WESTERN WAKE PARTNERS

Report to the Policy Advisory Committee (PAC09-25)

Date:	September 29, 2008
To:	Western Wake Partners
From:	Tim Bailey, P.E., Director of Engineering, Town of Cary
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Subject:	Consultant Selection for Design of Western Wake Biosolids Drying and Energy Recovery Facility

Background:

Early in preliminary engineering, biosolids disposal strategies such as offsite composting, landfilling and land application were all evaluated for the Western Wake Water Reclamation Facility, (WWWRF). As a result of continued growth and development in Wake County, landfilling and land application were not deemed feasible for the Western Wake Facility. There were several reasons that contributed to the dismissal of landfilling and land application including long trucking distances, securing the required 1,500 acres of farmland to support land application, the immense volume of long term aerated tank capacity required for seasonal storage and the relative short term use of landfill and land application sites. Another major factor considered with respect to land application is the phosphorus limiting nature of soils in Wake County and outlying areas. Most Wake County soils already have high phosphorus levels and the use of phosphorus as a limiting nutrient for land application has the potential to significantly drive up the acreage of land required to sustain a land application program.

At the completion of preliminary engineering, offsite composting was selected as the preferred biosolids disposal option. Offsite composting was believed to require the lowest capital cost, while requiring less aerated storage volume than landfilling or land application. When compared with landfilling and land application, offsite composting provided a more permanent solution with a higher degree of security from adverse weather events. Other onsite Class A options such as heat drying, incineration, etc. were not considered during the preliminary engineering phase.

Value Engineering Review of Biosolids Management Strategy

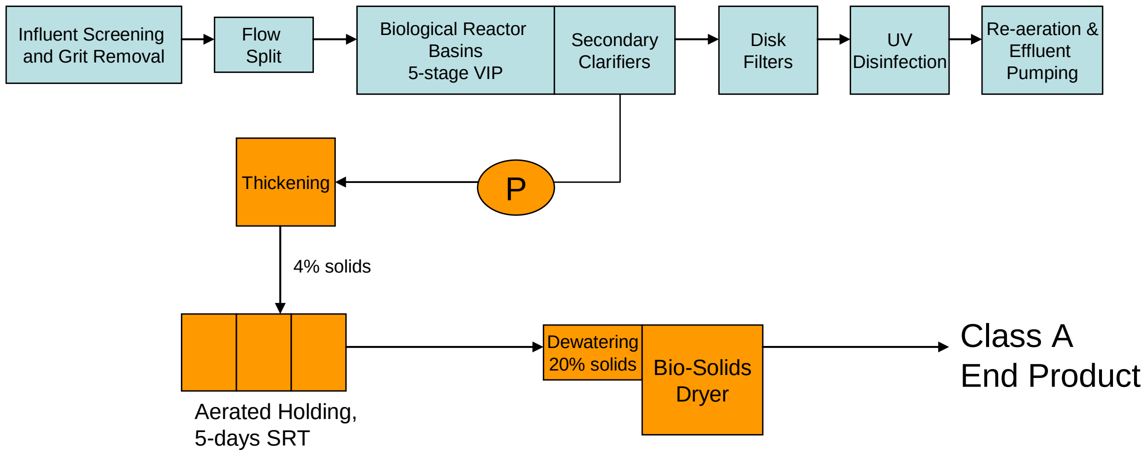
The Arcadis/CH2M Hill design team proceeded with the design of aerated holding tanks, gravity belt thickeners and dewatering equipment as envisioned during preliminary engineering to produce a dewatered cake biosolids material that would be hauled offsite to a merchant composting facility. In keeping with this design concept, the aerated holding tanks were designed for a storage volume of 20-days, which was deemed sufficient to provide both onsite storage and partially stabilize the sludge in advance of composting.

