# Rancho Las Virgenes Composting Facility

# Net Present Worth Analysis Comparing Composting to Hauling

# June 6, 2011 JPA Meeting

In January 2002 the JPA completed a Biosolids Handling Master Plan.[1] The master plan included an implementation schedule with recommended improvements related to thickening, dewatering, digestion, amendment preparation, composting and cogeneration. The master plan concluded that the preferred method of managing the dewatered biosolids was improved composting. The executive summary from the master plan and an updated implementation schedule are attached.

The master plan also evaluated various long term options including improvements to the composting process and trucking. The estimated capital cost for the long term trucking option was $1,800,000 in 2002 and the annual estimated operation and maintenance costs were $670,000. The master plan included an economic evaluation that compared the present worth of each long term option including continuing to compost and hauling on a 20 year basis. The economic evaluation concluded that the total present worth of continuing to compost and the long term trucking option were similar at $13.9 million and $12.4 million respectively.

The master plan concluded that the best alternative was to continue composting while upgrading the process equipment. This conclusion was partially based on the uncertainty of offsite disposal options for the dewatered biosolids. Several factors have changed since the Master Plan was completed in 2002 most notably the start-up of the Toland Landfill facility and the possibility of disposing of dewatered biosolids at that facility, if the facility's Conditional Use Permit can be revised to accept out of county bio-solids. The following present worth analysis uses updated capital, operations and maintenance costs and assumes disposal of biosolids at the Toland facility[2].

Present Worth Analysis

Assumptions:
Planning period: 10 years[3]
Interest rate: 4%

| Alternative | Capital Cost | O & M Costs (year 1) | Present Worth |
|---|---|---|---|
| Hauling | $2.05M | $0.82M | $9.36M |
| Composting | $2.55M | $1.91M | $16.11M |

Assumptions:
Planning period: 20 years
Interest rate: 4%
Additional capital of $0.5 million required

| Alternative | Capital Cost | O & M Costs (year 1) | Present Worth |
|---|---|---|---|
| Hauling | $2.55M | $0.82M | $19.03M |
| Composting | $3.05M | $1.91M | $30.85M |

[1] LVWMD Report # 2182.00 Biosolids Handling Master Plan, CH2MHILL January 2002
[2] O&M costs from "Cost Analysis for the Rancho Las Virgenes Composting Facility" July 2010 by LVMWD staff
[3] Ten years is the length of most agreements with VRSD to process biosolids at Toland

For a planning period of ten years the net present worth for hauling of dewatered biosolids is $6.75 million less that the net present worth of continuing to compost the dewatered biosolids and for a planning period of twenty years the net present worth for hauling of dewatered biosolids is about $11 million less that the net present worth of continuing to compost the dewatered biosolids. The attached chart shows the changes to the NPV depending on the discount rate used.

Both analyses assume labor increases of 2% per year, electrical increases of 5% per year and an annual 1% increase for all other items except hauling costs. Hauling costs are assumed to increase 3.5% per year based on a typical VRSD agreement.

Capital improvement assumptions are:

