Organic Waste Processing Capacity Study

For the

San Francisco Bay Area Region

Prepared for:

Recology WASTE ZERO

Prepared by:

TOTAL COMPLIANCE MANAGEMENT

Sacramento, California

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Background

The purpose of this report is to quantify the amount of organic waste that San Francisco will need to divert from landfills to comply with California's newest statewide mandates, and identify the amount of additional organic waste processing needed capacity to meet these goals. Specifically, this report will identify food waste quantities to be diverted, which is a more challenging feedstock to recover than yard waste or other organics. Food waste requires a special type of facility in order to be composted, and is subject to a greater regulatory burden than yard waste only composting facilities. This report will then estimate the new composting infrastructure requirements and costs based on projected food waste diversion goals.

The mandates driving the organic waste diversion goals, described below, each have an organic waste diversion target and a time frame. These tonnage targets are described in the following section and are based on the best publically available data.

AB 1826

In October of 2014 Governor Brown signed AB 1826 into law requiring businesses to recycle their organic waste on and after April 1, 2016, depending on the amount of waste they generate per week. This law also requires that on and after January 1, 2016, local jurisdictions across the state implement a commercial **Organic Waste Recycling Program** to divert organic waste generated by businesses. Jurisdictions must conduct outreach, education, and monitoring to ensure qualified business participate and comply with the law. The ultimate goal of the bill is to divert 50% of organics disposal from commercial businesses by 2020 as compared to 2014, estimated at 8.1 million new statewide tons of organics by 2020.

Specific requirements for the Organic Waste Recycling Program include:

- ✓ Identification of the number of regulated businesses that generate organic waste.
- ✓ Education, Outreach, and Monitoring following the AB 341 (Mandatory Commercial Recycling) regulations.
- ✓ Existing organic waste recycling facilities within a reasonable vicinity and the capacities available for materials to be accepted at each facility.
- ✓ Existing solid waste and organic waste recycling facilities within the jurisdiction that may be suitable for potential expansion or colocation of organic waste processing or recycling facilities.
- ✓ Efforts of which the jurisdiction is aware that are underway to develop new private or public regional organic waste recycling facilities that may serve some or all of the organic waste recycling needs of the commercial waste generators within the jurisdiction subject to this chapter, and the anticipated timeframe for completion of those facilities.
- ✓ Closed or abandoned sites that might be available for new organic waste recycling facilities.
- ✓ Other non-disposal opportunities and markets.
- ✓ Appropriate zoning and permit requirements for the location of new organic waste recycling facilities.

- ✓ Incentives available, if any, for developing new organic waste recycling facilities within the jurisdiction.

AB 1826 phases in the mandatory recycling of commercial organics. The implementation schedule outlined is as follows:

- ✓ **January 1, 2016 |** On and after this date, local jurisdictions must have an Organic Waste Recycling Program in place. Jurisdictions must identify regulated businesses and conduct outreach and education to inform those businesses how to recycle organic waste in the jurisdiction, and monitor to identify those not recycling and inform them of the law and how to recycle organic waste.
- ✓ **April 1, 2016 |** Businesses that generate 8 cubic yards of organic waste per week must arrange for organic waste recycling services.
- ✓ **January 1, 2017 |** Businesses that generate 4 cubic yards of organic waste per week must arrange for organic waste recycling services.
- ✓ **August 1, 2017 and ongoing |** Jurisdictions must provide information about their Organic Waste Recycling Program implementation in the annual report submitted to CalRecycle.
- ✓ **Fall 2018 |** After receipt of the 2017 annual reports submitted on August 1, 2018, CalRecycle shall conduct its formal review of those jurisdictions that are on a two-year review cycle.
- ✓ **January 1, 2019 |** Businesses that generate 4 cubic yards or more of commercial solid waste per week must arrange for organic waste recycling services.
- ✓ **January 1, 2020 |** On or after January 1, 2020, if CalRecycle determines that the statewide disposal of organic waste has not been reduced by 50% of the level of disposal in 2014, the organic recycling requirements on businesses will expand to cover businesses that generate 2 cubic yards or more of commercial solid waste per week. Additionally, certain exemptions may no longer be available if the 2020 target is not met.
- ✓ **Fall 2020 |** After receipt of the 2019 annual reports submitted on August 1, 2020, CalRecycle shall conduct its formal review of all jurisdictions. CalRecycle will continue to conduct the two- and four-year reviews after this cycle.

SB 1383

The recently adopted Senate Bill 1383 has identified the reduction of methane generation of organic waste as a prioritized climate change mitigation strategy. As such, SB 1383 mandates reduction in the landfilling of organic waste and thereby methane emissions.

Specifically, this bill adds two goals for organic waste disposal reductions:

- ✓ A 50% reduction in the level of statewide disposal of organic waste from the 2014 level by 2020.
- ✓ A 75% reduction in the level of statewide disposal of organic waste from the 2014 level by 2025.

As with AB 1826, this law authorizes jurisdictions to impose requirements upon waste generators as a means of reaching the organic waste reduction targets. Jurisdictions may impose penalties on generators for non-compliance, and collect fees to recover costs incurred in complying with the regulations.

By 2020, the California Air Resources Board shall analyze the progress made by state government, local governments, and the waste sector in achieving the 2020 and 2025 waste reduction goals. This analysis will include:

- ✓ Status of new organics recycling infrastructure development, including the commitment of state funding and appropriate rate increases for solid waste and recycling services to support infrastructure expansion.
- ✓ Progress made in reducing barriers to the siting of organics recycling facilities and the timing and effectiveness of policies that will facilitate the permitting of organic's recycling infrastructure.
- ✓ Status of markets for the products generated by organics recycling facilities.

This report will identify both 2020 and 2025 organics disposal targets for San Francisco, as well as provide a benchmark for measuring the above goals.

AB 1594

The Integrated Waste Management Act of 1989 (AB 939) established statewide goals for recycling, and sought to achieve 50% landfill diversion of solid waste by the year 2000. Under current regulations, the use of green waste material as alternative daily cover (ADC) at a landfill is considered 'diversion' for the purposes of AB 939. However, with the adoption of AB 1594 diversion credits for the use of green waste ADC will be phased out.

Beginning January 1st 2020, the use of green material as ADC will no longer be considered diversion for reporting purposes. Rather, this material will count towards the jurisdiction's disposal rate. AB 1594 requires local jurisdictions to report on how they will maintain diversion requirements and divert green material that is currently being used as alternative daily cover. Jurisdictions that fail to meet a diversion requirement as a result of no longer being able to claim diversion for the use of green materials as ADC are required to write an annual report. This annual report will explain the barriers to recycling green material, and how the jurisdiction plans on addressing them.

This law will affect the demand for organic materials recycling facilities throughout the state, as jurisdictions that have depended on ADC credit for AB 939 compliance are compelled to find new ways to divert this material. Since green waste ADC is currently not reported as 'disposal', these tons of material are not included in the targets of AB 1826 and SB 1383, but will require organics recycling infrastructure all the same.

AB 876

This law requires regional agencies to include in their annual reports estimates of the amount of organic waste, in cubic yards, that will be generated in the region over a 15-year period. Furthermore, the regional agencies must identify the amount of organic waste recycling capacity available from facilities to process that amount of waste. The bill requires locations for new and expanded organic waste recycling facilities to be identified to meet the remaining capacity needs.

The purpose of this report is to evaluate these organics processing capacity needs for the City and County of San Francisco. Consideration of the impacts of AB 1826, SB 1383, AB 1594, and population growth are all essential components of this evaluation. Once determined, the amount of required organics recycling capacity will be considered within the context of existing regional capacity. The costs of maintaining this existing capacity and developing new capacity will then be estimated to provide an understanding of the resources required to meet the requirements of all of California's organic waste diversion mandates.

Organic Waste Diversion Timeline

The above legislation can be summarized into several distinct goals which the City of San Francisco will have to meet. These goals are as follows:

1) **AB 1826**: Reduce disposal of commercial organic waste to 50% of 2014 levels by 2020.
2) **SB 1383**: Reduce disposal of all organic waste to 75% of 2014 levels by 2025.
3) **AB 876**: Demonstrate adequate organic waste processing capacity for AB 1826 and SB 1383 for 15 years (until 2031).

2020

For both AB 1826 and SB 1383, 2014 is set as the benchmark year for setting organics diversion goals. These 2014-based goals are applied throughout California, however jurisdictions within the state vary widely with respect to the amount of organics diversion infrastructure in place that year. In 2014, some jurisdictions had little to no organics diversion programs. Other jurisdictions however, such as San Francisco, had robust organics recycling programs established by 2014.

San Francisco is therefore in a unique position with respect to these statewide goals. The amount of organic waste disposed of in San Francisco in 2014 is lower as a result of these programs, thus its 2020 targets for organics disposal are likewise lower (50% disposal reduction of commercial organics for AB 1826, and 50% of all organics for SB 1383). This may cause San Francisco to face a greater challenge when asked to reduce its organics disposal 50%, as many of the less expensive and easier diversion strategies are already in place. Conversely, San

Francisco may also find achieving its 2020 targets facilitated by the collection and diversion infrastructure already in place.

Whether achieving 50% organic waste disposal reductions is more or less difficult for San Francisco than for other cities, the calculation of these targets remain the same; A determination of the amount of total organic waste disposed of in 2014 (per SB 1383), and a determination of the amount of *commercial* organic waste disposed of in 2014 (per AB 1826) must be made. Overall disposal figures for this jurisdiction are available through CalRecycle's disposal reporting system, and reveal that a total of **529,782 tons** of material were disposed of by San Franciscans in 2014.

AB 1826 Calculation

For the sake of computing the amount of commercial organic waste disposed of in 2014 for AB 1826, the proportion of this waste attributable to the commercial sector is required. The best estimate for the share of disposal belonging to the commercial sector can be found in CalRecycle's 2008 Waste Characterization Study which finds estimates this figure at **49.5%**. Applying this to San Francisco's disposal figures suggest that **262,372 tons** of material were disposed of by the commercial sector in 2014.

Table 1: Calculation of San Francisco's AB 1826 New Tons

Calculation	Tonnage		Data Source
Disposal Amount in 2014	529,782	total tons disposed	CalRecycle Disposal Reporting System
49.5% of Total Disposal is Commercial	262,372	tons of commercial disposal	2008 State Waste Characterization
47.8% of SF Commercial Disposal is Organic	125,414	tons of organic commercial disposal	2006 SF Waste Characterization
AB 1826 Target - 50% reduction by 2020	62,707	target tons of organic commercial disposal	AB 1826 Law Text
New Tons to be Diverted by 2020 with Population Growth	84,619	total new tons of organics	Dept. of Finance: Population Growth
92.5% of Organics in SF are Compostable Paper/Food	**78,246**	**total new tons of food and compostable paper**	2006 SF Waste Characterization

Lastly, to determine how much of this commercial disposal was organic a region-specific characterization is used. The 2006 San Francisco Waste Characterization suggests that **47.8%** of commercial disposal in San Francisco is compostable (organic). Of this **38.6%** is estimated to be food scraps, and **5.6%** compostable paper. This results in a 2014 commercial organics disposal amount of 125,414 tons, and a 2020 goal of disposing of fewer than **62,707 tons per year.** Given San Francisco's projected population growth rate, **84,619 new tons** of organic waste will need to be diverted to reach AB 1826's 50% reduction in 2020.

Given the proportion of food waste and soiled paper in this waste stream (44.2% of all commercial disposal/92.5% of commercial organics disposal), the amount of this material can be ascertained. Meeting the diversion goals of AB 1826 will require a total of **78,246 tons** of new diversion to facilities permitted to handle food waste, as soiled paper is not an appropriate feedstock for green waste only facilities.

SB 1383 Calculation

As with AB 1826, the calculation of SB 1383's target disposal rates for San Francisco relies upon waste characterizations and reported disposal tonnages. Unlike AB 1826, SB 1383 applies to *all* sectors of waste generation: commercial, residential, and self-haul. As such, SB 1383's goals are more ambitious in terms of new tons to be diverted than AB 1826. The San Francisco overall disposal stream is estimated to comprise **36.2%** organic waste, **26.8%** of which is food waste and **5.5%** of which is compostable paper. Given these percentages, San Francisco discarded **191,781 tons** of organic waste in 2014 and will have to reduce this amount to **95,891 tons** in 2020 to contribute to California's SB 1383 goals. Population growth will force San Francisco to develop **129,399 new tons** of diversion capacity to meet this target in 2020.

Table 2: Calculation of San Francisco's SB 1383 New Tons			
Calculation	**Tonnage**		**Data Source**
Disposal Amount in 2014	529,782	total tons disposed	CalRecycle Disposal Reporting System
36.2% of SF Total Disposal is Organic	191,781	tons of total organic disposal	2006 SF Waste Characterization
SB 1383 Target - 50% Reduction by 2020	95,891	tons of total organic disposal	SB 1383 Law Text
New Tons to be Diverted by 2020 with Population Growth	129,399	new tons of organics	Dept. of Finance: Population Growth
89.2% of Organics in SF are Compostable Paper/Food	**115,458**	**total new tons of food and compostable paper**	2006 SF Waste Characterization

Food and food soiled paper waste represents 32.3% of all disposal, or 89.2% of organics disposal. As such, on average SB 1383 will require **115,458 new tons** of food waste capacity.

Summary of San Francisco's Food Waste Capacity Needs

To meet the goals of AB 1826 and SB 1383 San Francisco must divert **129,399 new** tons of organic waste by 2020. At least **84,619 tons** of this will be from the commercial sector, and **115,458 tons** of the total is expected to be food or compostable paper.

2025

Although the mandate of AB 1826 extends only to 2020, SB 1383's goals persist to the year 2025. SB 1383 sets a Statewide target of a 75% reduction in this disposal of all organic material by 2025. As established earlier, San Francisco disposed of an estimated 191,781 tons of organic waste in 2014. Reducing this amount 75% results in a 2025 organics disposal target of **47,945 tons**. Given expected population growth in the region, this will require **187,681 tons** of new organics diversion, **167,681 tons** of which would be food waste.

2031

At present, there are no pieces of legislation mandating further expansion of diversion programs beyond 2025. However, maintaining SB 1383's organic materials disposal limit in the face of persistent population growth will continue to present a diversion challenge. By 2031, **176,747 new tons** of food waste processing capacity will be required. Demonstrating adequate capacity for these tons is required by AB 876 (15 years of compost capacity – 2016 to 2031). AB 876 will likely accelerate competition for the region's limited food waste processing capacity as jurisdictions identify projected needs and plan for meeting this 15-year horizon.

Table 3: New Tons of Food Waste to be Diverted Timeline		
2020	2025	2031
115,458	167,461	176,747

Existing and Projected Regional Food Waste Processing Capacity

As mandated diversion of food waste and other organics increases, it is necessary for San Francisco to ensure there is adequate capacity at organics processing facilities to accept and process this material. This capacity, as provided by each facility, is constrained by several factors including:

- Is the facility reasonably close to the San Francisco collection area?
- Is it permitted to handle food waste, and if so how many tons per year can it accept?
- Of these permitted tons, how many can the facility feasibly process in a year?
- Of this feasible capacity, how much is being used to process existing material flows?
- Of the remaining unused capacity, how much will be needed to address other local AB 1826 diversion needs?

After considering the above constraints, the amount of remaining food waste processing capacity for San Francisco can be ascertained. The difference between the new tons to be diverted in Table 3, and the amount of existing capacity represents the amount of new regional capacity to be developed in order to address San Francisco's forecasted food waste diversion needs. As described in the text and Figure 1 below, multiple factors reduce the amount of food waste processing capacity that will be available to San Francisco. The shortfalls in this available capacity will need to be addressed with new or expanded food waste processing facilities.

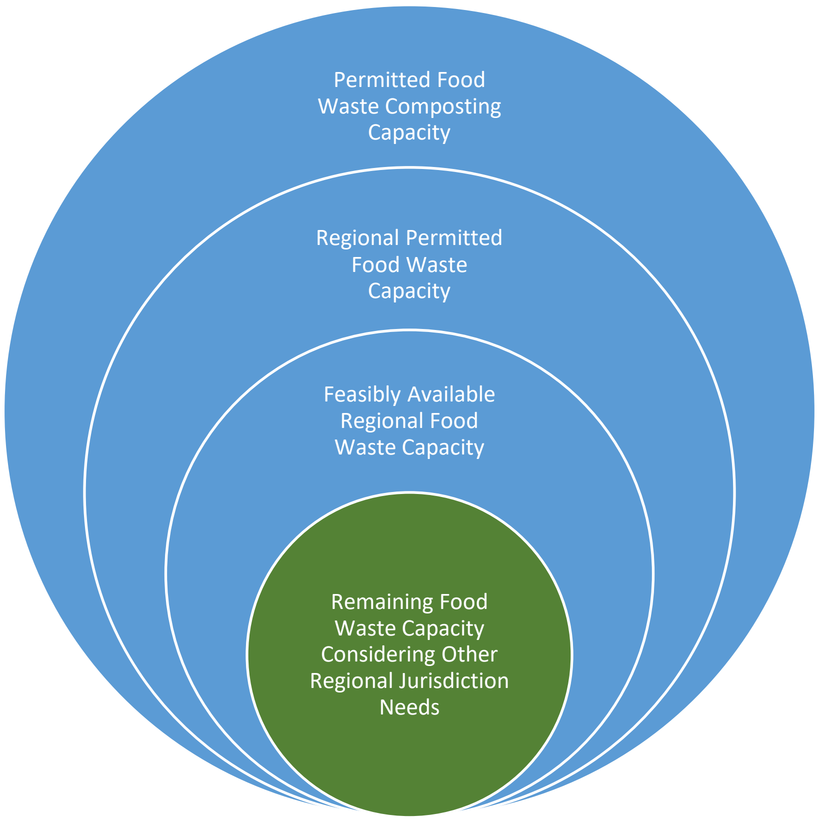


Figure 1- Food Waste Processing Capacity Available to San Francisco

Regional Permitted Food Waste Facilities

CalRecycle's website hosts information pertaining waste processing facilities in its Facility Information Toolbox (FacIT) and Solid Waste Information System (SWIS). These tools provide the location, acceptable feedstocks, and permitted capacity of organics processing facilities throughout the state. Regional permitted capacity is determined by tallying all active food waste processing facilities within a 100 mile radius of Recology's 501 Tunnel Road facility.

Feasible Capacity

Of the permitted capacity for food waste that is available in the region, not all of it will necessarily be available for the diversion of San Francisco's food waste. Some facilities may be permitted to process more material than their current operations can actually process due to technical, logistic, or other constraints. For instance, although a facility may be permitted to compost a certain amount of green and food waste each year, it may find that dedicating 100% of that capacity to food waste is infeasible due to the excessive moisture or density involved in processing a food waste only feedstock. For the purposes of estimating food waste processing capacity, this study assumes that no more than 40% by weight of remaining organics capacity can be used to process food waste.