In April 2007, a team composed of engineers from HDR conducted a value engineering review of the project at 50% design. The VE team focused on biosolids handling as a potential area to recognize savings. The VE team noted in their report that the suggested 20-day aerated holding tanks would require approximately 800-HP, which for an 18-MGD facility would incur substantial power costs just to maintain aeration. As an option, the VE team proposed modifications to the biosolids stabilization approach focused on reducing aeration power requirements. The anaerobic digesters proposed by the Value Engineering team did not require massive aeration power, but rather a modest 150-HP for mixing, representing approximately $300K in annualized operational cost savings at full capacity. While modest in power requirements, the anaerobic digesters presented the design team with other complex problems such as more intense odor potential, increased capital cost, multifaceted operating strategy and the potential for an emergency or failure related to holding the explosive methane gas generated during anaerobic digestion. Despite the savings in operating costs, there were a number of other potential process related problems related to nutrient recycles and chemical additions that contributed to a higher degree of complexity, not only with the biosolids management strategy, but also with the overall treatment process. In the final evaluation, both aerobic sludge holding and anaerobic digestion stabilization processes were found to produce a substantial volume of dewatered cake to haul away via offsite composting. The partially stabilized sludge created under either process would be a highly regulated product subject to additional pathogen and vector attraction reduction procedures and/or intensely restrictive regulations for disposal. In conclusion, it was determined that the most beneficial means to truly improve flexibility in biosolids management was to develop a Class A product and reduce overall sludge volume to the maximum extent possible.

Dryer Option

Recognizing there were benefits in both prior approaches, Town staff continued to evaluate alternate process technologies that would maintain the current secondary treatment process, reduce aerated storage volume and associated power requirements, and provide the maximum possible biosolids disposal with a Class A product. As heat drying technologies for municipal biosolids have evolved during the last several years to incorporate belt drying, heat drying has also been targeted to much smaller facilities on a more cost competitive basis than ever before. As a result, a quick preliminary evaluation was compiled to determine if integrating heat drying into the biosolids disposal process was feasible. The preliminary approach included heat drying to reduce sludge volume and provide a Class A product, while at the same time significantly reducing aerated holding tank volume from 20-days to 5-days, thereby significantly reducing aeration power consumption as suggested by the VE team and potentially offsetting energy costs required for drying, see Figure 1.

Figure 1: Process Schematic of Dryer Option



The feasibility of the dryer option was verified and the process was studied in detail by Arcadis and CH2M Hill.

Dryer Technologies Investigation

During detailed review of the various dryer technologies, several drying methods were investigated including rotary drum dryers, paddle dryers and belt dryers. While all of the drying technologies possess the capability to adequately dry municipal biosolids in compliance with Class A standards, the belt dryer design was found to best meet the needs of the Western Wake Partners. The belt dryer provides the following advantages over competing dryer technologies: (1) no product recycles are required, (2) redundancy is provided in a 2 train drying approach, (3) modular design aids in constructability and simplifies future expansion projects, (4) EPA Class A standards can be met without additional unit processing, (5) stainless steel mesh belt design does not require routine maintenance, (6) drying system can be operated with less personnel and oversight, (7) system can be operated exclusively from the SCADA system, (8) lower drying temperatures, 350°F or less, allow more options for disposing of exhaust gases (9) high level safety controls are provided to prevent fires (9) reduced product handling minimizes potential for dust problems and (10) the belt drying equipment is integrally supported on a standard concrete floor without the need for additional concrete support structure.

Energy Recovery System

A secondary benefit of the belt dryer is that it can be coupled to operate with an energy recovery system provided by the same manufacturer. The energy recovery system provides a furnace that combusts dried sludge and captures the heat to reuse in the drying process. The energy recovery system takes advantage of the energy content in the dried sludge to provide approximately 80% to 100% of the thermal energy required for drying. At 2020 projected sludge processing capacity, approximately 980 MMBtu's would be required per week. At a market cost of $12/MMBtu, the natural gas cost of drying without energy recovery translates into approximately $11,760 per week. The energy recovery system would allow the natural gas utilization to be reduced by 80% or greater through combusting the dry sludge as a fuel source. This would translate into a weekly savings of $9,400, or greater as natural gas prices continue to escalate. On a yearly basis, this translates into an annualized operating cost savings of $500K. As a further benefit, the heat balance between the dryer and energy recovery system could be optimized along with operating times and loading conditions to offset nearly 100% of the heat energy demand. In conclusion, the energy recovery system not only decreases natural gas use by 80% or more, but also contributes to a further reduction in final biosolids volume well beyond the substantial volume reduction experienced by drying alone.

