City of Davis
Organics Processing Facility
Feasibility Analysis

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Section 1
Executive Summary

The City of Davis hired the Clements Environmental team, including sub-contractors Sloan Vazquez McAfee and Diversion Strategies, to assess the feasibility of various organics processing scenarios for the diversion of organic waste from the landfill. These scenarios included:

1. Joining the County of Yolo's bioreactor project at the Central Landfill
2. Developing a new City-Sponsored Project
    a. At the Old Landfill
    b. At the Wastewater Treatment Plant (WWTP)
    c. At a site adjacent to the University of California (UC) Davis Anaerobic Digestion (AD) plant
3. Contributing feedstock to a new UC Davis project adjacent to the university's AD plant

During the course of the study, Recology Services offered to purchase Davis Waste Removal. The Clements team provided input into the feasibility of the City committing its organic material to Recology and tasking them with handling these feedstocks in their regional organics system. This system includes most importantly the Jepson Prairie Organics composting operation near Vacaville.

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APPROACH

The Clements team gathered data by various methods and from numerous sources including:

1. Meetings with City staff and Davis Waste Removal
2. Meeting and discussions with UC Davis
3. Discussions with Yolo County
4. Meeting with the Yolo-Solano Air Quality Management District
5. In-depth discussions with Davis Waste Removal, and brief review of Recology and Waste Management's operations
6. Discussions with composting and AD technology providers
7. Team knowledge of the industry in general and the City of Davis region in particular
8. Team pro formas generated over decades of work with facilities and operations in the solid waste field
9. EPA, CalRecycle, and other databases

This information was then used to assess the feasibility, costs and benefits, of the selected organics diversion opportunities available to the City.

FEEDSTOCKS

The feedstock study performed by Diversion Strategies reveals that the City collects about 48 tons per day (TPD) of organic material from customers, comprised of roughly two percent (2%) food waste with the remainder as green and wood waste. This is the first complete year of the City's organics collection program, and the team expects the percentage of food waste to increase to typical municipal organics program rates of five percent (5%) in the residential collection and ten percent (10%) in the commercial collection, and perhaps even more as the organics source separation programs mature. The study found that the source separated organic material was relatively free of contamination as compared to other cities with similar programs. This is a testament to both the effectiveness of the City's program design and education, and to the environmental ethic and performance of the residents of the City of Davis.

In addition, UC Davis also generates approximately 48 TPD of organics including food waste, green waste, digestate from their anaerobic digestion (AD) facility, and most of all, animal manure and bedding. The University has expressed interest in a joint project with the City and thus this material could be available as a feedstock.

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PRODUCTS MARKET ASSESSMENT

In order for any organics management system to be effective, there must be a market for the products the system generates. In the case of this study, the key products are compost and biogas. The latter can be used to generate electricity, to fuel Compressed Natural Gas (CNG) vehicles, or as renewable natural gas for injection in the utility gas pipeline. This study focused on generating electricity and fueling CNG vehicles as the quantities of biogas that could be generated were too low to make the more complex pipeline injection alternative feasible.

The results of the study found that there was a strong market for compost in the area with a value of roughly $20 per ton. Likewise, biogas was found to be a valuable commodity as a generator of electricity to help power the WWTP; or even more when converted to CNG vehicle fuel.

ALTERNATIVE PROJECT EVALUATIONS

The Clements team evaluated five options as summarized below and in detail in the body of the report.

Joining the Yolo County Organics Project at the Central Landfill

The Clements team evaluated the feasibility of the City participating in the Yolo County Central Landfill's (YCCL) organic processing project. This option offers advantages in that the City would only be required to guarantee delivery of their organics to the County project at a specific, as yet undetermined, tipping fee. The disadvantage is primarily one of control in that the City may be wedded to the County and its project for decades into the future, and would not have the flexibility to change direction in programs or facilities as organics diversion progresses.

City Project at the Old Landfill

Although the City's Old Landfill is a potential site for an organics facility, the team quickly eliminated this option from further analysis because:

- It is located relatively close to residential neighborhoods;
- The City is strongly considering other uses for the site that would take precedent over an organics project;
- City staff indicated that this site had little potential for development of an organics facility based on input from other City departments

City Project at the WWTP

The City's WWTP is an excellent site for an organics processing facility. The City owns the land and there is a large acreage vacant and available. The site is remote from sensitive receptors such as residential areas, schools, and hospitals. There are certain synergies between an organics project and the WWTP operations and its by-products. Reclaimed water is available should an organics project, such as composting, require water for optimal processing conditions. Both the WWTP and an AD facility generate biogas that could be combined and make either power generation or conversion to CNG fuel more economical. In addition, the City would control much of the permitting and CEQA process.

For this study, the Clements team evaluated two basic scenarios: a composting facility; or an AD facility co-located with a composting facility. For the latter, a composting operation is integral to the operation of the AD facility to handle the AD digestate and supernatant. The general types of technologies evaluated as best suited for this application were as follows:

Composting

- Covered Static Pile (12 inch compost cover)
- Covered Aerated Static Pile (CASP) (membrane cover)

Anaerobic Digestion (AD)

- High Solids Discontinuous / Batch-Flow Type
- High Solids Continuous / Plug-Flow Type

Biogas Use

- Power Production
- CNG Fuel

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For purposes of this study, the team combined Covered Static Pile Composting, the Discontinuous/Batch Flow AD, and biogas power production as the less sophisticated and less expensive scenario; and the Covered Aerated Static Pile composting, the Continuous/Plug Flow AD, and the CNG production as the more sophisticated, higher performing, and expensive option. In this way, the range of project possibilities was covered, without having to analyze every possible combination of composting, AD, and biogas utilization technologies, which was beyond the scope of this work.

City Project at UC Davis

UC Davis has expressed interested in hosting a City-operated composting project adjacent to the university's AD facility. Since the team assessed the feasibility of an identical composting operation at the City's WWTP, the same technology design, costs, and revenues were applied to this project.

The two key differences between a composting project at the City's WWTP and at UC Davis are: 1) UC Davis would be the lead agency during the CEQA and land use permitting process; and 2) the City would most likely be required to pay to lease the UC Davis property.

Alternatively, the City could commit its organic material to a university owned and operated composting project at the same location. This would alleviate the City from having to pay for and develop its own project, but would severely limit the City's flexibility moving forward as its feedstock would likely have to be committed for years to the university's project.

Recology Services

Recology Services has offered to purchase Davis Waste Removal, both its business and all its assets. The City is currently vetting this proposal; it is unclear whether the purchase will occur or not. If it does, Recology has local organics infrastructure that could receive the City of Davis material. The Jepson Prairie Organics (JPO) facility in Vacaville, only 19 miles from the City of Davis, is within direct haul distance. This site is permitted for composting and could process the City's material, although this would require Recology to free up capacity the composting operation is near permitted limits. Alternatively, Recology could transfer material from JPO to a larger facility in Vernalis.

This may well be the least expensive option for the City depending on the pricing Recology offers. However, it is one which also provides little control moving into the future in relation to new technology options and price control.

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Project Economics

The team used data from current composting and AD operations, and recent grant applications to populate the Sloan/Vazquez/McAfee pro forma for each of the options for City-developed projects. We also utilized data from the City on labor rates, power pricing, and other factors. It should be emphasized that this is a "concept level" analysis and is not meant as a definitive cost evaluation. It does offer a general comparison of costs and revenues between composting and AD scenarios, and provides a yardstick with which to compare future organics projects with existing costs, and other options, such as a proposal from Recology.

The table below provides a summary of per ton costs for the four options of a City-developed project at the WWTP (A through D), and at the UC Davis site (E and F).

	NO.	TECHNOLOGY	TYPE	PRODUCTS	$ / TON
City WWTP	A	Stand Alone Composting	Covered Static Pile (12-inch compost cover)	Compost	$19.69
	B	Stand Alone Composting	Covered Aerated Static Pile (CASP) (membrane cover)	Compost	$44.20
	C	AD with Composting	Discontinuous / Batch-Flow (AD-D) + Covered Static Pile	Power Production + Compost	$70.31
	D	AD with Composting	Continuous / Plug-Flow (AD-C) + CASP	CNG fuel + Compost	$119.25
UC Davis	E	Stand Alone Composting	Covered Static Pile (12-inch compost cover)	Compost	$19.69
	F	Stand Alone Composting	Covered Aerated Static Pile (CASP) (membrane cover)	Compost	$44.20

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Refer to *Section 7, Project Economics* of this report for details of the economic analysis, and **Appendix D** for copies of the pro forma output.

As shown, the options vary significantly in bottom line cost from roughly $20/ton for basic composting to $120/ton for a more advanced project including both AD, composting, and CNG production.

Section 2
Introduction and Background

The purpose of this *Organics Processing Facility Feasibility Analysis* was to provide an analysis of the current and potential future options for organic waste diversion for the City of Davis (City). Specifically, the Clements Environmental team was to determine the feasibility of a City-owned and/or operated organics processing facility at two possible locations, a County-owned and operated facility at the Yolo County Central Landfill (YCCL), and a possible joint project with University of California Davis (UCD).

The following aspects were evaluated:

- Feedstocks
- Products Markets
- Site Features
- Technology Evaluation and Concept Layout
- Environmental Regulatory Requirements
- Capital, Operation & Maintenance, and Equipment Costs
- Policy Considerations

The City identified a need for this analysis based on current and future State of California policies and current organics processing projects moving forward in Yolo County.

The City implemented a mandatory City-wide organics program in July 2016. Over the past year, the City has diverted 14,946 tons of organics. These organics include mixed green and food waste, construction and demolition debris wood drop boxes, street sweepings, and loose green waste piles. Of this waste, roughly 45% is from the organics cart collection (i.e. mixed green and food waste). The City is unique in that it has no large industrial businesses, nor does the City provide waste services to the nearby University of California, Davis. The City's largest organic waste producers are its grocery stores (i.e. Nugget Markets, Safeway, and Savemart) which have adopted individual organic waste policies and programs and, at the time of this study, did not participate in the City's organics collection.

Three major legislative mandates affect the City's organic waste: AB 341, AB 1826, and SB 1383. AB 341 sets a statewide mandate to reduce, recycle, or compost 75% of waste generated by 2020. AB 1826, which came into effect April 1, 2016, requires businesses and multifamily dwellings of certain size to divert their organic waste from the landfill. SB 1383 specifically identifies organic waste diversion targets to reduce statewide greenhouse gas emissions to 1990 levels; CalRecycle plans to adopt formal regulations by 2019 to take effect in 2022.

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Only one permitted composting facility is located within Yolo County; Northern Recycling in Zamora. Currently, all of the City-generated organics are processed at this composting facility. The City's contracted hauler (Davis Waste Removal) currently collects and delivers all organics to the Yolo County Central Landfill (YCCL), where the organics are either preprocessed and transferred, or transferred directly to Zamora for composting. YCCL has developed a partnership with Northern Recycling to move the composting operation in Zamora to YCCL. In addition, YCCL is currently permitting and constructing anaerobic bioreactor digestion cells and a liquid and food waste processing system at the landfill. Per the Yolo County's Waste Advisory Committee meeting in October 2017, YCCL anticipates the anaerobic bioreactor cells to be operational by Fall 2018, with the composting component operational in Fall 2019.

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Section 3
Approach

The Clements team performed the following tasks for this analysis:

- Feedstock Study
- Products Market Assessment
- Site Assessments
- Technology Evaluation and Concept Layouts
- Environmental Regulatory Requirements
- Capital, Operation & Maintenance (O&M), and Equipment Costs
- Policy Considerations

In the course of this project, the Clements team met with representatives of the City of Davis, Davis Waste Removal, University of California Davis, and the Yolo Solano Air Quality Management District. Representatives from Yolo County were contacted via telephone.

Feedstock Study

Clements team member, Diversion Strategies (DS), conducted a review of the City's current waste collection routes, schedule, and organics programs; evaluated the City's organic feedstock tonnage and waste composition; and performed an assessment of potential organic feedstocks from the nearby municipalities' of Winters, West Sacramento, Woodland, and Unincorporated Yolo County. From this information, the team was able to identify the organics feedstock quantity and quality generally available for a City organics processing facility.

Products Markets Assessment

Diversion Strategies (DS) identified and described local and State finished compost standards applicable to this project. The team then identified potential uses for all organic products including compost and biogas. DS outlined the feasibility of marketing and distributing each end product, and identified potential outlets, uses, and pricing. In addition, the economics of utilizing the biogas for power generation and transportation fuel were evaluated.

Site Assessments

The Clements team conducted thorough location analyses for the two sites identified by the City as potential areas for an organics processing facility. This included evaluating the sites' land availability, proximity to sensitive receptors, zoning and permitting, utility availability, and future potential uses. In addition, Clements conducted a comprehensive review of the Yolo County

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Central Landfill's (YCCL) organics project including proposed operations, project status, and tip fees.

Technology Evaluation & Concept Layout

The Clements team identified the most applicable organics processing technologies and evaluated access, land, and operational requirements. The latter included power, labor, and equipment considerations. The potential processing technologies were sized based on the City's and UC Davis's actual feedstock types and quantities. Concept site layouts were prepared depicting key functions and space requirements.

Environmental Regulatory Requirements

Several regulatory bodies govern organics processing facilities in California including: CalRecycle, the Yolo-Solano Air Quality Management District, the State Water Resources Control Board, and the Central Valley Regional Water Quality Control Board. The Clements team has decades of experience permitting solid waste, organics and recycling facilities, and used their expertise to provide the potential impacts of regulations on the project options. Several regulatory requirements were considered in this feasibility analysis, including, but not limited to, California Environmental Quality Act (CEQA), Best Available Control Technology (BACT), National Pollutant Discharge Elimination System (NPDES) Waste Discharge Requirements (WDR), the Industrial General Permit (IGP), and Compostable Materials Handling Facilities State Minimum Standards.

Capital, O&M, and Equipment Costs

As part of the Clements team, Sloan Vazquez McAfee (SVM) used the conceptual project design and their proprietary pro formas to identify annual and per ton project costs based on capital and operation requirements and product revenues.

Policy Considerations

The Clements team evaluated the advantages and disadvantages of the City's participation in each option from a policy perspective. Key among these policy issues is the balance between the effort, cost and risk of developing the City's own projects; and the loss of control and flexibility that comes with participation in a project by either Yolo County or UC Davis.

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Section 4
Feedstock Study

4.1 OVERVIEW

The City of Davis, with a population of approximately 68,000 people, is adjacent to the UC Davis campus which has a student population of over 35,000 people. The fluctuation of population both seasonally and over time due to students coming and going from the University has impacts on the variation of feedstock in both volume and make up.

Due to the size of the City and the fluctuation of volume, collection vehicle routes are optimized for route efficiency and not for material type. This results in commingled loads of residential green/food and commercial green/food that currently contain approximately 2-3% food waste by weight.

Commercial organics accounts and residential organics accounts are picked up on the same route and co-mingled to avoid disjointed collection. If collection routes were created based on account type rather than location, vehicle miles traveled and fuel costs would increase.

4.1.1 Hauler

Davis Waste Removal (DWR) is a local waste hauler who has the exclusive franchise for trash, recycling and organic waste pick up in the City of Davis and the non-exclusive franchise for the adjacent unincorporated Yolo County areas. DWR has been operating in City of Davis since 1972. They collect both commercial and residential accounts for municipal solid waste, recyclables, and organics.

4.1.2 Routes and Collection Schedule

DWR operates collection routes for municipal solid waste (MSW), mixed recyclables, and organics in and near the City of Davis. The collection truck routes include both residential and commercial accounts. Routing is mapped to optimize collection efficiency and to reduce vehicle miles travelled.

Toters are used exclusively for organics collection. Collection vehicles are equipped with hydraulic arms for automated pick up. Curbside residential, commercial organics, and commercial recycling collection use an automated cart system. All trash, organics, and recyclables are placed inside the toters. MSW and organics carts are available in 95, 65, and 35-gallon sizes. MSW rates are based on the bin size and frequency of service. One organics toter per customer is included in MSW rates. Additional organics toters and/or more frequent service is available for additional cost.

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Organics collection occurs Monday through Friday, with a fleet of four trucks/routes per day. The City of Davis' organics program provides for both green and food materials to be co-collected in the same bin. Most hauling routes consist of both commercial accounts and residential accounts commingled in the same truck to ensure route efficiency. Multi-family housing such as large apartment complexes are collected as commercial accounts as well as offices, retail, restaurants, and industry. Route details for organics are as follows:

- Year-Round, Monday through Friday: residential and commercial organics co-collection of green waste and food waste materials.
- Year-Round, Monday and Fridays: restaurant food waste is collected with residential co-collected organics.
- Year-Round, Tuesday: DWR collects one dedicated commercial route along with co-collected commercial and residential organics routes.
- January to October, First full week of each month: Loose green waste piles are collected. Customers are encouraged to fill their organics toter first before placing the loose green waste piles on the street for pick up.
- October to December, Weekly: Loose green waste piles are collected. Customers are encouraged to fill their organics toter first before placing the loose green waste piles on the street for pick up.
- DWR also collects green waste material from City of Davis' Parks Department (Parks Department).

4.1.3 Current Organics Processing

Once collected, DWR hauls the organics to the Yolo County Central Landfill (YCCL). Source-separated green materials such as the loose green waste pile pick up and material collected from the Parks Department is unloaded at the dedicated green waste area next to the Construction & Demolition Debris (C&D) area. Co-collected food and green waste materials are unloaded in a dedicated green and food organics area.

Green waste is consolidated in the green waste/C&D area by a third party hauler and transported to Northern Recycling in Zamora, California for composting.

Likewise, the co-mingled green and food waste is consolidated in the co-mingled green and food organics area and transferred by a third party hauler to Northern Recycling in Zamora, California for composting.

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4.2 ORGANICS FEEDSTOCK

4.2.1 Tonnage from City of Davis

Tonnage from DWR's hauling data was provided by the City of Davis. For purposes of this assessment, organics tonnage beginning Third Quarter of 2016 was evaluated. This is due to the beginning of the City's expanded organics collection program in July 2016.

Tonnage numbers include both residential and commercial organics, as well as street sweeping organics, C&D materials, and green waste loose piles. Please see **Table 4.1** for a summary of the DWR hauling data.

Table 4.1 DWR Hauling Data Summary

	Organics Carts (Green and Food Scraps)	*Recyclable Wood Waste[1]*	*Street Sweepings*	*Green Waste Loose Piles*	**Total Organics Tons Per Quarter**	**Average Tons Per Month[2]**	**Average Tons Per Day[3]**
3rd Quarter 2016	1,114.10	85.33	100.31	843.43	2,143.17	714	32
4th Quarter 2016	1,643.53	106.95	253.65	2,022.13	4,026.26	1,342	61
1st Quarter 2017	1,914.99	98.07	201.94	1251.5	3,466.50	1,156	52
2nd Quarter 2017	2,136.53	110.65	130.15	661.3	3,038.63	1,013	46
TOTAL ORGANICS	6,809	401	686	4,778	12,674	1,056	48

[1] Recyclable wood waste from C&D drop boxes was estimated at 15% of total C&D tonnage. This estimate was specified by CalRecycle's 2006 Detailed Characterization of Construction and Demolition Waste.
[2] Tons per quarter divided by 3 to determine tons per month (TPM).
[3] Calculated 22 business days average per mo., divided TPM by 22.

The tonnage increase in the Fourth Quarter of 2016 can be attributed to several factors. First, the frequency of loose green waste pile pick up increases to weekly from October to December. This quarter shows the highest amount of green waste loose pile tonnage. In addition, UC Davis begins its Fall Quarter in the end of October, causing many student residents to return to Davis. Lastly, the expansion of the food scrap collection program was initiated in the Third Quarter of 2016.

New programs typically have a ramp up period, which seems to be consistent with the increased tonnage from the organics carts for each of the quarters.

4.2.2 City of Davis Feedstock Composition

In addition to the organics volumes generated and recovered in the City, the composition of this feedstock is also relevant to determining processing options.

For this feedstock study, three site visits were conducted at the YCCL to view the City's different collection routes and multiple types of generators of organic feedstock. Site visits occurred midday on July 20, 2017; July 28, 2017; and August 1, 2017. John Geisler of DWR attended all three site visits; Jennifer Gilbert with City of Davis attended the site visit on July 20; and Richard Tsai with City of Davis attended the site visit on July 28. Observations of the feedstock on each day are addressed below.

YCCL Site Visit #1: July 20, 2017

The first site visit to YCCL was conducted to view the co-collected green waste and food waste materials commingled from both residential and commercial accounts. Four collection trucks were observed unloading their route material at the dedicated green and food material receiving area of the landfill.

The co-collected wastes contained predominantly green wastes (i.e. yard clippings, branches, leaves, flowers, and dried grasses). A small amount of vegetative food wastes, food-soiled paper (i.e. paper plates and cardboard pizza boxes), non-soiled cardboard packaging, and compostable plastic bags were also present in the material. Non-organic contaminants were present, but consisted of a low percentage of the feedstock. It is estimated from visual assessment that contaminants consisted of roughly three percent (3%) of the material by weight. Common contaminants observed were film plastics, plastic bags, and plastic beverage containers. **Figures 4.1, 4.2, and 4.3** are photographs of the observed City organic waste during Site Visit #1.

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Figure 4.1 YCCL Site Visit #1, City Organics Waste Photograph #1

Figure 4.2 YCCL Site Visit #1, City Organics Waste Photograph #2

Figure 4.3 YCCL Site Visit #1, City Organics Waste Photograph #3

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YCCL Site Visit #2: July 28, 2017

The second site visit to YCCL was conducted to view the co-collected green waste and food waste materials commingled from both residential and commercial accounts. The commercial accounts on routes from this day included commercial food waste from restaurants. Three of the four collection trucks were observed unloading their route material at the dedicated green and food material receiving area on the landfill portion. A fourth truck had tipped at the dedicated green and food material receiving area prior to our arrival at YCCL. All four trucks contained food and green materials from residential and commercial accounts.

The co-collected wastes contained predominantly green wastes (i.e. yard clippings, branches, leaves, flowers, and dried grasses), but had a visible increase in the amount of food waste content compared to Site Visit #1. Food waste was recognizable and consistent with commercial restaurants, including a bag of flour, loaves of bread, bags of discarded bagels, and popcorn from the local movie theater. Vegetative food wastes along with food-soiled paper (i.e. paper plates and cardboard pizza boxes), non-soiled cardboard packaging, and compostable plastic bags were also present in the material. Contamination was visibly higher, but still consisted of a low percentage of the feedstock. It is estimated from visual assessment that contaminants consisted of roughly seven percent (7%) of the material by weight. Common contaminants observed were film plastics/plastic bags (non-compostable), plastic and glass beverage containers, and foamed plastic and canned food containers from households. **Figures 4.4, 4.5, 4.6, and 4.7** are photographs of the City organic waste observed during Site Visit #2.

During this site visit at the YCCL, the dedicated green waste area adjacent to the C&D area was also observed. Material in this area consisted of leaves, grass and branches and had very little, if any, visible contamination. **Figure 4.8** is a photograph of the YCCL green waste area.

Figure 4.4 YCCL Site Visit #2, City Organics Waste Photograph #1

Figure 4.5 YCCL Site Visit #2, City Organics Waste Photograph #2

Figure 4.6 YCCL Site Visit #2, City Organics Waste Photograph #3

Figure 4.7 YCCL Site Visit #2, City Organics Waste Photograph #4

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Figure 4.8 YCCL Site Visit #2, YCCL Green Waste Area Photograph #1

YCCL Site Visit #3: August 1, 2017

The August 1st site visit to YCCL was conducted to view a dedicated commercial organics route operated by DWR. The commercial accounts on this route were downtown commercial businesses and offices.

The dedicated commercial route contained predominantly green wastes (i.e. yard clippings, branches, leaves, flowers, and dried grasses). Some food wastes were observed, although in not as high a concentration as Site Visit #2. Food waste was recognizable and appeared to be mostly scraps and vegetative food wastes. A high amount of food-soiled paper (i.e. paper plates and cardboard pizza boxes) was present in the feedstock along with non-soiled cardboard packaging and some compostable plastic bags. Contamination within the feedstock was the highest of the three site visits, estimated to be roughly ten percent (10%) by weight. Common contaminants observed were film plastics/plastic bags (non-compostable), plastic and glass beverage containers, foamed plastic and canned food containers from households. Household garbage, including electronics, and office break room garbage were observed in the loads. **Figures 4.9 and 4.10** are photographs of the City's organics waste from Site Visit #3.

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Figure 4.9 YCCL Site Visit #3, City Organics Waste Photograph #1

Figure 4.10 YCCL Site Visit #3, City Organics Waste Photograph #2

YCCL Site Visit by DWR: August 7, 2017

John Geisler of DWR provided photographs of the collected feedstock from a dedicated commercial partial route that operated on August 7th. The load contained cardboard, food, and compostable plastic bags. According to Mr. Geisler, this commercial route includes the Davis Food Co-op, and contained the highest amount of food observed during any of the site visits. **Figure 4.11** is a photograph taken by DWR during DWR's YCCL Site Visit.

Figure 4.11 YCCL Site Visit by DWR, City Organics Waste Photograph #1

(Source: DWR)

Feedstock Composition Summary

The food and green commingled feedstock observed on the three site visits and the photographs provided by DWR consistently showed a high content of green waste with approximately two to three percent food waste, and three to ten percent contamination. The City's commingled organics cart program has shown an increase in every quarter since the beginning of the program in July 2016. We would expect the percentage of food waste to increase over the months and years as the residents and businesses in Davis grow accustomed to the program, gain proficiency in the source separation tasks, and as even more stringent organics recovery legislation is passed in the future. This assumption is based on the team's observation of waste composition of other, existing municipal organics and recycling programs.

City of Davis Wastewater Treatment Plant

The City Wastewater Treatment Plant (WWTP) currently sends its biosolids to YCCL for use as Alternative Daily Cover (ADC) at a tip fee of $20 per ton. The WWTP has recently installed secondary and tertiary treatment site improvements. The installation is still underway, so it is not clear as to the exact quantity of biosolids from the City WWTP that will be available for a potential organics processing facility. From the data provided by the City, the maximum amount of dry solids expected from the WWTP is 8,040 pounds per day. Using a 365 calendar year, this equates to roughly 4 TPD or 1,467 TPY. For purposes of this study, it was assumed that the City would continue sending its biosolids to the YCCL for use as ADC into the foreseeable future as the $20 tipping fee and the simplicity of the program are very beneficial.

4.2.3 Other Feedstocks

Yolo County Organics

Yolo County is a predominantly agricultural county. The Yolo County seat is located north of Davis, in Woodland. Other cities in Yolo County include West Sacramento and Winters.

Table 4.2 shows the estimated theoretical breakdown of organics generation within Yolo County, per the 2014 CalRecycle Waste Characterization.

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Table 4.2 Yolo County Theoretical Organics Generation
(Source: 2014 CalRecycle Waste Characterization)

JURISDICTION	WASTE TYPE	TPY	TOTAL TPY
Davis	Total Commercial[1] Organics	11,921 TPY	20,507 TPY
	Total Residential[2] Organics	8,586 TPY	
Woodland	Total Commercial[1] Organics	13,484 TPY	20,828 TPY
	Total Residential[2] Organics	7,344 TPY	
Winters	Total Commercial[1] Organics	1,027 TPY	1,966 TPY
	Total Residential[2] Organics	939 TPY	
West Sac	Total Commercial[1] Organics	17,541 TPY	24,382 TPY
	Total Residential[2] Organics	6,814 TPY	
Unincorporated Yolo County	Total Commercial[1] Organics	4,127 TPY	6,638 TPY
	Total Residential[2] Organics	2,511 TPY	

[1] Commercial organics wastes are generated by businesses, industries (e.g., factories, farms), institutions, and public areas (e.g., roads, parks). Commercial estimate on the types and amounts of materials in the waste streams of California jurisdictions based on statewide average data collected in recent CalRecycle studies that is then combined with local employment or housing data.
[2] Residential organics wastes are generated by households, consisting of both single family residential and multi-family that includes four or less units. Residential estimates are based on statewide data collected in recent CalRecycle studies that is then combined with local housing and population data.

DWR is the hauler for the City of Davis, and a portion of unincorporated Yolo County. Waste Management, Inc. (WMI) is the hauler for the cities of Woodland, West Sacramento, and Winters, and the other portion of unincorporated Yolo County. WMI takes their collected material to YCCL.

