DRAFT BIOSOLIDS MANAGEMENT REPORT (PART 1)

December 18, 2014

Orange Water and Sewer Authority

Carrboro – Chapel Hill, North Carolina

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

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***Cover**: Rotary press discharging dewatered biosolids into container at the Mason Farm Wastewater Treatment Plant.*

ORANGE WATER AND SEWER AUTHORITY

A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

EXECUTIVE SUMMARY

At their November 13, 2014 work session, the OWASA Board of Directors agreed with staff's recommendation that the following question be addressed as a logical first step to determining the future of our biosolids management program:

> ***Should we discontinue our liquid biosolids land application program in favor of dewatering 100% of our biosolids for transport to a private company for composting?***

With technical assistance from an engineering consultant (Brown and Caldwell), OWASA staff evaluated the relative performance of our current program of land applying 50% of our liquid biosolids and dewatering the remaining 50% of the biosolids for transport to McGill Environmental Systems (McGill) for composting against dewatering 100% of the biosolids for transport to McGill. For each of our Biosolids Management Objectives, 100% dewatered biosolids to McGill offered clear social, environmental, and financial benefits. Specifically, this improvement to our program will enhance employee safety, reduce public health and environmental risks, simplify regulatory compliance and operations, decrease our carbon footprint, and save an estimated $100,000+ annually in operations and maintenance costs.

Therefore, staff recommends the following:

1. Discontinue the liquid land application program and inform farmers participating in our program.

2. Re-assign biosolids program staff to currently funded Utility Maintenance Mechanic positions through attrition as necessary.

3. Use existing liquid biosolids storage facilities to manage short-term equipment or service downtime. Use contract mobile dewatering assistance to manage longer-term equipment or service downtime.

4. For the 700-acre tract of land that OWASA acquired for the biosolids management program, maintain the 153 acres of cleared farmland for use as a contingency land application site. Consider the long-term need for the land as part of Strategic Plan Initiative #7 (Develop a plan and policy framework for long-term management and disposition of OWASA lands).

5. Complete Draft Biosolids Management Report (Part 2) by March 6, 2015 to answer key question 2 – "***What near-term action(s) should be considered to further optimize biosolids management?***"

DRAFT BIOSOLIDS MANAGEMENT REPORT (PART 1)
December 18, 2014

Purpose

The purpose of the Draft Biosolids Management Report (Part 1) is to provide the information needed to determine if we should discontinue our current liquid biosolids land application program in favor of dewatering 100% of our biosolids for transport to a private company for composting.

Approach for Determining Desired Biosolids Management Program

At their November 13, 2014 work session, the OWASA Board of Directors agreed with staff's recommendation that three basic questions should be answered in sequence to determine the desired biosolids management program, now and into the future:

First, should we discontinue our liquid biosolids land application program in favor of dewatering 100% of our biosolids for transport to a private company for composting?

This Report (Part 1) answers this question and has been prepared by OWASA staff. OWASA's consultant, Brown and Caldwell, has provided technical assistance in the preparation of this report.

Second, what near-term action(s) should be considered to further optimize biosolids management?

This question will be answered in the next Report (Part 2), which is currently planned to be completed in March 2015.

Third, what longer-term action(s) should be considered to further optimize biosolids management?

The schedule to answer this question will be discussed after completion of the next Report (Part 2).

This approach reflects the following key points:

- Any significant changes in biosolids management technologies will likely involve considerable capital investment and require long lead times to design, permit, and construct.
- Strategies involving potential partnerships with others to plan, design, finance and build new regional biosolids facilities will require considerable lead time to implement.

- Near-term priority is to determine how we can optimize our existing biosolids management program (facilities, equipment, staff, etc.).

This approach generally follows the successful strategy we used for the optimization study for the Mason Farm Wastewater Treatment Plant (WWTP), which resulted in substantial cost savings, important process improvements and strategic guidance for future WWTP improvements.

Wastewater and Biosolids Treatment Processes

OWASA is responsible for protecting the environment through effective management and operation of our wastewater (domestic sewage) collection, treatment and recycling system. Our WWTP treats the community's wastewater to a very high quality, and the treated water is either recycled to Morgan Creek or beneficially used for non-drinking purposes (reclaimed water) on the University of North Carolina at Chapel Hill campus. The solids generated at the WWTP are also treated to a high level to make them safe for recycling, at which point they are called biosolids. OWASA is committed to recycling biosolids in a responsible, reliable and cost-effective way.

The WWTP has a permitted maximum month treatment capacity of 14.5 million gallons per day (MGD). In Fiscal Year (FY) 2014, the WWTP treated a total of 3.0 billion gallons for an annual average flow rate of 8.3 MGD. In FY 2014, the WWTP treated and recycled about 1,185 dry tons of biosolids for an annual average rate of about 3.25 dry tons per day. Figure 1 is an aerial photograph of the WWTP.