Other constraints on the amount of processing capacity a facility has to process food waste could be daily tonnage limits, storage availability, staffing, and limitations of the processing equipment, which may have been established during land use permitting, or other regulatory permitting, including under the authority of CalRecycle or local air districts, most typically. These constraints, where known, are considered for each of the regional permitted facilities to determine whether technical or permitting limitations are binding on maximum food waste processing capacity.

Existing Use of Available Capacity

Food waste processing facilities in the region are already processing waste materials, and therefore not all of the capacity at the facilities can be used to process *new* tons. While existing throughput is sometime difficult to quantify for lack of publically available data, known throughputs are counted against available capacities when available. Facilities which are known to either not be accepting food waste or that are at capacity are considered having '0' remaining tons of food waste processing capacity.

Future Demand for Food Waste Processing Capacity

Although regional food waste processing capacity may be available given current throughputs of material, San Francisco is not the only jurisdiction subject to the expanded diversion requirements of AB 1826 and SB 1383. As such, the future food waste processing capacity needs of these other counties must be considered when determining how much regional available capacity San Francisco will have. Estimates of the future demands of other jurisdictions in the region are determined on a county by county basis using 2014 disposal figures and the 2008 and 2014 Waste Characterizations. Using the statewide average of 49.5% of disposal being commercial, and that 51.1% of these commercial organics are either food wastes or compostable paper wastes, future AB 1826 food waste processing capacity for these counties is calculated. Population growth for each of these counties is also taken into consideration based on forecasts from the Department of Finance.

Table 4 below summarizes each county's projected *new* tons of food waste infrastructure needed, current available capacity within the county, and the net capacity remaining for the region. As evidenced in the table below, only Stanislaus County will have sufficient food waste processing capacity for its own diversion needs. Overall, there is a **227,451 ton** regional deficit of food waste composting infrastructure, which will need to be addressed through the development of new and expanded facilities.

Table 4: 2020 Regional Surplus/Deficit Food Waste Processing Capacity with AB 1826 (tons)				
County	AB 1826: 2020 Target New Tons	Food Waste Portion	Remaining FW Capacity	Net Food Waste Capacity
San Francisco	84,619	78,246*	0	-78,246
San Mateo	63,806	26,779	0	-26,779
Alameda	134,524	56,458	6,600	-49,858
Marin	19,304	8,102	0	-8,102
Contra Costa	83,714	35,134	20,000	-15,134
Santa Cruz	20,109	8,439	0	-8,439
Monterey	40,981	17,199	0	-17,199
Santa Clara	148,105	62,158	55,944	-6,214
Sonoma	39,279	16,485	0	-16,485
Napa	14,324	6,011	0	-6,011
Solano	40,888	17,160	0	-17,160
Sacramento	138,095	57,957	0	-57,957
San Joaquin*	79,906	33,535	1,100	-32,435
Stanislaus	60,042	25,199	146,383	121,185
Yolo	20,533	8,618	0	-8,618
Total	**988,230**	**457,479**	**230,027**	**-227,451**

Notes

San Francisco has a relatively higher proportion of food waste among organics than other counties. Other counties are modelled using the statewide waste characterizations, which assume higher proportions of green waste than the largely paved and relatively un-vegetated San Francisco County.

* Harvest Power in Lathrop is permitted only to receive food waste from residential sources where it is co-collected with green waste, with a maximum of 15% food waste, a program not currently in place in San Francisco.

It is important to observe that this estimate of food waste processing capacity is conservatively based off of the requirements of AB 1826 rather than of SB 1383, under which regulations will not be effective until 2022. SB 1383 requires greater amounts of organics diversion than AB 1826 as it applies to *all sectors* rather than just *commercial* organics. For instance, in San Francisco an estimated total of 115,458 tons of food waste shall be diverted under SB 1383, yet only 78,246 tons are required under AB 1826.

The facility by facility determination of remaining capacity used in **Table 4** above is based on whether a facility is currently accepting food waste, and if so, an estimate of how many more tons per year can be accepted. **Table 5** on the following page identifies all of these facilities, and lists the remaining facilities which still may have food waste processing capacity.

Table 5: Remaining Regional Food Waste Processing Capacity by Facility (tons)			
Facility	County	Total Permitted Throughput	Remaining Feasible Capacity
Blue Line Transfer MRF And TS	San Mateo	11,200	0
East Bay Municipal Utility District	Alameda	36,500	6,600
Central Marin Sanitation Agency (CMSA)	Marin	2,600	0
Redwood Sanitary Landfill/WM Earthcare	Marin	8,250	0
WCCSLF Organic Materials Processing	Contra Costa	130,000	20,000
AgroThrive, Inc.	Monterey	2,600	0
Monterey Regional Wst Mgmt Dst/Marina LF and SmartFerm Composting	Monterey	9,900	0
Newby Island Sanitary Landfill*	Santa Clara	87,360	18,944*
South Valley Organic Composting	Santa Clara	195,980	0
Z-Best Composting Facility	Santa Clara	218,400	0
Zero Waste Energy Development San Jose AD Facility**	Santa Clara	90,000**	37,000
City of Napa Materials Diversion Facility	Napa	75,000	0
Clover Flat Resource Recovery Park	Napa	7,888	0
Upper Valley Recycling, Inc.	Napa	3,000	0
Jepson Prairie Organics Composting Facility	Solano	30,938	0
Clean World Partners AD at SATS	Sacramento	5,330	0
Harvest Power, Inc.***	San Joaquin	23,250	0***
Tracy Material Recovery T.S./Tracy-Delta Disposal	San Joaquin	9,446	0
Forward Landfill, Inc. Resource Recovery Facility	San Joaquin	100,000	0
City Of Modesto Co-Compost Project	Stanislaus	5,958	1,583
Recology Blossom Valley Organics North	Stanislaus	624,000	144,800
UC Davis READ Facility	Yolo	18,250	0
Northern Recycling Compost - Zamora	Yolo	20,000	0
	Total	**1,715,850**	**228,927**

Notes

For "Permitted Food Waste" Some Composting Facilities permitted capacities are listed in cubic yards, these capacities are converted to tons assuming 770 lbs. /cubic yard densities. Capacities are taken from CalRecycle's SWIS database, and represent only those facilities permitted to compost or digest food waste.

* Newby Island Sanitary Landfill is included here, yet may cease composting operations by December 31, 2017 depending on whether or not aerated static pile technology, mandated by a recent legal settlement is implemented.

** ZWED is permitted for up to 182,500 tons annually, however this capacity is dependent on construction of Phase 2 digester. Current capacity is limited to 90,000 tons annually as described in Transfer/Processing Report for current, Phase 1 digester.

*** Harvest Power in Lathrop is permitted only to receive food waste from residential sources where it is co-collected with green waste, a program not currently in place in San Francisco.

Required New Organics Capacity

As evidenced by the regional analysis above, existing regional capacity can be used to absorb **228,927 tons** of food waste diversion. However, with the implementation of AB 1826 and SB 1383, this capacity will be oversubscribed by nearly a factor of two as other jurisdictions divert food waste from their own landfills. Regionally, there is a projected deficit of at least **228,551 tons** of food waste processing capacity. In order to achieve the State's objectives, new capacity will need to be developed to process this material. This new capacity can be developed either by expanding existing programs and facilities, or developing new ones.

Expanding Existing Programs and Facilities

Given the close 2020 horizon of AB 1826 and SB 1383, and the length of time necessary to permit and construct new facilities, expanding the capacity of existing infrastructure is an attractive tool to address short-term capacity needs. Although not every program or facility has the potential for expansion, several operations could potentially be enhanced to accommodate a portion of the region's future food waste diversion needs. Given the magnitude of the regional processing capacity deficit, and the limited number of viable facilities, it is unlikely that expansion of existing facilities alone will significantly impact the food waste processing needs for San Francisco.

Develop New Capacity:

To address the long term food waste diversion needs of San Francisco, some new facilities must be sited, permitted, and put into operation. This is especially important for addressing the more stringent diversion requirements of SB 1383 in 2025, and AB 876's 2031 processing capacity. Since these facilities will need to be able to process food waste and food soiled paper, they must adhere to a stricter set of environmental standards. This in turn raises development costs. Depending on how much food waste capacity can be attained through the expansion of existing programs and facilities, one or more new facilities will need to be sited in the region. Facilities can vary in size and capacity, and can be right-sized to meet the jurisdictions needs.

Despite the regional shortfall, San Francisco need only to procure capacity for its own 176,474 tons of food waste by 2031 as described earlier in Table 3. Given that food waste can at best comprise 40% of an operations throughput, approximately 450,000 tons of organic processing capacity must be developed within a reasonable proximity of San Francisco. The remaining 60+% of the capacity would then be used for other feedstocks such as yard waste.

For the purposes of this analysis, three scenarios are employed below to address this need.

Table 6: Possible Scenarios for Developing Necessary Food Waste Processing Infrastructure				
Scenario	**Facility Size (tons/year)**	**Food Waste Capacity (tons/year)***	**Number of Facilities**	**Total Food Waste Capacity (tons/year)**
Scenario 1	150,000	60,000	3	180,000
Scenario 2	225,000	90,000	2	180,000
Scenario 3	450,000	180,000	1	180,000

*Assuming compost operations cannot effectively process food waste in excess of 40% of total incoming feedstock weight.

Given the current economics of composting in this region, facilities with smaller annual throughputs are less viable. As such, Scenario 3 in which one 450,000 TPY facility can address all of San Francisco's food waste diversion needs through 2031 is the lowest cost scenario. Conversely, developing three 150,000 TPY facilities as in Scenario 1, is the least cost-effective option modelled here.

Regulatory Constraints and Cost Impacts

Maintaining existing capacity and developing new necessary capacity for food waste diversion may be a costly endeavor. In addition to construction, capital investments, operational costs, and other expenses there are substantial costs incurred in meeting the environmental standards of regulatory agencies. These costs include investments in technologies that mitigate the negative externalities that can occur during operation of a food waste processing facility.

The development costs of new or expanded facilities will be incorporated into tipping fees resulting in greater costs to haulers depositing food waste at these facilities. These costs will be greater than historic composting costs due to stricter regulations by regional water boards and air districts requiring additional operational expenses (e.g. concrete pads, covered aerated static piles, linings) for facilities, which have yet to be implemented at most facilities. In the case of meeting the new General Waste Discharge Requirements for Composting Operations, facilities may have until 2021 or 2022 to complete improvements.

Even in the absence of developing new capacity, increases in regulatory requirements will incur costs on existing food waste processing facilities. These costs include updated requirements from the California Water Resources Control Board, the regional Air Quality Control districts, and other regulatory agencies.

The purpose of this section is to estimate the additional regulatory costs that would be encountered by the three scenarios described in **Table 6**. These costs, expressed in dollars per year, would be additional costs incurred on top of regular operating costs. Costs for this new infrastructure fall into the following five categories.

- Water Board Compliance Costs
- Air District Compliance Costs
- Permitting Costs
- Land Costs for New Facility
- Construction Costs

Costs for each of these items are spread over the useful life – estimated in this case at 20 years – of the composting facilities to arrive at annual costs.

Water Board Regulations and Costs

New regulations put forth by the Water Resources Control Board have implications for composting facilities throughout the state. These regulations may require facilities to install costly infrastructure and monitoring to mitigate water impacts of their operations.
The Water Resources Control Board conducted an economic analysis of these regulations to ascertain the amount of cost burden compost facilities would bear to achieve compliance. Using pad size, amount of compost processed, and precipitation as inputs, the Water Board developed a model for estimating these costs.

Based on the Water Board's methodology and an assumption of one pad acre for each 5,000 tons per year processing capacity, several different sized compost facilities' associated regulatory costs are estimated below.

Table 7: Water Board Regulatory Costs to Compost Facilities				
Food Waste Tons per Year*	**Total Tons per Year****	**Estimated Pad Area (acres)**	**Annual Cost of Regulations*****	**Cost per ton of Food Waste**
60,000	150,000	30	$774,127	$12.90
90,000	225,000	45	$1,157,039	$12.86
180,000	450,000	90	$2,305,744	$12.81

* The technical limitations of food waste processing are estimated to be 40% by weight of the total feedstock processed at the facility.
** Food waste is estimated as having a density of 1,100 pounds per cubic yard, whereas yard waste is estimated to have a density of 550 pounds per cubic yard.
***Costs for all facilities modelled as choosing pads as opposed to groundwater monitoring. Recology has received bids from $270,000/acre to $300,000 per acre to build its pads. The lower figure is used for this analysis.

Air Districts' Regulations and Costs

The Bay Area Air Quality Management District (BAAQMD), San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), and other agencies are responsible for air quality regulatory enforcement for the counties within a 100 mile radius of San Francisco. These bodies are concerned with emissions of odors, volatile organic compounds, particulate matter, and other air emissions potentially generated at a compost facility. As such, the BAAQMD and SJVUAPCD hold compost facilities to environmental requirements which have associated costs to the facilities. A 2010 SJVUAPCD assessment of these costs produced the following cost range estimates for establishing engineered composting controls, which is the current baseline technology required for compliance with regional air quality requirements.

These annual costs are modelled by SJVUAPCD as a function of feedstock throughput, and are adjusted for inflation to estimate the regulatory costs for Scenarios 1, 2, and 3 below.

Table 8: Annual Engineered Control Costs for Air District Compliance

Scenario	Throughput (tons/year)	Weighted Cost Average per Ton	Estimated Annual Cost
Scenario 1	150,000	$3.91	$585,750
Scenario 2	225,000	$3.51	$788,625
Scenario 3	450,000	$3.73	$1,678,500

Permitting Costs

The development of 450,000 new tons of organics processing capacity necessary to accommodate San Francisco's food waste diversion needs (176,747 tons per year) will incur permitting costs associated with siting new facilities. The California Environmental Quality Act (CEQA) and regulations such as those pertaining to the development of solid waste facility apply to large composting operations, especially those processing food material. Annual cost estimates for attaining the appropriate permitting are estimated in **Table 9:** Assuming 5.75% interest over a ten year period yields an estimated mean annual cost of permitting of $173,871 per year.

Table 9: Permitting Costs for New Composting Facilities			
Activity	**Low Cost**	**High Cost**	**Mean Cost**
Land Use Permitting	$25,000	$200,000	**$112,500**
CEQA EIR and associated Studies	$450,000	$1,000,000	**$725,000**
Air District Permitting New Source Review, Emissions Testing, Emissions Offsets, Fees	$50,000	$500,000	**$275,000**
Water Board Permitting Technical Report Development	$30,000	$60,000	**$45,000**
Solid Waste Facility Permitting	$75,000	$200,000	**$137,500**
Total Cost:	**$630,000**	**$1,960,000**	**$1,295,000**

Land Costs for Developing a New Facility

New compost facilities will need to be sited on sufficiently large parcels of land, with access to roads, and adequate spacing from sources of complaints such as residents and businesses. Furthermore, such a facility would need to be sited reasonably close to the San Francisco Bay to lower transportation costs. This is likely to prove challenging given the scarcity of inexpensive open land in the San Francisco Bay Area.

Current prices for industrial-zoned properties of adequate size range from $65,000 to $200,000 per acre, for a mean price of $132,411 per acre, based upon current listings on Loopnet, the results of which are attached as an Appendix.

Table 10: Land Acquisition Costs for New Composting Facilities					
Scenario	**Throughput (tons/year)**	**Estimated Facility Size (acres)**	**Mean Cost/Acre Industrial Land In Region**	**Total Land Cost**	**Annual Repayment Cost**
Scenario 1	150,000	42.8	$132,411	$5,667,191	$760,896
Scenario 2	225,000	64.3	$132,411	$8,514,027	$1,143,121
Scenario 3	450,000	128.6	$132,411	$17,028,054	$2,286,242

Capital Expenditures for Developing a New Facility

The initial capital expenditure on equipment and construction for new facilities are costs that investors in new facilities will expect to recover over time. These costs, evaluated in dollars per year, are estimated in **Table 11** below.

Table 11: Estimated Other Capital Expenditures for New Facilities			
Capital Expense	**Scenario 1**	**Scenario 2**	**Scenario 3**
Compost Turner	$450,000	$900,000	$1,350,000
Loader	$200,000	$400,000	$600,000
Screening Plant	$320,000	$640,000	$960,000
Back up Screens	$320,000	$640,000	$960,000
Water Truck	$85,000	$170,000	$255,000
Fire Suppression System	$50,000	$75,000	$150,000
Litter Control Fence	$50,000	$75,000	$150,000
Total	$1,475,000	$2,900,000	$4,425,000
Annual Repayment Cost*	$198,038	$389,363	$594,115

*Amortized costs based off of 5.75% interest rate, and a 10 year repayment period.

Total Costs of Developing New Capacity

Table 12: Estimated Annual Costs for New Infrastructure			
Scenario	**One**	**Two**	**Three**
Water Board Costs	**$774,137**	**$1,157,039**	**$2,305,744**
Air District Costs	**$649,341**	**$874,241**	**$1,860,725**
Permitting Costs	**$173,871**	**$173,871**	**$173,871**
Land Costs	**$760,896**	**$1,143,121**	**$2,286,242**
Capital Costs	**$198,038**	**$389,363**	**$594,115**
Cost per Facility	**$2,556,284**	**$3,737,636**	**$7,220,697**
Facilities to Meet Capacity Needs	**3**	**2**	**1**
Total Annual Cost:	**$7,668,851**	**$7,475,272**	**$7,220,697**
Cost/Ton of Organic Material	**$17.04**	**$16.61**	**$16.05**

Summary

The total costs of developing adequate food waste processing capacity for San Francisco for the State's mandates is conservatively estimated to be between **$7,220,697** and **$7,668,851 per year.** These are the costs associated with developing the new infrastructure that San Francisco will need to process **115,458 tons** of food waste in 2020, **167,461 tons** of food waste in 2025, and **176,747 tons** of food waste in 2031 in accordance with **AB 1826, SB 1383,** and **AB 876** respectively.

Given that existing regional capacity will be oversubscribed by 2020, and that food waste can at most comprise 40% of a new composting facility's throughput, at least 450,000 new tons of annual organics processing capacity will be required to meet San Francisco's needs. As the 40% limit of food waste is a conservatively high estimate, it is likely that more than 450,000 tons per year of capacity will be required.

Facilities benefit from economies of scale, thus the low cost range estimate for this capacity is the development of a single 450,000 ton per year facility. The high-end cost estimate for such an endeavor is estimated as the cost of developing three 150,000-ton-per-year facilities.

When expressed in terms of costs per ton, the above costs amount to **$16.05** to **$17.04** per ton of organic material. These costs are only the per ton costs of infrastructure development, and do not include operating expenses, profit, or consideration of sale of final compost product. Operating expenses comprise the majority of the embedded costs reflected in a tip fee and can vary significantly from one facility to another.

Sources

AB 1826: Text of the Law. http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB1826

SB 1383: Text of the Law. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383

AB 876: Text of the Law. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB876

San Francisco's 2014 Disposal.

