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Composting landscape waste from the University of Nevada, Las Vegas

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University of Nevada Las Vegas

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Composting Landscape Waste
from the University of Nevada, Las Vegas

A Thesis submitted in partial satisfaction
of the requirement for the degree of
Bachelor of Arts
in
Environmental Studies
UNIVERSITY OF NEVADA
Las Vegas

by

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ABSTRACT

Composting Landscape Waste
from the University of Nevada, Las Vegas

by

K. Jill Hammond

The University of Nevada, Las Vegas is a major producer of organic waste in the Las Vegas Valley. Composting landscape wastes is one way to reduce both landfill dumping and fertilizer costs for the university. It is also an environmentally friendly means of curbing a nationwide problem: unnecessary use of landfill space. Three sites within Clark County were analyzed for the feasibility of composting: Frenchman Mountain, UNLV Campus, and Boulder City Landfill. Using cost analysis, water availability, and other factors to analyze each site, Boulder City Landfill appears to be the best place to house UNLV’s composting operation. Composting in Boulder City offers a low cost, low maintenance means of disposing of UNLV’s landscape wastes. Unfortunately, it offers little opportunity of establishing a composting educational program for Clark County citizens.
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INTRODUCTION

According to Nevada Administrative Code (444.572), “composting” means a
controlled process of biological degradation of solid waste to an inoffensive humus-like
product. It is a process used, especially in states where landfill space is a premium, to
convert organic wastes into a product useful as a fertilizer or soil amendment. Effective in
diverting waste from landfill sites and aiding growth of plants, composting can help
Nevada meet its goal of diverting 25 percent of the waste stream away from landfills.

The University of Nevada, Las Vegas produces approximately 1200 cubic yards of
organic landscape waste annually (Swartzell, personal communication, 1996). This waste
has the potential to be composted but is currently sent to the Silver State disposal landfill
where it is deposited at a cost of $4.50-$6.00 per cubic yard ($6600/year). Travel
expenses to haul this waste to the landfill add another $470 per year. Composting could
not only potentially save this money but could also reduce landscaping costs because the
product could be used as a soil amendment, mulch, or mixed with chemical fertilizers.

The university has shown interest in composting its landscape wastes for over 2
years. During that time, landscape maintenance crews have been piling woodchips as well
as shrub material north of the Myron Partridge track on campus. The size of these piles
has fluctuated from approximately 20 cubic yards to almost 200 cubic yards. Material
from these piles has been used as a decorative ground cover around trees east of the
Partridge track as well as a cover to hold wild flower seed on a plot of university land
located at the northeast corner of Harmon and Swenson Streets. The university also uses
mulch producing lawn mowers which allow grass clippings to remain on the lawn from
which they were cut, providing nutrients for the lawn’s new growth. Still, the university
does send approximately 20 cubic yards of landscape waste to the landfill each week (Swartzell 1996). The goal of the university is to send no landscape waste to the landfill.

Although composting is not a popular means of disposing of yard wastes in Clark County, laws do exist for its regulation. According to Nevada Administrative Code 444.670 (1977), a compost plant may not be established until its plan for operation has been approved by the Solid Waste Management Authority. The same law requires that a buffer zone be maintained between a compost plant and an adjoining property. The landscape waste must be confined to as small an area as possible, and by-products must be handled and disposed of in a sanitary manner. Compost laws in Nevada do not require the placement of a liner or pad to prevent leaching into the ground. According to Shane Martin of the Solid Waste Management Authority (personal communication, 10/24/96), one of the most important aspects of composting is to keep odor to a minimum.

My thesis describes three sites in Clark County that could be utilized to compost UNLV’s landscape waste. Boulder City Disposal, which manages Boulder City’s landfill, is currently composting and is interested in acquiring more green waste for its facility. The other two sites are owned by UNLV. One is located east of Frenchman Mountain and the other is on the campus grounds. Feasibility of composting UNLV’s landscape waste at each of these sites is analyzed.

