CONSOLIDATED MATERIAL RECOVERY FACILITY AND COMPOST FEASIBILITY STUDY

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

SEPTEMBER 5, 2014

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EXECUTIVE SUMMARY

The University of California, Santa Cruz is a leader in sustainability and environmental stewardship, as demonstrated by the Campus' inclusion in Princeton Review's 2014 "Green College Honor Roll' with a perfect score for sustainability and by the UCSC Grounds Services Department receiving the prestigious Sustainability Best Practice Award for Innovative Waste Reduction at the 2014 California Higher Education Sustainability Conference. This tradition of sustainability goes back to UCSC's establishment in 1965, when its founders placed environmental stewardship as the cornerstone of the new university's philosophy and approach to planning. This stewardship continues today and is demonstrated not only by the accolades of other environmentally minded groups, but by UCSC's ongoing commitment to responsibly diverting 95% of campus waste from the landfill to resource recovery. The Campus' current excellence in waste stream diversion places it in an ideal position to meet the University of California Regents challenge to achieve Zero Waste by 2020.

To further the success of current practices and meet the Zero Waste challenge, UCSC commissioned a team of consultants versed in campus planning and resource recovery to assess the feasibility of establishing an on-campus consolidated material recovery facility. The team was charged with evaluating two pre-vetted sites on the campus in terms of each site's economic and environmental viability to serve UCSC's current and future resource recovery and composting needs. The site assessment and evaluation is described in detail in the following Consolidated Material Recovery Facility and Compost Feasibility Study. The study outlines UCSC's various waste streams and its current processing systems, then evaluates six waste diversion alternatives. Qualitative analysis of each option's potential to meet UCSC's goals, remain cost effective, improve operating efficiencies, enhance land use, and maximize educational opportunities reveals that centralization of all operations in one consolidated material recovery facility is the best option for the Campus to pursue.

The study also provides detailed analysis of the two pre-selected sites, known as the Bowl and North Remote, as potential homes for a consolidated material recovery facility. Although no site is without its challenges, the Bowl offers adequate space to accommodate all of UCSC's current and future waste diversion efforts, is large enough to house stormwater management features, encourages potential partnering with neighboring Center for Agroecology & Sustainable Food Systems (CASFS), is accessible to the larger campus, and has minimal impact on existing parking. The Bowl has been selected as the preferred site for future material recovery efforts.

UCSC's commitment to producing zero waste by the year 2020 has motivated Campus representatives to explore ways of diverting all campus organic material, including food scraps, paper towels, and compostable ware, from the landfill; this organic material currently makes up 48% (by weight) of campus solid waste[1] (see chart at right). The feasibility study has explored every option for off-campus processing of organic materials within the region and found that there are no facilities willing to accept the campus' organic material due to large volumes of paper towels and compostable ware. This leaves the Campus with no options for off-campus disposal that will still enable it to achieve Zero Waste. To respond to this constraint, the study

1 "Solid Waste Assessment and Early Action Items Report, University of California, Santa Cruz," SAIC, February 2012.

evaluates the feasibility of establishing an on-campus composting facility. Based on environmental impacts, costs, and permitting requirements, the study recommends an in-vessel composting system.

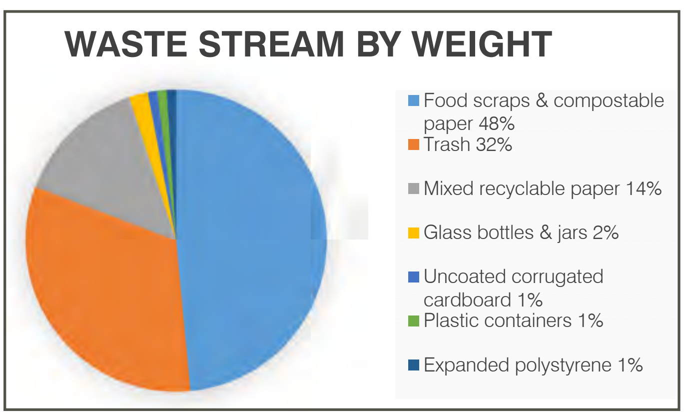
The team was also charged with developing a conceptual layout for the consolidated resource recovery facility at the Bowl which includes all current and future program elements. An early programmatic cost estimate prepared in December 2013, included in the appendices, estimated that the full construction of the facility and site would cost approximately $3.5 million. Since implementation of the full program is not possible within the budget currently allocated to this project, the study recommend that the initial phase of work, to be constructed in Summer 2015 with a budget of $671,000, include the following:

- Bring utilities to the site for future build-out;
- Complete site grading and paving for construction and demolition debris processing, bins and equipment storage, and greenwaste storage;
- Create a stormwater treatment area;
- Restore the Great Meadow at the current Grounds Services storage area, to be completed in-house by Grounds Services.

Additionally, the feasibility study discusses and recommends safety improvements for the Great Meadow Bike Path. Locating the facility at the Bowl will unavoidably increase traffic crossing the existing bike path, making safety improvements a necessity. The study contains a separate cost estimate for this work (approximately $226,750); Transportation and Parking services (TAPS) has acquired grant funding to implement these improvements.

Developed in close partnership with UCSC stakeholders and representatives, this study's recommendations are in balance with human and environmental resources, with campus education and stewardship, as well as with long-range physical planning objectives for campus lands. The key findings are:

- Consolidate all material recovery operations in one facility.
- Locate the consolidated material recovery facility at the Bowl site.
- Incorporate an in-vessel composting system to process organic material.
- Implementation to be phased, with Phase 1 construction scheduled for Summer 2015.
- Great Meadow Bike Path improvements planned and to be funded by TAPS grant.



Disclaimer: The use of the word "waste" in this document has generated some controversy. Since 95% of UCSC's "waste" is actually a resource, rather than trash to be discarded, it has seemed misleading to employ the term. However, in the absence of an appropriate synonym, and in the interest of legibility and conciseness, continued use of the term "waste" seems the best option. We ask the reader to keep in mind that, to paraphrase the proverb, one person's waste is another person's resource.

OVERVIEW

In addressing the University of California Santa Cruz's options for a consolidated material recovery facility and the feasibility of including composting, this study also provides an overview of the Campus' current waste diversion system, its current and projected waste stream, and its waste-related sustainability goals. A thorough analysis of the viability and costs of a range of compost technologies provides real-world data to help Campus staff assess their options. The advantages and disadvantages of the two potential sites are discussed, one site is recommended, and a site diagram of the recommended site is provided.

This study aims to help UCSC answer the following questions:

Current Waste Diversion Services Analysis

Should UCSC continue on-campus processing of recyclables and sell materials to various vendors as they currently do, or out-source processing to off-campus facilities?

Compost Program Analysis

What options does UCSC have to achieve Zero Waste by 2020? Does the campus produce enough materials to sustain a viable on-campus composting facility? Are there existing off-campus composting facilities that are willing to take the paper towel-laden stream the campus plans to collect and, if so, at what price?

Analysis of Two Potential Sites

Of the two proposed sites—the Bowl and North Remote—which location provides the most opportunity to consolidate resource recovery operations while meeting UCSC's long-range planning and sustainability goals?

CAMPUS SUSTAINABILITY GOALS

The University of California Regents created a Sustainable Practices Policy in June of 2004 with the most recent updates in August of 2013 (http://sustainability.ucsc.edu/governance/files/CSP_2013_2016.pdf). One of the policy's goals is for each University of California campus to achieve Zero Waste by 2020. Currently, the Campus is sending 1,369 tons per year (TPY) of solid waste to the City of Santa Cruz Resource Recovery Facility (RRF) for disposal. In order to achieve Zero Waste, 95% of all waste must be diverted from the landfill. Achieving Zero Waste will require aggressive resource recovery measures and this feasibility study is intended to help UCSC fully understand its options in order to map out the most effective strategy.

STUDY SCOPE AND PURPOSE

The Consolidated Material Recovery Facility and Compost Feasibility Study is divided into six sections:

- Review of current campus waste diversion operations and system alternatives;
- Analysis of a potential compost program on the UCSC campus;
- Discussion of consolidated material recovery facilities and associated permitting requirements;
- Analysis of potential sites for a consolidated material recovery facility;
- Detailed discussion of the recommended site with design concept plan and cost estimate;
- Appendices with related materials.

Waste System Analysis

The first section, review of existing campus waste diversion operations, outlines current recycling efforts on campus, overseen by the Campus Grounds Services department, and describes the collection, processing, and disposal of each waste stream. This study explores several alternatives available to UCSC for processing campus-produced recyclable materials such as cardboard, paper, plastic, and glass. Acknowledging that the campus is a learning environment, this study recognizes that the criteria for deciding what is appropriate for a university may be different than those of a corporate enterprise. Therefore, this study provides recommendations for how recycling efforts can be streamlined and made more cost efficient, in addition to a qualitative analysis of options. To assist UCSC in selecting the optimum approach to meeting its goals—sustainable, budgetary, and academic—this section concludes with a matrix of different alternatives.

Compost Program Analysis

The second section, analysis of a potential compost program, grew out of the need to achieve Zero Waste by 2020. There is strong interest at UCSC in closing the loop—turning organic waste generated on campus into a usable product that stays on campus—as well as increasing awareness and educational opportunities about reducing the waste stream. In order to achieve Zero Waste, measures must be taken to remove the organic material currently making up a significant portion of campus solid waste. A waste analysis completed in 2012 found that food scraps and compostable paper make up 48% (by weight) of campus refuse[1]; more recent assessments done by campus staff have shown that the actual percentage may be higher. UCSC has posed the question of whether or not processing organics on campus is the most economical, sustainable, and beneficial approach. This study explores the options and iterations available to UCSC as it answers that question.

Consolidated Material Recovery Facility

The study's third section describes what a consolidated material recovery facility at UCSC would include and outlines program elements. This section also addresses regulatory concerns and permitting requirements.

Site Analysis and Recommendation

The fourth section of this study analyzes the two sites pre-selected by the Campus as potential locations for a consolidated recycling yard: the Bowl and North Remote. The analysis consists of presenting each site's opportunities and constraints, a site analysis diagram, and a feasibility-level discussion

1 "Solid Waste Assessment and Early Action Items Report, University of California, Santa Cruz," SAIC, February 2012.

of the resources and potential impacts of developing a consolidated material recovery facility at each site. Initial programmatic layouts for the two sites were prepared and presented to Campus representatives and the Design Advisory Board on December 13, 2013. Campus representatives also presented materials to the Campus Planning and Stewardship Committee (CPS) in regards to site selection and recommended the Bowl site based on analysis prepared for this study. The Bowl site was approved for further study, review, and costing by the Office of the Chancellor in February 2014.

Recommended Site: The Bowl

This section provides a detailed analysis of the Bowl, the site recommended for a consolidated material recovery facility. It includes a design narrative, site diagram, site sections, precedent images, and cost estimate.

Appendices

The sixth and final section, the Appendices, contains background and supporting material, such as site plans, cost estimates, research reports, and lists of acronyms and definitions, relevant to this study's analyses and recommendations.

UCSC Hay Barn (Photo by JLJA)

PROJECT GOALS AND OBJECTIVES

There are three time frames embodied in this project: immediate, mid-term, and long-term. The immediate aim of this project is to relocate the current waste diversion activities that were taking place at the Hay Barn on campus. Since the Hay Barn's reconstruction has begun, the construction and demolition debris sorting and the bin and equipment storage currently located in the Hay Barn yard must be relocated.

While considering this immediate goal, UCSC looked ahead to the mid-term and decided to investigate their options for consolidating into one facility the recycling and waste processing which currently occurs in multiple locations across campus. In the spring of 2013, the Campus formed a committee to study the potential for a consolidated recycling yard and to identify potential locations. Two sites were identified and the Campus hired the Consulting Team to do the following:

- Review current campus waste diversion services and provide recommendations to increase efficiency;
- Quantify expenses associated with processing organics on campus;
- Analyze and document the options and risks of contracting off-campus vendors to manage all streams of waste diversion;
- Analyze two pre-selected sites for compatibility with consolidated material recovery facility objectives and recommend a preferred site;
- Provide conceptual-level plans for the two sites and a budget-level cost estimate for their development.

UCSC requested that this study keep in mind future growth planned for the campus and the challenges of achieving Zero Waste in the long-term. To that end, this study provides options for how the Campus can process its organic waste stream and presents plans for facilities that can expand and meet additional capacity as the campus grows.

METHODOLOGY

This study is based on thorough review of University policies and goals, including the Regents' Sustainable Practices Policy mandating Zero Waste by 2020 and the "2013-16 Campus Sustainability Plan." Discussions with Campus representatives from the Office of Sustainability and the Center for Agroecology and Sustainable Food Systems (CASFS) helped define the larger goals towards which the Campus is working.

Grounds Services has provided substantial data on quantities and types of waste and recyclable materials currently collected and processed on campus. Meetings with Grounds Services, tours of campus waste collection and processing facilities, and review of prior meeting minutes from the campus Committee on a Consolidated Recycling Yard have provided crucial information for understanding the campus waste stream.

Conversations with municipalities and resource recovery facilities in the area proved critical to fully developing the options available to UCSC. Tours of local facilities and discussions with the City of Santa Cruz Public Works, County of Santa Cruz Public Works, Monterey Regional Waste Management District, and Zanker Resource Management provided significant input to the results and proposals this study presents.

UCSC Consolidated Material Recovery Facility and Compost Feasibility Study - Kick-Off Meeting, October 25, 2013 (Photo by UCSC)

CURRENT WASTE DIVERSION SERVICES

Grounds Services oversees the majority of recycling and waste collection efforts on campus, collecting and sorting materials. These materials are either delivered off-campus by Grounds Services or picked up on campus by outside vendors. Operations are limited by available space with consolidation sites scattered across campus. (See aerial view on page 16.)

Mixed Container

Mixed container bins are located throughout campus and are used for collecting aluminum, plastic, and glass. The contents of the bins are transferred to a roll-off box when full; the roll-off boxes are then brought to the Lower Campus. There, the mixed containers pass through a sorting line where the more valuable polyethylene terephthalate (PET), aluminum, and glass that have California Redemption Value (CRV) are separated from the non-CRV items. Grounds Services hauls and sells the CRV materials to a variety of commercial recycling facilities, depending on who offers the most redemption. Grounds Services hauls the non-CRV materials to the City of Santa Cruz Resource Recovery Facility (RRF), a 10-mile round trip.

Paper

Segregated recycling bins for mixed paper and white office paper are picked up throughout campus by Grounds Services. The paper is transferred to large box bins ("Maggies") stored at the Lower Campus. An outside vendor picks up the Maggies and hauls away the contents.

Cardboard

Grounds Services collects cardboard from green dumpsters located near the loading docks of most buildings. Grounds Services continues collection until the truck is full and then delivers the cardboard to various off-campus vendors, including some in San Jose and Castroville, approximately once a week.

Polystyrene (Styrofoam)

Collection of polystyrene on campus is greatest during student move-in periods. During the rest of the year, polystyrene is deposited at building loading docks and Grounds Services collects and stores the material in a roll-off box until the box is full. Typically, the material is taken to a recycling center once a year, before the next academic year move-in. This roll-off box was recently relocated from the Hay Barn to the Bowl.

Batteries

Grounds Services currently collects used batteries throughout the campus. The batteries are sorted and stored in a 15' x 15' metal shed in the Lower Campus until Environmental Health & Safety (EH&S) ships them to an off-campus recycling center.

E-Waste

Students, faculty, and staff may dispose of their e-waste on campus by either scheduling a pick-up with Receiving Services for a fee or dropping items off at H Barn on designated days. Also, each college mail room has a receptacle for small e-waste items such as compact discs, printer cartridges, batteries, and small electronics.

Construction Waste

All construction projects on campus are required to divert 75% (by weight) of their waste from the landfill.[1] The general contractors or on-site waste managers of the projects have the option to contract with Grounds Services to do their Construction and

1 "Landfill Solid Waste Task Force Report and Waste Diversion Plan, 2012", July 31, 2012.

Demolition collection and sorting. When contracted, Grounds Services sorts and separates the materials into separate roll-off boxes and sells them to off-campus recycling centers. These activities currently take place at the Hay Barn.

Compostable Material

The five dining halls on campus collect compostable materials in compactors located at the loading docks. When the compactors have reached capacity, Grounds Services hauls them to the Monterey Regional Waste Management District (MRWMD) Landfill in Marina, a 70-mile round trip that occurs approximately every seven to ten days. This compostable material is not accepted at the nearby City of Santa Cruz RRF, thus necessitating the longer journey.

Greenwaste such as landscape trimmings, tree pruning, and grass clippings, generated by Grounds Services, the Arboretum, and the CASFS, is another part of the compostable waste stream. These materials are stored at the Bowl and at a half-acre site adjacent to the Arboretum. Grounds Services chips all of the brush and smaller trimmings and uses the resulting material as mulch throughout campus. Materials too large for existing campus equipment are stored until the materials have built up to a cost-effective quantity. At that time, Grounds Services contracts a third-party ventor to set up their equipment on campus and convert the materials into mulch for distribution on campus. Grounds Services hauls any materials not used on campus to the City of Santa Cruz RRF as greenwaste, a 10-mile round trip.

Campus Housing Compost Program

Campus Housing has a voluntary cold composting program that residents can participate in. The programs differ slightly in collection method depending on the residence facility; however, all materials are composted near where they are collected and used in local gardens or landscaping. Student workers hired by Housing and Dining Facilities manage the collection bins and compost material. According to the Office of Sustainability, estimates from the 2012-2013 academic year show 1.59 tons per quarter or 4.77 tons per year of collected material diverted from the waste stream.

Table 1-4
Estimated Weight of Discards, by College Affiliation

COLLEGE	Uncoated Corrugated Cardboard	Mixed Recyclable Paper	Expanded Polystyrene	Landscape Trimmings	Food Scraps + Compostable Paper	Glass Bottles & Jars	Aluminum Containers	Ferrous Containers (tin cans)	Plastic Containers	Trash
	MATERIAL CATEGORIES % of Total Waste (tons)									
No Affiliation	2%	17%	1%	0%	48%	2%	0%	0%	1%	29%
College 8	1%	6%	0%	2%	28%	2%	0%	0%	1%	60%
College 9	1%	15%	1%	0%	40%	6%	0%	0%	1%	36%
College 10	1%	23%	1%	0%	53%	0%	0%	0%	2%	20%
Cowell	1%	8%	0%	0%	36%	1%	1%	0%	1%	53%
Crown	1%	8%	0%	0%	66%	1%	0%	2%	0%	20%
Kresge	2%	10%	0%	0%	45%	10%	0%	0%	2%	32%
Merrill	0%	6%	0%	0%	71%	0%	0%	0%	1%	21%
Oakes	0%	7%	0%	0%	69%	0%	1%	0%	1%	22%
Porter	1%	17%	0%	0%	47%	0%	1%	0%	1%	34%
Stevenson	2%	15%	0%	0%	45%	6%	2%	0%	2%	29%
TOTAL	1%	14%	1%	0%	48%	2%	0%	0%	1%	32%

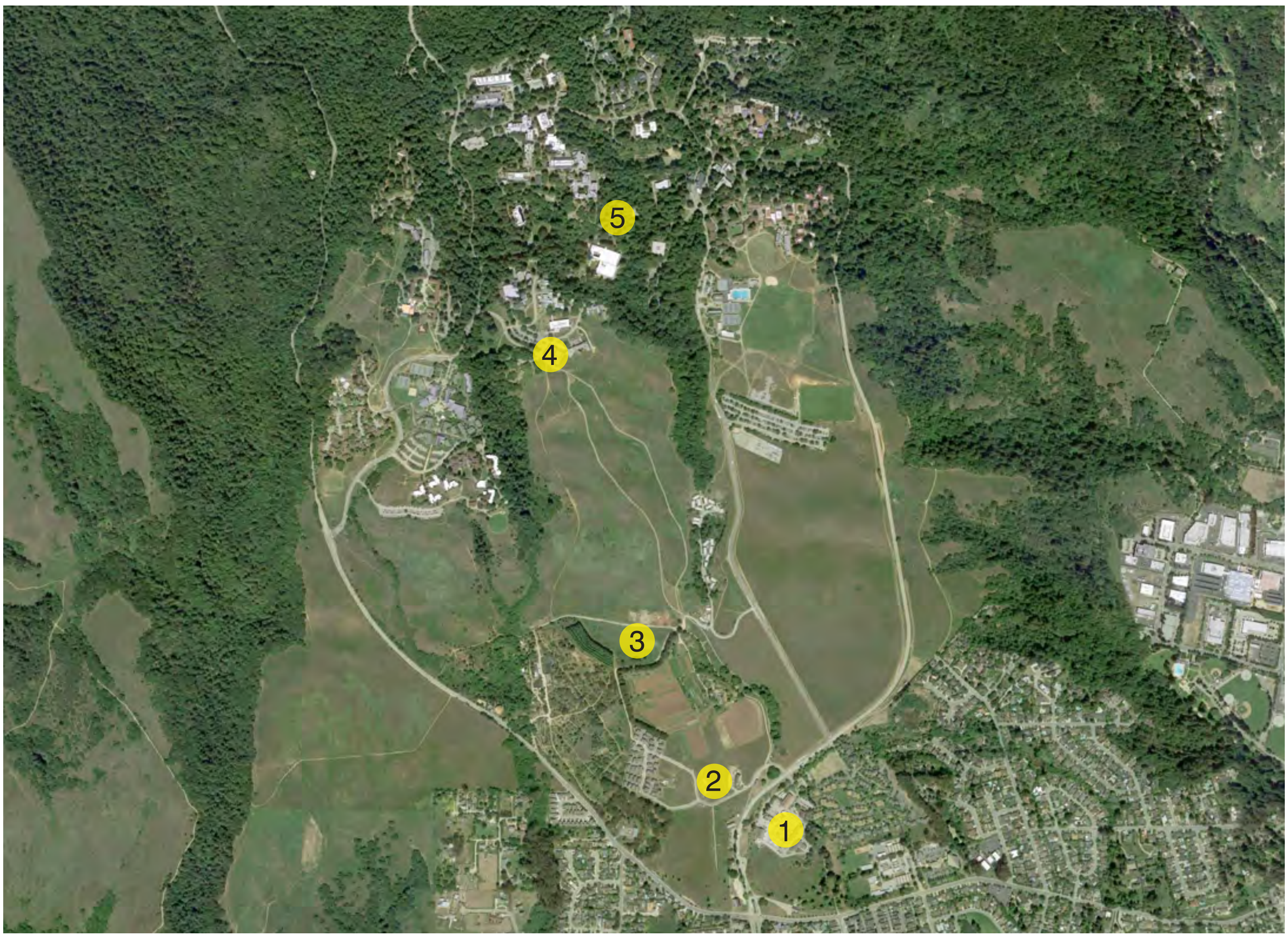
Totals may not sum to 100 percent due to rounding.

"Solid Waste Assessment and Early Action Items Report," SAIC, Table 1-4, showing UCSC discards, by weight, as extrapolated from the 2012 study's waste assessment.

EXISTING LOCATIONS

Campus consolidation sites are currently housed in five locations.

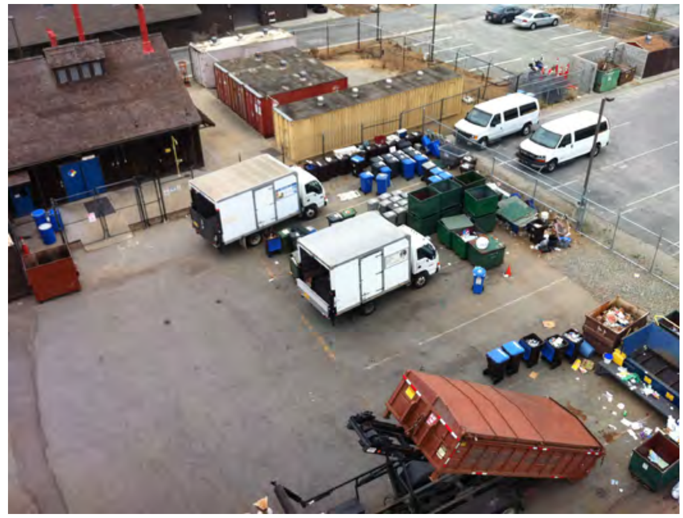
1. Lower Campus
2. Hay Barn
3. The Bowl
4. Music Center Loading Dock
5. Steinhart Way Turnout



Campus Aerial with Recycling Locations

1 Lower Campus

Approximately 6,000 square feet (0.14 acres) of the Physical Plant Corporation Yard, at Lower Campus, is dedicated to recycling activities and storage. This area houses the mixed container sorting line and roll-off boxes, paper sorting, and battery storage and sorting, while also providing bin storage and parking for Grounds Services trucks.



UCSC Lower Campus (Photo by UCSC Grounds Services)

2 Hay Barn

Bin storage as well as Construction and Demolition sorting and storage occur in an area approximately a third to a half acre. There is an immediate need to relocate this activity as the Hay Barn re-construction began in Winter 2014. (As of writing, some bin storage has been relocated to the Bowl.)

UCSC Hay Barn (Photo by UCSC Grounds Services)

3 The Bowl

Consisting of approximately two acres, the Bowl is currently used to store purchased landscape materials, greenwaste, boulders, logs from on-campus tree removal, and wood chips.

UCSC The Bowl (Photo by JLJA)

4 Music Center Loading Dock

Seven to eight dumpsters are located along the edge of the road and are used as a small sorting and transfer area for Grounds Services. The dumpsters are stored in an unimproved area lacking visual screening and proper base material for stability and ease of transfer to and from trucks. Ad hoc positioning of dumpsters leaves the area susceptible to contamination.

UCSC Music Center Loading Dock (Photo by JLJA)

5 Steinhart Way Turnout

Approximately a dozen dumpsters and two roll-off boxes are housed in a turnout space that serves as a satellite sorting area. The turnout is centrally located to campus collection areas and provides a location for materials to be sorted and stored. However, this turnout experiences high volumes of traffic, including pedestrian, cyclist, and vehicular (transit, delivery, Grounds Services, ADA-permitted, and emergency vehicles). It is also a future gateway and pedestrian access point to the classroom and amphitheater to the northeast.

UCSC Steinhart Way Turnout (Photo by JLJA)

CAMPUS OBJECTIVES

The Consultant Team developed a list of key objectives as an outgrowth of meetings with staff, campus tours, review of the Regents' Sustainable Practices Policy, and review of earlier Recycling Yard Working Group meeting agendas. The following considerations were critical to analyzing UCSC's waste diversion options:

- Achieve Zero Waste by 2020;
- Limit impact of environmental factors (noise, dust, odor, stormwater, greenhouse gas (GHG) emissions);
- Prioritize an economic, sustainable, and efficient operation appropriately sized for UCSC's waste stream;
- Provide for ease of operation, focus on automation, and maximize staff resources;
- Consider aesthetics so that the operation complements the LRDP's goals and objectives;
- Develop a strong educational outreach and awareness component.

WASTE SYSTEM ALTERNATIVES

This study identifies six basic waste diversion alternatives for the UCSC campus:

1. Continue operations as they are—the Status Quo.
2. Consolidate all operations at one integrated recycling/composting site.
3. Consolidate operations, but in two locations (using both potential sites).
4. Consolidate some operations and transfer others to off-campus facilities.
5. Abandon all on-campus processing and transfer all material to off-campus facilities.
6. Transition the entire waste system to a "three bin" system and contract for collection as well as processing of all material off-campus.

The advantages and disadvantages of each are discussed below.

Alternative 1: The Status Quo

The advantage of the status quo is that nothing changes and operations continue as is. This is also the major disadvantage in that it will provide neither the programs nor the facilities to achieve Zero Waste. In addition, the current system's fragmentation across several locations creates inefficiencies. Because none of the project's chief objectives are achieved, this alternative is dropped from further consideration.

Alternative 2: Consolidate All Operations at One Integrated Recycling/Composting Site

With this option, all recycling and all organics activities would take place at one site. This includes:

- Construction and Demolition debris receiving, sorting, and load-out;
- Source-separated cardboard and paper receiving, possible baling, and load-out;
- Commingled recyclable container sorting;
- Greenwaste chipping and grinding;
- Future organics composting and possible vermiculture;
- Inert materials and equipment storage;
- Potential future anaerobic digestion (AD) for generating fuel and/or electricity.

In developing programmatic layouts for the two sites, it became apparent that a consolidated facility could be housed at the Bowl site, but not at the North Remote site due to space constraints. Enlarging the North Remote site into steeper terrain in order to accommodate the full material recovery program would be prohibitively expensive.

The advantages of a consolidated and fully-integrated waste diversion yard at the Bowl are:

- All diversion activities would occur at one site, thus increasing economies and efficiencies;
- This is the most compact use of land and frees up for other valuable uses the small, multiple locations on campus where waste diversion activities currently take place;
- Consolidation maximizes educational opportunities with all activities available in one on-campus location for tours or classroom outreach;
- It maximizes control over future activities and costs and flexibility in matching programs and materials to facilities in order to achieve Zero Waste -- this is particularly relevant to the planned recovery of paper towels and mixed organics, which the Marina Landfill will not accept for either AD or composting;
- It reduces regional truck transportation and the attendant air emissions, including GHGs;
- It facilitates collection and distribution of organic end products for use in the campus landscape;
- It enables more centralized administrative and record-keeping activities.

Disadvantages include:

- The smaller scale of the operation makes it relatively expensive in terms of cost per ton of material handled;
- The Campus bears all the cost of infrastructure development;
- If composting is included, consolidation will require an expansion of current staff to operate the facility, including the following tasks:
  - sorting organics for contaminant removal,
  - loading and maintaining the in-vessel composters,
  - maintaining compost curing windrows and optional vermiculture operation,
  - marketing end products,
  - maintaining stormwater capture and control system,
  - keeping records and interfacing with regulatory agencies,
  - conducting tours and other educational activities.
- It may have local environmental impacts such as noise, dust, and stormwater contamination in an area with suspect soils (sink holes), even though design and operational parameters will minimize such impacts.

Alternative 3: Consolidate All Operations in Two Locations (Using Both Potential Sites)

This option is the same as the full consolidation above except that operations would be split between the two potential sites, most likely with organics composting at the Bowl and recycling activities at the North Remote (Construction and Demolition debris sorting, inert materials storage, mini-MRF operation, cardboard and paper salvage). In this scheme, the benefits of both sites can be realized with the more sensitive composting activity next to the farm and furthest from housing and classrooms, and the recycling operation closer to the centroid of the recyclables collection points.

The disadvantage is that both sites would have to be used, albeit with a smaller footprint at each. This would result in greater capital costs for improving both sites, along with land use implications in relation to the LRDP. Such an approach would also increase potential environmental impacts and operating costs.

Alternative 4: Process Organics On Campus and Transfer Other Operations to Off-Campus Facilities

This alternative recognizes that the campus must process their own organic waste stream in order to achieve Zero Waste by 2020. Importantly, the handling of organics is a very different type of activity from the handling of recyclable materials—the former is more of an agrarian-type operation, whereas the latter has a more industrial feel to it, although this can be mitigated by design elements.

The advantages of providing new composting operations on-campus and transferring recycling operations off-site include:

- Smaller footprint, so either site would be adequate (although the agrarian feel of an organics composting and vermiculture operation would fit well with the demonstration organic farm, CASFS, and Life Lab adjacent to the Bowl);
- Recyclables would be transferred off-campus to be processed by larger operations;
- Reduction in labor required by Grounds Services related to recycling activities;
- Educational benefit of an on-campus organics facility;
- Production of compost end products for use by Grounds Services at other facilities around campus. While it is unlikely that the compost would meet the organic certification required for use on the farm, worm castings and vermiculture tea may be of value to CASFS or the public.

Disadvantages include:

- Loss of specific recycling revenues;
- Loss of control over costs as off-campus facilities may raise tipping fees or reduce payments for materials in the future;
- Off-campus processors could impose more stringent material quality standards in the future

that could be difficult to meet, thus impacting UCSC's ability to achieve Zero Waste;

- Depending on the distance to processors, overall truck miles and air emissions may increase;
- Possible loss of jobs in Grounds Services.

Alternative 5: Abandon All Current On-Campus Processing and Transfer All Material to Off-Campus Facilities

This scenario would maintain the existing collection system and programs, but transfer all collected material off-campus for processing. This would include the following streams of material:

- All food waste from the dining halls would continue to be trucked to Marina Landfill or Z-Best in Gilroy for digestion and/or composting, or to new facilities developed elsewhere (such as the possible composting operation at the City of Santa Cruz RRF, one of the County landfills, or the Harvest Power regional AD project that is in the early development stage);
- All commingled recyclables, plus the source-separated cardboard, would be trucked to the City of Santa Cruz RRF or to similar facilities in the region.

The advantages of this alternative include:

- Removes the burden and cost of processing small quantities of recyclables and organics on-campus and consolidates this material at much larger operations;
- By partnering with other regional facilities, it fosters a sense of teamwork and synergy moving into the future;
- It frees up the space now occupied at several campus locations currently committed to processing recyclables and would eliminate the need for land on-campus for future composting;
- It shifts the burden of environmental controls (e.g. stormwater and air quality) to off-campus facilities which, if they are sizable operations such as the Marina Landfill and Z-Best, will likely have larger, more robust environmental control systems already in place.

Disadvantages include:

- Does not allow Campus to meet Zero Waste by 2020 goal since paper towels and organics are not accepted.
- Since off-campus vendors may raise tipping fees significantly in the future, the cost ramifications are undetermined and unpredictable, making long-term planning a challenge.
- Off-campus processors of either recyclables or organics may impose more stringent material quality standards or refuse to accept certain recyclable or organic materials in the future.
- Transferring all materials off-campus results in the loss of a valuable educational component--since processing facilities would not be readily available on-campus for touring and classroom outreach, UCSC would miss an important opportunity to increase student awareness and would devalue part of their mission as a teaching institution;
- Increased environmental costs of trucking the material to off-campus locations in Santa Cruz, Marina, or the San Jose area. These costs include truck air emissions of both criteria pollutants, diesel particulants, and greenhouse gases. The latter, in particular, are a concern for the UC system, and the Campus is committed to reducing GHG emissions to 1990 levels by 2020.