The cities of Davis and Winters have co-collected residential green and food curbside organics pickup. The cities of West Sacramento and Woodland have residential curbside green waste organics pickup. West Sacramento will be starting a residential co-collected green and food curbside organic program in January 2018.

Since 2014, programs have been put in place at both the state and local level to increase organics diversion from landfills (see *Section 5.* Organics Waste Composition Variables for more detail). It could be expected that the amount of organics separated from the disposal stream has increased since 2014. Updated data should be presented from the state next year. CalRecycle expects to perform a 2018 Waste Characterization which will analyze progress towards state goals.

Commercial Organics

In addition to common commercial businesses such as retail shops, restaurants, and offices, Yolo County is home to commercial food processing plants and wineries. According to the Yolo County General Plan, this includes one tomato processor, two rice mills, nine wineries, eight nut and nut oil processors, three dairies, 16 seed labelers, and a prune processor.

Due to exclusive franchise agreements with the local jurisdictions, WMI hauls all its collected waste to YCCL and therefore cannot participate in a City of Davis project unless approval from the local jurisdictions is obtained. These agreements were recently extended for years, including all the commercial processing facilities within these jurisdictions.

Yolo County contains several vineyard areas in Clarksburg, Winters, and Capay/Dunnigan Hills. In 2015, Yolo County vineyards produced 28,612 tons of red wine grapes and 62,341 tons of white wine grapes. Winery wastes are high-liquid with a solid content consisting of grape pomace (seeds, skins and stems) and lees. Generally one ton of pomace is produced from every five (5) tons of grapes crushed.

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Food processing and winery wastes can be managed in a variety of ways. Some material might go to disposal, however, these organics can also go to land application, reuse on site, waste water treatment plants, animal feed, composting (both on-site and commercial scale), and a small volume may to go the UC Davis anaerobic digester. Availability of this material for a City project would depend on factors such as local franchise agreements, pricing, and local/regional/state regulations.

University of California, Davis

Waste generated at UC Davis (UCD) is collected and managed by the University and includes green and food wastes as well as animal bedding and manure.

In 2015, CleanWorld constructed and began operating an AD system on UCD property to manage organic feedstocks from the campus. UCD purchased the digester in August 2017. The digester is designed to process up to 50 tons per day (TPD) of organic waste. Currently the system operates at 60 percent capacity, processing approximately 30 TPD of pre-consumer food from UCD, produce wastes from private food distribution companies, tomato wastes, and ice cream wastes.

The organic feedstock generated by UCD that may be available for a potential City organics processing facility is broken down by material type in **Table 4.3.**

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Table 4.3 Estimated UCD Available Organics Tonnage

MATERIAL	AVERAGE ANNUAL TONNAGE	TONS PER DAY[1]	FINAL DESTINATION
Food Waste (postconsumer)[2]	150	0.5	Northern Recycling Compost Facility in Zamora
Animal Science Bedding (60% manure)	8,000	30	Green Belt Carrier composting facility in Dixon, CA[3]
Straw, Shavings & Manure	3,000	11	California Soils composting facility in Vernalis, CA
Green Waste	1,250	5	YCCL
Biosolids	400	1.5	YCCL
AD[4] digestate	528	2	Not confirmed.
TOTAL ORGANICS	**13,328**	**50**	

[1] Daily tonnage based on 22 working days per month rounded to the nearest half.

[2] Waste audits at the Coffee House (which accounts for half of the material stream) consistently has shown less than 10% contamination by weight. The audits do not consider PLA or bioplastics as contamination.

[3] Any tonnage not removed by Green Belt Carrier is stockpiled on UCD property.

[4] The UCD AD system also produces 10,000 gallons per day of wastewater

4.3 ORGANIC WASTE COMPOSITION VARIABLES

Policy at both the state and local level can influence the quantity and composition of feedstocks as programs mature. Both the State as well as the City have established aggressive programs geared towards diverting organics from disposal.

4.3.1 City of Davis Organics Programs

In June 2016, the City implemented a food scrap collection program whereby both residents and businesses within the City can put their green and food wastes in the organics carts for pick up by DWR. Being only a year old, the program is still in a ramp up phase. Since the program started, tonnage within the carts has continued to increase each quarter despite the population characteristics and seasonal fluctuations in the number of students in residence at UCD.

The City continues education efforts including providing information to residents on the program and having DWR perform waste audits on local businesses. Based on the team's experience of established organics programs, five percent (5%) food content in residential organics and ten percent (10%) food content in commercial organics would be an optimistic but achievable near term goal, which may likely rise in future years as the program matures.

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4.3.2 State of California Policy

California has a long history of encouraging robust recycling programs by passing legislation and mandates that require local government to meet aggressive recycling targets. Once the foundation was set by AB 939, which mandated that cities and counties divert at least 50% of their solid waste from landfills by the year 2000, the Integrated Waste Management Act continued to be amended to foster ever more aggressive recycling programs across the State. While AB 939 focused mainly on traditional recyclables found in "blue bin" programs as well as construction and demolition wastes, subsequent legislation requiring organics collection and diversion have emerged in the last five years. Relevant policies that pertain to organics diversion from landfills are detailed below. These current policies, paired with the more aggressive recycling goals and mandates coming from the state and local levels is expected to have a positive effect on the City's organic waste generation, recovery, and potential for a processing facility.

SB 1383

SB 1383 (Short Lived Climate Pollutants) includes a component that establishes targets to achieve a 50 percent reduction in the level of the statewide disposal of organic waste (from the 2014 level) by 2020 and a 75 percent reduction by 2025. The bill was signed by the Governor in October 2016, and CalRecycle is currently drafting regulations. The rulemaking process is in the preliminary, informal workshop stage, with formal rulemaking expected in 2018 and adoption of the new regulations by early 2019.

AB 1826

AB 1826 (Mandatory Commercial Organics Recycling) requires businesses and multifamily dwellings to recycle their organic waste on and after April 1, 2016, depending on the amount of waste they generate per week. The bill was signed by Governor Brown in October 2014. 1826 provides for a phased approach, increasing the thresholds for generators to comply over the course of several years. 2017 is the first year under the bill that jurisdictions must report information to CalRecycle about their organic waste recycling program implementations. The annual reports were due to CalRecycle on August 1st.

4.4 CONCLUSION

Based on this information, the team is designing the conceptual organics facility for the following feedstocks shown below in **Table 4.4. Tables 4.5**, **4.6, and 4.7** categorize the available organics that could be utilized in the alternative projects evaluated in this study.

For the purposes of this feasibility assessment, the Team has eliminated the biosolids from the City's and UCD's wastewater treatment plants as potential feedstocks. This is due to the fact that both treatment plants have very favorable current programs whereby the biosolids are used for ADC at the YCCL, and also because the inclusion of biosolids negatively effects the potential market for the final compost product.

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Table 4.4 Available Organic Feedstocks Summary

	Green Material (TPD)[1]	Food and Commingled Food/Green (TPD)[1]	Other Organics (TPD)[1]	TOTAL TPD[1]	TOTAL TPY
City of Davis	18.0	26.0	4.0[2]	48	12,672
UC Davis	5.0	0.5	43.0[3]	48.5	12,804
Total	**23.0**	**26.5**	**47.0**	**96.5**	**25,476**

[1] TPD based on 22 working days per month
[2] Other organics is the combined City wood waste from C&D drop boxes and street sweepings
[3] Other organics is the combined UCD animal manure and bedding, and AD digestate

Table 4.5 Available Organic Feedstocks for Stand Alone Composting

City of Davis		Tons per Day[1]	% Contamination
	Mixed Green and Foodwaste[2]	26	< 10%
	Greenwaste (loose)	18	0%
	Other Organics[3]	4	0%
	City Total Organics:	**48**	
UC Davis		**Tons per Day[1]**	**% Contamination**
	Postconsumer Foodwaste	0.5	< 10%
	Greenwaste	5	
	UC Digestate	2	
	Animal Manure & Bedding	41	
	UC Davis Total Organics:	**48.5**	
TOTAL COMPOSTING FEEDSTOCKS:		**96.5**	

[1] TPD based on 22 working days per month
[2] Residential and commercial green/food contain approximately 2-3% foodwaste by weight
[3] Other organics is the combined City woodwaste from C&D drop boxes and street sweeping

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Table 4.6 Available Organic Feedstocks for Anaerobic Digestion

City of Davis		Tons per Day[1]
	Mixed Green and Foodwaste	26
	Greenwaste (loose)	18
	Other Organics[2]	4
	City Total Organics:	**48**
UC Davis		**Tons per Day[1]**
	Postconsumer Foodwaste	0.5
	Greenwaste	5
	UC Davis Total Organics:	**5.5**
	TOTAL AD FEEDSTOCKS:	**53.5**

[1] TPD based on 22 working days per month

[2] Other organics is the combined City woodwaste from C&D drop boxes and street sweeping

Table 4.7 Available Organic Feedstocks for Composting with AD

City of Davis		Tons per Day[1]
	Digestate (50% of AD feedstocks)	26.75
	City Total Organics:	**26.75**
UC Davis		**Tons per Day[1]**
	UC Digestate	2
	Animal Manure & Bedding	41
	UC Davis Total Organics:	**43**
	TOTAL COMPOSTING FEEDSTOCKS:	**69.75**

[1] TPD based on 22 working days per month

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Section 5
Products Market Assessment

5.1 INTRODUCTION

This section provides an overview of the markets for the key products and by-products of possible organics infrastructure. Most importantly for this study, these products include compost from a composting operation, and biogas from an AD system.

5.2 FINISHED COMPOST QUALITY

Finished compost appears as a dark brown, soil like humus with an earthy smell. Title 14, Chapter 3 of the California Code of Regulations ("regulations") establishes standards for the compost product. Key components to finished compost quality are:

1. Pathogen reduction
2. Metals concentrations
3. Physical contaminants

Finished compost will have gone through a pathogen reduction process during its active composting phase, reaching temperatures of over 55 degrees Celsius (131 degrees Fahrenheit) for a period of at least three days during this active composting phase. The length of time will vary dependent on the composting process used (in-vessel, open windrow, aerated static pile, etc.). The finished product must meet requirements for maximum acceptable pathogen concentrations for Salmonella and fecal coliform as outlined in the regulations.

Finished compost product must also meet maximum acceptable metals concentrations as outlined in the regulations. Metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, and Zinc.

Physical Contamination of the finished compost product is also limited by the regulations. Finished product cannot contain more than 0.5% by weight of contaminants greater than 4 millimeters, and no more than 20% of that 0.5% can be film plastic greater than 4 millimeters.

Testing and sampling occurs during and after the composting process to ensure these standards are met prior to removal of the compost from the facility.

A blend of carbon and nitrogen is essential for the composting process. Grasses and green wastes such as leaves, along with food wastes and biosolids contain more nitrogen while more fibrous sources such as wood chips, branches, dried leaves, dried grasses, and straw provide a higher carbon content. Having a balanced ratio of carbon and nitrogen is a necessary component for the

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composting process to maintain aerobic conditions within the compost pile and sustain microbial activity.

Temperatures reached during pathogen reduction should be sufficient to kill off weed seeds. If the compost product has reached desired temperatures of over 55 degree Celsius for a period of time during the active composting process, it is unlikely that weed seeds will survive and be passed on in the finished compost product.

5.3 AMENDMENTS

Compost additives can be incorporated into the compost process to provide nutrients (including carbon and/or nitrogen), aid in pile porosity, aid in moisture control, achieve desired PH levels, and aid in minimizing nuisance conditions such as leachate and odors. Common amendments to the compost process include: wood chips, straw, shredded paper, sawdust, rice hulls, manures, and gypsum.

Materials found in recycling streams such as paper, yard material, clean construction & demolition (C&D) waste, and clean wood waste can be used as amendments. However, it should be determined if use of these materials as an amendment is the highest and best use as compared to reuse or manufacturing a new product for the market.

Food soiled paper is good feedstock for composting since it cannot be recycled. Clean paper (including printed printed) can also be used as an amendment, but should be evaluated if use as an amendment is the highest and best use of material as compared to a conventional paper recycling process. Some paper such as newsprint can contain a high lignin content which can be resistant to decomposition. Inks should not pose an issue for a compost amendment although many composters do try to avoid including substantial amounts of paper with ink on it. Most newspapers nowadays use water or soy based inks, however glossy magazines do sometimes use heavy metal-based inks.

As indicated above, yard materials such as branches, dried grasses, leaves, and straw provide a good carbon source for compost. In addition, agricultural sources such as orchard waste can be used as a carbon source as well. These materials not only add carbon, but also increase porosity and aeration as well.

Ground wood waste also provides a good carbon source. Again, it should be evaluated if use as an amendment is the highest and best use for clean wood and clean C&D. Reuse and processing clean wood as a mulch product provides a quicker production time and faster path to market. In addition, processing clean C&D and clean wood into an amendment would require processing, which increases handling, equipment requirements, manpower and cost.

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The use of amendments in the anaerobic digestion process is dependent on the technology chosen. Generally, food material as a feedstock provides for a higher energy offtake than green/wood feedstocks in the digestion process. However, these amendments can be used for the composting of digestate following the AD process.

5.4 FINISHED PRODUCT USES AND MARKET ASSESSMENT

Diverting organics away from the landfill to other management options introduces new products and byproducts into the marketplace. Several products and commodities can be generated from the composting and digestion processes. While some, like compost and biogas, can be revenue generating, others such as leachate and digestate can be an expense to the operation depending on how it is managed.

5.4.1 Revenue Generating Byproducts of Organic's Management Options

Compost

The City of Davis is located in an optimal geographic location for the sale of compost and compost products. Not only is Davis surrounded by agricultural land, but many crops grown exclusively in the area are regular consumers of compost products. Over the last several years, water use restrictions tightened due to drought conditions in California. As a result, the water retention capabilities of compost attracted both big and small agriculture to invest the time and money associated with compost application over the last several years.

California has made a large investment in composting in the form of the Healthy Soils Initiative. Governor Brown's office has included funding of $25 million to support a statewide "soil carbon" program, aimed at providing financial incentives for farmers and ranchers to implement soil management and agricultural practices that sequester carbon and improve soil health, including increasing the carbon/organic matter of soils through the use of compost. Key state agencies are considering setting a soil carbon target, where the State would attempt to increase soil carbon levels by one to five percent over the next three to five years. Compost use is considered one of the best ways to return organic matter to the soil and cultivate soil health quickly. This initiative is currently being administered by the California Department of Food and Agriculture (CDFA), in collaboration with various state agencies and departments, and is thought to be a program that will enhance the marketability of compost in the state.

One of the key limiting factors for marketing compost is haul distance. For most crops, the margins only allow for the cost of hauling the compost up to 50 miles. This haul distance varies based on: volume of product purchased, crop profit margin, and value of compost product (100% compost vs specialized blend, etc.)

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Potential Volume of Marketable Compost Product Available

Based on the assessment of the City of Davis' organic feedstock, if the City were to divert all of its current material to a new composting facility, it would result in an approximate amount of 12,000 to 13,000 tons of feedstock/year. For UCD, the similar organic feedstock is also about 13,000 TPY. Conditions such as contamination level, screen size, and biological activity greatly influence how much compost can be produced from one cubic yard (cy) of municipally-derived food/yard waste compost. For the purposes of this study, the following factor was used: for every one ton of feedstock, approximately two-thirds or 0.67 ton of compost can be manufactured and sold. This factor was based on data from an active, organics windrow composting operation in California. Therefore, it is estimated that the annual amount of compost manufactured including both the City and UCD material is about 17,000 tons. This equates to 28,000 cy assuming a compost density of 1,200 lbs per cy.

Potential End Users of Compost and Compost Products

Bulk Agricultural Sales:

Compost manufacturing is similar to other manufacturing where inventory control is important to keeping operations running smoothly. One way to ensure compost is sold and moved quickly is through bulk sales to large agricultural operations in the region.

The top 10 crops, ranked by highest revenue per acre, in the Yolo/Solano/Sacramento are shown in **Table 5.1**. Of these top 10 crops, six are compost users within a reasonable hauling distance from the City of Davis. While box tree nursery operations do not represent a large acreage, they have been avid purchasers of compost and mulch products. Bartlett pears, almonds, walnuts, and wine grapes represent over 100,000 acres of cropland that regularly use and benefit from agronomic application of compost and compost blends.

For most crop producers, hauling distance is a significant limiting factor, which is why we have chosen to limit the market area to Yolo, Solano and Sacramento Counties. However, some crops defy this industry norm. Cannabis farmers, for example, operate on high revenue per acre and have unique custom compost blend needs. This allows cannabis producers to haul custom blends longer distances to ensure a highly stable, uncontaminated product.

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Table 5.1 Top 10 Crops in the Yolo/Solano/Sacramento Region

COMMODITY	HARVESTED ACRES	REVENUE	REVENUE / ACRE	YEAR	COMPOST USER?
Nursery	2,589	$50,925,000.00	$19,669.76	2015	Y
Bartlett Pears	5,072	$39,893,000.00	$7,865.34	2015	Y
Almond	27,988	$116,053,000.00	$4,146.53	2015	Y
Tomatoes	48,978	$181,291,000.00	$3,701.48	2015	N
Walnuts	25,981	$81,245,000.00	$3,127.09	2015	Y
Wine Grapes	48,951	$143,192,462.00	$2,925.22	2015	Y
Rice	31,260	$50,854,000.00	$1,626.81	2015	N
Sunflowers	30,385	$42,963,000.00	$1,413.95	2015	N
Organic Production	42,656	$51,173,000.00	$1,199.67	2015	Y
Hay	79,401	$84,622,000.00	$1,065.75	2015	N

*All data pulled from County Crop Reports written by County Ag Departments reported annually.

Pricing for Bulk Compost Sales

In the region around the City of Davis, bulk compost typically sells for between $12 and $25 per cy depending on the volume sold and whether or not the compost is Organic Materials Review Institute (OMRI) listed, and/or certified organic. Compost used for organic production can yield a price closer to $25 per cy while non-organic, raw compost can sell for as low as $10 to $12 per cy.

Using an average density of 1,200 pounds per cubic yard of compost, the average price per ton of compost is $20 to $40 per ton depending on certification, quality, and volume.

Bagged Compost Products

One way to maximize the profit per ton of compost is by offering a bagged product to retailers in the region. Bagged products yield a higher price per ton of compost, but require more equipment and labor to produce, as well as increased distribution channels leading to more customers and customer service requests.

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One way to avoid the increased equipment, labor, and customer service demands of manufacturing bagged product is by partnering with an agricultural bagging service like E.B. Stone in Suisun City. Such an arrangement is a win-win scenario because the partner without a bagging system is able to increase sales potential by offering a bagged product, and the bagging contractor can optimize the use of its bagging system while also generating new revenue for the company.

The average price for bagged compost is $6.00/ft^3 of product which is equal to approximately 40 pounds. Using the estimated volume of roughly 17,100 tons of potential manufactured compost, as outlined on Page 31, from the combined City and UCD organic feedstocks, this would result in approximately 855,000 bags of compost. Based on the consulting team's knowledge of the composting industry and local markets for the product, we believe the City can realistically sell 100% of their marketable product, and using the average price for bagged compost of $6.00 a bag this results in $5.13M gross revenue annually from the sale of bagged compost. Although this amount might look enticing compared to bulk agricultural sales, it comes with significant expense in: quality control, labor, bag cost, equipment cost and maintenance, marketing, and customer service requirements. For the purposes of the Financial Pro Forma included in **Appendix D**, the average price per ton of bulk compost product was used.

Compost Give-a-ways

Local community give-a-ways provide a good outlet for the finished compost product, while supporting and giving back to the local community. While compost give-a-ways may not generate monetary revenue, they generate goodwill as well as educating the public on the benefits of local organic programs. Typically programs such as this are staffed by volunteers, and local companies may volunteer transportation of the product from the compost site to the give-a-way location, so monetary costs of executing such a program are low.

Compost Blends

One way to maximize both the economic and environmental impact of manufacturing compost is by offering custom blending for many different applications. Custom compost blending not only maximizes the profitability of selling compost, it opens additional market opportunities.

Compost can be blended with soil, or other amendments such as gypsum, lime, worm castings, bat guano, feather meal, and other additives for specific application in niche markets. Market opportunities for compost blends in Yolo County range from wetland restoration to serving the growing cannabis farming community.

Wetland Restoration: Given Yolo County's large wetland footprint, using a compost and soil blend for wetland restoration is one way to market compost in the area. Rich in organic matter, and

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microbial populations, a soil and compost blend mimics the characteristics of wetland soil which can help spur growth of native plant species.

Cannabis Production: With the legalization of the cultivation and sale of cannabis, California expects the cannabis market to have a value of around $7 billion once the legal market is established. With legalization comes regulation, and meeting requirements for pesticide levels in cannabis will likely steer cannabis farmers toward more sustainable farming practices, including using compost blends to optimize soil and plant health.

Much like the trend in viticulture, cannabis farmers are growing a wide variety of plant types, each requiring slightly different growing conditions for optimal production and potency. This lends itself to opportunities for marketing highly customized blends to end users in this market.

Table 5.2 shows some common additives, their approximate cost, and potential for profit.

Table 5.2 Costs for Common Compost Amendments

Common Compost Amendment	Approx. Cost of Goods Sold/ton*	Compost Price/ton **	Operating Cost/ton** *	Profit Margin/ton @ 25%	Profit Margin/ton @ 35%
Bat Guano	$500	$20	$4	$131	$183
Dolomite	$47	$20	$4	$18	$25
Feather meal	$400	$20	$4	$106	$148
Potassium Sulfate	$145	$20	$4	$42	$59
Sulfur	$225	$20	$4	$62	$87
Worm Castings	$350	$20	$4	$94	$131
Gypsum	$40	$20	$4	$16	$22
Lime	$15	$20	$4	$10	$14
Perlite	$30	$20	$4	$14	$19

*cost/ton of additives found on global trade site alibaba.com and are approximations based on data available at the time of report
**compost price/ton is based on market area's average price/ton of compost
***operating cost/ton based on industry knowledge of market area operating cost/ton of compost blend

It is evident that adding custom blending to any compost operation can greatly increase the revenue from the back end of the compost operation, which will in turn allow the facility to rely less on tip fees as a means of cash flow.

Mulch and Landscape Products

One way to greatly enhance the marketability of a site's feedstock is to ensure the material is managed in the most economically favorable way by assessing the value stream of each incoming feedstock. Dimensional lumber and wood pallets are considered organic, but may have a higher and better use than as an added carbon source for the composting process.

A potential product from processing dimensional lumber and wood pallets is mulch. Mulch is a rapidly growing niche in the California landscape market due to an increased awareness of water use reduction practices. Replacing both residential and commercial lawns with drought resistant landscapes has been a common practice with residents and businesses alike over the past five years as California struggles to reduce water consumption.

Outdoor landscaping is the single largest use of water in the typical California home. In most yards, grass consumes the most water, so reducing or eliminating grass in landscapes can make a significant impact on the State's water use.

Governor Brown issued an Executive Order on April 1, 2015 that directed the implementation of specific actions to reduce potable water use in the urban sector. Directive number three declared that 50 million square feet of turf be replaced with drought-tolerant landscapes, such as mulch. This is to be accomplished by local water agency programs and a complementing statewide residential turf rebate program implemented by Department of Water Resources.

In order to manufacture drought-tolerant landscape products, such as mulch, the City would have to invest in a grinder and coloring machine to correctly size the product and prepare it for sale into the marketplace. Alternatively, some industrial applications such as sheet mulching will only require size reduction of dimensional lumber and wood pallets, unlike landscaping application which requires more stringent specifications such as color and zero contamination tolerance. While landscape mulch yields a higher price in the marketplace, sheet mulching is a less labor and capital intensive way of getting this recycled product into the marketplace for a higher and better use.

Potential Volume of Marketable Mulch and Landscape Products

Based on the feedstock assessment of the City of Davis' organic feedstock, the available dimensional lumber and wood pallets in the City's waste stream is 2,673 tons per year. Taking into account volume reduction as a result of losing fines from grinding, it can be assumed that 90% of the dimensional lumber product can be sold as marketable product. The City of Davis would have approximately 2,400 tons of marketable mulch product available for sale annually.

Distribution Models for Compost

Compost distribution from facility to end user can take on several different models, including: partnering with a bagging operation, distributing through an agricultural products broker, purchasing delivery trucks and equipment like spreading machines, finding customers that prefer to handle the logistics of compost pick-up and delivery. However, given the expected volume of compost produced by the City, the models that make the most economic sense for the City are:

- Sell compost to a compost broker at a reduced rate
- Establish facility's own customer base for bulk agricultural sales with customers that handle their own logistics for delivery of compost; and
- Establish facility's own customer base for bulk agricultural sales and contract with third party haulers to distribute compost to customers.

Distributing through brokers

Distributing compost through brokers is a good way to ensure product is moving from production to inventory to market quickly, with minimal expense to the compost manufacturer. This is an ideal situation if the City is not interested in hiring additional staff to both sell the compost and service the end user. Contracts with one or more agricultural products brokers can be negotiated for 100% or less of the overall compost volume.

Gross revenue from compost sales will be much less with this option since brokers are only willing to pay a fraction of the average per ton price for compost. However, most of the revenue will be profit since there is limited operational costs associated with this model besides the labor and equipment costs associated with loading the compost into transfer trucks for distribution.

Distributing through third-party haulers

Contracting with third party haulers to distribute compost product to customers is another option for distributing City compost product. In this scenario, the City would incur the time and expense of customer acquisition as well as customer service, but would contract out the hauling and delivery of the compost product to third party hauling services. The cost of hauling and delivery of the compost product would be returned to the City through additional fees to the end user meant to cover these costs. In addition, the City could charge a small profit margin for the service of facilitating the logistics of delivery.

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This model is a good option if the City is interested in selling compost at its full market value while maintaining control of the product's brand. Gross revenue from compost sales will be higher than under the broker model, however, more staff time will be dedicated to attracting and servicing customers.

Scheduled pick-ups by customers

Another option for compost distribution is to limit the City's customer base to end users with logistical functions that prefer to pick up, haul and deliver compost using their own trucks. This model allows for reduced costs associated with scheduling and negotiating rates with third party haulers while still maintaining a decent profit margin. One thing to consider with this distribution model is that it seriously narrows the type of customer the City can do business with. This focused sales effort can result in acquiring customers with a need for large volumes of compost. This model carries considerable risk since the customer base is likely to be less diversified and losing one customer can result in unsold inventory.

This model is a good option if the City can secure long term agreements with end users in close proximity to the compost site.

Competitors in Region

The two main competitors in the region are Recology Jepson Prairie Organics located in Vacaville, CA and Northern Recycling located in Zamora, CA.

- Recology averages approximately $12 per cy bulk raw compost ($20/ton)
- Northern Recycling advertises $18 per ton bulk raw compost

Although the region's main competitors are close by, due to the agricultural nature of the region, the market is not saturated, and market penetration should not be a problem with a quality product.

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5.3.2 Anaerobic Digestion and Gas Projections

Anaerobic Digestion Process Description and Selection

The organic waste anaerobic digestion industry is relatively young. While a limited number of facilities were installed in the 1980s, the industry's rapid growth did not begin until the mid-1990s. Given that the industry is merely three decades old, it is no surprise that there are many different anaerobic digestion (AD) technologies available. Another reason for the variety in process types is the wide range of feedstocks processed. Organic waste feedstocks differ substantially, from unsorted municipal solid waste (MSW) to homogenous industrial food wastes, to curbside-collected green waste. Anaerobic digestion technologies can be categorized based on the following features:

- Number of stages
  - Single-Stage
  - Two-Stage
- Feed Total Solids (TS) content
  - "Wet"/Low solids process (<15 – 20 percent TS)
  - "Dry"/ High-solids process (>15 – 20 percent TS)
- Operating temperature
  - Mesophilic (approximately 93 to 98 °F [34 to 37 °C])
  - Thermophilic (approximately 131 to 140 °F or [55 to 60 °C])
- Agitation
  - Gas injection
  - Internal mechanical components (agitator)
  - Re-pumping / Re-circulation
- Reactor / Digester type
  - Vertical positioning
  - Horizontal positioning
- Process flow
  - Continuous (fully mixed or plug flow)
  - Discontinuous (batch)

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In general the various AD technologies can be grouped into the following three process types:

- Wet/Low-Solids Continuously Mixed (LS-C); (TS <15-20 percent)
- Dry/High-Solids Batch/Discontinuous (AD-D); (TS >30 percent)
- Dry/High-Solids Continuous (Plug) Flow (AD-C); (TS >20 percent)

Biogas projections

To assess the biogas production potential for the available organic feedstocks for the City of Davis, the team selected a high-solids AD process. The advantages of a high-solids system include the capability to process:

- A wider range of organic feedstocks,
- Green waste and certain types of agricultural waste, and
- Compostable bags potentially used for collecting residential and commercial organics.