Figure 1. Mason Farm Wastewater Treatment Plant

Solids generated from the wastewater treatment process are pumped to three gravity belt thickeners to thicken the solids (remove excess liquid) from about a 1% solid material to about a 5% solid material. Thickening of the solids reduces the volume of material to be treated, which optimizes the sizing and performance of the anaerobic digestion process described below.

The thickened solids are pumped to a series of four anaerobic digesters, in which the solids are processed for a period of at least 30 days. During that period, micro-organisms break down the organic solids into component substances in an atmosphere without oxygen, while other micro-organisms and undesirable bacteria are destroyed. This process is referred to as anaerobic digestion. Heat is added to the anaerobic digestion process to improve its performance (130 - 140 degrees F). By varying the temperature and holding time within the digesters, the process can produce either Class A (contains no detectible levels of fecal coliform or *Salmonella*) or

Class B (contains low but detectible levels of pathogens) quality biosolids. Our biosolids currently meet the U.S. Environmental Protection Agency's (EPA) criteria for "exceptional quality" (EQ) biosolids because they are Class A and have very low levels of metals.

The anaerobic digestion process produces a biogas consisting of methane, carbon dioxide and other trace gases. The biogas is captured and a portion is used as fuel for two boilers that provide heat for the digestion process. Excess biogas is currently flared (burned off) at the WWTP.

Figure 2 is a schematic of the biosolids treatment process at the WWTP.

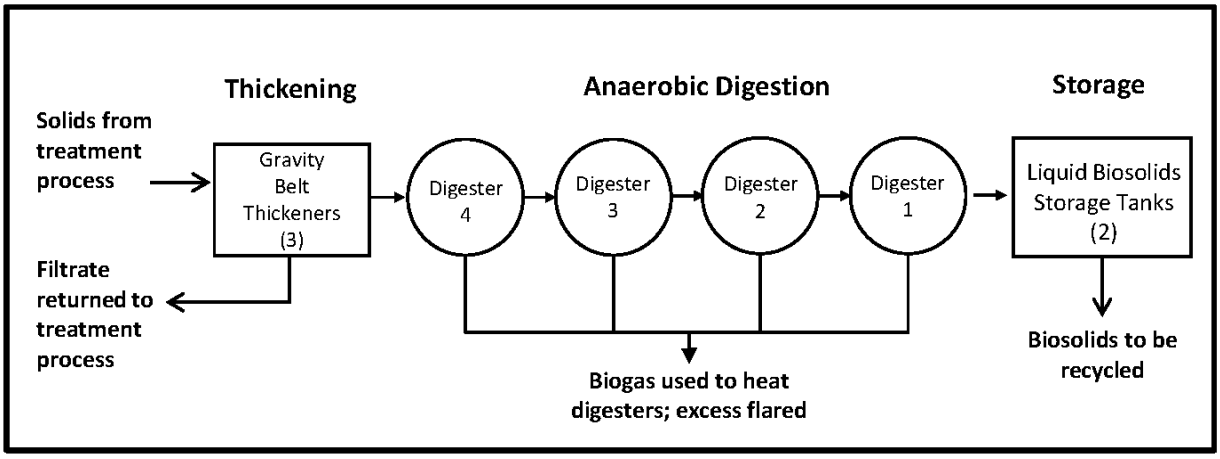


Figure 2. Biosolids Treatment Process Schematic

There are two liquid biosolids storage tanks located at the WWTP, and they have a total capacity of 672,000 gallons. We also have two off-site storage tanks located on OWASA-owned property northwest of the intersection of NC Highway 54 and Orange Grove Road. The off-site storage tanks have a combined capacity of nearly 2.4 million gallons (MG). At a combined capacity of more than 3 MG, the on-site and off-site tanks enable us to store about 75 days of liquid biosolids production when needed, assuming current WWTP flows and operations.

Current Approach to Recycle Biosolids

OWASA uses two primary methods to recycle biosolids: 1) liquid land application on local farmland and 2) dewatering of biosolids for transport to McGill Environmental Systems (McGill) located in New Hill, North Carolina for composting (for subsequent land application as mulch). The current split between liquid biosolids to land application and dewatered biosolids to McGill is about 50:50. When weather or other conditions prohibit liquid land application, the WWTP relies on 100% dewatered biosolids transported to McGill, and storage of liquid biosolids in the off-site tanks.

1) Liquid Land Application

Liquid biosolids are pumped out of the WWTP's on-site storage tanks directly into tanker trucks that have a capacity of 6,500 gallons. The loaded tanker trucks are driven to local farms where the biosolids are pumped into a special piece of equipment called a TerraGator, which is shown in Figure 3.

The TerraGator has a capacity of about 4,000 gallons and is used to spread the liquid biosolids on the farmland. The liquid biosolids are applied at an agronomic rate that is appropriate for the cover crop, in accordance with Federal and State requirements. The agronomic rate is the rate at which nutrients can be added to soils for optimum plant growth, without degrading water quality. The biosolids are provided at no cost to the farmers. OWASA staff and equipment are used for liquid land application. Currently, the average round-trip distance to our land application sites is about 40 miles per tanker load.