Alternative 6: Transition the Entire Trash System to a “Three Bin” System and Contract for Collection as well as Processing of All Material Off-Campus

Although not directly part of this study, one fairly radical alternative would be to shift the entire solid waste system over to a three-bin system (black, blue, green). This is the traditional system used by the majority of California cities and would provide a simpler, more uniform system that fits existing infrastructure (blue bin - recyclables to MRF, green bin - greenwaste and food waste to AD or composting, black bin - waste to the landfill). The Campus could then contract with one of the local private haulers to collect and process or dispose of the materials. Through the franchise agreement, UCSC could still control the system and require high levels of diversion, but would no longer be in the waste collection and processing business. At the same time, UCSC would likely not achieve their Zero Waste by 2020 goal.

This alternative would require a complete make-over of the system and a significant reduction in the current labor and equipment force currently assigned to this task by Grounds Services. What would be lost is the flexibility in being able to match programs and materials with UCSC-owned facilities, plus some of the individualized programs that the current “home grown” system has encouraged. Losing the educational component related to the processing of materials on campus is another factor of this alternative.

An additional possibility within this approach would be to transition to the three-bin system but have Grounds Services continue the collection and hauling to regional facilities. This would necessitate a major shift in collection equipment (trucks and bins) and a significant investment in new equipment, plus possible alterations of staffing at Grounds

EVALUATION OF ALTERNATIVES

This study has presented a wide range of alternative systems for UCSC's recycling and potential composting programs and includes a qualitative assessment of the strengths and weaknesses of the six alternatives in crucial areas. The essential, determining factors are as follows:

- Zero Waste: Does the alternative maximize diversion in support of Zero Waste by 2020?
- Minimize Campus Environmental Impacts: Does the alternative minimize impacts to the environment, including air and water quality, greenhouse gas emissions, and other factors?
- Cost: How well does the alternative minimize and stabilize UCSC's costs and/or make the system more cost effective?
- Level of UCSC Control: Does the alternative provide UCSC with a high level of control in both the mid-term and long-term?
- Campus Land: Does the alternative make efficient use of campus land and conform to land use requirements?
- Aesthetics: Does the alternative provide for attractive facilities which complement the LRDP's goals and objectives?
- Education Potential: How effectively does the alternative provide an environmental educational experience for the UCSC community?

The matrix below compiles each alternative's rating in relation to these factors. As shown, the lowest scoring alternative is Alternative 1, the Status Quo. The highest scoring alternative is Alternative 2, centralization of all operations at one site.

Comparison Matrix
Waste System Alternatives

Key: -1 Poor, 0 Neutral, 1 Good

Evaluation Factors	**Alternative #**					
	1	**2**	**3**	**4**	**5**	**6**
Support Zero Waste by 2020	-1	1	1	1	1	1
Minimize Campus Environmental Impacts	0	0	0	0	1	1
Minimize and Stabilize Cost	-1	0	0	-1	-1	-1
Make Efficient Use of Campus Land	-1	0	-1	0	1	1
Provide High Level of UCSC Control	0	1	1	0	-1	-1
Complement Campus Aesthetics and LRDP	0	0	0	0	1	1
Provide On-Campus Educational Potential	0	1	1	0	-1	-1
Overall Score (Higher = Stronger)	-3	3	2	0	1	1

Alternatives:
1 Status Quo
2 Consolidate All Operations (Recycling and Composting) at One Site
3 Consolidate Operations at Two Sites (Recycling at North Remote, Composting at the Bowl)
4 Consolidate Some Operations, Transfer Others Off-Campus
5 Abandon All Processing and Transfer All Materials Off-Campus
6 Transition to Three-Bin System and Abandon All Processing

CAMPUS-GENERATED COMPOSTABLE MATERIAL

According to Grounds Services data, 561 tons of food waste were collected from the five dining halls on campus in the 2013 calendar year. The food waste is sorted in the dining hall kitchens, bagged in compostable bags, and then placed into a compactor at the back of the kitchen. A Grounds Services roll-off truck picks up the compactors full of food waste twice a week and delivers them to the Monterey Regional Waste Management District's (MRWMD) facility in Marina where it is processed in an anaerobic digester and then composted in windrows.

This amount of compostable organics would increase by roughly 540 TPY, to a total of 1,100 TPY, if the campus could successfully capture and source-separate all the currently unavailable organics (largely soiled paper towels) in the general solid waste stream. This would contribute significantly to achieving Zero Waste by 2020.

In addition, there is greenwaste generated by Grounds Services, the Arboretum, and CASFS. These materials are either chipped by Grounds Services or an off-campus vendor and used on campus, or directed to the City of Santa Cruz RRF for chipping and grinding.

OFF-CAMPUS COMPOSTING OPTIONS

Currently, Grounds Services makes eight to ten trips per month to Marina (70 miles round trip) with the compactor trucks that collect food waste from the campus' five dining halls. Marina Landfill has communicated that they cannot accept an increase in soiled paper, thus limiting this potential contribution to Zero Waste by 2020.

The Consultant Team and Grounds Services have investigated the possibility of partnering with regional resource management facilities, such as the Z-Best Composting Facility in Gilroy (sister company to the San Jose-based GreenWaste) and Recology in Vacaville. Neither of these facilities are willing to accept organic material which includes paper towels and compostable ware.

The City of Santa Cruz Public Works Department is actively engaged with developing potential future programs to improve the City's current waste management. Public Works Operations Manager, Mary Arman, noted that the next big goal for the City is to reduce the amount of food waste that is sent to the landfill: 10,000 tons of food scraps three years ago, according to a 2009 waste audit.[1] The City is hoping to develop a program to manage the food waste and is eager to partner with other cities, the County, and/or UCSC. They are currently interested in studying the viability of stand-alone anaerobic digestion, taking food waste to the waste water treatment plant to be processed in their existing digesters, developing a covered windrow composting system on a 5-acre parcel adjacent to the City of Santa Cruz RRF, or creating a public/private partnership with an outside entity to compost the material.

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1 "Compost: Recycling's Last Frontier," *Good Times*, March 27, 2014, p.16.

Santa Cruz County conducted a study a number of years ago that looked at the possibility of converting the Buena Vista Landfill site into a zero-waste park. Citizens of South Santa Cruz County resisted the idea, but there was some interest in developing a compost program at the site. At some point in the future, this possibility could be actualized.

Finally, Harvest Power is developing a regional AD project that could potentially accept UCSC organics, if the project comes to fruition.

It should be noted, however, that it takes five-plus years to develop an AD and composting project and, thus, it is unlikely that any newly proposed facility will be operational in time to help UCSC achieve Zero Waste by 2020. In addition, any AD project will be hesitant to take UCSC's recovered paper towel waste as it contributes little to biogas production.

ON-CAMPUS OPPORTUNITIES AND CONSTRAINTS

Campus Objectives

Key aspects of the potential composting operation that influence selection of a technology and, in the future, an equipment vendor, include:

- Maximum environmental control:
  - Concern for stormwater runoff is high;
  - Odor and noise must be held to a minimum and cannot create a nuisance;
  - Any leachate must be collected and controlled as discharge to groundwater will not be allowed;
  - Vectors, such as mice and coyotes, must be prevented.
- Aesthetics are important and the operation must represent UCSC well.
- Economic and efficient operation at a capacity appropriate to UCSC's waste stream.
- Ease of operation with as much automation as possible – labor resources are scarce.
- The recommended site is located near a wildlife area and the composting operation must not negatively impact nearby species.
- Final compost product should be high quality so that it can be used on UCSC athletic fields.
- Although the preferred site has sufficient acreage for traditional windrow composting, the smaller the footprint of the operation, the better.

Permit Requirements

CalRecyle is the governing body for composting facilities in California. There are three different permitting scenarios that would apply to an on-campus composting operation at UCSC.

Option 1- Exclusion to Permit

UCSC could claim exclusion to the Compostable Material Handling Facility Permit by using an in-vessel composter with less than 50-cubic-yard capacity. Most of the technologies noted in this section of the study meet this requirement.

Option 2- Research Composting Operation
If either an in-vessel composter with capacity greater than 50 cubic yards or traditional windrow composting is used, UCSC could be eligible for permitting as a Research Composting Operation at the Notification Tier level. This requires that UCSC submit a project description, with details of the research project, to CalRecycle notifying them of the intention to develop and operate a facility.

Option 3- Compostable Material Handling Facility Permit
This top tier compost permit is required of any facility receiving substantial percentages of food waste, regardless of the size of the operation. CalRecycle may require a CEQA review, or at minimum a statement from UCSC that the project is exempt. Prior to issuance of the permit, CalRecycle staff will visit the site for a pre-permit inspection to ensure that permit application documentation is accurate. After permitting, CalRecycle will inspect the facility once per month, unannounced, to verify that permit conditions are being carried out correctly. CalRecycle will charge the facility $100 per hour for inspection and reporting. It is estimated that this will cost UCSC $10,000 a year.

The Compostable Material Handling Facility Permit requires recording of tonnages received and diverted, where materials are sold or used, and all lab test results. If 1,000 cubic yards per year of compost is sold or given away, the facility must verify that the compost meet acceptable metal and pathogen levels by sampling and analyzing one sample per 5,000 cubic yards produced. The sampling will be necessary when UCSC is processing the full 1,100 TPY of materials and it is estimated to cost $1,500 per year.

The California Regional Water Control Board is in the process preparing the Draft Environmental Impact Report for the proposed General Waste Discharge Requirements for Composting Operations (Order). According to the May 2014 draft order, a composting facility at UCSC would not be required to obtain coverage if processing were completed within an in-vessel compost machine. If windrow composting is selected, the campus can still be exempt from coverage as quantity will be less than 5,000 cubic yards per year. The projected 1,100 tons per year of organic material the campus would be composting equates to approximately 2,200 cubic yards. The facility would need to adhere to requirements stating that all materials be completely covered during rain events and that the application of process water to prevent leachate be managed.

Material Preparation

It is important to note that all composting operations require clean organic feedstock; if the feedstock is contaminated (e.g. plastic bags, utensils, glass), there must be a means to remove the contamination either before or after composting. This is particularly true when UCSC begins recovering organics from the solid waste stream. Although this activity would roughly double the diversion of organics on campus, it could lead to greater contamination.

Most composting operations in California that must deal with contamination (in curbside green waste, for example) remove the contamination after composting via intense screening and, in some instances, air classification (separating materials with a high-velocity air blast). Although this has advantages in that the material has been broken down to a smaller and more consistent size which lends itself to screening, composting windrows that contain contaminants can look unsightly – a situation which may be problematic on campus.

Ideally, contamination issues are minimized by campus staff, students, and faculty who are vigilant in their source-separation practices, both in the dining halls and in future efforts to separate food waste and paper towels from the solid waste stream. Education may need to be intensified and reinforced periodically to ensure that contamination is held to a minimum. Subsequently, at the consolidated material recovery facility, workers may need to conduct a further pre-sort of the material before loading into the compost system. This is a thankless task, but must be done to remove film plastic (non-compostable type), glass, and other types of non-organic material. Larger operations are beginning to use new, innovative machinery for this cleaning task, but such a system would not be cost effective at UCSC.

COMPOSTING TECHNOLOGY OPTIONS

These options are available for composting at UCSC:

- Anaerobic Digestion (AD)
- In-Vessel Machine
  - Rotating drum type
  - Larger container type
- Covered Aerated Static Pile
- Traditional Windrow
- Vermiculture

The following analysis shows that new, small-scale anaerobic digestion, both types of in-vessel machine systems, a traditional windrow system, and vermiculture would be appropriate composting solutions for campus. The covered aerated static pile system is excluded due to being better suited to larger facilities.

ANAEROBIC DIGESTION

Many communities in California and throughout the nation are exploring the development of anaerobic digestion (AD) for processing organic waste (primarily food waste, greenwaste, and animal manures) and creating renewable energy and compost feedstock as end products. According to CalRecycle, there are ten such projects in California either already operating or nearing completion of construction, and another 25 in active development.

These projects offer significant sustainability achievements in GHG reduction, renewable energy generation (both electricity and transportation fuels), compost production, and diversion from landfills.

Even the smallest of these commercial systems, for example the SmartFerm AD at the MRWMD facility in Marina, process 5,000 TPY of organics, roughly five times the maximum UCSC can recover on campus. Thus, one way for UCSC to gain access to the benefits of AD is to join in a larger regional project, such as that being proposed in the area by Harvest Power.

However, just recently, the Consultant Team learned of a small-scale digestion project developed by Michigan State University and the University of Costa Rica (detailed in the March/April edition of BioCycle Magazine, and included here in the Appendices). This small AD plant processes one TPD of manures and food waste and generates enough biogas to run two 16 kW combined heat and power engine-generators. This size and capacity is a perfect fit for the waste stream generated at UCSC, currently 1.5 TPD with potential growth to 3 TPD. Digestate from the AD process is separated into solids and liquid, with the former applicable as compost feedstock and the latter treated in a wetlands biological system and available for irrigation. The article also highlights the project's beneficial educational components which would be virtually identical for an AD project at the Bowl.

The entire project was funded with a $1 million grant from the U.S. State Department. The AD system itself cost $150,000 and project leaders estimate that with sales of electricity at $0.17/kWh, the project will pay for itself in seven to ten years. Notably, even better economics may be possible at UCSC through the following avenues:

- Sale of the composted digestate;
- Reuse of the reclaimed water;
- Savings in fees for hauling and off-campus processing of these organics;
- On-campus use of the power;
- Potential savings from carbon emission reductions.

The feasibility of an on-campus AD project could be further enhanced by a composting facility at the Bowl, as this operation could handle the digestate from the AD process along with greenwaste and other organic waste streams. The Consultant Team recommends that the small AD option be further examined in future phases of the Consolidated Material Recovery Facility project.

IN-VESSEL MACHINE

Rotating Drum Type

There are several manufacturers of in-vessel composting machines, including the following:

- *Hot Rot*
- *BIOvator*
- *FOR Solutions*
- *EnviroDrum*
- *Black Earth*
- *Backus*
- *Tidy Earth*

These units are similar in that they are small, fully-enclosed vessels that either rotate or have mechanical mixers for agitation. Organic feedstock is fed in one end and, in a matter of a few days, raw compost is discharged from the other. This material will need to be further cured in piles, but the initial composting task is completed in the machine.

Although most compost is cured for weeks and even months beyond the "active" phase, it can be used directly after the active phase depending on the application. In its rawer form, compost continues to generate NH_3 and CO_2 gases and some farmers and vintners prefer this younger, more active material. However, for most applications, a mature compost is preferred.

BIOvator - Rotating Drum Type In-Vessel Composting Machine (Photo by Nioex Systems)

A compost's maturity is measured using the Solvita Index, which combines testing of ammonia (NH_3) and carbon dioxide (CO_2). For a detailed discussion, see the Solvita website at http://solvita.com/compost.

The advantage of in-vessel technology for application at UCSC is that its size matches the campus' organic waste stream (approximately 550 TPY). The units are compact and attractive for what they do. They can be located outside and are basically self-operating with labor required only to load the machine and perform routine maintenance. They are also modular, so an additional unit can easily be added as the organic waste stream grows. In-vessel composters range from $150,000 to $450,000 per unit in capital cost.

Larger Container Type

Several manufacturers build shipping-container-size in-vessel systems that typically feature front end mixers and feed conveyors to facilitate loading, air exhausted through a biofilter for odor control, and containment of any leachate. Ranging in installed cost from $300,000 for a basic system to $500,000 for a "fully loaded" configuration, these container systems can process a wide range of throughput tonnage from 1-2 tons per day (TPD) up to 50 TPD. The UCSC application would be at the lower range for these units.

Manufacturers include:

- *Engineered Compost Systems* (ECS)
- *Green Mountain Technologies*

The advantage of this technology is the high level of environmental control, compact footprint, large capacity range, and simplicity of operation. These traits make these units a good fit for UCSC, especially because the organic waste stream may grow significantly in the future paper towels and mixed organics diverted from the solid waste stream.

The material coming out of the compost unit still needs to be cured in piles for a period of up to two months. However, the "active" composting phase with the potential for greater air emissions and odor will have been completed inside the vessel.

Engineered Compost Systems (ECS) - Large Container Type In-Vessel Composting (Photo by ECS)

COVERED AERATED STATIC PILE

Textile Cover Type

Due to increasing restrictions regarding stormwater and air emissions, several of the newer, larger composting operations now being developed in California are covered aerated static piles (CASP).

The two most prominent manufacturers of these systems are:

- *GORE Cover Systems*
- *Engineered Compost Systems* (ECS)

These systems involve aeration pipes laid on the ground or imbedded in the paving and a textile cover. The GORE system uses a specialized cover that allows air to escape but traps heavier air contaminants, which are broken down by microbial action in the covered piles. GORE uses a positive aeration scheme, blowing air into the piles from below. The membrane cover both controls air pollution and sheds rainfall. The aeration channels also serve to collect leachate, which can be treated and reused. At UCSC, the initial six weeks of composting would occur under cover and in the controlled system; the final two weeks of curing would simply be in traditional windrows. At this point, the composting process is virtually complete and the material poses no significant environmental hazard to air or water.

ECS uses a simpler cover and a negative air system in which air is pulled down through the cover and the pile and exhausted to a biofilter for air emission control. The cover sheds rainfall and the system is designed to collect leachate as well.

One advantage of these types of systems is that they provide “in-vessel”-type control without having to construct machines or house the operation in a building. These systems also significantly reduce the amount of land required compared to traditional windrows. In addition, composting conditions are optimized such that the active composting time is reduced to four weeks and the entire process, including curing, is only two months, as compared to four months or longer for traditional windrow composting. These covered systems also provide

GORE - Cover System

very good environmental protection, controlling air emissions and water discharges, as well as a relatively neat appearance.

The critical disadvantage of textile-covered aerated static piles for application at UCSC is that these are larger systems designed for waste streams ten times or more the size of the campus'.

Compost Blanket Type

Another variation of the aerated static pile system uses finished compost applied as a 6 to 12-inch "blanket" over the active windrows instead of a textile cover. This, in effect, works as a biofilter on the windrow; recent research and development tests have shown high reduction of volatile organic compounds (VOCs) with this simple system, if properly designed and operated—close to that of textile covered systems, in fact. If further tests show similar positive results, it would be possible to include other system manufacturers to the list of potential system providers, such as Green Mountain, who provide the aeration system, but no textile cover, .

The final conclusion, however, is that an aerated static pile is not a cost effective solution for UCSC's organic waste stream.

TRADITIONAL WINDROW

With proper controls, UCSC could use traditional windrow composting at the Bowl. This would involve mixing food waste with wood chips or other ground carbonaceous material available on campus, and building windrows that are typically 6-8 feet high, 15-20 feet wide, and 100 feet long or longer, depending on site configuration and size. For this scale of operation, a wheeled loader can be used to construct and turn the piles.

The advantage of windrow composting, and the reason it is by far the most common method in California, is its simplicity. All one needs is a loader and a screen, and perhaps a grinder for the wood or greenwaste, and a piece of relatively flat land. At the Bowl, the agricultural-looking windrows would blend with the look of the farm. The windrows are turned and perhaps watered, depending on the climate, in order to maintain optimal temperatures, oxygen, and moisture for the micro-organisms that do the work. Reclaimed water can be used, if available.

A disadvantages of windrow composting is that it takes a comparatively long time, approximately four months, plus or minus thirty days. Consequently, it also requires a lot of space—an area of approximately 20,000 s.f. is anticipated to fill UCSC's

Tierra Verde Industries, Irvine - Windrow Compost System needs. This technique also provides little in the way of air emission reductions, yet recent research by CalRecycle, the San Joaquin Valley Air Pollution Control District, and others has shown that VOC emissions can be reduced by watering the windrows before turning, and even more so by covering the active windrows with a 6 to12-inch blanket of finished compost. Decreased stormwater control is another disadvantage of the open windrow system. While stormwater runoff can be controlled to a certain degree by on-site capture and control systems that minimize the impact of rain contacting the material in the windrows, the level of stormwater control is not as extensive as with in-vessel systems.

The initial windrows may appear unsightly with the mixture of paper, plastic utensils, and other organics. Also, the "active phase" windrows containing food waste and compostable paper would be more susceptible to vector infestation such as rats, mice, and birds; rodent presence may then attract coyotes. This risk could be minimized by appropriate design strategies. Note: This issue would not be expected for the "curing phase" of compost processed in an in-vessel compost unit.

Windrow composting requires more labor for maintenance of the active windrows than the in-vessel machines, and an experienced manager to keep the system in balance to produce a good product. However, it should be noted that any of these composting techniques will require an experienced person to manage them.

VERMICULTURE

Vermiculture is gaining popularity in California as an adjunct to composting. This operation can either be conducted in small windrows (similar to the larger compost windrows) or at a smaller scale, through in-vessel systems.

In both systems, red-wriggler worms process either raw organics (a blend of food waste and additives like pine shavings or stable bedding) or partially composted organics, such as the material discharged from an in-vessel composting machine. In some operations, food waste and other feedstocks are ground as they are mixed to optimize particle size for worm consumption.

The worms eat the organic material and excrete one of the best organic fertilizers available: “worm castings”. These castings can be blended as-is with other ingredients to create a multitude of soil amendment and fertilizer products or can be diluted into a liquid fertilizer called “tea”. UCSC farm management has already expressed an interest in this product and may be a willing partner in the vermiculture operation, as long as the castings and tea meet the farm's organic standards. Note: The worms would process only a portion of the material, so regular composting would also be required on site.

Oak Tree Worm Farm - Vermiculture

The benefit of an in-vessel system is that it automatically collects the castings and tea and provides a tightly controlled environment. Unfortunately, such systems are best suited to very small settings, such as hotels or restaurants, and are generally used where windrow composting is not possible. Depending on the size of vermiculture operation that UCSC desires, these in-vessel systems may be an option, although with composting also occurring at the site, the simpler windrow vermiculture method is probably preferable. The main advantage of vermiculture is the very high value of the final product as compared to the products made, for example, from composting greenwaste. In addition, the worm operation is usually of interest to school children and other visitors, thus providing a valuable educational exhibit on organic sustainability.

The primary disadvantage of vermiculture is that it is almost always a small-scale operation, with the worms consuming about half their body weight per day, depending on climate, food source, and other factors. It takes months to build up the worm population to the point where they can make even a small commercial operation viable. Given the size of UCSC's waste stream, vermiculture actually fits the scale of the campus system well.

Even more than composting, vermiculture requires a skilled and experienced operator. This cannot be overemphasized. Vermiculture is a living system and one critical mistake--overheating or lack of moisture--can lead to a mass die off of worms and the system must begin anew. In addition, the proper feeding, maintenance of environmental conditions in the small windrows, and ultimate separation of worms from castings requires a trained eye.

ACADEMIC CALENDAR NOTE

One complicating factor related to on-campus composting is the fluctuation of organic waste production in relation to the academic calendar. The latest information from Grounds Services shows that the months of August and September are the least productive months of the year when food waste generation drops to near zero.

This is offset to some degree by the increase in grass clippings during those summer months, and may also be modulated by increases in summer organics with the start of the new program of pulling paper towels and mixed organics from the campus buildings.

The compost windrows can continue to cure and mature during the summer months and the vermiculture operation would require a "maintenance"-level of food waste to keep the worms alive and well at a subsistence level until volumes pick back up again.

In conclusion, the changes in organic waste production throughout the year are not considered a significant issue.

ASSOCIATED COSTS FOR COMPOSTING ALTERNATIVES

The tables on the following pages show the costs and revenues associated with each of the composting systems considered for application at UCSC:

- Traditional Windrow
- In-Vessel Machine
- Vermiculture (add-on)

Note: Anaerobic Digestion is not included in these cost analyses because the Consultant Team learned of appropriate small-scale systems immediately before release of study.

There is a correlation between cost and level of environmental control: the higher the level of control and enclosure, the higher the cost. Educational value is a more abstract consideration and is difficult to monetize.

Key assumptions used in preparing these tables:

- New equipment to be purchased, depending on the alternative, may include:
  - one small loader ($100,000)
  - one Rotochopper MP2 ($300,000)
  - one trommel screen ($50,000)
  - one worm trommel screen ($35,000)
  - one in-vessel composting unit(s) ($400,000)
- Equipment operating time varies depending on alternative and was factored into O&M costs.
- Labor:
  - One part-time to full-time manager/equipment operator would run the entire facility ($25/hour plus 35% benefits;
  - One part-time laborer ($10/hour plus 35% benefits).
- Feedstock: the current food waste generation of roughly 560 TPY, plus 140-560 TPY of ground green and wood waste as bulking agent, to form the blend for composting, depending on the technology used.
- No costs for land, site improvements, utilities, or structures were included. However, these costs, amortized over 20 years or more, are typically minor compared to the annual operating costs.
- Final product revenue:
  - $40/ton compost
  - $600/ton worm castings (wholesale price).
- The addition of 400 to 500 TPY of paper towels and mixed organics from the solid waste stream could require additional in-vessel compost machines, depending on the technology. However, this approximate doubling in capacity would make a more efficient operation as it would be handled by the same labor and equipment.

As shown in the tables on the following pages, the composting operation is expensive, primarily because of its small size. Taking credit for the revenues for final product sale, traditional windrow composting of the current food waste, blended with ground green and wood waste, would cost approximately $150,000 per year, plus $11,500 for permitting. Using in-vessel technology would increase the net cost to $175,000 per year, but would afford better environmental controls. Adding vermiculture to either composting operation would add another $30,000 per year to the net cost. See figure on next page for a summary.

These costs can be compared to the current cost of hauling the food waste to the Marina Landfill ($34,500 per year) and paying the tipping fee for digestion and composting of $42/ton ($23,585 per year), for a total annual cost of about $58,000.

In addition, UCSC paid $6,650 in tipping fees for 217 tons of greenwaste delivered to the nearby City of Santa Cruz RRF at $30.72/ton.

Thus the total cost for the 2012-2013 year for delivering organics to off-campus facilities was approximately $65,000.

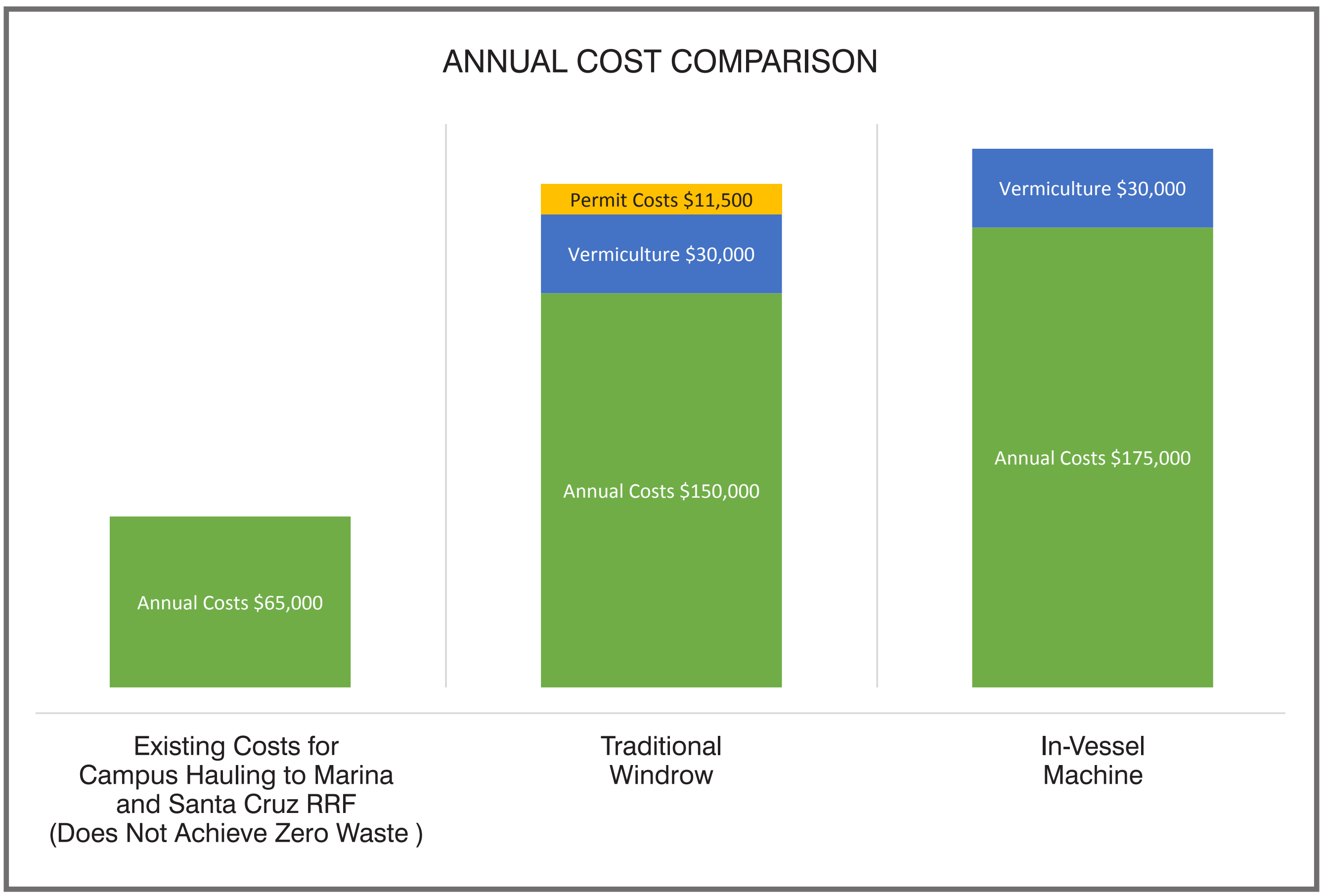
These costs are for the existing organics system at UCSC, covering only the food waste from the dining halls. In order for the campus to meet its Zero Waste by 2020 mandate, however, other methods of diversion must be found. The largest potential is the recovery of paper towels and mixed organics from the solid waste stream, estimated at up to 500 additional TPY.

As previously mentioned, Marina Landfill and Z-Best have stated that they will not take this additional organic stream for either AD or composting. Therefore, any analysis of future economic impact must shift to an on-campus solution.

FINDING

Given the greater flexibility, control, and educational components of the on-campus alternative, and the inability to meet Zero Waste by 2020 goals with off-campus options, implementing an on-campus composting solution is UCSC's only path.

As detailed above, an in-vessel system appears to be the most appropriate option for UCSC's needs due to its high level of environmental control, compact footprint, large capacity range, and simplicity of operation.