The high-solids (HS) anaerobic digestion process can either be performed in a discontinuous/batch-type flow configuration (AD-D) or in a continuous/plug-flow type design (AD-C). The photographs in **Figure 5.1** show examples of AD-D and AD-C type installations.

Figure 5.1 Examples of Anaerobic Digestion Processes: BEKON AD-D Process (left) and Hitachi Zosen Inova AD-C Process (right)

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Depending upon the flow configuration and resulting digester design, pre-treatment of the organic feedstocks prior to digestion may or may not be required. A mechanical removal step for physical contaminations downstream of the digestion process is typically required to achieve a high-quality compost product.

Adding AD capacity to the City of Davis waste water treatment plant's (WWTP) low-solids digester capacity for primary sludge (PS) and thickened waste activated sludge (TWAS) could provide more flexibility in biogas utilization options.

Digestion of Organic Waste in AD Processes

Two cases were selected for projecting the biogas potential from AD for an assumed annual throughput of 13,250 tons (at 50 tons per day * 265 days per year) of source separated organics (SSO):

- Case A: Digestion of SSO (food waste and green waste), (AD-D)
- Case B: Digestion of SSO (food waste and green waste), (AD-C)

Table 5.3 and **Table 5.4** summarize feedstock characteristics (assumed quantities and composition and specific gas yields) along with related biogas projections for both cases. Based on the feedstock characteristics for the City of Davis and UC Davis, 98 percent (by weight) is comprised of green waste and 2 percent (by weight) of pre- and post-consumer food waste.

As illustrated in the two tables, the biogas production from the 13,250 tons/yr of SSO input is 50.2 cfm for the AD-C process compared with 33.2 cfm for the AD-D process. A slightly higher methane content of 55.3 percent in the biogas from the AD-C process can be expected compared with 55 percent for the AD-D process.

As the food waste co-collection program is maturing over time, it is reasonable to expect an increase in the amount of collected food scraps in the organics bin. **Figure 5.2** shows an example where the collected food waste of currently 2 percent of the total amount is increased to 5 percent and then to 10 percent, along with the correlating biogas production. (For this example it is assumed that the amount of collected green waste remains the same; it does not account for future population growth which would result in an increase in generated and collected organics.)

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Table 5.3 Case A – AD-D Process; Organic Waste Quantity and Composition

PARAMETER	FOOD WASTE (PRE- AND POST CONSUMER)	GREEN WASTE (INCL. OTHER ORGANICS) [1]
Mass	265 tons/yr (240.4 MT/yr)	12,985 tons/yr (11,779.8 MT/yr)
Total Solids	28%	55%
Volatile Solids	80%	80%
Specific Biogas Yield per wet ton input	1,317.5 ft^3/ton (41.1 m^3/MT)	
Methane Content	55 %	
Biogas Flowrate	33.19 cfm = 17,446,504 ft^3/yr (494,303 m^3/yr)	

[1] Other organics is the combined City wood waste from C&D drop boxes and street sweeping

Table 5.4 Case B – AD-C Process; Organic Waste Quantity and Composition

PARAMETER	FOOD WASTE (PRE- AND POST CONSUMER)	GREEN WASTE INCL. OTHER ORGANICS [1]
Mass	265 tons/yr (240.4 MT/yr)	12,985 tons/yr (11,779.8 MT/yr)
Total Solids	28%	55%
Volatile Solids	80%	70%
Specific Biogas Yield per wet ton input	1,993.8 ft^3/ton (62.2 m^3/MT)	
Methane Content	55.3 %	
Biogas Flowrate	50.23 cfm = 26,403,222 ft^3/yr (747,656 m^3/yr)	

[1] Other organics is the combined City wood waste from C&D drop boxes and street sweeping

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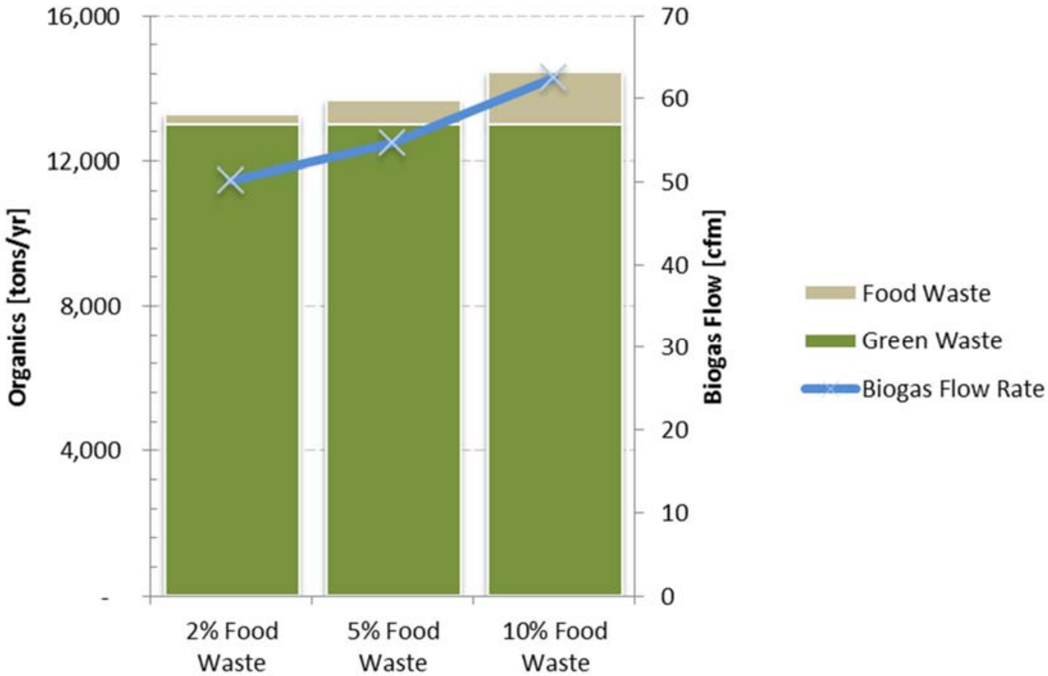
Gas projections from AD-C Process with increased organics diversion

Figure 5.2 Increase in Food Waste Collection and Resulting Biogas Production



The biogas flow rate rises from 50.2 cfm (at 2 percent food waste) to 62.5 cfm (at 10 percent food waste). This illustrates that even a small overall increase in collected food waste can have a significant impact on the biogas production due to a higher specific gas yield for food waste compared with green waste.

Combined biogas production – sludge digestion and municipal SSO digestion

The average biogas flow rate from the City of Davis WWTP's sludge digesters is projected at 48 cfm under dry weather conditions. Hence, a high-solids digestion process would boost the overall biogas production on site. As shown in **Figure 5.3,** an AD-C process (fed with green waste comingled with only 2 percent food waste) could more than double the plant's projected average dry weather biogas production.

Biogas Utilization

As illustrated in **Figure 5.4**, a range of biogas utilization options are available to put the produced biogas to beneficial use:

- Upgrade for pipeline injection or compressed natural gas (CNG) for vehicle use,
- Generate electric power, or
- Recover heat for on and offsite use.

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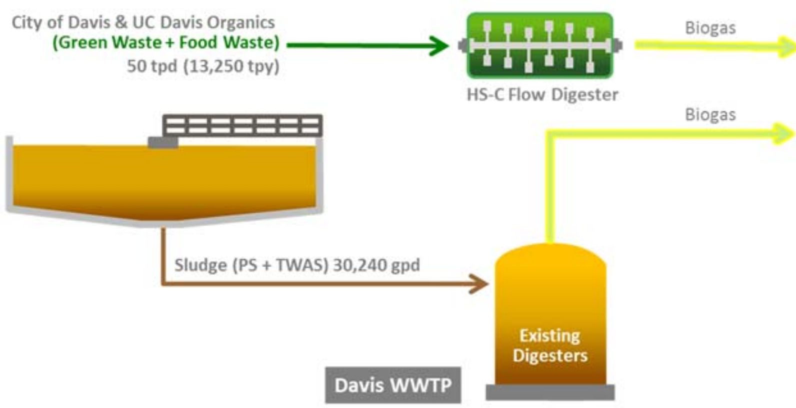
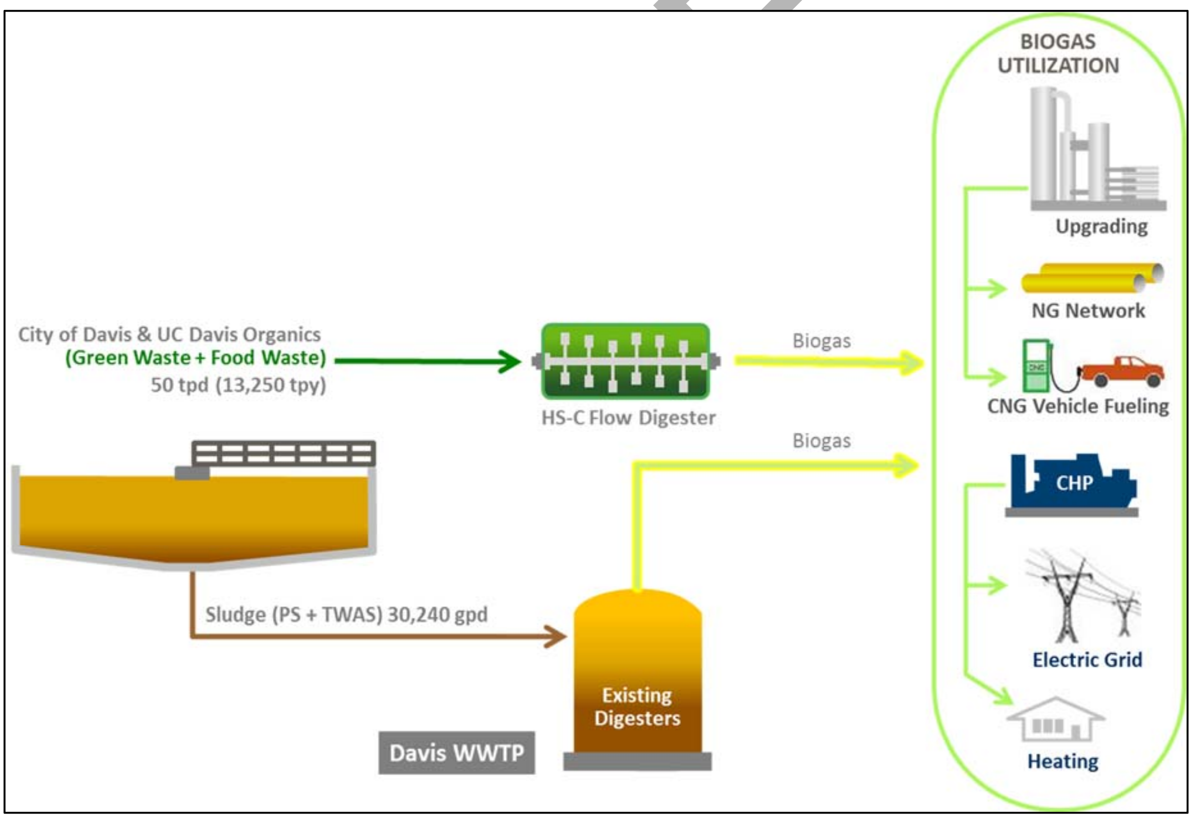
Figure 5.3 Biogas Production Potential Combining the Biogas Flows from the WWTP with the AD-C Process



Biogas Production for Utilization		Increase
From HS-C Digestion	72,331 ft^3/d (≈50.2 cfm)	+105%
From Sludge (baseline)	69,120 ft^3/d (≈48 cfm)	- -

Figure 5.4 Biogas Utilization Options



The WWTP is currently flaring all produced biogas due to no identified economical option. In the future and with the addition of the biogas from an organics AD facility, the WWTP may utilize the biogas onsite to generate electricity for the WWTP's power consumption, or to generate CNG vehicle fuel.

Table 5.5 summarizes the biogas production and electric power output for the two digestion processes for the utilization of biogas in reciprocating internal combustion engines (RICE) for electric power (and heat generation) as one of the possible options.

Table 5.5 Electric Power Generation Potential from Biogas Production – WWTP Sludge Digestion and Organics AD-C Digestion

PARAMETER	WWTP SLUDGE DIGESITON	ORGANICS HS-C DIGESTION
Biogas Production	69,120 ft^3/d (≈48 cfm)	72,331 ft^3/d (≈50.2 cfm)
Methane Content	60%	55.3%
Energy Content [1]	41.47 MMBTU/d = 1.73 MMBTU/hr	39.99 MMBTU/d = 1.67 MMBTU/hr
RICE Combined heat and Power Electric Efficiency	40%	
RICE CHP Power Rating	195 kWel	188 kWel

[1] Assumed Methane Energy Content of 1,000 BTU/ft^3

Cost Comparison for Biogas Utilization Options

In September 2016, the U.S. Environmental Protection Agency (EPA) published a report titled "Evaluating the Air Quality, Climate & Economic Impacts of Biogas Management Technologies". Led by the University of California Biomass Collaborative, the report presents the efficiency, cost of energy, and criteria pollutant and greenhouse gas emissions (GHG) associated with seven California-based biogas management technologies:

1) Combustion in a RICE,
2) Combustion in a gas turbine,
3) Combustion in a microturbine,
4) Conversion in a fuel cell,
5) Processing for injection into a natural gas pipeline,

6) Processing to create renewable compressed natural gas (R-CNG) for vehicle fueling, and
7) Flaring.

Among other characteristics evaluated and compared in this report, levelized cost of energy (LCOE) was expressing as: dollar per kilowatt hour ($/kWh) or dollar per million British Thermal Units ($/MMBTU).

Summary Cost Results

For the seven management technologies, the costs required to process biogas are illustrated in **Figure 5.5**. The cost ranges for them are as follows:

1) Combustion in a RICE: cost ranging from $4.40 – $5.35/MMBTU,
2) Combustion in a gas turbine: cost ranging from $3.25 - $4.20/MMBTU,
3) Combustion in a microturbine: costs ranging from $4.30 - $6.85/MMBTU,
4) Conversion in a fuel cell: costs ranging from $10.40 – $18.40/MMBTU,
5) Processing for injection into a natural gas pipeline: cost ranging from $7 - $25/MMBTU,
6) Processing to create renewable compressed natural gas (R-CNG) for vehicle fueling: $3.40 – 12.80/MMBTU, and
7) Flaring: lowest cost option at less than $1/MMBTU.

As depicted in **Figure 5.5,** all of the investigated processes show economies of scale; this is most strongly pronounced for microturbines, fuel cells and upgrading systems for R-CNG and pipeline injection, due to a combination of a couple of factors: lower per-unit capital and operating costs, and higher efficiencies at a larger scale. For locations where biogas is already available (e.g., landfills or WWTPs), management of biogas using microturbines, reciprocating engines, and gas turbines would compete with industrial and commercial electricity prices in CA.

Figure 5.6 shows the levelized cost of electricity (LCOE) for electricity producing systems. This includes the electric power generation system discussed for the City of Davis summarized in **Table 5.5**.

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Figure 5.5 Biogas Processing Cost (Source: BioCycle Journal, October 2016)

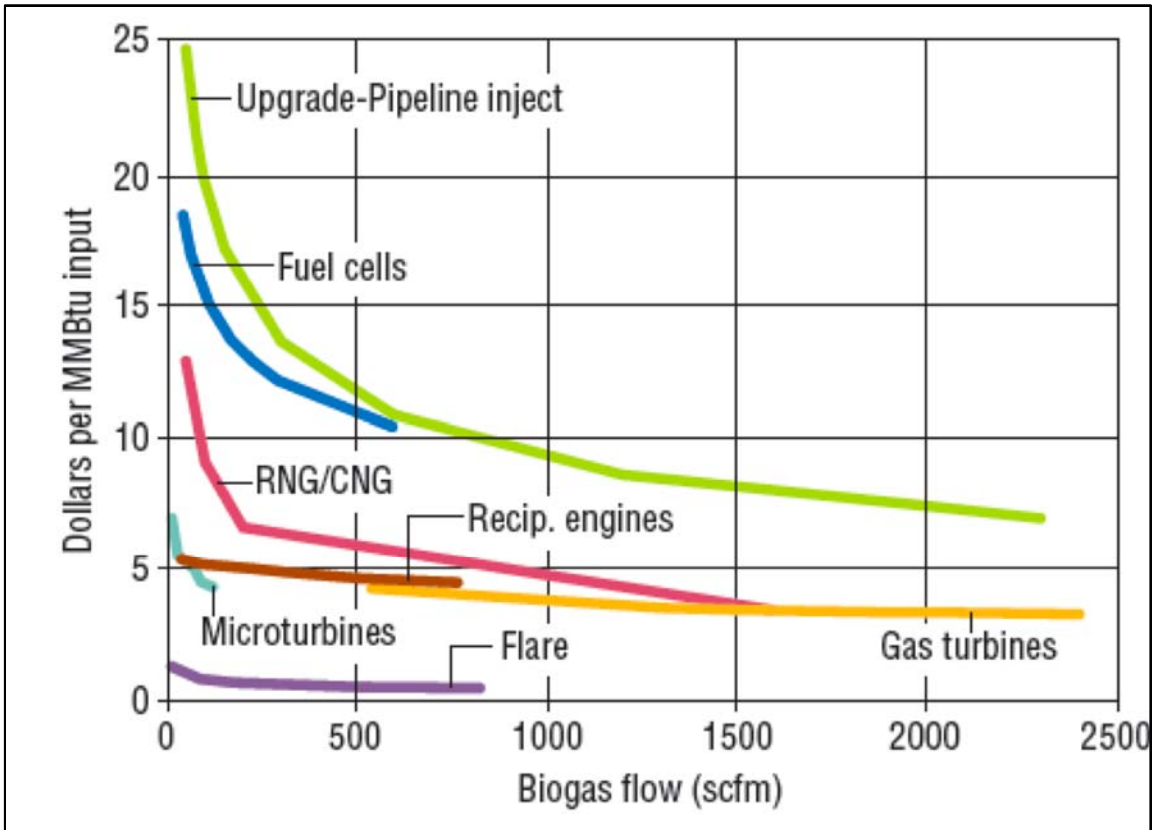
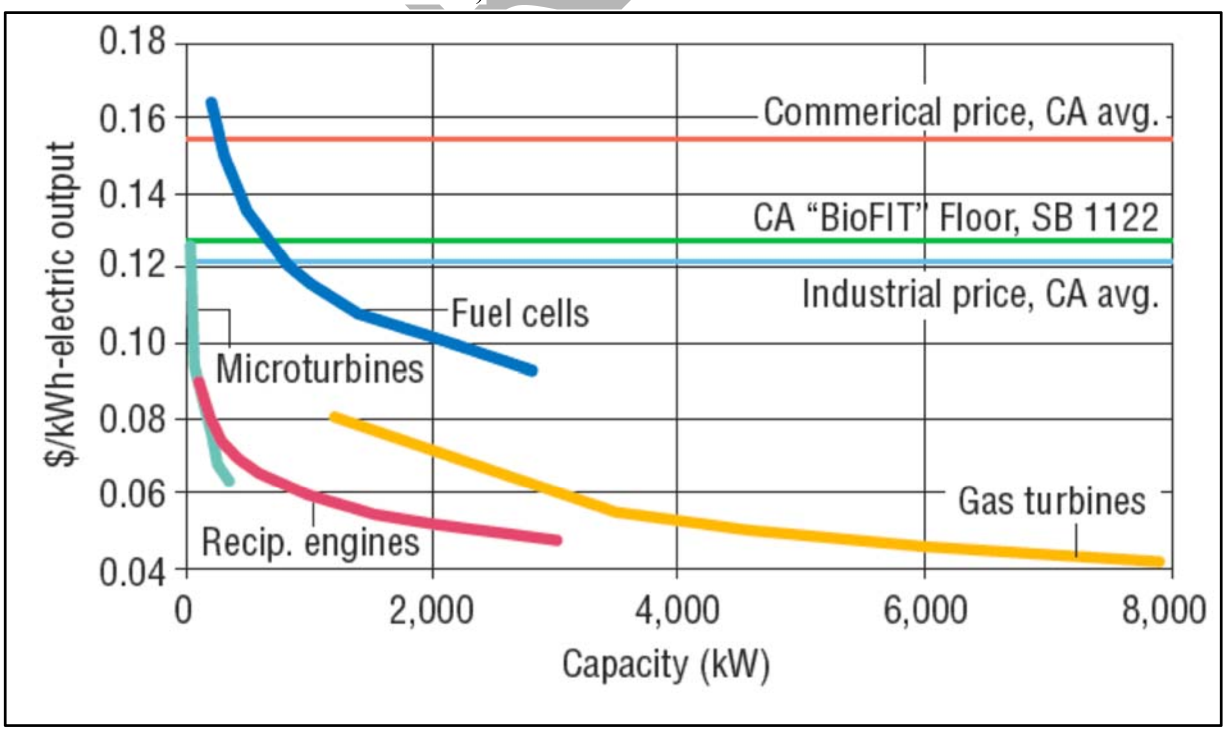


Figure 5.6 Levelized Cost of Energy Comparison (Source: BioCycle Journal, October 2016)



The cost ranges for the four applicable power producing systems are as follows:

1) Combustion in a RICE: cost ranging from \$0.09/kW for 100 kW capacity to \$0.05/kW for 3 MW capacity ,
2) Combustion in a gas turbine: cost ranging from \$0.08/kW for 1,2 MW capacity to \$0.04/kW for 7.9 MW capacity,
3) Combustion in a microturbine: costs ranging from \$0.13/kW for 30 kW capacity to \$0.06/kW for 333 kW capacity,
4) Conversion in a fuel cell: costs ranging from \$0.16 per kWh at a smaller capacity (200kW) to around \$0.09/kWh at 3 MW capacity.

The biogas market continues to grow in the State of California. Renewable Natural Gas (RNG) derived from organic sources like food scraps is the next frontier as the State seeks to maximize and optimize renewable sources of energy.

CNG produced from the digestion of organic waste is one of the lowest carbon intensity fuel sources available as assessed by the California Air Resources Board (CARB). Over the lifecycle of CNG fuel, it will cut GHG emissions by 80% or more compared to diesel. According to CARB, CNG is considered net-carbon-negative when produced from food waste. The use of CNG also and drastically cuts health-damaging air pollutants like particulates and NOx.

Potential End Users

The biogas generated can be used as fuel for electricity generation in on-site or adjacent furnaces, boilers or other fuel needs. In addition to electricity generation the gas can also be upgraded for use in vehicles or distribution through natural gas pipelines. If absolutely necessary it can also be flared. The electricity or biogas can be used to power onsite operations, or sold to local entities or energy utilities.

When choosing biogas use options, facilities must examine each option's potential effects on economic performance, on-site labor needs, the skillsets needed to maintain and repair the equipment, and the potential need to hire a third-party operator.

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<u>Compressed Natural Gas</u>

- Pipeline: PG&E and the California Public Utilities Commission (PUC) have historically avoided approving pipeline injection of food waste derived RNG. However, there have been recent developments on this issue and the PUC is set to be adopting achievable standards in the near term. This will greatly increase the viability of pipeline injection projects in Northern California.

- Fueling Stations: If there is a nearby fleet of CNG vehicles that can use the CNG produced by the digestion project, constructing a fueling station is the preferable method of utilizing the biogas in the region. The California Energy Commission has awarded more than $37 million in grants for the development and deployment of heavy duty natural gas trucks and installation and upgrades to a wide assortment of fueling stations. These programs will only continue to grow as RNG standards increase over time to meet GHG reduction goals.

5.3.3 Cost of Disposal and/or Recycling Byproducts

Some byproducts from organics management processes are not currently marketable in the state of California. One of the main hurdles to an economically viable organics management facility is the ability to manage and/or dispose of the manufacturing byproducts in an economical way. While compost, mulch, CNG, and electrical generation are all revenue generating byproducts of organics management options; leachate, supernatant, and digestate are byproducts which require management that results in an expense to the organics management operation.

Leachate

Leachate is an unavoidable byproduct of the composting process. Recent requirements from the State Water Resources Control Board require that leachate be managed at compost facilities through a combination of collection and conveyance systems to stormwater ponds that collect the leachate as a part of the facility's ground and stormwater management systems. This stormwater/leachate combination can be used to moisten the compost piles, while also providing a catalyst to the composting process through increased biological activity since this liquid is considered nutrient rich.

If leachate cannot be managed through a dedicated stormwater and leachate management system as described above, the leachate would have to be hauled off for treatment to the City's wastewater treatment plant (WWTP), or potentially hauled off for disposal to the Yolo County Central Landfill for injection into the bioreactor.

The cost for industrial wastewater disposal at the City WWTP is $3.94 per account plus $6.74 per 100 cubic feet. The most recent anticipated tip fee for YCCL's organics processing facility is $65 per ton as received.

Supernatant

Supernatant is a byproduct of the Anaerobic Digestion process and can be described as the liquid that remains after digestion. This liquid is a result of water pumped in during the digestion process as well as water formed during the digestion process. Supernatant typically has high levels of

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biological oxygen demand, ammonia, and solids. Most AD facilities currently market this to agricultural communities, either for profit or at a cost.

The most common way of managing supernatant is by introducing it back to the headworks of a WWTP. Although the supernatant is relatively small in volume, it contains dissolved and suspended organic and inorganic materials. These materials add suspended solids, nutrients (nitrogen and phosphorus), and organic compounds to the influent. Operational problems can occur as a result of introducing supernatant into the headworks of a WWTP. Potential operational issues include: increased chlorine demand, odor problems, sludge bulking, and undesired impact of high concentrations of nitrogen and phosphorus. Several operational problems are associated with the presence of high concentrations of nitrogen and phosphorus. These problems include possible permit violations, nitrification, denitrification, and excess growth of algae in secondary clarifiers. These concerns from WWTP operators could result in either the WWTP not accepting the supernatant or requiring excessively high fees for disposal at the headworks of the plant.

Digestate

Digestate is the solids byproduct of the Anaerobic Digestion process. It is comprised of the fraction of the feedstock introduced to the digesters that the microbes cannot use and the mineralized remains of the dead bacteria used in the digesters. Digestate can come in three forms: fibrous, or acidogenic digestate; liquor, or methanogenic digestate; or a sludge-based combination of the two fractions. In two-stage systems the different forms of digestate come from different digestion tanks. In single stage digestion systems the two fractions will be combined and, if desired, separated by further processing.

Acidogenic digestate is a stable organic material comprised largely of lignin and cellulose, as well as a variety of mineral components. This material is similar to compost, but with a greater lignin content. Methanogenic digestate is rich in nutrients and can be used as a fertilizer dependent based on the levels of potentially toxic elements (PTE) in the initial feedstock. Most non-industrial waste streams have low PTE levels. PTEs are typically heavy metals such as Cd, Cr, Cu, Ni, Pb, and Zn. For example, digestate produced from the source-separated organics (SSO) as an anaerobic digestion feedstock typically shows low concentrations of these PTEs whereas digestate generated from organics extraction from mixed MSW (also called organic fraction of MSW) may show higher PTEs.

Theoretically, digestate may be seen as a marketable commodity for agriculture, currently there is no viable or stable market for digestate in the State of California. This results in digestate being seen as a disposal expense to AD facility operators. Since one of the values of AD is diversion from landfills, it is important that AD facility operators look at options for disposal that are considered diversion such as composting. The diversion of the incoming organic waste to the digester would count as diversion, but not the digestate from the digester itself if used as ADC.

Lab testing of all digestate will be important and necessary for ensuring the digestate will be accepted at both composting facilities for compost feedstock as well as landfills for ADC. Potential high concentrations of metals and/or ammonia may result in difficulty finding an option for digestate management. Since the material requires little to no processing and/or size reduction, tip fees will be much less than that for raw unprocessed feedstock.

For this project, it is assumed that digestate from an AD project at the WWTP would be composted there on-site. Roughly 50% of the incoming feedstock to the AD system would become digestate. Using 13,250 tons per year (50 tons per day * 265 days per year), this would equate to 6,625 tons per year of digestate.