Figure 3. TerraGator Used to Land Apply Liquid Biosolids

OWASA uses 1,087 acres of farmland in Orange, Chatham and Alamance counties available for the land application program. Nearly 86% (934 acres) is privately owned. The remaining 153 acres are owned by OWASA as part of a 700-acre tract west of Orange Grove Road in Orange County. Also located on this site are the two liquid biosolids storage tanks, which are used to store liquid biosolids when weather or other conditions prohibit us from land applying the biosolids and/or when the capacity of the on-site storage tanks at the WWTP is reached. The off-site storage tanks are essential for management of the liquid land application program; however, when those tanks are used, the additional handling results in higher operating costs and reduced efficiencies for the land application program.

OWASA also periodically contracts with private companies to assist with land application of liquid biosolids when needed.

Appendix 1 is a map showing the general locations of OWASA's biosolids land application sites.

2) Dewatered Biosolids to McGill

Liquid biosolids are pumped out of the WWTP's on-site storage tanks to a rotary press which removes water (called filtrate) and produces a dewatered "cake" which has the

texture of moist soil. The liquid biosolids enter the rotary press at about 2% total solids and leave at about 20% total solids, which greatly reduces the volume and weight (10 times drier) of water that must be transported with the biosolids. Figure 4 is a photograph of OWASA's rotary press.

The dewatered biosolids are loaded directly from the rotary press into a roll-off container which has a capacity of 20 cubic yards. Due to road weight limits, the effective capacity of our existing roll-off containers is about 10 to 12 wet tons of dewatered biosolids. When a roll-off container is filled, it is loaded onto a truck and transported by OWASA staff and equipment to McGill for composting.

Figure 4. Rotary Press for Dewatering Biosolids

McGill owns and operates regional composting facilities in the United States and Ireland. For more than 20 years, McGill has specialized in manufacturing premium compost products through the processing and recycling of non-hazardous, biodegradable by-products and residuals from municipal, industrial and agribusiness sources. OWASA has contracted with McGill for water plant residuals recycling since 2003, and wastewater biosolids recycling since 2007. Additional information about McGill is found in Appendix 2.

The round trip travel distance between the WWTP and McGill is about 50 miles. OWASA pays McGill a tipping fee of $26 per wet ton of biosolids. McGill blends the biosolids with other materials for composting, and packages and sells the finished compost. McGill's composting process meets Class A biosolids processing requirements.

The filtrate removed from the liquid biosolids by the rotary press is high in nutrients (nitrogen and phosphorus) and is recycled back to the head (beginning) of the WWTP for processing. The treatment of filtrate increases the WWTP's operating costs to reduce the increased levels of nitrogen and phosphorus, which must be removed to meet the limits specified in our WWTP operating permit.

We also use our staff and equipment to haul dewatered solids from the Jones Ferry Road Water Treatment Plant for recycling at McGill at $30 per wet ton. The water plant residuals tip fee is higher as it has very little organic content. We will consider further opportunities to increase efficiencies for transporting both water plant residuals and wastewater biosolids.

Biosolids Management Objectives

To guide our decisions, we established these objectives for biosolids management:

Social Performance: Our biosolids operations can impact people and the communities in which we operate. Our objectives are:

a) Safety for OWASA's employees and others.
b) Full compliance with all regulatory standards established to protect public health.
c) No excessive events of odor, dust, noise, or other nuisances.

Environmental Performance: Our biosolids operations can impact natural systems. Our objectives are:

d) Full compliance with all regulatory standards established to protect and preserve the environment.
e) Reliable removal of biosolids from the WWTP to ensure all treated effluent and reclaimed water quality standards are met.
f) Evaluate biosolids management alternatives against their relative projected net energy use and greenhouse gas emissions.
g) Beneficially recycle 100% of the biosolids produced at the WWTP.

Financial Performance: The economic well-being of our customers and our community depends upon our ability to ensure high quality and reliable biosolids management at an acceptable financial cost. Our objectives are:

h) Evaluate biosolids management alternatives against their relative life cycle costs (capital, operating and maintenance costs).
i) Maintain a cost-effective biosolids management program that represents a reasonable balance of financial considerations with our social and environmental performance objectives.
j) Manage our risks by selecting and implementing strategies that are proven and reliable at an appropriate scale, and for which we can establish appropriate contingency plans.

Biosolids Production

The graph in Figure 5 shows annual biosolids production for the past 14 years and our projections for the next 21 years, as well as the biosolids dewatering capacity of our rotary press.