OPERATING PROFORMA

	Traditional			In-Vessel			Vermi-Culture		
REVENUE	*Annual Tons*	*$/ton*	**Annual**	*Annual Tons*	*$/ton*	**Annual**	*Annual Tons*	*$/ton*	**Annual**
Commodity Sales	*630*	*$40.00*	25,200	*630*	*$40.00*	25,200	*50*	*$600.00*	30,000
Total Revenue	*840*	***$30.00***	***25,200***	*840*	***$30.00***	***25,200***	*60*	***$500.00***	***30,000***
Operational Expenses									
Wages		*$92.66*	77,831		*$70.94*	59,586		*$309.79*	18,587
Equipment O&M		*$65.00*	54,600		*$49.91*	41,928		*$346.67*	20,800
Sub-Total		***$157.66***	***132,431***		***$120.85***	***101,514***		***$656.46***	***39,387***
G&A		*$0.00*			*$0.00*			*$0.00*	
Interest & Depreciation									
Interest		*$20.53*	17,241		*$38.85*	32,637		*$85.29*	5,117
Depreciation		*$58.67*	49,286		*$106.29*	89,286		*$296.43*	17,786
Sub-Total		***$79.20***	**66,527**		***$145.15***	**121,923**		***$381.72***	**22,903**
Total Expense		***$236.85***	**198,958**		***$266.00***	**223,436**		***$1,038.17***	**62,290**
Profit/Loss		***($206.85)***	**(173,758)**		***($236.00)***	**(198,236)**		*($538.17)*	**(32,290)**

SALARIES AND WAGES SCHEDULE

Traditional Windrow

Classification	Regular Rate	Annual Regular Hours	Annual Base Pay	Annual Payroll Tax	Annual Workers Comp	Pension	Medical	Annual Total	Loaded Hourly Rate	Qty	Annual Total	OT Rate	Annual OT Hours	Annual OT Pay	Annual OT Payroll Tax	Annual OT Workers Comp	Annual OT Total	Loaded OT Hourly Rate	OT Qty	Annual OT Total	Grand Total
Facility Manager/Equip Op	24.25	2,080.0	50,440	4,202	7,566	1,513	9,600	73,321	35.25	1.000	**73,321**	36.38	-	-	-	-	-	-	-	-	**73,321**
Labor	10.00	2,080.0	20,800	1,934	3,120	624	9,600	36,078	17.35	0.125	**4,510**	15.00	-	-	-	-	-	-	-	-	**4,510**
SUB-TOTALS		4,160.0	71,240.0	6,135.9	10,686.0	2,137.2	19,200.0	109,399.1	26.30	1.125	**77,831**		-	-	-	-	-	-	-	-	**77,831**
Percent			*65.1%*	*5.6%*	*9.8%*	*2.0%*	*17.6%*	*100.0%*						0.0%	0.0%	0.0%	0.0%				
							34.9%														

In-Vessel

Classification	Regular Rate	Annual Regular Hours	Annual Base Pay	Annual Payroll Tax	Annual Workers Comp	Pension	Medical	Annual Total	Loaded Hourly Rate	Qty	Annual Total	OT Rate	Annual OT Hours	Annual OT Pay	Annual OT Payroll Tax	Annual OT Workers Comp	Annual OT Total	Loaded OT Hourly Rate	OT Qty	Annual OT Total	Grand Total
Facility Manager/Equip Op	24.25	1,560.0	37,830	3,237	5,675	1,135	7,200	55,076	35.31	1.0	**55,076**	36.38	-	-	-	-	-	-	-	-	**55,076**
Labor	10.00	2,080.0	20,800	1,934	3,120	624	9,600	36,078	17.35	0.125	**4,510**	15.00	-	-	-	-	-	-	-	-	**4,510**
SUB-TOTALS		3,640.0	58,630.0	5,171.2	8,794.5	1,758.9	16,800.0	91,154.6	25.04	1.125	**59,586**		-	-	-	-	-	-	-	-	**59,586**
Percent			*64.3%*	*5.7%*	*9.6%*	*1.9%*	*18.4%*	*100.0%*						0.0%	0.0%	0.0%	0.0%				
							35.7%														

Vermi-Culture

Classification	Regular Rate	Annual Regular Hours	Annual Base Pay	Annual Payroll Tax	Annual Workers Comp	Pension	Medical	Annual Total	Loaded Hourly Rate	Qty	Annual Total	OT Rate	Annual OT Hours	Annual OT Pay	Annual OT Payroll Tax	Annual OT Workers Comp	Annual OT Total	Loaded OT Hourly Rate	OT Qty	Annual OT Total	Grand Total
Facility Manager/Equip Op	24.25	520.0	12,610	1,308	1,892	378	2,400	18,587	35.75	1.0	**18,587**	36.38	-	-	-	-	-	-	-	-	**18,587**
SUB-TOTALS		520.0	12,610	1,308	1,892	378	2,400	18,587	35.75	1.0	**18,587**		-	-	-	-	-	-	-	-	**18,587**
Percent			*67.8%*	*7.0%*	*10.2%*	*2.0%*	*12.9%*	*100.0%*						0.0%	0.0%	0.0%	0.0%				
							32.2%														

EQUIPMENT O&M SCHEDULE

Traditional Windrows		**Unit**	**$/Unit**	**Monthly Expense**	**Annual Expense**	**Notes**	Gal/Hr	Gal	$/Gal	$/Month	$/Year	Non Fuel
CAT 914 Loader	*hrs*	86.7	25.00	$ 2,167	$ 26,000		5	433.33	4	1,733.33	20,800	$ 5,200
Small Trommel	*hrs*	43.3	25.00	$ 1,083	$ 13,000		5	216.67	4	866.67	10,400	$ 2,600
Rotochopper	*hrs*	17.3	75.00	$ 1,300	$ 15,600		15	260.00	4	1,040.00	12,480	$ 3,120
Total Equipment				**4,550**	**54,600**							

In-Vessel		**Unit**	**$/Unit**	**Monthly Expense**	**Annual Expense**	**Notes**						
CAT 914 Loader	*hrs*	43.3	25.00	$ 1,083	$ 13,000		5	216.67	4	866.67	10,400	$ 2,600
Small Trommel	*hrs*	43.3	25.00	$ 1,083	$ 13,000		5	216.67	4	866.67	10,400	$ 2,600
Rotochopper	*hrs*	17.3	75.00	1,300	15,600		15	260.00	4	1,040.00	12,480	$ 3,120
Composter	*hrs*	86.7	$0.32	27	328							
Total Equipment				**3,494**	**41,928**							

Vermiculture		**Unit**	**$/Unit**	**Monthly Expense**	**Annual Expense**	**Notes**						
CAT 914 Loader	*hrs*	43.3	25.00	$ 1,083	$ 13,000		5	216.67	4	866.67	10,400	$ 2,600
Worm trommel	*hrs*	43.3	15.00	$ 650	$ 7,800		3	130.00	4	520.00	6,240	$ 1,560
Total Equipment				**1,733**	**20,800**							

ELECTRICAL	
HP	
Composter	5
	5
Conversion Factor	0.75
Total KW	3.75
Eff	70.0%
KW Consumption per Hr	2.625
Rate	$0.12
$ KW Per Hour	$0.32

INTEREST DEPRECIATION

Traditional Windrow

Principal	Price	QTY	Total	Years	Depre	Int	0	12	24	36	48	60	72	84	96	108	Total
CAT 914 Loader	$100,000	1.0	100,000	7	(14,286)	4.0%	(12,632)	(13,147)	(13,683)	(14,240)	(14,820)	(15,424)	(16,053)	-	-	-	(100,000)
Trommel	$50,000	1.0	50,000	10	(5,000)	4.0%	(4,150)	(4,319)	(4,495)	(4,678)	(4,869)	(5,067)	(5,274)	(5,489)	(5,712)	(5,945)	(50,000)
Rotochopper MP2	$300,000	1.0	300,000	10	(30,000)	4.0%	(24,901)	(25,916)	(26,972)	(28,071)	(29,214)	(30,405)	(31,643)	(32,933)	(34,274)	(35,671)	(300,000)
Total Principal			450,000		(49,286)		(41,684)	(43,383)	(45,150)	(46,989)	(48,904)	(50,896)	(52,970)	(38,421)	(39,987)	(41,616)	(450,000)
Interest																	
CAT 914 Loader							(3,770)	(3,255)	(2,720)	(2,162)	(1,582)	(978)	(350)	-	-	-	(14,818)
Trommel							(1,924)	(1,755)	(1,579)	(1,396)	(1,206)	(1,007)	(801)	(586)	(362)	(130)	(10,747)
Rotochopper MP2							(11,547)	(10,532)	(9,476)	(8,378)	(7,234)	(6,044)	(4,805)	(3,516)	(2,174)	(778)	(64,482)
Total Interest							(17,241)	(15,543)	(13,776)	(11,936)	(10,022)	(8,029)	(5,956)	(4,102)	(2,536)	(907)	(90,048)
Principal & Interest																	
CAT 914 Loader (used)							(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	-	-	-	(114,818)
Trommel							(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(60,747)
Rotochopper MP2							(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(364,482)
Total P&I							(58,926)	(58,926)	(58,926)	(58,926)	(58,926)	(58,926)	(58,926)	(42,523)	(42,523)	(42,523)	(540,048)

In-Vessel

Principal	Price	QTY	Total	Years	Depre	Int	0	12	24	36	48	60	72	84	96	108	Total
CAT 914 Loader	$100,000	1.0	100,000	7	(14,286)	4.0%	(12,632)	(13,147)	(13,683)	(14,240)	(14,820)	(15,424)	(16,053)	-	-	-	(100,000)
Trommel	$50,000	1.0	50,000	10	(5,000)	4.0%	(4,150)	(4,319)	(4,495)	(4,678)	(4,869)	(5,067)	(5,274)	(5,489)	(5,712)	(5,945)	(50,000)
Rotochopper MP2	$300,000	1.0	300,000	10	(30,000)	4.0%	(24,901)	(25,916)	(26,972)	(28,071)	(29,214)	(30,405)	(31,643)	(32,933)	(34,274)	(35,671)	(300,000)
Composter	$400,000	1.0	400,000	10	(40,000)	4.0%	(33,202)	(34,555)	(35,962)	(37,428)	(38,953)	(40,540)	(42,191)	(43,910)	(45,699)	(47,561)	(400,000)
Total Principal			850,000		(89,286)		(74,886)	(77,937)	(81,112)	(84,417)	(87,856)	(91,436)	(95,161)	(82,331)	(85,686)	(89,177)	(850,000)
Interest																	
CAT 914 Loader							(3,770)	(3,255)	(2,720)	(2,162)	(1,582)	(978)	(350)	-	-	-	(14,818)
Trommel							(1,924)	(1,755)	(1,579)	(1,396)	(1,206)	(1,007)	(801)	(586)	(362)	(130)	(10,747)
Rotochopper MP2							(11,547)	(10,532)	(9,476)	(8,378)	(7,234)	(6,044)	(4,805)	(3,516)	(2,174)	(778)	(64,482)
Composter							(15,396)	(14,043)	(12,635)	(11,170)	(9,645)	(8,058)	(6,407)	(4,688)	(2,899)	(1,037)	(85,977)
Total Interest							(32,637)	(29,586)	(26,411)	(23,106)	(19,667)	(16,087)	(12,362)	(8,789)	(5,435)	(1,944)	(176,024)
Principal & Interest																	
CAT 914 Loader							(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	-	-	-	(114,818)
Trommel							(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(6,075)	(60,747)
Rotochopper MP2							(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(36,448)	(364,482)
Composter							(48,598)	(48,598)	(48,598)	(48,598)	(48,598)	(48,598)	(48,598)	(48,598)	(48,598)	(48,598)	(485,977)
Total P&I							######	######	######	######	######	######	######	(91,121)	(91,121)	(91,121)	#######

Vermiculture

Principal	Price	QTY	Total	Years	Depre	Int	0	12	24	36	48	60	72	84	96	108	Total
CAT 914 Loader	$100,000	1.0	100,000	7	(14,286)	4.0%	(12,632)	(13,147)	(13,683)	(14,240)	(14,820)	(15,424)	(16,053)	-	-	-	(100,000)
Small Trommel	$35,000	1.0	35,000	10	(3,500)	4.0%	(2,905)	(3,024)	(3,147)	(3,275)	(3,408)	(3,547)	(3,692)	(3,842)	(3,999)	(4,162)	-
Total Principal			135,000		(17,786)		(15,538)	(16,171)	(16,830)	(17,515)	(18,229)	(18,971)	(19,744)	(3,842)	(3,999)	(4,162)	(100,000)
Interest																	
CAT 914 Loader (used)							(3,770)	(3,255)	(2,720)	(2,162)	(1,582)	(978)	(350)	-	-	-	(14,818)
Small Trommel							(1,347)	(1,229)	(1,106)	(977)	(844)	(705)	(561)	(410)	(254)	(91)	(7,523)
Total Interest							(5,117)	(4,484)	(3,825)	(3,140)	(2,426)	(1,683)	(910)	(410)	(254)	(91)	(22,341)
Principal & Interest																	
CAT 914 Loader (used)							(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	(16,403)	-	-	-	(114,818)
Small Trommel							(4,252)	(4,252)	(4,252)	(4,252)	(4,252)	(4,252)	(4,252)	(4,252)	(4,252)	(4,252)	(42,523)
Total P&I							(20,655)	(20,655)	(20,655)	(20,655)	(20,655)	(20,655)	(20,655)	(4,252)	(4,252)	(4,252)	(157,341)

DESCRIPTION OF A CONSOLIDATED MATERIAL RECOVERY FACILITY

All current and future waste diversion operations, including the organics processing, have been identified and gross square footage (GSF) of space requirement based on anticipated 2020 levels have been assigned (see figure below).

PROGRAM	AREA (GSF)
RESOURCE RECOVERY	
RECYCLABLES SORTING LINE[1]	7,000 GSF
RECYCLABLES TIPPING AREA[1]	1,000 GSF
MIXED PAPER SORTING AND STORAGE[1]	1,000 GSF
CARDBOARD BALING AND STORAGE[1]	900 GSF
BATTERY SORTING AND STORAGE[1]	400 GSF
CONSTRUCTION AND DEMOLITION MATERIALS	15,000 GSF
BINS AND EQUIPMENT	10,000 GSF
ORGANIC SYSTEMS	
GREENWASTE	15,000 GSF
FOOD WASTE TIPPING/PROCESSING[2]	1,000 GSF
COMPOST BLENDING AREA[2]	500 GSF
IN-VESSEL COMPOSTER[2]	1,000 GSF
COMPOST SCREENING	500 GSF
CURING WINDROWS	20,000 GSF
VERMICULTURE WINDROWS	16,000 GSF
GENERAL	
BATHROOM/ADMINISTRATION SPACE[1]	1,000 GSF
PARKING AREA (6 cars + 1 bus)	3,000 GSF
TRUCK ACCESS AND MANEUVERING	40,000 GSF
STORMWATER TREATEMENT	5,000 GSF
TOTAL	
	138,000 GSF
	3.2 ACRES
[1] DENOTES RESOURCE RECOVERY WITHIN THE MRF	11,300 GSF
[2] DENOTES ORGANIC SYSTEMS WITHIN THE MRF	2,500 GSF

All program elements that include mechanical equipment or require cover from rainfall are part of the Material Recovery Facility (MRF). The MRF includes:

- the sorting line,
- paper sorting and storage,
- cardboard baling and storage,
- battery sorting and storage.

If composting is initiated, a food waste tipping area and in-vessel composter would be housed within the MRF. This study includes the necessary GSF to phase-in the composting component.

Grounds Services has stated that approximately twelve visitors each month tour the sorting line. If all activities were concentrated in one location, there is a potential for an increase in visitation and educational opportunities. Encouraging facility visits and tours could also increase recycling awareness and improve recycling results across campus. Since education and outreach are part of the long-term success of achieving Zero Waste, the program includes an Administration space for use by visitors and staff. The Administration space will be a flexible space appropriate for personnel training and meetings held at Grounds Services facilities, plus will include an accessible restroom.

Consolidating material recovery activities will create greater efficiencies for Grounds Services and remove the ad-hoc service and pick-up areas distributed throughout campus. It will also concentrate circulation of Grounds Services recycling trucks to one area of campus. Grounds Services estimates that there will be fifteen trips to the facility per day, totaling 75 trips per week.

PERMIT REQUIREMENTS

The recycling activities the Campus performs do not fall within the Standard Industrial Classification (SIC) codes for industrial activities triggering the need for an industrial general permit. The Campus currently manages stormwater in each of the recycling locations through implementation of its Storm Water Management Program under its General Permit for Municipal Separate Storm Sewer Systems (MS4). This will continue when activities are consolidated into one location. All constituents of concern will be identified and treated on site.

Through the course of this study, all permit requirements were reviewed and addressed. A description of the Campus' different alternatives if the activities did, in fact, trigger an industrial permit requirement follow for reference only.

The State Water Resources Control Board adopted the new National Pollution Discharge Elimination System (NPDES) General Permit on April 1, 2014 that will become effective July 1, 2015. Under this new permit, projects can apply for a Notice of Non-Applicability (NONA) if the facility does not discharge to waters of the United States. The permit regulations state that the facility must be either of the below:

a. "Engineered and constructed to contain all storm water associated with industrial activities from discharging to waters of the United States, including no discharge to groundwater that has a direct hydrologic connection to waters of the United States."[1]
b. "Located in basins or other physical locations that are not hydrologically connected to water of the United States."[2]

In order to apply for a NONA, the Campus must submit through the Storm Water Multi-Application Reporting and Tracking System (SMARTS) a NONA Technical Report that is wet-signed by a California-licensed professional engineer.

If the project does not qualify for a NONA, it would be advantageous to ensure that a No Exposure Certification (NEC) would be obtained. The Campus would have to apply every year through SMARTS for the NEC and pay a fee (currently $242 and subject to change). To achieve No Exposure, "all industrial materials and activities are protected by storm-resistant shelter to prevent exposure to rain, snow, snowmelt and/or runoff."[3] A storm-resistant shelter can be a roofed-only structure with permanent supports as long as there are no materials inside that are being carried out via wind or tracking. Dumpsters, bins, and barrels can be stored outside as long as they are lidded and do not have any holes where materials can leak out of the bottom. Materials that are considered final products can be stored uncovered outside as these items generally do not contain stormwater contaminants.

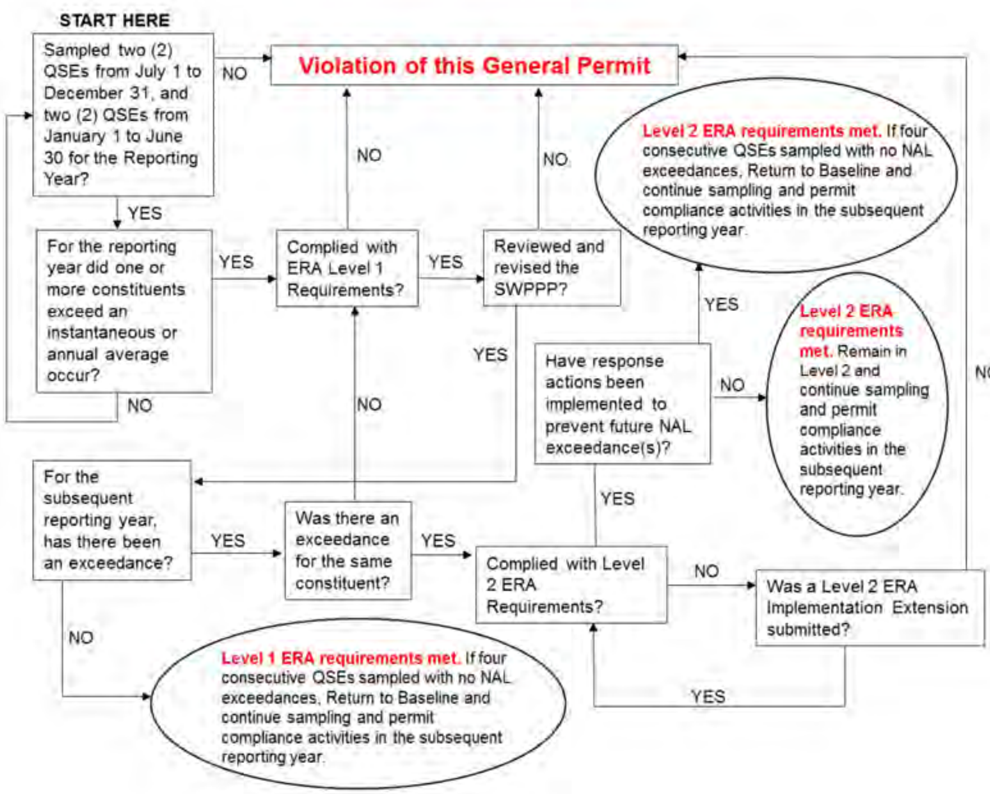
Facilities that do not qualify for an exemption must file a Notice of Intent (NOI) with fee (currently $1,359 and subject to change) and Permit Registration Documents, including a Stormwater Pollution Prevention Plan (SWPPP). Each year, the facility will be required to perform monitoring requirements and submit Annual Reports to the State Water Board via SMARTS.

Sampling stormwater discharge would be required and the Campus Stormwater Programs Manager would submit the sampling results to the State Water Board via SMARTS. Monitoring requirements include:

- Visual inspection once per month for non-

1 "National Pollution Discharge Elimination System General Permit Fact Sheet," State Water Resources Control Board, p.70.
2 SWRCB, p.70.
3 SWRCB, Appendix 2, p.3.

COMPLIANCE DETERMINATION FLOWCHART



Industrial General Permit Fact Sheet, Adopted April 1, 2014, Effective July 1, 2015, p.45

stormwater discharge and potential sources of industrial pollutants.

- Sampling at each representative drainage location is required four times per year during Qualifying Storm Events (QSE). Two QSE's must be sampled in each half of the reporting year. "The General Permit defines a QSE as a precipitation event that produces a discharge for at least one drainage area; and is preceded by 48 hours with no discharge at any drainage area."[4]

In the event that sampling and analysis indicates water quality has been affected, there are two different response action levels (see flowchart above). The first exceedance of a water quality standard will trigger a Level 1 review and revision of the SWPPP by a Qualified Industrial Stormwater Practitioner (QISP). This likely includes alteration to existing BMP's to increase their effectiveness.

If the exceedance occurs again after Level 1 changes are implemented, Level 2 requirements are triggered. At Level 2, a QISP must develop an action plan and then prepare a technical report evaluating the effectiveness of the plan. Level 2 likely requires the addition of structural controls to existing BMP's. These reports, monitoring results, and the SWPPP are submitted annually to SMARTS and become public information. A significant amount of work will be required of Campus staff or a hired consultant to do the required reporting and any additional Level 1

4 SWRCB, p.7

or Level 2 changes to meet the IGP requirements.

The matrix on the following pages identifies all potential pollutants associated with each recycling activity, proposed source control, and potential treatment methods. Stormwater contaminants such as silts, inorganic contaminants, and organic chemicals and pathogens will be first treated by routing the runoff through either a vegetated bio-swale or a bio-retention area prior to entering the detention facility. If additional treatment is required prior to reaching the detention facility, a mechanical filter treatment unit could be added to the treatment train.

POTENTIAL POLLUTION SOURCES AND BEST MANAGEMENT PRACTICES

PROGRAM ELEMENT	ACTIVITY	POLLUTANT SOURCES	POLLUTANT	SOURCE CONTROL	TREATMENT CONTROL
RESOURCE RECOVERY					
SORTING LINE	Recyclable materials are sorted, including cans, glass containers, and plastics	Combined unknown liquids from bins and trucks; conveyor belt; windblown trash; natural gas, propane, oil; tracking from vehicles; wash area for trucks and bins	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS; nitrogen, phosphorous	Roof or cover; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Sanitary Sewer Connection
MIXED PAPER SORTING AND STORAGE	Paper products are sorted then either picked up by a vendor for reuse or composted	Fuel, oil, grease from trucks and loader; leachate from inks, bleach, coatings; windblown debris	ORGANIC CHEMICALS: oil, gasoline, grease; SEDIMENT	Roof or cover; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Sanitary Sewer Connection
CARDBOARD BALING AND STORAGE	Cardboard products are sorted then either picked up by a vendor for reuse or composted	Fuel, oil, grease from trucks and loader; leachate from inks, bleach, coatings; windblown debris	ORGANIC CHEMICALS: oil, gasoline, grease; SEDIMENT	Roof or cover; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Sanitary Sewer Connection
BATTERY SORTING AND STORAGE	Batteries are sorted and stored before bulk disposal	Battery storage	METALS: zinc, cadmium, copper, mercury, lithium	Roof or cover; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Sanitary Sewer Connection
CONSTRUCTION AND DEMOLITION MATERIALS	Materials from campus construction and demolition projects are sorted, then stored or hauled off for reuse	Fuel, oil, grease from trucks, loader; tracking from vehicles; chemicals from treated and painted products; leachate from concrete and asphalt grindings; leachate from rust, painted, treated metal products	METALS: zinc, cadmium, copper, chromium, arsenic, lead; ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS; nitrogen, phosphorous; BOD: hydrocarbons; SEDIMENT	Cover from rainfall; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Bio-Filtration; Detention and Settling; Mechanical Filtration
BINS AND EQUIPMENT	Storage for dumpsters, debris boxes, bins and cans; idle equipment storage	wash area, oxidation, diesel/gas refueling, hydraulic fluid, paint	ORGANIC CHEMICALS: oil, gasoline, grease; SEDIMENT	Protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Bio-Filtration; Detention and Settling; Mechanical Filtration

POTENTIAL POLLUTION SOURCES AND BEST MANAGEMENT PRACTICES, cont'd

ORGANIC SYSTEMS					
GREENWASTE	Tree trimmings and other landscape materials are chipped and stored; active piles and stockpiles; mulch	Fuel, oil, grease from grinder, trucks, loader; tracking from vehicles; pathogens from vermin; windblown dust, leaves, clippings	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS; nitrogen, phosphorous; PATHOGENS: bacteria, protozoa; BOD: hydrocarbons,grass clippings, leaves, animal waste; SEDIMENT	Cover from rainfall; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Bio-Filtration; Detention and Settling; Mechanical Filtration
FOODWASTE TIPPING/PROCESSING	Foodwaste tipping and loading into bio-bin or in-vessel composter	combined unknown liquids from bins, trucks, loader; tracking from vehicles; wash area for trucks, loader, bins	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS; nitrogen, phosphorous; PATHOGENS: bacteria, protozoa; BOD: hydrocarbons; SEDIMENT	Roof or cover; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sump; trench drain to sanitary sewer	Sanitary Sewer Connection
IN-VESSEL COMPOSTER	Contained unit for processing and composting; loading requirements vary by size/manufacturer	Conveyor belt; fuel, oil, grease from diesel generator, trucks, loader; tracking from vehicles; spills from loading/unloading; effluent from finished product	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS: nitrogen, phosphorous; SEDIMENT	Roof or cover; protect from run-on using grading and berms; grade area to direct flow toward inlet with shut-off valve or dead-end sum; trench drain to sanitary sewer	Sanitary Sewer Connection
COMPOST SCREENING	Before/after in-vessel processing compost is screened to remove large debris	Fuel, oil, grease from loader; tracking from vehicles; effluent from finished product; wind blown dust and sediment	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS: nitrogen, phosphorous; SEDIMENT	Protect from run-on using grading and berms; grade area to direct flow to treatment train	Bio-Filtration; Detention and Settling; Mechanical Filtration
CURING WINDROWS	Compost left in windrows to cure for up to a few months; may be turned occasionally with loader	Fuel, oil, grease from loader; tracking from vehicles; pathogens from vermin; nutrients may leach from windrows	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS; nitrogen, phosphorous; PATHOGENS: bacteria, protozoa; BOD: hydrocarbons; SEDIMENT	Protect from run-on using grading and berms; grade area to direct flow to treatment train	Bio-Filtration; Detention and Settling; Mechanical Filtration
VERMICULTURE WINDROWS	Compost left in windrows to be decomposed by worms; may be turned occasionally with loader	Fuel, oil, grease from loader; tracking from vehicles; pathogens from vermin; nutrients may leach from windrows	ORGANIC CHEMICALS: oil, gasoline, grease; NUTRIENTS; nitrogen, phosphorous; PATHOGENS: bacteria, protozoa; BOD: hydrocarbons, animal waste; SEDIMENT	Protect from run-on using grading and berms; grade area to direct flow to treatment train	Bio-Filtration; Detention and Settling; Mechanical Filtration
GENERAL					
PARKING AREA	For vehicles, trucks, and equipment	Fuel, oil, grease from trucks, equipment; sediment	ORGANIC CHEMICALS: oil, gasoline, grease; SEDIMENT	Grade area to direct flow to treatment train	Bio-Filtration; Detention and Settling; Mechanical Filtration
BATHROOM/TRAINING ROOM					Sanitary Sewer Connection

OVERVIEW

This section of the study provides an analysis of two sites identified as potential locations on campus for a consolidated material recovery facility. This analysis considers potential impacts of consolidating all the activities into one location and concludes with a recommendation for the preferred site.

CAMPUS AERIAL OF THE TWO POTENTIAL SITES

SITE OPTION 1: THE BOWL

The Bowl is located close to the main entrance of campus. It is approximately 5 to 6 acres and is a relatively level and open site. Consisting of grassland and coyote brush scrub, it is bordered to the south by a cypress row which separates it from the Center for Agroecology and Sustainable Food Systems (CASFS) and organic farm. The site meets UCSC's current material recovery needs and, with thoughtful planning and design, is able to meet future needs for resource recovery. In addition, the site has the capacity to include organics processing. While being adjacent to CASFS may require design considerations to attenuate noise and possible scheduling of work at the consolidated material recovery facility in order to not interfere with interns housed on the Farm, it offers the potential for a partnership for processing organics.

Portions of the Bowl are currently designated Protected Landscape and Site Research and Support in the 2005 Long Range Development Plan (LRDP). With selection of this site, approximately 3½ to 4 acres would need to be redesignated as Campus Support, requiring a minor amendment to the LRDP.

View of the Bowl from northeast of site (photo by JLJA)

View of the Great Meadow and existing greenwaste and landscape supply piles (photo by JLJA)

Opportunities

- Composting, outreach, and educational program compatible with CASFS, Life Lab, and Arboretum.
- Close to campus entry for off-site transfer of materials.
- Existing vegetation reduces potential visual impacts.
- Space allows for efficient function and circulation of recycling yard and salvage needs.
- Potential for expansion to aid in achieving Zero Waste by 2020.
- Good potential for solar energy array.
- Grassland/meadow conducive to stormwater management measures.

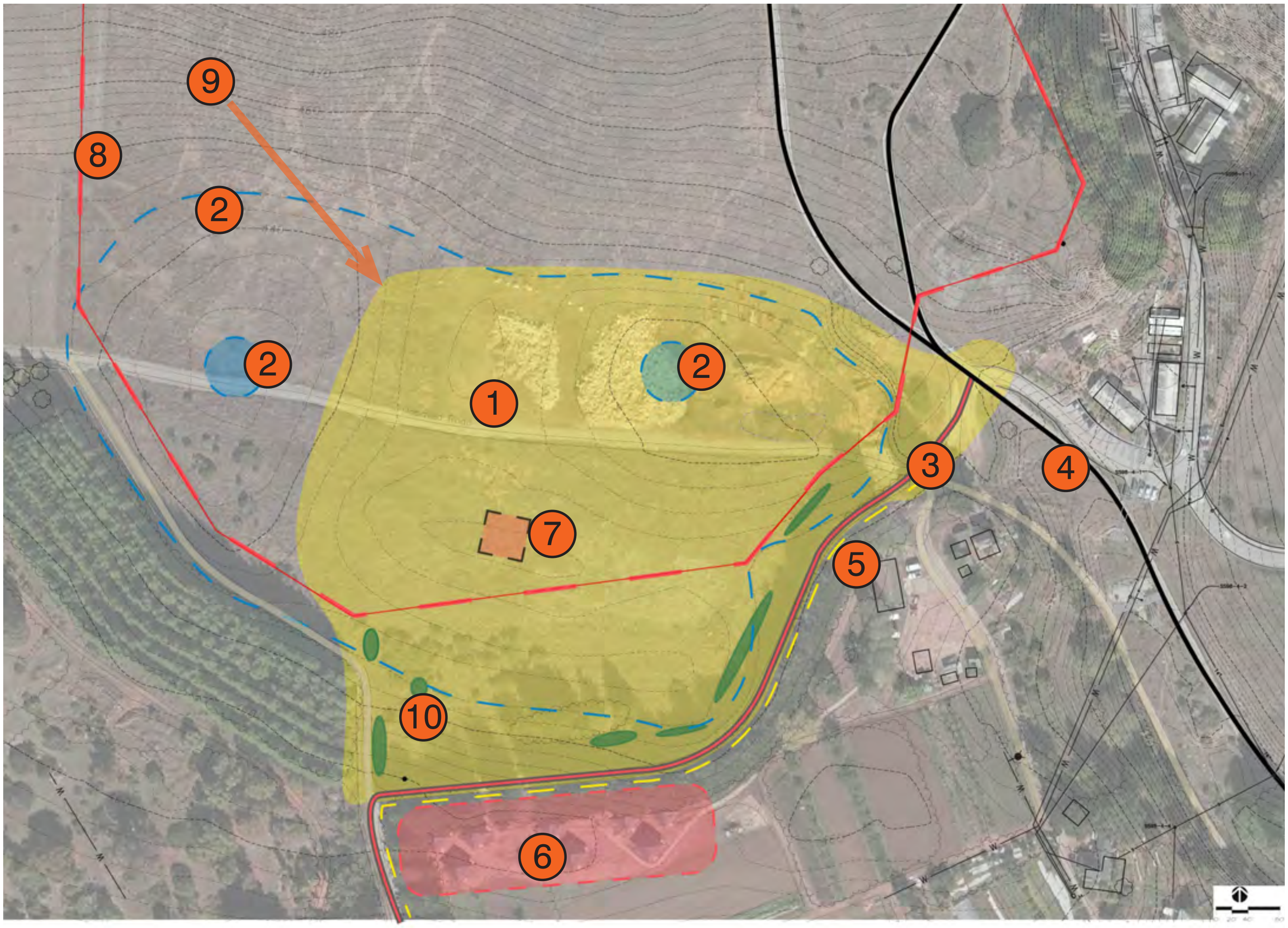
Constraints

- Possible partial sight line from University House and Great Meadow.
- Noise impact on neighboring residential housing may require scheduling of activities.
- Increased vehicular traffic crossing the Class I bike path will require mitigation.
- Potential sink holes may require special foundation systems and careful location of program elements.
- Not centrally located to majority of campus buildings where material is generated.
- Protected Landscape status will require a minor LRDP amendment to Campus Support status.
- Existing stone foundation will require monitoring during portion of construction.
- Native grass species of concern will require mitigation, if impacted.

The Great Meadow Bike Path (Photo by JLJA)


Neighboring CASFS Housing (Photo by JLJA)

SITE ANALYSIS DIAGRAM - THE BOWL



1. Site study area
2. Closed depression with Karst topography with assumed sinkhole locations[1]
3. Ranch View Road
4. Class I bicycle path
5. Perimeter deer fence
6. CASFS cabins
7. Existing stone foundation
8. Protected Landscape boundary
9. Sight line from University House
10. Possible locations of native grassland species[2]

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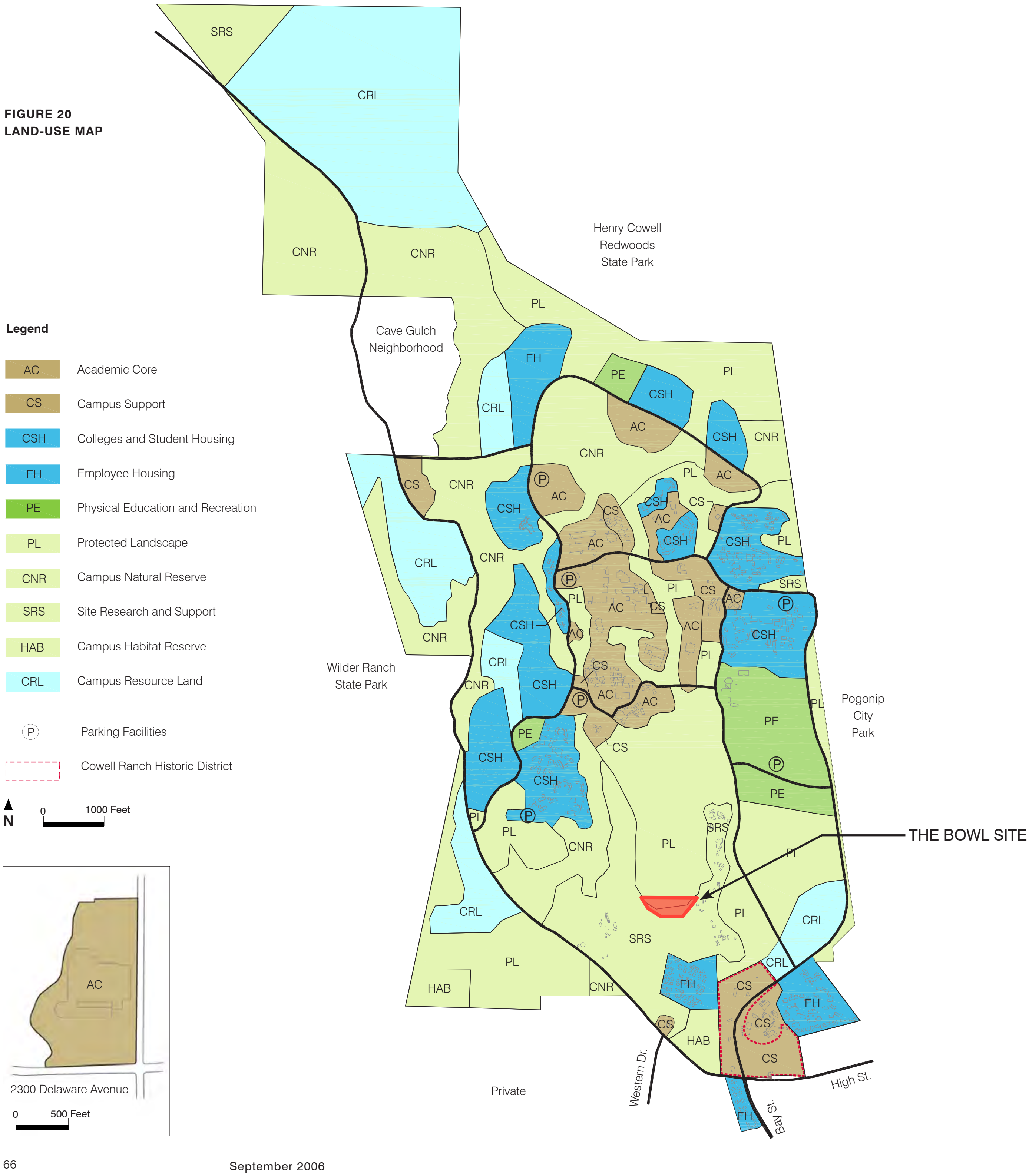
1 "Stormwater and Drainage Master Plan, UCSC Drainage and Sub-drainage Boundaries," Kennedy Jenks, March 2004.