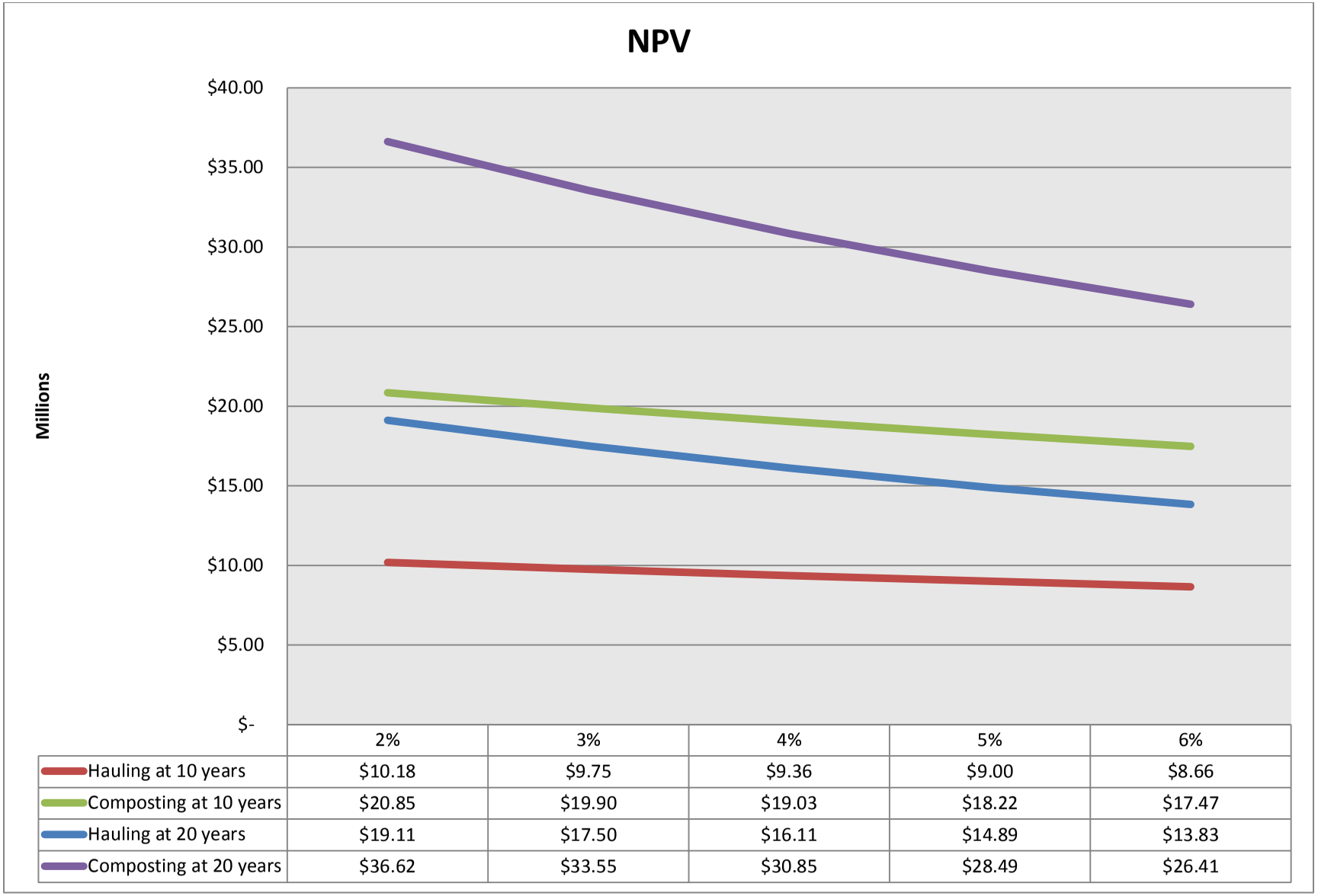
Hauling:

The 2002 Bio-solids Master Plan estimated $1.8M in improvements for hauling, escalating this value to 2011 dollars using the Building Cost Index results in $2.05M. An additional $0.5M is assumed for the twenty year term.

Composting:

| | |
|---|---|
| Reactor building roof repairs | $0.30M |
| Replace agitators | $0.50M |
| Rehab reactor building | $1.00M |
| Replace loader | $0.50M |
| Replace liners and screws for conveyors | $0.25M |
| Total | $2.55M |

An additional $0.5M is assumed for the twenty year term.




| | 2% | 3% | 4% | 5% | 6% |
|---|---|---|---|---|---|
| Hauling at 10 years | $10.18 | $9.75 | $9.36 | $9.00 | $8.66 |
| Composting at 10 years | $20.85 | $19.90 | $19.03 | $18.22 | $17.47 |
| Hauling at 20 years | $19.11 | $17.50 | $16.11 | $14.89 | $13.83 |
| Composting at 20 years | $36.62 | $33.55 | $30.85 | $28.49 | $26.41 |

# Biosolids Handling Master Plan

# Executive Summary

# January 2002

# Biosolids Handling Master Plan
# Executive Summary

**PREPARED FOR:** Las Virgenes Municipal Water District and Triunfo Sanitation District

**PREPARED BY:** CH2M HILL

**DATE:** January 2002

## Overview

The Biosolids Handling Master Plan recommends addition of waste activated sludge (WAS) thickening facilities at Tapia Water Reclamation Facility (Tapia) and continuation of digestion, dewatering and composting at the Rancho Las Virgenes Composting Facility (Rancho). Continued composting appears to be the most cost-effective and reliable alternative for short-term and long-term management of biosolids.

Septage treatment at Las Virgenes Municipal Water District (LVMWD) is not cost competitive with other available septage treatment options and is not recommended at this time. Additionally, septage treatment would result in derating of Tapia by one to two million gallons per day (mgd), increased solids loading at Rancho by 25 percent, and increased odor risk and potential operational upsets.

For cogeneration optimization, digester gas storage is recommended to maximize the beneficial use of gas and power production of the fuel cells. Installing floating gas-holder covers on the proposed new digesters will provide the necessary storage at low pressures and does not require additional facilities. Ultrasound technology can increase digester gas production and should be considered for installation at WAS thickening facilities at Tapia. The installation time should coincide with construction of new anaerobic digesters.

The preliminary cost opinion for the recommended improvements to the biosolids handling facilities are categorized as short-term, interim, and ultimate phases. The short-term improvements are focused on improving compost product quality and operational safety and adding WAS thickening facilities at Tapia in the next three years. Estimated costs for the short term are $3.3 million, of which $2.5 million is for thickening. The interim and ultimate phases focus on the increased capacity of solids handling. Estimated costs to increase capacity are $10.7 million, of which $8.0 million is for two new anaerobic digesters.