California Department of Resource Recovery (CalRecycle), Disposal Reporting System. Accessed October 2016. **http://www.calrecycle.ca.gov/LGCentral/Reports/Viewer.aspx?P=ReportYear%3d2014%26ReportName%3dReportEDRSJurisDisposalByFacility%26OriginJurisdictionIDs%3d438**

Population Projection.

California Department of Finance, Demographic Research Unit, "State and County Total Population Projections by Race/Ethnicity and Detailed Age", December 15, 2014.

http://www.dof.ca.gov/research/demographic/reports/projections/P-3/

Waste Characterization.

- California Department of Resource Recovery (CalRecycle), "California 2008 Statewide Waste Characterization Study", November 10, 2009. Cascadia Consulting Group.
- California Department of Resource Recovery (CalRecycle), "2014 Disposal-Facility-Based Characterization of Solid Waste in California", October 6, 2015. Cascadia Consulting Group.

https://www2.calrecycle.ca.gov/WasteCharacterization/Study

San Francisco Waste Characterization

- Environmental Science Associates, "Waste Characterization Study Prepared for the City and County of San Francisco Department of the Environment", March, 2006.

http://sfenvironment.org/sites/default/files/fliers/files/sfe_zw_waste_characterization_study_2006.pdf

Regional Permitted Food Waste Facilities

- California Department of Resource Recovery (CalRecycle), "Solid Waste Information System Facility Database", Accessed October 2016.

http://www.calrecycle.ca.gov/SWFacilities/Directory/Search.aspx

Existing and Feasible Use of Permitted Capacity

- Discussions with the California Compost Coalition and Recology, October 2016.

- Integrated Waste Management Consulting, LLC, “Food Scraps Capacity in the Bay Area 2013 Benchmark Data – Final Report”, April 2013.

Water Resources Control Board Regulatory Costs

- California State Water Resources Control Board, “Draft Environmental Impact Report: General Waste Discharge Requirements for Composting Operations”, Appendix D “Economic Considerations”. July 20, 2015.
- Costs of Pad Development, Bids Received by Recology. Phone conversation, December 6th, 2016.

http://www.waterboards.ca.gov/water_issues/programs/compost/docs/deir_apxd.pdf

Air Districts’ Regulations and Costs – Engineered Control Costs

- San Joaquin Valley Unified Air Pollution Control District “Draft New Rule 4566 (Composting and Related Operations) Costs and Cost Effectiveness Analysis, Appendix C”, September 22, 2010.

http://www.healthysoil.org/images/Appendix_C-Cost_Analysis.pdf

Estimated Other Capital Expenditures

- Conversations with the California Compost Coalition based on prior experience with compost facility development.

Inflation Calculations

Bureau of Labor Statistics “CPI Inflation Calculator”, Accessed November 2016.

http://www.bls.gov/data/inflation_calculator.htm

Land Price Estimations

CoStar Group, Inc. “Loopnet” Real Estate Search Tool. Accessed November 2016

http://www.loopnet.com/ (Search Results Attached).

APPENDICES

A) 2013 Integrated Waste Management Consulting Report: Food Scraps Capacity in the Bay Area

B) Loopnet Industrial Land Search

C) Air Board Regulations: Cost of Engineered Controls

D) Water Board Regulations: Costs of Compliance with General Order

E) Calculation Spreadsheets (Excel)

Appendix A

Food Scraps Capacity in the Bay Area 2013 Benchmark Data

FINAL REPORT

April 2013

Prepared by:

INTEGRATED WASTE MANAGEMENT CONSULTING, LLC

Nevada City, California

Prepared for:

Recology

San Francisco

Executive Summary

This report examines existing permitted capacity for food scraps composting in the Bay Area. The report also seeks to compare available sites, capacities, and rates with what Recology is proposing in its most recent Rate Application.

While there are a number of permitted composting facilities within 100 miles of 501 Tunnel Avenue, few of these have the combination of permits and capacity that could accommodate 600 - 700 tons per day of *new* mixed green material and food scraps. This report examines those facilities and provides additional information relative to these facilities including a range of likely tipping fees.

The data for this report included Solid Waste Facility Permits, Local Enforcement Agency records, publicly available data, and personal communications. The report makes general conclusions based on the data that was available. Prices quoted in the report are cited when possible, and reflect an order-of-magnitude rather than a specific price. Prices for disposal of green waste and food scraps are elastic and are typically negotiated rates rather than posted gate rates. Data shown in Table 3 are a mix of gate rates and negotiated rates based on recent bid activity (when available). Both should be seen as order-of-magnitude costs.

The conclusion of this research is that few available facilities exist within the study area which are capable of accepting an additional 600 - 700 tons per day. These potentially available facilities include, the Newby Island Composting Facility, the Forward Resource Recovery Composting Facility, and the West County SLF Composting Facility. The unit cost of accepting yard trimmings mixed with food scraps at these facilities ranges from $55 - $65 per ton.

Estimating *available* capacity (as opposed to *permitted* capacity) at composting facilities can be difficult due to a number of factors which an operator can manipulate to increase the operational capacity of a given site by increasing pile size, decreasing compost retention time, increasing management intensity, or by displacing certain sources of feedstocks (i.e., dropping lower priced volumes in favor of higher priced ones). *Permitted* capacity is not the same thing as *available* capacity. In some cases, facilities with very high permitted capacity numbers would not be able to meet that capacity under normal operating circumstances. Further, operational limitations may limit a given facility's ability to manage additional capacity. However, estimating available and operational capacity is beyond the scope of this report. Thus the determination of which facilities might *potentially* be available for Recology to access was made based on an analysis of permit documents and permitted capacity. To be clear, this analysis identified existing permitted capacity, not planned or actual capacity, as several of the identified facilities are in the process of expanding, but there is no guarantee of when or if planned expansions may be achieved.

Contents

The Bay Area leads the nation in food scraps diversion to composting. Despite the enviable amount of programs and infrastructure that has been developed, there remains inadequate capacity to process municipal and commercial food scraps within a reasonable distance of the Bay Area. While there are over 100 permitted composting facilities in the state, less than 25 percent of these are permitted to take food scraps. Food scraps can be more challenging to compost, may require advanced technology to control odors and emissions, has more complicated permitting requirements, and can be more challenging to process and market than yard trimmings-only compost. There are few existing facilities capable of handling the significant amounts of organics that are being generated in the Bay Area.

In addition to Recology composting facilities, there are 3 large, commercial compost facilities that are possibly capable of handling an additional 600 - 700 tons per day of mixed food scraps in the Bay Area.

These facilities are described below and subject data is presented in the following series of tables.

West Contra Costa SLF Composting Facility (WCCSLFCF). This regional composting facility is the closest composting facility to 501 Tunnel Avenue. Owned by Republic Services, the WCCSLFCF is permitted for 1,100 tons and is reportedly not close to approaching this capacity.

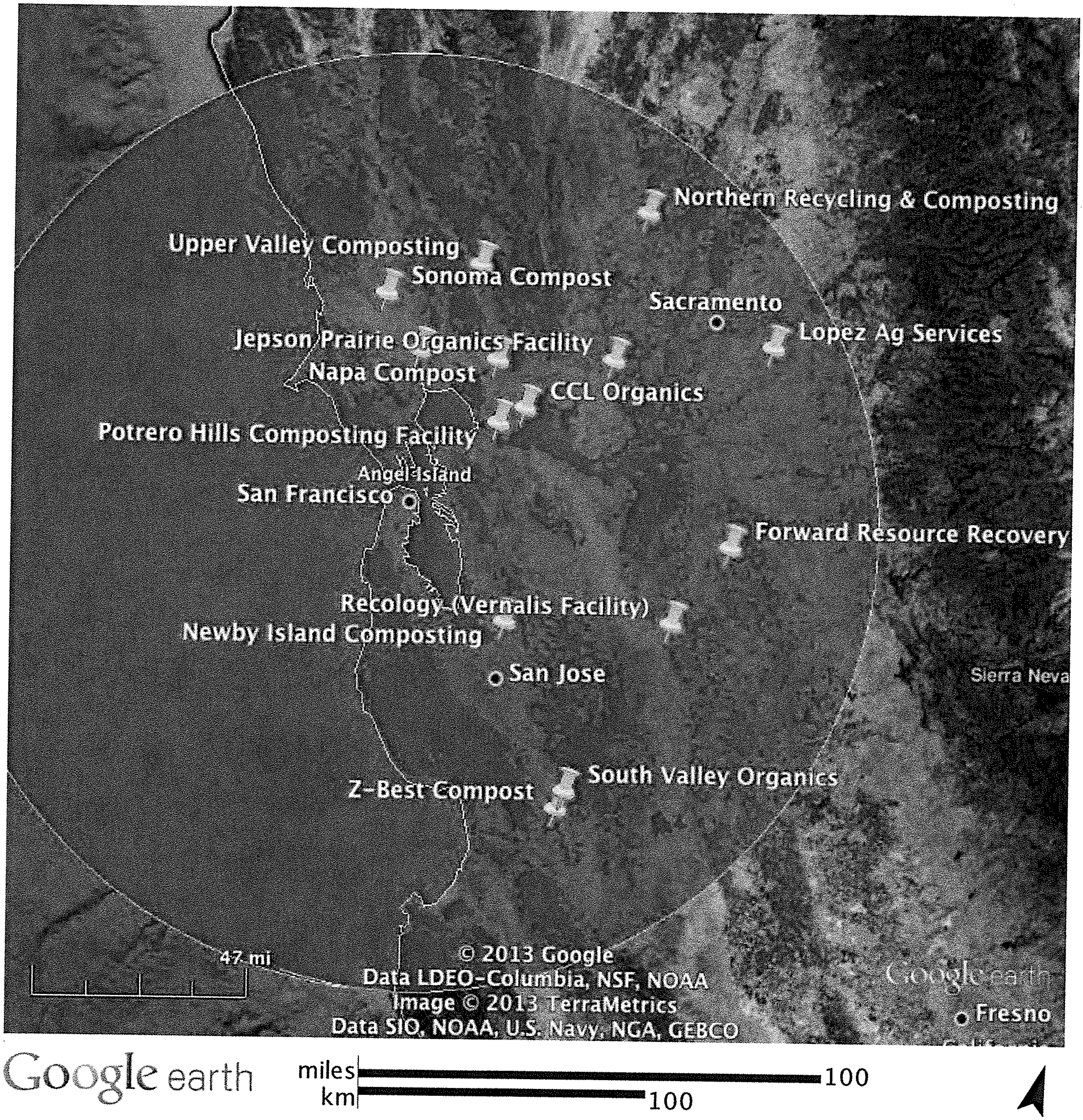
Newby Island Composting Facility. The Newby Island Composting Facility is located in the city of Milpitas, and is a part of the larger Newby Island Landfill and associated facilities. The facility is permitted for 980 tons per day, though only a portion of this can be food scraps. Given the dense urban location of the Newby Facility, considerable changes would need to be made for this facility to accept 600 – 700 additional tons per day of food scraps.

Forward Resource Recovery Facility. The Forward Resource Recovery Composting Facility is the furthest permitted facility from 501 Tunnel Avenue. Forward possibly has the capacity to accept an additional 600 - 700 tons per day of food scraps.

Table 1
Identified Facilities within 100 miles of 501 Tunnel Ave

Facility	Location	In/Out[1]	Reason
CCL Organics	Benicia	OUT	Too small, not permitted for food scraps
Lopez Ag Services	Sacramento	OUT	Not permitted for food scraps
Sonoma Compost	Petaluma	OUT	Publicly –owned facility (not accepting merchant loads), limited capacity.
City of Palo Alto Compost Facility	Palo Alto	OUT	Limited to City-generated materials
Upper Valley Compost	Rutherford	OUT	Limited capacity for food scraps.
City of Napa Compost Facility	Napa	OUT	Limited capacity to manage food scraps.
EBMUD	Oakland	OUT	Limited capacity.
ZWED		OUT	Not currently built or operating
South Valley Organics	Gilroy	IN	
Jepson Prairie Organics	Vacaville	IN	
Recology/Grover Compost Facility	Vernalis	IN	
West Contra Costa Compost Facility	Richmond	IN	
Redwood Landfill Composting Facility	Novato	IN	
Newby Island Compost Facility	Milpitas	IN	
Potrero Hills Composting Facility	Fairfield	IN	
Z-Best Composting Facility	Gilroy	IN	
Forward Resource Recovery Facility	Stockton	IN	
Northern Recycling Composting Facility	Zamora	IN	

[1] For this analysis, large permitted composting facilities within 100 miles of 501 Tunnel Avenue in San Francisco were identified. Facilities that were not permitted for food scraps, do not accept merchant feedstocks (i.e., county-owned facilities) or otherwise were not likely to have the potential to accept 500 – 600 tons per day of food scraps were deemed "out". Facilities with the potential to meet these criteria were identified as "in".



Northern Recycling & Composting
Upper Valley Composting
Sonoma Compost
Sacramento
Lopez Ag Services
Jepson Prairie Organics Facility
Napa Compost
CCL Organics
Potrero Hills Composting Facility
Angel Island
San Francisco
Forward Resource Recovery
Recology (Vernalis Facility)
Newby Island Composting
San Jose
Sierra Neva
South Valley Organics
Z-Best Compost
47 mi
© 2013 Google
Data LDEO-Columbia, NSF, NOAA
Image © 2013 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Fresno
Google earth
miles
100
km
100

Table 2
Location and Ownership of Compost Facilities

Facility Name	Location	Owner	Distance from 501 Tunnel
West Contra Costa Compost Facility	Parr Blvd Richmond, CA 94801	Republic Services	25 miles
Redwood Landfill Composting Facility	8950 Redwood Highway Novato, CA 94945	Waste Management	38 miles
Newby Island Compost Facility	1601 Dixon Landing Road San Jose, CA 95035	Republic Services	44 miles
Potrero Hills Composting Facility	3675 Potrero Hills Lane, Suisun City, CA 94585	Waste Connections	55 miles
Jepson Prairie Organics	6426 Hay Road Vacaville, CA 95687	Recology	69 miles
South Valley Organics	3675 Pacheco Pass Road Gilroy, CA 95020	Recology	78 miles
Z-Best Composting Facility	State Hwy. 25 Gilroy, CA 95020	Zanker Road Resource Management Limited	78 miles
Recology/Grover Facility	3909 Gaffery Road, Vernalis, CA 95385	Recology	83 miles
Forward Resource Recovery Facility	999 S. Austin Road Stockton, CA 95206	Republic Services	89 miles
Northern Recycling	11220 County Road 94 Zamora, CA 95698	Northern Recycling & Composting	93 miles

Table 3
Tipping Fees and Permitted Capacity

Facility	Allowable Feedstocks	Tipping fee		Permitted Capacity	Limitations
		Yard Trimmings	Food Scraps		
Forward Resource Recovery	Green material, food scraps	--	$56.94[2]	1,100 TPD	Although Forward appears to have excess permitted capacity for composting, they do not seem to be utilizing this resource.[3]
Jepson Prairie Organics	Green material, food scraps	--	--	600 TPD(7) (750 Peak)	
Newby Island Compost Facility	Yard trimmings (Type I), food scraps (Type II)[4]	$40 - $60	$55[5] - $60	980 TPD	
Northern Recycling	Yard waste with up to 40% food	--	$30	300 TPD (Up to 5,000 cubic yards)	Currently limited to 5,000 cubic yards of mixed green waste & food scraps (40%).
Potrero Hills Composting Facility	Green material (food scraps allowable with notification)	--	n/a	200 TPD (320 avg.)	Not actively composting food scraps, need ops plan prior to accepting.
Recology/Grover Compost Facility	Green material, food scraps	--	--	2,000 TPD(6)	
Redwood Landfill Composting Facility	Feedstock limited to Class B biosolids, food waste and green/yard waste	$33/cubic yard[6]	Neg.[7]	170 TPD	Compost operation currently limited to 60,000 cubic yards of feedstock, active compost, and finished product at any one time.
South Valley Organics	Green material, food scraps	--	--	750 TPD (7)	
West County SLF Compost Facility	Green waste, food waste, ag. materials, manure, biosolids	$51.50	$63.50[8]	630 TPD	
Z-Best Composting Facility	Municipal Solid Waste/Yard Trimmings	--	~$85[9]	1,500 TPD* (700 TPD)	Latest inspection report mentions maximum tonnage exceeded in 2012

[2] Personal Communication, City of San Ramon staff, 2/22/13.
[3] Personal Communication, Chuck Helget, 3/6/13
[4] Solid Waste Facility Permit SWIS #43-AN-0017 dated January 29, 2002.
[5] Proposed rates submitted to SBWMA in 2008.
[6] Rates as posted on http://Redwoodlandfill.wm.com/about-us/rates.jsp accessed 2/7/13, 2:00 pm.
[7] The operator of this facility would not provide an estimated rate as these types of commercial volumes would be negotiated on a case-by-case basis.
[8] Rates as quoted from WCCSWA, Personal Communication 2/19/13.
[9] Personal Communication, Michael Gross, 2/21/13

Table 4
Facility Information

Facility	Compost Product Names	OMRI Listed[10]	CDFA Registered[11]	STA[12] Participant[13]	Markets
Forward Resource Recovery	Unknown	NO	NO	NO	Unknown
Jepson Prairie Organics	"Clean City Compost" "Four Course Compost"	YES	YES	YES	Agriculture and horticulture
Newby Island Compost Facility	"Super Humus Compost"	YES	YES	YES	Agriculture and horticulture
Northern Recycling	"Compost"	YES	YES	YES	Predominantly agriculture
Potrero Hills Compost Facility	Unknown	NO	NO	NO	Not aggressively marketing compost
Recology/Grover Composting Facility	"Grover Wonder Grow Compost"	YES	YES	YES	Predominantly agriculture
Redwood Landfill Composting Facility	WM EARTHCARE™ Homegrown Compost	YES	YES	YES	Unknown
South Valley Organics	"SVO Clean City Compost"	YES	YES	YES	Predominantly agriculture
West Contra Costa Compost Facility	Unknown	NO	YES	NO	Unknown
Z-Best Compost Facility	"Z-Best Organic Compost"	YES	YES	YES	Various, Primarily agricultural compost

[10] Based on OMRI Product List search for "Compost" on http://www.omri.org/simple-opl-search/results/compost accessed 2/13/13
[11] Based on spreadsheet of entities that manufacture, produce, or distribute compost in California produced by CDFA.
[12] "STA" is the acronym for the US Composting Council's Seal of Testing Assurance, a voluntary customer assurance, testing, and disclosure program.
[13] Based on listing on USCC website for STA Participants, http://compostingcouncil.org/participants/, accessed 2/13/13.