2 "Results of Botanical Review of Proposed Consolidated Material Recovery Facility," Biotic Resources Group, April 8, 2014.

FIGURE 20
LAND-USE MAP



Bowl site outlined in red. This figure has been modified from its source, the 2005 Long Range Development Plan.

Access and Transportation

Vehicular access to the site is from Hagar Drive and Village Road, both of which will accommodate campus refuse trucks. Minor improvements may be needed in the parking lot off Village Road to allow easier maneuvering. Neither Hagar Drive nor Village Road will accommodate larger, 18-wheel transfer trucks if that should be required in the future. Based on the long-range capacity of the facility, this study's findings do not foresee the need for transfer truck use.

Vehicles must cross the Class I bicycle path at the Great Meadow, aggravating a situation that is already of concern to the Campus for bicycle safety. As part of the development of the Bowl site, safety improvements to the existing bicycle path located east of the site will be necessary. Currently, vehicles crossing the bicycle path from Village Road are forced to stop on a steep upslope and at a skewed angle to the path. The downhill bicycle path also has a slight “dip” located about 150 feet uphill from the current intersection. These two factors combined make it difficult for vehicles at the intersection to see downhill traveling bicycles and also for the cyclists to see vehicles entering the intersection. The Consultant Team advises that realigning the intersection, shifting both the downhill and uphill bicycle paths to the west, and eliminating the dip in the bicycle path will mediate the issue and meet or exceed safety standards.

Utility/Infrastructure

Power for the Bowl (90 amps) is available from the campus loop southeast of the site near CASFS. Power needs for the consolidated material recovery facility must be verified to ensure that 90 amps is adequate. Preliminary estimates indicate that this would accommodate all of the equipment that may be desired, but this must be confirmed as the project is more fully developed. Another option is to tie into the PG&E service line that runs to the Arboretum and Ranch View Terrace. Connecting to PG&E creates opportunity for a buy back agreement if solar power was produced on the site; excess solar power could also be kept within the campus power grid. The fairly large roofed structure, which would be required for housing a cardboard baler and potentially the sorting line, food waste tipping, and organics processing, would offer an excellent opportunity for photovoltaics.

Connection for the domestic and fire water line can be made southeast of the site along the dirt road from the existing water main line. Another option would be to connect to the line at Village Road.

A new sanitary sewer connection can be made at Village Road, providing adequate gravity fall. Connecting to the line at the dirt road where the water connection is located was considered, but it would be difficult to achieve the required 10-foot horizontal separation between water and sewer within the 10-foot wide dirt road.

Geotechnical Resources

As the Bowl is known to have an underground Karst system, a Preliminary Geotechnical and Geologic Feasibility Study was completed by Pacific Crest Engineering and Zinn Geology in May of 2014 to provide recommendations. “The Karst terrane that encompasses the UC Santa Cruz campus has evolved landforms that were created by ground collapse caused by the dissolution of water soluble rocks such as limestone and marble…. In general, the solution cavities consist of highly irregular, interconnected caverns and channels through the marble bedrock. Where they intersect the ground surface, they form pits, called sink holes or dolines, which may gradually fill by infiltration of fine grained sediments from the surface or by collapse of the adjacent rock walls or roof into the cavity."[1] The Bowl lies in an area rated as a high potential for hazards due to Karst conditions, but because minimal grading and structural improvements will be associated with the consolidated material recovery facility, the site is conducive to housing the facility. The geotechnical report includes specific recommendations for minimizing the risks associated with developing a project at this site, such as constructing foundations in such a way as to remove the existing expansive soil or treat it with lime, maintaining loading as even as possible within any structures, and preventing the introduction of surface water near developed areas.

Hydrological Resources

There is ample space at the site to create a series of swales and retention pond(s) to allow stormwater to be treated and evaporate. Initial geotechnical recommendations are to locate stormwater treatment in areas of the site that have slow draining soil, allowing time for treatment and reducing the chances of triggering a collapse or eroding the underground Karst. Initial investigations show the area at the west end of the site near the existing stand of redwood trees is conducive for stormwater treatment. A safe path for the surface water to reach the retention area must be created away from new structures to reduce risks of failure.

Biological Resources

The Bowl is a mostly non-native grassland with stands of native grassland species identified containing foothill needlegrass (*Stipa lepida*), purple needlegrass (*Stipa pulchra*), and California oatgrass (*Danthonia californica*).[2] The complete botanical review is included in the Appendices.

During a 2001 biotic assessment, no signs of any protected wildlife species were observed; however, there is potential for burrowing owls to be in this area and their presence should be investigated. Also, there is potential for impacts from noise and dust during construction to winter roosting monarch butterflies in the Arboretum and to neighboring raptors if these species are present at that time. Mitigation measures would include timing of construction activities.[3]

Cultural Resources

An existing stone foundation, which was once part of the Cowell Ranch complex, sits on the site's high point. An archaeology report prepared in early 2014 notes that the foundation does not need to be retained; however, when digging occurs within 70 feet of the foundation, monitoring will be required. The archaeology report is on file with Physical Planning and Construction.

Viewshed/Aesthetic/Sensory

The Bowl sits at the bottom of UCSC's Great Meadow. Portions of the Bowl are visible from The Great Meadow Bike Path, Hagar Drive, and the University House. Careful placement of program elements on the site can minimize visibility from these vantage points. Design considerations can also reduce the industrial feel of a consolidated material recovery facility by using materials and patterns associated with the neighboring farm and historical area of campus.

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1 "Preliminary Geotechnical and Geologic Feasibility Study for Recycling Yard University of California, Santa Cruz", Pacific Crest Engineering Inc., May 2014, p. 4.

2 "Results of Botanical Review of Proposed Consolidated Material Recovery Facility," Biotic Resources Group, April 8, 2014.

3 "UCSC Farm and Garden Expansion Sites Biological Assessment", Biotic Resources Group, July 2001.

The Bowl is adjacent to CASFS and therefore requires appropriate visual and auditory screening. There is an existing row of cypress trees on the CASFS side of the fence which will provide some filtering of views, but additional planting may be needed. As elevations and site grading are decided upon for the material recovery facility, consideration should be given to the associated impacts to CASFS. For example, setting the facility into grade will help reduce the height of various elements and will attenuate noise. Site walls and plantings can also absorb noise. Scheduling of recycling operations may be needed to minimize disturbance to CASFS residents and a noise study may be needed.

Prevailing winds from the northwest create a potential for smells to reach CASFS cabins, although the existing cypress row and grade changes will mitigate this risk to some degree. Appropriate planning and design, plus proper facility maintenance, will minimize olfactory impacts.

View from University House Lawn towards the Bowl (Photo by UCSC Physical Planning and Construction)

SITE OPTION 2: NORTH REMOTE

This site sits to the west of the North Remote Parking Lot in an area designated College and Student Housing by the 2005 Long Range Development Plan (LRDP). A minor amendment to the LRDP would be required to house a consolidated material recovery facility here; however, the site was always considered for development. There is approximately one acre of the site that is relatively flat; out from the main portion, the site slopes on average from 6-10% and most of the site is heavily forested. The Campus Housing-run Camper Park is located south of the site which may require scheduling of activities to keep disturbance at a minimum.

The Consultant Team studied various programmatic layouts for the North Remote site and found that the carrying capacity of the site limits the activities that can be accommodated. The programmatic plans show existing waste diversion activities that Grounds Services currently undertakes, including the sorting line, construction and demolition, and bin/equipment storage. There is not adequate space to accommodate organics processing or expansion of existing activities on this site without significant grading and use of retaining walls.

Opportunities

- Central to campus core and future campus growth areas.
- Tucked into forest and hidden from view.
- Limited potential for solar energy array.
- 2005 LRDP anticipated development of site.
- Potentially less construction cost due to stable geology.

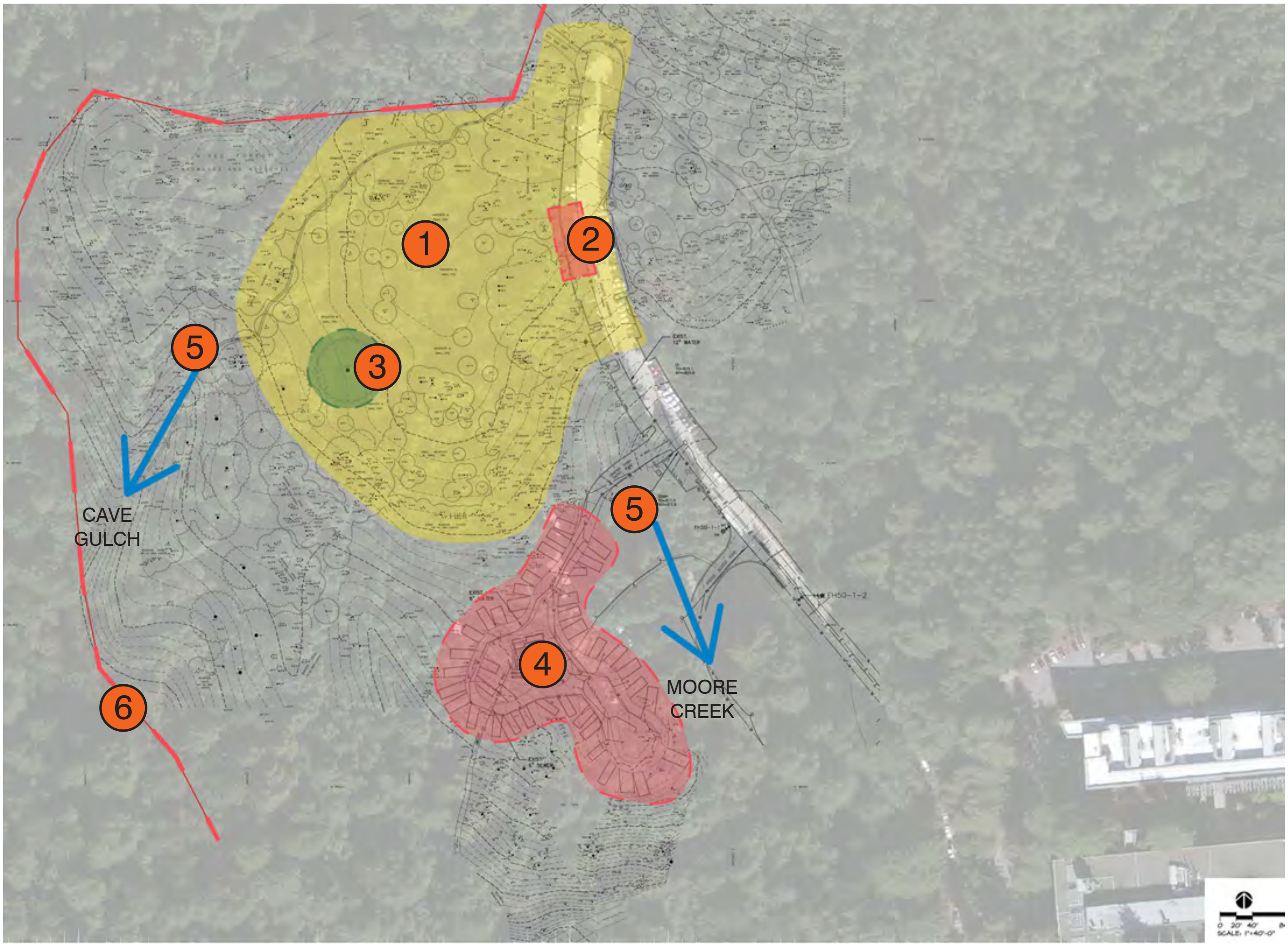
Constraints

- Extensive tree removal.
- Extensive stormwater management to control potential downstream impacts.
- Noise impacts to neighboring campus housing.
- Distance from campus entrance for off-campus transfer.
- Potential cost for retaining walls due to sloped site.
- Site restrictions limit future expansion and contribution to achieving Zero Waste.
- Loss of 4 to 5 parking space(s) for access drive results in revenue loss.
- Manzanita of special status may require mitigation if more than a quarter of an acre impacted.

North Remote Parking Lot (Photo by JLJA)

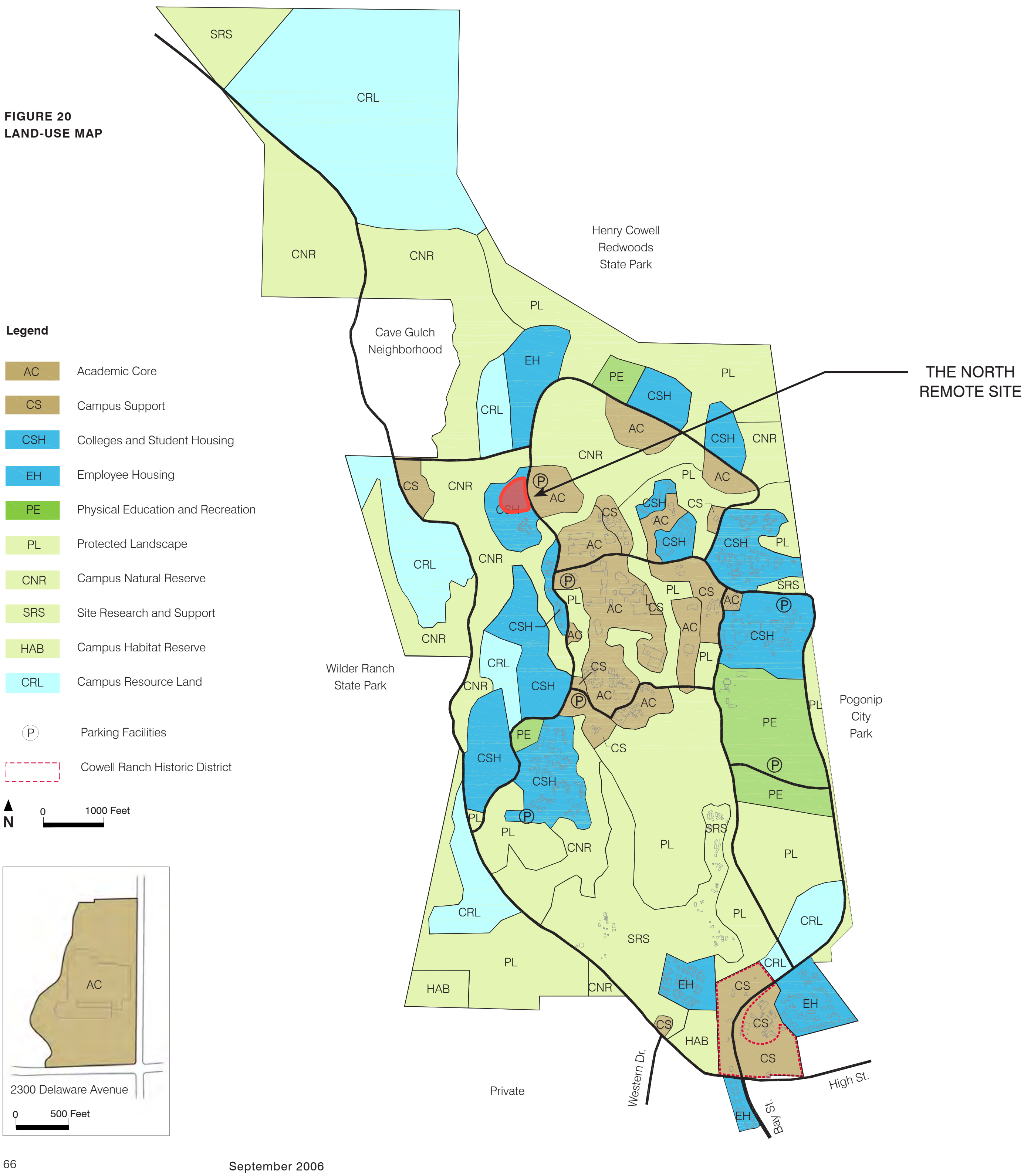
Stand of Trees Typical of North Remote Site (Photo by JLJA)

SITE ANALYSIS DIAGRAM - NORTH REMOTE



1. Site study area
2. Loss of 4 to 5 parking spaces and associated revenue
3. Tree to be protected
4. Camper Park
5. Potential downstream impacts
6. Campus Natural Reserve Boundary

FIGURE 20
LAND-USE MAP



The North Remote site is outlined in orange. This figure has been modified from its source, the 2005 Long Range Development Plan.

Access and Transportation

Access to the North Remote site is from Heller Drive and through the North Remote Parking Lot. The lot dead-ends at a turnaround and traffic past the Camper Park is for parking only. Four to five parking stalls would be eliminated to create an entrance/exit into the consolidated material recovery facility. The 2005 Long Range Development Plan calls for future development of the campus north of this area. At some point in time, parking along this road may be removed and the road may lead to other campus buildings.

Utility/Infrastructure

Power for the site would come from an existing campus loop feeder line in Heller Drive at the Camper Park. This existing line is undersized for the consolidated material recovery facility and will not provide new connections that meet UCSC campus standards. Moreover, it may not have capacity for the requisite equipment.

The domestic water and fire line runs under the North Remote Parking Lot. Connection would occur at the entrance/exit location to the consolidated material recovery facility.

The sanitary sewer connection would come from a 6-inch existing line located in the Camper Park, south of the site. There may be significant tree root intrusion at the point of connection, which would require upgrades. Any new trenching will need to avoid existing trees to remain.

Geotechnical Resources

Preliminary geological investigations were done by Steven Raas & Associates in March of 1992 in the vicinity of the North Remote site for potential future locations of Colleges 11 and 12. These initial investigations show that the geology of this area is fairly stable with Santa Margarita sandstone overlaying schist. The preliminary investigations state that the site is adequate for development, but subsurface drains may be needed to stabilize the area from seepage. If loose upper soils are encountered, densification of that soil may be required for structures and roadways. The report notes that the southern part of their investigations, near the site considered the North Remote for this study, could potentially have a system of underground doline structures which have potential to create sinkholes over time.[1]

Hydrological Resources

Drainage flows from the east towards Cave Gulch and to the southwest towards the Moore Creek East Fork. All stormwater must be treated on site and not allowed into Cave Gulch or Moore Creek in order to be eligible for a NONA to the Industrial General Permit. Treating the water on-site would be problematic as space on the site is limited.

Biological Resources

The North Remote site is a densely vegetated site with Chaparral and Dwarf Redwood-Chaparral plant communities. There are large numbers of Douglas fir trees across the site and clumps of coastal redwoods. Santa Cruz manzanita, a species of special concern, was found on the site during

1 "Preliminary Geotechnical Investigation for Colleges 11 & 12, UCSC," Steven Raas & Associates, March 1992.

investigations for the 2005 Long Range Development Plan environmental impact report. Mitigation would be required if more than a quarter of an acre of the Santa Cruz manzanita is disturbed. There is a large Douglas fir that is significant and should be retained. Design consideration should also be given to retaining stands of coastal redwoods where feasible. Development of this site will require a Timber Harvest plan and permit, a process which can take six to nine months.

Cultural Resources

There are no identified cultural resources within this site.

Viewshed/Aesthetic/Sensory

Due to the dense vegetation, a consolidated material recovery facility at this site would be relatively hidden from view. There may be filtered views from the North Remote Parking Lot, the Camper Park located to the south of the site, or from future campus development.

There is potential for noise generated from waste diversion activities to impact the neighboring campus housing. Scheduling of operations could abate this issue.

Prevailing winds from the northwest create a potential for smells to reach Camper Park, although the surrounding forest will mitigate this risk to some degree. Appropriate planning and design, plus proper facility maintenance, will minimize olfactory impacts.

SITE SELECTION RECOMMENDATION

In addition to the site analysis, the Consultant Team created an evaluation form (see the following page) as a means to objectively assign a numerical value to the different aspects of site selection. The criteria used in the evaluation included site development, environmental impact, and land use issues, as well as traffic and proximity to service areas. If there would be a negative impact on a particular criteria at the site, a (1) was given; if the impact would be neutral, a (2) was assigned; and a (3) given for a positive impact. This exercise resulted in a higher score for the Bowl site.

The Consultant Team provided analysis of the two sites and the campus chose the Bowl for further study as the site for the consolidated material recovery facility. Although no site is without its challenges, the Bowl is large enough to house stormwater management features, encourages potential partnering with neighboring CASFS, is accessible to the larger campus, can be designed to minimize effect on the viewshed, and has minimal impact on existing parking. Most importantly, if the campus decides to move forward with their own organics processing, the Bowl site offers adequate space to accommodate this, plus any other future waste diversion efforts.

SITE EVALUATION FORM

SITE EVALUATION CRITERIA Rating: 1 - Negative Impact; 2 – Neutral; 3 - Positive Impact	THE BOWL	NORTH REMOTE
Site Development Issues (minimize difficulty, maximize flexibility):		
Relative Cost/Difficulty: Presence of major design constraints (parcel shape, slope, soils, rock, flooding, etc.)	1	1
Useable Acreage:		
Large enough for Hay Barn functions	2	2
Expansion potential	3	1
Proximity and Adequacy of Utilities	2	2
Natural Environment Issues (minimize possible impacts):		
Potential for Biological Impacts (sensitive habitats or species)	1	1
Potential for Cultural Resources (known historic/archaeological sites)	1	2
Water Quality: Potential for either surface or ground water contamination	2	2
Land Use Issues (minimize possible conflicts):		
Noise (site proximity to sensitive receptors such as residences, classrooms)	1	1
Visual Issues (visibility from residences, entry to UCSC, University House)	1	3
LRDP:		
Is facility permissible with 2005 LRDP, or is change required?	1	2
Is facility compatible with zoning of adjacent parcels?	3	1
Existing Land Use:		
Would facility displace a current use important to UCSC?	2	2
Does the site have a competing future use which could render this project site temporary only?	2	1
Traffic Issues (minimize congestion / safety / air quality impacts):		
Ease of Access	2	1
Traffic Safety Issues (vehicular, pedestrian, bicycle)	1	1
Avoid access through or adjacent to residential areas	2	2
Availability of two or more site access points for circulation and separation of the public from collection trucks	3	2
Site Proximity to Service Areas (locate near waste stream; near end users):		
Proximity to waste stream	1	3
Permitting:		
Permit timeline	2	1
Ease of achieving desired IGP permit status	3	1
TOTAL POINTS	36	32
RECOMMENDATION	Yes	No

SITE DIAGRAM NARRATIVE

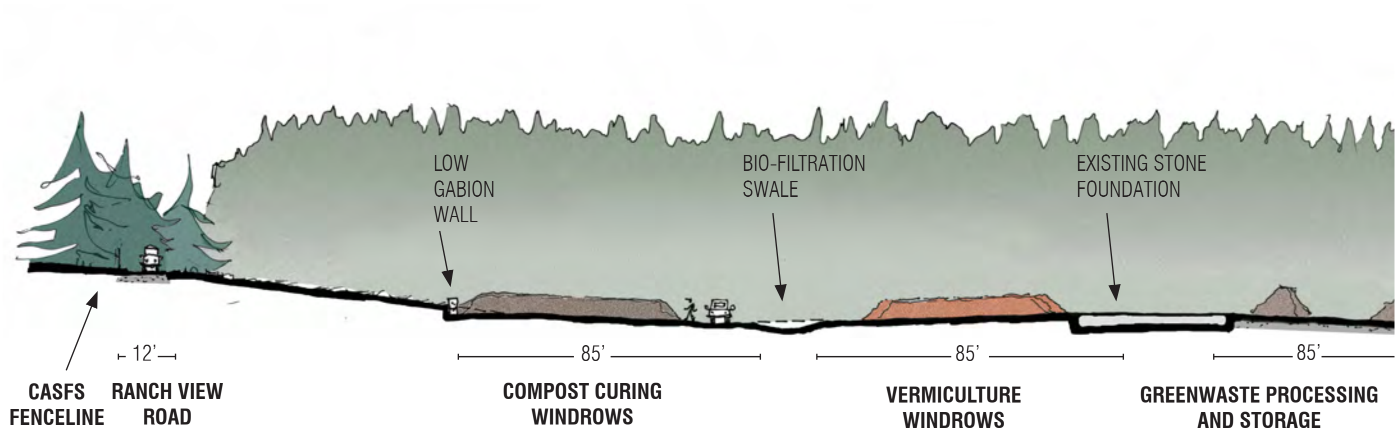
The Site Diagram for the Bowl incorporates all existing and potential future resource recovery program elements, including organics processing, even though full program development is not possible within the pre-established budget of this project. Suggested improvements estimated at $671,000 include relocating all campus bins and equipment, plus construction/demolition and greenwaste activities, to the site and restoring the area north of the dirt access road to meadow. This initial phase also includes installation of a series of bio-filtration swales and bio-retention pond(s) to treat all stormwater.

Phase I includes

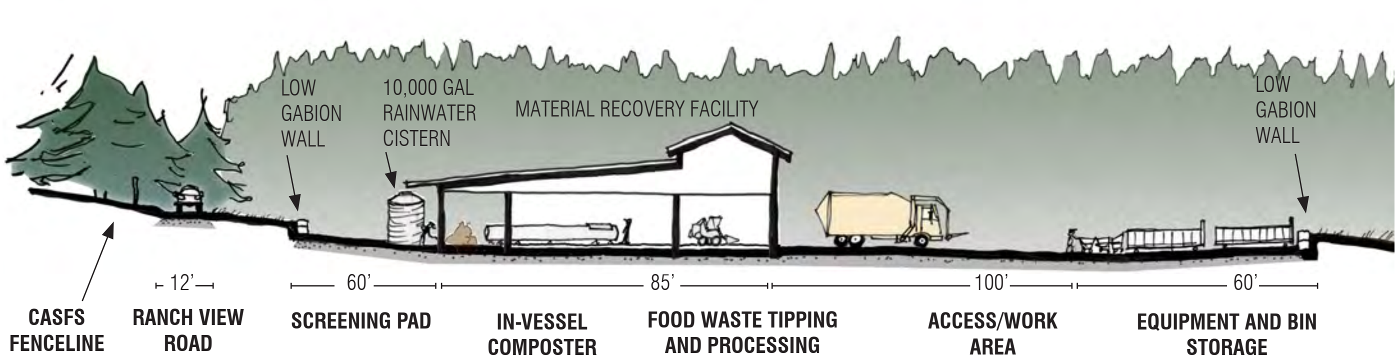
- 15,000 s.f. of compacted aggregate base for construction and demolition;
- 10,000 s.f. of compacted aggregate base for bins and equipment storage;
- 15,000 s.f. of compacted earth for greenwaste and landscape supply storage;
- and 30,000 s.f. of additional compacted aggregate base for access.

Fencing will match the adjacent CASFS deer fencing and will have manual vehicular and pedestrian gates. Site design will strive to blend these features into the Great Meadow.

A large portion of the project budget will be allotted to bringing utilities to the site which will enable future activities such as the relocated sorting line, a cardboard baler, in-vessel composting machine, a restroom, and administrative space. Program elements shown on the Site Diagram that require utilities are located close to the access point from the Lower Village in order to minimize site work and utility trench lengths. These elements will also require a roofed structure. This structure will likely be close to



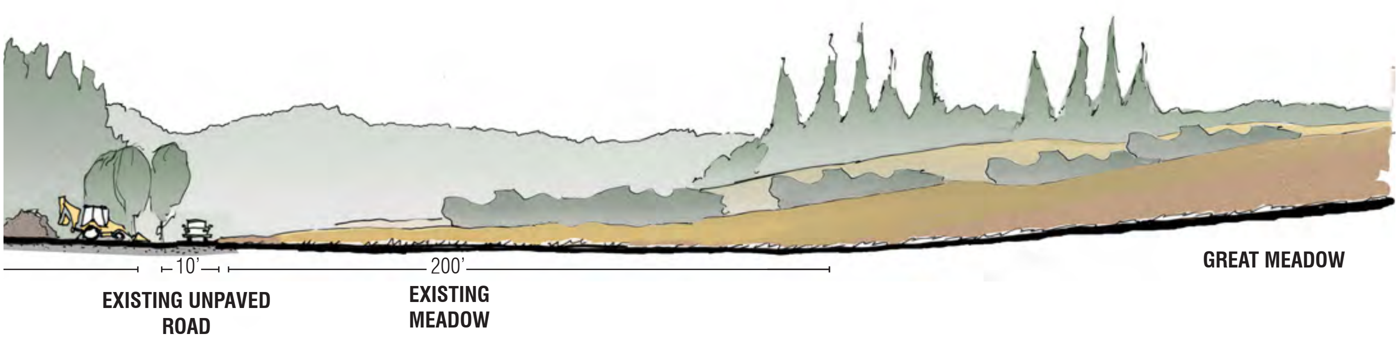
Section A-A - Organic Systems on the Bowl.

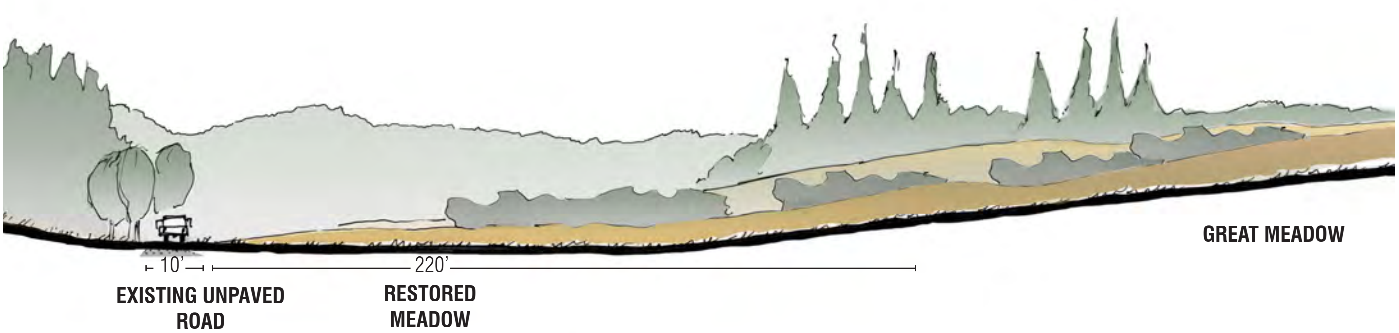


Section B-B - Resource Recovery on the Bowl.

35 feet tall to allow for front loader trucks to tip their contents; however, it is possible that only a portion of the structure would need to be that height, or that the roof line may step down in places. Siting the structure against the southern hill allows it to be sunk into grade and be screened by both the existing cypress trees and new trees, minimizing the visual impact. Phase I program elements are clustered together to minimize site impacts and those with a more agrarian quality are placed within the University House viewshed.

In future phases, additional elements of the consolidated material recovery facility can fit into the site by being tucked into the hill south of the site and using language and patterns typical of the farm and historic ranch. Simple and functional materials such as rock, metal, wood, or fabric would be appropriate. Design features could include gabion walls or supports for a roofed structure built with the rock currently stored at the Bowl. Elements required to be under a roofed structure include the restroom and administrative space, cardboard baler, and foodwaste tipping. Ideally, the sort line, paper sorting, and paper storage would also be included within the structure. The structure could be designed to resemble a barn or farm building to fit the aesthetic of the neighboring CASFS farm and be reminiscent of the Cowell Ranch. As the design for the site is developed beyond the feasibility study, alternative building and roof types will be examined. Alternatives include a standing seam metal roof with either open sides or walls, a pre-fabricated metal building, or a fabric roof with pre-fabricated steel supports. The site exposure and large roof area make the project conducive to incorporating photovoltaic panels at some point in time and will be included as an option in the design process.





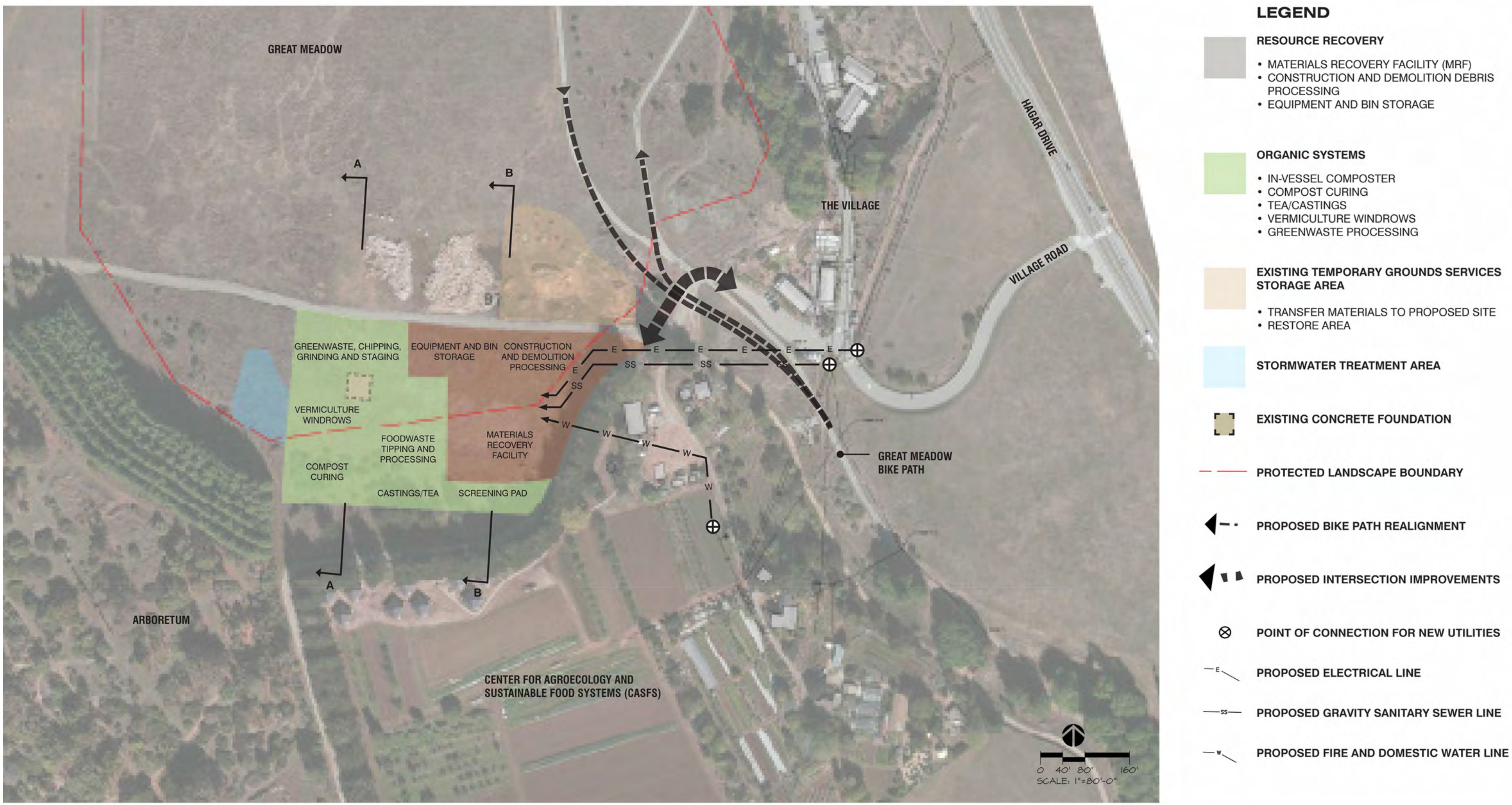
Bicycle Path and Road Safety Improvements

As part of the development of the Bowl site, safety improvements to the existing cross-campus bicycle path located east of the site will be necessary. One approach to improving bicycle path safety is to realign the path by shifting the bicycle path 40 feet to the southwest at the intersection with the driveway from the lower quarry housing parking lot. This realignment will increase the downhill cyclists' stopping sight distance plus the sight distance for vehicles crossing the path. It will also allow vehicles entering the intersection from the north and south to stop at right angles and at a fairly level surface to the bicycle path. The intersection will feature stop signs and be striped with stop bars in both directions and will also have bicycle crossing warning signs. Both the downhill and uphill bicycle paths will post warning signs of the upcoming intersection and vehicle crossing.