Long Term Benefits of Dryer and Energy Recover System

The four principle benefits of the dryer/ERS system for biosolids management are volume reduction, producing a Class A product, maintaining independent control of biosolids management and conserving drying energy by using the dried sludge product as a fuel source.

Control Our Own Destiny: The dryer/ERS system retains nearly all operations, processing and scheduling tasks for biosolids management with the Western Wake Partners. By maintaining control of biosolids processing onsite at the WWWRF, the Western Wake Partners would be isolated from potential interruptions in service and/or other changes in operating conditions caused by dependence on private sector contractors. For instance, the merchant composting option proposed under the original design would require total and complete reliance on outside contractors to provide biosolids disposal needs for the Western Wake facility. If the composting company were sold, bankrupt, or shut down due to permitting problems or natural disasters; the Western Wake Partners would be faced with either building massive capital facilities on short notice or entering into a series of short term agreements with private firms to provide biosolids disposal. Since there is only one composting firm in close proximity to the West Plant, it would be highly likely that any interruption in service would require a substantial increase in short term operating costs to continue biosolids disposal. Further, due to the size and magnitude of the Western Wake Facility, no single private sector composting firm would likely be able to cover the capacity required by the Western Wake Facility in the case of an emergency shut down of the contract composting firm. This would likely result in the short term solicitation of several outside composting firms at highly variable cost ranges dependent upon factors such as available capacity, fuel prices and trucking distance.

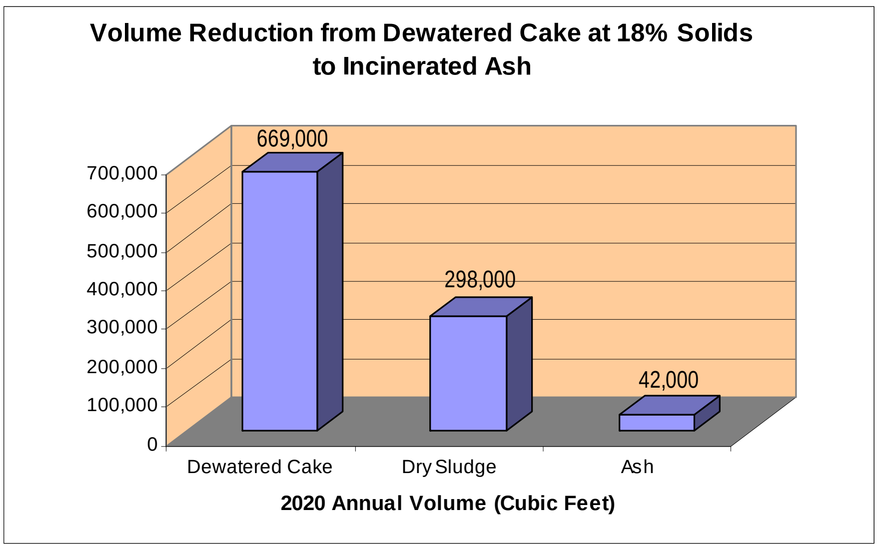
Conversely, the dryer/ERS system places complete operational control with the Western Wake Partners combined with producing a Class A product that achieves the maximum possible volume reduction. This strategy allows the most flexibility and options for ultimate disposal of biosolids including offsite sale of a Class A soil amendment that could be applied to agriculture or forestry resources. Alternatively, the dry sludge could be combusted and utilized as a renewable fuel source for drying, thereby reducing facility dependence on fossil fuels.

Volume Reduction: As noted by Figure 1, the volume reduction produced by the dryer/ERS system is unparalleled among the other biosolids disposal strategies considered for the Western Wake WRF. The benefit of volume reduction is to reduce storage and processing costs. For instance, under the original plan, 20-

day aerated storage must be provided to stabilize the sludge in advance of composting. This requires capital infrastructure to store the sludge and higher operating costs to aerate the sludge. Additionally, when the partially stabilized sludge is dewatered and hauled offsite for composting, the volume is actually increased by adding wood chips, sawdust, etc. to provide a beneficially viable product for public use.