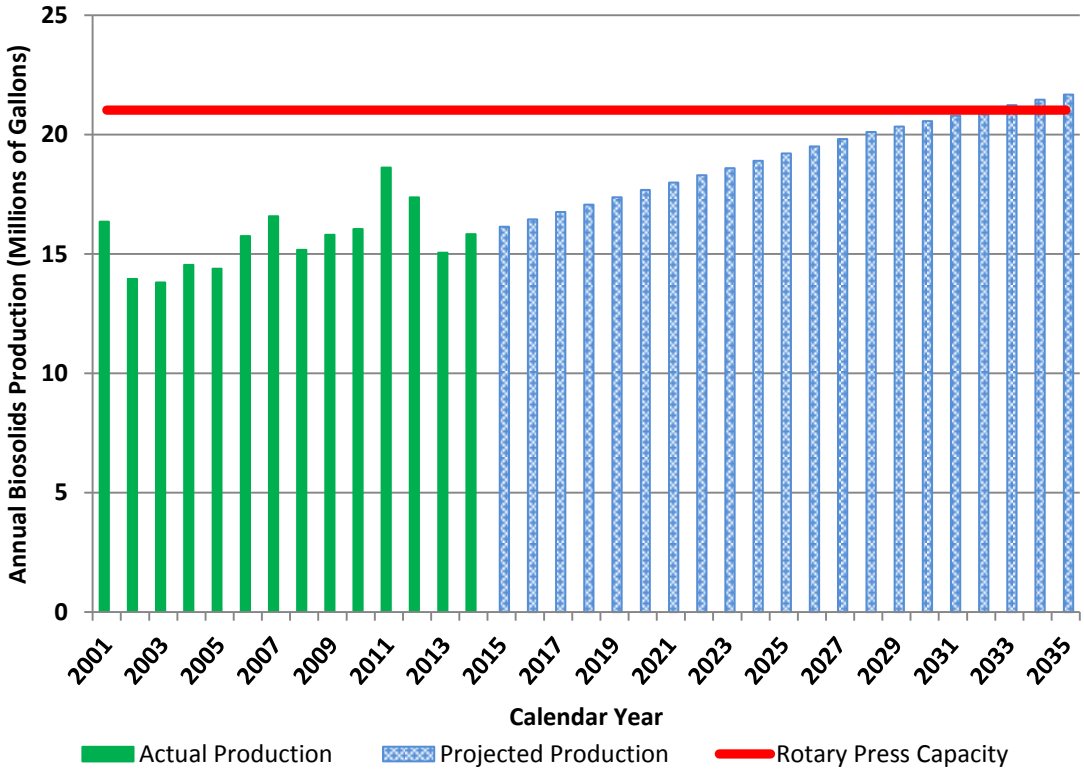


Figure 5. Biosolids Production

Notes:
Rotary press capacity is based on a 40 gallons per minute (gpm) feed rate. Forecasted production is based on a rate of 1,750 pounds of biosolids produced per projected million gallons of wastewater treated. Wastewater flow projections are based on water demand projections developed for OWASA's *2010 Long-Range Water Supply Plan*.

Cost Comparison

Brown and Caldwell assisted staff in completing a detailed cost comparison of our existing biosolids recycling program (50% liquid land application and 50% dewatered to McGill) to 100% dewatered biosolids to McGill. The analysis considers how each alternative would affect the amount and cost of labor required for biosolids loading, transport, and application (if applicable); the cost for additional chemicals and power needed to treat filtrate from dewatering; the cost to maintain equipment specific to each alternative; the cost of fuel for biosolids transport and land application; and other applicable expenses such as tipping fees charged by McGill for processing of dewatered biosolids.

The results of the cost comparison are summarized in Tables 1 through 4. Additional details are provided in Appendix 3.

As summarized in Table 1, we estimate that by transitioning to 100% dewatering for composting by McGill, we would save about $113,000 in annual operating and maintenance (O&M) costs. Most of the annual savings in operational costs come from significant reductions in staffing associated with the labor-intensive liquid land application program. Additional cost savings in maintenance and power are realized in reductions in equipment and lower operating horsepower. The collective cost savings are offset somewhat by the increased chemical costs associated with treating additional filtrate from the rotary press.

Table 1. Comparison of Annual O&M Costs

O&M Costs by Category (CY-13 Conditions)	50% Dewatering	100% Dewatering
Labor	$272,000	$87,000
Maintenance	$74,000	$24,000
Power	$137,000	$132,000
Chemicals	$264,000	$437,000
Disposal	$228,000	$182,000
Total Current Cost	**$975,000**	**$862,000**

The cumulative operating and maintenance costs for each scenario over a 20-year planning horizon are shown in the Table 2. These costs have not been escalated for inflation or discounted to net present value. The tip fees we pay to McGill have been very stable since we began using their services, and those fees are expected to remain stable for the foreseeable future.

Table 2. Comparison of Cumulative 20-Year O&M Costs

	50% Dewatering	100% Dewatering
20 Year O&M Costs	**$19,500,000**	**$17,240,000**

As shown in Table 3, maintaining the liquid land application would require greater capital investments over a 20-year planning horizon. (Not considered in this analysis are the costs of capital improvements that would enable further optimization of a 100% dewatering program. Those improvements and associated costs will be addressed in the Part 2 Report.)