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Section 6
Alternative Project Evaluations

6.1 INTRODUCTION

The City of Davis collects a total of roughly 15,000 tons per year of organic material through its curbside and other collection programs, but only roughly 13,000 tons per year are organic material that may be used for this project due to excluding the inerts from the City's C&D collection. This report evaluates several organics diversion options for the City, culminating in an alternative project ranking matrix that highlights key factors necessary for an environmentally and financially successful project. This assessment identifies the most practical facility design and other specifications based on available feedstock, desired capacity, economical technology, and operator responsibilities.

The projects that have been identified for evaluation and comparison are:

- Yolo County Central Landfill BioReactor and Food Processing Facility
- City of Davis Old Landfill Organics Processing Facility
- City of Davis Wastewater Treatment Plant Organics Processing Facility
- University of California Davis Composting Facility
- Recology Services

Table 6.1 on the following page summarizes the key aspects of each of these five potential projects. The sections that follow provide more detailed discussion.

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6.2 YOLO COUNTY CENTRAL LANDFILL

6.2.1 Project Overview

Existing Operations

Yolo County Central Landfill (YCCL) is an active landfill with a maximum permitted throughput of 2,800 tons per day (TPD) broken down as follows: 1,800 TPD for disposal; 500 TPD for construction, demolition, and inerts (CDI) processing; and 500 TPD for composting. Currently the composting component operates as a chip and grind operation with no active composting. A copy of YCCL's current SWFP is included in **Appendix A.**

Table 6.1 City of Davis Comparative Evaluation Matrix

PROJECT	ACRES	FEEDSTOCKS	TONS PER DAY(1)	TECHNOLOGY	PRODUCTS	ADVANTAGES	DISADVANTAGES
1) YCCL	61	City of Davis · Mixed green and foodwaste · Greenwaste (loose) · Other Organics	 26 18 4	Bioreactor Cell AD Composting	1) Biogas to electricity 2) Compost	No infrastructure for City No permitting/project dev. for City Supports overall County effort Most likely quickest, simplest, & least expensive No impact on hauler No product marketing/value for City Remote from sensitve receptors	Feesdtock guarantee may be required Loss of control of future system options Uncertain $/ton price and stability Likely poor performance of bioreactor County gets all the glory County gets GHG credits
2) City WWTP	170	City of Davis · Mixed green and foodwaste · Greenwaste (loose) · Other Organics UC Davis · Postconsumer Foodwaste · Greenwaste · Digestate · Animal Bedding	 26 18 4 0.5 5 2 41	1) High solids AD w/ Composting 2) Stand Alone Composting	1) Biogas w/ WWTP · CNG · Electricity · to YCCL 2) Compost	City controls own destiny City owned Land City-controlled land use and CEQA permitting Synergies with WWTP (feedstocks, products) Full city control of design, operations, cost City control of products for optimal benefit Free compost giveaway possible to residents Potential better economies of scale w/ other towns and industries No impact on hauler City gets GHG credits & glory	Extensive permitting required Long lead time Likely higher cost than options 1 & 5 Product marketing risk/reward is City's
3) UC Davis	13.4	Same feedstocks as Project #3		Composting 1) City lease/op. 2) UC own/op.	1) Compost	Supports a regional effort with UC If UC own/op: No infrastructure for City No permitting/project dev. for City Minimal impact on hauler No product marketing/value for City If City lease/op: Remote from sensitive receptors Land currently used for chip/grind & storage	<u>If UC own/op:</u> Feesdtock guarantee may be required Loss of control of future system options Uncertain $/ton price and stability UC Davis gets all the glory UC Davis gets GHG credits <u>If City lease/op:</u> Cost of lease Responsible for UC waste diversion
4) Old City Landfill	10	Same feedstocks as Project #3		N/A	N/A	City controls own destiny City owned land currently vacant (mostly) Current SWFP? No. Not even "Inactive" Current C.U.P. and CEQA? Probably Not	Cannot build on fill material Feesdtock guarantee may be required City plans for other development at site No ability to use electricity on site May require utility work
5) Recology	10	Same feedstocks as Project #1		N/A	1) Compost	No infrastructure for City No permitting/project dev. for City Most likely quickest, simplest, & least expensive No product marketing/value for City	Feesdtock guarantee may be required Loss of control of future system options Uncertain $/ton price and stability Recology gets all the glory & GHG credits

(1) Tons per day based on 265 days per year

Proposed Operations

Yolo County Central Landfill (YCCL) is in the permitting and construction phases of its BioReactor cells, and liquid and food waste processing project. YCCL is also expanding its existing composting permitted area and design capacity. **Figure 6.1** is the YCCL Storm Water Drainage Plan which identifies the liquid and food waste processing area and the location of the composting operation. A copy of YCCL's most recently proposed revised SWFP is included in **Appendix B.**

Bioreactor Cells (AD)

The AD project consists of seven (7) bioreactor cells spread across 21 acres. Each cell is designed to hold 23,000 cubic yards, for a combined total on-site capacity of 161,000 cubic yards of material. Each cell is 150 ft. wide, 300 ft. long, and 30 ft. in height to the bioreactor cover. See **Figure 6.2**, Bioreactor Cell Site Plan.

Assuming the high-moisture feedstocks (ie. food waste, green waste, biosolids) have a bulk density between 350 lbs/cy to 1,500 lbs/cy, the total tonnage that could be stored in each bioreactor cell is approximately 4,025 to 17,250 tons.

YCCL plans to load the bioreactor cells with ground food waste, green waste, and other high-moisture feedstocks in horizontal layers to a depth of 30 feet, then seal the bioreactor. The waste will anaerobically digest for 22 weeks, with liquid waste from YCCL's other processing area injected into the pile to increase biogas production which is collected through a series of piping inside the bioreactor. When the cap is removed after the anaerobic treatment, the pile is then injected with air for aerobic treatment for a period of 2 weeks. After 24 weeks, the digestate is excavated, screened, and either sent to Northern Recycling for composting or marketed directly as a soil amendment.

Liquid and Food Waste Processing Area

The liquid and food waste processing area has a maximum on-site capacity of 500 cubic yards of material. This capacity limit may or may not include the six (6) 7,600 gallon storage tanks used to settle solids. This area is made up of three components: 1) Liquid waste receiving, bio-separating, and dewatering area; 2) Food waste processing area; and 3) Liquid waste digester. See **Figure 6.3**, YCCL Liquid and Food Waste Processing Area.

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Figure 6.1 YCCL Storm Water Drainage Plan (Source: YCCL Joint Technical Document, April 2017)

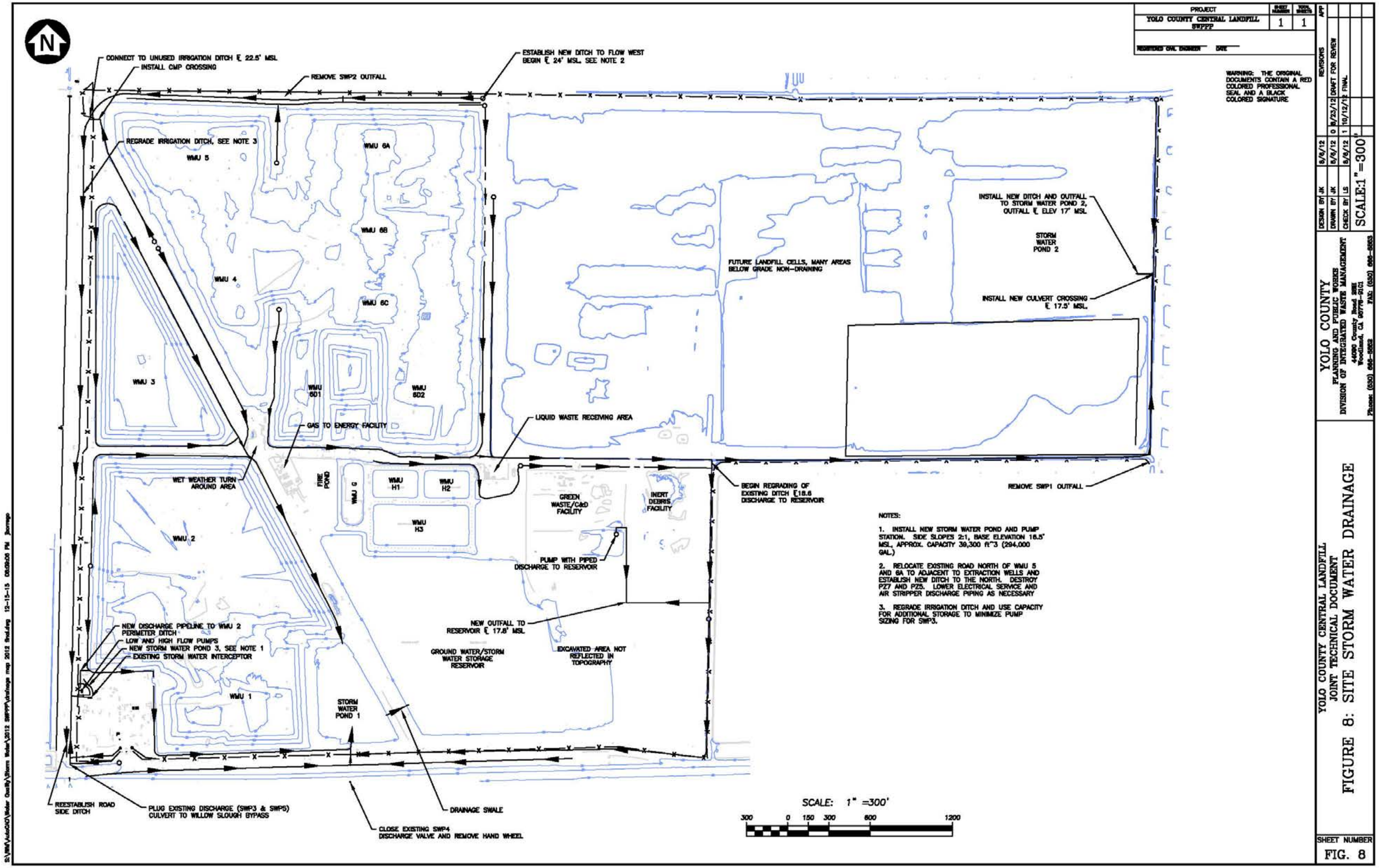


Figure 6.2 YCCL BioReactor Cell Site Plan (Source: YCCL Joint Technical Document, April 2017)

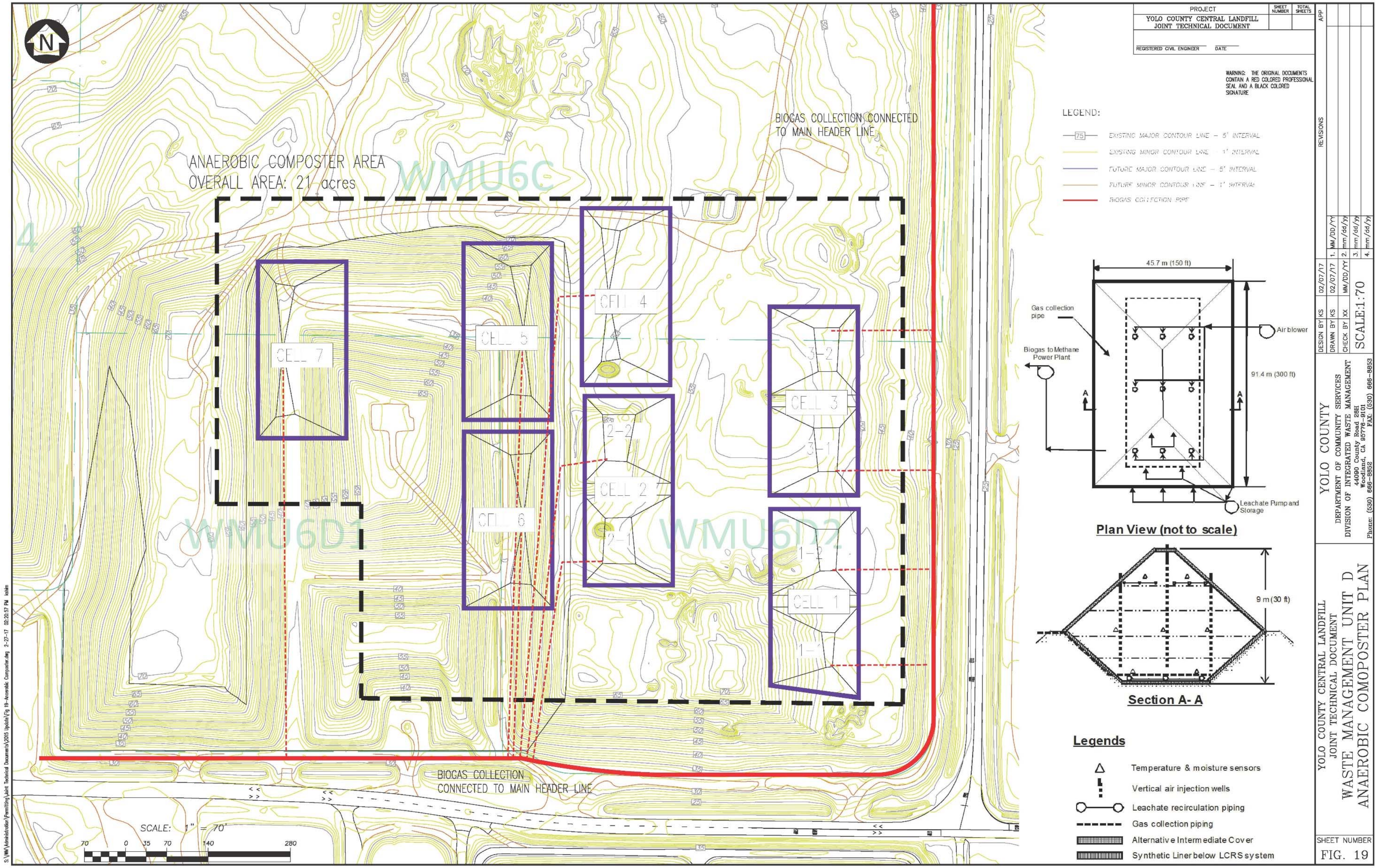
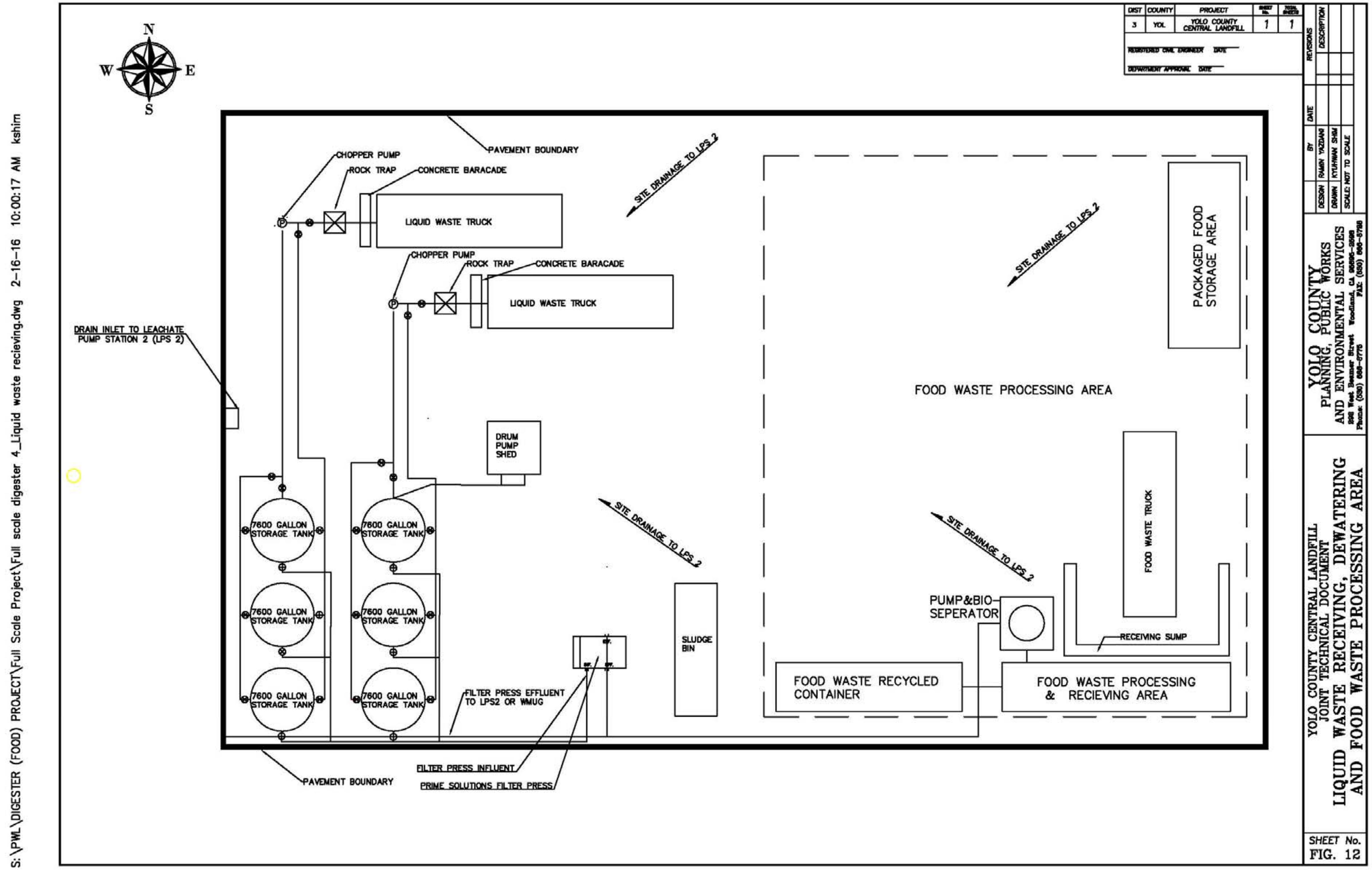


Figure 6.3 YCCL Liquid and Food Waste Processing Area (Source: YCCL Joint Technical Document)



Composting Operation

YCCL was originally permitted to actively compost on five (5) acres with a maximum on-site capacity of 45,000 cubic yards. The future composting operation will expand the existing 20 acres used for the YCCL Wood and Yard Waste Facility to 40 acres with a total on-site capacity of 208,000 cubic yards. The additional 20 acres will be used for compost curing and finished product storage and be located either on top of existing landfill or on undeveloped YCCL property. Refer to **Figure 6.1** for the current location of the YCCL Wood and Yard Waste Facility which is labeled as "Green Waste / C&D Facility".

Assuming the wood and green wastes have a bulk density of 350 lbs/cy, the total tonnage that could be stored in the compost area is approximately 36,400 tons.

Feedstocks

The lined bioreactor cells will receive food waste, green waste, manure, wastewater treatment sludge, and other high-moisture feedstocks. In addition, the liquid waste extracted from the liquid waste processing area will be injected into the bioreactor cells.

The composting operation component is permitted to receive municipal solid waste (MSW), green material, and construction and demolition debris (C&D).

Currently YCCL has conveyed it does not have any feedstock agreements or other forms of agreement for organic waste from municipalities or industrial processors. However, the franchised hauler, Waste Management Inc., for the Cities of Winters, Woodland, and West Sacramento, Unincorporated Yolo County, and the associated food processing facilities currently hauls all organic waste to YCCL and is expected to continue this due to the hauler's franchise agreements with each jurisdiction. In order to receive source separated or mixed organic wastes from these jurisdictions, the City of Davis would have to work with Waste Management, Inc., the franchised hauler, and these jurisdictions to direct these wastestreams to a new City facility.

Technology

Clements created a waste flow diagram to display the movements of feedstocks through the YCCL proposed projects, and is located in **Appendix C.** YCCL Senior Engineer Ramin Yazdani is responsible for the design of the bioreactor cells, which prior to this full-scale project were implemented at YCCL as a pilot research study. It appears Yolo County is also responsible for the design of the liquid waste and food waste processing area.

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Northern Recycling is in the process of moving its composting operations in Zamora to YCCL, and will be responsible for the composting operation at YCCL. Currently Northern Recycling uses traditional windrow composting at their facility in Zamora, CA. Northern Recycling may be allowed to use windrow composting at YCCL instead of advanced methods such as aerated static pile (ASP) or use of geomembrane textile covers. The technology selection is contingent on the interpretation of the Yolo Solano Air Quality Management District (YSAQMD). As of August 23, 2017, Northern Recycling has not officially submitted a permit application to YSAQMD, therefore, no final determination has been made on the mitigation measures required for this project. However, YSAQMD has stated that Best Available Control Technology is applicable for any new or modified source where daily pollutant emissions exceed the BACT thresholds, and there is an increase in quarterly emissions. Northern Recycling's compost operation at YCCL would most likely be considered a modified source and be required to meet YSAQMD BACT standards.

Operator

Yolo County Planning and Public Works Department is listed as the sole operator of this Solid Waste Facility Permit.

Northern Recycling currently operates the Wood and Yard Waste Facility at YCCL and is in the negotiation and permitting process to operate the future composting operation located at YCCL. Northern Recycling has elected to move to YCCL to expand its composting operations. At its current location in Zamora, Northern Recycling was unable to expand due to permitting obstacles and community criticism.

B&D Geerts currently operates the CDI facility at YCCL.

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6.2.2 Project Status

YCCL submitted its application for a revised Solid Waste Facility Permit (SWFP) to include the bioreactor cells and other organics processing operations this May. The following describes YCCL's 2017 revised SWFP application timeline:

- May 1st – YCCL submits revised SWFP application
- May 30th – LEA accepts application at complete
- June 29th – LEA holds public information meeting & public comment period starts
- July 28th – LEA submits proposed SWFP to CalRecycle
- August 3rd – LEA resubmits proposed SWFP to CalRecycle
- October 2nd – Revised SWFP approved & public comment period ends

The public comment period was from June 29th to October 2nd, 2017.

YCCL plans to have the bioreactor cells and liquid waste processing area operational by Fall 2018 and are in the process of hiring a contractor to complete the necessary site improvements, construction, and equipment purchases. Once the contractor is selected, YCCL expects to have construction completed within 40 days, and be fully operational 30 days after that.

The composting facility is on a different timeline dependent on Northern Recycling's Zamora composting operation moving to YCCL. Northern Recycling is not expected to be operational at YCCL until Fall 2019. YCCL plans to continue its Wood and Yard Waste Facility as it currently operates, sending processed wood chips and mulches to Northern Recycling's composting operation in Zamora. The organic residuals from the bioreactor cells will also be sent to Zamora.

YCCL will have to revise its Joint Technical Document prior to composting on-site. Although permitted through CEQA and CalRecycle for operations at YCCL, Northern Recycling is currently securing its own State Water Resources Control Board, Waste Discharge Requirements (WDR) Permit. The WDR is requiring Northern Recycling to construct a levee around the entire composting area proposed at YCCL, and also includes some site preparation requirements. Northern Recycling has not yet submitted its application to YSAQMD for a permit to operate at YCCL.

6.2.3 Financial Aspects

Tipping Fee

The current YCCL tipping fee for clean wood, green, and food wastes is $54.00 per ton and their most recent estimate for the bioreactor cell project is $63.00 per ton. This estimate is based on the assumption that the project will process 50,000 tons per year. If there is less material available for processing via the bioreactor cells, then the per ton rate may increase.

Additionally, YCCL's tipping fee for the bioreactor cell project is contingent on the cost to relocate Northern Recycling to YCCL. The $63.00 per ton rate was determined late 2016, prior to the Regional Water Quality Control Board's requirement that Northern Recycling build a levee around the composting operation. The cost of construction for this levee has yet to be incorporated into Northern Recycling's rate, which in turn will most likely increase the YCCL's tipping fee for the bioreactor cells.

Referring to *Section 4*, Feedstock Study, **Table 4.1**, DWR Hauling data, the City sent roughly 15,000 tons of organics, including C&D materials, to YCCL. Assuming YCCL will raise the tip fee from $54.00 to $63.00 per ton, the City will pay an increase of $135,000 per year to take their

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organics to YCCL. Using the following equation, over ten (10) years, this equates to the City paying a total of about $1.5 million more for the YCCL project compared to the current system.

Assumptions:

Organic Waste Tonnage will remain the same

Current U.S. Inflation Rate = 1.7%

$$F = A[\frac{(1+i)^n}{i}]$$

where *F* = Future Cost; *A* = Annual Cost; *i* = inflation rate; and *n* = time

$$\boldsymbol{F = \$135{,}000/year[\frac{(1+1.7\%)^{10yr}-1}{1.7\%}]}$$

Future Cost = $1,458,098.97

If the City were to experience a 5% increase of Organic Waste Tonnage per year, then the increased total 10-year cost of the YCCL project to the City would be $1.7 million compared to the status quo (i.e. $54 per ton). Refer to **Table 6.2**, Organics Growth Tonnage and Cost with YCCL Project and **Table 6.3**, Organics Growth Tonnage and Cost at Status Quo.

Table 6.2. Organics Growth Tonnage and Cost with YCCL Project

Year	Previous Tonnage	Growth Rate	Growth	Total Tonnage	Est. Cost @ $63/ton	Inflation (1.7%)	Cost w/Inflation
1				14,969	$943,047.00		$943,047.00
2	14,969	0.05	748	15,717	$990,199.35	$16,833.39	$1,007,032.74
3	15,717	0.05	786	16,503	$1,039,709.32	$17,675.06	$1,057,384.38
4	16,503	0.05	825	17,328	$1,091,694.78	$18,558.81	$1,110,253.59
5	17,328	0.05	866	18,195	$1,146,279.52	$19,486.75	$1,165,766.27
6	18,195	0.05	910	19,105	$1,203,593.50	$20,461.09	$1,224,054.59
7	19,105	0.05	955	20,060	$1,263,773.17	$21,484.14	$1,285,257.32
8	20,060	0.05	1003	21,063	$1,326,961.83	$22,558.35	$1,349,520.18
9	21,063	0.05	1053	22,116	$1,393,309.92	$23,686.27	$1,416,996.19
10	22,116	0.05	1106	23,222	$1,462,975.42	$24,870.58	$1,487,846.00
Total Organics Tonnage:				**188,278**	**Total Cost w/Inflation:**		**$12,047,158.27**

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Table 6.3. Organics Growth Tonnage and Cost at Status Quo

Year	Previous Tonnage	Growth Rate	Growth	Total Tonnage	Est. Cost @ $54/ton	Inflation (1.7%)	Cost w/Inflation
1				14,969	$808,326.00		$808,326.00
2	14,969	0.05	748	15,717	$848,742.30	$14,428.62	$863,170.92
3	15,717	0.05	786	16,503	$891,179.42	$15,150.05	$906,329.47
4	16,503	0.05	825	17,328	$935,738.39	$15,907.55	$951,645.94
5	17,328	0.05	866	18,195	$982,525.31	$16,702.93	$999,228.24
6	18,195	0.05	910	19,105	$1,031,651.57	$17,538.08	$1,049,189.65
7	19,105	0.05	955	20,060	$1,083,234.15	$18,414.98	$1,101,649.13
8	20,060	0.05	1003	21,063	$1,137,395.86	$19,335.73	$1,156,731.59
9	21,063	0.05	1053	22,116	$1,194,265.65	$20,302.52	$1,214,568.17
10	22,116	0.05	1106	23,222	$1,253,978.93	$21,317.64	$1,275,296.57
Total Organics Tonnage:				**188,278**	**Total Cost w/Inflation:**		**$10,326,135.66**

6.2.4 Policy Issues

According to Yolo County, YCCL currently does not have organic waste flow control agreements with any of the haulers, cities, or businesses in Yolo County. However, when Northern Recycling moves its location to YCCL, Yolo County should receive the roughly 180,000 tons of organic material per year that Northern Recycling is currently processing in Zamora. Depending on the feedstock, this material may either be fed into the bioreactor cells or composted by Northern Recycling.

Due to the cost of the project as a whole (bioreactor cells, liquid waste processing, and Northern Recycling composting component), YCCL is suggesting a 10-year feedstock agreement with the City of Davis. To date, no negotiations have taken place in this regard.

The greatest advantages of this project for the City is that there are no infrastructure, permitting, or project development requirements for the City. This project is remote from sensitive receptors and will have no impact on the hauler, who currently brings all organics to YCCL where it is transferred to Northern Recycling, therefore there will have no additional transportation costs or logistics alterations. The City may not receive any of the organics products (i.e. compost or biogas), but would also not be responsible for product marketing. The YCCL project supports the overall County effort in diverting waste from the landfill, and is most likely the quickest, simplest, and least expensive option for the City.