Before discussing the actual site analyses, I believe it is important to discuss a composting plan which UNLV must devise before it can begin composting anywhere, whether it is at Frenchman Mountain, on campus, or in Boulder City. The plan must include anticipated amount of compostable waste generated by UNLV, type of composting to be utilized by the university, rate of decomposition and estimated time from
acquiring waste to producing a viable compost product, safety and emergency procedures for working with compost, intended use for the finished product, and other issues pertaining to implementation of a successful composting operation. Many books and articles, which may be helpful in devising a compost implementation plan, have been published on the subject of composting. The BioCycle Guide to Yard Waste Composting (BioCycle 1990) is a particularly good book which describes the basics of composting, from how to start to what to do with the finished product. A good description of desert composting is offered in Landfilling Versus Composting for Disposal of Clark County School District's Green Waste (Romero 1996).

One of the most important aspects of a composting plan is that of public awareness and education. Educating the public about composting not only benefits those who are learning, it can also benefit the university by allowing students to volunteer services associated with composting. It may also help the university obtain grants for composting projects.

METHODS

To complete the project, a literature review, field work and personal interviews were conducted.

References in UNLV’s Dickinson Library were helpful in determining costs and providing general information about composting. Nevada Revised Statutes, found in the government documents department of the library, were also used to complete this paper.
Field work was necessary to assess each site for its feasibility to compost green waste. Frenchman Mountain was visited four times, Boulder City Disposal twice, and UNLV almost daily. Each site was analyzed by determining the following:

1. cost of transport
2. cost of dumping
3. equipment needs
4. labor needs
5. size of site
6. water availability

Road conditions, general geology, and potential hazards at the Frenchman Mountain site were also examined.

Personal interviews provided information on factors such as the quantities and types of yard waste produced by UNLV. Dennis Swartzell provided me with a tour of the university’s grounds, a master plan for the university which is directed to the year 2015, and other information pertinent to my research. Teresa Mann from Boulder City Disposal and Shane Martin from the Clark County Health District also provided useful information.

RESULTS

Site Evaluations

FRENCHMAN MOUNTAIN SITE

In 1982, UNLV acquired approximately 511 acres of land, located at two sites east of Frenchman Mountain (Figure 1). This land was previously owned by Pabco Mining
Figure 1. Aerial photograph of Frenchman Mountain site (Rupp Aerial Photography 1993).
Company and was once mined for gypsum. The remnants of quarries and tailings piles still exist. Today the land is used by gun enthusiasts and off-road vehicle drivers for recreation. There is a possibility that UNLV may sell this land due to the tremendous liability incurred when it acquired the land (Swartzell, personal communication, 1997).

Factors such as space, geology, location of the water table, security, safety, and water supply must be taken into consideration when trying to site a composting facility on this undeveloped land. Below is an assessment of the Frenchman Mountain Site.

The land consists of ridges of limestone, mudstone, and conglomerate with some flat areas which were once quarried for gypsum. Except for the quarries, this type of terrain is not readily suitable for a composting facility. The lithology of these flat areas consists of unconsolidated, medium grained, gypsum rich sediments. Atop these sediments are a few limestone clasts from three to fifteen centimeters in diameter. Litter, including couches, oil cans, paint, and shotgun shells is everywhere (see Figure 2).

Figure 2. Litter scattered about the Frenchman Mountain site.
The most appropriate area for composting is shown in Figure 3. Its topography is shown on the Henderson 15' Quadrangle in Figure 4. It is approximately 4 acres in size and is one of the few flat sections of land found within the area. Access via the dirt road is good because it is at the southern portion of the area closest to Boulder Highway. The road is dirt and mostly smooth.

FIGURE 3. Land at Frenchman Mountain suitable for composting.
FIGURE 4. The portion of the Henderson 7.5' and Frenchman Mountain 7.5'
Quadrangles showing the Frenchman Mountain site. The area shown in Figure 3 is
highlighted in red. (USGS 1970)
To operate a compost facility at Frenchman Mountain, it would be necessary to purchase and house equipment at the site. A front end loader would be needed to turn the windrows. UNLV currently owns a front end loader which it uses on campus. This loader could be utilized at both the campus and the Frenchman Mountain site but time and costs for transporting it would be high. Other recommended equipment includes: a sorter to sort trash from the landscape waste (unless a thorough job of picking can be accomplished before transport to the site), a tub grinder to chip the waste into bits, and a thermometer to gauge compost windrow temperatures. Table 1 gives a detailed list of equipment costs for the Frenchman Mountain site as well as the other evaluated sites.