Alternatively, the ash product generated after the drying/ERS process will be reduced by more than 90% from its original volume as a dewatered cake, a form solid material composed of 80% water. This massive volume reduction to a dry ash product allows for storage in relatively small 2.5 cubic yard reusable storage bags that can be stacked away for weeks until the ash is ultimately sent to a landfill site or other beneficial reuse such as brick or concrete production. Without the dryer/ERS system, the Western Wake Partners would be responsible for hauling the full volume of dewatered cake to an outside composting firm for further treatment and disposal.

Figure 2: Volume Reduction with Drying and Energy Recovery



Class A Product: The EPA has established different classifications for biosolids treatment that regulate how the biosolids can be disposed. A tremendous benefit of a drying process is that it meets the requirements for a Class A product, which can be disposed in any number of ways with minimum regulatory requirements. The Class A certification assures the dried sludge product has been proven safe for both pathogen reduction and vector attraction reduction. A further benefit of the energy recovery furnace is that by combusting the dry sludge up to 1,500 degrees Fahrenheit, there is no opportunity for pathogen regrowth or vector attraction. Class A biosolids can be applied to places such as parks and golf courses without site or use restrictions.

Conservation of Energy: The dryer/ERS system successfully conserves energy by creating a valuable commodity in the form of dried biosolids. The dried biosolids have a fuel content that when combusted can release a substantial quantity of energy. The energy released from the sludge in the ERS phase of the system can be harnessed to heat the drying process. The utilization of the ERS phase of the system places a commodity value on the dried sludge since it offsets up to 80% or more of the natural gas required for the drying process. As an added benefit, the reduced stabilization and storage time of 5-days contributes to an increase in the fuel value of the sludge. As stated earlier, the natural gas cost savings at 2020 plant capacity with the dryer/ERS system would most likely top $500,000 per year over the dryer option without an ERS. Through utilizing the dried sludge as a fuel source, the Western Wake Partners would be buffered against continued increases in natural gas prices. As an additional consideration, if natural gas prices continue to exceed anticipated price increases, dry sludge pellets from the South Cary WRF could be combusted at the West Plant to further reduce natural gas consumption by fueling dryer operations.

Biosolids Drying Facility Capital Costs

Integrating a dryer and energy recovery system into the current design affords the Western Wake Partners a unique opportunity to streamline the capital facilities required for the biosolids facility. As an example, the dryer and energy recovery system, which operates more on a continuous basis as opposed to shift basis, provides an opportunity to substantially reduce aerated holding volume required for sludge stabilization. Several other equipment operations included in the original design could be downsized or minimized due to the redundancy provided by the dryer and energy recovery system. Examples are elevated truck loading, high capacity dewatering, additional polymer makeup and feed systems, etc. Based on current projections, the biosolids drying facility capital costs would be reasonably competitive with the current design utilizing the composting option.

Life Cycle Costs

Prior 20-year present worth evaluations have demonstrated that the belt dryer with ERS option provides a lower life cycle cost than the current design, which utilizes 20-day storage and massive 800-HP blowers to partially stabilize sludge in advance of dewatering and offsite composting. The magnitude of the capital costs required for extended sludge storage and the increased operating costs for aeration contribute to the lower present worth analysis for the dryer/ERS option. In addition to aeration power, several operating cost factors were considered in the prior present worth analysis including dewatering power, natural gas, composting fees, dewatering polymer, chemical requirements and maintenance. Operations labor was determined to be equal and offsetting among the composting and drying options and wasn't considered as a determining factor in the present worth analysis.

Present worth cost determinations will be computed when the final process schematic has been determined and will likely show a greater 20-year present worth advantage in favor of drying and energy recovery over the existing design with aerated holding and composting.

Why Consider Drying Now

Aside from the numerous long term benefits of the dryer/ERS facility, there are also benefits with reducing overall capital construction costs for a drying facility that can be derived from building this facility integral to original plant construction.