The most significant disadvantage of the City participating in the Yolo County YCCL organics project is the uncertain cost per ton price and stability. Without understanding the actual cost of this project, it is difficult to assess the total cost of the City's participation. In addition, YCCL may

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require a long-term feedstock guarantee from the City, which will cause the City to lose control of future diversion options. This bioreactor technology, with the aeration and excavation components, is a new system developed by Yolo County. While the pilot program was deemed successful, there is a potential for poor performance of the bioreactor. Lastly, the County will receive all the glory for its environmental stewardship.

6.3 CITY OF DAVIS OLD LANDFILL

The City identified their old landfill as a possible site for an organics facility. However, subsequent to the team starting work on this project, other potential uses of that site by the City came to light. As such, the site was only to be considered if the Clements team identified unique, beneficial aspects that made the Old Landfill the most ideal location for an organics facility.

The Clements team has found no such significant beneficial aspects to utilizing the Old Landfill as host for a City organics facility. However, given that conditions may change in the future, the following discussion is provided.

6.3.1 Project Overview

The Clements team completed an analysis of the following:

- Land Availability
- Proximity to Sensitive Receptors
- Zoning & Permitting
- Access
- Floodplain
- Utility Availability
- Future Outlook
- Conclusion

Land Availability

The City of Davis has an inactive landfill located in unincorporated Yolo County roughly two (2) miles due north of the City center. The Old City of Davis Landfill has approximately 30 acres of land available for a potential City organics project. The available land is outlined in red in **Figure 6.5**.

Approximately 10 acres of this land is currently being used by Blue Max Kart Club and Rate Karts! Inc. These companies livelihood depend on the availability of this land. The City would need to negotiate for the eviction of these tenants or otherwise terminate the current lease agreements.

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Both of these options would cost the City financially, and potentially cast a negative public perception on the City's attitude towards small, local businesses.

Proximity to Sensitive Receptors

Less than 200 feet northwest of the property is the Davis Paintball Center. The Wildhorse Golf Club is located southeast across the street. All of these activities are outdoor public recreational areas. In addition, the nearest residential homes are roughly 0.3 miles from the property line.

The close proximity of this site to sensitive receptors could be problematic during the public permitting process for an organics facility.

Figure 6.4 Old City of Davis Landfill Available Land (Source: Google Earth)

Zoning & Permitting

The Old Davis Landfill is zoned "Agricultural Intensive". As described in the Yolo County Municipal Code:

> "The Agricultural Intensive Zone is applied to preserve lands best suited for intensive agricultural uses typically dependent on high quality soils, water availability, and relatively flat topography."

This zone designation may require a potential organics processing facility to go through a re-zoning process to obtain the proper zoning designation. This parcel is not subject to the Williamson Act, therefore there is no requirement to pursue the agricultural use.

Access

The Old Landfill has one access point from Pole Line Road. Collection trucks would access Pole Line Road from E Covell Blvd. (from the south) or County Road 29 (from the north). The south access runs parallel with several residential neighborhoods, a soccer field, and the Wildhorse Golf Club. Therefore, there is a potential increase of truck traffic affecting these sensitive receptors.

Floodplain

The City's Old Landfill is located in a FEMA Flood Zone A. The area is subject to the 100-year flood event. If used for an organics composting facility, this property must to hold, at a minimum, the 25-year 24-hour storm event to comply with the State Water Resources Control Board's (SWRCB) new General Order Waste Discharge Requirements for Composting Operations. Given the close proximity of this site to sensitive receptors, the Lead Agency (City of Davis) or SWRCB may require protection for the 100-year flood event.

Utility Availability

This site has no available utilities (water and power). However, there is a nearby solar farm that may be willing to provide power to a future facility.

Future Outlook

The City has prospective plans to utilize some of the land adjacent to this area. Depending on the final use, this could result in another sensitive receptor or less available land for the project. Given this uncertainty and the other negative issues, the team has dropped this site from further considerations.

6.4 CITY OF DAVIS WASTEWATER TREATMENT PLANT

6.4.1 Project Overview

The City of Davis has a wastewater treatment plant (WWTP) located in unincorporated Yolo County near the Yolo County Central Landfill and roughly five (5) miles from the City center.

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The Clements team completed an analysis of the following:

- Land Availability
- Proximity to Sensitive Receptors
- Zoning & Permitting
- Access
- Floodplain
- Utility Availability
- Future Outlook

Land Availability

The City WWTP has 170 acres of land available for a potential City organics facility. The available land is outlined in red in **Figure 6.5**.

At the time of this report, this land is being used as an irrigation field for WWTP effluent. The WWTP recently went through an upgrade and will no longer require the irrigation field for additional treatment once the upgrade is complete.

Figure 6.5 City WWTP Available Land (Source: Google Earth)

Proximity to Sensitive Receptors

The City WWTP is surrounded by agricultural land to the north, east, and south and by the YCCL to the west. The nearest residential home is over 3,500 feet southwest from the potential project area.

The 400-acre City wetlands is roughly 0.8 miles southeast from the potential project area and is home to hundreds of birds, mammals, amphibians and reptiles, and native plants.

Zoning & Permitting

The site is located in Yolo County and zoned "Public and Quasi-Public". As described in the Yolo County Municipal Code:

> "The Public and Quasi-Public zone is applied to lands that are occupied or used for public and governmental offices, places of worship, schools, libraries, and other civic uses. Other typical uses include airports, water and wastewater treatment plants, drainage basins, and sanitary landfills."

This zoning would be appropriate for a composting or Anaerobic Digestion (AD) project, particularly if there are synergies with the WWTP.

Access

The City WWTP is located adjacent to YCCL. Davis Waste Removal (DWR) collection vehicles currently deliver the City's organics to YCCL for processing, and/or transfer to Northern Recycling in Zamora. The financial, environmental, and operational impact to divert the City's organics to the City WWTP instead of YCCL is insignificant. The WWTP has one access point off County Road 28H.

Floodplain

The City WWTP is located in a FEMA Flood Zone A. The area is subject to the 100-year flood event. The City WWTP currently has a National Pollutant Discharge Elimination System (NPDES) permit to discharge stormwater to the Davis Wetlands. There is an opportunity for a future organics facility to be incorporated into the WWTP's NPDES permit, but most likely it will be easier to permit the organics facility separately through the General Industrial Stormwater Permit and/or the General Order Waste Discharge Requirements (WDR) for Composting Operations. At a minimum, the site would need to hold the 25-year, 24-hour storm per the SWRCB WDR. This

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may be provided by earthen berms, or a lined detention pond. The lead agency may require the facility to provide capacity for the 100-year storm event.

Utility Availability

Due to the close proximity of the City WWTP, this land has access to power from the Pacific Gas and Electric Corporation and from the adjacent WWTP solar farm. The solar farm currently provides 40% of the power requirements for the City WWTP. Discussions with the solar farm operator to expand its power generation are currently taking place, but no determination or project timeline has been established.

The City WWTP upgrade provides approximately 1.5 to 2 million gallon per day (MGD) of reclaimed water available for use in the summer, and 0.5 MGD of reclaimed water available for use in the winter. This could be a good source of water for an AD and/or composting project.

Future Outlook

The WWTP has no current plans to utilize the area identified in this assessment, and has designated that 170 acres are available for a project.

6.4.2 Technical Aspects

Conceptual Site Plan

Figure 6.6 shows the location of the organics facility in relation to the WWTP. **Figure 6.7** shows the conceptual site plan of an organics processing facility.

Organics Throughput

For the purposes of this study, the Clements team assumes that the project will process all available organics from the City of Davis and UC Davis, approximately 48 and 48.5 tons per day, respectively. Thus, any composting technology must be able to process roughly 100 tons per day.

Since about 85% of UC Davis' available organics is made up of animal bedding and manure, this tonnage is excluded from the potential tonnage available for an anaerobic digestion (AD) system. Thus, any proposed AD system must be able to process roughly 50 tons per day.

See **Table 6.1** for the breakdown of these organics.

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Figure 6.6 City WWTP Organics Processing Facility Conceptual Site Plan

Figure 6.7 City WWTP Organics Processing Facility Conceptual Site Plan II

Technology

The Clements team has identified two potential projects at the City WWTP as follows:

Project 1: Stand Alone Composting Operation
Project 2: Integrated Anaerobic Digestion (AD) and Composting

Project #1 – Composting

The Clements team has identified the following potential composting technologies applicable for the City project. More detailed air emissions analysis in coordination with the Yolo Solano Air Quality Management District will be needed in order to make a decision on which technology is best suited for this application:

1) Static Pile Composting (12-inch compost cover)
2) Covered Aerated Static Pile (CASP) Composting (membrane cover)

Static Pile Composting

The simplest composting method to process organics comprised of predominately green, food, and animal waste, is static pile composting (typically windrows) with a 6 to 12-inch finished compost cap and watering system. Compost windrows can range in length from 200 to 600 feet long, and are typically 12 feet wide and 6 to 8 feet high. The typical composting period for this technology is 90 to 120 days. **Figures 6.8** and **6.9** show photographs of an operational static pile composting facility.

Figure 6.8 Example Static Pile Composting Facility Aerial (Source: Google Earth)

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Figure 6.9 Example Static Pile Composting Pile Formation (Source: Tierra Verde Industries)

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Covered Aerated Static Pile (CASP) Composting

The advanced composting method to process these organics is a Covered Aerated Static Pile (CASP) Composting System. One example of this technology that will be used to represent a CASP is the GORE® Cover System as shown in **Figures 6.10** and **6.11.** There are other composting technologies provided by companies such as Engineered Compost Solutions (ECS) and Green Mountain Technologies. The GORE® system is used here mainly as an example of the CASP technology with which the team is very familiar, not as an endorsement.

The standard GORE® system consists of eight (8) concrete bunkers each 165 feet long, 35 feet wide, and 8 feet high and is designed to process 100 tons per day (TPD). Each bunker can hold approximately 1,300 cubic yards of material. The GORE® system operates as follows:

- Phase I active composting: 28 days (4 bunkers)
- Phase II secondary composting: 14 days (2 bunkers)
- Phase III curing: 14 days (2 bunkers)

After each phase, the material is moved by a wheeled loader to the bunkers of the next phase. During the composting, the bunkers are covered with a semipermeable membrane that traps VOC and NH_3 emissions within the compost piles where they are destroyed. The piles are aerated to control temperature and moisture, and channels installed in the concrete floor collect leachate and divert it to a holding tank for further processing and reuse.

Figure 6.10 GORE® Composting Facility Aerial (Source: Sustainable Generation)

Figure 6.11 GORE® Composting Facility Compost Piles

See **Table 6.4** for a general comparison of these two technologies.

Table 6.4 Static Pile vs. CASP General Comparison

TECHNOLOGY TYPE	LAND REQUIRED	PILE SIZE	ACTIVE PHASE	PILE TURNINGS	TOTAL RETENTION TIME
Static Pile	15 acres	200’ x 12’ x 6’	15 days	5	90 to 120 days
CASP	2 acres	165’ x 35’ x 8’	28 days	1	56 days

Project #2 – AD with Composting

The Clements team has identified two potential AD technologies:

1) High Solids Discontinuous / Batch-Flow Type (AD-D)
2) High Solids Continuous / Plug-Flow Type (AD-C)

Anaerobic Digestion Overview

Anaerobic digestion is the reduction of carbon-based organic materials through controlled decomposition by microbes, accompanied by the generation of liquids and gases. In anaerobic digestion, the biodegradable, organic components of the waste stream are metabolized by microorganisms in the absence of oxygen, producing a biogas (primarily methane and carbon dioxide), a solid byproduct (called "digestate", which is generally considered to be a compost), and reclaimed water. The anaerobic digesters achieve significant diversion of 60 percent to 80 percent, assuming the composted residue can be marketed.

High solids anaerobic digestion technology can operate on a wide range of feedstocks including: green waste, food waste, food processing plant wastes, and other organic waste streams. This flexibility makes it attractive for a project in Davis with its surrounding agricultural community where a variety of feedstocks are possible. There are two types of high solids AD technologies, discontinuous and continuous, as described in *Section 5.3.2.*

High Solids – Discontinuous / Batch-Type Flow (AD-D)

Some of the companies providing AD-D type technologies include:

- SMARTFerm
- Organic Waste Systems (OWS)
- BEKON
- Eggersmann

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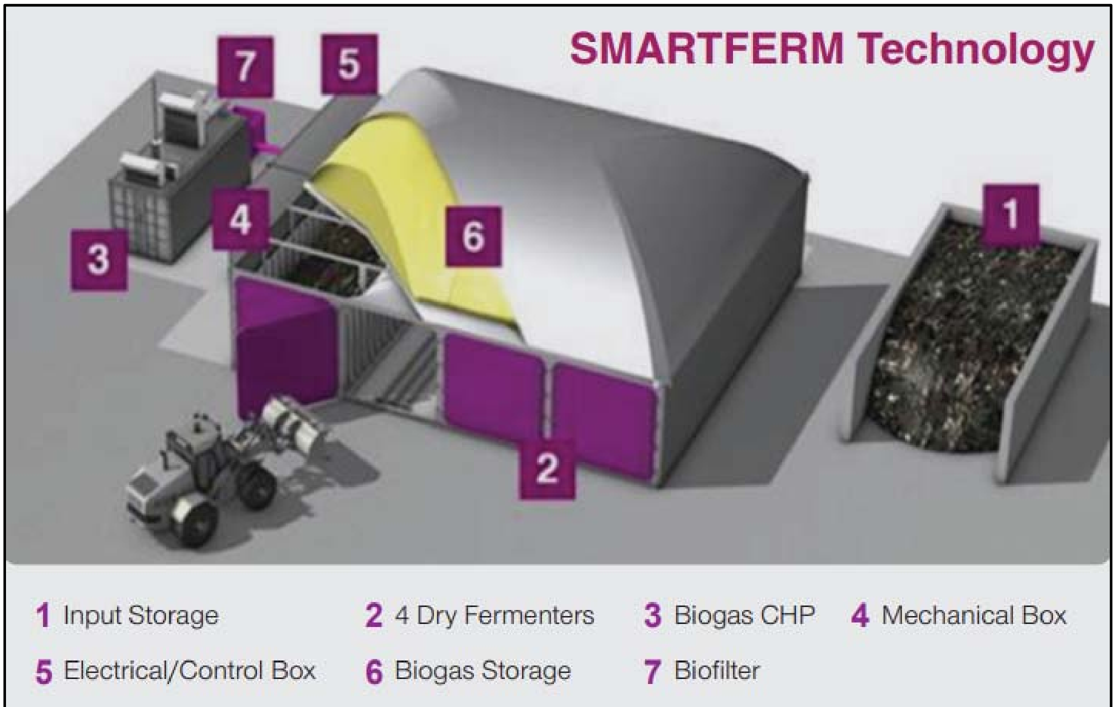
The team is using the SMARTFerm technology for this study due to the small size of the proposed AD facility and the team's knowledge of the technology, its performance, and cost. This is not an endorsement of this vendor over the other competitors.

The SMARTFerm offers a 50 TPD shop fabricated steel digester, requiring roughly 4,000 square feet and can be fully assembled in as little as 90 days. The system is made up of four (4) digestion bays each 12 feet in width, 12 feet in height, and 40 feet in length. After organic waste is loaded into one of four digesters, the hatch is closed and sealed as the in-floor aeration system blows air through the material for six to eight hours. The aeration helps to biologically heat the waste to a maximum of 131 degrees Fahrenheit to support thermophilic AD. Heated liquid biological inoculant is introduced to the waste to maintain this temperate and assist in biogas production. The total residence time is 21 days, with the generation of approximately 100 to 120 scfm biogas. At the end of this process, the hatch is opened and digestate is removed to be sent to a composting operation for finishing. **Figures 6.12** and **6.13** are photos of the SMARTFerm system.

Figure 6.12 SMARTFerm System at Monterey Regional Waste Management District
(Source: SMARTFerm)

Figure 6.13 SMARTFerm Conceptual Site Layout (Source: SMARTFerm)



High Solids – Continuous / Plug-Type Flow (AD-C)

Examples of AD-C type technologies include:

- Eisenmann
- Clean World
- GICON

Eisenmann's concrete square primary digester with round post digester can process up to 60 TPD, and requires 8,000 square feet. This AD system uses a two-stage process. The first stage is a horizontal plug-flow digester that is heated, insulated, and fit with a horizontal agitator to create a homogenous mixture. The feedstock is continuously mixed to ensure the biological processes occur throughout the load to maximize biogas generation. The second stage is a heated and stirred tank with a double-membrane roof to store biogas. The typical residence time is 21 days, after which the digestate is applied directly as a soil amendment or composted for finishing. This system can process high organic loads (i.e. food waste) as well as dry materials (i.e. green waste). Eisenmann has shown to achieve 80% digestate and 150 to 165 scfm biogas production from feedstock inputs. **Figures 6.14** and **6.15** are photos of the 60 TPD Eisenmann system.

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Figure 6.14 Eisenmann Main Digester Schematic (Source: Eisenmann)

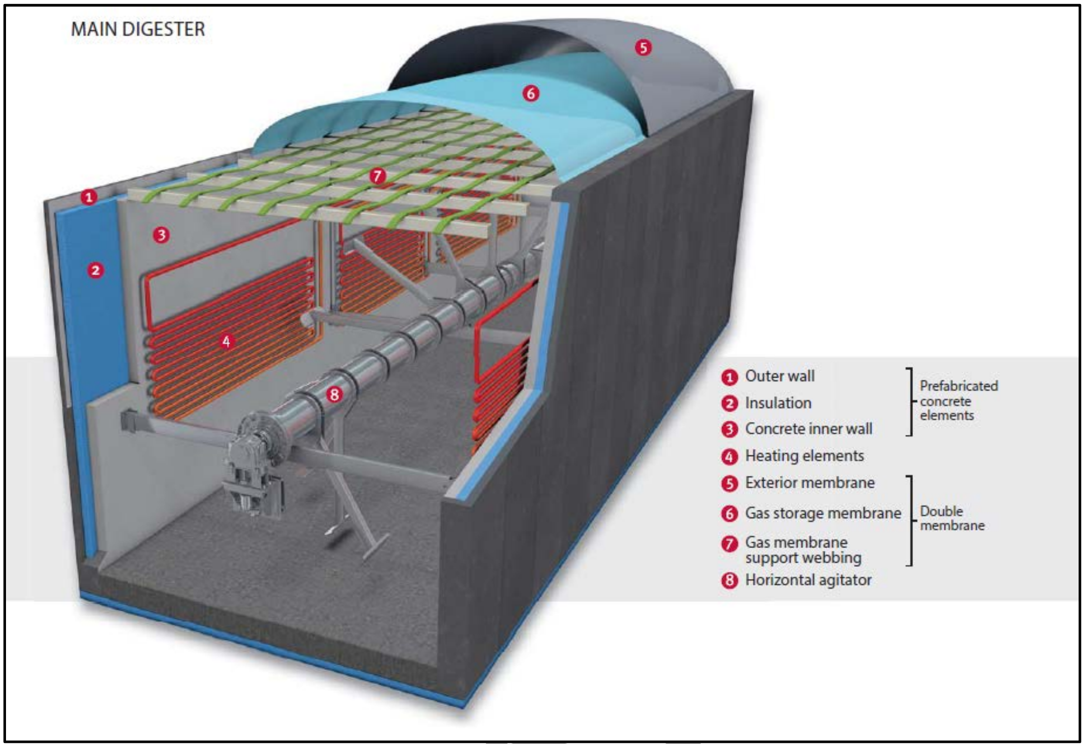
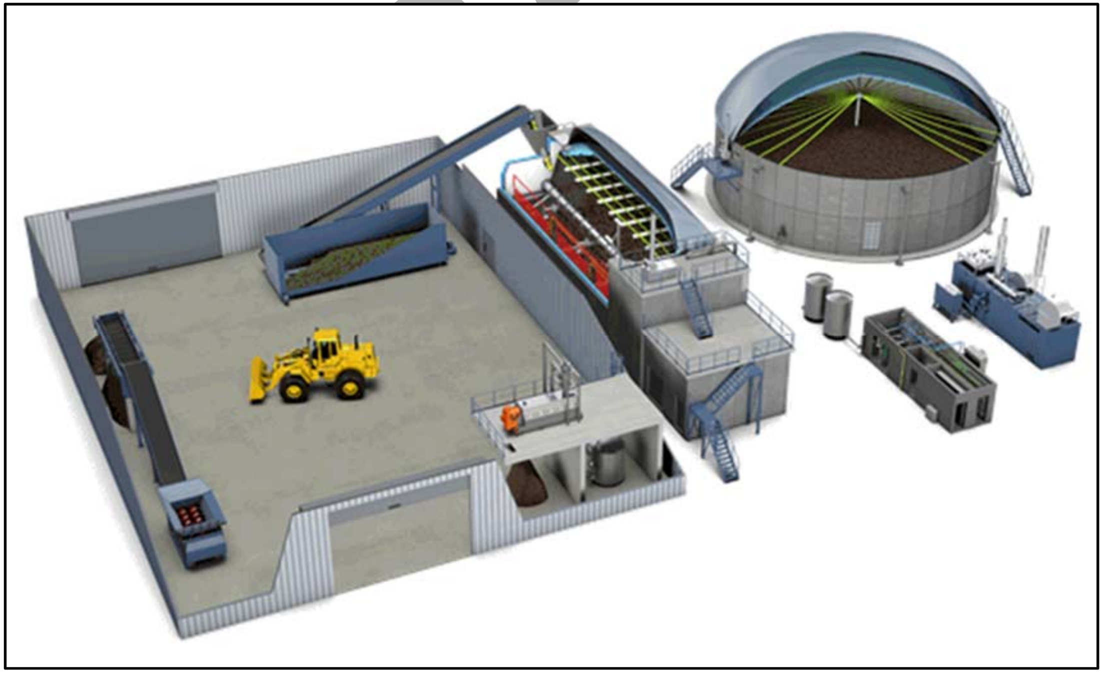


Figure 6.15 Eisenmann Conceptual Site Layout (Source: Eisenmann)



See **Table 6.5** for a general comparison of these two technologies.

Table 6.5. AD-D vs AD-C General Comparison

TECHNOLOGY TYPE	TONS / DAY	SYSTEM FOOTPRINT	RETENTION TIME	DIGESTATE PRODUCTION	BIOGAS OUTPUT
AD-D	50	4,000 sf	21	50%	100 to 120 scfm
AD-C	60	8,000 sf	21	50%	150 to 165 scfm

6.4.3 Environmental Aspects

There are several key environmental regulations that must be considered during the design of an organics facility. For the purposes of this study, the regulations are divided by the governing body.

CEQA Analysis – City of Davis

The first step to securing permits for this City organics project is controlled by the City.

This project will require land use and CEQA approval from the lead agency, which in this case is the City of Davis. Technically, the project is located in unincorporated Yolo County, but the City has always acted as the lead agency for the City's WWTP. Based on the project's zoning of Public and Quasi-Public (PQP), the Lead Agency may determine only a site plan review is required. The project will most likely result in a Mitigated Negative Declaration (MND) based on the lead agency's California Environmental Quality Act (CEQA) Initial Study. The MND will have project-specific mitigation measures to ensure the project does not have a significant effect on the environment or human health. As the lead agency, the City and/or its CEQA consultant would determine the most appropriate mitigation measures for this project.

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State Water Resources Control Board

The State Water Resources Control Board requires all composting facilities to comply with the General Order, Waste Discharge Requirements (WDR). Based on the tonnage throughput and feedstock types, the City's composting operation would qualify as a Tier I facility. The requirements of a Tier I facility are summarized below:

1. Tier I feedstocks are limited to agricultural materials, green materials, paper materials, vegetative food waste, residentially co-collected or self-hauled food and green materials, and AD digestate from any allowable Tier I feedstocks;
2. The facility receives, processes, and stores less than 25,000 cubic yards of allowable compostable materials on-site at any given time;

3. The percolation rate and depth to the highest anticipated groundwater level meets the allowable WDR standards. See **Table 6.6.**
4. Areas used for receiving, processing, or storing compostable materials must be designed, constructed, and maintained to control and manage all run-on, run-off, and precipitation which falls onto or within the boundaries of these areas from a 25-year, 24-hour peak storm event, at a minimum.

These WDR requirements do not limit the City from accepting organic waste from other cities or nearby industries as long as the City accepts only allowable feedstocks, stores no more than 25,000 cubic yards of compostable material on-site at any given time, and has adequate protection from the 25-year, 24-hour storm for all operational areas.

Meat, bones, eggs, and other non-plant-based food materials are not allowed to be accepted as a Tier I facility, unless the feedstock source is considered, "residentially co-collected or self-haul food and green materials".

Table 6.6 WDR Tier I Percolation Rate and Depth to Groundwater Standards

SOIL PERCOLATION RATE (MPI – MINUTES PER INCH)	DEPTH TO GROUNDWATER (MINIMUM)
< 1 MPI	50 feet
1 MPI – 5 MPI	20 feet
> 5 MPI – 30 MPI	8 feet
> 30 MPI	5 feet

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The National Oceanic and Atmospheric Administration's Point Precipitation Frequency estimates the 25-year 24-hour storm event for the project site to be 4.07 inches. Based on this size storm and the project acreage shown in **Figure 6.6** and **Figure 6.7**, the project would require, at the minimum, a 2-foot earthen berm around the operations' perimeter for stormwater protection. This is subject to approval by the Central Valley Regional Water Quality Control Board.

At a maximum, the facility would be required to meet the following:

- Working surfaces must meet a hydraulic conductivity of 1.0 x 10^{-5} cm per second. Must consist of one of the following:
    - Compacted soils, with a minimum thickness of one foot;
    - Asphaltic concrete or Portland cement concrete;
- Detention ponds must meet a hydraulic conductivity of 1.0 x 10^{-5} cm per second. Must include one of the following:
    - A liner system consisting of a 40 thousandths of an inch (mil) synthetic geomembrane (or 60-mil HDPE), underlain by either one foot of compacted clay or a geosynthetic clay liner installed over a prepared base.

  - o A liner system that includes Portland cement concrete, underlain by a 40-mil synthetic geomembrane (or 60-mil HDPE)
- Detention ponds must be designed and constructed with a pan lysimeter

<u>Yolo Solano Air Quality Management District (YSAQMD)</u>

Yolo-Solano is currently designated "non-attainment" for ozone, which is created by the chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOCs), both of which are produced from composting.

Therefore, composting operations will need to achieve Best Available Control Technology (BACT) certification. The two requirements are:

1) Achieved in practice
2) Technologically feasible (Cost-benefits ratio for cost per emission reduction)

YSAQMD has accepted aerated static piles, such as the GORE® Covered Composting System, as a BACT technology, but will assess projects with lesser air emission controls on a case-by-case basis. The San Joaquin Valley Air Pollution Control District (SJVAPC) has BACT-certified static pile composting with 6-inches of finished compost cover plus a watering system as this method has shown to achieve 60% reduction in VOCs and 60% reduction in NH_3 compared to traditional windrow composting. In comparison, the GORE® Covered Composting System has consistently shown at least 80% reduction, with as high as 95% reduction, in VOCs and 75% reduction in NH_3. Depending on the cost-benefit ratio, YSAQMD may require the City to use GORE® Covered Composting System instead of static pile with 6-inch compost cap.

Currently YSAQMD only has two composting operations within the district, both of which are existing facilities and not subject to BACT requirements. However, Recology Jepson Prairie utilizes an aerated static pile system.

<u>CalRecycle</u>

This organics processing facility would need to apply for a Full Solid Waste Facility Permit, which includes a Report of Composting Site Information and Odor Impact Minimization Plan. The anaerobic digestion component would require an In-Vessel Digestion Report and a Transfer Processing Report. Each of these documents have numerous requirements including, but not limited to, operations to meet state minimum standards, schematic drawings, hours of operation, equipment requirements, design capacity, anticipated volume of quench or process water, and final disposal method.

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Upon submittal of the application, it takes at least 150 days to secure a Full Solid Waste Facility Permit. This includes 30 days to deem the application complete, 30 days to hold a public information meeting, 30 days to draft proposed permit, and 60 days for CalRecycle to approve.

