Attachment A
Palo Alto Organics Facilities Plan – April 2014

The Organics Facilities Plan (OFP), has resulted from Palo Alto's review of proposals submitted in response to the "Energy/Compost Facility or Export Option for Food Scraps, Yard Trimmings, and Biosolids" Request For Proposals (E/CF RFP) and the draft Biosolids Facilities Plan (BFP). The OFP provides the City of Palo Alto (City) and the Regional Water Quality Control Plant (RWQCP) partners the best option for short-term resilience and long-term cost savings, energy production and a reduction in greenhouse gas emissions (GHG[1]) of greater than 8,000 metric tons CO_2e.

The OFP consists of four Components:

Component One:	Biosolids Dewatering and Truck Haul-Out Facility
Component Two:	Wet Anaerobic Digestion (AD) Facility Utilizing the Thermal Hydrolysis Process (THP)
Component Three:	Food Preprocessing Facility
Component Four:	The Pursuit of Technologies to Harness the Energy and Resource Potential of Yard Trimmings

Components One and Two, recommendations from the Biosolids Facilities Plan (BFP) prepared by CH2M Hill, address Biosolids from the RWQCP and will be paid for by the Wastewater Fund. Components Three and Four will be funded by the City Refuse Fund. Components One, Two, and Three are interconnected and will be planned concurrently. Work can begin concurrently on all four components, but the components will not be completed by the same date.

Component One is a Biosolids Dewatering and Truck Haul-Out Facility. This will allow the RWQCP to both operate during emergencies and to decommission the sewage sludge incinerators as soon as practical, per Council direction. The incinerators are the City's largest point source of City-generated GHG.

The development of the Component One Biosolids Dewatering and Truck Haul-

[1] Reported as annual metric tons (MT) of anthropogenic CO_2-equivalent greenhouse gas emissions throughout report

Out Facility can begin immediately and can be completed by 2018 at an estimated cost of $12 million. Once this dewatering and haul-out facility is constructed, the City will export its dewatered sludge for further treatment, retire the incinerators, and provide an approximate annual reduction of 2,343 tons of GHG.

Component Two develops a THP[2] AD facility at the RWQCP to process sewage sludge into biosolids for ultimate disposal. Component Two uses Component One for final dewatering and truck load-out. The THP AD process beneficially creates biogas (e.g., methane), which combusts into renewable energy.

The THP AD facility can also receive food scraps under the OFP's Component Three. Under Component Three, staff will evaluate potential preprocessing technology options and locations.

Predesign and financial analysis of the Component Two THP AD Facility and the Component Three Food Preprocessing Facility requires staff to define the price for the facility's renewable energy output and its optimal size (i.e., quantifying capacity for food scraps). Component Two is estimated to cost $57 million.

Component Four, yard trimmings research and development, involves research into emerging technologies to capture the energy and resource potential embedded within yard trimmings. The deployment of such a technology could be on the 3.8-acre flat portion of the 10-acre Measure E site on the closed Palo Alto Landfill or another location. Until such a facility is developed, the current aerobic composting conducted near Gilroy, CA, provides the best value for the City with relatively moderate GHG. The development of Component Four is independent of the development of Components One, Two, and Three, and will be planned separately.

[2] THP is a high-pressure steam pretreatment for downstream AD systems; the thermal hydrolysis step disintegrates cell structures and dissolves naturally occurring cell polymers into an easily digestible feed for AD; the pretreatment step also makes the sludge more flowable, allowing a smaller footprint for the digesters, which is a real advantage for the constrained 25-acre RWQCP site; THP increases organic biodegradability, yielding more biogas and energy and offsetting more GHG than other AD systems; THP yields a final dewatered solids up to 40%, much higher than traditional AD systems at 28% solids, resulting in less hauling and land application costs; the final THP dewatered biosolids are sterilized and pathogen free due to 165C treatment for 20 minutes

More detail on the four Components follows:

1. Component One: The Development of Wastewater Solids Dewatering and Truck Haul-Out Facility

   CH2M HILL has completed a final draft of the Biosolids Facilities Plan. Component One is a is a key priority. The Wastewater Solids Dewatering and Truck Haul-Out facility will provide the necessary resilience to allow the RWQCP to transport solids in the case of a disaster, emergency, or failure of the current solids handling system. The facility can be designed and built ahead of Component Two.

   Component ONe allows the RWQCP decommission and demolish the sewage sludge incinerators. This component reduces 2,343 annual tons of GHG. The demolition of the incinerators opens up another half-acre for efficient design and construction of the Component Two.