Integrated Design Reduces Overall Facility Costs:
Sludge that will be combusted doesn't require aerobic stabilization and therefore, aerated storage volume under the dryer/ERS plan can potentially be eliminated as opposed to providing 20-days of aerated storage and stabilization required under the composting option. If the dryer facility were constructed separately and not integrated into the current site plan, the total cost of adding a separate drying facility with an energy recovery system would total approximately $16M. Conversely, integrating the dryer and energy recovery system into the current design provides an opportunity to construct the drying facility for nearly the same capital cost as the original design by not overbuilding aerated storage tanks that would not be necessary for a drying and energy recovery facility.

Reduced Long Term Aeration Operating Costs:
One of the key VE suggestions to reduce operating cost was reducing power requirements for aerated sludge holding. Under the original design, aerated sludge holding would require approximately 800-HP to operate at 20-days of storage required for the composting option. This translates into roughly $1,000 per day in power consumption at full capacity. The suggested drying and energy recovery facility with limited aerated holding would greatly reduce routine operations costs associated with aeration.

Reduced Size of Solids Handling Building:
The original design includes a larger solids handling building to house sludge thickening equipment, dewatering equipment, blowers, chemical storage, polymer storage, feed pumps, lab equipment, etc. Integrating the dryer/ERS system into the current site layout would actually serve to reduce the size and footprint of the solids handling building because the dryer/ERS option doesn't require the massive blower room required under the original design concept. In the final evaluation, integrating the dryer/ERS facility into the current design assures that long term operational capacity can be met by constructing one comprehensive solids handling building, as opposed to constructing a separate building to house a dryer in the future.

Residual Drying Capacity Available to Western Wake Partners:
A final benefit of integrating the dryer/ERS into the current design is that it would provide some supplemental biosolids processing capacity during the early years of operation that could be utilized by the Western Wake Partners. This supplemental capacity could potentially be provided to the Western Wake Partners at a lower operating cost than their current biosolids disposal options. If the Western Wake Partners elect not to utilize any of the reserve capacity at the Western Wake Facility, it could still provide an outlet to support the Partners during emergency shut downs or suspensions of their existing contract arrangements for biosolids disposal.

Suggested Approach
In order to provide a true competitive cost evaluation backed by actual bid data, the suggested approach is to complete the original biosolids facility design supplemented by offsite composting and bid this facility design against the preferred dryer/ERS facility. This approach provides a more competition driven incentive to the vendors included

under both options. While it's already determined that a drying facility will be higher in initial capital cost than the original design option, the actual bid data could be utilized to run a secondary present worth evaluation at the time bids are received to verify which system best meets the long term expectations of the Western Wake Partners. The original biosolids facility design based on offsite composting is nearly complete and only minimal engineering design effort will be required to bring this design contract to bid phase completion. The dryer/ERS facility design has not been initiated at this time.

Consultant Selection Process

A Request for Proposals was advertised on July 28, 2008 and proposals were received on August 22, 2008 from two firms: Brown & Caldwell and Bolten & Menk. After a thorough review process, a selection committee composed of staff members from the Project Partners unanimously agreed to recommend that Brown & Caldwell be awarded the design services contract. Factors that contributed to the selection included B&C's process schematic that substantially reduces aerated holding, their ability to balance drying and energy recovery to achieve higher energy efficiency and their focus on reducing nuisance conditions such as noise, odor, light spillover, etc. Both firms submitted excellent proposals and conducted exceptional interviews with the selection committee. In the final review, the B&C team provided the Western Wake Partners with the best opportunity to reduce expenses associated with constructing and operating the biosolids facility.

The engineering fee estimates submitted by both firms are as follows:

Brown and Caldwell:	$830,000
Bolten and Menk:	$848,000

Requested Action:

Staff recommends PAC approval to enter into a design services contract with Brown and Caldwell in the amount of $830,000 for engineering design of a biosolids drying and energy recovery facility as a bid alternate to the current design. The bid alternate approach for the drying and energy recovery facility would provide an onsite biosolids management option that would be bid against the original design, which is dependent upon offsite composting by a private company. The two competing biosolids facility design plans would be evaluated using competitive bids combined with consideration of life cycle operations and maintenance costs, including offsite composting service fees. This suggested approach provides market driven incentives to both dryer/ERS equipment vendors and private composting firms to minimize costs and compete for award of the biosolids facility contract.