## Introduction

LVMWD and its joint venture partner, Triunfo Sanitation District (TSD), operate Tapia, Rancho, and the Rancho Las Virgenes Farm (Farm). LVMWD is planning to expand the existing biosolids handling facilities at Rancho from 8 mgd to 16.1 mgd capacity, with interim capacity of 12 mgd. CH2M HILL was commissioned to prepare a Biosolids Handling Master Plan, focusing on the following objectives:

- Evaluate thickening options
- Optimize digestion, dewatering, composting, and cogeneration facilities
- Evaluate trucking and offsite processing
- Develop a long-term plan for biosolids handling and reuse
- Evaluate septage receiving and treatment

## Biosolids Processing and Reuse Rules and Regulations

The 40 Code of Federal Regulations (CFR), Part 503 establishes pathogen and vector attraction requirements, pollutant limits, and management and operational standards for use or disposal of biosolids. Pathogen requirements are classified as "Class A" and "Class B" with Class A being more stringent. Class B biosolids are limited to bulk application to agricultural land, forest or reclamation sites, with additional restrictions for public access while Class A biosolids have minimal regulatory requirements (but are subject to evolving political restrictions). The dewatered biosolids at Rancho meet Class B, while the compost meets Class A pathogen and vector attraction requirements. Public concerns at the local level regarding the potential health risks have resulted in the development or enactment of ordinances that ban land application of Class B biosolids. On January 1, 2001, an ordinance went into effect in Kern County that bans land application of all residuals except Class A biosolids after January 2003. This ordinance set a precedent and resulted in Riverside and Kings Counties adopting ordinances that are effective as of November 25, 2001, and December 31, 2002, respectively. These ordinances also will ban land application of Class B biosolids.

The South Coast Air Quality Management District (SCAQMD) has also proposed Rule 1133 to limit ammonia and volatile organic compounds (VOC) emissions from composting facilities. While they are currently undergoing revision as a result of public comment, the initial draft rule included requirements to enclose the active portion of all new or modified composting facilities with ventilation to an emission control device (i.e., biofilter) of facilities that process more than 38 wet tons per day of biosolids. Proposed durations for composting are 21 days of active composting and 28 days for curing. Presently, the Rancho facility meets all of these proposed requirements, except Curing Building ventilation to the biofilter.

## Other Southern California Municipalities Biosolids Reuse and Disposal Operations

The local ordinances banning land application of Class B biosolids and the political and public acceptance issues are significantly impacting the biosolids management practices and costs for municipalities that export their biosolids. For many Southern California municipalities, the unit costs have been going up substantially due to added cost of transportation, road use fees, tipping fees, and/or processing requirements. Diminishing number of potential remote locations in Southern California for reuse or disposal are causing some municipalities to search for potential sites in neighboring states. Discussions with various Southern California municipalities indicate that the cost of biosolids reuse and disposal has risen by more than 10-percent this year alone to a range of $35 to $45 per wet ton. Many of these municipalities are in the process of reviewing their plans for long-term biosolids management, in response to these escalating costs. The risk of losing dedicated reuse or disposal sites and the associated costs are prompting municipalities to re-examine the viability of implementing their own processing techniques such as enhanced digestion, composting, heat drying, etc. to meet Class A requirements and to locally reuse their biosolids.

## Existing Capacity of Digester and Dewatering Processes

The existing digesters at Rancho have capacity at current conditions for 100,600 gallons of feed per day on the average, using a solids concentration of 3.1 percent and both digesters on line. Assuming similar conditions, when wastewater flows at Tapia reach 12 mgd the

digesters will be near capacity. However, if one digester is out of service for maintenance, the capacity of the remaining digester will be inadequate at 12 mgd. Feed concentrations are extremely important in the capacity calculations. If the water content of solids is reduced, the available detention time is proportionally increased. At 6 percent solids, the existing digestion system has sufficient capability without expansion when wastewater flows at Tapia reach 16.1 mgd, assuming no redundancy in this process. Redundancy is required to allow one digester to be taken out of service for maintenance and cleaning. Assuming thickening is implemented, additional digester capacity is required to allow for expansion to 16.1 mgd and provide for redundancy. The cost for two digesters, as originally proposed, is approximately $8.0 million.

Determining the capacity of the dewatering equipment is dependent upon several factors such as the operating time spent on dewatering solids, upstream storage of liquid sludge and downstream storage of dewatered cake. Presently, only one centrifuge is used and it is operated 6 to 8 hours per day, 5 days per week. As Tapia grows to 16.1 mgd from the current 9.7 mgd, at the present digester feed solids concentrations, another centrifuge will be required to maintain a similar operating schedule. However, if the digester feed solids concentration is increased to about 6 percent, then one centrifuge can dewater the digested biosolids in a 6- to 8-hour period per day.