6.4.4 Policy Aspects

The major advantage of the City developing and operating an organics facility is the City's ability to control its own destiny. The City will be able to utilize vacant City-owned property, control the land use and CEQA permitting, and have full control over the design, operations, and cost. In addition, this project has two possible synergies with the adjacent WWTP:

- Compost or digest the WWTP's biosolids; and/or
- Combine the AD-generated biogas with the WWTP's biogas to produce renewable electricity to operate the WWTP

The major disadvantage of this project is the likely higher cost compared to sending the City's organic waste to YCCL, or to contracting with Recology to haul the City's organics to one of their existing processing facilities. This project will also require extensive permitting, and most likely will have a long lead time until the project is operational. While the City will enjoy profits from the generated products from this project, the City will also be in charge of marketing these products which has potential risks if the demand is low.

6.5 UNIVERSITY OF CALIFORNIA, DAVIS

6.5.1 Project Overview

The University of California, Davis (UCD) has a 50 TPD AD system at 28068 County Road 98, west of the main UCD campus. UCD is interested in developing a partnership, either through formal agreements or voluntary participation, with the City for organics processing as follows:

1. City to own and operate a composting operation on UCD property
2. City to provide its organic waste to support UCD-owned and operated composting operation on UCD property
3. UCD to provide its organic waste to a City-owned and operated organics processing facility located on City property.

Of these options, #1 would require a clear partnership through a lease agreement and waste agreement between the City and UCD. Options #2 and #3 can be merely participation in the other entity's organics program or through formal partnership through a waste agreement.

The Clements team completed an analysis of following:

- Land Availability
- Proximity to Sensitive Receptors

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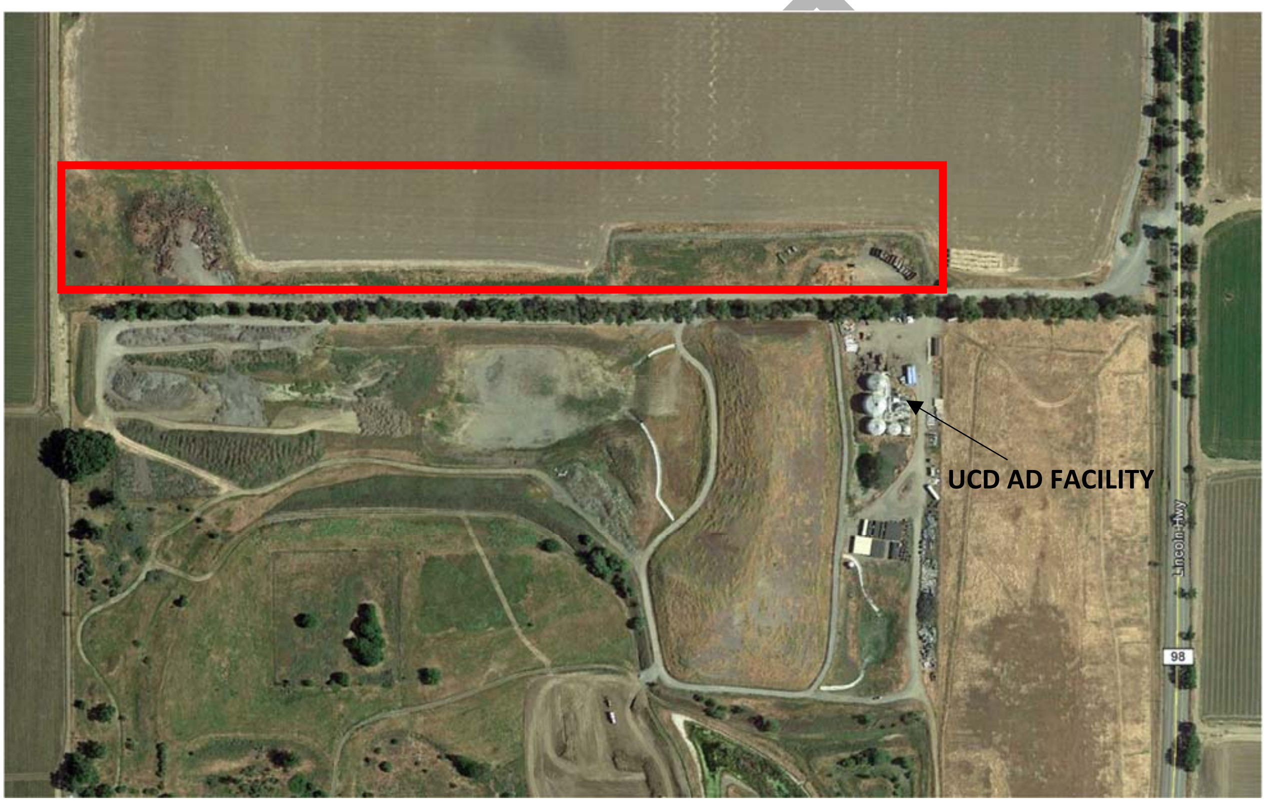
- Zoning & Permitting
- Access
- Floodplain
- Utility Availability
- Future Outlook

Land Availability

UCD has identified roughly 13.4 acres of available land for an organics processing facility, specifically composting, to support the UCD AD facility. The available land is outlined in red in **Figure 6.16.**

Figure 6.16 UCD Available Land (Source: Google Earth)



Proximity to Sensitive Receptors

The available UCD land is surrounded by vacant agricultural land, the UCD AD facility, and the UCD landfill. The nearest residential homes are roughly three-quarter of a mile north.

Zoning & Permitting

This land is owned by UC Davis, and UC Davis would act as the lead agency during the CEQA process for a potential project. This allows UC Davis to require specific mitigation measures for this project.

Access

As this property is directly across the street from the UCD AD facility, there is access to the site from Lincoln Highway. This is the only access to the site and would be shared with all traffic to the UCD AD facility.

Floodplain

This property is located in a FEMA Flood Zone A and is subject to the 100-year flood event. This composting project would need to comply with the NPDES General Industrial Stormwater Permit and/or the General Order Waste Discharge Requirements (WDR) for Composting Operations. At a minimum, the site would need to hold the 25-year, 24-hour storm per the SWRCB WDR. This may be provided by earthen berms, or a lined detention pond. The lead agency may require the facility to provide capacity for the 100-year storm event.

Utility Availability

Due to the close proximity of the UCD AD facility, it can be assumed that this facility will have access to water and power.

Future Outlook

UCD needs an economical outlet for their AD facility's digestate and process water effluent, regardless of the City's interest in developing an organics processing facility.

6.5.2 Technical Aspects

Conceptual Site Plan

Please see **Figure 6.17** for a conceptual site plan of an organics processing facility adjacent to the UCD AD facility.

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Figure 6.17 City Organics Processing Facility at UCD

NOTES

AVAILABLE LAND: ~13.4 acres

MATERIAL UNLOADING
Area footprint: ~1.4 acres

COVERED COMPOSTING
System Footprint: ~1.0 acre

STATIC PILE COMPOSTING
System Footprint: ~9.2 acre

REVISIONS

City of Davis UCD Organics Facility Concept Plan

45400 County Road 28H
Davis, CA 95616

CLEMENTS ENVIRONMENTAL
15230 Burbank Bl. Ste. 103
Sherman Oaks, CA 91411
(818) 267-5100

DATE: 10/04/2017
FILE: UCDavis Concept Plan
SCALE: 1" = 150' when printed 11" x 17"

N

Organics Throughput

For the purposes of this study, the Clements team assumes that the project will process all available organics from the City of Davis and UC Davis, approximately 48 and 48.5 tons per day, respectively. See **Table 6.1** for the breakdown of these organics.

Technology

UC Davis is only interested in a City-owned and operated, or UC Davis-owned and operated composting system. The Clements team proposes the same composting technologies as recommended for the City WWTP organics project. Please see **Table 6.4** for a general comparison of these two technologies.

6.5.3 Environmental Aspects

The environmental regulatory requirements for an organics processing facility at UCD are identical to the requirements if the project were to be at the City's WWTP, except which public agency is the lead agency.

For a project at the City's WWTP, the City would be the lead agency during the CEQA and land use permit process. For a project at UCD, UCD would be the lead agency. This means UCD would have ultimate authority over the project's land use approval, level of CEQA required (i.e. MND or EIR), fees, and mitigation measures.

6.5.4 Policy Aspects

There are two options for this project, either the City leases the UCD land and operates the organics processing facility, or the City participates in a UCD owned and operated facility.

Option #1: City Lease and Operate

The main unique advantage for the City to operate a facility on UCD property is to support a regional effort with the university. Other advantages include the site's remote location to sensitive receptors and current use as a chip and grind storage area.

However, the City would be subject to some type of lease agreement with UCD most likely in the form of a long-term lease. Per the latest meeting, UCD would be willing to negotiate a cost for the land, however admits to charging CleanWorld a very high lease. UCD would also have the power to take over the facility from the City, similar to the recent change of ownership on the UCD AD facility. Additionally, the City would be responsible to support UC waste diversion efforts.

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Options #2: UCD Own and Operate

Similarly, if UCD operated the facility, the main advantage for the City to participate in a UCD owned and operated facility is to support a regional effort between the City and university. Other advantages include no infrastructure, permitting, or product-marking burden on the City. This option would have minimal impact on the hauler, as the travel distance is similar to or less than to YCCL.

The drawbacks to this project are similar to those if the City were to participate in the YCCL organics project. The City would most likely be subject to a feedstock guarantee, lose control of future system options, and face an uncertain or unstable price per ton. UCD would also receive all the positive publicity for its waste diversion efforts.

6.6 RECOLOGY, INC.

On August 29, 2017, Davis Waste Removal (DWR) informed the City that Recology, Inc. (Recology) offered to purchase all of the assets of DWR and continue DWR's operations in the City under the existing franchise agreement. The City has the "first right of refusal" to purchase DWR's physical assets (truck yard, MRF, etc.) and is evaluating that option now.

6.6.1 Project Overview

Recology, Inc. (Recology) was founded in San Francisco and provides an array of services throughout California, Oregon, and Washington. Within a 70-mile radius of the City center, Recology currently owns and operates four (4) organics composting facilities and two (2) sanitary landfills. These facilities are shown in **Figure 6.18.**

6.6.2 Technical Aspects

Due to the potential monopoly nature of Recology's nearby organics processing and disposal facilities, Recology may propose to direct all of the City's organics tonnage to their nearest facilities Jepson Prairie Organics and Hay Road Landfill. See vicinity map for the nearest Recology facilities compared to Yolo County Central Landfill in **Figure 6.19.**

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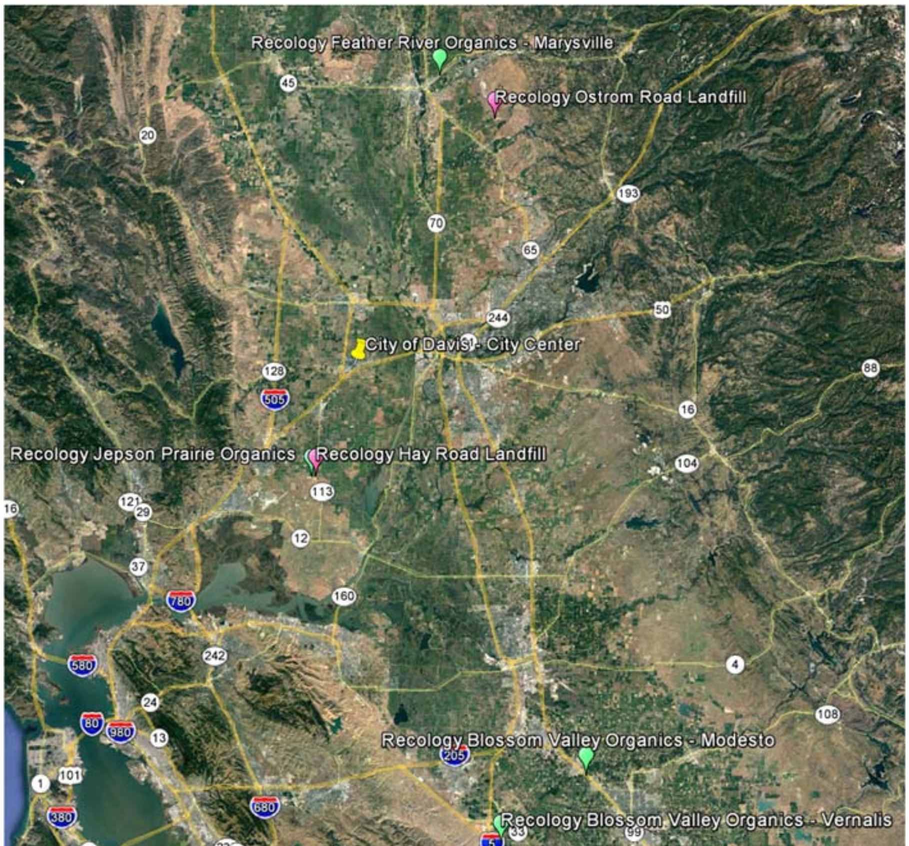
Figure 6.18 Potential Recology Organics Facilities



Jepson Prairie Organics

Jepson Prairie Organics (JPO) has a current maximum permitted throughput of 750 tons per day for composting agricultural, food, and green wastes on 54 acres.

JPO currently uses aerated static pile composting technology. The facility is subject to the State Water Resources Control Board's new General Order Waste Discharge Requirements (WDR) for Composting Operations and will be required to make site improvements. Recology may be able to incorporate the WDR into existing NPDES permits associated with Hay Road Landfill, therefore resulting in no additional financial burden from the WDR.

Hay Road Landfill

Recology's Hay Road Landfill is permitted for a maximum of 2,400 tons per day for disposal or municipal solid waste, biosolids, and organics (i.e. construction/demolition, agricultural, etc.).

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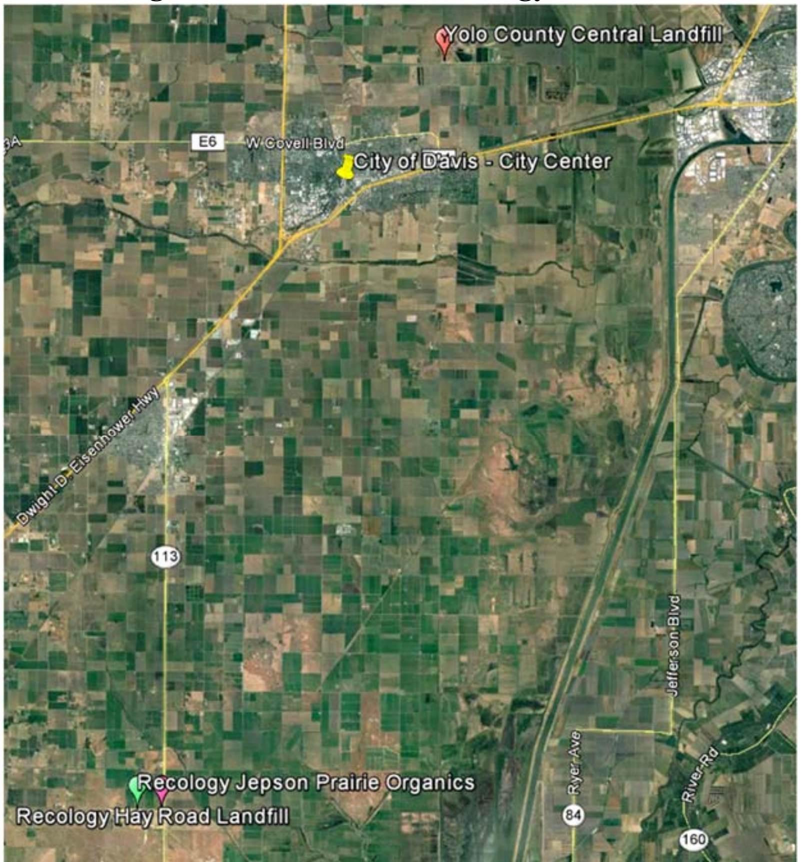
Figure 6.19 Nearest Recology Facilities



Blossom Valley Organics North

If the City's organics needed additional processing for which JPO did not have the capacity, then Recology would most likely transfer these organics at JPO and haul them by transfer truck to Blossom Valley Organics North (BVON), Recology's largest organics processing facility in the area. BVON is located in Vernalis, CA and has a current maximum permitted capacity of 2,000 tons per day for composting food and green wastes on 123.5 acres. BVON currently uses traditional windrow composting.

6.6.3 <u>Environmental Aspects</u>

Transportation Emissions

The City has asked the team to compare the potential environmental impacts of hauling the City's organic waste to Jepson Prairie Organics or Hay Road Landfill with to the current practice of hauling to the Yolo County Central Landfill. DWR trucks are currently fueled with compressed natural gas (CNG), and it can be assumed that Recology will continue using these trucks to provide City hauling services. From the City center, one roundtrip to Recology's JPO releases roughly 3.17

times more CO_2 equivalent (CO_2E) into the atmosphere than one roundtrip to YCCL. Please see **Table 6.7** for a summary of the primary transportation impacts.

Table 6.7 Primary Transportation Impacts

PROJECT	FACILITY	ROUNDTRIP DISTANCE PER TRIP	VEHICLE TYPE	EMISSIONS FACTOR[1]	CO_2E PER TRIP
STATUS QUO[2]	YCCL	12.0 miles	CNG collection vehicles	1.996 g CH_4 per mile 0.175 g N_20 per mile	2.70 lbs.
Recology	JPO	38.0 miles	CNG collection vehicles		8.55 lbs.

1

2Assumes future composting will occur at YCCL, not Zamora

Currently, YCCL sends preprocessed and unprocessed green waste to Northern Recycling's composting facility in Zamora. YCCL plans to relocate the composting operation to YCCL, however there is no anticipated start date for this change to occur.

If Recology were to need additional processing capacity not available at JPO, Recology would most likely transfer the organic waste to BVON, via diesel fueled transfer trucks.

Composting Emissions

Recology JPO currently uses aerated static pile composting, which is a certified Best Available Control Technology by the San Joaquin Valley Air Pollution Control District (SJVAPCD). The Yolo-Solano Air Quality Management District (AQMD) does not have a list of technologies that are certified BACT, but require new composting operations to meet BACT-requirements. Yolo-Solano AQMD and many Air Districts rely on the more stringent Air Districts for guidance since the more stringent districts have established rules, certifications, technology review, emissions data, and etc. For this particular project, SJVAPCD has defined stringent emissions requirements, and adopted specific rules that relate to the composting operations. This technology has shown to reduce VOC emissions by 80% and ammonia emissions by 50% compared to traditional composting methods. BVON uses traditional windrow composting methods.

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6.6.5 Financial Aspects

The tipping fee at JPO and Hay Road Landfill are dependent on waste type, volume, and contamination level as well as the processing or disposal contract. Typically tipping fees at JPO are $40 per ton for clean green, $70 per ton for residential green and food waste, and $90 per ton for commercial organics. The typical tip fee for MSW at Hay Road is $40 per ton. The City may have some room to negotiate with Recology on these tip fees.

6.6.6 Policy Aspects

Due to Recology's possible acquisition of DWR, this is most likely the quickest, simplest, and least expensive option for the City. Recology may be able to offer the City a deal if the City agrees to send its organics waste to JPO for processing and solid waste to Hay Road Landfill for disposal. This option also demands no infrastructure, permitting, or product marketing efforts from the City.

As with any project where the City is not the operator, the City will most likely be required to commit to a feedstock guarantee and, therefore, lose control of future system options. The City would be subject to the cost per ton as determined by Recology, which could change significantly and suddenly. With this option, Recology would get all the glory for its waste diversion efforts.

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Section 7
Project Economics

7.1 SUMMARY

The Clements team has identified four options for the City of Davis to own and operate an organics processing facility at the City's WWTP, and two on UC Davis property. For purposes of this study, the team combined Covered Static Pile Composting, the Discontinuous/Batch Flow AD, and biogas power production as the less sophisticated and less expensive scenario (Option C); and the Covered Aerated Static Pile composting, the Continuous/Plug Flow AD, and the CNG production as the more sophisticated, higher performing, and expensive option (Option D). In this way, the range of project possibilities was covered, without having to analyze every possible combination of composting, AD, and biogas utilization technologies, which was beyond the scope of this work. **Table 7.1** shows these options broken down by location, technology, type, and products for City.

Table 7.1 City of Davis Organic Processing Facility Options

CITY WWTP LOCATION			
NO.	**TECH .**	**TYPE**	**PRODUCTS**
A	Stand Alone Composting	Covered Static Pile (12-inch compost cover)	Compost
B	Stand Alone Composting	Covered Aerated Static Pile (CASP) (membrane cover)	Compost
C	AD with Composting	Discontinuous / Batch-Flow (AD-D) + Covered Static Pile	Power Production + Compost
D	AD with Composting	Continuous / Plug-Flow (AD-C) + CASP	CNG fuel + Compost
UC DAVIS LOCATION			
NO.	**TECH .**	**TYPE**	**PRODUCTS**
E	Stand Alone Composting	Covered Static Pile (12-inch compost cover)	Compost
F	Stand Alone Composting	Covered Aerated Static Pile (CASP) (membrane cover)	Compost

To calculate cost per ton, the Clements team determined equipment and labor requirements, capital, operational, and maintenance expenses, and value of the products generated. **Table 7.2** shows the pro forma summary. Please refer to **Appendix D** for the full pro forma.

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Table 7.2 Pro Forma Summary

	SITE - WWTP								SITE - UC DAVIS			
	Option A Composting Covered Static Pile		Option B Composting CASP		Option C AD & Composting AD-D & Covered Static Pile		Option D AD & Composting AD-C & CASP		Option E Composting Covered Static Pile		Option F Composting CASP	
	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual
Operations Costs												
Labor	$17.05	$434,417	$13.78	$351,184	$26.86	$684,321	$27.46	$699,622	$17.05	$434,417	$13.78	$351,184
Equip Maint & Ops	$5.58	$142,032	$5.51	$140,376	$10.48	$267,032	$14.34	$365,376	$5.58	$142,032	$5.51	$140,376
Sub-Total	**$22.63**	**$576,449**	**$19.29**	**$491,560**	**$37.34**	**$951,353**	**$41.80**	**$1,064,998**	**$22.63**	**$576,449**	**$19.29**	**$491,560**
Disposal Costs [1]												
Disposal - Residual Solid Waste	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-
Recovered/Diverted w/Negative Value	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-
Sub-Total	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**
General & Administrative Costs [2]												
Personnel [3]												
Facility G&A	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400
Sub-Total	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**
Debt Service & Equipment Replacement												
Debt Service [4]	$4.97	126,531	$20.48	521,740	$33.04	841,836	$65.40	1,666,073	$4.97	126,531	$20.48	521,740
Equipment Replacement	$3.45	$87,857	$15.78	$402,071	$25.51	$649,857	$48.02	$1,223,371	$3.45	$87,857	$15.78	$402,071
Sub-Total	**$8.42**	**$214,388**	**$36.26**	**$923,812**	**$58.55**	**$1,491,694**	**$113.42**	**$2,889,444**	**$8.42**	**$214,388**	**$36.26**	**$923,812**
Total Costs	**$33.02**	**$841,237**	**$57.54**	**$1,465,772**	**$97.87**	**$2,493,447**	**$157.20**	**$4,004,842**	**$33.02**	**$841,237**	**$57.54**	**$1,465,772**
Revenue from Commodity Sales	$13.33	$339,682	$13.33	$339,682	$27.57	$702,272	$37.95	$966,702	$13.33	$339,682	$13.33	$339,682
Net Cost	**$19.69**	**$501,555**	**$44.20**	**$1,126,090**	**$70.31**	**$1,791,175**	**$119.25**	**$3,038,140**	**$19.69**	**$501,555**	**$44.20**	**$1,126,090**
Incoming Tons	*25,476*		*25,476*		*25,476*		*25,476*		*25,476*		*25,476*	

Notes

1. Assumes no disposal costs.
2. General and administrative costs are expenses required to administer a business, and which are not related to the construction, production or sale of goods or services.
3. No General & Administrative staff is included in this Pro-Forma.
4. This represents principal and interest.

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7.2 PROJECT DISCUSSIONS

This section provides an overview discussion of the key economic aspects of each option.

7.2.1 WWTP Located Options

Table 7.3 displays the key financial points for a project at the City WWTP.

Table 7.3 City WWTP Project Key Financial Points

OPTION	CAPEX[1]	$ / TON	REVENUE / UNIT	TOTAL REVENUE	# OF STAFF
A	$982,000	$19.69	Compost: $20/ton	**$339,682**	4.5
B	$3,996,000	$44.20	Compost: $20/ton	**$339,682**	3.5
C	$6,602,000	$70.31	Power: $0.166/kwh	$456,751	7.0
			Compost: $20/ton	+$245,521	
				$702,272	
D	$13,459,000	$119.25	CNG: $2.00/gal	$721,181	7.0
			Compost: $20/ton	+$245,521	
				$966,702	

[1] Capital Expenditures

Options A and B – Stand Alone Composting

Options A and B assume available organics from the City and UCD, except their respective biosolids, are sent to the composting system from which two-thirds is converted into a finished compost product. As described in the product market study, compost product sells for an average of $20 to $40 per ton depending on certification, quality, and volume. For the purposes of this pro forma, the Team gave the compost product the conservative value of $20 per ton.

While the CAPEX for the static pile composting system (Option A) is less than half that of the covered aerated static pile (Option B), it is more labor intensive. Essentially, with the more expensive Option B composting technology, the City is paying for a much higher level of environmental control, for both air emissions and stormwater runoff.

It is important to note that the City must receive approval from the YSAQMD prior to operation of either composting system. This is particularly important for Option A because the YSAQMD has not made a determination if static pile composting (Option A) would be permitted within the District. The San Joaquin APCD has certified such a system as BACT, which is a positive indication that this more simple technology may be approved in the YSAQMD.

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Options C and D – AD with Composting

Options C and D assume all green waste, mixed green and food wastes, post-consumer food waste , and other City organics (street sweepings and 15% wood waste recovery from City C&D boxes) is sent directly to the AD system, and the UCD animal bedding and digestate are sent directly to the composting system. Roughly 50% of the incoming feedstock to the AD system will become digestate, which will then be mixed with the UCD feedstocks and placed into the composting system. The same composting conversion factor of two-thirds of the incoming mass becoming compost, and product market value of $20 per ton used for Options A and B were applied.

One key addition that was necessary for the Option D AD system was a receiving building of 15,000 sf to receive and process the incoming organic material prior to feeding into the digestion system.

Both AD technologies produce biogas which can be converted into electricity or CNG fuel. For the purposes of this study, the Team paired the discontinuous, batch-flow type (AD-D) system with electricity generation and the continuous, plug-flow type (AD-C) AD system with CNG generation. The AD-C system produces almost 30% more biogas than the AD-D system, therefore is categorized as a more advanced technology due to the increase in energy recovery. Currently, the City and UCD feedstocks contain roughly 2% food waste. Since this is the onset of the City's organics collection program, it is reasonable to assume the percentage of food waste will increase over time. For the purposes of this pro forma and the biogas generation, the Team used a value of 10% food waste for incoming feedstock to the AD system.

The value of the electricity was determined by using the weighted average of the price per kilowatt-hour (kwh) over the City WWTP's utility bills for the past 11 months. The value of CNG is highly volatile. Thus, even though existing AD plants in California are receiving as much as $4/diesel gallon equivalent ($4/DGE) we assumed a much more conservative value of $2/DGE for this proforma. At the $4/DGE revenue number, that net cost for Option D drops to about $91/ton.

The options for use of the biogas, in this study and pro forma do not include upgrading of the raw biogas to pipeline quality renewable natural gas for utility pipeline injection. This option in the State of California is extremely expensive with stringent quality requirements. In recent years, the State has begun to encourage pipeline injections and currently is currently offering financial incentives, however, the current requirements make this option nearly infeasible for a project of this size. The ideal situation would be for the City to fuel its own truck fleet, or other third party vehicles at a CNG fueling station at the WWTP.

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7.2.2 UC Davis Located Options

Table 7.4 displays the key financial points for a project at the UC Davis location.

Table 7.4 UC Davis Project Key Financial Points

OPTION	CAPEX	$ / TON	REVENUE / UNIT	TOTAL REVENUE	# OF STAFF
E	$982,000	$19.69	Compost: $20/ton	**$339,682**	4.5
F	$3,996,000	$44.20	Compost: $20/ton	**$339,682**	3.5

Options E and F – Stand Alone Composting

Options E and F have identical cost estimates as Options A and B, respectively. The pro forma assumes that there is no cost to the City to operate a composting operation on land owned by UC Davis. If such a fee were imposed, the net $/ton cost would increase accordingly.

