

EXECUTIVE SUMMARY

The Georgia Environment Partnership (GEP) has recognized the need to meet and exceed Georgia's waste reduction goals. One primary goal for Georgia is the reduction of traditional waste products presently going to landfills. To achieve these goals the University of Georgia's Department of Biological and Agricultural Engineering (BAE) is working within GEP to complete waste characterization studies pertaining to forest products, textiles, food processing industries, and municipal biosolids production. This report is a waste characterization study of biosolids production by municipal biological wastewater treatment plants in the state of Georgia.

This report quantifies and characterizes current municipal biosolids production in Georgia; critically analyses the five biosolids disposal methods currently used throughout the state; and provides education, policy and research recommendations for increasing the beneficial reuse of biosolids in the future. In addition the report provides a brief outline of a typical municipal wastewater treatment system, presents a sampling of various public opinions on beneficial reuse of biosolids, and outlines emerging technologies in biosolids management.

This report does not address biosolids removed from municipal wastewater treatment lagoon systems since solids removal from these systems are performed on an irregular, limited basis. Also, biosolids produced on-site by industries operating privately owned wastewater pretreatment systems are not addressed in the scope of this report.

Most municipal wastewater treatment facilities receive waste from two sources. The first is known as “sanitary” or “domestic” waste which consists of waste liquid and associated solids from toilets, sinks, baths and washing machines. Waste from household septic systems is also classified as sanitary waste. Second, many municipal wastewater treatment facilities receive a portion of their flow from commercial and industrial customers. This waste is classified as “non-sanitary” or “industrial” waste. The level of contamination of many non-sanitary waste streams is higher than that of sanitary waste streams and thus requires some amount of pretreatment prior to treatment at the municipal wastewater treatment plant.

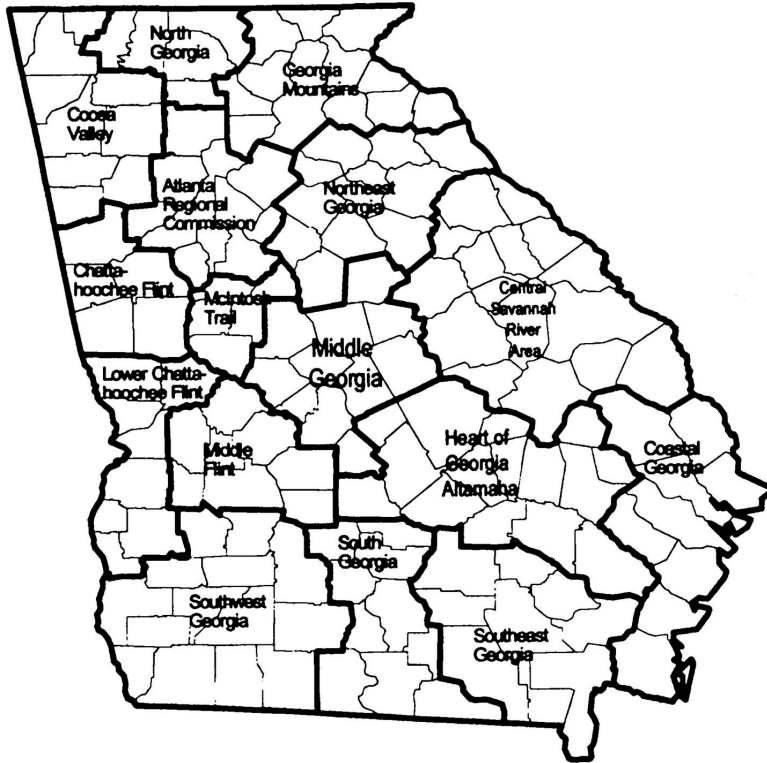
Customers releasing non-sanitary wastewater to public sewerage systems are monitored by either the Georgia Department of Natural Resources Environmental Protection Division or a local state approved industrial pretreatment program. The high strength of the waste derived

from industry can and does have a direct effect on the quality of biosolids that result from the processes used to clean the wastewater. There are concerns about utilization of these "stronger" biosolids in a land application system. Wastewater facilities utilize a variety of processes to clean and treat domestic waste or sewage. These processes, commonly known as preliminary, primary, secondary and tertiary treatments, all have a multitude of techniques to accomplish the purpose of cleansing wastewater.

A wastewater treatment plant produces two products, treated water and biosolids. Currently two terms, "sludge" and "biosolids", are used in the wastewater industry to describe the residual solids removed during the treatment process. Many wastewater professionals use these terms interchangeably; while others define sludge as the solids removed from the wastewater treatment process prior to any stabilizing treatment, and biosolids as sludge which has been treated and approved for beneficial reuse. For the purpose of this report, biosolids are the stabilized organic based solids removed from sewage during the wastewater treatment process that have the potential for beneficial reuse following acceptable stabilizing treatment.

Biosolids generally go through some form of solids handling process prior to disposal or beneficial reuse in order to increase stability and often increase the percent solids of the "cake". Biosolids are classified by level of stabilization and pathogen reduction under Title 40 of the Code of Federal Regulations [CFR], Part 503. Commonly referred to as "Part 503", these regulations establish the requirements for the final use or disposal of biosolids when they are applied to land as a soil conditioner or fertilizer, placed on a surface disposal site for final disposal, fired in a biosolids incinerator, or placed in a municipal solid waste landfill (Walker, 1994).

For the purposes of presenting information in this report the 159 counties in the state of Georgia have been divided into 16 regional areas as shown on the map. Georgia produces approximately 175,000 dry tons of biosolids per year from municipal wastewater treatment systems. An ideal estimation is used that the average dewatered biosolids contain 20% solids and 80% water, 175,000 dry tons represents over 875,000 wet tons of biosolids cake produced each year. The following table shows Georgia biosolids generation by region:



Regional Development Centers of Georgia

Regional generation by flow class.