## Waste Activated Sludge Thickening

Consideration of WAS treatment is particularly important in that it initially has a much higher water content than primary sludge. The goal of WAS treatment is to optimize digestion and dewatering capacity by reducing this water content using either thickening at Tapia or Rancho, or dewatering and disposing of WAS prior to pumping to Rancho. Dewatering and disposing of WAS, using a high solids filter press, such as Dry-Vac or J-Vap, before pumping to Rancho provides additional capacity in the anaerobic digesters; however, additional truck loading and solids storage facilities at Tapia would be required.

The location of WAS treatment depends on several factors including: technology to be used, available space, support equipment and facilities required, power demands, and sludge pump and pipeline limitations. The recommended alternative is adding two gravity belt thickeners at Tapia to thicken the WAS before combining with primary sludge and pumping to Rancho. The benefits of thickening at Tapia include increased operational flexibility, less pumping from Tapia to Rancho, reduced volume of solids to handle in the downstream processes, and decreased centrate flows from Rancho to Tapia. The cost comparison of the three alternatives is outlined in Table ES-1.

**TABLE ES-1**
Solids Thickening Costs[a]

| Option | Construction Cost, $ Millions | O & M Cost, $ Millions/year | Total Present Worth, $ Millions |
|---|---|---|---|
| Thickening at Rancho | 2.4 | 0.23 | 5.9 |
| Thickening at Tapia | 2.5 | 0.23 | 6.1 |
| High Solids Filter Press at Tapia | 8.7 | 0.21 | 12.5 |

[a] Budgetary cost estimate, +50 to –30 percent accuracy

## Composting Operation

The processing of the biosolids should be viewed as a manufacturing process, which will strive to produce beneficial products that have sufficient quality and consistency to satisfy the end user. LVMWD presently uses a series of bucket and screw conveyors and an International Process Systems (IPS) (agitated bin) composting system to produce approximately 15,000 cubic yards of compost per year. Public health protection and market acceptance are complimentary goals and should be achieved for successful marketing of the product. From a public health standpoint, the product meets the Class A low pathogen levels and the vector attraction reduction requirements specified under Environmental Protection Agency (EPA) Part 503 Regulations. From a market acceptance standpoint, product improvements through moisture control and screening of the product would be required to improve marketing of the product, reduce the ammonium and potential phytotoxicity (due to high ammonium), improve compost quality, and make it more suitable for a diverse and reliable long-term market. In particular, the conveyance (bucket and screw conveyors) and IPS systems typically have suffered from the tendency to overdry the final compost. This, in turn, can prematurely arrest the active composting phase before the product is fully stable.

From an equipment standpoint, the amendment or feedstock preparation building has a number of operational issues that should be addressed to improve safety, efficiency, and reliability of the existing facilities. Replacement of the existing bucket elevators and knife gates are required to reduce plugging and hazards associated with efforts to resolve this on a daily basis. The reactor unloading screw conveyors need to be modified to eliminate plugging and bridging, thus improving operational efficiencies. Also, installation of a parallel amendment system for high moisture and oversized amendment with improvements to the sludge metering cake hopper and upgrade of IPS agitators should be implemented to reduce amendment cost and increase throughput of the IPS system.

## Short-Term Biosolids Management Options

As an alternative to improving or modifying the composting system, the biosolids can be transported to an offsite location for beneficial reuse or disposal. For these alternatives, a truck loading facility is required. Options for a truck loading facility, including a drive-through truck access adjacent to the compost reactor building or loading inside the building, conveyor modifications, onsite storage requirements, odor control, and long-term impacts on the IPS system were considered. Table ES-2 presents the cost comparison of the alternatives. The cost for onsite composting is similar to the truck loading and offsite processing. For offsite processing, as discussed before, the recent local ordinances and proposed SCAQMD rules are resulting in loss of biosolids reuse and disposal sites and increase in cost associated with transportation and processing.

**TABLE ES-2**
Short-term Onsite Composting vs. Trucking and Offsite Processing[a]

| Alternative | Construction Cost, $ Millions | O & M Cost[b], $ Millions/year | Total Present Worth[c], $ Millions |
|---|---|---|---|
| Continue onsite composting | 0.8 | 0.61 | 3.5 |
| Truck loading With onsite storage | 1.8 | 0.53 | 4.1 |
| Truck loading without onsite storage | 1.2 | 0.57 | 3.8 |

[a] Budgetary cost estimate, +50 to –30 percent accuracy.

[b] Based on OMI's review of Rancho operation, the overall cost to continue current composting operation by LVMWD was $1.42 million compared to $1.38 million for trucking alternative without onsite storage. When the operations and maintenance (O&M) costs of digestion and dewatering (estimated at $0.81 million) are subtracted from both costs, the result is $0.61 million for composting and $0.57 million for trucking.