**TABLE 1.** Composting costs for all three sites + the cost of landfilling with Silver State Disposal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Frenchman Mtn</th>
<th>Frenchman Mtn (w/ other entities)</th>
<th>UNLV</th>
<th>Boulder City Disposal</th>
<th>Silver State Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-end loader</td>
<td>$150,000</td>
<td>$50,000</td>
<td>$150,000</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Haul truck</td>
<td>$ 70,000</td>
<td>$ 23,334</td>
<td>$ 70,000</td>
<td>$ 70,000</td>
<td>$ 70,000</td>
</tr>
<tr>
<td>Tub grinder</td>
<td>$ 80,000</td>
<td>$ 26,667</td>
<td>$ 80,000</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Mechanical turner attachment</td>
<td>$ 10,000</td>
<td>$ 3,334</td>
<td>$ 10,000</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Screen</td>
<td>$ 15,000</td>
<td>$ 5,000</td>
<td>$ 15,000</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Water tank truck</td>
<td>$ 65,000</td>
<td>$ 21,667</td>
<td>$ 0</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Fence</td>
<td>$ 2,400</td>
<td>$ 800</td>
<td>$ 2,400</td>
<td>$ 0</td>
<td>$ 0</td>
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<tr>
<td>Thermometer</td>
<td>$ 70</td>
<td>$ 24</td>
<td>$ 70</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Fuel/year</td>
<td>$ 740</td>
<td>$ 480</td>
<td>$ 80</td>
<td>$ 400</td>
<td>$ 470</td>
</tr>
<tr>
<td>Water/year</td>
<td>$ 360</td>
<td>$ 360</td>
<td>$ 360</td>
<td>$ 0</td>
<td>$ 0</td>
</tr>
<tr>
<td>Labor/year</td>
<td>$44,000</td>
<td>$44,000</td>
<td>$44,000</td>
<td>$22,800</td>
<td>$22,800</td>
</tr>
<tr>
<td>Maintenance (amortization)</td>
<td>$20,840</td>
<td>$ 6,947</td>
<td>$20,840</td>
<td>$ 3,500</td>
<td>$ 3,500</td>
</tr>
<tr>
<td>Dumping Fee</td>
<td>$ 0</td>
<td>$ 0</td>
<td>$ 0</td>
<td>$ 5,400</td>
<td>$ 6,600</td>
</tr>
<tr>
<td>Compost/mulch purchase cost</td>
<td>$ 0</td>
<td>$ 0</td>
<td>$ 0</td>
<td>$ 1,560</td>
<td>$ 2,880</td>
</tr>
<tr>
<td><strong>TOTAL MAXIMUM COST/YEAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Year</td>
<td>$458,410</td>
<td>$182,613</td>
<td>$392,750</td>
<td>$103,660</td>
<td>$106,260</td>
</tr>
<tr>
<td>Proceeding Years</td>
<td>$ 65,940</td>
<td>$ 51,787</td>
<td>$ 65,280</td>
<td>$ 33,660</td>
<td>$ 36,250</td>
</tr>
</tbody>
</table>
According to the Environmental Protection Agency (1994), the desired minimum depth from the base of the green waste to the water table is five feet. In a U.S.G.S. report completed in 1987 (Dettinger 1987), it was determined that the water table at the Frenchman Mountain site owned by UNLV is 10 to 30 feet below ground surface. In some states, a liner is required between the compost and the earth to keep fluids from leaching into the ground (Moeger 1994). Nevada does not require the emplacement of such a liner (NAC 444.670).