Along with the improved intersection geometrics, the “dip” in the downhill bicycle path will be eliminated and the bicycle path will have a larger, 500-radius curve. The combination of the intersection improvements and the bicycle path grade changes and realignment will greatly increase the sight distance for both cyclists traveling downhill and vehicles entering the intersection.

Chapter 1000 of the 2012 Caltrans Highway Design Manual specifies a minimum stopping sight distance of 230 feet for a cyclist traveling 30 miles per hour. For a cyclist traveling 35 mph and on a downhill grade of 5%, the safe stopping sight distance is about 330 feet. It appears that a stopping sight distance in excess of 330 feet for the downhill bicycle path could be achieved with the bicycle path realignment, however a more detailed study should be performed prior to final design.

Improvements to the bicycle path will consist of the removal of approximately 10,000 square feet of existing bicycle path pavement and the construction of 10,000 square feet of new bicycle path pavement. Additionally, there will be some cut and fill earthwork involved with the bicycle path realignment. Unidirectional bicycle paths will be paved to 7 feet wide and two-way bi bicycle ke paths will be paved to a minimum of 12 feet wide.


GREAT MEADOW
A
B
THE VILLAGE
HAGAR DRIVE
VILLAGE ROAD
GREENWASTE, CHIPPING, GRINDING AND STAGING
EQUIPMENT AND BIN STORAGE
CONSTRUCTION AND DEMOLITION PROCESSING
VERMICULTURE WINDROWS
FOODWASTE TIPPING AND PROCESSING
MATERIALS RECOVERY FACILITY
COMPOST CURING
CASTINGS/TEA
SCREENING PAD
GREAT MEADOW BIKE PATH
ARBORETUM
CENTER FOR AGROECOLOGY AND SUSTAINABLE FOOD SYSTEMS (CASFS)
0 40' 80' 160'
SCALE: 1"=80'-0"
LEGEND
RESOURCE RECOVERY
• MATERIALS RECOVERY FACILITY (MRF)
• CONSTRUCTION AND DEMOLITION DEBRIS PROCESSING
• EQUIPMENT AND BIN STORAGE
ORGANIC SYSTEMS
• IN-VESSEL COMPOSTER
• COMPOST CURING
• TEA/CASTINGS
• VERMICULTURE WINDROWS
• GREENWASTE PROCESSING
EXISTING TEMPORARY GROUNDS SERVICES STORAGE AREA
• TRANSFER MATERIALS TO PROPOSED SITE
• RESTORE AREA
STORMWATER TREATMENT AREA
EXISTING CONCRETE FOUNDATION
PROTECTED LANDSCAPE BOUNDARY
PROPOSED BIKE PATH REALIGNMENT
PROPOSED INTERSECTION IMPROVEMENTS
POINT OF CONNECTION FOR NEW UTILITIES
PROPOSED ELECTRICAL LINE
PROPOSED GRAVITY SANITARY SEWER LINE
PROPOSED FIRE AND DOMESTIC WATER LINE

PRECEDENT DESIGN IMAGES - BARN TYPOLOGY & SUSTAINABLE BUILDING ELEMENTS

Carport with solar panels, Sunshine Canyon House, Boulder, Colorado, designed by Renée del Gaudio Architecture. Photo courtesy David Lauer, ©2013 David Lauer Photography.

Open air barn structure using sustainable, 'low tech' building strategies. Mason Lane Farm Operations Facility, Kentucky, by De Leon & Primmer Architecture Workshop. Photo courtesy Roberto de Leon.

PRECEDENT DESIGN IMAGES - GABION WALLS

University of Memphis "Recycle Zone." Photo courtesy Midwest Construction Products (http://www.gabionbaskets.com/gabion_recycle_zone.php).

Gabion walls filled with recycled waste, above and below. Landfill restoration project at Vall d'en Joan, Spain. Photos courtesy Battle i Roig Arquitectes.

Lindale Beach House, Great Barrier Island, New Zealand, designed by Herbst Architects. Photo by Patrick Reynolds, courtesy Herbst Architects.

PRECEDENT DESIGN IMAGES - SHELL STRUCTURES

Stepped roof heights at Ithaca Farmers Market, Ithaca, NY. Photo courtesy Alana Mautone (http://ramblinwitham.blogspot.com/2011/10/ithaca-ny-farmers-market-buying-local.html).

Prefabricated steel structure. Jensen Shed by WAZ Steel and Sheds, Queensland. Photo courtesy of WAZ Steel and Sheds (http://steelandsheds.com.au/jensen-shed-photos/4576223477).

Prefabricated metal structure and modern interpretation of barn typology. Shed Store and Cafe, Healdsburg, by Jensen Architects. Photo by Mariko Reed, courtesy Jensen Architects (http://jensen-architects.com/our_work/featured_projects).

COST ESTIMATE, PREPARED BY AECOM, APRIL 14, 2014 (complete document in Appendices)

Bowl Site

Item Description	Quantity	Unit	Rate	Total
6 Site Contruction				
14 Site Preparation & Demolition	**246,000**	**SF**	**0.34**	**82,920**
Site protection				
Erosion control	246,000	SF	0.10	24,600
Protect existing features (historic pad, prairie grass, etc.)	1	LS	5,000.00	5,000
Construction fencing, allow (assumes permanent site fencing installed at outset of project)	400	LF	12.00	4,800
Site clearing and grading				
Remove existing foundation	1,760	SF	2.00	3,520
Rough grading	70,000	SF	0.35	24,500
Fine grading at areas of compacted base rock, compacted earth	70,000	SF	0.15	10,500
Surveying	1	LS	10,000.00	10,000
15 Site Paving, Structure & Landscaping	**246,000**	**SF**	**0.83**	**204,500**
Vehicular paving				
Asphalt paving				
Patch and repair, allow	3,000	SF	2.50	7,500
Compacted base rock, 6"				
Access roads	30,000	SF	2.20	66,000
Bike path			*Budgeted separately*	
Main yard				
Construction & Demolition area	15,000	SF	2.20	33,000
Bins & Equipment area	10,000	SF	2.20	22,000
Compacted earth pads, Greenwaste Storage	15,000	SF	0.50	7,500
Landscaping, allow native grasses				
Stormwater detention, allow for unlined pond with imported soil mix and planting	1	LS	10,000.00	10,000
Seeding and temporary irrigation at Restoration area only (performed by Ground Services)	40,000	SF	0.25	10,000
Site accessories				
Bollards	1	LS	5,000.00	5,000
Fencing				
Wood post with wire mesh, 7' tall	1,100	LF	35.00	38,500
Non-automated vehicular entry gate, allow	1	EA	4,000.00	4,000
Person gates, allow	1	EA	1,000.00	1,000

Bowl Site

Item Description	Quantity	Unit	Rate	Total
16 Site Utilities	**246,000**	**SF**	**0.73**	**179,550**
Mechanical utilities, allowances				
Domestic water				
Pipework < 2" - stubbed out at hydrant	50	LF	45.00	2,250
Hose bibbs	1	LS	2,500.00	2,500
Connect to existing	1	LS	2,500.00	2,500
Fire water & domestic water				
Pipework	450	LF	95.00	42,750
Hydrants	1	EA	5,500.00	5,500
Connect to existing	1	LS	5,000.00	5,000
Sanitary sewer				
Pipework < 4"	570	LF	65.00	37,050
Connect to existing	1	LS	2,500.00	2,500
Storm drainage				*Sheet runoff to detention pond*
Electrical utilities allowances				
Panel connections, 200 amp	1	LS	5,000.00	5,000
Feeder conduit and wire	600	LF	110.00	66,000
Equipment connections	1	LS	3,500.00	3,500
Lighting				
Site lighting allowance	1	LS	5,000.00	5,000
Security				*NIC*
Fire alarm				
Devices connected to campus system				*NIC*
				466,970

Bicycle Path

Item Description	Quantity	Unit	Rate	Total
6 Site Contruction				
14 Site Preparation & Demolition	**45,000**	**SF**	**2.24**	**100,900**
Site protection				
Erosion control	45,000	SF	0.30	13,500
Protect existing features	1	LS	5,000.00	5,000
Construction fencing	1,200	LF	12.00	14,400
Site clearing and grading				
Demolish existing bike path	10,000	SF	1.00	10,000
Rough grading	45,000	SF	0.75	33,750
Fine grading	45,000	SF	0.25	11,250
Surveying	1	LS	10,000.00	10,000
Miscellaneous site clearing	1	LS	3,000.00	3,000
15 Site Paving, Structure & Landscaping	**45,000**	**SF**	**2.80**	**125,850**
Vehicular paving				
Asphalt paving				
Access road	5,700	SF	5.50	31,350
Bike paths, 2" asphalt	10,000	SF	2.75	27,500
Signage				
Striping, stop signs, warning signs	1	LS	4,000.00	4,000
Structures				*NIC*
Landscaping, allow native species				
Alongside re-aligned pathway	14,000	SF	3.00	42,000
Temporary irrigation	14,000	SF	1.50	21,000
Site accessories				*NIC*
Fencing				*NIC*
16 Site Utilities	**45,000**	**SF**		
No work anticipated				
				226,750

APPENDICES

APPENDICES

This section contains the following appendices:

Consolidated Recycling Yard University of California

Prepared for:

Joni L. Janecki & Associates, Inc.
515 Swift Street
Santa Cruz California 95060

Prepared by:

AECOM
300 California Street
Suite 400
San Francisco CA 94104
(415) 796-8100

Consolidated Recycling Yard
University of California

Contents

Consolidated Recycling Yard
University of California

Overall Summary

			SF	$/SF	TOTAL $ x 1,000
S1	Bicycle Path		45,000	6.78	305
	Construction Contingency per Owner	7%			21
BICYCLE PATH SITEWORK (June 2015)					326
S2	Bowl Site		246,000	2.55	627
	Construction Contingency per Owner	7%			44
BOWL SITEWORK (June 2015)					671
TOTAL, BOWL SITE & BICYCLE PATH (June 2015)					997

Escalation To Start Date Included Above

Consolidated Recycling Yard
University of California

Scope of Work

Project Scope Description

The project consists of a site analysis for the location of a new recycling facility and the relocation of portions of an existing bike path. There are no structures. Paving is asphalt and compacted base rock. Utility infrastructure assumes 450 - 600 foot runs at the Bowl site. Approximately 50% of the proposed site area receives no treatment.

Consolidated Recycling Yard
University of California

Basis of Estimate

Assumptions and Clarifications

Design Information

Drawings

The Bowl Site Diagram, March 24, 2014

Revised utility layout, August 20, 2014

Meeting minutes, weekly

Conditions of Construction

A start date of June 2015

A construction period of 3 months

The general contract will be competitively bid with qualified general contractors

The entire scope of work will be bid as one project

There will not be small business set aside requirements

The contractor will be required to pay prevailing wages

There are no phasing requirements

The general contractor will have full access to the site during normal business hours

Exclusions

Soft costs, including construction contingency, design fees and project management

Soil remediation

Soil export off site

Delays due to archeological monitoring and discoveries

Special procedures for species protection

Structures

Storm drain overflow pipework

Hose stations

Hot water

Site lighting

Site security

Major site utility relocations and upgrades (extensions of existing only)

Utility connection charges and fees

Telephone/data 'active' equipment - including hubs, routers, servers, LAN, switches, etc.

Public address & centralized clocks

Audio visual equipment

Emergency call stations

Interpretive signage

Recycling equipment such as compactors, sorters, etc.

Consolidated Recycling Yard
University of California

Basis of Estimate

Loose furniture and equipment except as specifically identified

Hazardous material handling, disposal and abatement

Compression of schedule, premium or shift work, and restrictions on the contractor's working hours

Testing and inspection fees

Architectural, design and construction management fees

Scope change and post contract contingencies

Assessments, taxes, finance, legal and development charges

Environmental impact mitigation

Builder's risk, project wrap-up and other owner provided insurance program

Consolidated Recycling Yard
University of California

Market Conditions

This document is based on the measurement and pricing of quantities wherever information is provided and/or reasonable assumptions for other work not covered in the drawings or specifications, as stated within this document. Unit rates have been obtained from historical records and/or discussion with contractors. The unit rates reflect current bid costs in the area. All unit rates relevant to subcontractor work include the subcontractors overhead and profit unless otherwise stated. The mark-ups cover the costs of field overhead, home office overhead and profit and range from 15% to 25% of the cost for a particular item of work.

Pricing reflects probable construction costs obtainable in the project locality on the date of this statement of probable costs. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all subcontractors and general contractors, with a minimum of 4 bidders for all items of subcontracted work and 6-7 general contractor bids. Experience indicates that a fewer number of bidders may result in higher bids, conversely an increased number of bidders may result in more competitive bids.

Since AECOM has no control over the cost of labor, material, equipment, or over the contractor's method of determining prices, or over the competitive bidding or market conditions at the time of bid, the statement of probable construction cost is based on industry practice, professional experience and qualifications, and represents AECOM's best judgment as professional construction consultant familiar with the construction industry. However, AECOM cannot and does not guarantee that the proposals, bids, or the construction cost will not vary from opinions of probable cost prepared by them.

Project Specific Factors and Escalation

Cost escalation is included up to a projected start date of June 2015. Escalation rates of 5% - 6% are anticipated for the year following the date of issuance of this report, with 3.5% thereafter.

Consolidated Recycling Yard
University of California

Bicycle Path Summary

			%	$/SF	TOTAL $ x 1,000
			Gross Area:	45,000 SF	
14	Site Preparation & Demolition		33%	2.24	101
15	Site Paving, Structure & Landscaping		41%	2.80	126
16	Site Utilities		0%	0.00	0
SITE CONSTRUCTION			74%	5.04	227
17	General Conditions	7.50%	6%	0.38	17
18	Contractor's Overhead & Profit or Fee	4.00%	3%	0.22	10
PLANNED SITE CONSTRUCTION COST			83%	5.63	254
19	Contingency for Development of Design	15.00%	12%	0.85	38
CONSTRUCTION COST BEFORE ESCALATION			96%	6.48	292
20	Escalation to Start Date (Jun 2015)	4.50%	4%	0.29	13
RECOMMENDED BUDGET			100%	6.78	305

Consolidated Recycling Yard
University of California

Bicycle Path

Item Description	Quantity	Unit	Rate	Total
6 Site Contruction				
14 Site Preparation & Demolition	**45,000**	**SF**	**2.24**	**100,900**
Site protection				
Erosion control	45,000	SF	0.30	13,500
Protect existing features	1	LS	5,000.00	5,000
Construction fencing	1,200	LF	12.00	14,400
Site clearing and grading				
Demolish existing bike path	10,000	SF	1.00	10,000
Rough grading	45,000	SF	0.75	33,750
Fine grading	45,000	SF	0.25	11,250
Surveying	1	LS	10,000.00	10,000
Miscellaneous site clearing	1	LS	3,000.00	3,000
15 Site Paving, Structure & Landscaping	**45,000**	**SF**	**2.80**	**125,850**
Vehicular paving				
Asphalt paving				
Access road	5,700	SF	5.50	31,350
Bike paths, 2" asphalt	10,000	SF	2.75	27,500
Signage				
Striping, stop signs, warning signs	1	LS	4,000.00	4,000
Structures				*NIC*
Landscaping, allow native species				
Alongside re-aligned pathway	14,000	SF	3.00	42,000
Temporary irrigation	14,000	SF	1.50	21,000
Site accessories				*NIC*
Fencing				*NIC*
16 Site Utilities	**45,000**	**SF**		
No work anticipated				
				226,750

Consolidated Recycling Yard
University of California

Bowl Site Areas & Control Quantities

	SF	SF	SF
Areas			
Net Site Areas			
Restoration Area (excluding boulder stockpile)	40,000		
Organic Systems	130,000		
Resource Recovery	76,000		
TOTAL SITE AREA			**246,000**

Control Quantities			Ratio to Site
Compacted base rock	55,000	SF	0.224
Roads (included with base rock)	0	SF	-
Landscaping and Softscape	40,000	SF	0.163
Other Features, Undeveloped	151,000	SF	0.614
Built Areas	0	SF	-

Consolidated Recycling Yard
University of California

Bowl Site Summary

			%	$/SF	TOTAL $ x 1,000
			Gross Area:	246,000 SF	
14	Site Preparation & Demolition		13%	0.34	83
15	Site Paving, Structure & Landscaping		33%	0.83	205
16	Site Utilities		29%	0.73	180
	SITE CONSTRUCTION		74%	1.90	467
17	General Conditions	7.50%	6%	0.14	35
18	Contractor's Overhead & Profit or Fee	4.00%	3%	0.08	20
	PLANNED SITE CONSTRUCTION COST		83%	2.12	522
19	Contingency for Development of Design	15.00%	12%	0.32	78
	CONSTRUCTION COST BEFORE ESCALATION		96%	2.44	600
20	Escalation to Start Date (Jun 2015)	4.50%	4%	0.11	27
	RECOMMENDED BUDGET		100%	2.55	627

Consolidated Recycling Yard
University of California

Bowl Site

Item Description	Quantity	Unit	Rate	Total
6 Site Contruction				
14 Site Preparation & Demolition	**246,000**	**SF**	**0.34**	**82,920**
Site protection				
Erosion control	246,000	SF	0.10	24,600
Protect existing features (historic pad, prairie grass, etc.)	1	LS	5,000.00	5,000
Construction fencing, allow (assumes permanent site fencing installed at outset of project)	400	LF	12.00	4,800
Site clearing and grading				
Remove existing foundation	1,760	SF	2.00	3,520
Rough grading	70,000	SF	0.35	24,500
Fine grading at areas of compacted base rock, compacted earth	70,000	SF	0.15	10,500
Surveying	1	LS	10,000.00	10,000
15 Site Paving, Structure & Landscaping	**246,000**	**SF**	**0.83**	**204,500**
Vehicular paving				
Asphalt paving				
Patch and repair, allow	3,000	SF	2.50	7,500
Compacted base rock, 6"				
Access roads	30,000	SF	2.20	66,000
92 Bike path			*Budgeted separately*	
Main yard				
Construction & Demolition area	15,000	SF	2.20	33,000
Bins & Equipment area	10,000	SF	2.20	22,000
Compacted earth pads, Greenwaste Storage	15,000	SF	0.50	7,500
Landscaping, allow native grasses				
Stormwater detention, allow for unlined pond with imported soil mix and planting	1	LS	10,000.00	10,000
Seeding and temporary irrigation at Restoration area only (performed by Ground Services)	40,000	SF	0.25	10,000
Site accessories				
Bollards	1	LS	5,000.00	5,000
Fencing				
Wood post with wire mesh, 7' tall	1,100	LF	35.00	38,500
Non-automated vehicular entry gate, allow	1	EA	4,000.00	4,000
Person gates, allow	1	EA	1,000.00	1,000

Consolidated Recycling Yard
University of California

Bowl Site

Item Description	Quantity	Unit	Rate	Total
16 Site Utilities	**246,000**	**SF**	**0.73**	**179,550**
Mechanical utilities, allowances				
Domestic water				
Pipework < 2" - stubbed out at hydrant	50	LF	45.00	2,250
Hose bibbs	1	LS	2,500.00	2,500
Connect to existing	1	LS	2,500.00	2,500
Fire water & domestic water				
Pipework	450	LF	95.00	42,750
Hydrants	1	EA	5,500.00	5,500
Connect to existing	1	LS	5,000.00	5,000
Sanitary sewer				
Pipework < 4"	570	LF	65.00	37,050
Connect to existing	1	LS	2,500.00	2,500
Storm drainage			*Sheet runoff to detention pond*	
Electrical utilities allowances				
Panel connections, 200 amp	1	LS	5,000.00	5,000
Feeder conduit and wire	600	LF	110.00	66,000
Equipment connections	1	LS	3,500.00	3,500
Lighting				
Site lighting allowance	1	LS	5,000.00	5,000
Security				*NIC*
Fire alarm				
Devices connected to campus system				*NIC*
				466,970

Biotic Resources Group

Biotic Assessments ◆ Resource Management ◆ Permitting

April 8, 2014

Alisa Klaus
University of California, Santa Cruz
Physical Planning and Construction
1156 High Street
Santa Cruz, CA 95064

RE: Results of Botanical Review of Proposed Consolidated Material Recovery Facility, Bowl Area

Dear Ms. Klaus,

The Biotic Resources Group conducted a botanical review of an area north of the arboretum that is proposed for a material recovery and compost facility (Bowl Area), as per your request. The review was focused on identifying the location of native grass stands within the proposed facility area. The results of this field review are described herein.

BACKGROUND AND SURVEY METHODOLOGY

The biological resources within the proposed recovery facility study area were mapped in 2001 (UCSC Farm and Garden Expansion Sites, Biotic Assessment, BRG, 2001). In 2001 one stand of native bunchgrasses was documented within the proposed recovery study area; the proposed recovery area is located within the eastern portion of what was then referred to as "Area D". The native grass stands were documented within a grassland area and were comprised of *Nassella spp.* (currently known as *Stipa spp.)* and *Danthonia californica*.

Kathleen Lyons, plant ecologist, conducted a site visit of the proposed material recovery facility area (Bowl Area) on April 6, 2014. Systematic walking surveys were conducted to detect native grass stands. The area previously identified as supporting stands of *Nassella (*now *Stipa)* and *Danthonia californica* were walked as well as other portions of the proposed facility area were inspected for native grasses. Where native grass stands were observed their location was marked on an aerial photo (source: Google, 2013). In addition, an aerial photo of the area, dated 2001, was reviewed to detect any changes in vegetation patterns.

RESULTS

The majority of the proposed recovery facility study area currently supports grassland that is comprised of a dense growth of non-native grasses and forbs. This is similar to the condition documented in 2001. The proposed recovery facility area also supports groves of Monterey cypress (*Cupressus marcrocarpa)* trees and a large patch of coyote brush scrub. The extent of the cypress grove has increased since 2001. The scrub, dominated by coyote brush (*Baccharis pilularis)*, has established on site since 2001 and occupies most of the area previously mapped as supporting native grass stands. The understory within the scrub is comprised of annual grasses and forbs; one small patch of *Stipa pulchra* was observed amid the shrubs (see Figure 1). Additional patches of native grasses were observed in the recovery area. As

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depicted on Figure 1, these patches are confined to the edge of the existing roadway and appear to be growing within areas that are periodically mowed.

Figure 1. Distribution of vegetation types, including native grass stands, April 2014.

Thank you for the opportunity to assist you in your project planning. Please give me a call if you have any questions on these findings.

Sincerely,

Kathleen Lyons
Plant Ecologist

AD In Action

POWERING RURAL COMMUNITIES

Universities Collaborate On Small-Scale Digester Technology

Small-scale digester at an experimental station in Costa Rica has potential to be a model for rural communities throughout Latin America.

Katrina Mendrey

MICHIGAN State University (MSU) researchers are taking advantage of the reliable solar energy of the tropics to heat an anaerobic digester that not only produces biogas, but is the first step in a process that reclaims water and nutrients. The project is the result of a partnership between researchers in the departments of Biosystems and Agricultural Engineering at MSU and Agricultural Engineering at the University of Costa Rica (UCR). Other institutional partners include Universidad Nacional Autónoma de Nicaragua León and Universidad Autónoma de Chiriquí in Panama.

The continuously stirred tank reactor (CSTR) is housed at the Fabio Baudrit Experimental Station located near Alejuela, Costa Rica, where other projects include a poultry breeding program and a plant genetics laboratory mostly focusing on mangos and papaya. The location was chosen as the project fits in well with other work at the experimental station, which is focused on sustainable agriculture and science. Finding a site in Latin America was important to the project as the region is characterized by unequal distribution of income with a majority of the poor living in rural areas. Bringing reliable sources of renewable energy to these regions would help alleviate some of the issues associated with rural poverty.

"Anaerobic digesters aren't new in this region," says Dana Kirk, manager of Anaerobic Digestion Research at MSU. "But the technologies that exist are mostly low-tech, low-cost bag systems not designed for optimization or longevity." The CSTR system can mske full use of resources and potential to extract energy, water and nutrients from local waste streams more efficiently.

The system is designed to operate at thermophilic temperatures (45-55°C or 113-131°F) as opposed to mesophilic (35-40°C or 95-104°F), temperatures that would be sustained in most areas of the United States. Prior to designing the digester, a bench top experiment was performed in both Costa Rica and Michigan to compare microbial communities in digesters at the different temperature regimes and in the different locations. The experiment also tested different feedstock mixtures for optimization. Wei Liao, project co-principal investigator and Associate Professor at MSU, reports that results from this experiment indicated that geography had little influence on biogas productivity. Rather, culture temperature, hydraulic retention time and composition of feedstocks were the primary factors influencing gas production. Results from the study indicated that an 80:20 mixture of poultry manure to food waste resulted in a 37 percent increase in biogas production when digested at 50°C compared to 35°C in 20 days of the hydraulic retention time. Other ratios of manure to food waste tested included 100:0 and 90:10.

SYSTEM DESIGN

The system in place in Costa Rica has a total footprint of 900 m^2 (about 10,000 sq. ft). Water is used as the heating transfer fluid to maintain the reactor temperature. Thermophilic temperatures are sustained using a solar thermal collector to heat the water to 70°C during daylight hours. The heated water is stored in a tank to sustain temperatures of 45°C in the reactor over a 24-hour period allowing the digester to operate continuously. The cool water after heating the reactor is circulated back to the solar thermal collector, and reheated to 70°C.

With a capacity of 20 cubic meters (5,300 gallons), the CSTR is fed one metric ton (1.1 tons) of material per day

The solar-biopower unit includes a 32 m² solar thermal panel (above), a 20 m³ digester and a 50 m³ biogas storage bag (close up of digester and storage bag on left). One metric ton/day of poultry and cattle manure and food waste is processed.

consisting of approximately 70 percent poultry manure, 20 percent cattle manure and 10 percent food waste. The final mix has a C:N ratio of 15:1. The feedstocks come mostly from the experimental station's poultry and farming operations, as well as preconsumer kitchen scraps collected from UCR cafeterias and local restaurants. The food scraps and cattle manure are collected in 50-gallon plastic drums that are delivered weekly to the site. The poultry manure is collected on site using recycled feed sacks. It also contains some wood shavings used as bedding.

The feedstocks are ground on-site using a hammer mill and auger typically used by the coffee industry. The mixture is diluted to about 4 percent solids with reclaimed water. Feedstocks are stored at ambient temperatures for 24 to 48 hours before being fed into the digester. Hydraulic retention time in the digester is approximately 20 days.

The biogas produced is about 60 to 65 percent methane. The biogas is stored in a 60 cubic meter gas bladder. Daily gas production is around 8 to 12 cubic meters, and is used to run two 16 kW combined heat and power (CHP) units. This electricity is used to power plastic grinding at a recycling facility located near the site. In the next phase of the project the energy might also be used to power an adsorption chiller to provide cooling for produce grown at the site.

WATER AND NUTRIENT RECOVERY

After treatment the digestate passes through a solids separator, which removes particles over 1mm (<half-inch) from the liquid stream. Until recently, any chunks or pieces were collected for composting with plant waste produced at the station. However, a recent salmonella outbreak attributed to the cattle manure has led to temporarily discontinuing composting. (Undigested manure residue in the transfer barrels contaminated the digested solids.) For now, the remaining solids are mixed with soil in a nearby field.

The filtrate (liquid portion) is passed through a series of sand and wetland filters two of each. The filtration system includes an initial sand filter followed by a planted wetland with some vegetation and two open surface filters with floating plants and vegetative mats. Vegetation includes papyrus (*Cyperus papyrus*), iris (*Iris gaminea*), juncus (*Juncus effusus*), bandera (*Canna indica*), Job's Tears (*Coix Laycrma jobi L.*), water lettuce (*Pistia stratiotes*) and water hyacinth (*Eichhornia crassipes*). According to Ronald Esteban Aguilar Alvarez, Graduate Research Assistant in MSU's Department of Biosystems and Agricultural Engineering, the plants were chosen for their known abilities to withstand wet soil conditions and their local availability either from nurseries or collected from Costa Rican forests. The sand and wetland cells also are used for other effluent treatment research.

Data collection from the wetland is currently underway. To date, qualitative sampling has demonstrated measurable differences in water clarity as water moves through the filtration cells. Additionally, researchers are monitoring the wetland to identify optimal plant species, harvest times and processes as well as how to handle harvested plants.

Water collected from the last cell is being used to dilute feedstocks into a pumpable slurry prior to digestion and to reduce the nutrient concentration in liquid digestate to a level tolerated by the wetland plants. Eventually, the recovered water could be used as irrigation for crops or to offset potable water consumption elsewhere. "This is really looking at combining both organic waste management, renewable energy and water quality needs of a developing region and doing it in an optimized way," explains Kirk. "It is more sophisticated than the traditional systems."

Effluent (filtrate) from the digester is treated in a wetland with some vegetation and two open surface filters with floating plants and vegetative mats.

COST AND PAYBACK

Kirk is the first to admit that with this sophistication comes a cost. The entire project including design, construction, monitoring and outreach has been funded with a $1 million grant from the U.S. Department of State's Division of Western Hemisphere Affairs. The prototype system currently in operation at the experiment station cost $150,000 USD including instruments and control units (this is included in the $1 million total). The current payback period is seven to ten years and is based mostly on capital offsets provided by savings from the energy generated. Electricity in Costa Rica is relatively clean and inexpensive. Most of the energy is produced by hydro and is around $0.17/kWh. Kirk believes a more desirable payback period of less than six years could be possible. "If we could extract value from the digestate or have a system that is marketing salable compost or if we had situations where there was a liability on the feedstocks then the savings would help reduce the payback period," says Kirk.

For now, Kirk is confident that the payback period will be shortened as the

EDUCATIONAL OPPORTUNITIES

IN addition to assisting communities in the developing world, the program in Costa Rica has also diversified and expanded enrollment in the Department of Biosystems and Agricultural Engineering at MSU. The Costa Rica project has been integrated primarily with biosystems engineering courses at the university, but has also been incorporated into a study abroad program focused on engineering in the tropics.

"From our departmental standpoint it has become a key part of our curriculum at both the undergraduate and graduate level," explains Kirk. "Our international involvement has significantly impacted our graduate degree enrollment and composition as well as undergrad. We have more or less seen a doubling in enrollment."

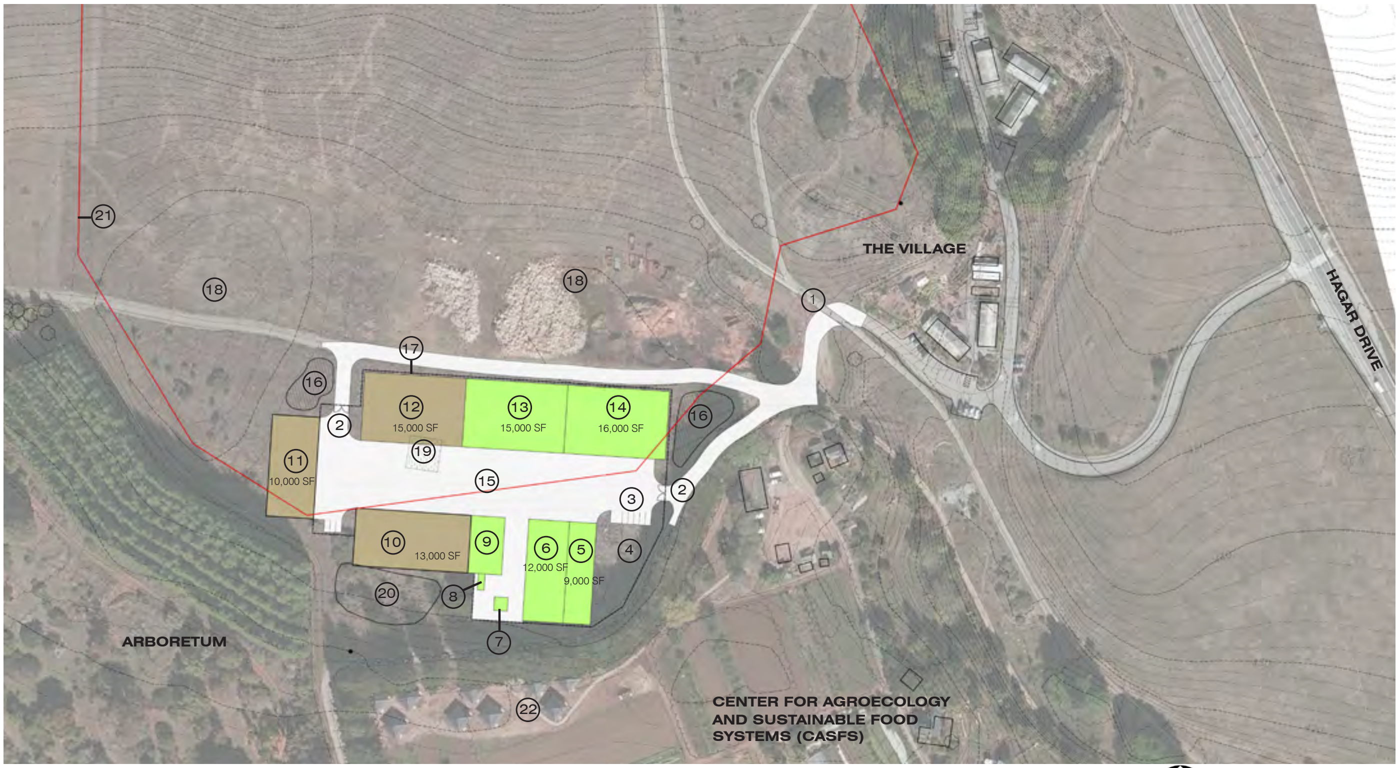
In addition to learning about engineering in the tropics, students also participate in a cultural peer exchange. Students from Costa Rica work with American students on engineering projects as part of the study abroad program. This sort of experience, Kirk notes, is priceless to the future of projects like this one. "If we can work together and have a better understanding of the barriers to projects like this in places like Costa Rica, we have a far better chance of creating successful projects down the road."

system is perfected with the partnership between MSU engineers and local implementers, including those in the coffee industry. "There is enough technical expertise both in Michigan and Costa Rica that the next system will be simpler, more robust and more cost-effective than the system we have today."