[c] Present worth for the short-term options was calculated assuming a 5-year planning period.

## Long-Term Biosolids Management Options

LVMWD has several basic alternatives available for continued biosolids disposal including: improving existing onsite composting and pursuing privatized or wholesale marketing of the compost product, abandoning or mothballing the onsite composting facility and trucking the dewatered biosolids for offsite processing or disposal, or replacing the current operation with an alternative technology to produce Class A biosolids for reuse. The long-term biosolids management options and alternatives evaluated include:

- Improved composting process - baseline option
- Long-term trucking for offsite composting
- Steam hydrolysis (Cambi), followed by digestion
- High solids filter press dewatering (Dry Vac and J-Vap) after digestion, before hauling offsite, would not require composting
- Thermal drying after digestion, before hauling offsite, would not require composting.
- Steam addition to centrifuges (Centridry) for reducing the biosolids trucking cost to a remote composting location.

The cost comparison of these technologies is outlined in Table ES-3.

The cost for onsite composting improvements and long-term trucking are similar. For long-term trucking; however, the offsite processing costs have risen by more than 10 percent per year in recent years. If this trend continues, the present worth of long-term trucking could substantially increase. Overall, LVMWD's strongest position appears to be to continue onsite composting and diversify their client base for the sales of compost. Private-public partnership provides a good opportunity for the next few years to market the compost while the LVMWD is working to improve the Rancho compost facility and compost quality. In the meantime, LVMWD should market some portion of their compost directly with local municipalities, nurseries, and agricultural users, while continuing the Saturday morning, customer pick-up program.

**TABLE ES-3**
Long-term Biosolids Management Options[a]

| Alternative | Construction Cost, $ Millions | O & M Cost[b], $ Millions/year | Total Present Worth, $ Millions |
|---|---|---|---|
| Composting Improvements | 2.7[c] | 0.71[d, e] | 13.9 |
| Long-term Trucking | 1.8 | 0.67[e] | 12.4 |
| Steam Hydrolysis (Cambi) | 12.1 | 0.69 | 22.9 |
| High Solids Filter Press (J-Vap or Dry-Vac) | 18.8 | 0.97 | 34.2 |
| Thermal Drying | 23.8 | 0.75 | 31.8 |
| Steam Addition to Centrifuges (CentriDry) | 14.8 | 0.51 | 26.6 |

a. Budgetary cost estimate, +50 to –30 percent accuracy.

b. O&M costs were developed as an average between current O&M costs and projected O&M costs at 16.1 mgd.

c. Construction costs for composting include the $0.8 million as described for the short-term improvements. However, the construction costs do not include costs associated with proposed AQMD rule changes.

d. Composting O&M costs do not include revenue from sale of compost product.

e. The results of the OMI cost review were used for the current O&M costs and averaged with projected costs at 16.1 mgd to develop the overall O&M cost.

## Septage Receiving and Treatment

The feasibility of accepting septage at the LVMWD treatment facilities was assessed to determine its impact on facilities capacities and operations and maintenance (O&M) costs. The septage characteristics and anticipated flow rates, based on conversations from local septage haulers and design experience with similar sized facilities, were used to develop a conceptual design and budgetary capital and O&M cost for the facilities.

The impact to nutrient levels at Tapia is a derating of the facility by 1 to 2 mgd. The impact of septage receiving at Rancho is estimated to be an increase of 25 percent in solids loading on the processes. The estimated fee that would be charged to the septage hauler is $0.11 per gallon of septage, to cover the costs of septage receiving and treatment, not including any markups for LVMWD. As compared to the range of charges by other Southern California agencies of $0.02 to $0.05 per gallon, the LVMWD fee would be two to five times higher.

Other impacts of receiving and treating septage at LVMWD facilities include loss of capacity at Tapia and Rancho, risk of increased odor complaints, increased traffic on Las Virgenes Road, and potential operational upsets at Tapia. For these reasons, the septage receiving and treatment at LVMWD facilities is not a viable option.

## Cogeneration and Gas Storage

Optimization of the existing cogeneration facility, which consists of two fuel cells, can be achieved by adding gas storage, maximizing digester gas production, and improving the heat recovery system.

Three different gas storage options were evaluated including high-pressure Hortonspheres, tanks with floating gas-holder covers, and tanks with fixed covers. Tanks with floating gas-holder covers is the recommended gas storage option because the tanks do not require gas compression for storage, and they are easy to operate. Also, the proposed digesters to be

constructed at Rancho could be designed to include floating gas-holder covers, avoiding the necessity for construction of separate gas storage tanks. The estimated construction cost for installation of floating covers on the digesters increases the cost of each digester by approximately $350,000.