The availability of water is a problem at the Frenchman Mountain site. There is currently no water at the site. Options for obtaining water at the site are to purchase a watering truck or to utilize one that the university currently owns. The truck currently on campus is used to keep dust down and to water trees and shrubs. This truck could be used to transport water to the Frenchman Mountain site. Depending on the season, daily trips to the site could be required. Optimum moisture levels for a composting pile for maximum microbial activity are 50 to 65 percent (Polprasert 1989). If this truck is not available for the site, the cost for a water truck is approximately $65,000.(Martin and Gershuny, 1992).

Maintaining safety and security at the Frenchman site would probably entail installing a fence and perhaps even constructing a garage. The site should definitely be identified with signs as well as contain warning signs such as “Keep Out” and “No Dumping” (BioCycle, 1990). On each of six visits to the site, I was met by both gun and off-road vehicle enthusiasts. Squatters also enjoy the university’s land at no cost but at a great liability to the university. Although these individuals were friendly, they may pose a threat to the success of composting at the site. They may also pose a threat to themselves
if they disturbed the piles which can reach temperatures of over 170 degrees Fahrenheit in the summer.

Nevada composting regulations do not require the installation of a barrier but both theft and injury could be reduced with such an installation. Sign installation is inexpensive as well as explicit. If someone is injured at a composting facility it could be grounds for a lawsuit, so it is worthwhile to invest in safety and security.

The distance from UNLV to the site is 17.3 miles. The university owns more than one haul truck which could be used to take the material this distance to the site. At 8 miles/gallon for a large truck and a cost of $1.45/gallon for fuel, the cost of hauling the material to the site would be approximately $5.00 per trip. The same cost also applies to the watering truck. The cost of dumping would be nothing due to the fact that UNLV owns the land.

Labor is another issue that must be considered when determining the feasibility of composting at Frenchman Mountain. According to Diaz, Eggerth, and Golueke (1995), small, low-technology compost operations usually have one full-time employee and one part-time equipment operator. Croteau, May, and Schaan (1996) assessed the cost of labor at $18.35 per hour for a full-time employee. The part-time employee described by Diaz, Eggerth, and Golueke was a student worker who, in the state of Nevada, would be paid $6.00 per hour. Using these pay rates, labor costs would total approximately $44,000 per year.

Siting the compost facility at Frenchman Mountain is the most expensive option discussed in this paper. Initial costs could reach well above $400,000. However, one way to reduce these costs would be to enter into a joint operation with other entities who may...
be interested in composting their landscape waste (such as Clark County School District and Clark County Parks). This would drop the initial costs by more than 60%. Further study of this option is necessary.

UNLV CAMPUS

Composting on the university grounds would entail committing a plot or plots of land solely for the purpose of composting the green waste. Plots of land designated for composting are typically sized at one acre per 3000-3500 cubic yards of composting material (Anonymous 1996). Because the university presently produces about 1200 cubic yards of landscape waste per year, one acre should easily accommodate composting piles. Currently, there is undeveloped land of this size which could temporarily be utilized for this purpose (Figure 5).

In the spring of 1993, Robert A. Fielden, Incorporated completed UNLV’s Comprehensive Master Plan Update (Fielden 1993). This report was designed to show the architectural and landscape changes that will take place over the next 20 years on campus. Figure 5 shows the campus as it is today. Figure 6 shows the campus as it is planned to stand 20 years from now. The area that currently holds UNLV’s woodchip piles (Figure 7) will be the home to a continuing education center which is scheduled to be constructed from years 11 to 20.
Figure 5. Campus as it stands today (Fielder 1997)
In a phone interview with Shane Martin of the Clark County Health District (10/24/96), Mr. Martin stated that he thought it would be a good idea to begin composting where the piles currently stand and then move them when building of the continuing education center begins (this allows plenty of time to decide on another appropriate spot for composting). In the future, when more buildings are constructed, it may actually be necessary to compost on currently landscaped areas. An article in the Southeast View (a special section of The Las Vegas Review-Journal) printed on February 26, 1997, stated that Paradise Elementary School, located at the southeast corner of Swenson and Tropicana Avenue, will be relocated to the Myron Partridge Track, no more than twenty meters south of the area where the piles are currently held (Parker 1997). The track will be destroyed and rebuilt in another location over the next year. The new elementary school is scheduled to open August 1997, and because of its proximity to the
compost piles, will undoubtedly cause the piles to be moved (perhaps only a few tens of meters north of their current location).