Experiences drawn from this initial project, Kirk believes, will certainly help reduce costs even in the next project. For example, many of the challenges presented by the first project have been worked out through simple communication, especially given the language barriers. For example, the CAD drawings for the engineered system were contracted out to a local firm that drafted the plans in Spanish making implementation easier for local contractors. In addition, the team in Costa Rica was able to identify local manufacturers to provide much of the equipment including the auger, grinder, conveyor belts, solids separator and hot water storage tanks — all items used by the coffee industry. "It was a good partnership for the coffee industry and potentially something that could hopefully allow them to diversify their manufacturing base," explains Kirk.

While the initial project started in 2011, the system has now been running smoothly for several months and the team hopes to expand the project through outreach to other Latin American communities. Currently a portable digester consisting of a 500 L (132 gallons) reactor tank, 150 L (40 gallons) water tank and a two by one meter (6.5-ft by 3.2-ft) solar panel is being used to test this type of system at a dairy farm and will later be used at a coffee farm. Researchers hope this will lead to further implementation of the technology across Latin America. Other similar projects under various stages of development that are supported by MSU are under way in Africa and Southeast Asia. ■

BOWL PROGRAMMATIC SITE PLAN, PRESENTED TO DAB DECEMBER 13, 2013



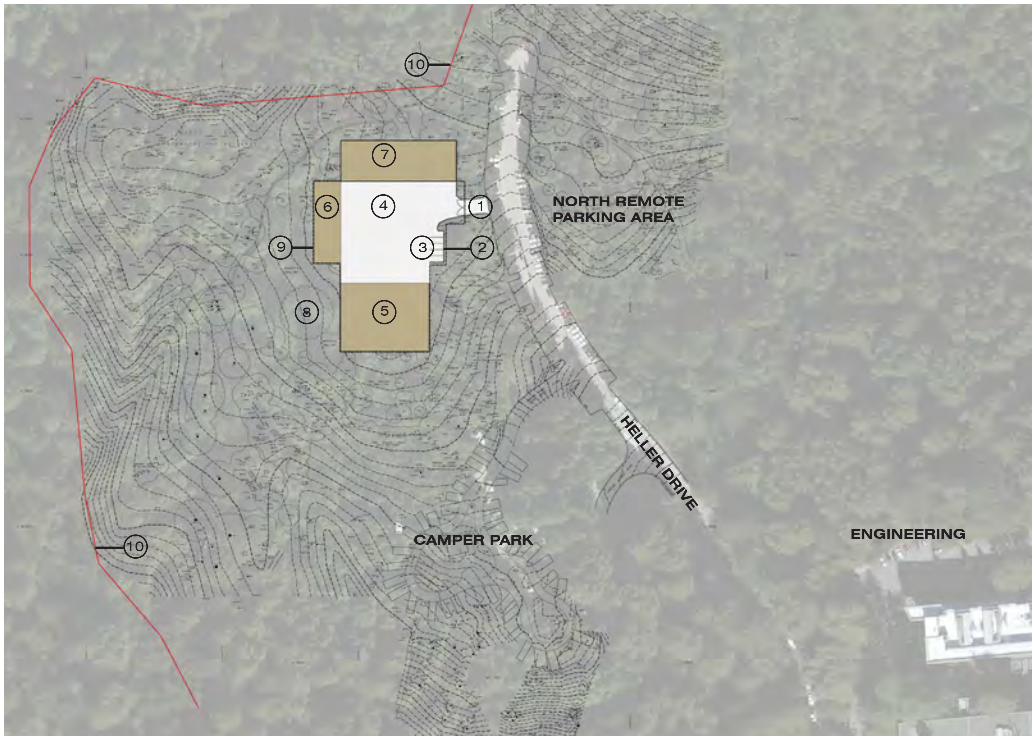
Programmatic Site Plan - For Reference Only

0 40' 80' 160'
SCALE: 1" = 80' - 0"

LEGEND

1. IMPROVED ACCESS ROAD AND BIKE PATH MITIGATION
2. GATE(S)
3. PARKING (1-VAN ADA AND 8 SPACES)
4. VISITOR AREA
5. CASTINGS/TEA
6. COMPOST CURING
7. SCREENING PAD
8. IN-VESSEL COMPOSTING
9. FOODWASTE TIPPING AND PRE-PROCESSING (INSIDE MRF)
10. MATERIALS RECOVERY FACILITY (MRF) 13,000 SF
11. EQUIPMENT AND BIN STORAGE - 10,000 SF
12. CONSTRUCTION AND DEMOLITION PROCESSING (C&D) - 15,000 SF
13. GREENWASTE CHIPPING, GRINDING, AND STAGING
14. VERMICULTURE WINDROWS
15. PAVING
16. STORMWATER DETENTION
17. FENCING
18. SINKHOLE
19. EXISTING ‘HISTORIC’ PAD
20. APPROXIMATE LOCATION OF COASTAL PRAIRIE GRASS
21. PROTECTED LANDSCAPE BOUNDARY
22. CENTER FOR AGROECOLOGY AND SUSTAINABLE FOOD SYSTEMS (CASFS) TENT CABINS

NORTH REMOTE PROGRAMMATIC SITE PLAN, PRESENTED TO DAB DECEMBER 13, 2013



Programmatic Site Plan - For Reference Only

0 40' 80' 160'
SCALE: 1" = 80' - 0"

LEGEND

1. GATE(S)
2. FENCING
3. PARKING (1-VAN ADA AND 3 SPACES)
4. PAVING
5. CONSTRUCTION AND DEMOLITION PROCESSING (C&D) 13,000 SF
6. EQUIPMENT AND BIN STORAGE 4,800 SF
7. MATERIALS RECOVERY FACILITY (MRF) 12,000 SF
8. PROTECT (E) FIR TREE
9. WALL(S)
10. RESERVE BOUNDARY

PROGRAMMATIC SITE COST ESTIMATE
PREPARED BY AECOM, DECEMBER 12, 2013

Consolidated Recycling Yard
University of California

Prepared for:

Joni L. Janecki & Associates, Inc.
515 Swift Street
Santa Cruz California 95060

Prepared by:

AECOM
300 California Street
Suite 400
San Francisco CA 94104
(415) 796-8100

Project Reference: 60312672.110

Consolidated Recycling Yard
University of California

Contents

Consolidated Recycling Yard
University of California

Overall Summary

		SF	$/SF	TOTAL $ x 1,000
S1	North Remote Site	70,000	30.87	2,161
S2	Bowl Site	260,000	13.48	3,504

Escalation To Start Date Included Above

Consolidated Recycling Yard
University of California

Scope of Work

Project Scope Description

The project consists of a site analysis for the location of a new recycling facility. There is a covered shed with a 35-foot tall roof, open on all sides, which also houses one unisex toilet room. The remaining work areas are paved, but without roofs. Utility infrastructure assumes 1,000-foot runs at the Bowl site, and 800-foot runs at the North Remote site.

Consolidated Recycling Yard
University of California

Basis of Estimate

Assumptions and Clarifications

Design Information

Drawings

231125 Recycling North Remote Layout and UCSC Recycling Bowl Layout

Meeting minutes, weekly

Conditions of Construction

A start date of September 2014

A construction period of 3 months

The general contract will be competitively bid with qualified general contractors

The entire scope of work will be bid as one project

There will not be small business set aside requirements

The contractor will be required to pay prevailing wages

There are no phasing requirements

The general contractor will have full access to the site during normal business hours

Exclusions

Soft costs, including construction contingency, design fees and project management

Soil remediation

Soil export off site

Delays due to archeological monitoring and discoveries

Special procedures for species protection

Bus stops

Storm drain overflow pipework

Hose stations

Hot water

Major site utility relocations and upgrades

Utility connection charges and fees

Telephone/data 'active' equipment - including hubs, routers, servers, LAN, switches, etc.

Public address & centralized clocks

Audio visual equipment

Emergency call stations

Interpretive signage

Recycling equipment such as compactors, sorters, etc.

Loose furniture and equipment except as specifically identified

Hazardous material handling, disposal and abatement

Consolidated Recycling Yard
University of California

Basis of Estimate

Compression of schedule, premium or shift work, and restrictions on the contractor's working hours

Testing and inspection fees

Architectural, design and construction management fees

Scope change and post contract contingencies

Assessments, taxes, finance, legal and development charges

Environmental impact mitigation

Builder's risk, project wrap-up and other owner provided insurance program

Land and easement acquisition

Cost escalation beyond a start date of September 2014

Consolidated Recycling Yard
University of California

Market Conditions

Global and National Construction Market

This document is based on the measurement and pricing of quantities wherever information is provided and/or reasonable assumptions for other work not covered in the drawings or specifications, as stated within this document. Unit rates have been obtained from historical records and/or discussion with contractors. The unit rates reflect current bid costs in the area. All unit rates relevant to subcontractor work include the subcontractors overhead and profit unless otherwise stated. The mark-ups cover the costs of field overhead, home office overhead and profit and range from 15% to 25% of the cost for a particular item of work.

Pricing reflects probable construction costs obtainable in the project locality on the date of this statement of probable costs. This estimate is a determination of fair market value for the construction of this project. It is not a prediction of low bid. Pricing assumes competitive bidding for every portion of the construction work for all subcontractors and general contractors, with a minimum of 4 bidders for all items of subcontracted work and 6-7 general contractor bids. Experience indicates that a fewer number of bidders may result in higher bids, conversely an increased number of bidders may result in more competitive bids.

Since AECOM has no control over the cost of labor, material, equipment, or over the contractor's method of determining prices, or over the competitive bidding or market conditions at the time of bid, the statement of probable construction cost is based on industry practice, professional experience and qualifications, and represents AECOM's best judgment as professional construction consultant familiar with the construction industry. However, AECOM cannot and does not guarantee that the proposals, bids, or the construction cost will not vary from opinions of probable cost prepared by them.

Project Specific Factors and Escalation

Cost escalation is included up to a projected start date of September 2014. Escalation rates of 5% - 6% are anticipated for the year following the date of issuance of this report, with 3.5% thereafter.

Consolidated Recycling Yard
University of California

North Remote Site Summary

			%	$/SF	TOTAL $ x 1,000
			Gross Area:	70,000 SF	
14	Site Preparation & Demolition		5%	1.61	113
15	Site Paving, Structure & Landscaping		47%	14.65	1,025
16	Site Utilities		20%	6.32	443
6	Site Contruction		73%	22.58	1,581
SITE CONSTRUCTION			73%	22.58	1,581
17	General Conditions	7.00%	5%	1.58	111
18	Contractor's Overhead & Profit or Fee	3.00%	2%	0.72	51
PLANNED SITE CONSTRUCTION COST			81%	24.89	1,742
19	Contingency for Development of Design	15.00%	12%	3.73	261
CONSTRUCTION COST BEFORE ESCALATION			93%	28.62	2,003
20	Escalation to Start Date (Sep 2014)	3.93%	7%	2.25	157
RECOMMENDED BUDGET			100%	30.87	2,161

Consolidated Recycling Yard
University of California

North Remote Site

Item Description	Quantity	Unit	Rate	Total
6 Site Contruction				
14 Site Preparation & Demolition	**70,000**	**SF**	**1.61**	**112,900**
Site protection				
Erosion control	70,000	SF	0.15	10,500
Protect existing features (manzanita, trees, etc.)	1	LS	5,000.00	5,000
Construction fencing	1,200	LF	12.00	14,400
Site clearing and grading				
Rough grading	70,000	SF	0.15	10,500
Fine grading	70,000	SF	0.15	10,500
Surveying	1	LS	12,000.00	12,000
Fell and remove existing trees, allow	1	LS	20,000.00	20,000
Compacted fill at Construction Demolition & Processing, assume 2' depth	1,000	CY	30.00	30,000
15 Site Paving, Structure & Landscaping	**70,000**	**SF**	**14.65**	**1,025,275**
Vehicular paving				
Asphalt paving				
Access roads	1,200	SF	5.00	6,000
Main yard	23,700	SF	5.00	118,500
Compacted earth pads				*Composting NIC*
Concrete pads				
Reinforced concrete, 6" thick, MRF, Equipment & Bin Storage, Construction & Demolition Processing, Compost Screening Pad	28,600	SF	7.00	200,200
Structures				
Materials Recovery Facility, open on four sides				
Allowance for drilled piers and footings at columns	10,200	SF	6.00	61,200
Columns, sloping roof structure, 35' tall	10,200	SF	23.00	234,600
Standing seam roofing	10,200	SF	12.00	122,400
Unisex toilet room	75	SF	500.00	37,500
Masonry walls, 3 sides each at Equipment & Bin Storage and at Construction & Demolition Processing, 5' tall	2,675	SF	25.00	66,875
Landscaping, allow native grasses				
Visitor area	3,000	SF	3.00	9,000
Stormwater detention				*See Utilities*
Temporary irrigation	3,000	SF	2.00	6,000

Consolidated Recycling Yard
University of California

North Remote Site

Item Description	Quantity	Unit	Rate	Total
Site accessories				
Picnic tables	1	LS	5,000.00	5,000
Bollards, bike racks, etc.	1	LS	10,000.00	10,000
Fencing				
Prefabricated ornamental metal, 6' tall	800	LF	120.00	96,000
Automated vehicular entry gates with card key access	1	EA	45,000.00	45,000
Person gates, allow	2	EA	3,500.00	7,000
16 Site Utilities	**70,000**	**SF**	**6.32**	**442,500**
Mechanical utilities, allowances				
Domestic water				
Pipework < 2"	800	LF	45.00	36,000
Hose bibbs	1	LS	7,500.00	7,500
Connect to existing	1	LS	2,500.00	2,500
Fire water				
Pipework	800	LF	95.00	76,000
Hydrants	2	EA	5,500.00	11,000
Connect to existing	1	LS	5,000.00	5,000
Sanitary sewer				
Pipework < 4"	800	LF	65.00	52,000
Floor grate at MRF	1	EA	1,500.00	1,500
Connect to existing	1	LS	2,500.00	2,500
Storm drainage				
Storm drain pipework	800	LF	45.00	36,000
Storm drains and manholes	1	LS	10,000.00	10,000
Connect to existing	1	LS	2,500.00	2,500
Electrical utilities allowances				
Panel connections, 200 amp	1	LS	5,000.00	5,000
Feeder conduit and wire	800	LF	110.00	88,000
Equipment connections	1	LS	10,000.00	10,000
Lighting controller	1	EA	3,000.00	3,000
Lighting				
Street lights, pole mounted LED	2	EA	6,000.00	12,000
Wall-mounted lights, allow	6	EA	2,500.00	15,000

Consolidated Recycling Yard
University of California

North Remote Site

Item Description	Quantity	Unit	Rate	Total
Security				
Cameras mounted on light poles and new walls, fixed	4	EA	2,500.00	10,000
Gate controllers	1	EA	5,000.00	5,000
Power and data lines	1,200	LF	35.00	42,000
Fire alarm				
Devices connected to campus system	1	LS	10,000.00	10,000
				1,580,675

Consolidated Recycling Yard
University of California

Bowl Site Summary

			%	$/SF	TOTAL $ x 1,000
			Gross Area:	260,000 SF	
14	Site Preparation & Demolition		3%	0.38	99
15	Site Paving, Structure & Landscaping		58%	7.85	2,041
16	Site Utilities		13%	1.82	473
6	Site Contruction		75%	10.05	2,612
SITE CONSTRUCTION			75%	10.05	2,612
17	General Conditions	5.00%	4%	0.50	131
18	Contractor's Overhead & Profit or Fee	3.00%	2%	0.32	82
PLANNED SITE CONSTRUCTION COST			81%	10.87	2,825
19	Contingency for Development of Design	15.00%	12%	1.63	424
CONSTRUCTION COST BEFORE ESCALATION			93%	12.50	3,249
20	Escalation to Start Date (Sep 2014)	3.93%	7%	0.98	255
RECOMMENDED BUDGET			100%	13.48	3,504

Consolidated Recycling Yard
University of California

Bowl Site

Item Description	Quantity	Unit	Rate	Total
6 Site Contruction				
14 Site Preparation & Demolition	**260,000**	**SF**	**0.38**	**98,820**
Site protection				
Erosion control	260,000	SF	0.08	20,800
Protect existing features (historic pad, prairie grass, etc.)	1	LS	5,000.00	5,000
Construction fencing	2,000	LF	12.00	24,000
Site clearing and grading				
Rough grading	185,100	SF	0.10	18,510
Fine grading	185,100	SF	0.10	18,510
Surveying	1	LS	12,000.00	12,000
15 Site Paving, Structure & Landscaping	**260,000**	**SF**	**7.85**	**2,040,900**
Vehicular paving				
Asphalt paving				
Access roads	31,000	SF	5.00	155,000
Bike path	2,000	SF	3.50	7,000
Main yard	62,500	SF	5.00	312,500
Compacted earth pads	45,000	SF	0.50	22,500
Concrete pads				
Reinforced concrete, 6" thick, MRF, Equipment & Bin Storage, Construction & Demolition Processing, Compost Screening Pad	44,600	SF	7.00	312,200
Structures				
Materials Recovery Facility, open on four sides				
Allowance for drilled piers and footings at columns	18,700	SF	6.00	112,200
Columns, sloping roof structure, 35' tall	18,700	SF	23.00	430,100
Standing seam roofing	18,700	SF	12.00	224,400
Unisex toilet room	75	SF	500.00	37,500
Masonry walls, 3 sides each at Equipment & Bin Storage and at Construction & Demolition Processing, 5' tall	3,200	SF	25.00	80,000
Landscaping, allow native grasses				
Visitor area	11,000	SF	3.00	33,000
Stormwater detention	9,000	SF	3.00	27,000
Temporary irrigation	20,000	SF	2.00	40,000
Site accessories				
Picnic tables	1	LS	5,000.00	5,000
Bollards, bike racks, etc.	1	LS	10,000.00	10,000

Consolidated Recycling Yard
University of California

Bowl Site

Item Description	Quantity	Unit	Rate	Total
Fencing				
Prefabricated ornamental metal, 6' tall	1,100	LF	120.00	132,000
Automated vehicular entry gates with card key access	2	EA	45,000.00	90,000
Person gates, allow	3	EA	3,500.00	10,500
16 Site Utilities	**260,000**	**SF**	**1.82**	**472,500**
Mechanical utilities, allowances				
Domestic water				
Pipework < 2"	1,000	LF	45.00	45,000
Hose bibbs	1	LS	7,500.00	7,500
Connect to existing	1	LS	2,500.00	2,500
Fire water				
Pipework	1,000	LF	95.00	95,000
Hydrants	2	EA	5,500.00	11,000
Connect to existing	1	LS	5,000.00	5,000
Sanitary sewer				
Pipework < 4"	1,000	LF	65.00	65,000
Floor grate at MRF	1	EA	1,500.00	1,500
Connect to existing	1	LS	2,500.00	2,500
Storm drainage	*Sheet runoff directed to detention areas*			
Electrical utilities allowances				
Panel connections, 200 amp	1	LS	5,000.00	5,000
Feeder conduit and wire	1,000	LF	110.00	110,000
Equipment connections	1	LS	10,000.00	10,000
Lighting controller	1	EA	3,000.00	3,000
Lighting				
Street lights, pole mounted LED	2	EA	6,000.00	12,000
Wall-mounted lights, allow	6	EA	2,500.00	15,000
Security				
Cameras mounted on light poles and new walls, fixed	4	EA	2,500.00	10,000
Gate controllers	2	EA	5,000.00	10,000
Power and data lines	1,500	LF	35.00	52,500
Fire alarm				
Devices connected to campus system	1	LS	10,000.00	10,000
				2,612,220

MEETING NOTES
DESIGN ADVISORY BOARD
University of California, Santa Cruz
Friday, December 13, 2013
9:30 a.m. to 2:30 p.m.
Physical Planning and Construction Conference Room

ATTENDEES

Board members present:	Tito Patri, Chair Richard Fernau
UCSC employees present:	John Barnes, AVC PPC/Campus Architect Dean Fitch, Director of Campus Planning Felix Ang, Director of Architectural Services Elijah Mowbray, Senior Civil Engineer Diane Lallemand, Assistant to the Campus Architect

CALL TO ORDER, ANNOUNCEMENTS AND REPORTS

The Chair called the meeting to order at 9:40 am.

Announcements / Reports

The Campus Architect and Director of Campus Planning provided a status report on the following projects:

- Recycling Yard
- Merrill
- Telecom
- Infrastructure
- IAS
- Hay Barn
- Coastal Biology
- Big Creek
- Infill Exterior Repairs
- DAB Schedule for 2014 move to every second Wednesday of the month
- Feasibility Study for Slaughter House - Donor funded
- West Campus Development Planning – FSH, Kresge Redevelopment

INFORMATION ITEMS

Upper Quarry Amphitheater

Project Manager	Dean Fitch
Consultant	The Office of Cheryl Barton, landscape architects

The project team is working on the feasibility study now through June, 2014, his will assist in forming the needs of the site and its program. It is anticipated that project design would begin Summer 2014. The following items will be addressed in the first phase of the project:

- Universal access is problematic
- Secondary fire/life safety egress problematic
- Must think about the historical significance of the original Royston design

DAB Notes.12.13.13_Final.doc

Design Advisory Board Meeting Notes
13 December 2013

- What is the potential use, performance or casual?
- Upgrade of restrooms is required
- Service access during events needs to be improved
- Original construction introduced fill – should that stay?
- Removal of trees to open an entry for better connection to Quarry Plaza
- Pedestrian sequence of activities and spaces moving from Steinhart northwards
- Security for ticketed events

ITEMS UNDER CONSIDERATON

Recycle Yard
Project Manager Elijah Mowbray
Consultant Joni Janecki, Janecki & Associates, Inc.

Project Background
The project proposes to relocate recycling activities currently operating at the Hay Barn site and consolidate recycling activities located around the campus at one location for efficiencies of operation. During a site selection process, the campus narrowed down the location to two sites for preliminary study. Recycling activities include: internal collection and sorting, hauling kitchen waste to Marina (~2 tons per day), hauling to San Jose CRV material. Regents policy identifies Zero waste goal by 2020; UCSC diverts about 75%, which is good. Our current waste stream includes about 46% compostable material and the campus is exploring whether to include an on-site composting operation. Student involvement in waste diversion is high.

The board toured both Recycling Yard Sites and the Upper Quarry Amphitheater site

Informational Presentation
Background on project: The immediate objective is to, relocate recycling away from Hay Barn. Longer term goals include consolidation of the operation in one location and flexibility to expand based on UC's zero waste goals. Working with Janecki & Associates, Inc. the consultant team includes: Clements Environmental – specializes in waste management help reduce stream; Bowman Williams – Civil; AE Com – Cost; Pac Crest – Geotechnical Engineer.
The site selection process looked at eight sites initially, incorporated 10-12 more, now down to 2 sites. The site criteria: 3 acres, truck access, pedestrian traffic, utilities, sanitary sewer.

Consultant presentation
Review of current activities and zero waste by 2020 goals. It is an 80-mile round trip to Marina to transport compost, but facility cannot process paper towels, which is a large portion of the campus waste stream. The following is a review of the two sites:

"North Remote" Site Opportunities and Constraints
- Central location and close to developed area of the campus and waste generators
- Tucked in forest – hidden
- Potential for photo voltaic is good
- 2005 LRDP anticipated development with lands use designation of Colleges and Housing Student– EIR contemplated development
- Lower construction cost due to stable geology
- Extensive tree removal, has been cleared in the 1970s but all grown back
- Site drains to two gulches that would need control for storm water

Design Advisory Board Meeting Notes
13 December 2013

- Noise impacts to adjacent trailer park
- Distance to campus entrance
- Cost for retaining walls as site is sloped
- Site area limits future expansion
- Loss of parking spaces to accommodate entrance from Heller Drive
- Manzanita with special species – requires study and mitigation
- Green waste organic composting or vermiculture not possible at this site

"Bowl" Site Opportunities and Constraints
- Requires modification at intersection between road and bike path
- Proximate to life lab program
- Close to campus entry/exit
- Existing vegetation reduces some visual impact
- Good southern exposure for photo voltaics
- Mostly level site
- No tree removal
- Potential for expansion
- Conducive to storm water management
- Potential negative sight lines from University House and the Great Meadow
- Noise impacts for adjacent farm residents, but able to mitigate and flex program
- Potential sink holes, 2 known currently
- Not centrally located to campus and generation of material
- Partially in meadow and would require an LRDP amendment
- Need to study a historic foundation
- Native grass species adjacent to site

A Site Evaluation criteria matrix was presented that ranked the "bowl" site slightly more favorable than the "north remote" site.

Board Discussion
Has the team explored splitting up recycling operations by leaving some operations at the corporation yard and locating organics at the bowl site?

Site sections would assist in understanding the amount of grading, visual impacts and screening opportunities related to the bowl site.

DAB sees the "bowl" site as another encroachment on the meadow, but asks the consultant to examine spacing out the structures even more and maybe separating the organic materials operation.

DAB would like to see how to break down industrial use.

Need to explore relationship between building arrangement/landscape breathing room.
Need to study stopping distances for trucks and bikes related to safety at the bowl site intersection.

Board Recommendations
- More analysis of site and functions being separated
- Site sections of the bowl site would help at the next review
- DAB prefers the "north remote" site and suggests consideration of the "north remote" Site as an interim solution – maybe 10-15 years - design for future use
- Examine the impacts and necessity of a 35' tall roofed structure

Design Advisory Board Meeting Notes
13 December 2013

- Study how you can make an industrial site fit better in the forest
- "Bowl" site negatives are huge, life safety, visual
- Look at each piece of the program and ask, can current operations be more efficient?

Hay Barn Rehabilitation

Project Manager	Henry Hooker (not present)
Consultant	Richard Fernau, Fernau + Hartman Architects

(Richard Fernau recused himself from DAB for this portion of the meeting)

Project Background
A $5 million gift from a donor will both rehabilitate the Hay Barn and support programs and activities in environmental studies that will take place at that venue.

Board Discussion
The proposed Kalwall material, seems "shockingly modern."
Is there a color choice for the Kalwall material,
What are the R ratings and will that control the opacity.
Patterning of kalwall wall does not match historical small vertical unit vocabulary
Opening at ends to retain original heights
No need for rigid edge at hillside parking push back waste containers
Allow parking to be more informally placed into hillside and hillside contours could be treated more sensitively
Is there a way to pull ADA path away from drive to avoid hard corner at entrance
Need to look at fence drawings and make detail comments
Mechanical/electrical equipment might be hidden well in corral structure
Reinforce retaining the meadow right to the Barn and avoid additional planting

Board Recommendations

Site work:
- Condenser enclosure can be used to reconstitute the corrals and fencing patterns
- Explore elements that need outside storage space to utilize the mechanical enclosure?
- Edge of parking is arbitrary and should be more fluid with waste enclosure tucked further back
- North east corner grading should be a little less sharp
- ADA Entrance awkward, can you make it a path not a sidewalk?
- Prefer no curb at walkway, explore options with Fire Marshall
- Need to see samples landscape materials

Barn:
- The Kalwall has a look of plastic on the historical building, explore a more transparent version, internal grid should match the scale of an historical vertical pattern
- The look of Kalwall vs glass at door seems odd. Consider all glass?
- Historical photo shows the gable at the top of the hay door is not there, reexamine the opening up to the roof line.

- Only native grass around the building as it is critical image to set history for those who have not been to campus before. To plant gardens or agriculture patches here would take away the history. It must be restored to original meadow conditions.

ADJOURNMENT
The meeting was adjourned at 2:30pm.

Next Meeting: January 8, 2014

RECYCLING YARD PROJECT

MAY 22, 2013

RECYCLING YARD KICK-OFF MEETING

PHYSICAL PLANNING & CONSTRUCTION CONFERENCE ROOM
9 AM – 10:30 AM

AGENDA

I. BACKGROUND

II. EXISTING CONDITIONS
- A. Recycling Operation
- B. Existing Recycling Yard Areas

III. SITE SELECTION
- A. Requirements / Goals for New Recycling Yard
- B. Discussion of Possible Sites
  1. West of the North Remote Parking Lot
  2. The Bowl
  3. Old LPG Facility
  4. Existing Corporation Yard
  5. East Remote Parking Lot
  6. Empire Grade Site
  7. 2300 Delaware Facility
  8. North of Crown/Merrill Apartments & Firehouse
  9. Others?

IV. NEXT STEPS
- A. Site Selection Process
- B. Feasibility of Composting Waste on Campus
- C. Selection of Design Professional
- D. CEQA Review
- E. Future Meetings

Attachments:
(1) Preliminary Location Analysis
(2) Letter Dated March 19, 2013, Re: Pre-Design Studies and Preliminary Plans
(3) Campus Sustainability Plan 1.5, Waste & Recycling – Purpose, Vision, Goals

RECYCLING YARD PROJECT

PRELIMINARY LOCATION ANALYSIS

I. BACKGROUND

Introduction

Recycling – the recovery of reusable material from the refuse stream – is a key component of modern waste reduction. The goal is to prevent waste of potentially useful materials, which reduces the need for conventional disposal of waste in a landfill. Effective recycling serves to reduce the consumption of fresh raw materials, reduce energy usage, reduce air & water pollution and lower greenhouse gas emissions.

For our purposes, recycling includes any useful diversion of materials from the waste stream either diversion at the source or after materials are discarded. This includes minimizing source waste, salvage, reuse after collection, and composting or other reuse of biodegradable waste – such as food or garden waste.

The goal of the *Recycling Yard* project is to identify and develop a site which can accommodate an efficient and robust Campus Recycling operation. Ideally, the *Recycling Yard* will be sited in a permanent, on-campus location with ability to expand as needed to efficiently support the infrastructure required to facilitate increased waste diversion practices on campus. More immediately, the minimum short term goal is to relocate the recycling/material handling operations which currently occupy the area adjacent to the Hay Barn in support of its planned reconstruction which is scheduled to begin in 2014.

Sustainability

UC Santa Cruz is committed to sustainability. Our campus goal is to be "zero waste" by 2020 as set forth by the UC Policy on Sustainable Practices. A zero-waste community strives first to reduce consumption in order to minimize waste wherever possible. Secondarily, materials should be reusable in some way, whether it is conventional reuse where the item is used again for the same function or new-life reuse where it is used for a different function. The campus strives to maximize the potential of recovery of materials for the reuse in an efficient and sustainable manner.

The *Recycling Yard* project represents a key opportunity to effectively integrate sustainability into campus life and achieve target goals of the Campus Sustainability Plan – for example, by providing the space required for on-campus composting of 100% of potentially compostable and biodegradable materials from all UCSC Dining operations.

A *Recycling Yard* which is well situated and designed for that function will increase opportunities for student participation in Zero Waste goals and promote outstanding programs in Sustainable Food Systems. In sum, the capacity and efficiency of our waste management facilities needs to increase if we are to achieve sustainability goals and be a global leader in modeling sustainability.

Opportunity

Everyone on campus contributes to the waste stream and thus has the potential to make key decisions affecting overall campus diversion success. An effective waste diversion operation can benefit from a wide range of solutions: proper sorting at the initial collection sites can result from education and mass action; organic composting stems from knowledge of the natural environment; scientists and engineers continue to advance the design of materials recovery facilities and the composition of materials entering the waste stream.

Recycling is therefore a natural area of collaboration between campus operations, student life, academics and research – a potential growth area for interdisciplinary action. Our campus culture of environmental & social justice combined with cutting edge science & research uniquely lends itself to the development of better waste diversion.

II. EXISTING CONDITIONS

Ground Services

Campus recycling has been centralized within Ground Services since 1996. Grounds Services self-hauls to off-campus locations refuse and recyclables (materials and compostable waste) including construction waste. The recycling operation does not have a permanent on-campus home with sufficient space to allow the consolidation of its current recycling activities. As a result, operations are spread out over multiple locations, each of which has very limited space.

More generally, Ground Services has experienced a substantial reduction in available on-campus space over the years. Reasons for this reduction include the following:

Emergency Response Center – In 2004, construction of the ERC displaced a large portion of the Corporation Yard including the Recycling Operations, Landscape Storage, Equipment Storage and Building Materials Storage. Ground Services was able to relocate some of these functions with financial assistance from the campus. Efforts to find suitable relocation sites mirrored the current one and in fact considered almost all of the same locations that we are looking at today. In the end, no satisfactory permanent solution was implemented, the amount of space allocated to Ground Services was never fully replaced, and operations were diffused to various locations.

The Hay Barn - In the past, the Hay Barn and adjacent lands served as a major hub for maintenance operations – in fact some campus maps still refer to the structure as the Equipment Barn. It accommodated office space, covered work space and storage for equipment and materials. There was ample outdoor storage for Grounds equipment and materials in the area surrounding the barn. Over time the structural integrity of the Hay Barn degraded to the point where it was no longer safe to occupy; the structure was abandoned and eventually Ground Services was left with only a portion of the outside space surrounding the building. Now the *Hay Barn Reconstruction* project intends to displace the remaining space allocated to Ground Services at this location.