Table 3. Comparison of 20-Year Capital Investment Required

Capital Investments	50% Dewatering	100% Dewatering
TerraGator	$350,000	-
Road Tractors & Trailers	$300,000	-
Roll Off Container Truck & Boxes	$200,000	$200,000
Total	**$850,000**	**$200,000**

Table 4 summarizes total life cycle costs (operating, maintenance, and capital expenditures) over the 20-year planning period. (As noted above, costs have not been escalated for inflation or discounted to net present value.) We estimate that implementation of a 100% dewatering program will be 14% less expensive than continuing the current 50:50 program.

Table 4. Comparison of 20-Year Life-Cycle Costs

	50% Dewatering	100% Dewatering
Total Life Cycle Costs	**$20,350,000**	**$17,440,000**

Relative Performance of Management Alternatives Compared to Our Objectives

Staff has compared the relative performance of the two biosolids management alternatives to OWASA's Biosolids Management Objectives. Table 5 presents the results of that evaluation.

Table 5. Comparison of Alternatives to OWASA's Biosolids Program Objectives

Objective	Comments	Which alternative best meets objective?	
		Existing 50:50 Liquid and Dewatered	*100% Dewatered Biosolids to McGill*
Social Performance:			
a) Safety for OWASA's employees and others.	A dewatering program poses lower safety risks as it requires significantly fewer loading activities, transport trips, and miles driven to transport dewatered biosolids. We believe there is minimal difference in safety related risks between the land application of liquid biosolids on the farms and McGill's composting operation.		✓
b) Full compliance with all regulatory standards established to protect public health.	A dewatering program provides a greater level of assurance in complying with applicable public health regulations because: (a) there is less risk for vehicle accidents as transport miles are much lower; (b) a spill of dewatered biosolids can be contained and responded to much easier than a spill of liquid biosolids; and (c) there is a higher risk of error in land applying liquid biosolids.		✓
c) No excessive events of odor, dust, noise, or other nuisances.	While OWASA has received very few odor complaints in the past, there is a greater risk of odor for neighbors of the liquid land application sites compared to McGill's composting operation which is enclosed and has effective odor abatement measures in place which have been effective.		✓

Objective	Comments	Which alternative best meets objective?	
		Existing 50:50 Liquid and Dewatered	*100% Dewatered Biosolids to McGill*
Environmental Performance:			
d) Full compliance with all regulatory standards established to protect and preserve the environment.	A dewatering program provides a greater level of assurance in complying with applicable environmental regulations because: (a) there is less risk for vehicle accidents as transport miles are much lower; (b) a spill of dewatered biosolids can be contained and responded to much easier than a spill of liquid biosolids; and (c) there is a higher risk of error in land applying liquid biosolids.		✓
e) Reliable removal of biosolids from the WWTP to ensure all treated effluent and reclaimed water quality standards are met.	Both the liquid land application program and dewatered biosolids to McGill have been reliable in effectively removing biosolids from the WWTP to ensure compliance. However, weather conditions and other factors can limit opportunities to land apply.		✓
f) Evaluate biosolids management alternatives against their relative projected net energy use and greenhouse gas emissions.	Dewatering results in lower total carbon emissions than a liquid program, because it requires less fuel for biosolids transport and there would be much less electrical energy used at the off-site biosolids storage facility. Some of the carbon emission reductions are offset by increased energy use to operate the rotary press and to treat the additional nutrient load in the filtrate at the WWTP.		✓
g) Beneficially recycle 100% of the biosolids produced at the WWTP.	Both options meet the objective of beneficial use of 100% of our biosolids.	✓	✓
Financial Performance:			
h) Evaluate biosolids management alternatives against their relative life cycle costs (capital, operating and maintenance costs).	Life cycle costs (20 years) for dewatered biosolids to McGill are estimated to be 14% lower than liquid land application.		✓

Objective	Comments	Which alternative best meets objective?	
		Existing 50:50 Liquid and Dewatered	*100% Dewatered Biosolids to McGill*
i) Maintain a cost-effective biosolids management program that represents a reasonable balance of financial considerations with our social and environmental performance objectives.	Life cycle costs (20 years) for dewatered biosolids to McGill are estimated to be 14% lower than liquid land application. Additionally, dewatered biosolids to McGill compares very favorably with social and environmental performance objectives.		✓
j) Manage our risks by selecting and implementing strategies that are proven and reliable at an appropriate scale, and for which we can establish appropriate contingency plans.	While appropriate contingency plans can be established and improved for both alternatives (liquid land application and dewatered biosolids to McGill), more reliable contingency options are available for dewatered biosolids. A Dewatered Biosolids Contingency Plan is presented in Appendix 4.		✓

As summarized in the above comparison, the option of dewatering 100% of our biosolids for composting by McGill has clear advantages over our current program. Although not specifically addressed in our objectives, implementation of the 100% dewatering alternative would require less management oversight by OWASA.

Since first implementing our liquid biosolids land application program in the late-1970s, we have benefited from a successful partnership with farmers participating in the program. If we discontinue our land application program, those farmers will need to either obtain supplemental nutrients to replace those no longer provided by OWASA, or continue to grow their crops without the nutrients provided from OWASA's biosolids. We are sensitive to this consideration and will continue to serve as a resource for information.