Three technologies were evaluated for digester gas production maximization including recuperative thickening, Cambi process, and ultrasound technology. Use of ultrasound technology for digester gas production maximization is the recommended technology. The first full-scale installation of this system in United States is planned in Orange County Sanitation District (OCSD) facilities. The performance of this system should be monitored to validate the efficiency of the system and its feasibility for application at LVMWD facilities. The installation of the ultrasound equipment should coincide with the construction of new digester and gas storage facilities at Rancho. The preliminary cost of installation of ultrasound equipment is approximately $480,000.

At the time of the Master Plan, the heat recovery system was being upgraded. Additional improvements include replacing the boiler burner, and resizing the digester gas injectors to allow operation on a lower digester gas flow rate.

## Implementation Plan

Recommendations can be categorized in the following main general categories: Thickening, Dewatering, Digestion, Amendment Preparation, Composting, and Cogeneration. A summary of the recommendations, their associated cost estimate, benefit, implementation trigger, and schedule is provided in Table ES-4. Implementation priorities are categorized according to short-term, 12-mgd (interim) phase, and 16.1-mgd (ultimate) phase. The time frames for implementation of each improvement or upgrade are:

Short Term – These improvements should be implemented immediately to improve the quality of the compost, while reducing operating costs and the risk of injury. Implementation period for the short-term recommendations is 0 to 3 years (2002 to 2005).

12.0 mgd (interim) – These improvements should be implemented in the interim to increase capacity and operation flexibility. The time frame for these recommendations is 5 to 7 years (2007 to 2009).

16.1 mgd (ultimate) – These improvements should be implemented in the long term to meet overall capacity goals for the facility. These improvements should be implemented when funding becomes available or in 12 to 15 years (2014 to 2017).

**TABLE ES-4**
Biosolids Handling Master Plan – Summary of Improvements and Upgrades

| No. | Category | Improvement or Upgrade[a] | Benefit | Implementation Trigger | Preliminary Budgetary Estimate | | |
|---|---|---|---|---|---|---|---|
| | | | | | Short Term (0-3 yrs) | 12.0 mgd[b] (5-7 yrs) | 16.1 mgd[b] (12-15 yrs) |
| 1 | Thickening | Add 2 Gravity Belt Thickeners at Tapia | Reduces the volume of Solids pumped between Tapia and Rancho<br>Reduces centrate volume to equalize and pump back to Tapia<br>Improves digestion and dewatering facilities performance and capacity<br>Reduces digestion and dewatering facilities O&M | Recommended to replace the existing decanting at Tapia.<br>Needed to allow digester cleaning and maintenance in the short term | $2.5 M | | |
| 2 | Digestion | Add 2 anaerobic digesters at Rancho | Provides redundancy, to allow digester cleaning and maintenance<br>Provide gas equalization for fuel cells | Capacity driven<br>Additional digestion will provide operational flexibility in the interim, and is needed in the long term | | $8.0 M | |
| 3 | Amendment Preparation | Replace bucket elevator conveyors and feed chutes in Amendment Building | Reduce downtime from bucket elevator and feed chutes plugging<br>Improve worker safety in area by reducing plugging in conveyor<br>Allow some variability in moisture content. | Needed immediately to improve material handling and worker safety<br>May require bypass to allow material to be processed during downtime | $120,000 | | |
| 4 | Dewatering | Replace sludge cake metering hopper in Dewatering Building | Allows centrifuges to run at design production rate<br>Reduces dewatering O&M and bottlenecks | Required to allow dewatering system to operate at capacity and more efficiently | $180,000 | | |
| 5 | Amendment Preparation | Optimize amendment receiving station vibrators | Further reduce bridging and plugging at the amendment receiving station by optimizing existing electric vibrators | Seek vendor advice regarding the vibrator operation and any modification required. | Note (c) | | |

**TABLE ES-4**
Biosolids Handling Master Plan – Summary of Improvements and Upgrades

| No. | Category | Improvement or Upgrade[a] | Benefit | Implementation Trigger | Preliminary Budgetary Estimate | | |
|---|---|---|---|---|---|---|---|
| | | | | | Short Term (0-3 yrs) | 12.0 mgd[b] (5-7 yrs) | 16.1 mgd[b] (12-15 yrs) |
| 6 | Composting | Replace overhead conveyor knife gates with curved gates in Reactor Building | Eliminate manual labor and potential injury associated with unplugging the overhead knife gates | Required for worker safety and improved material handling. | $100,000 | | |
| 7 | Composting | Replace transfer conveyors from Reactor Building to Curing Building | Allows higher moisture content in product without plugging conveyors<br>Improve quality of compost, since it eliminates need for slow agitator cycle (which dehydrates the product)<br>Increases capacity of system, by allowing both agitators to operate simultaneously, saving labor and time. | Requires some bypassing of material during construction | $420,000 | | |
| 8 | Composting | Upgrade of US Filter agitator machine in Reactor Building | Reduce maintenance needs on equipment<br>Allow higher moisture content in system<br>Improve quality of compost<br>Increases biosolids throughput capacity | Required to decrease residence time and increase overall capacity<br>Required as maintenance costs increase | | $510,000[d] | |
| 9 | Composting | Alternative Amendment Supply System | Reduces amendment costs by allowing alternate amendments to be used<br>Provides redundancy to existing screw conveyor system | Needed if amendment costs become excessive or increase dramatically<br>Required if existing amendment supply becomes unreliable<br>Recommended as existing screw conveyors O&M costs increase or conveyors fail | | $1.37 M | |