Table 5
Composting Method(s)

Facility	Composting Method(s)
Forward Resource Recovery	Windrow
Jepson Prairie Organics	Negative Aerated Static Pile (ASP)
Newby Island Compost Facility	Windrow for Yard Trimmings, ASP for food scraps
Northern Recycling	Windrow for yard trimmings, ASP for food scraps.
Potrero Hills Compost Facility	Windrow for yard trimmings, likely ASP for food scraps.
Recology/Grover Compost Facility	Luebke Composting Method[14]
Redwood Landfill Composting Facility	Windrow for yard trimmings, ASP for food scraps.
South Valley Organics	ASP for food scraps
West Contra Costa Compost Facility	Windrow
Z-Best Compost Facility	Windrow for Yard Trimmings, ASP for food/MSW

The level of contamination present in curbside collected and commercial food scraps often requires additional operational capacities beyond basic windrow composting including closer attention to porosity, feedstock balance, carbon to nitrogen ratio, and odor and moisture management.

[14] The Recology/Grover compost facility uses a version of the Luebke method of composting, which involves maximizing air flow via smaller windrow sizes and more frequent windrow turning.

Table 6
Tonnage and Capacity 2012*

Processing Facility	Annual Incoming Volume (tons)	Average Tons Per Day (incoming)[15]	Permitted Tons Per Day[16]	Calculated Available Capacity[17]
Forward Resource Recovery	N/A	N/A	1,100 TPD	Unk.
Jepson Prairie Organics	--	--	600 TPD (7) (750 TPD Peak)	N/A
Newby Island Compost Facility	152,411 tons[18]	488 TPD	980 TPD	~500 TPD
Northern Recycling	N/A	N/A	300 TPD	Unk.
Potrero Hills Compost Facility	N/A	N/A	200 TPD	Unk.
Recology/Grover Compost Facility	--	--	2,000 TPD	N/A
Redwood Landfill	35,985.91[19]	115.3 TPD	170 TPD	~50 TPD
South Valley Organics	--	--	750 TPD (7)	N/A
West County Resource Recovery Facility	N/A	N/A	630 TPD	UNK.
Z-Best Composting Facility	315,496.80[20]	1,011 TPD	1,500 TPD (750 TPD)	~500 TPD

*Information in this table comes from LEA reports as required by Solid Waste Facility Permits. Sites without data indicate that the LEAs did not provide this data within the time constraints of this report.

[15] This data assumes a 6-day week divided by total annual incoming tons.
[16] See Table 3 for details.
[17] This column attempts to subtract the calculated average tons per day incoming from the permitted tons per day to estimate "available capacity".
[18] *"Newby Island Recyclery, Summary 2012 Tons"* Provided by City of San Jose LEA.
[19] Personal Communication Marin County LEA 2/21/13
[20] LEA Tonnage data based on required submittals from Z-Best Composting Facility.

Limitations

The information contained in this Report was gathered consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. This Report was completed consistent with our agreement with Recology. The report is solely for the use and information of Recology. Any reliance on this plan by a third-party is at such party's sole risk.

Information and opinions contained in this Report apply to conditions existing when services were performed and are intended for the client, purposes, locations, timeframes, and project parameters indicated. IWMC does not warrant the accuracy of information supplied by others, nor the use of segregated portions of this Report.

Appendix B

Landscape orientation recommended. Print | Close Window

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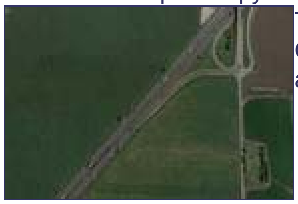


Turn Off alerts

Pedrick Rd and I-80
Dixon, CA
Zoning: CH-PD (Highway Commercial Planning Development)

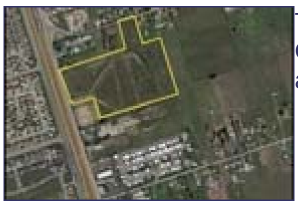
Status: Active
Price: $1,225,000
Lot Size: 37.57 Acres
Property Type: Commercial/Other (land)

Turn Off alerts

302 River Rd
Rio Vista, CA

Status: Active
Price: $2,150,000
Lot Size: 24.84 Acres
Property Type: Industrial (land)

Cushman & Wakefield - Walnut Creek



Turn Off alerts

Industrial Land For Sale - Freeway Visibility
Stockton, CA
Industrial zoning allows for a wide range of activities including warehousing and distribution. Truck / trailer use is allowed with county. Lot...

Status: Active
Price: $2,000,000
Lot Size: 23.00 Acres
Property Type: Industrial (land)

Turn Off alerts

Soscol Ferry Road
Napa, CA
22.4± Acres of land zoned Industrial Park. Ideal for an office campus, distribution center or a wide variety of wine related applications including...

Status: Active
Price: $3,900,000
Lot Size: 22.40 Acres
Property Type: Industrial (land)

Keegan & Coppin Company, Inc.

Turn Off alerts

1791 E. Kentucky Avenue
Woodland, CA
Zoned and ready-to-build, flat topography and all utilities in place; parcel map to split into 4 parcels is ready to file

Status: Active
Price: $10,993,891
Lot Size: 72.11 Acres
Property Type: Industrial (land)

Turn Off alerts

2484 Green Island Rd
American Canyon, CA
Zoned General Industrial Topography is generally flat excellent property for yard and/or storage Adjacent to rail line for possible spur Septic and...

Status: Active
Price: $1,500,000
Lot Size: 22.70 Acres
Property Type: Commercial/Other (land)

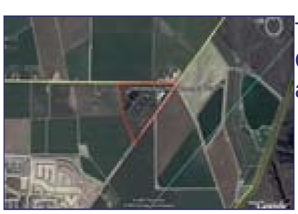
Colliers International

Turn Off alerts

First Park Arch Road
Stockton, CA
± 5 - 70AC. INDUSTRIAL LAND FOR SALE. 4554/5150 ARCH ROAD, STOCKTON, CALIFORNIA. Owned by First Industrial. Offered for sale, lease or...

Status: Active
Price: $15,246,000
Lot Size: 70.00 Acres
Property Type: Industrial (land)

CBRE, Inc.

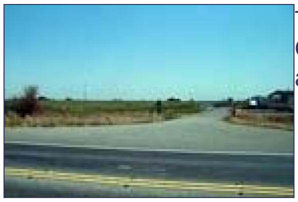


Turn Off alerts

Valley Winery Supplies Corporation
Newman, CA
Approximately 55.6 Acres of Industrial Zoned Land, with Approx. 11,000 sq. ft. of Warehouse. Warehouse built in 1997. Property previously used by...

Status: Active
Price: $8,062,000
Lot Size: 55.60 Acres
Property Type: Industrial (land)

PMZ Commercial



Turn Off alerts

5184 N Highway 12
Lodi, CA
The property may be subdivided for smaller built-to-suit lots with 5 acre minimums. The terminal facilities could include a loading dock, a yard for...

Status:	Active
Price:	$8,515,000
Lot Size:	37.00 Acres
Property Type:	Industrial (land)

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Appendix C

APPENDIX C

Draft New Rule 4566 (Composting and Related Operations)
Costs and Cost Effectiveness Analysis

September 22, 2010

I. SUMMARY

District staff has received cost information from stakeholders and vendors during the rule development process. Stakeholders and vendors are encouraged to continue to submit their compliance cost estimates to aid District staff with the cost effectiveness analysis. District staff will refine the cost effectiveness analysis to reflect any new information provided during the rulemaking process and at the focus group. Based on the cost-effectiveness of the control measures, the new draft rule requirements may be revised, as appropriate, to mitigate significant impacts to the operators.

Cost effectiveness is the estimated using the annualized cost of a control divided by the estimated emission reductions. It is not the actual cost paid by the operator but is a metric used to compare the relative cost between various control techniques and rules.

Draft Rule 4566 (Composting and Related Operations) would require operators who manage these materials to reduce VOC emissions through mitigation measures which are a combination of best management practices, emission reduction methods, and engineered emission controls systems. In the case of composting operations, small facilities, which have fewer resources and lower total emissions, would only be required to implement management practices. Larger facilities, that have greater resources and higher total emissions, would be required to implement best management practices and emission reduction methods or install and operate and engineered control system that achieves VOC reductions equivalent to the control methods.

II. REQUIREMENTS OF COST EFFECTIVENESS ANALYSIS

The California Health and Safety Code 40920.6(a) requires the San Joaquin Valley Unified Air Pollution Control District to conduct a cost effectiveness analysis of available emission control options before adopting each Best Available Retrofit Control Technology (BARCT) rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements listed in a rule. Absolute cost effectiveness of a control option is the added annual compliance cost in dollars per year divided by the emission reduction achieved in tons VOC reduced per year. This report presents the District staff's analysis of the absolute cost effectiveness of Draft Rule 4566.

Incremental cost effectiveness is intended to measure the change in costs, in dollars per year, and emissions reductions, in tons of VOC reduced per year, between two progressively more effective control options or technologies. Incremental cost effectiveness examines the additional costs and emission reductions that can be achieved by adding a second control to the primary control. Because the incremental reductions from the controlled source operation are typically low, incremental cost effectiveness produces a much higher cost-to-reduction ratio than the primary control and should not be compared to the absolute cost effectiveness value.

For composting operations, the additional annual costs will be developed as follows:

$$\text{Additional Cost} = \text{Cost to Implement Control (\$/wet-ton)} \times \text{Throughput (wet-ton/year)} = \text{\$/year}$$

$$\text{Absolute Cost Effectiveness} = \frac{\text{Incremental Cost (\$/year)}}{\text{Reductions (ton-VOC/year)}} = \text{\$/ton-VOC}$$

Draft Rule 4566 would provide compost facility operators with the flexibility to comply with the VOC control requirements by choosing the listed controls or developing mitigation measures of their own not specified in the rule, provided they could demonstrate that such measures could achieve specified VOC emission reductions. Since operators have the flexibility to develop other equivalent methods of achieving the required reductions, operators will choose the option with the best cost effectiveness for their particular operation.

III. SOURCES OF COST DATA

Costs for composting facilities were taken from two general categories of source: actual composting operators in the San Joaquin Valley and vendors of composting emission control systems. The vendors who provided data are Engineered Compost Systems (ECS), W.L. Gore & Associates (GORE), and Managed Organic Recycling (MOR). The Valley operators who provided data are from Tulare County Compost and Biomass (Tulare), HWY 59 (Merced), Mt Vernon Composting & Recycling (Bakersfield), and Community Recycling (Lamont), and the City of Modesto.

The cost information that District staff has considered in the revised cost analysis are as follow:

- The Modesto Composting facility is a 200,000 wet-ton/yr windrow composting operation with an overall operating budget of $1.34 million per year. Tipping fees are $18.35 per ton for organic material.
- Stanislaus Resource Recovery Facility is a Waste-to-Energy plant that charges a tipping fee of $28 per ton for organic material.
- Landfill tip fees within the region currently range from $25 per ton to $30 per ton for organic material.

Finished Compost Cover Control Method

The industry operators have participated in the rule development process and submitted cost information to the District, most recently in 2010. Their cost estimates were based on their site-specific requirements. Since the costs provided are based on site-specific requirements, there is a wide range of cost estimates to implement the control method. For the finished compost cover control method, operators provided costs including possible additional front-end loaders, dump trucks, and conveyors. While some facilities may need the additional heavy equipment, other facilities may be able to use existing equipment for the control measures. It is assumed that the finished compost cover control method does result increased labor, fuel, equipment, maintenance, and decreased amount of available finished compost for all applicable facilities.

To mitigate the impact of the rule and allow operators time to adjust to the practices, the rule allows a three year phase in period to full implementation.

- The first year of implementation, 33% or throughput or every third active-phase windrow would need to be covered with finished compost after formation and after each turning event, during the active composting phase. Curing-phase compost is not required to be covered with finished compost.
- The second year of implementation, an additional 33% of the active-phase piles shall be covered with finished compost after formation and after each turning event. During this year, a total of 66% of the active-phase piles would be covered.
- The third year, the remaining 34% of the facility's active-phase piles shall be covered with finished compost after formation and after each turning event.

The amount of finished compost needed to implement the control method is estimated to be approximately 12% of the facility's finished compost production for years 1 through 3, and an average of 3.6% over 10 years (see the compost cover volume determination spreadsheet for the detailed calculation). To summarize, the volume calculation is based on the following primary assumptions:

- Compost piles are triangular in shape,
- 6 turning events during active-phase,
- Finished compost cover is 6" at the peak and 2" at the base,
- Green waste volumetric shrink factor is 70%,
- Facilities process 4.5 compost cycles per year,
- Phase in schedule is 33%, 66%, and 100% of total throughput for years 1 - 3, respectively.

Based on the field study results, the footprint of the active-phase pile and the finished compost pile is not expected to be negatively affected. As the material composts, moisture and carbon are lost so that the normal compost pile is reduced by 70% in volume and 40% in mass. In addition the windrow machines, used t turn the piles, produce a consistent pile footprint. The finished compost cap adds mass, so there will be more volume initially on the curing-phase piles due to the finished compost covers added to them. The finished compost piles will be larger due to the material added for the covers and would potentially serve as the storage areas for the materials for next round of compost covers. As the process is implemented, more finished compost cover materials will be blended with the composting material until eventually 12% of the facility’s production during the first three years is stored on the piles.

Since the draft rule requires cover upon creating a new active-phase pile, the facility must have enough finished compost stored separately to cover the new material. Upon day 1 implementation, a new windrow created and turned requires approximately 27% of a finished compost windrow for one covering. Therefore, the facility begins “storing” the cover material within the active-phase piles. Upon completing the active-phase, 6 coverings in 22 days, this controlled windrow will have required 161% or 1.61 normal finished compost windrows to cover it. Cover is now being stored in the curing phase.

For example, a facility creates 100 yd^3 active-phase windrows and produces 30 yd^3 finished compost windrows. To cover a new windrow for the entire active-phase will take 48 yd^3, which is 1.61 normal finished windrows. When the controlled windrow completes the curing phase (day 60), the facility will have more than enough cover within that one controlled compost windrow to cover the next new one that enters the active-phase. In this example, when the controlled windrow finishes the curing phase, it will be 78 yd^3, which is based on a normal finished windrow volume (30 yd^3) plus the cover volume (48 yd^3). Therefore at day 60, any new windrow created requires only 62% of a finished windrow by volume, since the finished windrows will now contain more volume.

This volume of the minimum cover material needed is then kept onsite on an ongoing basis. As new windrows are created, the same volume is utilized for cover, allowing the facility to sell compost except for the finished compost cap volume, which is 12% of their throughput for the first 3 years. The 12% value hinges on the concept that once enough cover material is created, that cover material volume does not need to be created again. At full implementation, sellable material can come and go at the pre-implementation rates, while the cap volume remains constant and is “stored” on the composting and curing piles.

Below is an example of how the compost cover volume was determined. Table 1 lists the basic windrow information and assumptions.

Table 1: Compost Cover Volume Determination (Site Process Information)					
Pile length	**600**	ft			
Peak height	**8**	ft			
Base width	**20**	ft			
Number of windrows	**20**				
Number of compost cycles	**4.5**	per year			
Density of feedstocks	**0.25**	ton/yd3			
Density of finished compost	**0.5**	ton/yd3			
Shrink factor (volume basis)	**70%**	average			
Pile slant height of compost pile	12.8	ft			
One compost pile surface area (includes pile ends)	15,770	ft^2			
One compost pile volume (includes pile ends)	48,837	ft^3	equivalent to	1,809	yd^3
One compost pile production (1 cycle)	543	yd^3	equivalent to	271	ton
Incoming feedstocks (1 cycle)	36,176	yd^3	equivalent to	9,044	ton
Finished compost production (1 cycle)	10,853	yd^3	equivalent to	5,426	ton
Shrink factor, mass basis (for info only)				40%	
Incoming feedstocks (all cycles)	162,791	yd^3/yr	equivalent to	40,698	ton/yr
Finished compost production per year (all cycles)	**48,837**	**yd^3/yr**	equivalent to	24,419	ton/yr

Table 2 details the finished compost cover details and assumptions.

Table 2: Compost Cover Volume Determination (Compost Cover Information)					
Compost cover thickness at peak	**6**	in	equivalent to	0.50	ft
Compost cover thickness at base	**2**	in	equivalent to	0.167	ft
Number of active-phase cover applications	**6**	per windrow			
Peak height	8.5	ft			
Base width	20.33	ft			
Slant height of covered pile	13.3	ft			
One pile surface area with cover	16,325	ft^2			
One pile volume with cover	52,770	ft^3	equivalent to	1,954	yd^3
One pile cover volume	146	yd^3	per cover		
One pile cover volume	874	yd^3	per active-phase		

Table 3 details the required finished compost amounts as the rule is implemented over a three-year phase-in period.

Table 3: Compost Cover Volume Determination (Compost Cover Volume based on Draft Rule Requirements)

Day 1: Initial cover after formation	27%	of a finished windrow can cover a new windrow once after initial formation			
Day 22: After active-phase	161%	of an uncontrolled finished windrow can cover a new windrow six times after turning in the active-phase			
Day 60: After active and curing phases	62%	of a controlled finished windrow can cover a new windrow six times after turning in the active-phase, due to the additional mass of the cover material during the controlled active phase			
End of year 1, 33% of total throughput controlled	5,767	yd^3	equivalent to	2,884	ton
	12%	of facility's finished compost from 1st year			
End of year 2, 66% of total throughput controlled	5,767	yd^3	equivalent to	2,884	tons
	12%	of facility's finished compost from 2nd year			
End of year 3, 100% of total throughput controlled	5,942	yd^3	equivalent to	2,971	tons
	12%	of facility's finished compost from 3rd year			
Full rule implementation (Years 1 thru 3 total)	17,477	yd^3	equivalent to	8,738	tons
	12%	of facility's finished compost over 3 years			
	3.6%	of facility's finished compost over 10 years			

The loss of production revenue, 12% per year for 3 years, has been factored into the cost analysis as well, assuming product sales at $6/yd^3 ($12/ton) and lost interest revenue at 10% per year. The process should not require additional material storage or diversion after the third year, but District cost analysis policy annualizes capital expenses at 10% over 10 years so the 3.6% average over ten years figure is included.

Additional Irrigation

The industry operators have participated in the rule development process and submitted cost information to the District. Their cost estimates are based on their site-specific requirements. Operators provided costs of additional equipment and infrastructure necessary, such as sprinkler piping, water pumping equipment, power/fuel, and water. Since the costs reflect on site-specific conditions, there is a wide range of cost estimates to implement the control method. For example, one facility may have rights to water, while another would need to purchase the water needed for this control method. It is assumed that the additional irrigation would result increased labor, fuel, equipment, and maintenance.

Minimize Stockpile/Tipping Pile Storage Time

The District currently does not have an estimated cost to require the stockpile storage time does not exceed 3 days for larger facilities. As such, there are no costs factored into the VOC reductions claimed for this control method. This information will be updated later in the rule development process as cost data becomes available.

