination 2**	**Destination 3**	**Destination 4**
type	land application	Lystek	ADC	ADC
location	Solano County	Lystek OMRC	Potrero Hills Landfill	Vasco Rd Landfill
wet tons	20,236	5,496	20,285	14,466
cost ($/ton)	$56-$59	$92-$97	$58-$65	$57-$64
round trip distance (miles)	135	100	110	110

San Francisco Public Utilities Commission (Continued)			
	Destination 5	**Destination 6**	**Destination 7**
type	land application	ADC	compost
location	Sacramento County	Altamont Landfill	Merced County
wet tons	3769	362	23
cost ($/ton)	$84-$96	$57-$65	$96-$99
round trip distance (miles)	260	115	290

San Jose, City of	
type	ADC
location	Newby Island Landfill
wet tons	54,874
cost ($/ton)	$30
round trip distance (miles)	2

San Leandro, City of	
	Destination 1
type	Land app
location	Merced County
wet tons	Not provided – 1,248 dry metric tons of Class A and B were land applied
cost ($/ton)	$36 to $38
round trip distance (miles)	

San Mateo, City of				
	Destination 1	**Destination 2**	**Destination 3**	**Destination 4**
type	ADC	ADC	ADC	land application
location	Livermore	Suisun City	Los Banos	Colton
wet tons	158	2,428	888	1,756
cost ($/ton)	$36.82	$36.82	$36.82	$36.82
round trip distance (miles)	116	140	224	870

Santa Rosa, City of (Continues next page)					
	Destination 1	**Destination 2**	**Destination 3**	**Destination 4**	**Destination 5**
type	Compost	Land App	Land App	Land App	Land App
location	Compost Facility	Alpha Storage	Brown Farm	Lystek	Jacobsen
wet tons	8,578	6,773	1,936	510	1,760
cost ($/ton)	$3.25-$4	$4.00	$4.00	$85.26	$10
round trip distance (miles)	1	6	5	106	36-42

Santa Rosa, City of (Continued)					
	Destination 6	**Destination 7**	**Destination 8**	**Destination 9**	**Destination 10**
type	Land App	Land App	Land App	Land App	Land App
location	Leonard	Scallywag	Yenni	BBRRBR	Barella
wet tons	1,530	682	4,943	3,228	830
cost ($/ton)	$10	$10	$12	$10	$10
round trip distance (miles)	50-56	50-56	57-63	52	50
	Destination 11	**Destination 12**	**Destination 13**		
type	Land App	Land App	Landfill		
location	Herzog	Twin House	Redwood Landfill		
wet tons	2,038	1,957	1,758		
cost ($/ton)	$10	$10	$10		
round trip distance (miles)	48-54	48-54	42		

Sewer Authority Mid-Coastside	
type	ADC
location	landfill
wet tons	285
cost ($/ton)	$62.23
round trip distance (miles)	8

Sewerage Agency of Southern Marin	
type	ADC
location	Redwood Landfill
wet tons	1133.04
cost ($/ton)	$96.06/ton
round trip distance (miles)	43.1

Silicon Valley Clean Water					
	Destination 1	**Destination 2**	**Destination 3**	**Destination 4**	**Destination 5**
Type	Biochar	Compost	landfill disposal	ADC	land application
Location	Bioforce Tech	Merced County	Merced County	Solano County	Sacramento County
wet tons	266	964	659	256	6,956
cost ($/ton)	$48	$53	$51	$51	$38 Dry weather, $43 wet weather
round trip distance (miles)	0	250	250	150	250

South San Francisco/San Bruno	
type	ADC
location	Potrero Hills Landfill
wet tons	13,199
cost ($/ton)	$58
round trip distance (miles)	123

Sunnyvale, City of			
	Destination 1	**Destination 2**	**Destination 3**
type	land application	land application	Compost
location	Sacramento County	Merced County	Merced County
wet tons	11,883	66	94
cost ($/ton)	$450. Note that we pay Synagro a flat rate of $450 per dry ton regardless of the end use. It's a high rate because they dewater our solids on-site in addition to hauling/applying them offsite.		
round trip distance (miles)	130	250	220

Union Sanitary District			
	Destination 1	**Destination 2**	**Destination 3**
type	Compost	landfill disposal	land application
location	El Nido / Central Valley Composting Facility	Highway 59 Landfill	Sacramento and Solano Counties
wet tons	6,583.51	1624.27	11,783.80
cost ($/ton)	$56.16/wet ton	$31.94/wet ton	$31.94/wet ton
round trip distance (miles)	242	226	128

Vallejo Flood and Wastewater District	
type	land application
location	Tubbs Island
wet tons	11,632
cost ($/ton)	-
round trip distance (miles)	24

West County Wastewater Agency	
type	ADC
location	Keller Canyon Landfill
wet tons	27,908
cost ($/ton)	$0: barter with Republic
round trip distance (miles)	57