**TABLE ES-4**
Biosolids Handling Master Plan – Summary of Improvements and Upgrades

| No. | Category | Improvement or Upgrade[a] | Benefit | Implementation Trigger | Preliminary Budgetary Estimate | | |
|---|---|---|---|---|---|---|---|
| | | | | | Short Term (0-3 yrs) | 12.0 mgd[b] (5-7 yrs) | 16.1 mgd[b] (12-15 yrs) |
| 10 | Curing[e] | Screen final product in Curing Building | Improve quality of product, increase marketability | Recommended pilot screening to determine cost : benefit. | | Note (f) | |
| 11 | Cogeneration | Install ultrasound equipment | Increases digester gas production and increased cogeneration ability. | Coincide with digester construction. | | $480,000 | |
| 12 | Cogeneration | Install floating covers on one new digester | Provides dependable gas pressure without fluctuations<br>Optimizes fuel cell operation | Install floating gas-holder covers on one new digester | | $350,000 | |
| 13 | Cogeneration | Improvements to heat recovery system | Maximize waste heat recovery from fuel cells<br>Allow operation of the digester gas injectors at lower gas flow rate | On-going efforts to improve cogeneration system. | Note (g) | | |
| | **Subtotal** | | | | **$3.3 M** | **$10.7 M** | Note (h) |

[a] Costs shown do not include regular maintenance items required for existing digestion, dewatering, composting, cogeneration, and odor control facilities. These costs are part of LVMWD's annual O&M budget.

[b] Values represent solids produced at Tapia at noted flowrates and current BOD and TSS strengths. Analysis does not include septage treatment. It is assumed that negligible amount of sludge is disposed on the Farm.

[c] Optimization of amendment receiving station vibrators assumes LVMWD to contact vibrator manufacturer regarding the potential modifications to existing vibrators.

[d] Costs assume one agitator to be replaced and one existing agitator to be kept as backup. Costs include equipment, installation, and coordination.

[e] Additional modifications to the curing process and/or odor control in the Curing Building may be required as part of Rule 1133.

[f] Costs assume LVMWD to rent a temporary screen to determine value of increased product quality and amendment recycling versus cost of screen.

[g] Optimization of cogeneration system assumes LVMWD continues work with fuel cell contractor to correct defects in system.

[h] No new expansion costs are expected to treat 16.1 mgd; however, replacement of mechanical equipment is likely.

# Updated 2002 Implementation Plan from Biosolids Handling Master Plan

**TABLE ES-4**
Biosolids Handling Master Plan – Summary of Improvements and Upgrades

| No. | Category | Improvement or Upgrade[a] | Benefit | Implementation Trigger | Preliminary Budgetary Estimate Short Term (0-3 yrs) | 12.0 mgd[b] (5-7 yrs) | 16.1 mgd[b] (12-15 yrs) |
|---|---|---|---|---|---|---|---|
| 1 | Thickening | Add 2 Gravity Belt Thickeners at Tapia | Reduces the volume of Solids pumped between Tapia and Rancho<br>Reduces centrate volume to equalize and pump back to Tapia<br>Improves digestion and dewatering facilities performance and capacity<br>Reduces digestion and dewatering facilities O&M | Recommended to replace the existing decanting at Tapia.<br>Needed to allow digester cleaning and maintenance in the short term | $2.5 M<br>Project eliminated due to concerns about pumping thicker sludge from Tapia, thickening could be located at Rancho | | |
| 2 | Digestion | Add 2 anaerobic digesters at Rancho | Provides redundancy, to allow digester cleaning and maintenance<br>Provide gas equalization for fuel cells | Capacity driven<br>Additional digestion will provide operational flexibility in the interim, and is needed in the long term | | $8.0 M<br>Scheduled to start the design process to add one digester in FY 11-12 | |
| 3 | Amendment Preparation | Replace bucket elevator conveyors and feed chutes in Amendment Building | Reduce downtime from bucket elevator and feed chutes plugging<br>Improve worker safety in area by reducing plugging in conveyor<br>Allow some variability in moisture content. | Needed immediately to improve material handling and worker safety<br>May require bypass to allow material to be processed during downtime | $120,000<br>Completed in 2003 | | |
| 4 | Dewatering | Replace sludge cake metering hopper in Dewatering Building | Allows centrifuges to run at design production rate<br>Reduces dewatering O&M and bottlenecks | Required to allow dewatering system to operate at capacity and more efficiently | $180,000<br>Completed in 2003 | | |
| 5 | Amendment Preparation | Optimize amendment receiving station vibrators | Further reduce bridging and plugging at the amendment receiving station by optimizing existing electric vibrators | Seek vendor advice regarding the vibrator operation and any modification required. | Note (c)<br>Completed by replacement of agitators | | |