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APPENDICES

APPENDIX A	**YCCL Current SWFP**
APPENDIX B	**YCCL Proposed SWFP**
APPENDIX C	**YCCL Waste Flow Diagram**
APPENDIX D	**Financial Pro Formas**

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APPENDIX A

YCCL Current SWFP

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SOLID WASTE FACILITY PERMIT

1. Facility/Permit Number:
57-AA-0001

2. Name and Street Address of Facility:
Yolo County Central Landfill
44090 County Road 28H
Woodland, CA 95776-9101

3. Name and Mailing Address of Operator:
Yolo County Planning & Public Works Dept.
Division of Integrated Waste Mgmt.
44090 County Road 98H
Woodland, CA 95776-9101

4. Name and Mailing Address of Owner:
Yolo County Planning & Public Works Dept.
Division of Integrated Waste Mgmt.
44090 County Road 98H
Woodland, CA 95776-9101

5. Specifications:

a. Permitted Operations:

[ ] Composting Facility (mixed wastes)
[X] Composting Facility (yard waste)
[X] Landfill Disposal Site
[ ] Material Recovery Facility
[X] Processing Facility
[X] Transfer Station
[ ] Transformation Facility
[X] Other: Research, Development and Demonstration

b. Permitted Hours of Operation:
Monday through Saturday: 6 am to 5 pm, Sunday: 7 am to 6 pm
Closed: New Year's Day, Easter Sunday, Independence Day, Labor Day, Thanksgiving Day, Christmas Day

c. Permitted Tons per Operating Day: .....1,800.................................. Tons/Day

Non-Hazardous - General ....Tons/Day
Non-Hazardous - Sludge ....Tons/Day
Non-Hazardous - Separated or comingled recyclables..Tons/Day
Non-Hazardous - Other (See Section 14 of Permit) ....Tons/Day
Designated (See Section 14 of Permit) ....Tons/Day
Hazardous (See Section 14 of Permit) ....Tons/Day

d. Permitted Traffic Volume: ....1,047............................Total: Vehicles/Day

Incoming waste materials ....Vehicles/Day
Outgoing waste materials (for disposal) ....Vehicles/Day
Outgoing materials from material recovery operations..Vehicles/Day

e. Key Design Parameters (Detailed parameters are shown on site plans bearing LEA and CIWMB validations):

	Total	Disposal	Transfer	MRF	Composting	Transformation
Permitted Area (in acres)	724.54	473	10	N/A	5	N/A
Design Capacity (cu. Yds)		49,035,200	57,000	N/A	45,000	N/A
Max. Elevation (Ft. MSL)		141.4	N/A			
Max. Depth (Ft. BGS)		N/A	N/A			
Estimated Closure Date		2081				

Upon a significant change in design or operation from that described herein, this permit is subject to revocation or suspension. The stipulated permit findings and conditions are integral parts of this permit & supersede the conditions of any previously issued permit.

6. Approval:

Approving Officer Signature

Leslie Lindbo, MBA, REHS, Director of Environmental Health

Name/Title

7. Enforcement Agency Name and Address:
Yolo County Environmental Health
137 N. Cottonwood St., Ste 2400
Woodland, CA 95695

8. Received by CIWMB:
February 25, 2008

9. CIWMB Concurrence Date:
April 22, 2008

10. Permit Issued Date:
April 30, 2008

11A. Next Permit Review Due Date:
April 25, 2018

11B. Permit Transfer Date:
N/A

11C. Permit Review Date:
April 25, 2013

SOLID WASTE FACILITY PERMIT

Facility Number:

57-AA-0001

9. Permit Issued Date:	**10. Permit Review Due Date:**	**11. Owner/Operator Transfer Date:**
April 30th, 2008	April 30th, 2013	

12. Legal Description of Facility:

The legal description of this facility is contained in appendix G of the Joint Technical Document dated July 2007.

13. Findings:

a. This permit is consistent with the Yolo County Integrated Waste Management Plan (CIWMP), which was approved by the CIWMB on May 15, 2002, pursuant to Public Resources Code (PRC) Section 41721. The location of the facility is identified in the Countywide Siting Element, pursuant to PRC Section 50001(a)(1). A "Five-Year CIWMP Review Report" was submitted to the CIWMB on August 22, 2007 and approved on March 18, 2008.

b. This permit is consistent with the standards adopted by the CIWMB, pursuant to PRC 44010.

c. The design and operation of the facility is consistent with the State Minimum Standards for Solid Waste Handling and Disposal as determined by the enforcement agency, pursuant to PRC 44009.

d. The City of Davis Fire Department has determined that the facility is in conformance with applicable fire standards, pursuant to PRC, 44151.

e. A Subsequent Environmental Impact Report (EIR) was filed with the State Clearinghouse (SCH #1991073040) and certified by the County of Yolo Board of Supervisors on September 27, 2005. The Subsequent EIR (and an Addendum to it) describe and support the design and operation of the facility, which will be authorized by the issuance of this permit. A Notice of Determination was filed with the State Clearinghouse on October 4, 2005. CEQA history of the facility includes: an EIR for bringing the landfill into compliance was approved in October 1992 (SCH #91123015); a Notice of Exemption for the groundwater treatment system and airstripper was issued in November 1992; a Mitigated Negative Declaration for the source reduction and recycling element and household hazardous waste element was adopted in February 1993 (SCH #92073008); a Mitigated Negative Declaration for a self-haul transfer facility and metal recovery facility was adopted in March 1995 (SCH #94103016); a tiered Negative Declaration for construction of WMU H and renovation of WMU F was adopted in June 1999 (SCH #99062043); a Notice of Exemption for a sorting and mattress diversion program was issued in May 2000; a Negative Declaration for the WMU 6D bioreactor was adopted in June 2000 (SCH #2000022095); a Subsequent EIR for the numerous changes including height increase, bioreactor, HHW facility was approved in September 2005 (SCH #1991073040) ; and an addendum to the Subsequent EIR for a microwave communication tower and new office building was approved in April 2006 (SCH #1991073040).

14. Prohibitions:

(1) The permittee is prohibited from accepting any hazardous waste, designated waste, non-hazardous waste requiring special handling, or liquid waste sludge **unless such waste is specifically listed below**, and unless the acceptance of such waste is authorized by all applicable permits.

Acceptable Wastes:

Residential, commercial, industrial, construction, demolition and inerts, agricultural, dewatered sewage sludge, grits and screenings, treated medical waste, non-friable asbestos, tires and pesticide containers which have been triple rinsed and inspected by the Department of Agriculture. Designated liquid wastes including lime sludge and septage to be disposed of into two Class II liquid waste impoundments. Hazardous wastes accepted include used motor oil and automobile batteries. LEA approved atypical non-hazardous waste requiring special handling (i.e. Styrofoam, rice hulls, biomass ash, patient generated radioactive waste, etc.)

(2) The Household Hazardous Waste collection and storage program shall be held in accordance with requirements of the Department of Toxic Substances Control (Permit-by-Rule), the local fire jurisdiction, and in manner approved by the LEA. In addition, the frequency of events shall be as described in the facility JTD and as approved by the LEA.

(3) The facility is prohibited from accepting dead animals except as described in the JTD and approved by the LEA.

(4) The facility accepts universal waste and e-waste daily for recycling, such as: household alkaline batteries, button batteries, small sealed lead acid batteries, and rechargeable batteries; electronics (televisions, computer monitors, computers, computer accessories, keyboards, printers, scanners, music players (MP3, IPOD, etc.), copiers, cell phones, PDAs, telephones, speakers, radios, stereos, machinery and tools with electric motors, toasters, vacuum cleaners, blenders, video and still cameras, VCRs, CD players, DVDs, DVRs, coffee makers, irons, digital scales, electric toothbrushes, video game machines (PS, XBOX, etc.), other small handheld electronics, other small appliances, wall mounted thermostats).

(5) The landfill accepts latex paint daily that is bulked and shipped out.

15. The following documents describe and/or restrict the operation of this facility:

	Date		Date
Joint Technical Document	7/31/2007	Preliminary Closure and Postclosure Maintenance Plan (WMU 6,7, G and H)	July '07, in review
Subsequent Environmental Impact Report (EIR) (SCH #1991073040)	9/29/2005	Closure Financial Assurance Documentation	5/1/2008
Addendum to SEIR (SCH #1991073040)	4/18/2006	Operating Liability Certification	3/1/2008
Environmental Impact Report (SCH #91123015)	10/27/1992	Land Use and/or Conditional Use Permit	4/21/2006
Mitigated Negative Declarations, SCH #92073008 and SCH# 94103016	2/19/1993 and 3/23/1995	Contract Agreement - Operator and Contractor	3/15/2005
Tiered Negative Declaration (SCH #99062043) and Neg. Dec. (SCH #2000022095)	6/22/1999 and 6/15/2000	APCD Permits to Operate	Various (see JTD)
Notices of Exemption	11/5/1992 and 5/15/2000	NEPDES Permit # 97-03-DWQ	4/17/1997
Final Closure & Post Closure Maintenance Plan (WMU 1-5)	7/1/2004	Waste Discharge Requirements (R5-2007-0180), Waste Discharge Requirement (R5-2002-0078)	12/6/2007, 4/26/2002

SOLID WASTE FACILITY PERMIT

Facility Number:

57-AA-0001

16. Self Monitoring:

The owner/operator shall submit the results of all self monitoring programs to the Enforcement Agency within 30 days of the end of the reporting period *(for example, 1st quarter = January – March, the report is due by April 30, etc.. Information required on an annual basis shall be submitted with the 4th quarter monitoring report, unless otherwise stated.)*

Program	Reporting Frequency
a. The types and quantities (in tons) of waste, including separated or commingled recyclables, entering the facility per day.	Annually
b. The number and types of vehicles using the facility per day.	Annually
c. Results of the hazardous waste load checking program, including the quantities and types of hazardous wastes, medical wastes or otherwise prohibited wastes found in the waste stream and the disposition of these materials.	Annually
d. Copies of all written complaints regarding this facility and the operator's actions taken to resolve these complaints.	Within seven (7) calendar days
e. Results of the landfill gas monitoring program.	Quarterly
f. Wet weather preparedness report/winter operations plan.	Annual – due by November 1
g. Fill sequencing plan for the forthcoming year.	Annually
h. Remaining site capacity.	Annually
i. Groundwater Monitoring Reports	Semi-annual
j. Summary and analytical data confirming the presence of chemical constituents not previously defined.	Ten (10) working days
k. Log of special occurrences that include but are not limited to: fires, explosions, accidents, hazardous wastes, unauthorized dumping, equipment failures, and operational difficulties.	Available upon request
l. Significant special occurrences.	Within seventy-two (72) hours
m. Bioreactor-specific monitoring and testing results	Per JTD

17. Enforcement Agency (EA) Conditions:

a. The operator shall comply with all State Minimum Standards for solid waste handling and disposal as specified in Title 27, California Code of Regulations.

b. The operator shall maintain a log of special/unusual occurrences. This log shall include, but is not limited to, fires, explosions, the discharge and disposition of hazardous or unpermitted wastes, and significant injuries, accidents or property damage. Each log entry shall be accompanied by a summary of any actions taken by the operator to mitigate the occurrence. The log shall be available to site personnel and the EA at all times.

c. Additional information concerning the design and operation of the facility shall be furnished upon request and within the time frame specified by the EA.

d. The maximum permitted daily tonnage for this facility is 1,800 tons per day and the facility shall not receive more than this amount without a revision of this permit. The tonnage for the CDI facility (located within the landfill), and wood and yard waste facility (located within the landfill) are included in the facility total tonnage. The maximum permitted tonnage for the CDI facility is 500 tons per day and the maximum permitted tonnage for the wood and yard waste facility is 500 tons per day. The CDI facility will operate in two phases, Phase 1 and Phase 2. In Phase 1, the CDI facility will only be transferring CDI waste to another facility and there will not be any processing of CDI waste on site. In addition, during Phase 1, the maximum site capacity will be 28,500 cubic yards, and the CDI waste shall be shipped out within 15 days. In Phase 2, the CDI facility will operate as a Material Recovery Facility (MRF) and begin to process the CDI waste on site. Further, during Phase 2, the maximum site capacity for all material, unprocessed and processed, will be 57,000 cubic yards. In addition, during Phase 2, the unprocessed CDI waste shall not be stored for more than 15 days, and the processed CDI waste shall not be stored for more than one year. Prior to commencing Phase 2, the landfill shall prepare and submit to the LEA, for review and approval, a JTD amendment that meets the requirements of Title 14 CCR Sections 17383.6 and 18223.5.

e. This permit is subject to review by the EA and may be suspended, revoked, or revised at any time for sufficient cause.

f. The EA reserves the right to suspend or modify waste receiving and handling operations when deemed necessary due to an emergency, a potential health hazard, or the creation of a public nuisance.

g. Any change that would cause the design or operation of the facility not to conform to the terms and conditions of this permit is prohibited. Such a change may be considered a significant change, requiring a permit revision. In no case shall the operator implement any change without first submitting a written notice of the proposed change, in the form of an JTD amendment, to the EA at least 180 days in advance of the change.

h. A copy of this permit shall be maintained at the facility.

i. This facility must comply with all Federal, State, and Local requirements and enactments, including all mitigation measures given in any certified environmental documents filed pursuant to Public Resources Code, Section 21081.6.

j. No open burning of wastes will be allowed.

k. This permit prohibits public scavenging.

l. The operator shall record and retain an operating record according to the provisions of Title 14 CCR, Section 17258.29.

m. Standing water on covered fill areas will not be allowed.

n. Operation and monitoring of surface impoundment ponds shall be in conformance with the operational plan as specified in the Waste Discharge Requirements.

o. The drop off recycling area will be cleaned weekly.

p. The removal of metal recyclables at the metal recovery area shall be every 45 days or more frequent as determined by the LEA.

The facility is permitted to accept, stockpile, and use non-hazardous, non-designated contaminated soil for daily cover. The operator shall keep written screening procedures and records of acceptability reviews, including analytical test results. All conditions of Y/S AQMD, the CVRWQCB and the LEA shall be met.

r. If compost from the Anaerobic Digestion Compost Pilot Project or from future composting is used off-site, the landfill must comply with Environmental Health Standards and related Regulations specified in Title 14 CCR, Chapter 3.1.

s. Dewatered sewage sludge and grits and screenings may only be accepted Monday through Friday before 9 a.m.

t. The facility is allowed to use chipped green waste as Alternative Daily Cover (ADC) as described in the JTD. The use of chipped green waste as ADC will comply with any requirements of the LEA and CIWMB. Tarps may also be used as ADC as described in the facility JTD.

u. The final closure and post closure maintenance plans for WMU 1, 2, 3, 4 and 5 were approved by the LEA, CIWMB, and CVRWQCB in 2004. The preliminary closure and post closure maintenance plans for WMU 6 and 7 were submitted in conjunction with the JTD for this permit. The plans must be deemed approved within 180 days of the issuance of this Solid Waste Facility Permit, unless otherwise directed by the LEA.

v. This permit will reflect the following major changes: operate future WMU 6D through 7P as bioreactors; increase the final elevation of WMU 6E through 7P to 141.4 feet above MSL; landfill mining of bioreactor units including existing pilot-scale bioreactor project, WMU 6D and future WMU 6E through 7P; implement a construction, demolition and inert debris recovery facility; conduct a landfill-based anaerobic digestion (composting) project of organic waste, such as green waste, food waste and organic waste (previously addressed with April 2007 RFI Amendment); expand salvaging options to include a public reuse facility and sale of reuse material through avenues such as Ebay and Craigslist; construct a permanent household hazardous waste collection facility with operating hours to match the normal operating hours of the landfill. This permit will reflect the following minor changes: acceptance and transfer of treated wood to another permitted facility; acceptance of fluorescent bulbs at the recycling drop-off facility; acceptance of propane tanks and cylinders at the recycling drop-off facility; acceptance of fire extinguishers at the recycling drop-off facility; acceptance of printer and toner cartridges at the scalehouse; acceptance of used cooking oil at the recycling drop-off facility; extension of the soil/bentonite slurry wall and/or expansion of the groundwater extraction system; construction of a new office building; construction of an aboveground vehicle and equipment fueling facility; periodic crushing of accumulated concrete and asphalt rubble; elimination of the separate green waste facility operating permit and reabsorbing these activities under the YCCL operating permit; locating an aboveground used oil tank at the metal recovery facility; use of goats or similar livestock for vegetation control.

Both major and minor changes to the landfill's design and operation will be in conformance with the descriptions given in the facility JTD, and in a type and manner approved by the LEA.

w. Containers at the recycling drop-off area will be removed when full or more frequently as determined by the LEA.

x. This permit allows the facility to conduct chipping and grinding and composting operations, as described in the JTD. These operations must also comply with requirements of the Central Valley Regional Water Quality Control Board, the Yolo-Solano Air Quality Management District, the composting regulations specified in Title 14 CCR, Chapter 3.1, and be conducted in a type and manner approved by the LEA. Upon issuance of this permit, the registration permit for the chipping and grinding facility (SWIS # 57-AA-0033) located within the landfill will be rescinded, and the wood and yard waste operation will be reabsorbed under the full facility permit.

y. Per Title 27 CCR Section 20070(f), the RD&D components of this project, as specified in the JTD, are permitted for three years from the date of issue of this permit. Provided specific conditions outlined in Title 27 CCR Section 20070(f) are met, permitting of the RD&D components may be renewed for successive three year intervals for a total permit time period not to exceed twelve years.

z. Per Title 27 CCR Section 20070(d), the LEA or CIWMB may order an immediate termination of all RD&D related operations as described in the JTD, or other corrective measures, at any time either agency determines the overall goals of the project are not being attained, including protection of public health and safety or the environment.

aa. Any other information concerning the landfill must be provided to the LEA upon request.

bb. This Solid Waste Facility Permit supersedes any other previously dated Solid Waste Facility Permit.

APPENDIX B

YCCL Proposed SWFP

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SOLID WASTE FACILITY PERMIT

Facility Number:

57-AA-0001

1. Name and Street Address of Facility:

Yolo County Central Landfill
44090 CR 28H
Woodland, CA 95776

2. Name and Mailing Address of Operator:

Yolo County Planning and Public Works Dept.
Division of Integrated Waste Management
44090 CR 28H
Woodland, CA 95776

3. Name and Mailing Address of Owner:

Yolo County Planning and Public Works Dept.
Division of Integrated Waste Management
44090 CR 28H
Woodland, CA 95776

4. Specifications:

a. Permitted Operations:
☒ Solid Waste Disposal Site
☒ Transfer/Processing Facility (MRF)
☒ Composting Facility (MSW/green material/C&G)

b. Permitted Hours of Operation: **Hours of Operation:** 6:00am to 5:00pm, Monday to Saturday; 7:00am to 6:00pm, Sunday
Closed: New Year's Day, Easter Sunday, Independence Day, Labor Day, Thanksgiving Day, Christmas Day

c. Permitted Maximum Tonnage: 1800 Tons per Day

d. Permitted Traffic Volume: 1047 Vehicles per Day

e. Key Design Parameters (Detailed parameters are shown on site plans bearing EA and CalRecycle validations):

	Total	Disposal	Transfer/Processing	Composting
Permitted Area (in acres)	724.54	473	10	61
Design Capacity (cu.yds)		49,035,200	57,000	369,000
Max. Elevation (Ft. MSL)		141.4		
Estimated Closure Year		2124		

Upon a significant change in design or operation from that described herein, this permit is subject to revocation or suspension. The attached permit findings and conditions are integral parts of this permit and supersede the conditions of any previously issued solid waste facility permit.

5. Approval:

____

Approving Officer Signature
Leslie Lindbo, MBA, REHS, Director of Environmental Health

6. Enforcement Agency Name and Address:

Yolo County Environmental Health
292 W. Beamer Street
Woodland, CA 95695

7. Date Received by CalRecycle: August 3, 2017

8. CalRecycle Concurrence Date:

9. Permit Issued Date:

10. Permit Review Due Date:

11. Owner/Operator Transfer Date:

SOLID WASTE FACILITY PERMIT

Facility Number:

57-AA-0001

DRAFT

12. Legal Description of Facility:

The legal description of this facility is contained in Appendix F of the Joint Technical Document, dated April 2017.

13. Findings:

a. This permit is consistent with the Yolo County Integrated Waste Management Plan, which was approved by CalRecycle on May 15, 2002. The location of the facility is identified in the Countywide Siting Element, pursuant to Public Resources Code (PRC), Section 50001(a).

b. This permit is consistent with the standards adopted by CalRecycle, pursuant to PRC 44010.

c. The design and operation of the facility is consistent with the State Minimum Standards for Solid Waste Handling and Disposal as determined by the enforcement agency, pursuant to PRC 44009.

d. The City of Davis Fire Department has determined that the facility is in conformance with applicable fire standards, pursuant to PRC, 44151.

e. A Subsequent Environmental Impact Report (SEIR) was filed with the State Clearinghouse (SCH #1991073040) and certified by the County of Yolo Board of Supervisors on September 27, 2005. Addendum #3 to the SEIR was prepared by the Yolo County Planning, Public Works and Environmental Services Department in April 2017. The Subsequent EIR and Addendums describe and support the design and operation of the facility, which will be authorized by the issuance of this permit.

14. Prohibitions:

The permittee is prohibited from accepting the following wastes:

Hazardous, radioactive, medical (as defined in Chapter 6.1, Division 20 of the Health and Safety Code), liquid, designated, or other wastes requiring special treatment or handling, except as identified in the Report of Facility Information and approved amendments thereto and as approved by the enforcement agency.

15. The following documents describe and/or restrict the operation of this facility:

	Date		**Date**
Joint Technical Document (revised)	4/25/2017	Preliminary Closure and Postclosure Maintenance Plan (WMU 6-7)	November 2014
Addendum #3 to SEIR (SCH#1991073040)	April 2017	Final Closure and Post Closure Maintenance Plan (WMU 1-5)	November 2014
Subsequent Environmental Impact Report (EIR) (SCH#1991073040)	9/27/2005	Closure Financial Assurance Documentation	8/25/2016
Waste Discharge Requirements (R5-2016-0094)(R5-2002-0078)	12/14/2016 4/26/2002	Operating Liability Certification	3/1/2017
Environmental Impact Report (SCH#91123015)	10/27/1992	Land Use and/or Conditional Use Permit	4/21/2006
Mitigated Negative Declaration (SCH#92073008 and SCH#94103016)	2/19/1993 and 3/23/1995	APCD Permit to Operate #	Various (see JTD)
Tiered Negative Declaration (SCH #99062043) and Neg. Dec. (SCH #2000022095)	6/22/1999 and 6/15/2000	Notices of Exemption	11/5/1992 5/15/2000 3/29/2011

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SOLID WASTE FACILITY PERMIT	Facility Number: **57-AA-0001**

16. Self Monitoring:

The owner/operator shall submit the results of all self monitoring programs to the Enforcement Agency within 30 days of the end of the reporting period *(for example, 1st quarter = January – March, the report is due by April 30, etc.. Information required on an annual basis shall be submitted with the 4th quarter monitoring report, unless otherwise stated.)*

Program	Reporting Frequency
a. The types and quantities (in tons) of waste, including separated or commingled recyclables, entering the facility per day.	Annually
b. The number and types of vehicles using the facility per day.	Annually
c. Results of the hazardous waste load checking program, including the quantities and types of hazardous wastes, medical wastes or otherwise prohibited wastes found in the waste stream and the disposition of these materials.	Annually
d. Copies of all written complaints regarding this facility and the operator's actions taken to resolve these complaints.	Within seven (7) calendar days
e. Results of the landfill gas monitoring program.	Quarterly
f. Wet weather preparedness report/winter operations plan.	Annual – due by November 1
g. Fill sequencing plan for the forthcoming year.	Annually
h. Remaining site capacity.	Annually
i. Groundwater Monitoring Report	Semi-annual
j. Summary and analytical data confirming the presence of chemical constituents not previously defined.	Ten (10) working days
k. Log of special occurrences that include but are not limited to: fires, explosions, accidents, hazardous wastes, unauthorized dumping, equipment failures, and operation difficulties.	Available upon request
l. Significant special occurrences.	Within seventy-two (72) hours
m. Bioreactor-specific monitoring and testing results	Per JTD

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17. Enforcement Agency (EA) Conditions:

a. The operator shall comply with all State Minimum Standards for solid waste handling and disposal as specified in Titles 14 and 27, California Code of Regulations.

b. The operator shall maintain a log of special/unusual occurrences. This log shall include, but is not limited to, fires, explosions, the discharge and disposition of hazardous or unpermitted wastes, and significant injuries, accidents or property damage. Each log entry shall be accompanied by a summary of any actions taken by the operator to mitigate the occurrence. The log shall be available to site personnel and the EA at all times.

c. Additional information concerning the design and operation of the facility shall be furnished upon request and within the timeframe specified by the EA.

d. The maximum permitted daily tonnage for this facility is 1,800 tons per day. The facility shall not receive more than this amount without a revision of this permit.

e. The maximum permitted tonnage for the CDI facility is 500 tons per day and the maximum permitted tonnage for the wood and yard waste facility is 500 tons per day. The facility shall not receive more than this amount without a revision of this permit.

f. This permit is subject to review by the LEA and may be temporarily suspended or revoked at any time by the LEA for sufficient cause, in accordance with Division 30 of the Public Resource Code, Part 4, Chapter 4, Article 2, Sections 44305 et seq. and associated regulations.

g. The EA reserves the right to suspend or modify waste receiving and handling operations when deemed necessary due to an emergency, a potential health hazard, or the creation of a public nuisance.

h. Any change that would cause the design or operation of the facility not to conform to the terms and conditions of this permit is prohibited. Such a change may be considered a significant change, requiring a permit revision. In no case shall the operator implement any change without first submitting a written notice of the proposed change, in the form of a JTD amendment, to the EA at least 180 days in advance of the change.

i. A copy of this permit shall be maintained at the facility.

j. The drop off recycling area will be cleaned weekly.

k. The removal of metal recyclables at the metal recovery area shall be every 45 days or more frequent as determined by the LEA.

l. Dewatered sewage sludge and grits and screenings may only be accepted Monday through Friday before 9 a.m.

m. Containers at the recycling drop-off area will be removed when full or more frequently as determined by the LEA.