Engineered Control Vendors

ECS has participated in the rule development process and submitted cost information to the District, most recently in 2010. The cost estimates were for the AC Composter™ and CompDog™ (inflatable form) cover systems (negative ASPs vented to biofilter). The key assumptions are as follows:

- Capital costs of equipment, construction and start-up of control system (annualized over 10 years at 10%).
- Annual cost also includes operation and maintenance (O&M) of all equipment, labor, electrical power, and fuel.
- Paved surface for the AC Composter™ system to be built, unpaved for the CompDog™ cover system.
- Concrete pushwalls for both AC Composter™ and CompDog™ cover systems.
- Aeration vented to biofilter for both AC Composter™ and CompDog™ cover systems.
- Water management control system for separation of leachate and storm water to be built.
- Covered bunker or enclosed reception area to be built
- Water and Electricity in place

GORE has participated in the rule development process and submitted cost information to the District, most recently in 2010. The cost estimates were for a the GORE™ Cover System technology (positive ASPs with cover). The key assumptions are as follows:

- Annualized capital costs of equipment, construction and start-up of control system over 10 years at 10%,
- Annual cost also includes operation and maintenance (O&M) of all equipment, labor, electrical power, and fuel,
- Paved surface for the GORE™ Cover System to be built,
- Water management control system for separation of leachate and storm water to be built,
- Paved tipping area to be built,
- Water and Electricity in place

MOR has participated in the rule development process and submitted cost information to the District, most recently in 2010. The cost estimates were for a positive ASP with cover system. The key assumptions are as follows:

- Annualized capital costs of equipment, construction and start-up of control system over 10 years at 10%,
- Annual cost also includes operation and maintenance (O&M) of all equipment, labor, electrical power, and fuel,
- Paved surface for the covered system to be built,
- Water management control system for separation of leachate and storm water to be built,
- Paved tipping area to be built,
- Water and electricity in place

According to the vendors, the cost estimates are highly variable depending upon site specific requirements. For the purpose of this analysis, the cost estimates associated with the capture and control systems assume a flat and buildable site with all utilities in place. The District staff obtained as much data as available to establish the range of costs to implement an “engineered control system”. The collected cost estimations are for the purposes of the District’s cost effectiveness analysis during this rule project only.

The budgetary pricing from the mentioned vendors are the most current and best available information obtained at the time. Inclusion of these vendors in this report does not imply or serve as an endorsement of any vendor or product by the District.

IV. COSTS AND COST EFFECTIVENESS ESTIMATES

Proposed VOC control requirements would require operators to implement various mitigation measures, based on the operation type and facility size. All operators would be required to adopt management practices to reduce VOC emissions.

Management practices have been shown to promote efficient composting and still result in VOC reductions. No additional cost is associated with implementing these practices, since they are considered to be inherent in good composting practice at a well-managed facility.

Large facilities, defined as those with at least 25,000 wet tons per year throughput, would also be required to implement the finished compost cover control method, or an equally effective method at reducing VOC emissions. The finished compost cover method achieves VOC reductions of 53% over the active and curing phases. Therefore, if the finished compost method is not employed, another method or system shall meet a minimum of 53% overall VOC for the active and curing phases. Engineered controls, such as in-vessel systems, have demonstrated control efficiencies at or above 80% overall control. As such, these types of controls would be welcome to satisfy the rule.

The tables below summarize the District's cost findings, based on the information received from operators and vendors.

Finished Compost Cover Costs

Table 4 summarizes the cost information received from operators for site-specific costs to implement the requirement for a finished compost cover. These costs reflect the limited resources of the smaller facilities and a necessity to purchase additional equipment, resulting in a higher, per-ton implementation cost. Larger facilities may have greater equipment inventories and could possibly implement the rule requirements without additional equipment purchases.

Table 4: Finished Compost Cover Costs

Site	Feedstock Throughput (wet ton/yr)	Cost to Implement ($/wet ton)
1	25,000	5.65
2	100,000	3.48
3	150,000	0.59
4	200,000	0.60
5	1,300,000	1.93
	Average	**2.45**

If the resulting data was applied to a large facility, the total annualized costs for the finished compost cover method would range from $776,000/year to $7.43 million/year. Based on 1,789 tons per year of VOC emission reductions, the cost effectiveness for these largest compost facilities ranges from about $433 to $4,151/ton of VOC reduced.

Additional Irrigation Costs

Table 5 summarizes the cost information received from operators for site-specific costs to implement the requirement for additional irrigation before turning. These costs reflect the limited resources of the smaller facilities and a necessity to purchase equipment and water for the irrigation, resulting in a higher, per-ton implementation cost. One facility had access to water so costs included equipment and operating expenses but not water costs.

Table 5: Additional Irrigation Costs		
Site	**Feedstock Throughput (wet ton/yr)**	**Cost to Implement ($/wet ton)**
1	100,000	2.29
2	150,000	1.66
3	1,300,000	0.26
	Average	**1.4**

The rule would require medium facilities to implement the additional irrigation control. If the resulting cost data was applied to a medium facility, the total annualized costs for this control to medium sized facilities would range from $15 thousand per year to $132 thousand per year, depending on water availability. Based on 36 tons per year of VOC emission reductions, the cost effectiveness for these medium-sized compost facilities ranges from about $418 to $3,677 per ton VOC reduced.

Engineered Controls Costs

Table 6 summarizes the cost information received from vendors for hypothetical site-specific costs to install their specific control system. These costs reflect possible factors that could influence the installation and operation of the control system. In general, the cost per ton is lower for larger facilities since common equipment costs, like fans and ducting can be spread over a greater throughput.

It is important to note that the rule would not require any facility to install an engineered control system. An operator may consider installing such a system in lieu of using a finished compost cover, provided that it is demonstrated to achieve the same or better control efficiency as the finished compost cover. Because of the cost to install and run these systems, it is unlikely that even the largest facilities would find them to be cost-effective.

Table 6: Engineered Controls Costs			
Hypothetical Site	**Feedstock Throughput (wet ton/yr)**	**Cost to Implement ($/wet ton)**	**Cost Averages by Throughput ($/wet ton)**
1	25,000	6.79	7.44
2	25,000	6.79	
3	25,000	9.08	
4	25,000	9.91	
5	50,000	5.67	6.04
6	50,000	6.40	
7	100,000	3.24	4.33
8	100,000	3.48	
9	100,000	4.49	
10	100,000	5.20	
11	100,000	5.24	
12	200,000	2.57	3.48
13	200,000	3.10	
14	200,000	4.76	
15	500,000	2.78	3.78
16	500,000	3.80	
17	500,000	4.75	
18	1,000,000	3.09	3.80
19	1,000,000	3.21	
20	1,000,000	5.11	
	Average	**4.97**	

Staff only applied the cost data to large facilities given the lower cost of these controls relative to smaller facilities. For in-vessel engineered controls on these large facilities range, costs are estimated from $3.378 million per year to $13.026 million per year. Based on 3,001 tons per year of VOC emission reductions, the cost effectiveness for these largest compost facilities ranges from about $1,126 to $4,341 per ton VOC reduced.

Table 7 summarizes the Cost Effectiveness information based on draft rule requirements. The low - high range reflects the information received to date from stakeholders on possible implementation costs. Costs for covering the stockpiles after three days will be included in later staff reports and the cost data is available.

Table 7: Cost Effectiveness Summary (based on Rule Control Requirements)

Facility Receiving Volume	Actual Material Received (wet-ton/year)	Control Method	Emission Reductions (tons of VOC/year)	Cost ($/year) (Low - High Range)		Cost Effectiveness ($/ton-VOC Red) (Low - High Range)	
Large Facilities (Receives ≥ 25,000 tons/year)	1,314,451	Active+Curing Windrow (Finished Compost Cover on Active - 53% overall control)	1,988	775,526	7,426,648	390	3,736
		Active+Curing Windrow (Engineered Controls - 80% overall control)	3,001	3,378,139	13,026,209	1,126	4,341
		Stockpile (3-Day Max)	1,471	TBD	TBD	TBD	TBD
Medium Facilities (Receives < 25,000 and ≥ 10,000 tons/year)	57,808	Active Phase Windrow (Irrigation)	36	15,030	132,380	418	3,677
		Curing Phase Windrow (No Control)	0	0	0	0	0
		Stockpile (3-Day Max)	86	TBD	TBD	TBD	TBD
Small Facilities (Receives < 10,000 tons/year)	21,318	Active Phase Windrow (No Control)	0	0	0	0	0
		Curing Phase Windrow (No Control)	0	0	0	0	0
		Stockpile (No Control)	0	0	0	0	0

V. REFERENCES

1. City of Modesto. Public Comment Letter dated January 4, 2008.
2. SJVAPCD Draft Rule 4566 and staff report.
3. O'Neill, Tim - President & Engineer for Engineered Compost Systems (ECS), e-mail correspondence and ECS website at www.compostsystems.com.
4. Fuchs, Brian E. - Representative for W.L. Gore & Associates, Inc. for GORE™ Cover Systems - North America, e-mail correspondence and websites at www.gore.com and www.gorecover.com.
5. CIWMB. Public Comment Letter dated January 22, 2008.
6. Mt. Vernon Composting & Recycling (Bakersfield)
7. Tulare County Composting and Biomass
8. Community Recycling (Lamont)
9. HWY 59 (Merced)
10. Bouey, John, P.E. - President Managed Organic Recycling (MOR), e-mail correspondence and MOR website at http://www.odorfreecompost.com

Appendix D

APPENDIX D

ECONOMIC CONSIDERATIONS

GENERAL WASTE DISCHARGE REQUIREMENTS FOR COMPOSTING OPERATIONS - ECONOMIC CONSIDERATIONS

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State Water Resources Control Board

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State Water Resources Control Board

June 9, 2014

SUMMARY

The proposed *General Waste Discharge Requirements for Composting Operations* (Order) will impose compliance costs on the compost industry that will increase the total cost of operations and decrease net returns. The proposed Order will require initial capital investments of approximately $25.2 million in retention ponds, monitoring wells, and drains. Annual investment costs will be about $2.2 million, and annual monitoring and maintenance will be an additional $1 million. Although these amounts seem large when expressed in relative terms or in units of production, the effect on compost operators will be manageable. The industry has 121 facilities subject to the proposed Order that processes about 7.8 million cubic yards of compost annually.

The proposed Order will impose annual cost increases on the order of one percent to seven percent, depending on the size of operation and ownership. Net revenue will decline by 2.5 percent to 18 percent. However, projected profit margins vary between eight percent and 40 percent and therefore, the economic viability of the operations will not be in jeopardy.

Analysis shows that compliance with the proposed Order is highly unlikely to divert green waste from compost operations to landfills. The difference between the landfill disposal cost and the total compost cost varies from $12.10/ton to $23.74/ton of green waste. Total compost costs would have to increase by at least 26 percent to approach landfill disposal costs.

INTRODUCTION

Two economic considerations are addressed in this analysis. The first is to determine the effect of imposing the proposed Order compliance costs on the economic viability of composting operations. The second is to project the possible shift in compost feedstocks to landfills as a result of the proposed Order's requirements.

ECONOMIC VIABILITY UNDER THE PROPOSED ORDER

The proposed Order categorizes compost operations into two tiers, Tier I and Tier II. Tier I are those operations processing less than 25,000 cubic yards of material onsite at any given time that includes all material received, processed and stored on the premises. Tier I must meet all siting criteria: minimum groundwater depth based on soil percolation rate; distance to nearest surface water (≥ 100 feet); and distance to nearest drinking water supply well (≥ 100 feet). Tier I feedstocks are limited to agricultural, green, paper, and vegetative food materials.

Tier II operations process more than 25,000 cubic yards onsite at any given time of solid food material, biosolids and manure in addition to Tier I materials. Tier II operations also must meet certain siting criteria: minimum distances to the nearest surface water (≥ 100 feet); and distance to nearest drinking water supply well (≥ 100 feet).

Compliance with the proposed Order will require Tier II operations to either (1) upgrade the operation surface pad to meet a hydraulic conductivity standard, or (2) perform groundwater protection monitoring (assumed to be groundwater monitoring); install a lined retention pond; monitor water quality in the retention pond; and submit annual reports. Tier I operations are not subject to the operations surface pad hydraulic conductivity standard; retention pond hydraulic conductivity standard; or the groundwater protection monitoring requirements.

Eight Tier II compost facility operators volunteered to provide cost and revenue data for this analysis. The facilities represent a broad spectrum of private, public, and partnered operations receiving 25,000 to 140,000 tons per year of multiple types of feedstocks, using a variety of composting techniques. For the purposes of confidentiality, survey participants will not be identified.

Cost of Processing Compost With and Without the Proposed Order

Survey cost results were compiled on the basis of cubic yards of compost produced and sold annually as shown in Table 1. The total annualized cost of producing a cubic yard of compost (referred to as the *Total Processing Cost*) for the surveyed facilities ranged from $19.19 to $30.99.

Table 1. Compost Facility Characteristics and Costs by Category

		Surveyed Processing Cost				Projected Compliance Cost				
Facility[1]	Compost Processed (cy/yr)	Operating Cost ($/cy)	Business Overhead Cost ($/cy)	Investment Overhead Cost ($/cy)	**Total Processing Cost ($/cy)**	Plant Pad Size (ac)	30 year Average Annual Precipitation[2] (in/yr)	Compliance Cost w/o Pad Installation ($/cy)	**Total Compost Cost ($/cy)**	**Change in Compost Cost** (%)
Pvt 1	25,000	$15.67	$5.89	$7.26	**$28.82**	15.8	22.36	$2.00	**$30.83**	**6.9%**
Pub 1	40,000	$16.86	$5.76	$8.36	**$30.99**	12.0	22.14	$1.06	**$32.04**	**3.4%**
Pvt 2	56,000	$13.01	$7.79	$6.76	**$27.56**	10.7	19.99	$0.67	**$28.23**	**2.4%**
Pvt 3	75,000	$10.65	$4.40	$4.14	**$19.19**	20.0	12.50	$0.55	**$19.74**	**2.8%**
Pub 2	100,000	$13.98	$12.09	$4.51	**$30.58**	18.0	38.39	$0.80	**$31.38**	**2.6%**
Pub 3	100,000	$16.04	$8.06	$3.91	**$28.01**	45.0	11.37	$0.66	**$28.67**	**2.4%**
Pvt 4	103,152	$8.91	$9.20	$6.32	**$24.44**	6.0	15.76	$0.26	**$24.70**	**1.1%**
Pub 4	137,016	$11.84	$11.23	$3.64	**$26.70**	72.0	6.63	$0.50	**$27.20**	**1.9%**

[1] Pvt indicates private ownership and Pub is a publically owned facility

[2] PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 3/1/2014.

The cost to produce compost, referred to as the "Surveyed Processing Cost" in Table 1, are principally a function of: (1) the size of the operation, (2) the business arrangement (private or public), and (3) the processing techniques employed. The major cost categories of operating costs, business overhead costs, and investment overhead costs are defined as follows:

> Operating Costs – Includes receiving, grinding and screening, forming open windrows, turning windrows, separating fines, forming fines curing piles, and shipping. Costs of labor, equipment operating costs (i.e., energy and repairs), and interest on operating capital, are accounted for in this category.
>
> Business Overhead Costs – Includes staff and management costs, equipment rental, outside services, materials and supplies, office expenses, insurance, taxes, permits, fees, and land costs.

Investment Overhead Costs – Includes the annualized cost of purchased buildings, equipment, and long term facility improvements.

The cost to comply with the proposed Order was estimated assuming the annual capital costs of (1) upgrading the operation's pad surface to meet the proposed Order's hydraulic conductivity standard, or (2) installing groundwater monitoring wells and monitoring; installing a retention pond meeting the hydraulic conductivity standard; and constructing drainage conveyance ditches. Annual monitoring of pond water and maintenance costs are also included. Annual compliance cost per cubic yard of compost processed was calculated for the two options using the following equations:

Option 1: Cost of Operations Surface Pad Installation

If the operator chooses to upgrade the pad surface to meet the required hydraulic conductivity standard, the following equation calculates compliance costs:

Annual Compliance Cost With Pad Installation ($/cubic yard) = Annual Pad Installation Cost ($/cubic yard) + Annual Retention Pond Installation Cost ($/cubic yard) + Annual Conveyance Drain Installation Cost ($/cubic yard) + Annual Retention Pond Monitoring Cost ($) +Annual Maintenance Cost ($)

Where: Annual Pad Installation Cost ($/cubic yard) = (Pad Installation Cost ($/acre) x Pad Size (acre) x Capital Recovery Factor) / Compost Produced Annually (cubic yard)

Where: Pad Installation Cost ($/acre) = $81,675[1]

Capital Recovery Factor[2] = 0.08718 = (Interest Rate x (1 + Interest Rate)$^{\text{Economic Life}}$) / ((1 + Interest Rate)$^{\text{Economic Life}}$ – 1)

Where: Interest Rate = 6.0%

Economic Life = 20 years

Annual Retention Pond Installation Cost ($/cubic yard) = (Pond Installation Cost ($/ac) x Pad Size (ac) x Pond to Pad Factor (in^{-1}) x Average Annual Precipitation (in) x Capital Recovery Factor) / Compost Produced Annually (cubic yard)

Where: Pond Installation Cost ($/acre) = $147,388[3]

Pond to Pad Factor (in^{-1}) = 0.00692 = ((Pad Size (ac) x ((Open Area (% of Pad) x Pad Runoff Coefficient) + (Material Area (% of Pad) x Material Runoff Coefficient)) x 43,560 (ft^2/acre) x 1/12 (ft/in)) / Pond Depth (in)) x (1/43,560 (acre/ft^3))

Where: Open Area (% exposed surface) = 50%

Pad Runoff Coefficient = 0.69[4]

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[1] Based on actual bids 2008 for lime/cement treated (12" thick), place AC roads, construction 200' x 200' concrete pad. Cost includes construction, design engineering, and construction oversight.

[2] The Excel PMT function calculates the value which is defined as the payment for a loan based on constant payments and a constant interest rate.

[3] Assumes excavation, hauling, stockpiling, and finished grading (5' deep), installation of 60-mil HDPE membrane, and design, engineering and construction management.

[4] http://www.brighthubengineering.com/hydraulics-civil-engineering/93173-runoff-coefficients-for-use-in-rational-method-calculations/ Assumed disturbed area, 2 to 6% slope, Soil Group B with a coefficient of 0.68. However, 0.69 was inadvertently used in the calculations instead of 0.68.