   Component One is both essential for the RWQCP's reliable operations and a necessary first step towards the development of an AD facility. It is anticipated to cost $12 million (2015$) and be completed by 2018. Annual operational costs are estimated between $1.6 and $2.0 million. Design and construction details and cost will vary depending on the final disposition of the dewatered solids. Two currently viable and environmentally preferable destinations for the dewatered solids are: (1) aerobic composting at the Synagro Central Valley Compost Facility in Merced County, the same facility in the Synagro E/CF RFP proposal, and (2) anaerobic digestion and energy recovery at the East Bay Municipal Utility District (EBMUD) wastewater treatment plant in Oakland, CA.

2. Component Two: The Development of THP AD

   Component Two is the development of THP AD. Anaerobic digestion is a proven wastewater technology for stabilizing wastewater solids (also referred to as sludge) and biogas generation. Wastewater treatment plants worldwide use wet AD systems to treat sludge. Wet AD is an appropriate technology for high water and low solids content sludge. Wet AD is compatible with the

addition of the higher solid food scraps[3]. At least two wastewater treatment plants in the Bay Area (EBMUD in Oakland and Central Marin Sanitation Agency in San Rafael) are using wet AD to process and "co-digest" combined wastewater solids and food scraps.

The BFP evaluated three wet AD technologies and preprocessing options. The option that provides the greatest biogas yield, smallest physical footprint, and the highest quality biosolids, was the combination of the THP with wet AD. According to the BFP recommendations, THP AD technology provides clear non-monetary benefits for treatment and disposal of sewage sludge and favorable overall project economics. THP AD is a proprietary technology currently sold by CAMBI, Norway; CAMBI is the technology provider to the We Generation E/CF RFP proposal. The CAMBI THP technology has been installed and operated at 40 wastewater treatment plants throughout Europe, South America, Japan, and Australia. New CAMBI THP systems will begin operation in July 2014 at the District of Columbia Wastewater Treatment Plant, the first CAMBI in North America and largest in the world. A CAMBI system is in design for the Hampton Roads Sanitation District Wastewater Treatment Plant in Virginia Beach, VA. The San Francisco Public Utilities Commission (SFPUC) Southeast Wastewater Treatment Plant is evaluating use of a CAMBI THP system as part of its new digester project. The SFPUC project could also incorporate food scraps into the CAMBI THP AD system.

Prior to moving forward with Component Two, design development (predesign) is needed to answer vital questions related to project sizing and site considerations.

A THP AD Facility would supply electric energy through biogas combustion generated by the AD units. The energy is 100 percent renewable electric energy and provides 4,560 tons of GHG reduction.

[3] Much of the debate in the Measure E campaign revolved around the potential to use *dry* AD. The Feasibility Study in 2011 also looked at dry AD for much of the analysis. Since wastewater solids made up the majority of the material to be processed, dry AD was deemed infeasible. One E/CF RFP proposal included dry AD technology, but did not meet minimum qualifications and was not considered. Dry AD was also not likely to be an appropriate technology for the food scraps and yard trimmings only due to the ratio of the material. The dry AD facility recently constructed in San Jose has a yard trimming to food scrap ratio of 20:80, while the Palo Alto ratio of materials is closer to 50:50. This ratio would provide a low biogas yield, resulting in poor project economics.

2a Project Sizing

The THP AD system will be designed to accommodate the projected 30-year increase in wastewater solids loads based on population growth projections from the Association of Bay Area Governments (ABAG). While THP AD systems allow for some modularity for future expansion (e.g., adding a tank), the system will be designed to accommodate future capacity. The THP AD system will have that initial extra capacity available for the addition of food scraps as part of Component Three.

There are many questions that remain on sizing the food scrap systems. A food receiving station, energy generation equipment, and dewatering equipment may require upsizing to accommodate food scraps. Food scraps can be processed to maximize THP, digester, and dewatering use of surplus capacity until the initial excess capacity is needed for wastewater solids. This initial excess capacity might allow a THP AD system at the RWQCP to process most, and possibly all of Palo Alto's commercial food scraps for a period of time which would be determined during the predesign phase.

2b Site Considerations

The THP AD facility will impact existing RWQCP operations. The RWQCP has numerous underground utilities including large diameter pipes. The half-acre location set aside in the E/CF RFP for on-site digestion can be used, but cannot be optimized for Component Two until the incinerator is decommissioned and demolished. The removal of the incinerator prior to construction of the THP AD system will allow for the optimal design and minimal disturbance to existing operations.