If it is absolutely necessary to move the compost piles from their current location, it may be necessary to compost on a few small plots scattered about campus (due to the lack of large plots of land on campus). Another possibility would be to compost on land west of the Desert Research Institute, located on the southwest corner of Flamingo Rd. and Swenson St. It may be possible to gain assistance in the composting from the scientists at DRI if the piles were located adjacent to their building.

Water on campus is readily available. A spigot is currently set up at the existing woodchip piles. Controlling odors and maintaining safety may not be as easy, however. If maintained properly, compost piles should not smell badly and therefore not be bothersome but that is under ideal conditions. Safety need not be an issue if fences or other barriers are built around the compost piles. Because temperatures can reach 170 degrees Fahrenheit within the pile in the summer (T. Mann, personal communication, 1996), it is necessary to keep people away from this potential danger.

BOULDER CITY DISPOSAL

The third option I investigated for this project consists of composting in Boulder City. Boulder City Disposal, the company which manages the Boulder City Landfill located on Utah Street in Boulder City, began a compost pilot project in 1995 which is still in process. Figure 8 shows the current composting piles at the site. To begin the project, green waste was accepted at no charge from various entities who would have been charged to dump in the landfill.
The pilot project consisted of five windrows, each comprised of various mixes of wood chips, sludge, and duckweed distributed across one acre. Originally starting at a size of approximately 40 cubic yards each, on my visit in September, each pile had lost almost 50 percent of its volume. Approximately 1000 gallons of water per pile was used every other day to keep moisture content near 50 percent. In September, the compost was nearly ready for use. The last steps were to spread the piles to let them dry and then pile them up again to ensure that they did not reheat. Total time required from start to finish was approximately three months.

Boulder City Disposal has the necessary composting equipment, is permitted to handle landscape waste (though not permitted to compost at this time because the pilot project is not completed), and has access to sufficient water. Although it charged nothing to take green waste for the composting pilot project, the company cannot be expected to continue accepting green waste at no charge. Teresa Mann, operator of the landfill, stated that a lesser charge of approximately $4.50 per cubic yard would
probably be assessed for landscape waste (9/20/96). Current landfill charges at Boulder City Disposal are up to $13.50 per cubic yard for waste not generated in Boulder City. An additional fee of about $13 per ton of finished compost is also likely. Composting at Frenchman Mountain or on campus would cost UNLV nothing to obtain finished product. Boulder City is also the farthest distance from campus so fuel costs would be more expensive per trip. Located approximately 21 miles from UNLV, transportation costs would total an estimated $400 per year.

A factor that may either enlarge Boulder City Disposal's composting effort or shut it down completely is that Boulder City may relocate its landfill operations. Land in Eldorado Valley owned by the city (Figure 9) has been designated as the site of a landfill feasibility study.

Many Boulder City residents have expressed opposition to the proposed Eldorado Valley landfill. Silver State Disposal has threatened to sue Boulder City if the Eldorado Valley landfill is established. The area is being portrayed as a beautiful refuge for the desert tortoise by some and a dangerous place to house a landfill by others.

According to Teresa Mann, several acres of the proposed new landfill in Eldorado Valley could be used solely for composting. This site like the current site on Utah Street would have all of the necessary composting equipment, water, and permits to compost. Any public entity, company, or person would be allowed to drop landscape waste at the new landfill for a price lower than the dumping fees which are currently $4.50 for Boulder City residents, companies, and public entities, and $13.50 (maximum) for those not from Boulder City. Landscape waste must be relatively pure green waste with no substantial quantity of papers, wrappers, cans, etc.

On November 11, 1996, I attended a City Council meeting at Boulder City during which continuation of the preliminary permitting process for the Eldorado Valley landfill was discussed. This process would require spending approximately $400,000 just to get the Clark County Health District to consider permitting the site. It would not guarantee a permit.