Staff Recommendations and Proposed Next Steps

Based on the analysis summarized in this report, staff recommends that OWASA implement a 100% dewatering program and transport all our dewatered biosolids to McGill, as that is clearly our best short-term option because it out-performs our existing 50:50 liquid land application and dewatering program on our Biosolids Management Objectives. Specifically, this improvement to our program will enhance employee safety, reduce public health and environmental risks, simplify regulatory compliance and operations, decrease our carbon footprint, and save an estimated $100,000+ annually in operations and maintenance costs, consistent with the affordability theme in our Strategic Plan.

If the Board of Directors concurs with the recommendation, staff proposes the following next steps:

1. Discontinue the liquid land application program and inform farmers participating in our program.

2. Re-assign biosolids program staff to currently funded Utility Maintenance Mechanic positions through attrition as necessary.

3. Use existing liquid biosolids storage facilities to manage short-term equipment or service downtime. Use contract mobile dewatering assistance to manage longer-term equipment or service downtime.

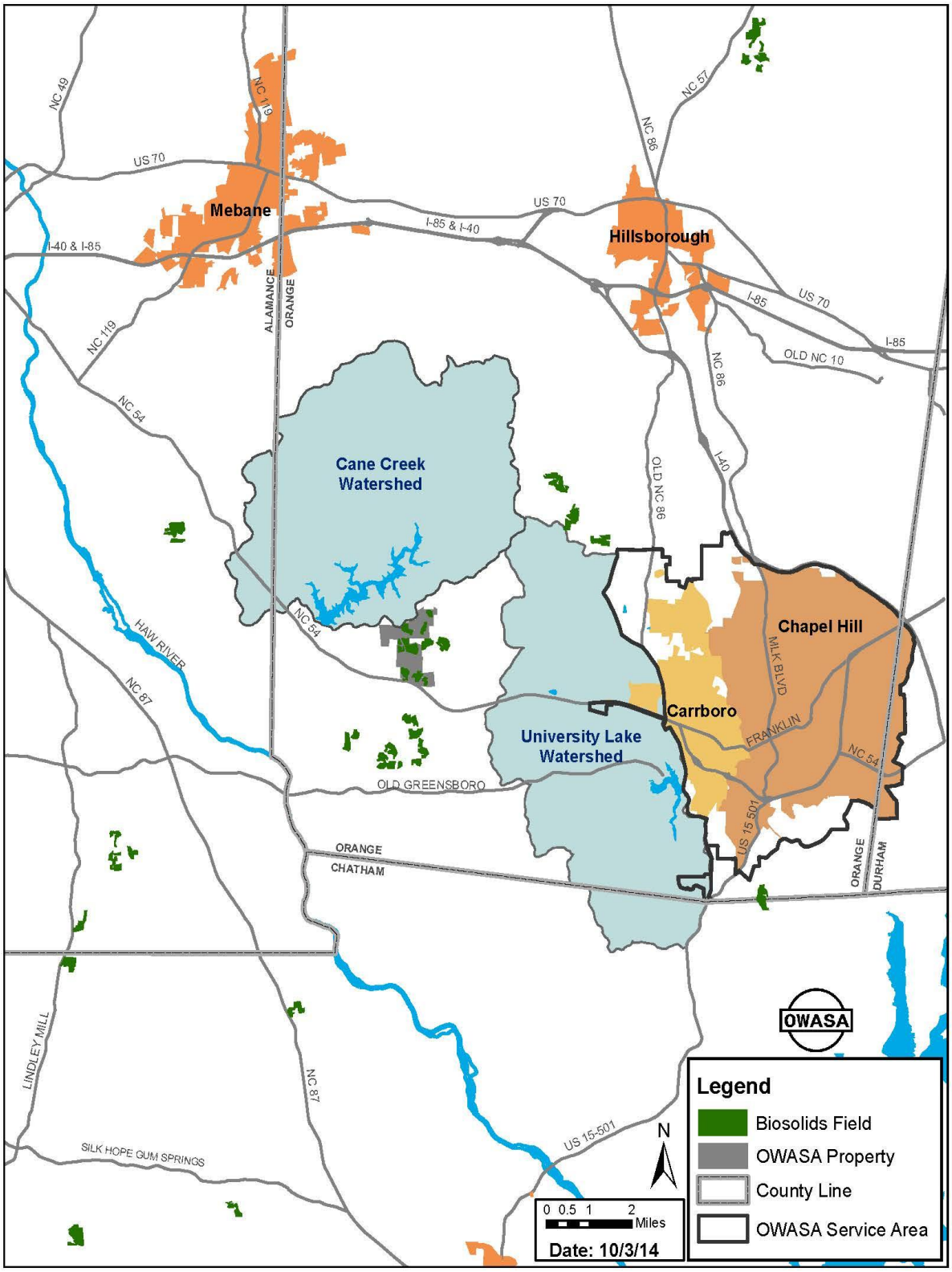
4. For the 700-acre tract of land that OWASA acquired for the biosolids management program, maintain the 153 acres of cleared farmland for use as a contingency land application site. Consider the long-term need for the land as part of Strategic Plan Initiative #7 (Develop a plan and policy framework for long-term management and disposition of OWASA lands).