Material Area (% covered surface) = 1 – Open Area

Material Runoff Coefficient = 0.14[5]

Average Annual Precipitation (in) = 30-Year Average Annual Precipitation (in)[6]

Annual Conveyance Drain Installation Cost ($/cubic yard) = (Conveyance Drain Installation Cost ($) x Capital Recovery Factor) / Compost Processed Annually (cubic yard)

Where: Conveyance Drain Installation Cost ($) = $10,000

Annual Retention Pond Monitoring Cost ($) = $3,962

Annual Maintenance Cost ($) = $3,500

Option 2: Cost of Groundwater Well Installation and Monitoring

If the operator chooses to monitor groundwater instead of upgrading the pad to the required hydraulic conductivity standard, the following equation calculates compliance costs:

Annual Compliance Cost Without Pad Installation ($/cubic yard) = Annual Retention Pond Installation Cost ($/cubic yard) + Annual Conveyance Drain Installation Cost ($/cubic yard) + Annual Groundwater/Retention Pond Monitoring Costs ($/cubic yard) + Annual Maintenance Cost ($/cubic yard) + Annual Groundwater Monitoring System Installation Cost ($/cubic yard)

Where: Annual Groundwater Monitoring System Installation Costs ($/cubic yard)[7] = ((If Pad Size $\geq$ 50 acres, then Cost of 5 Wells ($), If Pad Size < 50 acres, then Cost of 3 Wells ($)) x Capital Recovery Factor) / Compost Produced Annually (cubic yard)

Where: Installation Cost of 5 Wells ($) = $58,919

Installation Cost of 3 Wells ($) = $35,387

Annual Groundwater/Retention Pond Monitoring Costs ($/cubic yard)[8] = (If Pad Size $\geq$ 50 acres, then Annual Cost Monitoring 5 Wells ($), If Pad Size < 50 acres, then Annual Cost Monitoring 3 Wells ($)) / Compost Produced Annually (cubic yard)

Where: Annual Monitoring Costs for 5 Wells ($) = $16,667

Annual Monitoring Costs for 3 Wells ($) = $11,167

Surveyed Facilities' Costs by Category

Figure 1 graphs the costs of surveyed facilities presented in Table 1, and provides a visual comparison of cost categories by facility. The results assume that the operator chooses the lower cost (Option 2) of installing and monitoring groundwater rather than upgrading the operation's pad surface (Option 1).

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5 Op. cit. Compost material is similar to forested areas with a slope 2 to 6% on Soil Group B.

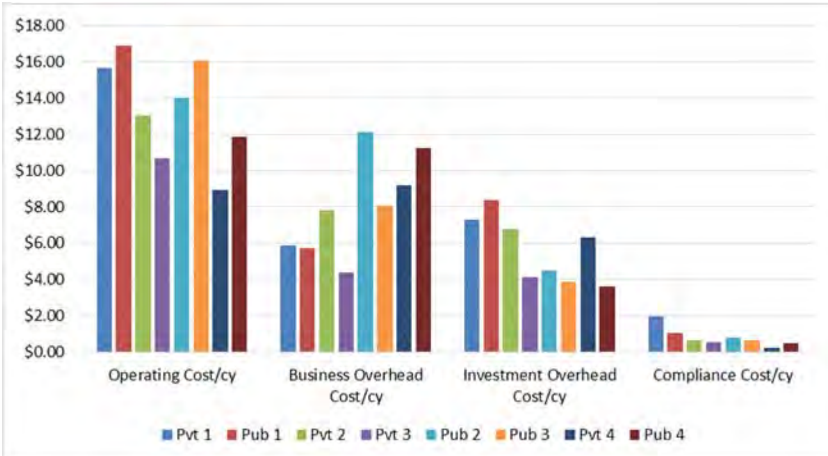
6 PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 3/1/2014. 30-year average was closest available data to the 25-year annual required in proposed Order.

7 Includes project management, planning, installation, sampling, and reporting for the first year.

8 Includes annual sampling and reporting costs.

The facilities are arrayed by size so that the effect of economies of size on the cost of producing per cubic yard is shown. Operating costs, investment overhead costs and compliance cost decline as the amount of compost produced increases while business overhead cost increases. This is attributed to the larger facilities in the sample tending to lease or rent rather than purchasing selected capital equipment. Other differences may be attributed to the various processing technologies employed and ownership type.

Figure 1. Comparison of Surveyed Compost Facilities Cost Categories



Compliance costs assume the operator chooses the lessor cost option of monitoring groundwater rather than upgrading the operation's pad surface. Compliance costs are principally the installation of the retention pond, which is determined by pad size and 30-year average annual precipitation. Comparing pad size and precipitation for facilities Pvt 1 and Pvt 4 illustrates the variables' effects on compliance cost.

Facility Pvt 1 has a pad size of 15.8 acres, a 30-year average annual precipitation is 22.36 inches, and processes 25,000 cubic yards of compost annually. Using the pond to pad factor ($0.00692 in^{-1}$), the pond installation cost of the single lined pond is $147,388 per acre. Therefore, facility Pvt 1 has a retention pond installation capital cost of $360,359. This capital cost is then annualized (assuming 6 percent interest rate over 20 years [0.0872]) and converted to a cost per cubic yard (by dividing the amount of compost produced annually), resulting in a cost of $1.26/cubic yard of compost produced. Adding in the cost of the drainage conveyance ($0.035/cubic yard); the compliance wells ($0.123/cubic yard); and retention pond monitoring and maintenance costs ($0.587/cubic yard), facility Pvt 1 has a total compliance cost of $2.00/cubic yard.

Much lower compliance costs were projected for facility Pvt 4. Facility Pvt 4 has a pad size of six acres, a 30-year average annual precipitation of 15.76 inches, and processes 103,152 cubic yards of compost annually. Therefore, facility Pvt 4 has a retention pond installation capital cost would be $96,457. Annualizing the cost and dividing by the amount of compost processed annually results in a cost of $0.082/cubic yard. Adding in the cost of the drainage conveyance ($0.008/cubic yard); the compliance wells ($0.030/cubic yard); and retention pond monitoring and maintenance costs ($0.142/cubic yard), facility Pvt 4 has a total compliance cost to $0.26/cubic yard, or approximately 13 percent of the compliance cost for facility Pvt 1.

Profit Margins With and Without the Proposed Order

The profit margin is one indication of the economic viability of an operation. Profit margins can be used to compare similar types of operations with respect to changes in operating costs to determine changes in economic viability.

The profit margin is calculated as follows:

$$\text{Profit Margin (\%)} = ((\text{Gross Revenue (\$)} - \text{Total Costs (\$)}) / \text{Gross Revenue (\$)}) \times 100$$

The profit margin is just one indicator of economic viability. Therefore, the rate of return on investment was also calculated and will be reported later in this report. Other measures of economic viability require knowledge of the operation's assets and debt situation, which are not addressed in this analysis.

Composting gross revenue is comprised of two major revenue sources. The first revenue source is termed "tipping fees", or the charge a facility requires for accepting feedstocks. The tipping fee is usually in units of gross tons. The second revenue source is from the sales of the finished product, typically on a bulk-wholesale cubic yard basis. Gross revenue, the revenue term used in the following text and tables, represents the sum of the two revenue sources.

Table 2 presents total costs, gross revenue, net revenue, profit margins, and rate of return on investment with and without compliance costs for the surveyed facilities. In this analysis, profits represent the economic returns that will be retained by the facility owner after all itemized expenses have been paid. Of the surveyed facilities, facility Pvt 3 had the largest profit margin, with a 41.8 percent profit margin (without compliance costs). Compliance costs for Pvt 3 was relatively low, at $.55 per cubic yard of compost sold, resulting in a profit margin with compliance costs of 40.2 percent, a reduction of 4.0 percent. Since the reduction in the profit margin is relatively low, it can be concluded that the proposed Order will not significantly affect the economic viability of Pvt 3.

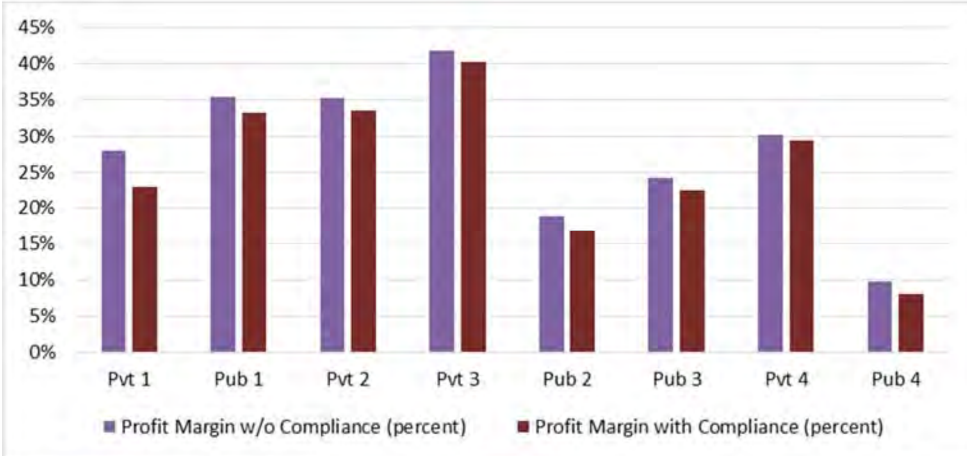
Table 2. Profit Margins

Facility	Total Cost w/o Compliance ($/cy)	Gross Revenue ($/cy)	Net Revenue w/o Compliance ($/cy)	**Profit Margin w/o Compliance (percent)**	Compliance Cost ($/cy)	Total Cost with Compliance ($/cy)	Net Revenue with Compliance ($/cy)	**Profit Margin with Compliance (percent)**	**Decline in Profit Margin (percent)**
Pvt 1	$28.82	$40.00	$11.18	**27.9%**	$2.00	$30.83	$9.17	**22.9%**	**17.9%**
Pub 1	$30.99	$48.00	$17.01	**35.4%**	$1.06	$32.04	$15.96	**33.2%**	**6.2%**
Pvt 2	$27.56	$42.50	$14.94	**35.2%**	$0.67	$28.23	$14.27	**33.6%**	**4.5%**
Pvt 3	$19.19	$33.00	$13.81	**41.8%**	$0.55	$19.74	$13.26	**40.2%**	**4.0%**
Pub 2	$30.58	$37.70	$7.12	**18.9%**	$0.80	$31.38	$6.32	**16.8%**	**11.2%**
Pub 3	$28.01	$37.00	$8.99	**24.3%**	$0.66	$28.67	$8.33	**22.5%**	**7.4%**
Pvt 4	$24.44	$35.00	$10.56	**30.2%**	$0.26	$24.70	$10.30	**29.4%**	**2.5%**
Pub 4	$26.70	$29.58	$2.87	**9.7%**	$0.50	$27.20	$2.37	**8.0%**	**17.4%**

Pub 4, the largest operation in the survey, has a 9.7 percent profit margin (without compliance costs), which is reduced to an eight percent profit margin when compliance costs are included. It should be noted that as wholly owned and operated by a public agency, profits are not the primary motivator for Pub 4. The objective of Pub 4 is to provide quality and cost-effective recycling services for the community at the lowest cost without negative financial returns. Pub 4 will provide composting services even if reasonable compliance costs increase the total cost of operation. Although the manager is charged with minimizing costs, the facility will not reduce operations due to a decline in net revenue.

Figure 2 presents a graphic comparison of facility profit margins with and without compliance costs. Pvt 1 is a privately owned, profit motivated company that will experience a decline of 17.9 percent in their profit margin. While a substantial decline in the profit margin, it leaves the operator with a 22.9 percent profit margin, which should not affect the economic viability of the facility.

Figure 2. Profit Margins With and Without Compliance Costs



The remaining five facilities will also experience reductions in net revenue, but should remain economically viable.

Four of the compost facilities are publicly owned or partnered with public entities. These operators have contractual obligations to provide compost services for the public and an additional objective to minimize costs. These operators will experience the most dramatic decline in projected profit margins, but are less vulnerable to economic hardship due to the participation of public partners. Four facilities are private operators with profit margins ranging from 22.9 to 40.2 percent after absorbing the compliance costs of the proposed Order and will remain economically viable.

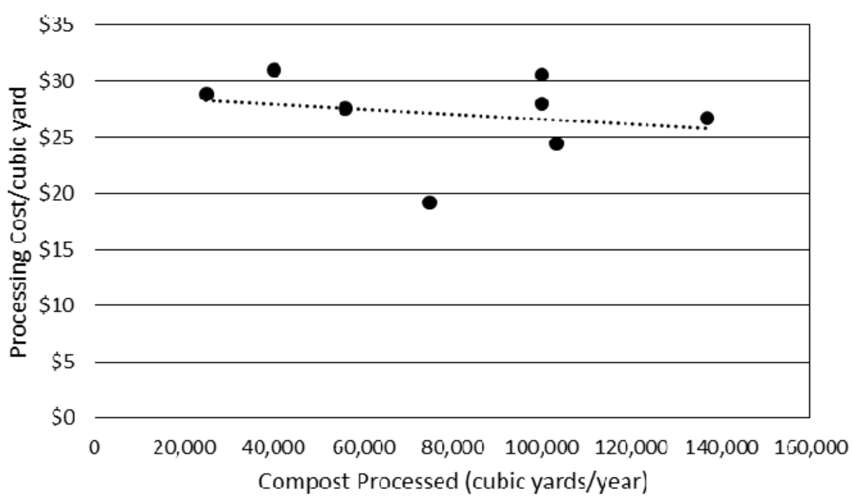
Profit Margins for California Compost Facilities

The data from the eight surveyed facilities were used to the estimate costs and revenues for the remaining 113 compost operations anticipated to be subject to the proposed Order. Facilities that are covered under existing waste discharge requirements; not currently operating; or exempted operations were not included in this analysis.

Processing Costs

Existing compost processing costs (without compliance costs added) for the surveyed facilities were plotted to obtain a trend line (Figure 3).

Figure 3. Existing Processing Costs and Total Annual Compost Processed



The trend line was estimated using the following regression model:

$y = \alpha + \beta x + \mu$

where: y is processing cost/cubic yard;

α is the intercept;

β is the slope of function;

x is the size of the facility in cubic yards processed annually; and

μ is the error term.

The estimated regression equation is:

Processing Cost ($/cubic yard) = $ 28.24 + (-$0.0000167 * Compost Processed Annually (cubic yard/year)

$R^2 = 0.018$

The R^2, or correlation of determination, indicates that proportion of the total variation of processing costs that is explained by the model. An R^2 of .018 is statistically insignificant but is consistent with the presence of economies of size. To improve the predicative properties of the model, a dummy variable was introduced to test the hypotheses that the type of ownership causes a structural change in processing costs. A dummy variable is a 0 or 1 numerical value, where a 0 represents a privately owned facility and a 1 represents a publically owned facility. The logic of this model is explained in the previous section on public and private ownership, and their differences in business objectives. The regression model now becomes:

$y = \alpha + \beta_1 x + \beta_2 p + \mu$

where: y is processing cost/cubic yard;

α is the intercept;

β_1 is the slope of function;

x is the size of the facility in cubic yards processed annually;

β_2 is the difference in the cost of processing for publically owned compost facilities;

p is 1 if the facility is publically owned, 0 otherwise; and

μ is the error term.

The estimated regression equation is:

Processing Cost ($/cubic yard) = $ 28.68 + (-$0.0000567 * Compost Processed Annually (cubic yard/year) + $5.74 for publically owned facilities.

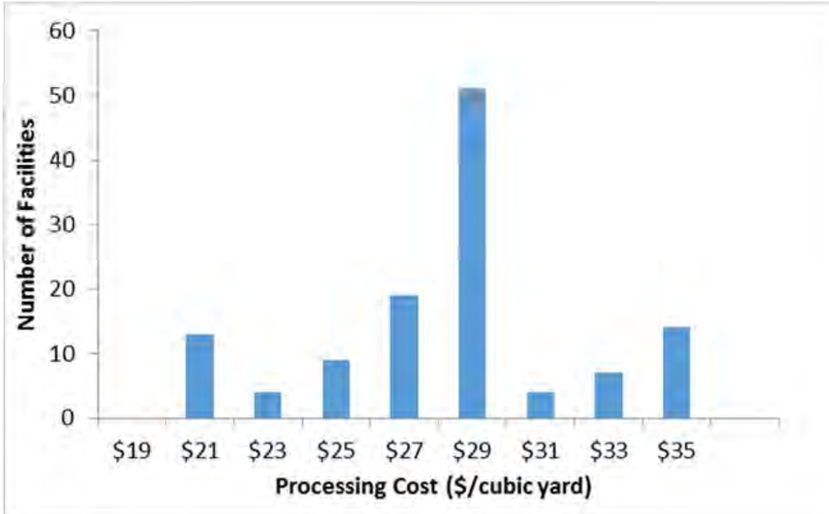
$R^2 = 0.58$

The R^2 indicates that 58 percent of the variation in the facility cost of processing is explained by the regression model.

The t statistic (coefficient divided by the standard error) of β_1 is 1.76, which is significant at the 90% confidence level. The t statistic of β_2 is 2.54, which is significant at the 95% confidence level. This set of regression coefficients was used to predict compost costs for the 113 statewide facilities subject to the proposed Order.

The frequency of compost processing costs for the 121 statewide facilities is presented in Figure 4.

Figure 4. Processing Cost



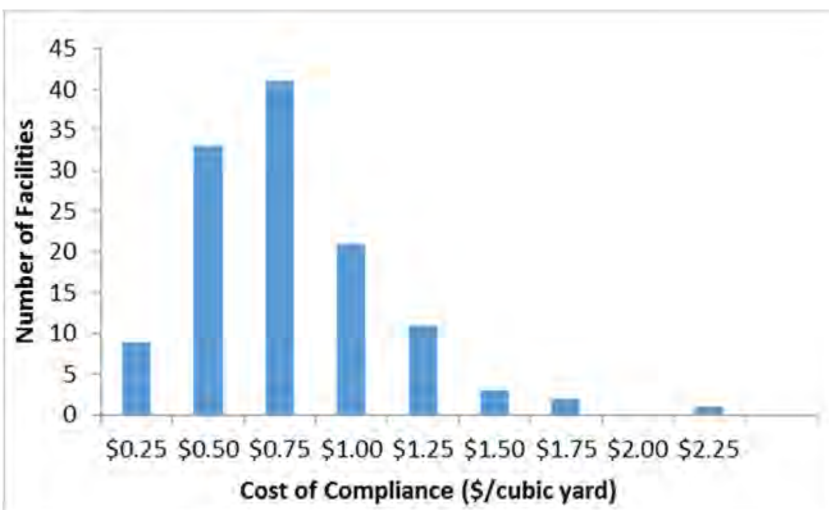
The minimum facility processing cost is $19.19/cubic yard and the maximum is $34.08/cubic yard. The mean is $27.20/cubic yard and the median is $27.66/cubic yard.

Compliance Costs

121 California compost operations are subject to the provisions of the proposed Order. CalRecycle's Solid Waste Information System (SWIS) facility database[9] provides collected data on the quantity of compost processed, and the size of each facility. As stated above, total compost costs for each facility is the total of processing costs plus compliance costs.

Figure 5 plots the frequency of compliance costs ($/cubic yard) for the 121 facilities. As previously stated, compliance cost is primarily determined by the pad size, and the average annual precipitation.