**TABLE ES-4**
Biosolids Handling Master Plan – Summary of Improvements and Upgrades

| No. | Category | Improvement or Upgrade[a] | Benefit | Implementation Trigger | Preliminary Budgetary Estimate Short Term (0-3 yrs) | 12.0 mgd[b] (5-7 yrs) | 16.1 mgd[b] (12-15 yrs) |
|---|---|---|---|---|---|---|---|
| 6 | Composting | Replace overhead conveyor knife gates with curved gates in Reactor Building | Eliminate manual labor and potential injury associated with unplugging the overhead knife gates | Required for worker safety and improved material handling. | $100,000<br>Completed in 2003 | | |
| 7 | Composting | Replace transfer conveyors from Reactor Building to Curing Building | Allows higher moisture content in product without plugging conveyors<br>Improve quality of compost, since it eliminates need for slow agitator cycle (which dehydrates the product)<br>Increases capacity of system, by allowing both agitators to operate simultaneously, saving labor and time. | Requires some bypassing of material during construction | $420,000<br>Still under consideration | | |
| 8 | Composting | Upgrade of US Filter agitator machine in Reactor Building | Reduce maintenance needs on equipment<br>Allow higher moisture content in system<br>Improve quality of compost<br>Increases biosolids throughput capacity | Required to decrease residence time and increase overall capacity<br>Required as maintenance costs increase | $510,000[d]<br>First agitator replaced in 2002, second agitator replaced in 2003 | | |
| 9 | Composting | Alternative Amendment Supply System | Reduces amendment costs by allowing alternate amendments to be used<br>Provides redundancy to existing screw conveyor system | Needed if amendment costs become excessive or increase dramatically<br>Required if existing amendment supply becomes unreliable<br>Recommended as existing screw conveyors O&M costs increase or conveyors fail | $1.37 M<br>No suitable alternative amendment has been identified todate | | |

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Biosolids Handling Master Plan – Summary of Improvements and Upgrades

| No. | Category | Improvement or Upgrade[a] | Benefit | Implementation Trigger | Preliminary Budgetary Estimate Short Term (0-3 yrs) | 12.0 mgd[b] (5-7 yrs) | 16.1 mgd[b] (12-15 yrs) |
|---|---|---|---|---|---|---|---|
| 10 | Curing[e] | Screen final product in Curing Building | Improve quality of product, increase marketability | Recommended pilot screening to determine cost : benefit. | Still under consideration | | |
| 11 | Cogeneration | Install ultrasound equipment | Increases digester gas production and increased cogeneration ability. | Coincide with digester construction. | | $480,000 To be considered in digester design | |
| 12 | Cogeneration | Install floating covers on one new digester | Provides dependable gas pressure without fluctuations<br>Optimizes fuel cell operation | Install floating gas-holder covers on one new digester | | $350,000 To be considered in digester design | |
| 13 | Cogeneration | Improvements to heat recovery system | Maximize waste heat recovery from fuel cells<br>Allow operation of the digester gas injectors at lower gas flow rate | On-going efforts to improve cogeneration system. | Note (g) Cogeneration system started up in 2011 included waste hear recovery | | |
| | **Subtotal** | | | | **$3.3 M** | **$10.7 M** | Note (h) |

[a] Costs shown do not include regular maintenance items required for existing digestion, dewatering, composting, cogeneration, and odor control facilities. These costs are part of LVMWD's annual O&M budget.

[b] Values represent solids produced at Tapia at noted flowrates and current BOD and TSS strengths. Analysis does not include septage treatment. It is assumed that negligible amount of sludge is disposed on the Farm.

[c] Optimization of amendment receiving station vibrators assumes LVMWD to contact vibrator manufacturer regarding the potential modifications to existing vibrators.

[d] Costs assume one agitator to be replaced and one existing agitator to be kept as backup. Costs include equipment, installation, and coordination.

[e] Additional modifications to the curing process and/or odor control in the Curing Building may be required as part of Rule 1133.

[f] Costs assume LVMWD to rent a temporary screen to determine value of increased product quality and amendment recycling versus cost of screen.

[g] Optimization of cogeneration system assumes LVMWD continues work with fuel cell contractor to correct defects in system.

[h] No new expansion costs are expected to treat 16.1 mgd; however, replacement of mechanical equipment is likely.