Ground Services currently occupies a variety of sites on the campus. These storage and operations areas have evolved over time – some have been officially designated for Ground Services to use, others have grown or changed uses more or less unofficially when storage needs outpaced available space. Space allocation among the various Physical Plant groups has also fluctuated over time. Some of the spaces currently used by Ground Services are discussed in greater detail below as part of the analysis of potential locations for the *Recycling Yard*.

Two salient points for the analysis of options presented below. First, the total space allocated to Ground Services is both smaller than ideal and fragmented in various locations; both tend to reduce efficiency of field operations. Second, many of the sites under consideration for expanded *Recycling Yard* operations – or at least replacement of the area to be lost at the Hay Barn – are currently being used by Ground Services and/or other campus groups. Therefore, depending on the final site chosen, this project may displace something else (and perhaps need to help relocate it in turn.)

Campus Recycling

Recycling at UCSC currently involves various streams of materials which are collected, sorted, and transferred off campus in different ways. Please note that this analysis does not cover many other diversion streams that are not handled directly by Grounds Services, such as: surplus items; kitchen grease; paper shredding; waste oil and other fluids from fleet maintenance; and carpet, mattresses, and appliances from Housing. To understand the criteria for a *Recycling Yard*, a broad overview of the current recycling operation follows.

Dual Stream Recycling Bins – in most locations, two streams of comingled materials are collected in recycling bins at nearly 100 public area locations throughout the campus. Each location typically has a separate bin for each material and users are expected to separate and place the correct materials the correct bins as follows:

- Mixed Containers – includes plastic, aluminum and glass containers.
- Mixed Paper – includes paper products such as the following: white and colored paper (bond, typing, copier, etc.), envelopes, fax paper, catalogues, magazines, phone books, newspaper, and paperboard (e.g. cereal boxes, shoe boxes, egg cartons, paper towel rolls, beer and soda packs, manila file folders)

RECYCLING YARD PROJECT
PRELIMINARY LOCATION ANALYSIS

In office spaces, additional bins are used for white office paper and mixed office paper, which are collected separately. The recycling bins are picked up, rolled to the access point where the truck is parked, and placed in the covered storage area of a campus box truck. In general empty bins are dropped off when full ones are picked up.

RECYCLING BIN LOCATIONS, PUBLIC AREAS OF CAMPUS *MIXED CONTAINERS & MIXED PAPER*	
AREA OF CAMPUS	**# OF BIN LOCATIONS**
Crown, Merrill	13
College 8, Oakes	11
Cowell, Stevenson, Bookstore	24
Kresge, Kresge East, Porter, Porter Infill	17
Lower Campus	5
Social Sciences, College 9 & 10	9
VAPA, McHenry, ARC, Music, Kerr Hall	16
Village	2
Source:	**97**
http://ucscplant.ucsc.edu/ucscplant/Grounds/index.jsp?page=Recycling_Maps	

Periodically the content of the bins is transferred to roll off boxes. Recycling team members visually inspect the bins beforehand and, depending on the composition of items in the bins, they complete some initial sorting. This effort is required because people tend to put incorrect items in the recycling bins. Office paper grades are transferred to large box bins (aka “maggies”) in the Corporation Yard to be picked up by a vendor.

Once enough is collected, the “mixed container” material is sorted using a line sorting machine. The purpose of the sort line is to separate out California Redemption Value (CRV) containers in three materials: PET, aluminum and glass. These separated CRV materials flow into roll off boxes for accumulation – when these boxes are full they are hauled to commercial recycling facilities and sold. This money helps to support the Recycling Program. Non-CRV recyclable materials are hauled to the City of Santa Cruz Resource Recovery Facility (a distance of about five miles each way) and transferred to their recycled materials stream.

Cardboard – Another material which is handled separately is cardboard. Campus users are asked to place cardboard in big green dumpsters that are located near the loading docks of most buildings. The cardboard is then collected using a front loader truck. The truck fills roughly weekly, and the cardboard is then hauled to a vendor.

Compostable Materials – Each campus dining hall has a compostable material container near its loading dock. These containers are enclosed and equipped with a compactor to internally consolidate materials. The compactor consolidates the material and keeps one side of the container clear so that the heavy bins full of compostable materials can raised and transferred using a fixed mechanical lifting device. When required the entire container (including compactor and all attached hardware) is picked up using a roll-on/roll-off style truck. It is hauled to a composting facility in Marina

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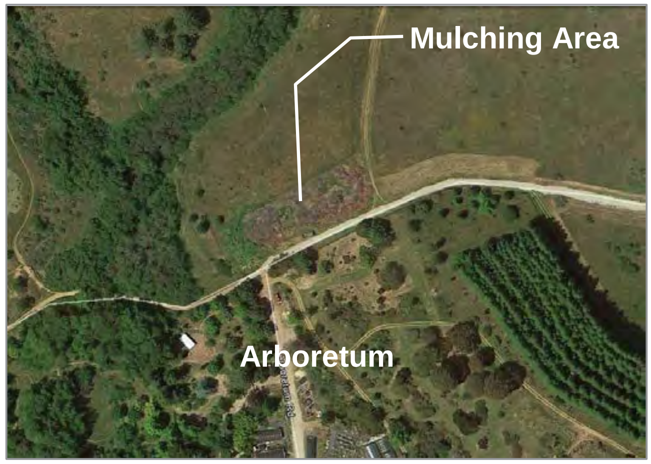


(MRWMD) which is in Monterey County approximately forty miles south of the main campus.

The Campus Sustainability Plan includes the following goal: "Compost 100% of potentially compostable & biodegradable materials from all UCSC Dining operations (UC Policy 2009.)" This target objective may be met by composting material in Marina but the development of an on-campus or closer composting facility may be desirable if infrastructure, equipment, and staff funding can be found to support it. The resulting material can be used on campus at the Farm or Arboretum, or sold to help offset the costs. Preliminary discussions to this end are underway, and it would be ideal to provide space for this operation at or near the *Recycling Yard*.

In addition to small scale mulching and composting which occurs at both the Farm and Arboretum, clean green waste is often stored in a ½ acre area adjacent to the Arboretum (picture above.) Mulched items include organic debris such as landscape trimmings, brush, tree pruning, and grass clippings. The area is used primarily by the Arboretum but at times Ground Services is involved. Grounds Services also has a green waste storage area more centrally located in "the Bowl". At times, sufficient material builds up to hire a contract tub grinder to reduce the material to mulch usable on site. Typically the material is hauled to the city green waste facility.

Construction Waste – Construction waste is handled by arrangement. Typically a roll-off box is ordered by a project or other unit on campus. The box is generally sorted through and separated into dedicated roll off boxes for various materials and recycled to the extent feasible.

Recycling Crew – A listing of items associated with Campus Recycling follows:

- 640 – 64 gallon Rolling Bins / Container and Paper Streams
- 80 – 35 gallon Rolling Bins / Container and Paper Streams
- 425 – 20 gallon Paper Cans / (Indoor) Office and Mixed Streams
- 26 – 35 gallon Compost Bins - from Cafes to Kitchen Compactors
- 88 indoor slim jims
- Battery collection
- Conveyor belt sorting line.
- Miscellaneous material pickups
- Event services

RECYCLING YARD PROJECT
PRELIMINARY LOCATION ANALYSIS

Front Loader Trucks / Dumpsters - 254 Total dumpster stops including:

- 127 Refuse Dumpsters
- 28 Mixed-Recycling Dumpsters
- 9 Greenwaste Dumpsters
- 81 Cardboard Dumpsters

Existing Recycling Yard Areas

The primary operations of Campus Recycling take place in multiple locations on campus:

Hay Barn Area – As pictured here, this area provides about one-third to one-half of an acre and is primarily used for sorting of construction materials in roll-off boxes, as well as bulk storage of items. The usable space at this site is smaller than it could be due to the tight configuration and topography. Still, it represents a substantial amount of the space dedicated to recycling (maybe one-fourth or more.)

Corporation Yard – Approximately 6,000 square feet (or 0.14 acres) of the Physical Plant Corporation yard is dedicated to recycling operations. Activities taking place in this area are CRV sorting, paper sorting, storage and loading into tractor trailer units, active bin storage, battery sorting and storage, bin maintenance, truck preparation, and recycle truck parking.

Steinhart Way Turnout – The recycling team currently utilizes a turnout on Steinhart Way as a satellite sort area. This space is just under one-quarter of an acre and is conveniently located near the campus core, allowing recycling trucks to transfer and complete an initial sort in the middle of their collection routes. Steinhart Way is a restricted access road, and thus does not experience public traffic. However, it is heavily used by pedestrians and bicycles and highly visible, thus it may be desirable to relocate this area. Alternatively, the area could be improved with appropriate fencing and utilities. The utility of a satellite drop off facility is highly dependent on proximity to the recycling generation, in our case the campus core. If we are to maintain satellite sorting, this activity must be located as close as possible to central campus.

Music Center Loading Dock – There is a smaller "satellite" or "transfer" site used by the recycling team across from the Music center loading dock. It is used for the same purpose as the Steinhart Way Turnout and variously houses seven or eight dumpsters for cardboard, container recycle, greenwaste, and trash (coming out of the recycle bins).

The "Bowl" – A major facility used by Grounds Services for recycling and storage of organic materials is located at the bottom of the "Great Meadow". Physical Planning and Construction has created a large rock stockpile in this area as well. The space used by Grounds Services is approximately an acre in size and is used for storing roll off containers; tree crew wood chips (for re-use on campus); logs, stumps and other wood (for processing); various soil, crushed rock, and base rock; and purchased landscape materials such as sawdust and furry mulch. The space is also used for the collection of organic materials destined to go to the city greenwaste facility. These materials are collected in various ways, i.e. from campus gardeners, the turf crew, site stewardship, and other grounds functions. It is periodically loaded into large roll off boxes and hauled to the City of Santa Cruz Resource Recovery Facility on Dimeo Lane.

Old LPG site **–** The site is currently used to store dumpsters that are used to collect material during peak times of the year – i.e. student move-in and move-out.

Summary

The search for a new location to accommodate the *Recycling Yard* naturally involves an understanding of the current operation in order to best determine the criteria governing the site selection process, e.g.: How much space does the operation need? Can the operation be streamlined in order to reduce the space requirements? Will the cost of the operation be substantially impacted by reducing, increasing or consolidating the amount of space? What site utilities will be required to make the site functional? How about security, offices, restrooms, equipment, composting facilities, large truck access, etc.?

It is assumed that a larger and more completely equipped *Recycling Yard* would allow the various operations to be consolidated and modified, thereby increasing the overall efficiency; it would also provide opportunity for future innovations and improvements. With a commitment to sustainable materials management, a well-planned and equipped recycling facility should be a permanent and integral part of the campus infrastructure.

The recycling operation has demonstrated the ability to adapt and modify their operation to achieve changing goals and work within their space and budget restraints. However, an adequate and consolidated facility may increase efficiencies and allow for greater recovery of materials. Therefore, finding and developing a location for the yard which provides enough space to grow and refine the recycling effort, rather than attempting to refine the operation now in order to lower the bar for the relocation site, is the goal of the project. Even if operational changes are practicable which will reduce their current space requirements, the long term goal is to increase our waste diversion to 100% which will likely require more space than the current operation.

RECYCLING YARD PROJECT
PRELIMINARY LOCATION ANALYSIS

III. SITE SELECTION

Each of the sites discussed below has good and bad qualities for the final *Recycling Yard* location. Acceptance of some negative consequences will be necessary if we are to develop a site which will help to achieve our sustainability goals.

Area of New Yard

EXISTING RECYCLE OPERATION EQUIVALENT REPLACEMENT AREAS	
DESCRIPTION	**AREA (SF)**
Roll Off Sort Area	13,200
Satellite Sort Area	9,375
Roll Off Storage Area	5,625
Bulk Material Storage Area	31,250
Equivalent Area Subtotal	**59,450**
Access / Entry	20,550
New Yard Area	**80,000**
	= 1.84 Acres
Source: Roger Edberg, Sr. Superintendent Grounds Services	

To complete an analysis of possible sites, it is necessary to determine the amount of area desired. Based on a review of one possible location – the area next to the North Remote Parking Lot – a new yard was estimated to be 80,000 square feet, or just less than two acres. This was based on providing equivalent areas to replace the existing ones as well as additional space for access and a driveway; note that it does not includes the 6,000 SF located at the Corporation Yard – which is paved, fenced and secured with access to restroom facilities and utilities. The "Equivalent Yard Location" area shown below includes the Corporation Yard outdoor storage space but not any built infrastructure.

More area will be needed if a compost operation is to be added at the same location. Using the existing mulch area (one-half acre) as a guide, a rough estimate of one acre for a composting & mulching operation seems reasonable as a starting point (please note that this will require further research.) Thus an ideal *Recycling Yard* site would provide at least three acres of land.

Less area will be needed if we limit our current project to simply replacing the area to be lost due to the *Hay Barn Reconstruction* project. As shown on the picture to the left, the portion of this site currently being used as a yard area for operations is approximately 19,000 SF (0.4 acres, Roll-Off Sort and Roll-Off Storage in table.) This represents an approximate lower limit for relocation space.

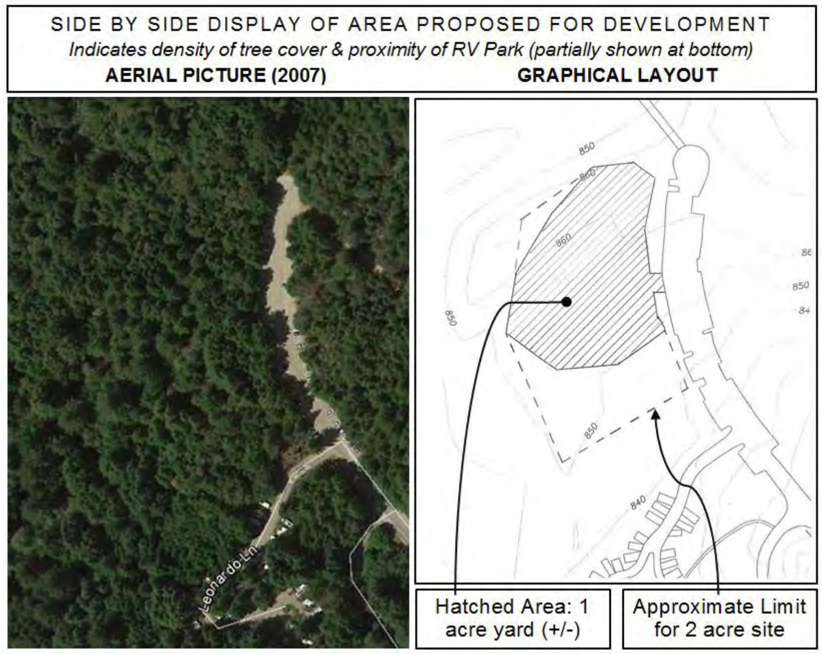
In sum, space goals for the *Recycling Yard* project:

- **Ideal Yard Location** (space for composting, expansion)
  3+ acres
- **Equivalent Yard Location** (consolidate existing operations)
  1.5 - 2 acres
- **Minimum Replacement Area** (for loss of Hay Barn site)
  0.4 acres

RECYCLING YARD PROJECT

PRELIMINARY LOCATION ANALYSIS

West of the North Remote Parking Lot



Pros – Space available: The area west of Parking Lot 150 can easily fit a yard which is between one and two acres in size – or larger though the topography becomes more challenging. This area is not currently occupied and is relatively flat in the proposed yard location. Location: at the north end of the campus but fairly close to the campus core and most generators. Utilities: both water and power are located in Heller Drive adjacent to the planned connection. The water line appears more than adequate but will require a new connection; the electrical lines may need to be upgraded to support the additional load.

Cons – Potential environmental impacts. The area is heavily forested and would require substantial tree removals via a Timber Harvesting Plan. The Timber Harvesting Plan alone can take six to nine months. Connecting to Heller Drive would likely require the removal of three or four parking spaces at a cost of $60,000 to $80,000. It may be possible to avoid the parking loss by connecting at the north end but this may be difficult. Development of this site is likely to be seen as a first step to North Campus expansion, thus creating opposition and controversy. The proximity of the RV Park adds further complications with potential noise impacts. The area is zoned CHS (Colleges and Student Housing) in the 2005 Long-Range Development Plan (2005 LRDP) thus the general impacts of development were analyzed for the area but would require project level analysis. Due to the 2005 LRDP designation, the site for recycling facilities would not be permanent but may be displaced when new facilities for the Colleges and Student Housing materialized. Thus this would only be a temporary location (albeit a potentially long term one) as the area is slated for other development in the LRDP.

Discussion – This area was considered and rejected in 2003 in advance of the ERC building displacement of Grounds Services space in the Corporation Yard; under the 1988 LRDP. New environmental analysis would need to take place before it could be developed. Careful review of the schedule will be necessary to ensure development could align with the *Hay Barn Reconstruction* project.

"The Bowl" Area

THE BOWL AREA NORTH OF THE FARM AND ARBORETUM
Note the Great Meadow Bike Path, Existing Stockpiles, and Service Roads.

Pros – Space available: the area at the base of the Great Meadow and just to the north of the Farm and Arboretum has ample space for a large yard. It is partially occupied by existing stockpiles which cover about 2 acres and are designated in the 2005 LRDP as Protected Landscape, thus not suitable for development. Location: lower portion of the campus but could develop access off of Hagar Drive. The bowl area is not visible from major access roads or facilities. The proximity to the Farm and Arboretum create great potential for development of composting operations and student involvement in the waste diversion operation. The general "flat bottom" of the bowl and gentle sloping sides may facilitate an effective yard layout including loading dock grade differentials with easy turnarounds. A gravel emergency/service access road serves the area from the Village Road. The Village road terminates at the campus Class 1 bike lane. Crossing the bike lane represents a potential safety hazard that would need to be mitigated. Utilities: Power and water trunk lines are located near Village Road, about 400 feet east of the proposed areas. It may be possible to connect nearer via other developed areas.

Cons – The area is a large depression with geologic challenges; it is classified as Karst Hazard Zone 4 in the 2005 LRDP. Drainage and water quality are concerns, as the area is a known sink hole. The area is zoned PL – Protected Landscape – north of the service road (stockpile area) and SRS – Site Research and Support – in the North Slope Triangle Area. SRS includes "Public Services" and research which may be applicable here. Development in PL area will probably need a change in land use, though "agricultural research" (composting?) may be allowed. The SRS area is set aside for future potential development for the Center for Agroecology and Sustainable Food Systems thus the recycling facilities would be considered temporary until the program for those facilities materialize. The access road intersection with the Great Meadow Bike Path has safety concerns which would be exacerbated by an increase in truck traffic; safety improvements are possible and in fact are under development on another project. The Hay Barn traffic crosses the same path, however the intersection is controlled with crosswalks and stop signs and the downhill speed of bikes is greatly reduced at the intersection location. The Hagar Drive / Village Road intersection would need analysis. Potential biological environmental issues would need to be considered in the project level analysis.

Discussion – Considering the availability of space, central location, and proximity to the Farm and Arboretum, this site has the potential to be developed into a *Recycling Yard* with the ability to meet our goals. The fact that part of the area is covered with bulk material storage lends support to developing a similar use.

Old LPG Facility

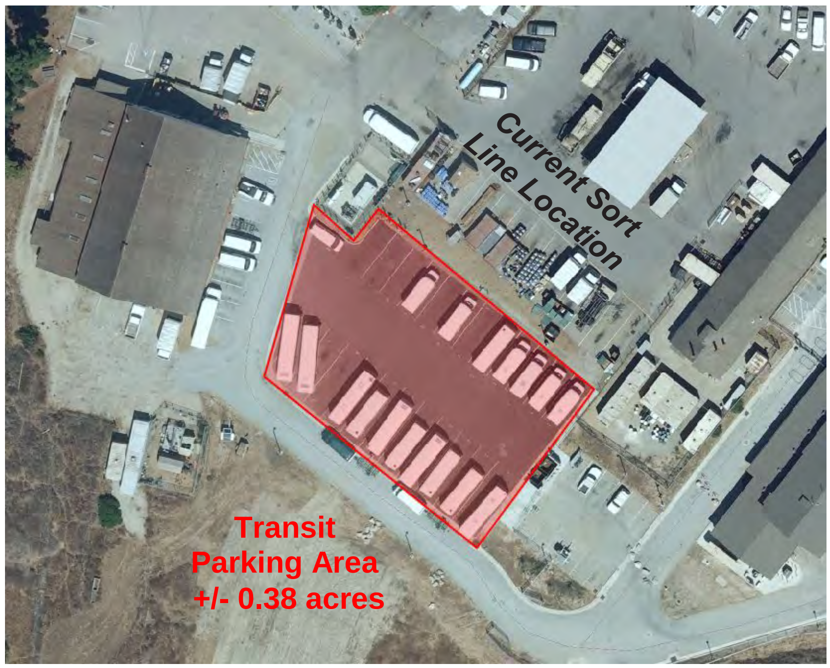
OVERVIEW OF OLD LPG SITE AND SURROUNDING AREA
Note the Arboretum Eucalyptus Grove, proximity to residents, access on High St.

Pros – Existing yard area which could be re-purposed for recycling. Land Use Zone CS – Campus Support – is correct. Site is developed, surfaced, and served by utilities.

Cons – The site is too small to functionally improve the recycling operation; could replace lost space at Hay Barn but probably nothing more. Area is already used by Ground Services so relocating recycling here would not increase overall space and require more space elsewhere to replace it. Noise and traffic analysis would need to be undertaken before the recycling operations would be allowed at the site. The adjacent Arboretum Eucalyptus Grove confines the available space – even expanding to one acre would be challenging and require major retaining walls. Driveway access from Empire Grade may be problematic for regular truck traffic.

Discussion – The LPG facility on Empire Grade represents a limited option since it is already developed and used as a campus operations yard and is zoned properly. As a result of the ERC displacement mentioned above, this site was improved for use as emergency storage, including a steel garage structure with an area of about 3600 SF. The site is small for the identified uses. Barring a major expansion into land currently occupied by the Arboretum, investment in this site as a *Recycling Yard* would essentially constitute a step backward for the recycling operation: about the same amount of space in a worse location.

Existing Corporation Yard Area



Reconfiguring and / or expanding the existing Corporation Yard may provide the necessary space. The majority of the recycling operations already occur in the area; it is near to the Grounds Services and Recycling offices; the site is already developed and zoned properly (CS) for this use; the fueling and vehicle storage and maintenance are located here. One option would include expanding into the space currently used as bus storage which represents about 0.38 acres, or about the same amount of space currently located at the Hay Barn. This space is directly adjacent to the existing sort line operation as well as other recycling functions. Therefore the additional space would be more useful than the satellite space at the Hay Barn. This space is designated for emergency law enforcement parking if needed and is currently used by TAPS. Potentially an alternate location for the TAPS parking can be found (for instance the east remote staging areas at least temporarily.)

Expansion of the existing facilities would represent only a mild improvement to the current recycling operation. More globally there may be potential for a broader reconfiguration of the Corporation Yard which more efficiently uses the amount of space – but any such effort is far beyond the scope of this project.

Another possible way to free up space here for the recycling operation would be to relocate other existing uses to locations such as the LPG Facility or 2300 Delaware. Perhaps other uses would be less affected by remote locations and/or less likely to generate neighbor opposition. The area is adjacent to the Cowell Lime Works Historic District and any development would need to take that into consideration.

More research could be done about the possibility of the Corporation Yard being reconfigured and/or expanded if there is a consensus that this is a desirable option.

East Remote Parking Lot Area

<u>OVERFLOW AREAS</u>
+/- 2 Acres (half dirt.)
Generally used for construction staging and temporarily for permit parking.

<u>STAGING AREAS 1 - 4</u>
+/- 2 Acres (surfaced.)
Used for construction staging, TAPS shuttle parking & special events.

To the north and south of the East Remote Parking Lot there are open areas which are partially developed and generally used for construction staging and for overflow parking demand, i.e. temporary storage of transit buses and overflow parking. These partially developed areas represent some of the only “clear” space on campus: there are no permanent buildings or surfacing yet the areas are no longer in a natural state. Accordingly, they are considered when locating a facility such as the Recycling Yard which requires a good deal of space.

Further analysis indicates this location is unsuitable for the permanent relocation of the Recycling Yard. The staging areas presently located here will eventually be abandoned and restored. A detailed plan for this area (Sasaki, July 2008) does not include this type of use, nor does it foresee available space. In addition, the location is situated along a primary access road to the campus core, and is therefore highly visible.

Should a should-term, temporary relocation be required to avoid impacts to the *Hay Barn Reconstruction* project, the staging areas around the East Remote Lot may be the most convenient option. It is hoped this can be avoided, however, as it will increase costs while just kicking the can down the line once again. But it may be necessary, particularly if a permanent home is being developed but requires more time.

OTHER SITES UNDER DISCUSSION

Empire Grade Site

The 8 acre site on Empire Grade identified in the LRDP for use as a Campus Support space has been mentioned as a possible location for the Recycling Yard. This site is not appealing due to its remote location; it will be very difficult to develop and effectively use this site for any campus support operation until such time as an additional road connection to the area is built. The site is not to be used for a “corporation yard” as agreed in the Comprehensive Settlement Agreement. Further research is necessary if the site is considered further. The site is identified as support land in the 2005 LRDP.

2300 Delaware Facility

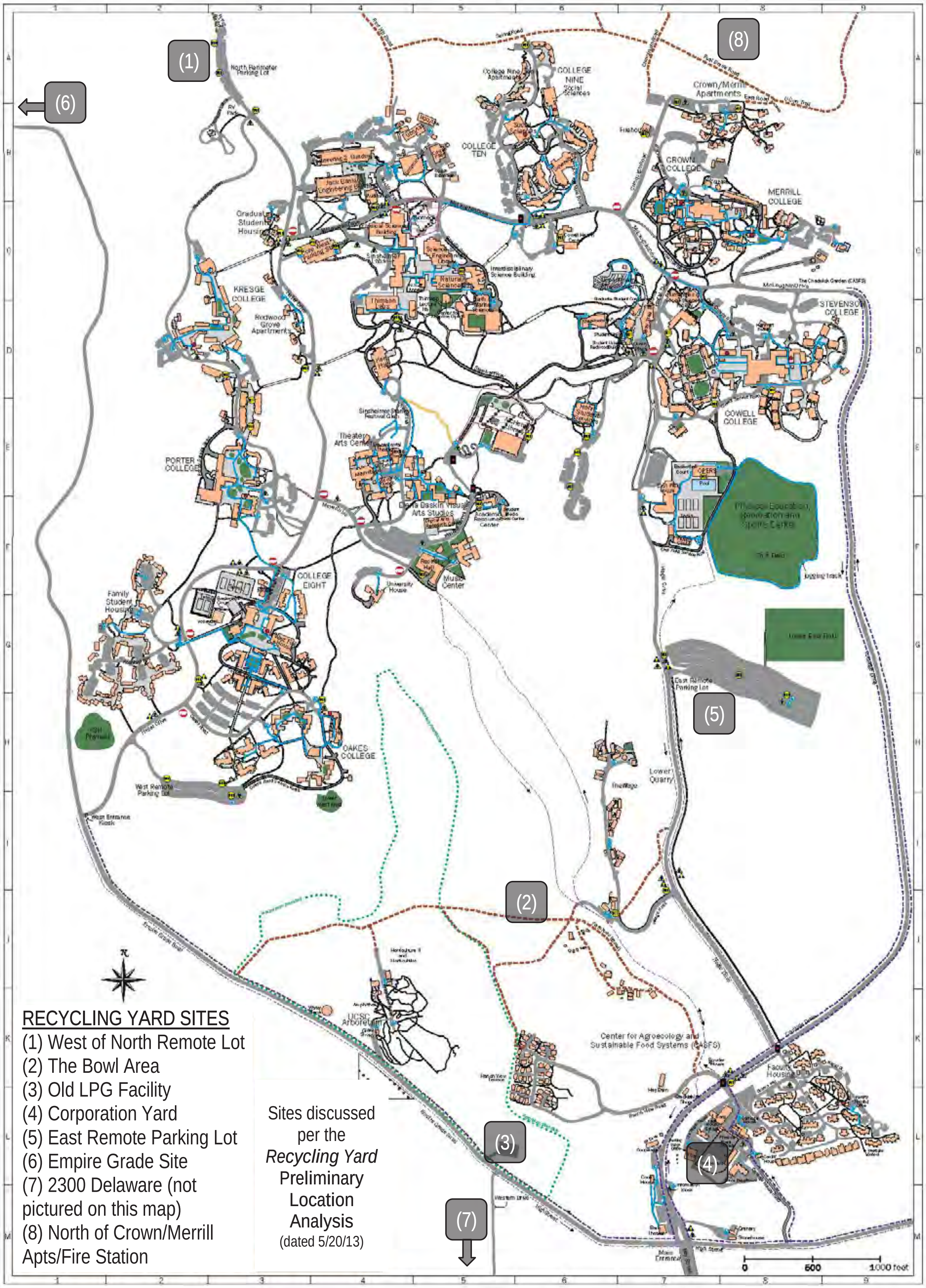
The majority of the facility at 2300 Delaware is currently unoccupied with the potential to utilize the free space in surfaced areas for recycling. Grounds Services is using portions of the northern end of this site; materials are being stored in the walled and gated area immediately adjacent to the northernmost structure; and containers have been placed at the north end of the parking lot. More intensive uses are planned for this facility, thus it is not certain if space will remain available for Grounds Services in the future.

There is the possibility of using this site more intensively for items which require long term storage, including those associated with the recycling operation. And it could perhaps absorb items currently stored at the LPG Site or Bowl Site should those areas be developed for recycling. But anything beyond this is unlikely as the site is too remote from the campus and majority of recycling generation.

Area north of Crown/Merrill Apts/Fire Station (east side)

This area has been mentioned but seems to have little possibility of further consideration as the Recycling Yard until other development (new academic or housing facilities) along with access roads in the general area are developed.

RECYCLING YARD PROJECT
PRELIMINARY LOCATION ANALYSIS

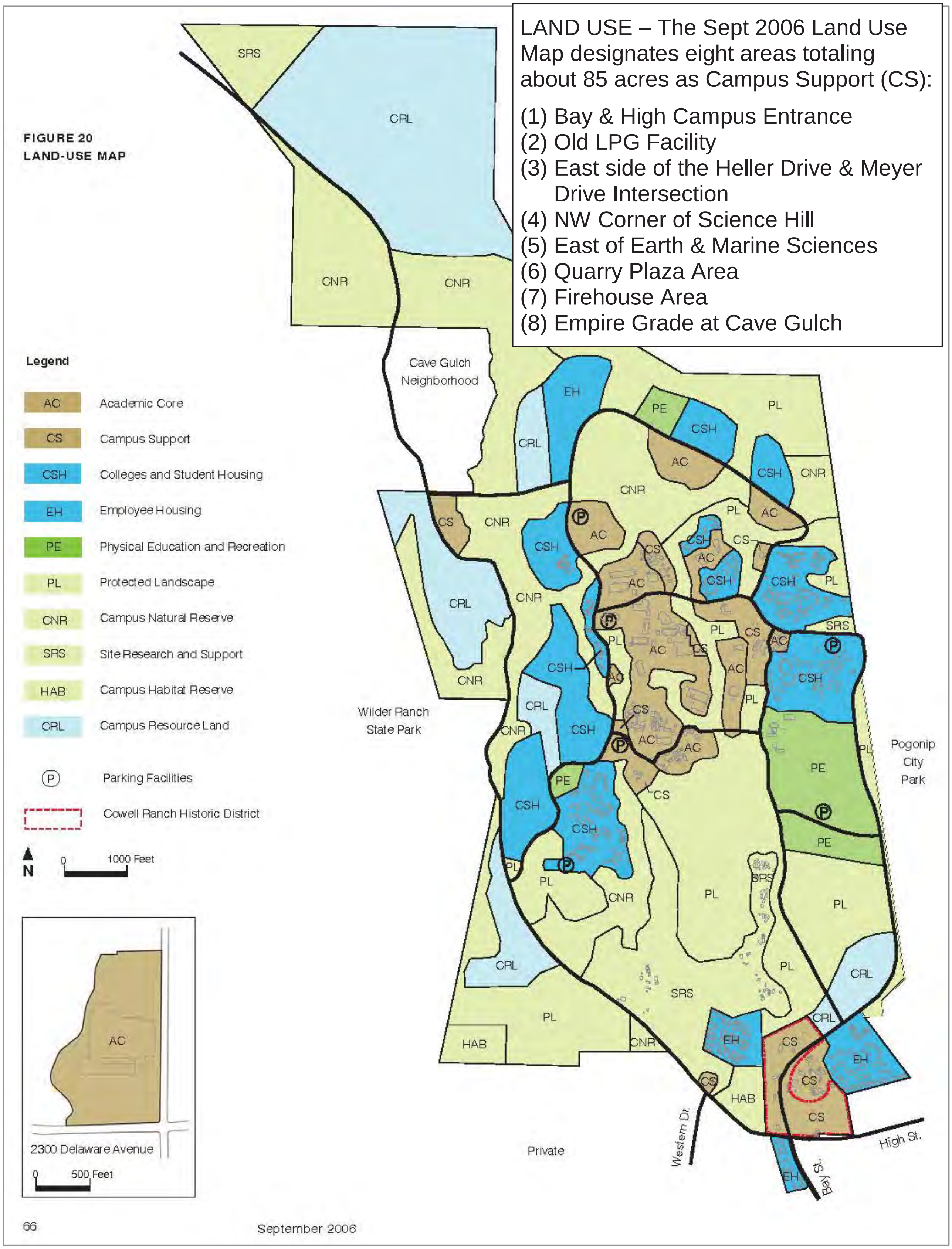


RECYCLING YARD PROJECT

PRELIMINARY LOCATION ANALYSIS

LAND USE – The Sept 2006 Land Use Map designates eight areas totaling about 85 acres as Campus Support (CS):

(1) Bay & High Campus Entrance
(2) Old LPG Facility
(3) East side of the Heller Drive & Meyer Drive Intersection
(4) NW Corner of Science Hill
(5) East of Earth & Marine Sciences
(6) Quarry Plaza Area
(7) Firehouse Area
(8) Empire Grade at Cave Gulch



Waste & Recycling

Purpose, Vision, Goals

Introduction

Beginning with pilot programs in 1989 and continuing with the centralization of Campus Recycling within Ground Services seven years later, UCSC has developed a variety of reuse, recycling, and composting systems to save energy, natural resources, and landfill space. Such efforts have resulted in a gradual increase in annual diversion rates [1], with the goal of achieving "zero waste" - 100% diversion from landfills. Having achieved 50% diversion in 2008, the campus aims to achieve 75% diversion of the campus waste stream by 2012 and "zero waste" by 2020, as set forth by the UC Policy on Sustainable Practices.