Figure 5. Compliance Costs



The minimum facility compliance cost is $.09/cubic yard and the maximum is $2.00/cubic yard. The mean is $0.66/cubic yard and the median is $0.59/cubic yard.

[9] http://www.calrecycle.ca.gov/swfacilities/Directory/

The location of the 121 compost facilities, their compliance costs, and 30-year average annual precipitation is shown in Figure 6. As previously stated, a high correlation exists between higher rainfall areas and higher compliance costs, which is prevalent in Northern California.

Compliance costs per unit of compost processed is a function of the size of the operation and the amount of compost processed annually. Facilities with lower compliance costs are generally located in the San Joaquin Valley and Southern California, and process larger amounts of compost annually. Plotting compliance costs and the amount of compost processed annually indicates the influence of the economies of size (Figure 7). The nonlinear Excel trendline indicates that costs decline as size increases, but most economies of size are achieved by the 50,000 cubic yard/year level. The deviations from the trendline can be attributed to distortions of pad size relative to facility size and average annual precipitation.

Figure 6. Compost Facilities and Compliance Cost

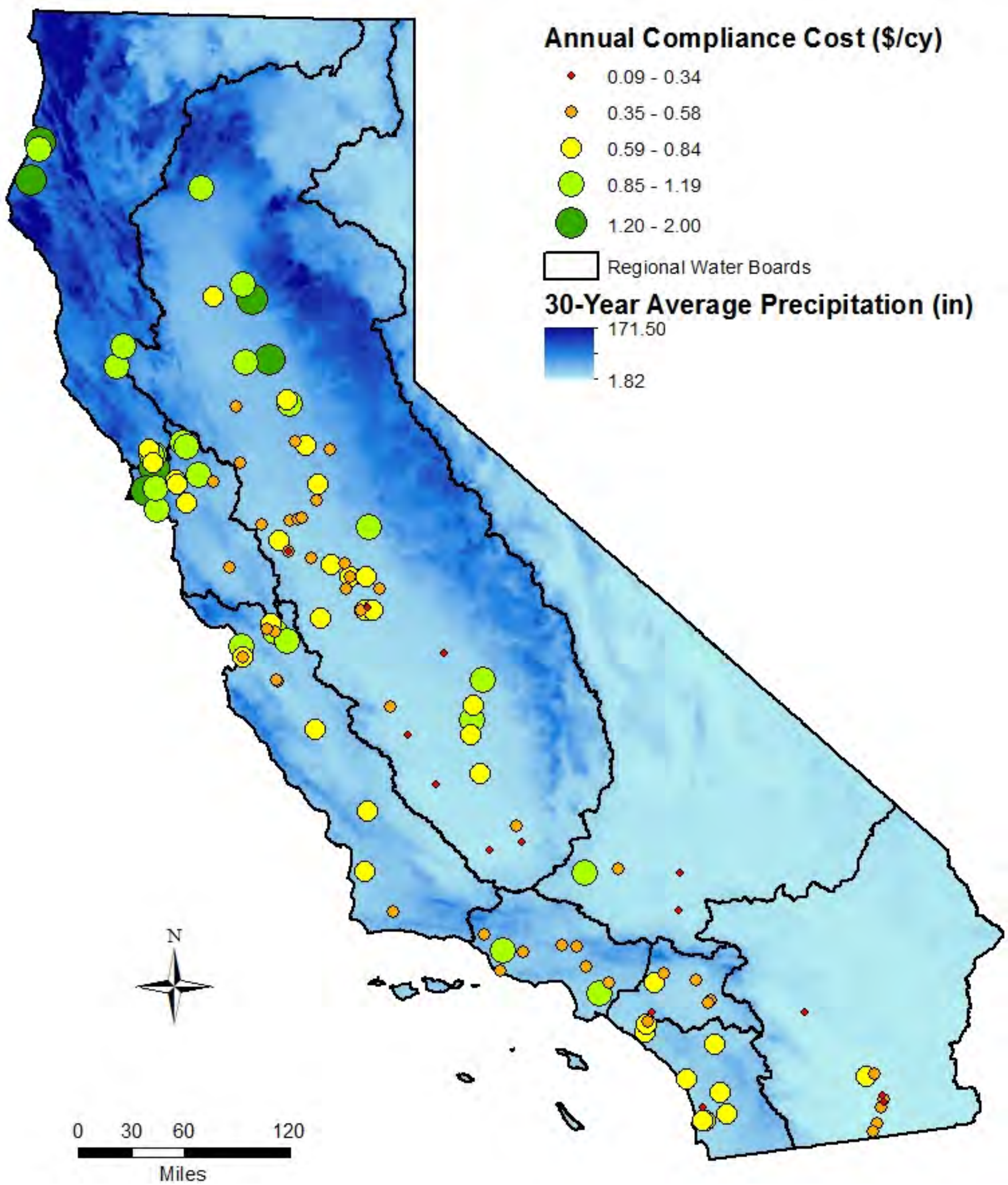
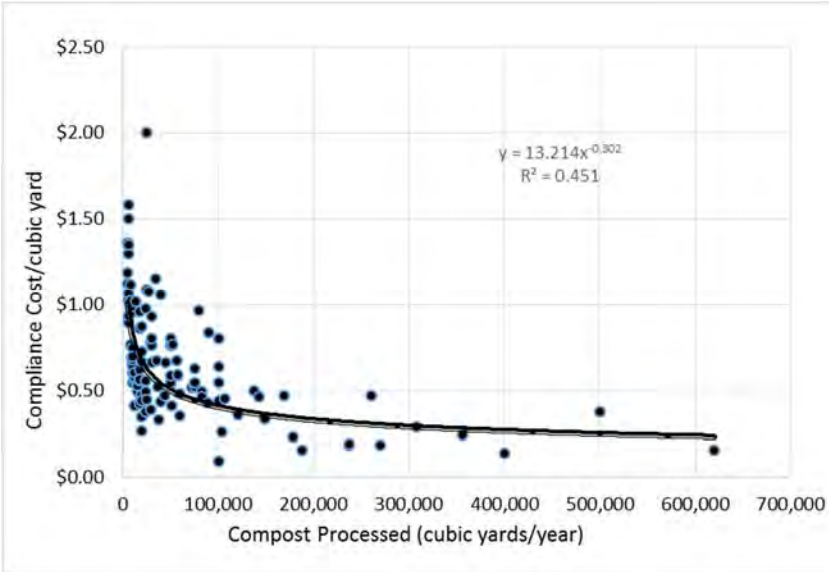


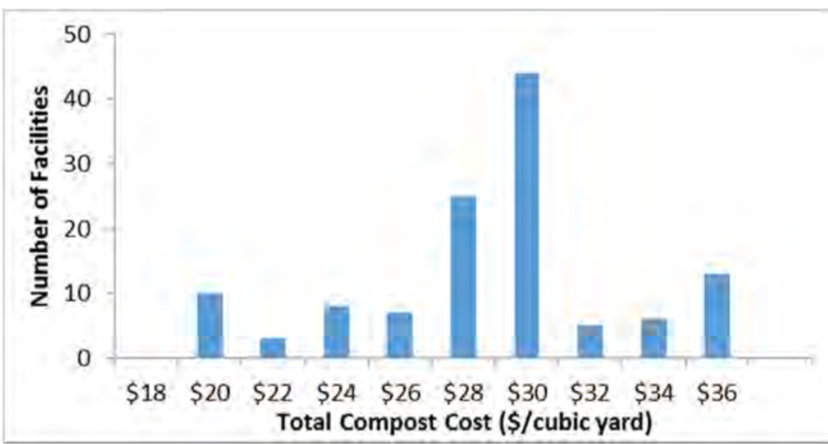
Figure 7. Compliance Cost and Size of Compost Facility



Total Compost Cost

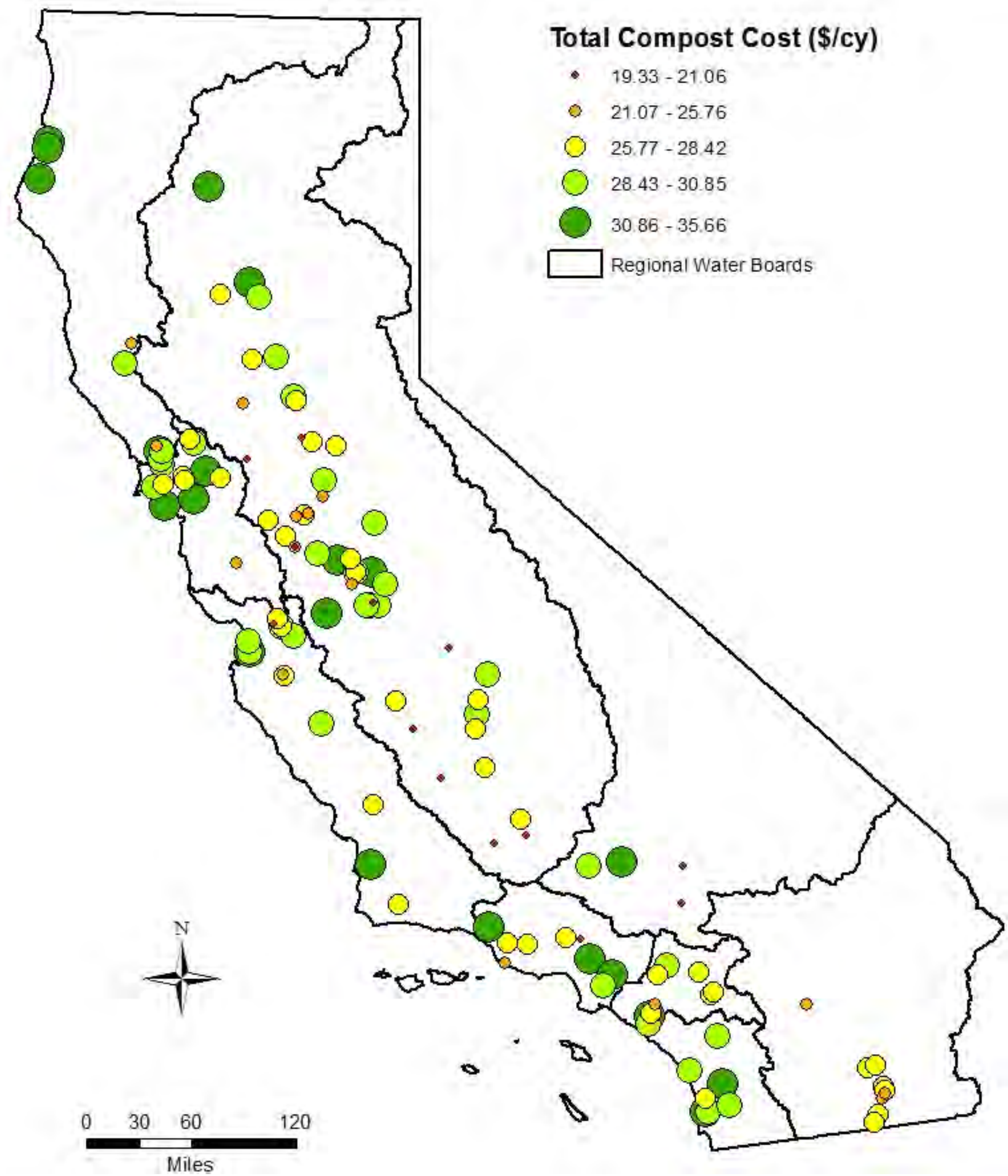
The total compost cost per cubic yard for each facility is the sum of the total processing cost and the annual compliance cost. The frequency of the facility total compost costs ($/cubic yard) for the 121 compost operations is presented in Figure 8.

Figure 8. Total Compost Cost



The estimated minimum facility total cost is $19.33/cubic yard and the maximum is $35.66 cubic yard. The mean is $27.85/cubic yard and the median is $28.28/cubic yard. Seventy of the 121 facilities fall into the $26/cubic yard to $30/cubic yard cost category. Twenty five of the 32 publically owned or operated facilities had total compost costs exceeding $29.79/cubic yard. Many of the low cost facility are located in the south central valley and southern California (Figure 9).

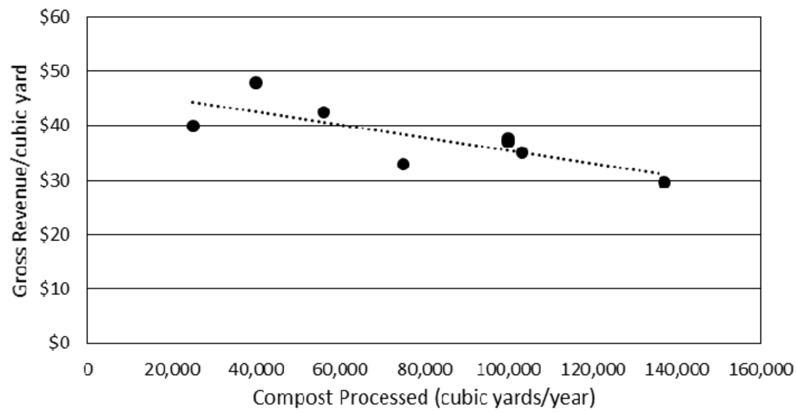
Figure 9. Compost Facilities and Total Compost Costs



Gross Revenue

Net revenue and profit margins were calculated for the 121 compost operations. First, gross revenue was projected using regression analysis. A plot of the compost gross revenue for the surveyed facilities and a linear trendline is presented in Figure 10.

Figure 10. Gross Revenue and Quantity of Compost Processed Annually



A linear regression analysis estimates the following relationship:

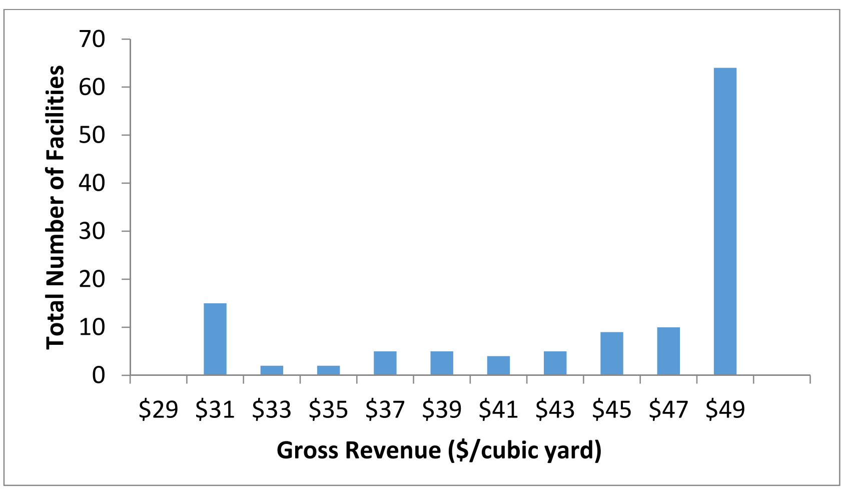
Gross Revenue ($/cubic yard) = $51.63 + (-$0.000161 * Compost Processed (tons/year)

$R^2 = .74$

The t statistic for the slope variable is 3.8 which is significant at the 95% confidence level.

The gross revenue was calculated for the 121 compost facilities subject to the proposed Order. The frequency of the facility gross revenue is presented in Figure 11. The minimum gross revenue is $29.58/cubic yard and the maximum is $48.00/cubic yard. The mean is $43.27/cubic yard and the median is $47.60/cubic yard.

Figure 11. Gross Revenue

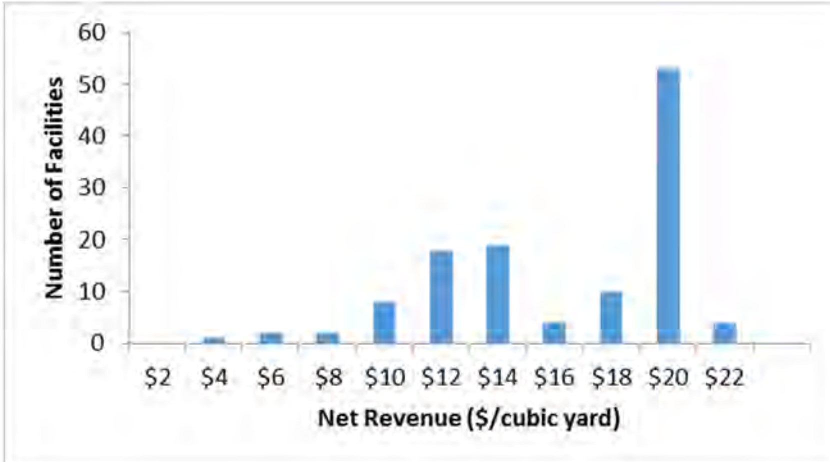


Due to the considerable slope of the regression equation, gross revenue was constrained to the upper and lower values ($48.00 and $29.58) of the sample data. This accounts for the high frequency (64) of Tier I and small Tier II facilities that fall into the $47/cubic yard - $49/cubic yard category. This is also exhibited in the number of facilities in the $29.00/cubic yard - $31.00/cubic yard category.

Net Revenue

Net revenue was calculated by subtracting total processing cost from gross revenue for each of the 121 compost facilities. The frequency of the facility net revenue is presented in Figure 12.

Figure 12. Net Revenue

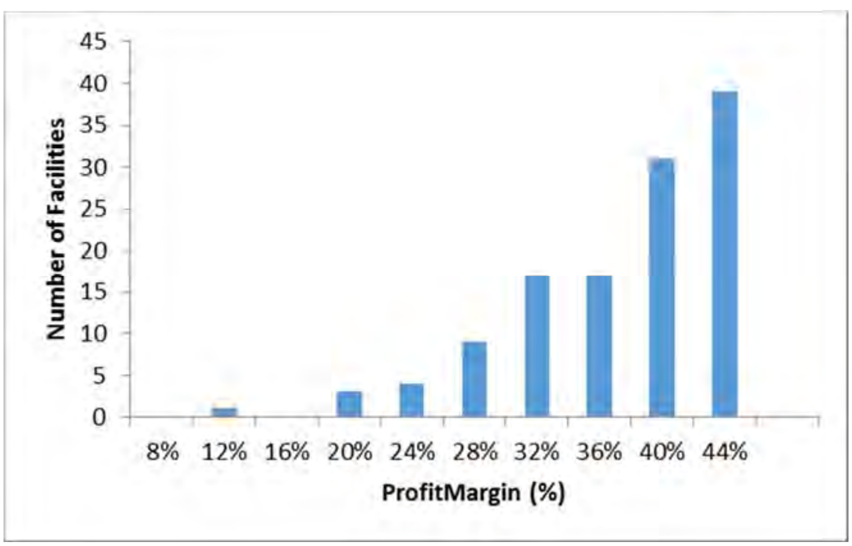


The minimum net revenue is $2.43/cubic yard and the maximum is $20.19/cubic yard. The mean is $15.42/cubic yard and the median is $17.17/cubic yard. As the regression equations indicate, both gross revenue and total costs decline as the quantity of compost processed increases but revenue declines faster than costs. While the lower net revenue per cubic yard seem small, total net revenue for a facility should be adequate to maintain economic viability due to the larger amount of compost processed. For example, the facility with the lowest net revenue ($2.43/cubic yard)[10] had a total net revenue of $402,000.