Careful consideration will need to be given to truck ingress and egress. Food waste trucks would arrive at the site (either small local haul trucks with approximately 6 tons of capacity or larger consolidated trucks with approximately 22 tons of capacity). The number of trucks will depend on the capacity of the facility and the acceptance of outside sources. Trucks will also leave the site transporting residual solids for either land application, further composting, or for further processing or energy production such as at the regional Bay Area Biosolids to Energy Project.

Closely linked to the site considerations is the location, on the RWQCP or

offsite, of the food preprocessing component (Component Three). Onsite preprocessing requires a truck scale, a fully enclosed tipping floor to contain odors, and space for the preprocessing equipment to remove contaminants from the food scraps and turn the scraps into a slurry for injection into the THP AD system. An offsite food scraps processing facility handles the preprocessing, but the onsite RWQCP system requires a food receiving station with rock trap, dilution water tank, pumps, and screening facility to protect the THP AD System. Onsite solid waste facilities at the RWQCP require permits from CalRecycle through the Local Enforcement Agency (LEA) at Santa Clara County.

3. Component Three – Food Scrap Preprocessing

Preprocessing of food scraps involves removal of contaminants and physical conversion into a pumpable mixture for delivery into the THP AD Facility. Food scraps provide energy potential by increasing the digester's biogas output and the marketplace has been active in developing new technologies for efficient preprocessing.

The City collects an estimated 12,100 tons of commercial food scraps. The City does not currently collect the estimated 3,400 tons of residential food scraps. Staff is evaluating the effectiveness of the Residential Two-Cart Pilot Program, which is, in part, designed to evaluate the potential to capture residential food scraps. Staff will evaluate the costs and benefits for increased collection and handling costs needed to separate food scraps from the residential garbage and yard trimmings, and will be reporting back to Council in the fall 2014.

The THP AD facility predesign will identify the initially available excess capacity for food scraps. This will help determine how much additional food could be accepted into the facility or if additional THP AD capacity should be built to accommodate available feedstocks. Additionally, the food waste tonnage and its source(s) will help define not only the size of the preprocessing equipment but also its potential location. The preprocessing facilities may be located on the RWQCP site next to the THP AD Facility despite the limited space. Conversely, the food scrap preprocessing could be located at an alternate location where the food scrap loads could be tipped, preprocessed into slurry, and consolidated into larger trucks to be pumped into the THP AD Facility. The

We Generation (Cambi Systems) proposal included the Shoreway Environmental Center in San Carlos as a preprocessing site. Other material recovery options include transfer stations, like the Sunnyvale Material Recovery and Transfer (SMaRT) Station, where the City of Palo Alto is a part investor.

The cost estimates are rough due to the current uncertainty regarding the sizing and location of a preprocessing facility. Capital costs are estimated at $8.9 million for preprocessing and digester preparation of the food scraps. Operating costs with built-in capital recovery in the tip fee is estimated at $46/per wet ton. Further research is needed to refine these estimates.

The development time for a food preprocessing system could be relatively short. The technology is modular and relatively compact. However, for food preprocessing and digestion in Component Three to begin the RWQCP must be certain that the THP AD Facility is fully operational and that it meets regulatory requirements. The full deployment of Component Three would be completed between 2020 and 2022 which is at least one year after the THP AD Facility begins operation.

The inclusion of food scraps in the digester increases biogas production and further reduces the City's GHG. Nevertheless, staff continues to support home composting and may consider the co-composting of residential food scraps with yard trimmings as a suitable and sustainable processing option.

4. <u>Component Four – The Evolution of Yard Trimmings Processing</u>

Aerobic composting is an established and environmentally sound processing option. However, new technologies are being developed to harness their energy and resource potential. The San José/Santa Clara Regional Wastewater Facility recently approved a demonstration project to gasify[4] woody waste with biosolids. Staff will continue to follow these technology developments and improvements in composting technology to evaluate whether a local facility is a sustainable option.

[4] Gasification is a thermal process using extremely high temperatures in the absence of oxygen that transforms a solid material into a synthesis gas that can be combusted to create energy. While gasification is a thermal process, it does not yield the same air pollutants as incineration. See BFP gasification Technical Memorandum on status of gasification for biosolids.

Attached is a visual representation of the OFP.

Organics Facilities Plan