5. Complete Draft Biosolids Management Report (Part 2) by March 6, 2015 to answer key question 2 – "***What near-term action(s) should be considered to further optimize biosolids management?***"

Distribution and Feedback on the Draft Report

OWASA staff will inform stakeholders that this draft report is available for viewing on our website at http://www.owasa.org/biosolids-recycling-program, and that the OWASA Board of Directors invites public comment on the draft on or before its January 8, 2015 work session, at which time the draft report will be discussed. Additionally, the Board will invite public comments up until the date when the Board acts on the recommendations in this report.

OWASA Biosolids Application Sites



Overview of McGill Environmental Systems Composting Operation

Introduction

Since 2003, OWASA has contracted with McGill Environmental Systems (McGill) for recycling of our water treatment plant residuals at McGill's composting facility in Chatham County. That contractual relationship expanded in 2007, when OWASA began transporting dewatered biosolids to McGill. We are in the third year of both a 5-year agreement with McGill for water plant residuals recycling, and a 5-year agreement for recycling of dewatered biosolids. McGill has met all of our expectations under those contracts.

Much of the following information is taken from McGill's website at: http://www.mcgillcompost.com/.

About McGill

McGill is a privately-owned company that specializes in designing, building, and operating industrial-scale composting facilities, and helping businesses manage their biodegradable waste and turn it into a beneficial resource. McGill accepts a wide range of biodegradable wastes from industrial, municipal, commercial and agribusiness sources. Yard waste, paper and cardboard, food waste, water and wastewater treatment residuals, biodegradable plastics, pallets, sheetrock and other biodegradable materials are used as feedstocks in the manufacture of a line of branded compost products for the professional landscape, turfgrass and erosion control markets, as well as landscape supply retailers.

McGill's composting operations are conducted in indoor, industrial-scale facilities using advanced systems and technologies with computerized monitoring and biofiltration. McGill's control approach over the composting environment provides for rapid throughput and high quality compost products, and enables the company to provide year-round, all-weather service for its customers. Indoor operations allow McGill to capture all processing air for biofiltration which greatly minimize odors.

The company has been in business since 1991, and owns and operates composting facilities in in North Carolina, Virginia, and Ireland. McGill's composting facility in New Hill is the largest composting facility approved for biosolids composting in North Carolina.

McGill also provides mobile dewatering services, transport and hauling, and recycling of all types of compostable materials and compost-compatible wastes. It also offers add-on services and technologies for anaerobic digestion and bioenergy facilities and design-build-operate (DBO) services for customer-owned composting plants. It provides a range of related services from design and engineering to construction management to operations management, including technology licensing and package plants.

McGill has U.S. Composting Council Seal of Testing Assurance (STA) certification, and produces large volumes of compost, which enables it to serve a wide range of clients throughout the year.

Operating and Maintenance Cost Details

Category	Components	CY 2013 Costs		Notes
		50% Dewatering	100% Dewatering	
Labor	Thickening	$12,000	$12,000	
	Dewatering	$9,000	$9,000	
	Composting - OWASA Hauling	$14,000	$66,000	
	Land Application - OWASA Fields	$237,000	$0	3 FTEs + Overtime
	Subtotals	**$272,000**	**$87,000**	
Maintenance	Thickening	$2,000	$2,000	
	Digestion	$10,000	$10,000	
	Dewatering	$2,000	$2,000	
	Aeration	$5,000	$5,000	
	Off-Site Storage	$2,000	$0	
	Composting - OWASA Hauling	$3,000	$5,000	Additional truck maintenance
	Land Application - OWASA Fields	$50,000	$0	Land application equipment
	Subtotals	**$74,000**	**$24,000**	
Power	Thickening	$18,000	$18,000	
	Digestion	$73,000	$73,000	
	Dewatering	$4,000	$7,000	Additional rotary press hours
	Aeration	$17,000	$34,000	Additional filtrate treatment
	Off-Site Storage	$25,000	$0	Pumping and mixing
	Subtotals	**$137,000**	**$132,000**	
Chemical	Thickening	$85,000	$85,000	
	Dewatering	$90,000	$180,000	Additional polymer
	Recycle Stream Chemicals	$89,000	$172,000	Additional filtrate treatment
	Subtotals	**$264,000**	**$437,000**	
Disposal	Composting - Contracted Hauling	$55,000	$19,000	Tipping fees, transport & fuel
	Composting - OWASA Hauling	$59,000	$163,000	Tipping fees & fuel
	Land Application - OWASA Fields	$45,000	$0	Land preparation & fuel
	Land Application - Contracted	$69,000	$0	~2,000,000 gallons annually
	Subtotals	**$228,000**	**$182,000**	

Grand Totals **$975,000** **$862,000**

Cost Assumptions:

Labor cost (wages + benefits) = $31.60/hour

Maintenance cost = incurred cost summary from Computerized Maintenance Management System historical data

Power cost = $0.06/kWh (WWTP) and $0.08/kWh (remote storage tanks)

Chemical cost = CY13 costs incurred for caustic, alum, acetic acid and polymer utilization attributed to biosolids management

Disposal cost = cost incurred to land apply liquid biosolids vs. hauling dewatered cake to McGill

- Average roundtrip mileage to farm fields = 40 miles
- Average roundtrip mileage to McGill = 50 miles
- Average tip fee to McGill = $26/wet ton
- Average cost for contracted land application service = $0.04/gallon
- Average cost for contracted transportation service to McGill = $300/load
- Average land application support costs (rock, weed control, seed, lime) = $25,000/year
- Average Biosolids production = 40,000 gallons/day
- Average number of liquid tanker loads needed for daily Biosolids production = 6
- Average number of dewatered cake container boxes for daily Biosolids production = 1.5
- Average number of staff needed to support land application of liquid Biosolids = 4
- Average number of staff needed to support dewatered cake Biosolids to McGill = 1

Dewatered Biosolids Contingency Plan

A successful biosolids management program includes contingency measures to deal with short- and longer-term periods when normal operations are not possible. If OWASA discontinues land application of liquid biosolids in favor of implementing a 100% dewatered biosolids program, it will face a different set of operating risks, such as: planned and unplanned downtime of dewatering equipment; or inability of McGill to accept biosolids for composting.

Following is a contingency plan if implement should it decide to implement a 100% dewatered biosolids program with transport for composting by McGill.

Equipment Downtime Mitigation Options:

OWASA has only one rotary press for dewatering biosolids; therefore, there is no permanent back-up dewatering equipment on-site. If the press is out of service for any extended period of time, other measures would need to be implemented to ensure biosolids can be reliably removed from the Mason Farm WWTP. This can be accomplished by one or more of several methods, as summarized below.

Option 1: On-Site and/or Off-Site Storage of Liquid Biosolids

Our current available combined on-site and off-site storage capacity is 3 million gallons; which is equal to approximately 75 days of available storage assuming an average biosolids production rate of 40,000 gallons/day. When dewatering operations are out of service for needed maintenance or repairs, liquid biosolids would be stored on-site until the unit is back in service. On-site storage volume (672,000 gallons) provides for upward of three (3) weeks of equipment downtime. Should the needed maintenance/repairs be prolonged (in excess of the noted on-site storage capacity) liquid biosolids would be stored in our off-site tanks until the rotary press is back in service. Off-site storage volume (2,398,000 gallons) provides for an additional eight (8) weeks of equipment downtime.

Option 2: Contract/Mobile Dewatering

If the maintenance/repairs were to be so severe that the total available on-site/off-site storage volume would be exceeded, then contract mobile dewatering would be initiated until dewatering operations were returned to service. Provisions for on-call contract mobile dewatering services have been discussed with several service providers. Mobile dewatering operations could be established within 24 to 48 hours. Given the noted available on-site/off-site storage volume, the need for contract mobile dewatering would be reserved for prolonged equipment downtime.

Option 3: Land Application of Liquid Biosolids

In the event it became necessary to transport liquid biosolids to the off-site storage tanks it would be advantageous to land apply that liquid volume to existing program fields on or adjacent to OWASA's property at the off-site storage tanks. OWASA will continue to maintain its biosolids land application permits; as well as two liquid biosolids tankers and TerraGator – they will be stored out at the off-site storage location. Land application of the biosolids could be completed by OWASA staff and equipment, or via a contract service provider. Land application activities

would serve to extend operations for equipment downtime based upon the volume removed from storage.

Alternatives to McGill's New Hill Facility:

Alternative 1: McGill's Delway Facility

McGill has another compost facility located in Rose Hill, NC which could serve as a viable alternative for a short-term period should the New Hill Facility be unavailable. The Rose Hill facility is about 110 miles from Chapel Hill; therefore, the distance to/from this location would impact transportation costs if OWASA were to assume responsibility for transporting dewatered biosolids to McGill. However, if OWASA were to contract with McGill for transportation services, this standby alternative would not involve any increased transportation costs to OWASA as McGill would absorb these as a condition of the contract services agreement.

Alternative 2: Land Application of Dewatered Biosolids

As noted previously, OWASA will continue to maintain its biosolids land application permits. OWASA's temperature-phased anaerobic digestion process will continue to provide for finished Class A EQ (exceptional quality) biosolids. Dewatered Class A EQ biosolids could be effectively land applied by a contract service provider. In addition, the Class A biosolids permit provides for marketing/distribution and subsequent unrestricted use of OWASA Class A EQ biosolids, should OWASA decide to pursue that alternative.

Alternative 3: Transport for End Management By Another Utility

One potential but uncertain standby alternative would be to temporarily transport dewatered biosolids to another utility for end management, such as by thermal drying or waste-to-energy processing. Applicable transportation costs and tipping fees would be incurred for this standby alternative.