Mayor Eric Lundgaard stated that spending this money would not force Boulder City residents to accept a landfill in Eldorado Valley. Rather, it would inform the residents about the feasibility of siting a new landfill there. If a permit were granted for the site, Boulder City may hold a special election to decide whether or not to open it. June 1997, is the earliest date that an election of this sort could be held. If the residents voted against the site in Eldorado Valley, Boulder City Disposal would continue to
operate at the existing site on Utah Street, eventually applying for lateral expansion of the existing landfill.

Teresa Mann, in a telephone interview on November 7, 1996, stated that composting may no longer be possible if the Eldorado Valley landfill is not opened. This is because space will be at a premium at the present location where landfilling is more profitable than composting. This means that UNLV may not be able to send its landscape waste to Boulder City, unless Boulder City Disposal changes its mind. For now, however, Boulder City Disposal is willing to take UNLV’s landscape waste at a charge to be determined through conversations between Boulder City Disposal and UNLV (Teresa Mann, personal interview, 2/6/97). Because no prices for dumping with Boulder City Disposal have been established in writing, I used the $4.50/cubic yard and $13/ton prices stated by Teresa Mann on 9/20/96 when determining total costs for composting with Boulder City.

DISCUSSION

Based on the results of my study, I believe that the best site for UNLV’s composting needs is Boulder City Disposal. Labor, equipment, water, and composting experience are all available at Boulder City Disposal. Costs could be as much as $20,000 per year less than composting at any other site. It may, however, be difficult to establish an educational program on composting if composting begins in Boulder City. Residents of the Las Vegas Valley and the Clark County School District will not likely be willing to travel to Boulder City for composting education.
Composting on the UNLV campus would be more than double the cost of composting at Boulder City but it would be the easiest location from which to educate the public. Environmental Studies, Biology, and Science Education majors could conduct research on a compost project located on campus. UNLV is also located more or less centrally in the Las Vegas Valley. Explanatory plaques and hands-on exhibits could be established near the compost site for self-guided public tours and pamphlets such as that produced by the San Francisco League of Urban Gardeners (Appendix 1) could be available for general and home composting information.

Frenchman Mountain, also twice as expensive as the Boulder City option, would be prohibitively costly in the first year. Perhaps feasible if a collaborative composting program were established between UNLV and other public entities in Clark County, it would be essential to conduct a study to determine which entities are interested in composting and which can afford to join such a venture. At this point, it is likely that the land will be sold, thus eliminating it as an option.

The current cost of landfilling landscape waste from UNLV is $36,250/year, which makes it more than $2500/year more expensive than the option of composting in Boulder City. Thus, it is still a cost effective means of managing the campus' landscape waste. There is, however, no opportunity to educate the public about composting.

**CONCLUSIONS**

Each of the studied options has at least one reason why it would be better than the next for composting. Frenchman Mountain offers the opportunity to work in a joint effort with other public entities, enhancing relations between the state, city, and county while
disposing of landscape wastes in an environmentally friendly manner. The UNLV campus offers the best opportunity for education and research. At 60% or less of the cost of composting at any other site, Boulder City Disposal and Silver State Disposal offer the most cost effective means of disposing of UNLV's landscape waste. The least expensive option, composting with Boulder City Disposal, is also the more environmentally sound means of disposing of landscape waste. The opportunity for compost education in Boulder City does exist and it is possible to set up an education center at UNLV for area residents who will not travel to Boulder City. For these reasons, I recommend composting with Boulder City Disposal.
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Martin, Shane. (1996). Clark County Health District. Phone Interview, October 24, Las Vegas, NV.


Nevada Administrative Code (NAC) 444.572 “Composting” defined. In Clark County Health District (Ed.) Solid Waste Disposal Regulations. Las Vegas: Clark County Health District.

NAC 444.670 System to process waste: Compost plant. In Clark County Health District (Ed.) Solid Waste Disposal Regulations. Las Vegas: Clark County Health District.