Profit Margins

Profit margins were calculated for the 121 compost facilities by subtracting total costs from gross revenue and dividing by gross revenue. The frequency of the facility profit margins is presented in Figure 13.

Figure 13. Profit Margins



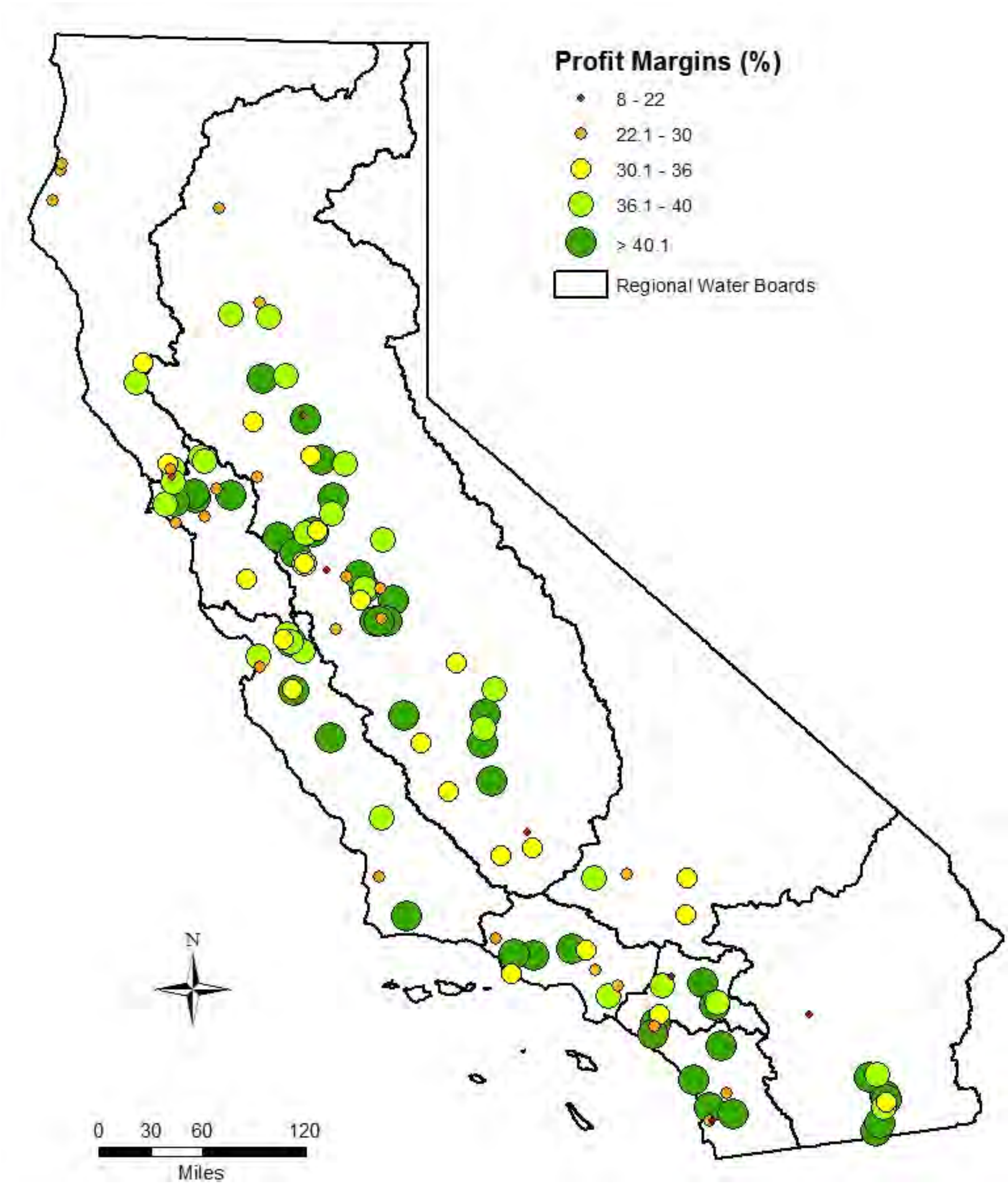
The minimum profit margin is 8.2 percent and the maximum 42.1 percent. The mean is 35.2 percent and the median is 38.5 percent.

The calculated profit margins indicate that the imposition of the proposed Order will not adversely affect the economic viability of California compost facilities. Lower profit margins (less than 18 percent) are experienced by larger, publically owned facilities (where profit margins are less significant on the

[10] Included in the $2 -$4 range of Figure 12.

continued running of the operation) located in the San Joaquin Valley and southern desert regions (Figure 14).

Figure 14. Compost Facilities and Profit Margins



FEEDSTOCK DISPOSAL DESTINATION – COMPOST OR LANDFILL

The second objective of this analysis is to project the possible shift of compost feedstocks from composting operations to landfills as the result of the proposed Order. To project the change in feedstock destination, compost costs of the surveyed landfill disposal facilities were compared to the regional cost of landfill disposal.

Landfill Disposal Alternatives

Landfill disposal costs estimated by HF&H Consultants and Cascadia Consulting Group were used in this comparison.[11] The per-ton disposal costs were gathered through a survey of disposal rates for municipal and high-volume customers. Where appropriate, these disposal rates were weighted to include the costs of transfer station and transport operations. Disposal rates include all government fees and taxes. Landfill disposal costs were calculated for seven regions (Figure 15). The per ton disposal costs for each region, and the counties comprising each region, are listed in Table 3.

Table 3. Landfill Disposal Costs by Region

Region	Counties	Landfill Disposal Costs ($/ton)
Northern California A (Urban Counties)	Marin, Sonoma, Solano, Sacramento, Contra Costa, Alameda, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, and Stanislaus	$43.48
Northern California A (Rural Counties)	Napa, Yolo, and San Benito	$49.88
Northern California B (Urban Counties)	Placer, Merced, Monterey, Butte, Fresno, and Tulare	$57.22
Northern California B (Rural Counties)	Alpine, Amador, Calaveras, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Madera, Mariposa, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Sutter, Tehama, Trinity, Tuolumne and Yuba	$46.59
Southern California A (Urban Counties)	Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura	$42.19
Southern California B (Urban Counties)	Imperial, Kern, San Luis Obispo, and Santa Barbara	$41.43
Southern California B (Rural Counties)	Inyo, Mono, and Kings	$49.53
California Average		$43.48

Source: “Cost Study on Commercial Recycling”. Contractor’s Report produced under contract by HF&H Consultants, Cascadia Consulting Group for Department of Resources Recycling and Recovery, State of California. January 2011.

[11] “Cost Study on Commercial Recycling”. Contractor’s Report produced under contract by HF&H Consultants, Cascadia Consulting Group for Department of Resources Recycling and Recovery, State of California. January 2011. 625 pages.

Figure 15. Definition of Regions

Source: "Cost Study on Commercial Recycling". Contractor's Report produced under contract by HF&H Consultants, Cascadia Consulting Group for Department of Resources Recycling and Recovery, State of California. January 2011. 625 pages.

Survey Compost Facilities Landfill – Compost Cost Margins

Compost feedstocks would probably be diverted from composting facilities to landfill sites if the compost tipping fees exceeded landfill tipping fees. Current compost feedstock tipping fees were not reported in the CalRecycle database therefore this comparison cannot be made. However, tipping fees were collected from the surveyed operators and they are reported in Table 4. As observed in the surveyed facilities data, tipping fees generally approximate the total cost of compost processing, and sales, represent net profit. As a result, the total cost of processing compost was assumed to approximate compost tipping fees and compared with the landfill disposal cost.

Tipping fee cost margins were calculated to easily compare the landfill and compost tipping fees. A cost margin is defined as the difference between the alternative landfill disposal cost and the total compost cost divided by the landfill disposal cost. The cost margin represents the percent increase in the compost tipping fee that would equal the landfill tipping fee. Landfill-compost cost margins for the surveyed facilities range between 27.8 and 54.6 percent (Table 4). This means that the total compost cost with compliance costs would have to increase by 27.8 percent to equal the landfill disposal cost. The high cost margins indicate that the imposition of the proposed Order compliance costs will not shift feedstock from compost sites to landfills.

Table 4. Total Compost Costs, Landfill Disposal Costs, and Cost Margin by Facility

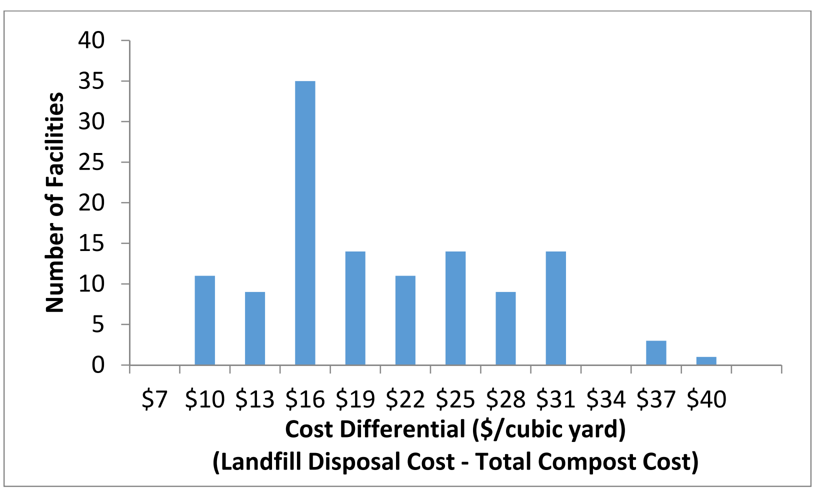
Facility	Total Cost ($/cy)	Gross Revenue ($/cy)	Compost Tipping Fee ($/t)	Landfill Disposal Cost ($/ton)	Cost Difference ($/ton)	Cost Margin[1] (percent)
Pub 1	$32.04	$48.00	$40.00	$49.48	$17.44	35.2%
Pub 4	$27.20	$29.58	$28.00	$49.53	$22.33	45.1%
Pvt 1	$30.83	$40.00	$30.00	$46.59	$15.76	33.8%
Pvt 4	$24.70	$35.00	$30.00	$42.19	$17.49	41.5%
Pvt 2	$28.23	$42.50	$30.00	$43.48	$15.25	35.1%
Pub 2	$31.38	$37.70	$30.00	$43.48	$12.10	27.8%
Pvt 3	$19.74	$33.00	$21.00	$43.48	$23.74	54.6%
Pub 3	$28.67	$37.00	$30.00	$42.19	$13.52	32.0%

[1] Cost Difference / Landfill Disposal Cost.

California Landfill and Compost Operation Cost Differential

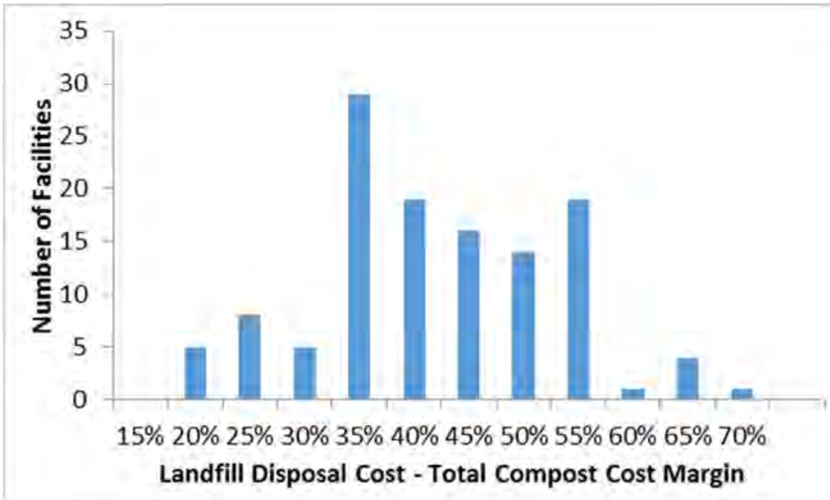
Comparing the total compost cost to the landfill disposal cost determines the possibility of compost feedstock being diverted to landfills. The frequency of the cost differential between the landfill cost and the total compost cost is presented in Figure 15.

Figure 15. Landfill Disposal Cost and Total Compost Cost Differential



The minimum cost differential is $7.04 per cubic yard and the maximum is $37.74 per cubic yard. The mean is $18.91 per cubic yard and the median is $17.34 per cubic yard. The results of this comparison indicate that compost feedstocks will not be diverted to landfills as a result of the proposed Order. The frequency of cost margins for the 121 California compost facilities is depicted in Figure 16.

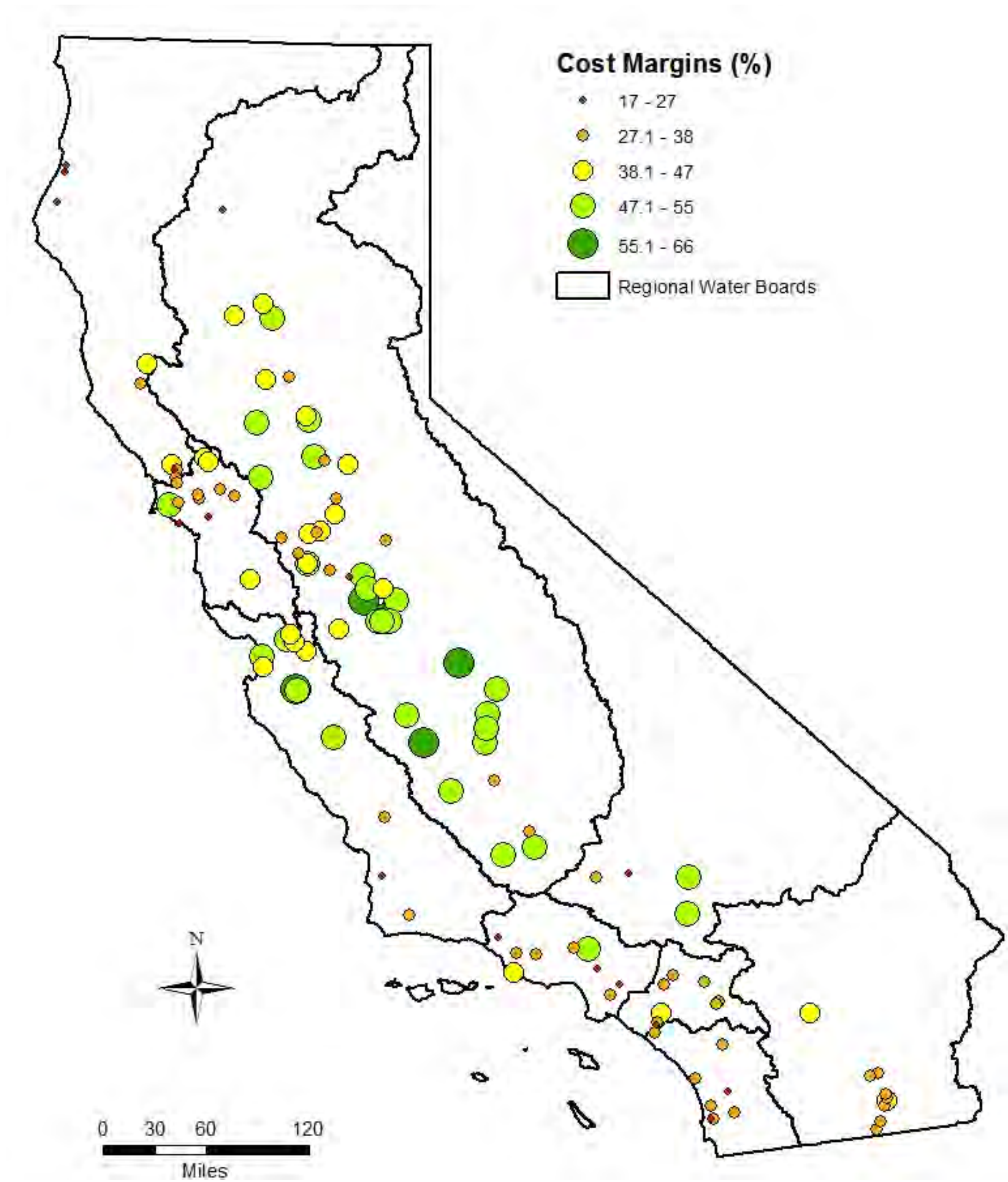
Figure 16. Landfill - Compost Cost Margins



The minimum cost margin is 17.0% and the maximum is 66.0%. The mean is 39.6% and the median is 38.3%. As stated above, the cost margins calculated here include the costs of compliance with the proposed Order.

Facilities located in the southern coastal region have the lowest cost margins and the lowest landfill disposal costs (Figure 17). Since the lowest cost margins estimated was 17.0%, there is very little possibility that compost feedstock will ever be diverted to landfills as a result of adopting the proposed Order.

Figure 17. Compost Facilities and Landfill - Compost Cost Margins



CONCLUSIONS

This report provides the results of an economic analysis of California compost operations. The objectives of the analysis were to (1) determine the economic viability of compost operations to absorb the financial costs of implementing the provisions of the proposed Order to protect groundwater, and (2) determine if compost feedstock might be diverted to landfills as a result of the proposed Order.

Specifically the proposed Order would require compost facilities to modify their operational pad to meet a permeability standard, and to install a pond to catch and store precipitation runoff. In lieu of upgrading the pad, operators can opt to install groundwater monitoring wells to determine if a groundwater threat is present. Since the latter option is the least cost option, it is assumed operators will install the groundwater monitoring system instead of upgrading the pad to meet the permeability standard.

Detailed compost processing costs and revenues were obtained from eight compost facilities located throughout California. The facilities vary in ownership structure, size and the type of technology employed. Compliance costs were combined with the surveyed costs and revenues to determine economic viability. The results of the surveyed operations were extended to the 121 California permitted compost operations that will be subject to the proposed Order. Imposition of the proposed Order will increase facility composting costs by 1.1 percent to 6.9 percent. This increase will not threaten the economic viability of compost operations subject to the proposed Order.

Compost tipping fees were compared to landfill tipping fees to determine the possibility of compost feedstocks being diverted to landfills as a result of the proposed Order. Compost tipping fees approximate the cost of processing. Compliance cost were added to the cost of compost processing to derive the projected, post-proposed Order, tipping fee. The projected tipping fee was then compared to the landfill tipping fee to determine if compost feedstock would be diverted to landfills. The difference between the projected compost tipping fees and landfill tipping fees ranged from $12.10 to $23.27 per ton of feedstock. This comparison can also be expressed as a cost margin. A cost margin is the percent change that compost costs would have to increase to equal the landfill disposal cost. The cost margin ranges from 27.8% to 54.6%. The compost tipping fee includes the projected cost of compliance, therefore, the imposition of the proposed Order will not cause a diversion of compost feedstocks to landfills.

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Appendix E