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APPENDIX C

YCCL Waste Flow Diagram

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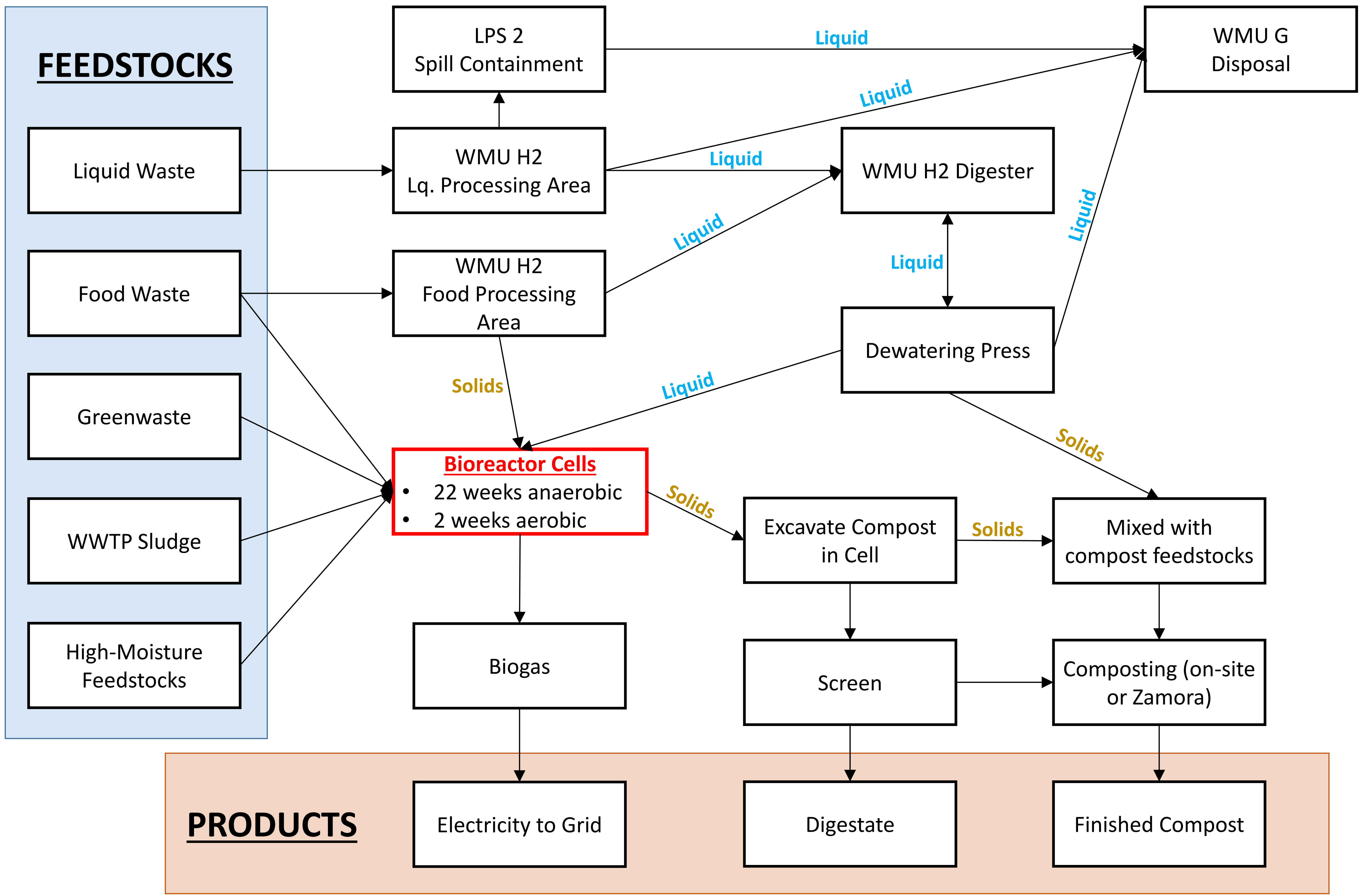

FEEDSTOCKS
Liquid Waste
Food Waste
Greenwaste
WWTP Sludge
High-Moisture Feedstocks
LPS 2 Spill Containment
WMU H2 Lq. Processing Area
WMU H2 Food Processing Area
WMU G Disposal
WMU H2 Digester
Dewatering Press
Liquid
Liquid
Liquid
Liquid
Liquid
Liquid
Liquid
Solids
Bioreactor Cells
• 22 weeks anaerobic
• 2 weeks aerobic
Solids
Solids
Solids
Excavate Compost in Cell
Mixed with compost feedstocks
Biogas
Screen
Composting (on-site or Zamora)
PRODUCTS
Electricity to Grid
Digestate
Finished Compost

APPENDIX D

Financial Pro Formas

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Basic Assumptions

	SITE WWTP				SITE UC DAVIS	
	Option A Composting Covered Static Pile	Option B Composting CASP	Option C AD & Composting AD-D & Covered Static Pile	Option D AD & Composting AD-C & CASP	Option E Composting Covered Static Pile	Option F Composting CASP
Incoming Tons						
TPD	96.5	96.5	96.5	96.5	96.5	96.5
TPY	25,476.0	25,476.0	25,476.0	25,476.0	25,476.0	25,476.0
Commodity Sales						
Compost TPY	16,984.1	16,984.1	12,276.1	12,276.1	16,984.1	16,984.1
Electricity kWh			2,751,512			
CNG Diesel gallon Equivalent				360,591		
Personnel	4.5	3.5	7.0	7.0	4.5	3.5
Equipment						
Trommel	1.0	1.0	1.0	1.0	1.0	1.0
Tub Grinder	1.0	1.0	1.0	1.0	1.0	1.0
Storage Tank	1.0		1.0		1.0	
CASP		1.0				1.0
Loader	1.0	1.0	1.0	1.0	1.0	1.0
Cover Winder		1.0		1.0		
AD-D			1.0			
Gas Cleanup			1.0	1.0		
Pipeline Connection			1.0	1.0		
AD-C				1.0		
Water Truck	1.0		1.0		1.0	
Facility						
Site Prep & Storm Water	1.0	1.0	1.0	1.0	1.0	1.0
Building				1.0		
Scale	1.0	1.0	1.0	1.0	1.0	1.0

Financial Proforma

	SITE - WWTP								SITE - UC DAVIS			
	Option A Composting Covered Static Pile		Option B Composting CASP		Option C AD & Composting AD-D & Covered Static Pile		Option D AD & Composting AD-C & CASP		Option E Composting Covered Static Pile		Option F Composting CASP	
	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual	$ Per Incoming ton	Annual
Operations Costs												
Labor	$17.05	$434,417	$13.78	$351,184	$26.86	$684,321	$27.46	$699,622	$17.05	$434,417	$13.78	$351,184
Equip Maint & Ops	$5.58	$142,032	$5.51	$140,376	$10.48	$267,032	$14.34	$365,376	$5.58	$142,032	$5.51	$140,376
Sub-Total	**$22.63**	**$576,449**	**$19.29**	**$491,560**	**$37.34**	**$951,353**	**$41.80**	**$1,064,998**	**$22.63**	**$576,449**	**$19.29**	**$491,560**
Disposal Costs [1]												
Disposal - Residual Solid Waste	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-
Recovered/Diverted w/Negative Value	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-	$0.00	-
Sub-Total	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**	**$0.00**	**$0**
General & Administrative Costs [2]												
Personnel [3]												
Facility G&A	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400	$1.98	$50,400
Sub-Total	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**	**$1.98**	**$50,400**
Debt Service & Equipment Replacement												
Debt Service [4]	$4.97	126,531	$20.48	521,740	$33.04	841,836	$65.40	1,666,073	$4.97	126,531	$20.48	521,740
Equipment Replacement	$3.45	$87,857	$15.78	$402,071	$25.51	$649,857	$48.02	$1,223,371	$3.45	$87,857	$15.78	$402,071
Sub-Total	**$8.42**	**$214,388**	**$36.26**	**$923,812**	**$58.55**	**$1,491,694**	**$113.42**	**$2,889,444**	**$8.42**	**$214,388**	**$36.26**	**$923,812**
Total Costs	**$33.02**	**$841,237**	**$57.54**	**$1,465,772**	**$97.87**	**$2,493,447**	**$157.20**	**$4,004,842**	**$33.02**	**$841,237**	**$57.54**	**$1,465,772**
Revenue from Commodity Sales	$13.33	$339,682	$13.33	$339,682	$27.57	$702,272	$37.95	$966,702	$13.33	$339,682	$13.33	$339,682
Net Cost	**$19.69**	**$501,555**	**$44.20**	**$1,126,090**	**$70.31**	**$1,791,175**	**$119.25**	**$3,038,140**	**$19.69**	**$501,555**	**$44.20**	**$1,126,090**
Incoming Tons	*25,476*		*25,476*		*25,476*		*25,476*		*25,476*		*25,476*	

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Notes

1. Assumes no disposal costs.
2. General and administrative costs are expenses required to administer a business, and which are not related to the construction, production or sale of goods or services.
3. No General & Administrative staff is included in this Pro-Forma.
4. This represents principal and interest.

Incoming Tonnage & Products Generated

				Option A Composting	Option B Composting	Option C AD & Composting			Option D AD & Composting			Option E Composting	Option F Composting
				Covered Static Pile	CASP	AD-D & Covered Static Pile			AD-C & CASP			Covered Static Pile	CASP
City of Davis	**TPD**	**TPY**	**%**	**Compost**	**Compost**	**Compost**	**Electricity**	**Total**	**Compost**	**CNG**	**Total**	**Compost**	**Compost**
Mixed GW & FW	26.00	6,864.0	54.2%										
GW Loose	18.0	4,752.0	37.5%										
Other Organics	4.0	1,056.0	8.3%										
Total	**48.0**	**12,672.0**	**100.0%**										
UC Davis													
Postconsumer FW	0.50	132.0	1.0%										
Digestate	2.0	528.0	4.1%										
Animal Bedding	41.0	10,824.0	84.5%										
GW	5.0	1,320.0	10.3%										
Total	**48.5**	**12,804.0**	**100.0%**										
GRAND TOTAL	**96.5**	**25,476.0**											
Compost Product Tons				16,984	16,984	12,276			12,276			16,984	16,984
Biogas to Electricity Product (kWh)							2,751,512						
Biogas to Fuel Product (Diesel Gallon Equivalent)										360,591			
Revenue per Unit				$20.00	$20.00	$20.00	$0.166		$20.00	$2.00		$20.00	$20.00
Commodity Sales Revenue				**$339,682**	**$339,682**	$245,521	$456,751	**$702,272**	$245,521	$721,181	**$966,702**	**$339,682**	**$339,682**

	Option A	Option B	Option C	Option D	Option E	Option F
Incoming Tons	**25,476.0**	**25,476.0**	**25,476.0**	**25,476.0**	**25,476.0**	**25,476.0**
% Tons to Composting Operation	100.0%	100.0%			100.0%	100.0%
Tons to Composting Operation	**25,476.0**	**25,476.0**	**11,352.0**	**11,352.0**	**25,476.0**	**25,476.0**
% Compost Production	66.667%	66.667%	66.7%	66.7%	66.667%	66.667%
Compost Product	16,984.1	16,984.1	7,568.0	7,568.0	16,984.1	16,984.1
Tons to Digester			14,124.0	14,124.0		
Tons to Composting Operation			7,062.0	7,062.0		
% Compost Production			66.7%	66.7%		
Compost Product			4,708.0	4,708.0		
Total Compost ProductTons	**16,984.1**	**16,984.1**	**12,276.1**	**12,276.1**	**16,984.1**	**16,984.1**

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Direct Labor

					Annual Hours					Annual Labor Hours				Annual Labor Compensation														
	Regular Hours	OT Hours	Total Weekly Hours	# of Shifts	Total Regular Hours	Total OT Hours	TOTAL HOURS	Crew Size	Total Crew	Total Regular Hours	Total OT Hours	TOTAL HOURS	Regular Rate	OT Rate	Regular Wages	OT Wages	Holiday Wages	Vacation Wages	Sick Leave Wages	Pension	Medical	Total Compensation	WC Factor	WC Rate	WC Expense	Uniform	Payroll Tax	Wages Expense
OPTION A WWTP - COMPOSTING Covered Static Pile																												
Supervisor/GM	20.0	-	20.0	1.00	1,040.0	-	1,040.0	1.00	1.00	880.0	-	880.0	40.00	60.00	35,200	-	2,880	4,800	1,600	2,640	14,400	61,520	445	10.00	4,448	-	5,229	71,197
Equipment Operators	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,840.0	-	3,840.0	30.00	45.00	115,200	-	4,320	7,200	2,400	11,520	28,800	169,440	1,291	10.00	12,912	-	14,402	196,754
Laborer	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,936.0	-	3,936.0	24.00	36.00	94,464	-	3,456	3,840	1,536	11,808	28,800	143,904	1,033	10.00	10,330	-	12,232	166,465
Unused			-		-	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-	-
					5,200.0	-	5,200.0	5.00	5.00	8,656.0	-	8,656.0			244,864	-	10,656	15,840	5,536	25,968	72,000	374,864			27,690	-	31,863	434,417
OPTION B WWTP - COMPOSTING CASP																												
Supervisor/GM	20.0	-	20.0	1.00	1,040.0	-	1,040.0	1.00	1.00	880.0	-	880.0	40.00	60.00	35,200	-	2,880	4,800	1,600	2,640	14,400	61,520	445	10.00	4,448	-	5,229	71,197
Equipment Operators	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,840.0	-	3,840.0	30.00	45.00	115,200	-	4,320	7,200	2,400	11,520	28,800	169,440	1,291	10.00	12,912	-	14,402	196,754
Laborer	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,968.0	-	1,968.0	24.00	36.00	47,232	-	1,728	1,920	768	5,904	14,400	71,952	516	10.00	5,165	-	6,116	83,233
Unused			-		-	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-	-
					5,200.0	-	5,200.0	4.00	4.00	6,688.0	-	6,688.0			197,632	-	8,928	13,920	4,768	20,064	57,600	302,912			22,525	-	25,748	351,184
OPTION C WWTP - AD & COMPOSTING																												
Supervisor	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,920.0	-	1,920.0	40.00	60.00	76,800	-	2,880	4,800	1,600	5,760	14,400	106,240	861	10.00	8,608	-	9,030	123,878
AD Operator Maintenance	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,920.0	-	1,920.0	30.00	45.00	57,600	-	2,160	3,600	1,200	5,760	14,400	84,720	646	10.00	6,456	-	7,201	98,377
AD Loader	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,968.0	-	1,968.0	30.00	45.00	59,040	-	2,160	2,400	960	5,904	14,400	84,864	646	10.00	6,456	-	7,213	98,533
Equipment Operators	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,936.0	-	3,936.0	30.00	45.00	118,080	-	4,320	4,800	1,920	11,808	28,800	169,728	1,291	10.00	12,912	-	14,427	197,067
Laborer	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,936.0	-	3,936.0	24.00	36.00	94,464	-	3,456	3,840	1,536	11,808	28,800	143,904	1,033	10.00	10,330	-	12,232	166,465
Unused			-		-	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-	-
					10,400.0	-	10,400.0	7.00	7.00	13,680.0	-	13,680.0			405,984	-	14,976	19,440	7,216	41,040	100,800	589,456			44,762	-	50,104	684,321
OPTIONE D WWTP - AD & COMPOSTING																												
Supervisor	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,920.0	-	1,920.0	40.00	60.00	76,800	-	2,880	4,800	1,600	5,760	14,400	106,240	861	10.00	8,608	-	9,030	123,878
AD Electrician	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,920.0	-	1,920.0	30.00	45.00	57,600	-	2,160	3,600	1,200	5,760	14,400	84,720	646	10.00	6,456	-	7,201	98,377
Mechanic	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,968.0	-	1,968.0	30.00	45.00	59,040	-	2,160	2,400	960	5,904	14,400	84,864	646	10.00	6,456	-	7,213	98,533
Plumber	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,968.0	-	1,968.0	30.00	45.00	59,040	-	2,160	2,400	960	5,904	14,400	84,864	646	10.00	6,456	-	7,213	98,533
Equipment Operators	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,936.0	-	3,936.0	30.00	45.00	118,080	-	4,320	4,800	1,920	11,808	28,800	169,728	1,291	10.00	12,912	-	14,427	197,067
Laborer	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,968.0	-	1,968.0	24.00	36.00	47,232	-	1,728	1,920	768	5,904	14,400	71,952	516	10.00	5,165	-	6,116	83,233
Unused			-		-	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-	-
					12,480.0	-	12,480.0	7.00	7.00	13,680.0	-	13,680.0			417,792	-	15,408	19,920	7,408	41,040	100,800	602,368			46,053	-	51,201	699,622
OPTION E UC DAVIS - COMPOSTING Covered Static Pile																												
Supervisor/GM	20.0	-	20.0	1.00	1,040.0	-	1,040.0	1.00	1.00	880.0	-	880.0	40.00	60.00	35,200	-	2,880	4,800	1,600	2,640	14,400	61,520	445	10.00	4,448	-	5,229	71,197
Equipment Operators	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,840.0	-	3,840.0	30.00	45.00	115,200	-	4,320	7,200	2,400	11,520	28,800	169,440	1,291	10.00	12,912	-	14,402	196,754
Laborer	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,936.0	-	3,936.0	24.00	36.00	94,464	-	3,456	3,840	1,536	11,808	28,800	143,904	1,033	10.00	10,330	-	12,232	166,465
Unused			-		-	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-	-
					5,200.0	-	5,200.0	5.00	5.00	8,656.0	-	8,656.0			244,864	-	10,656	15,840	5,536	25,968	72,000	374,864			27,690	-	31,863	434,417
OPTION F UC DAVIS - COMPOSTING CASP																												
Supervisor/GM	20.0	-	20.0	1.00	1,040.0	-	1,040.0	1.00	1.00	880.0	-	880.0	40.00	60.00	35,200	-	2,880	4,800	1,600	2,640	14,400	61,520	445	10.00	4,448	-	5,229	71,197
Equipment Operators	40.0	-	40.0	1.00	2,080.0	-	2,080.0	2.00	2.00	3,840.0	-	3,840.0	30.00	45.00	115,200	-	4,320	7,200	2,400	11,520	28,800	169,440	1,291	10.00	12,912	-	14,402	196,754
Laborer	40.0	-	40.0	1.00	2,080.0	-	2,080.0	1.00	1.00	1,968.0	-	1,968.0	24.00	36.00	47,232	-	1,728	1,920	768	5,904	14,400	71,952	516	10.00	5,165	-	6,116	83,233
Unused			-		-	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-		-	-	-	-
					5,200.0	-	5,200.0	4.00	4.00	6,688.0	-	6,688.0			197,632	-	8,928	13,920	4,768	20,064	57,600	302,912			22,525	-	25,748	351,184

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Annual General Admin Expenses

Cost Category	Option A Composting Covered Static Pile	Option B Composting CASP	Option C AD & Composting AD-D & Covered Static Pile	Option D AD & Composting AD-C & CASP	Option E Composting Covered Static Pile	Option F Composting CASP
Utilities	2,400	2,400	2,400	2,400	2,400	2,400
Telephone	6,000	6,000	6,000	6,000	6,000	6,000
Information Technology	18,000	18,000	18,000	18,000	18,000	18,000
Office Supplies	6,000	6,000	6,000	6,000	6,000	6,000
Facility/Landscaping	-	-	-	-	-	-
Janitorial	6,000	6,000	6,000	6,000	6,000	6,000
Operating Supplies	6,000	6,000	6,000	6,000	6,000	6,000
Personal Protection Equipment	6,000	6,000	6,000	6,000	6,000	6,000
TOTAL	50,400	50,400	50,400	50,400	50,400	50,400

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Equipment Operating Expenditures

						WWTP				UC DAVIS	
						OPTION A Composting	OPTION B Composting	Option C AD & Composting	Option D AD & Composting	Option E Composting	Option F Composting
Equipment	Hours per Day	Hours per Month[1]	$/Hour[2]	Monthly Expense	Annual Expense	Covered Static Pile	CASP	AD-D & Covered Static Pile	AD-C & CASP	Covered Static Pile	CASP
Trommel	4.0	88.0	26.00	$ 2,288	$ 27,456	$ 27,456	$ 27,456	$ 27,456	$ 27,456	$ 27,456	$ 27,456
Tub Grinder	2.0	44.0	40.00	$ 1,760	$ 21,120	$ 21,120	$ 21,120	$ 21,120	$ 21,120	$ 21,120	$ 21,120
Loader	5.0	110.0	50.00	$ 5,500	$ 66,000	$ 66,000	$ 66,000	$ 66,000	$ 66,000	$ 66,000	$ 66,000
Water Truck	4.0	88.0	26.00	$ 2,288	$ 27,456	$ 27,456		$ 27,456		$ 27,456	
CASP							$ 25,800		$ 25,800		$ 25,800
AD-D								$ 75,000			
AD-C									$ 75,000		
Gas Cleanup								$ 50,000	$ 150,000		
Total OPEX						**$ 142,032**	**$ 140,376**	**$ 267,032**	**$ 365,376**	**$ 142,032**	**$ 140,376**

Notes
1. Assumes 264 days per year.
2. Includes fuel and maintenance if applicable.

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Debt Service

		WWTP OPTION A COMPOSTING COVERED STATIC PILE	WWTP OPTION B COMPOSTING CASP	WWTP Option C AD & Composting AD-D & Covered Static Pile	WWTP Option D AD & Composting AD-C & CASP
1	**Building / Facility**				
	Loan Amount ($)	$ 232,000	$ 211,000	$ 232,000	$ 1,461,000
	Interest Rate (%)	5.00%	5.00%	5.00%	5.00%
	Term (Years)	20	20	20	20
	No. Payments	240	240	240	240
	Monthly Payment	$ 1,531	$ 1,393	$ 1,531	$ 9,642
	Interest Expense ($/year)	$ 11,443	$ 10,407	$ 11,443	$ 72,059
	Principal Payment ($/year)	$ 6,931	$ 6,303	$ 6,931	$ 43,645
	Total Payments ($/year)	$ 18,373	$ 16,710	$ 18,373	$ 115,703
	Replacement fund	$ -	$ -	$ -	$ -
2	**Processing Equipment**				
	Loan Amount ($)	$ 450,000	$ 3,235,000	$ 6,070,000	$ 11,448,000
	Interest Rate (%)	5.00%	5.00%	5.00%	5.00%
	Term (Years)	10	10	10	10
	No. Payments	120	120	120	120
	Monthly Payment	$ 4,773	$ 34,312	$ 64,382	$ 121,424
	Interest Expense ($/year)	$ 21,692	$ 155,941	$ 292,600	$ 551,842
	Principal Payment ($/year)	$ 35,583	$ 255,806	$ 479,982	$ 905,244
	Total Payments ($/year)	$ 57,275	$ 411,746	$ 772,581	$ 1,457,086
	Replacement fund	$ 45,000	$ 323,500	$ 607,000	$ 1,144,800

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Debt Service

		WWTP OPTION A COMPOSTING COVERED STATIC PILE	WWTP OPTION B COMPOSTING CASP	WWTP Option C AD & Composting AD-D & Covered Static Pile	WWTP Option D AD & Composting AD-C & CASP
3	**Rolling Stock**				
	Loan Amount ($)	$ 250,000	$ 200,000	$ 250,000	$ 200,000
	Interest Rate (%)	5.00%	5.00%	5.00%	5.00%
	Term (Years)	7	7	7	7
	No. Payments	84	84	84	84
	Monthly Payment	$ 3,533	$ 2,827	$ 3,533	$ 2,827
	Interest Expense ($/year)	$ 11,805	$ 9,444	$ 11,805	$ 9,444
	Principal Payment ($/year)	$ 30,597	$ 24,477	$ 30,597	$ 24,477
	Total Payments ($/year)	$ 42,402	$ 33,921	$ 42,402	$ 33,921
	Replacement fund	$ 35,714	$ 28,571	$ 35,714	$ 28,571
4	**Other Equipment**				
	Loan Amount ($)	$ 50,000	$ 350,000	$ 50,000	$ 350,000
	Interest Rate (%)	5.00%	5.00%	5.00%	5.00%
	Term (Years)	7	7	7	7
	No. Payments	84	84	84	84
	Monthly Payment	$ 707	$ 4,947	$ 707	$ 4,947
	Interest Expense ($/year)	$ 2,361	$ 16,527	$ 2,361	$ 16,527
	Principal Payment ($/year)	$ 6,119	$ 42,835	$ 6,119	$ 42,835
	Total Payments ($/year)	$ 8,480	$ 59,362	$ 8,480	$ 59,362
	Replacement fund	$ 7,143	$ 50,000	$ 7,143	$ 50,000
5	**TOTAL**				
	Loan Amount ($)	$ 982,000	$ 3,996,000	$ 6,602,000	$ 13,459,000
	Monthly Payment	$ 10,544	$ 43,478	$ 70,153	$ 138,839
	Interest Expense ($/year)	$ 47,301	$ 192,319	$ 318,208	$ 649,872
	Principal Payment ($/year)	$ 79,230	$ 329,421	$ 523,628	$ 1,016,201
	Total Payments ($/year)	$ 126,531	$ 521,740	$ 841,836	$ 1,666,073
	Replacement fund	$ 87,857	$ 402,071	$ 649,857	$ 1,223,371

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Capital Expenditures

WWTP											
OPTION A - COMPOSTING COVERED STATIC PILE				OPTION B - COMPOSTING CASP				Option C - AD & Composting AD-D & Covered Static Pile			
Building / Facility	**Qty**	**Price**	**Total**	**Building / Facility**	**Qty**	**Price**	**Total**	**Building / Facility**	**Qty**	**Price**	**Total**
Site Preparation	1.0	200,000	200,000	Site Preparation	1.0	200,000	200,000	Site Preparation	1.0	200,000	200,000
Storm Water	15.0	2,133	32,000	Storm Water	5.0	2,200	11,000	Storm Water	15.0	2,133	32,000
Unused			-	Unused			-	Unused			-
Subtotal			**232,000**	**Subtotal**			**211,000**	**Subtotal**			**232,000**
Processing Equip				**Processing Equip**				**Processing Equip**			
Trommel	1.0	200,000	200,000	Trommel	1.0	200,000	200,000	Trommel	1.0	200,000	200,000
Tub Grinder	1.0	250,000	250,000	Tub Grinder	1.0	250,000	250,000	Tub Grinder	1.0	250,000	250,000
Unused			-	CASP System	1.0	1,185,000	1,185,000	AD-D	1.0	2,000,000	2,000,000
Unused			-	CASP Construction	1.0	1,600,000	1,600,000	Construction	1.0	3,270,000	3,270,000
Unused			-	Unused			-	Gas Clean up (CoGen)	1.0	250,000	250,000
Unused			-				-	Pipeline and Connect to WWTP	1.0	100,000	100,000
Unused			-				-				
Unused			-				-				
Total Equip			**450,000**	**Total Equip**			**3,235,000**	**Total Equip**			**6,070,000**
Rolling Stock				**Rolling Stock**				**Rolling Stock**			
Loader	1.0	200,000	200,000	Loader	1.0	200,000	200,000	Loader	1.0	200,000	200,000
Water Truck	1.0	50,000	50,000	Unused			-	Water Truck	1.0	50,000	50,000
Unused			-	Unused			-	Unused			-
Unused			-	Unused			-	Unused			-
Total Rolling Stock			**250,000**	**Total Rolling Stock**			**200,000**	**Total Rolling Stock**			**250,000**
Other Equipment				**Other Equipment**				**Other Equipment**			
Scale	1.0	50,000	50,000	Scale	1.0	50,000	50,000	Scale	1.0	50,000	50,000
Unused			-	Cover Winder Machine	1.0	300,000	300,000	Unused			-
Total Other equip			**50,000**	**Total Other equip**			**350,000**	**Total Other equip**			**50,000**
TOTAL			**982,000**	**TOTAL**			**3,996,000**	**TOTAL**			**6,602,000**

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Capital Expenditures

WWTP				UC DAVIS							
Option D - AD & Composting AD-C & CASP				**OPTION E - COMPOSTING COVERED STATIC PILE**				**OPTION F - COMPOSTING CASP**			
Building / Facility	**Qty**	**Price**	**Total**	**Building / Facility**	**Qty**	**Price**	**Total**	**Building / Facility**	**Qty**	**Price**	**Total**
Site Preparation	1.0	200,000	200,000	Site Preparation	1.0	200,000.00	200,000	Site Preparation	1.0	200,000.00	200,000
Storm Water	5.0	2,200	11,000	Storm Water	15.0	2,133	32,000	Storm Water	5.0	2,200	11,000
Receiving Building	1.0	1,250,000	1,250,000	Unused			-	Unused			-
Subtotal			**1,461,000**	**Subtotal**			**232,000**	**Subtotal**			**211,000**
Processing Equip				**Processing Equip**				**Processing Equip**			
Trommel	1.0	200,000	200,000	Trommel	1.0	200,000	200,000	Trommel	1.0	200,000	200,000
Tub Grinder	1.0	250,000	250,000	Tub Grinder	1.0	250,000	250,000	Tub Grinder	1.0	250,000	250,000
CASP System	1.0	1,185,000	1,185,000	Unused			-	CASP System	1.0	1,185,000	1,185,000
CASP Construction	1.0	1,600,000	1,600,000	Unused				CASP Construction	1.0	1,600,000	1,600,000
Gas Clean up (CNG)	1.0	3,113,000	3,113,000	Unused			-	Unused			-
Pipeline and Connect to WWTP	1.0	100,000	100,000	Unused			-	Unused			-
AD-C	1.0	2,500,000	2,500,000	Unused			-	Unused			-
Construction	1.0	2,500,000	2,500,000	Unused			-	Unused			-
Total Equip			**11,448,000**	**Total Equip**			**450,000**	**Total Equip**			**3,235,000**
Rolling Stock				**Rolling Stock**				**Rolling Stock**			
Loader	1.0	200,000	200,000	Loader	1.0	200,000	200,000	Loader	1.0	200,000	200,000
Unused			-	Water Truck	1.0	50,000	50,000	Unused			-
Unused			-	Unused			-	Unused			-
Unused			-	Unused			-	Unused			-
Total Rolling Stock			**200,000**	**Total Rolling Stock**			**250,000**	**Total Rolling Stock**			**200,000**
Other Equipment				**Other Equipment**				**Other Equipment**			
Scale	1.0	50,000	50,000	Scale	1.0	50,000	50,000	Scale	1.0	50,000	50,000
Cover Winder Machine	1.0	300,000	300,000	Unused			-	Cover Winder Machine	1.0	300,000	300,000
Total Other equip			**350,000**	**Total Other equip**			**50,000**	**Total Other equip**			**350,000**
TOTAL			**13,459,000**	**TOTAL**			**982,000**	**TOTAL**			**3,996,000**

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