To help these ambitious goals, the Executive Vice Chancellor established the Landfill and Solid Waste Diversion Task Force in Spring 2011. The Task Force will leverage existing programs and recommend relevant waste stream assessments, critical infrastructure enhancements improvements in campus waste management processes, and implementation of behavioral change initiatives. This will create consistency, expand participation by the broader campus community, and deepen institutionalization of zero waste practices at UCSC.

Self-hauling of waste and recycling offers significant financial and resource conservation benefits. For example, through increased diversion and self-haul operations, the campus realized over one million dollars in cost avoidance in FY08-09 and helps divert recyclable materials back into the production cycle[1]. By accounting for the full cost of operation, adequate investment in infrastructure and equipment could maintain cost savings and ensure long-term viability of the benefits the campus currently derives from in-house waste management efficiencies and capacity.

Purpose

Create, develop, and implement programs and strategies to reduce waste on the UCSC Campus

2020 Vision

In 2020, UCSC is a "zero waste" campus. Waste avoidance is mandated by campus policy and integrated into the daily practices of all campus members. Material life cycles are considered during all stages of planning, procurement, and operations. In addition to using only compostable, reusable, or recyclable materials, overall levels of consumption are substantially reduced.

Overarching Goals

1. Achieve 75% waste diversion by June 30, 2012, and 100% diversion by 2020
2. Research and implement improvements to waste reduction practices and performance tracking systems
3. Provide infrastructure in facilitate increased waste diversion practices
4. Develop and implement collaborative, campus-wide outreach and education activities to affect behavioral change that increases waste diversion

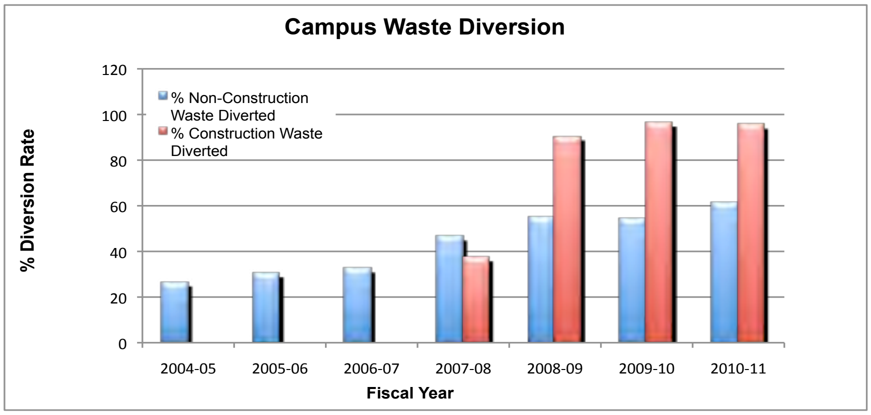
[1] "*Diverted waste*" is the portion of the waste stream that is recycled or composted and thus does not end up in a landfill.

Objectives, Metrics

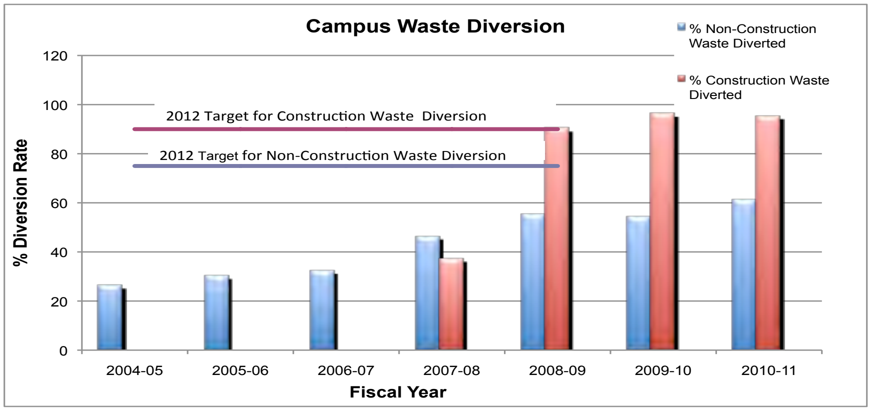
Waste & Recycling

2010-2013 Objectives	Collaborators
TARGET: Increase % of total reported waste self-hauled by Physical Plant to 90% for non-construction waste and 65% for construction waste by increasing capacity of waste management equipment, facilities, and staff to the extent resources permit	BAS - Physical Planning & Construction (PP&C), Physical Plant (PP)
TARGET: Increase non-construction waste diversion to 75% (*UC Policy 2009, LRDP, State and local Integrated Waste Management Plans*)	This target requires campus-wide collaboration Some key stakeholders include: BAS - PP, Ground Services, Custodial Services, Procurement & Business Contracts; SA - Colleges & University Housing Services (CUHS), Residential Life Staff, UCSC Dining; UR
TARGET: Compost 100% of potentially compostable & biodegradable materials from all UCSC Dining operations (*UC Policy 2009*)	BAS - PP; SA - UCSC Dining; Food Systems Working Group (FSWG), Santa Cruz County
Conduct baseline campus-wide audit to effectively identify, prioritize, and engage waste reduction/diversion strategies (*UC Policy 2009, State and local Integrated Waste Management Plans*)	BAS - PP; SA - CUHS
Develop a sustainable recharge rate to support long-term viability of waste diversion activities and strategies	BAS - PP

Key Metrics



Self-haul operations by campus units secured over one million dollars in cost savings in FY08-09 – a function otherwise performed by outside vendors. This figure illustrates the University's success in its efforts to 'self-haul' general campus waste (non-construction waste), and highlights the opportunity to increase self-haul of construction waste. The target for 2013 is to increase self-haul for construction waste to 65%. An increase of Physical Plant's capacity to serve the campus through self-haul could generate additional cost savings and provide more accurate records of the campus waste stream.



The campus has significantly increased the percentage of its waste stream which is diverted from the landfill ("diverted waste" is recycled in some way or composted, and thus does not end up in a landfill). Though diversion of construction waste successfully exceeded the 75% diversion target in FY08-09, the campus needs to increase diversion of non-construction waste to meet the requirements specified within the UC Policy on Sustainable Practices.[1] This is an ambitious objective, which will require increased collaboration and participation by the entire community.

[1] Data for self-haul operations and diversion rates in this plan are calculated using the scope of service for UCSC's Physical Plant, which includes the University's Main Campus, as well as UCSC facilities at 2300 Delaware Ave and the Marine Sciences Campus, but excludes some Housing Facilities, such as Cardiff Terrace and Ranch View Terrace, as well as the off-campus Laureate Court, the University's Town Center and University Inn - all of which are serviced by the City of Santa Cruz.

RECYCLING YARD PROJECT

JUNE 18, 2013, 10 AM – 11:30 AM

RECYCLING YARD PROJECT MEETING

PHYSICAL PLANNING & CONSTRUCTION ROOM 235

AGENDA

I. SITE SELECTION – *DETERMINE WHERE THE YARD WILL BE LOCATED*
   - A. Prominent Location Concept
   - B. Discussion of Possible Prominent Locations
     1. South Campus Area
     2. East Remote Area (Revisited)
     3. Heller Drive Area
   - C. Review of Other Sites – based on previous meeting, number of sites to consider further narrowed from 9 to 3 as follows:
     1. West of the North Remote Parking Lot
     2. The Bowl
     3. Existing Corporation Yard
   - D. Site Selection Process
     1. Matrix of Location Attributes – review, discuss, assist?

Available Area	*Land-Use Zoning*
Proximity to Campus Core	*Environmental Issues*
Utility Access & Feasibility	*Topography*
Road / Truck Access	*Neighbors / Adjacent Uses*

   - E. Timeline & Process for Recommended Alternative / Subsequent Approval

II. FEATURES – *DETERMINE WHAT WILL BE INCLUDED IN YARD*
   - A. Desirable Features for Recycling Yard – Ultimate goal is zero-net energy & water use facility. Example Features:

     Infrastructure Requirements, Surfacing, Building Features, Roof Cover, In-Vessel Composting, Baler/Compactor, Material Storage, Equipment, Alternative Energy Systems (e.g. PV for roof), Rainwater Harvesting System; Accommodations for visitors, research, student involvement; working model.
   - B. Design for Phased Implementation – plan for future in initial site design.
   - C. Matrix of Yard Features, including rough costs – assistance?

III. NEXT STEPS
   - A. Selection of Design Professional – Discuss timeline of project
   - B. CEQA Review
   - C. Future Meetings

Attachments:

(1) Prominent Location Discussion

(2) Review of Sites: South Campus Area, East Remote Area (Revisited), Heller Drive Area

PAGE 1 OF 1

RECYCLING YARD PROJECT
PRELIMINARY LOCATION ANALYSIS

Prominent Location Concept – Discussion

Siting the Recycling Yard in a prominent on-campus location such as near a campus entrance has potential benefits, particularly in terms of promoting sustainability. The cooperation of refuse generators is critical to an effective waste reduction effort and people naturally concern themselves more with things they see on a regular basis. When refuse is handled out of sight, there is a strong tendency to keep it out of mind. Conversely, the prominent location concept strives to put recycling front and center in order to promote individual awareness and involvement in pursuit of zero-waste.

There are also potential issues which are site specific yet may be exacerbated by placement in a prominent location since by definition these sites are located in close proximity to high traffic areas. Thus prominent sites are more likely to be negatively affected by noise, traffic and odor. Similar to each of the sites discussed to date, other factors also need to be considered including the available area, utility and road access, zoning, competing uses, and potential complications related to environmental impacts.

Since many of the issues to consider are site specific, it seems clear that the best way to further analyze the prominent location concept is to treat each potential site in the same manner as any other site. The short term goals remain the same:

(1) Identify potential sites.
(2) Analyze the pros and cons of each site.
(3) Generate a thorough analysis of preferred options.

In addition, the desirability of a prominent location versus a more discreet site is a matter of debate. There are pluses and minuses associated with both concepts, and the final analysis is essentially subjective as it depends on the strength and relative weight assigned to the various pros and cons. Or more simply it may be a matter of personal choice as much as rational analysis.

Expanding the range of potential sites to include more prominent locations has the obvious effect of greatly increasing the number of sites which merit at least some level of consideration. It is not feasible to complete highly detailed reviews of each and every potential site, hence the information following intends to summarize a range of prominent location alternatives with the short term goal of gaining some consensus on which – if any – merit further consideration and review.

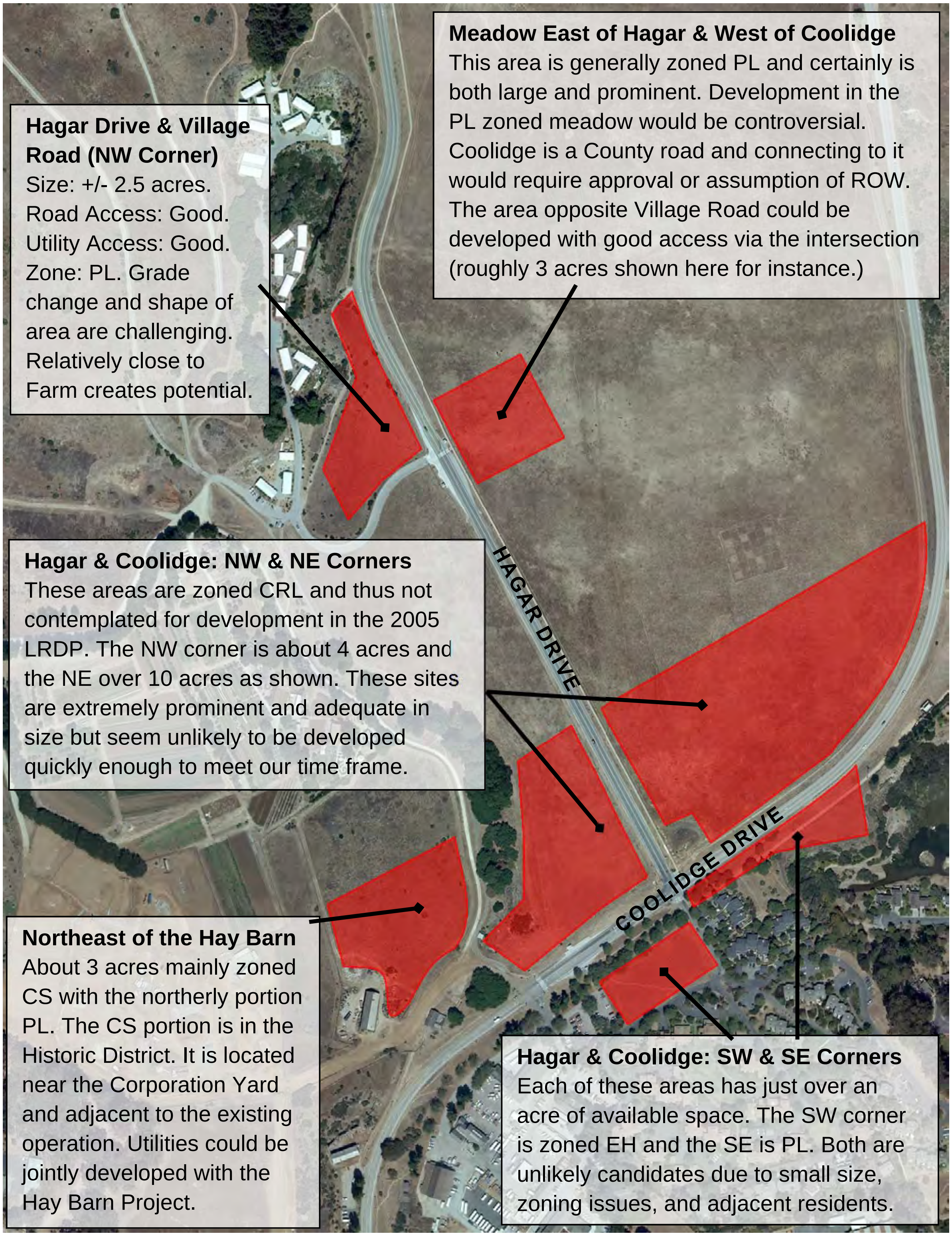
Three attached documents summarize the prominent locations proposed for review:

- Lower Campus Area
- East Remote Area (Revisited)
- Heller Drive Area

RECYCLING YARD PROJECT

PRELIMINARY LOCATION ANALYSIS

PROMINENT LOCATION CONCEPT – LOWER CAMPUS AREA



RECYCLING YARD PROJECT
PRELIMINARY LOCATION ANALYSIS

Prominent Location Concept – East Remote Area (Revisited)

Further consideration of the East Remote Area is warranted based on the prominent location concept for siting the Recycling Yard. The East Campus Facilities Study (Sasaki, July 2008) identified a preferred alternative for development of this area of campus. As mentioned in the previous Recycling Yard document, the study did not contemplate campus support facilities such as this. Rather, based on the 2005 LRDP, the area was assumed to include the following elements:

- Physical Education & Recreation
    - Additional field acreage including an expanded East Lower Field.
    - An Outdoor Events Venue.
- An Indoor Events Center (3,000 – 5,000 seats)
    - Per the *Student Life Facilities Feasibility Study* (SOM, 2003.)
- Circulation & Parking Improvements
    - Expanded East Remote Parking Facility.
    - Construction of a connector road between Hagar Dr. and Coolidge Drive
    - A transportation hub to facilitate mode transfers.
    - About 10,000 SF of administrative space for TAPS.

If it is desirable to place the Recycling Yard in this area, analysis of the Sasaki plan indicates it may be feasible without eliminating planned development. The preferred alternative layout is presented below along with two potential site locations, each of which can likely be developed into a permanent home for the Recycling Yard.

<u>Site 1 – North of the Planned Connector Road, West of Coolidge Drive</u>
This site may be extremely prominent in the future assuming a connector road is constructed and Coolidge Drive becomes the primary access route to the campus core. A three acre space can be developed which does not conflict with the planned playing field expansion and is located immediately north of the new connector road. The slope of the site would be challenging, and this area is visible from the City.

<u>Site 2 – Hagar Dr., South of the Proposed Parking Garage & Existing East Remote Lot</u>
This site is very prominent and will remain so even with potential future changes. A portion of this site is already developed as a staging area, though some of this land is planned for restoration. The grade is gentler and likely can be put to good use for loading dock type configurations. Access to the site may initially be provided via the existing parking lot but eventually a dedicated connection to Hagar seems likely. The proximity to the planned garage would complicate phasing as considered in Sasaki.

RECYCLING YARD PROJECT

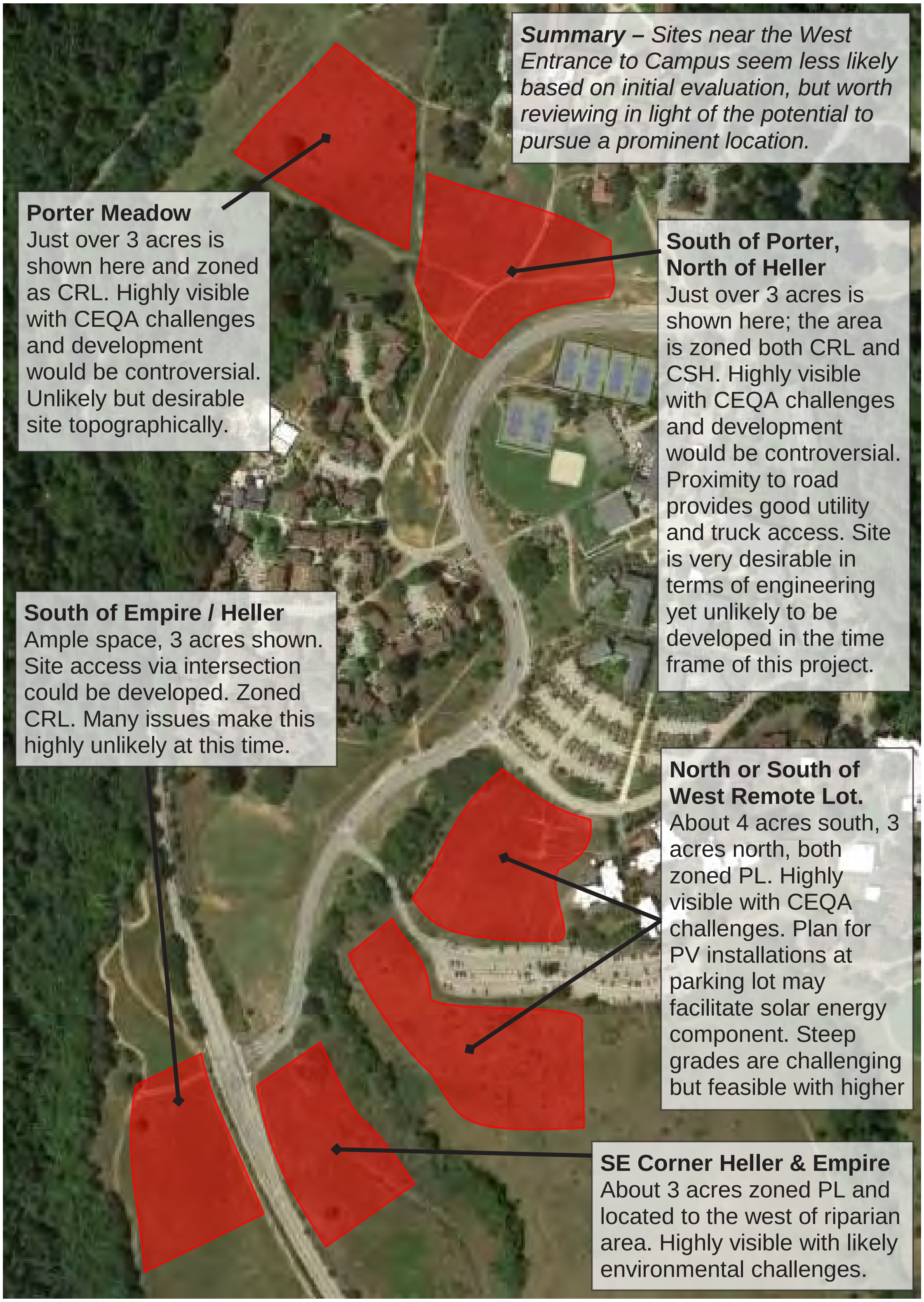
PRELIMINARY LOCATION ANALYSIS

PAGE 2
UPDATED 6/13/2013

RECYCLING YARD PROJECT

PRELIMINARY LOCATION ANALYSIS

PROMINENT LOCATION CONCEPT – HELLER DRIVE AREA



ACRONYMS

AD	Anaerobic Digestion
ADA	Americans with Disabilities Act
ASP	Aerated Static Pile
C&D	Construction and Demolition
CASFS	Center for Agroecology & Sustainable Food Systems
CASP	Covered Aerated Static Pile
CPS	Campus Planning and Stewardship
CRV	California Redemption Value
DAB	Design Advisory Board
EH&S	Environmental Health and Safety
HP	Horsepower
IGP	Industrial General Permit
KW	Kilowatt
LRDP	Long Range Development Plan
MRF	Materials Recovery Facility
MRWMD	Monterey Regional Waste Management District
MSW	Municipal Solid Waste
NEC	No Exposure Certification
NOI	Notice of Intent
NONA	Notice of Non-Applicability
NPDES	National Pollution Discharge Elimination System
O&M	Operations and Maintenance
OT	Overtime
PET	Polyethylene terephthalate
RRF	Resource Recovery Facility
SMARTS	Storm Water Multi Application Reporting and Tracking System
SF	Square Foot/Feet
SS	Sanitary Sewer
SWPPP	Stormwater Pollution Prevention Plan
TAPS	Transportation and Parking Services
TPD	Tons Per Day
TPY	Tons Per Year
UC	University of California
UCSC	University of California at Santa Cruz
VOC	Volatile Organic Compounds

DEFINITIONS

Aerated Static Pile: Composting system that uses a series of perforated pipes in an air distribution system running under the compost pile and connected to a blower. The pile is not turned. – compost.css.cornell.edu/glossary.html

Air Classification: Process in which a large volume of mixed materials with differing physical characteristics are separated by a combination of size, shape and density within an industrial machine that utilizes a rising column of air or vacuum. – Wikipedia

Aerobic: Occurring in the presence of oxygen. For successful composting, sufficient oxygen should be provided to keep the system aerobic. This ensures that the composting proceeds rapidly and with minimal odor. - compost.css.cornell.edu/glossary.html

Anaerobic: Occurring in the absence of oxygen. Anaerobic composting proceeds slowly and is odoriferous. - compost.css.cornell.edu/glossary.html

Anaerobic Digestion: A biological process that produces a gas principally composed of methane and carbon dioxide otherwise known as biogas. These gases are produced from organic wastes such as livestock manure, food processing waste, etc. Most anaerobic digestion technologies are commercially available. Where unprocessed wastes can cause odor and water pollution such as in large dairies, anaerobic digestion reduces the odor and liquid waste disposal problems and produces a biogas fuel that can be used for process heating and/or electricity generation. - http://www.energy.ca.gov/biomass/anaerobic.html

Biodegradability: The potential of an organic substance to be broken down into simpler compounds or molecules though the action of microorganisms. - compost.css.cornell.edu/glossary.html

Bio-filtration: Bio-filtration is provided by both Bio-filtration Strips and Bio-filtration Swales. Bio-filtration swales use plants in channels to capture and biologically degrade pollutants carried by stormwater runoff. As an additional benefit, Bio-filtration Swales also reduce the velocity and volume of stormwater runoff. Bio-filtration strips, also known as vegetated buffer strips, are vegetated sections of land over which stormwater flows as sheet flow. - http://www.dot.ca.gov/hq/LandArch/ec/stormwater/biofiltration_swales.htm

CalRecycle: California's Department of Resources Recycling and Recovery (CalRecycle) brings together the state's recycling and waste management programs and continues a tradition of environmental stewardship. CalRecycle's vision is to inspire and challenge Californians to achieve the highest waste reduction, recycling and reuse goals in the nation. - http://www.calrecycle.ca.gov/

Campus Support: Land Use Designation from the 2005-2020 UCSC Long Range Development Plan. Eight separate areas totaling approximately 85 acres are designated Campus Support. The largest of these, at the south entrance to the campus, will accommodate both public functions and operations-oriented functions in the corporation yard. To the extent feasible, some facility and operational corporation yard functions will be relocated under this LRDP, primarily to an 8-acre site off Empire Grade This would allow improvements to the main entrance area for public-oriented and visitor services and to improve efficiency in operations. - page 64-66 UCSC Long Range Development Plan 2005-2020: http://lrdp.ucsc.edu/

Carrying Capacity: The number or quantity of people, other living organisms, or crops that a region can support without environmental degradation. - www.oxforddictionaries.com

Class I Bicycle Path: A path that provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow minimized. - California Streets and Highways Code Section 890.4.

Construction and Demolition (C&D) Debris: Building materials and solid waste from construction, deconstruction, remodeling, repair, cleanup, or demolition operations that are not "hazardous" (as defined in Public Resources Code section 40101). This term includes, but is not limited to: asphalt, concrete, Portland cement, brick, lumber, wallboard, roofing material, ceramic tile, plastic pipe, and assorted packaging. - http://www.calrecycle.ca.gov/LGCentral/Glossary/

Contaminant: Unwanted material. Physical contaminants of compost include glass, plastic, and stones, and chemical contaminants include trace heavy metals and toxic compounds. - compost.css.cornell.edu/glossary.html

Composting: The biological decomposition of organic materials such as leaves, grass clippings, brush, and food waste into a soil amendment. Composting is a form of recycling. – www.calrecycle.ca.gov/reducewaste/define.htm#Composting

Curing: The last stage of composting that occurs after much of the readily metabolized material has been decomposed. Provides for additional stabilization and reduction of pathogens and allows further decomposition of cellulose and lignin. - compost.css.cornell.edu/glossary.html

Decomposition: The breakdown of organic matter through microbial action. - compost.css.cornell.edu/glossary.html

Detention: The capture and subsequent release of stormwater runoff from the site at a slower rate than it is collected the difference being held in temporary storage. See also Retention, - California Stormwater BMP Handbook, California Stormwater Quality Association

Doline: A sink hole, hollow, or basin in a karstic region. There are three types of dolines, as illustrated in figure 4.6-7, Sinkhole Formation Processes. Solution dolines are formed by gradual settling of surficial sediments into a solution cavity while solution is occurring. These dolines are characterized by gently sloping sides and an absence of rock outcrops along the walls. Such dolines do not have extensive caverns or experience rapid large-scale collapse. Collapse dolines are formed by the sudden collapse of the roof of and underground void. They have steep sides and rocky, irregular walls. Subsidence dolines are similar to solution dolines, but are formed when surface sediments are washed into existing subsurface cavities. The overlying soils subside since most of their volume has been washed into the adjacent void. See also Karst Geology, Sink hole. – www.oxforddictionaries.com, and 2005 LRDP Draft EIR section 4.6-2 and 3

Feedstock: Raw material to supply or fuel a machine or industrial process -www.oxforddictionaries.com
Greenhouse Gas: A gas that contributes to the greenhouse effect by absorbing infrared radiation. Carbon dioxide and chlorofluorocarbons are examples of greenhouse gases. - www.oxforddictionaries.com

In-vessel Composting: Organic materials are fed into a drum, silo, concrete-lined trench, or similar equipment where the environmental conditions – including temperature, moisture, and aeration – are closely controlled. The apparatus usually has a mechanism to turn or agitate the material for proper aeration. In-vessel composters vary in size and capacity. Conversion of organic material to compost can take as little as a few weeks. Once the compost comes out of the vessel, however, it still requires a few more weeks or months for the microbial activity to stabilize and the pile to cool. - http://www.epa.gov/composting/types.htm#ves

Karst Topography: A landscape unique to limestone and few other highly soluble rocks. Karst topography is characterized by the absence of an integrated surface drainage system and the presence of sink holes, which form closed depressions (see Section 4.6.1.7, Karst Hazard and Subsidence, for further detail). Karst features (including ravines, sink holes, closed depressions, swallow holes, underground streams, and caverns) develop in areas of fracture, joints, and faults where groundwater flow dissolves the marble. Karst features are readily apparent in the lower campus and are also present parts of the middle or central campus. – 2005 LRDP Draft EIR section 4.6-2 and 3

Leachate: Liquid that drains from the mix of fresh organic matter. - compost.css.cornell.edu/glossary.html

Loader: A loader (bucket loader, front loader, front-end loader, payloader, scoop, shovel, skip loader, or wheel loader) is a heavy equipment machine used in construction and sidewalk maintenance to move aside or load materials such as asphalt, demolition debris, dirt, snow, feed, gravel, logs, raw minerals, recycled material, rock, sand, woodchips, etc. into or onto another type of machinery (such as a dump truck, conveyor belt, feed-hopper, or railcar). - Wikipedia

Material Recovery Facility: More commonly called a MRF (pronounced “Murf”). An intermediate processing facility designed to remove recyclables and other valuable materials from the waste stream. - http://www.calrecycle.ca.gov/LGCentral/Glossary/

Municipal Solid Waste: More commonly known as trash or garbage, MSW consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses. - http://www.epa.gov/epawaste/nonhaz/municipal/index.htm

Organics: Materials that are or were recently living, such as, leaves, grass, agricultural crop residues, or food scraps. - http://www.calrecycle.ca.gov/LGCentral/Glossary/

Protected Landscape: The natural landscape of UC Santa Cruz has been recognized from the campus's inception as a unique asset that distinguishes UCSC from other universities. In addition to the 420 acres in the CNR, approximately 505 acres of land have been designated in the LRDP as Protected Landscape in order to maintain special campus landscapes for their scenic value and to maintain special vegetation and wildlife continuity zones. To the extent feasible, Protected Landscape will be retained in an undeveloped state as the campus grows. Any development within Protected Landscape will not impinge on its overall character. The meadows south of the developed center of the campus will be maintained as undisturbed grassland. In these meadows, no building will be allowed. Agricultural research that maintains the visual quality of the lower meadows may be allowed. – page 69 UCSC Long Range Development Plan 2005-2020: http://lrdp.ucsc.edu/

Retention: The storage of stormwater to prevent it from leaving the development site. See also Detention. - California Stormwater BMP Handbook, California Stormwater Quality Association

Resource Recovery Facility: A resource recovery facility is a new development in recycling. In its broadest sense, it is the co-location of reuse, recycling, compost processing, manufacturing, and retail business in a central facility. The public can bring all their wastes and recoverable materials to this facility at one time. A resource recovery park also goes by integrated resource recovery facility, serial material recovery facility (MRF), recycling estate, industrial recycling park, recycling-based industrial park, or discard mall. A number of market forces are encouraging this type of development. - http://www.calrecycle.ca.gov/LGCentral/Library/innovations/recoverypark/Summary.htm

Stormwater: Defined as urban runoff and snowmelt runoff consisting only of those discharges, which originate from precipitation events. Stormwater is that portion precipitation that flows across a surface to the storm drain system or receiving waters. – California Stormwater BMP Handbook, California Stormwater Quality Association

Sinkhole: Depressions in the land surface resulting either from intersection with a zone of solution or collapse of overlying sediments into a void, are called sink holes or dolines. Sinkholes form from the collapse of caverns or from the gradual settling of the ground surface over an area of dissolving marble. At least thirty sinkholes, ranging from a few feet to hundreds of feet in diameter, small caves, and a number of creeks that disappear into swallow holes are found on campus. See also Karst Topography, Doline. - 2005 LRDP Draft EIR section 4.6-2 and 3

Tipping Fee: Local Disposal Tipping fees provide funding for diversion programs administered by CalRecycle and local jurisdictions. Tipping fees are generally used to fund daily operational and closure costs of a landfill, but may also be used to fund recycling programs, litter abatement, public education efforts, and other programs. A local tipping fee can act as an incentive to encourage certain practices or disincentive to discourage other practices. Usually a dollar amount per ton. - http://www.calrecycle.ca.gov/Business/

Incentives.htm/#Tipping_Fees

Tub-grinder: The largest machines used in wood processing, may handle a material diameter of 8 feet or greater, and use carbide tipped flail hammers to pulverize wood rather than cut it. -Wikipedia

Trommel Screen: A rotating cylindrical sieve or screen used for washing and sorting materials. - www.oxforddictionaries.com

Vector: An organism or vehicle that transmits the causative agent or disease-causing organism from the reservoir to the host. - http://www.biology-online.org/dictionary/Vector

Vermiculture: Through this method, red worms – not nightcrawlers or field worms found in gardens – are placed in bins with organic matter in order to break it down into a high-value compost called castings. One pound of worms can eat up to half a pound of organic material per day. It typically takes three to four months for these worms to produce harvestable castings, which can be used as potting soil. Vermicomposting also produces compost or “worm” tea, a high quality liquid fertilizer. - http://www.epa.gov/composting/types.htm#ves

Waste Stream: Waste material output of a community, region, or state. -http://www.calrecycle.ca.gov/LGCentral/Glossary/

Waters of the United States: The current regulatory Definition of Waters of the U.S.:
40 CFR 230.3(s) The term Waters of the United States means:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters including interstate wetlands;
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
   (I) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
   (ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
   (iii) Which are used or could be used for industrial purposes by industries in interstate commerce;
4. All impoundments of waters otherwise defined as waters of the United States under this definition;
5. Tributaries of waters identified in paragraphs (s)(1) through (4) of this section;
6. The territorial sea;
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (s)(1) through (6) of this section; waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States.

Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.
- http://water.epa.gov/lawsregs/guidance/wetlands/CWAwaters.cfm

Windrows: Composting mixture is placed in elongated piles called windrows. These are aerated naturally through the chimney effect, or by mechanically turning the piles with a machine or by forced aeration. - compost.css.cornell.edu/glossary.html

Zero Waste: For the purposes of measuring compliance with UC's zero waste goal, locations need to meet or exceed 95% diversion of municipal solid waste. Ultimately, UC's zero waste goal strives for the elimination of all materials sent to the landfill by 2020. –University of California Sustainable Practices, issued 7/1/2004, effective 11/18/2013