Region	Number of Counties	Number of Facilities	Facilities <1 (MGD*)	Facilities 1<>10 (MGD)	Facilities >10 (MGD)	Total Flow (MGD)	Amount Removed (ton/yr.)
Atlanta Regional Commission	10	55	19	23	13	488.15	104,997.00
Central Savannah River Area	15	9	0	9	0	22.31	2,014.25
Chattahoochee Flint	5	11	8	3	0	14.98	776.17
Coastal Georgia	9	16	4	10	2	70.90	8,507.42
Coosa Valley	10	20	6	11	3	69.79	16,626.48
Georgia Mountains	13	15	10	5	0	21.53	2,610.85
Heart of Georgia Altamaha	12	8	2	6	0	14.76	1,491.57
Lower Chattahoochee Flint	5	4	3	0	1	42.81	5,297.98
McIntosh Trail	5	8	3	5	0	10.29	626.34
Middle Flint	7	9	6	3	0	13.86	891.33
Middle Georgia	11	14	5	7	2	69.96	16,526.29
North Georgia	5	4	1	2	1	46.30	3,296.32
Northeast Georgia	12	15	8	6	1	33.96	4,015.00
South Georgia	9	9	4	4	1	31.15	2,950.66
Southeast Georgia	8	6	4	2	0	14.66	699.89
Southwest Georgia	12	13	5	8	0	24.72	3,894.00
Totals	148	216	88	104	24	990.10	175,221.54

* MGD (Million Gallons Day)

The five basic methods of disposing of biosolids presently used in Georgia and listed in order of total amount of biosolids disposed/utilized (dry weight) each year are landfilling (43.23%), land application (25.21%), incineration (23.60%), composting (3.23%), pelletizing (2.99%) and a combination of landfilling/land application (1.73%). There are many benefits and drawbacks of each method that need to be examined by a municipality when determining the course of action to be taken to dispose of biosolids.

The table below presents the contribution of each region to the total for each disposal/utilization method:

Quantification of statewide disposal method.

	Composting	Incineration	Landfilling	Land Application	LA/LF Combined	Pelletizing
Statewide Disposal (100%)	3.23%	23.60%	43.23%	25.21%	1.73%	2.99%
Atlanta Regional Commission	42.06%	90.95%	75.00%	6.67%	0.00%	100.00%
Central Savannah River Area	0.00%	0.00%	2.37%	0.50%	0.00%	0.00%
Chattahoochee Flint	0.00%	0.00%	0.49%	0.90%	0.39%	0.00%
Coastal Georgia	36.15%	9.05%	3.57%	0.03%	0.00%	0.00%
Coosa Valley	0.00%	0.00%	1.41%	28.69%	95.10%	0.00%
Georgia Mountains	19.68%	0.00%	1.64%	0.58%	0.00%	0.00%
Heart of Georgia Altamaha	0.93%	0.00%	1.90%	0.00%	0.00%	0.00%
Lower Chattahoochee	0.00%	0.00%	0.05%	11.90%	0.00%	0.00%
McIntosh Trail	0.00%	0.00%	0.21%	1.06%	0.00%	0.00%
Middle Flint	0.05%	0.00%	0.22%	1.63%	0.00%	0.00%
Middle Georgia	0.00%	0.00%	0.95%	35.79%	0.00%	0.00%
North Georgia	0.00%	0.00%	0.68%	6.29%	0.00%	0.00%
Northeast Georgia	0.00%	0.00%	4.27%	1.77%	0.00%	0.00%
South Georgia	0.00%	0.00%	1.53%	4.06%	0.00%	0.00%
Southeast Georgia	1.12%	0.00%	0.76%	0.13%	0.00%	0.00%
Southwest Georgia	0.00%	0.00%	4.96%	0.00%	4.51%	0.00%
(%) Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

As the previous table shows, landfilling is by far the most widely chosen method of disposal throughout the regions, accounting for over 43% or 75,750 dry tons (378,750 wet tons) of biosolids a year. Incineration accounts for 23.60% (206,796 wet tons) of Georgia’s biosolids which come from only six wastewater treatment facilities, four in the Atlanta Regional Commission area and two in the Coastal Georgia Region.

In regions where open land is more readily available, approximately 25.21% (220,831 wet tons) of Georgia biosolids are land applied. Finally, composting, pelletizing, and plants using a combination of land application/landfilling constitutes 7.95% (69,731 wet tons) of the state's biosolids.

Quantification of statewide disposal methods (dry tons/yr).

	Composting	Incineration	Landfilling	Land Application	LA/LF Combined	Pelletizing	Regional Totals
Statewide Disposal (tons/yr)	5,660.42	41,359.25	75,749.73	44,166.28	3,039.90	5,245.96	175,221.54
Atlanta Regional Commission	2,380.71	37,615.44	56,810.24	2,944.64	0.00	5,245.96	104,997.00
Central Savannah River Area	0.00	0.00	1,794.16	220.10	0.00	0.00	2,014.25
Chattahoochee Flint	0.00	0.00	367.56	396.76	11.86	0.00	776.17
Coastal Georgia	2,046.19	3,743.81	2,705.38	12.05	0.00	0.00	8,507.42
Coosa Valley	0.00	0.00	1,065.44	12,670.06	2,890.98	0.00	16,626.48
Georgia Mountains	1,114.16	0.00	1,239.18	257.51	0.00	0.00	2,610.85
Heart of Georgia Altamaha	52.74	0.00	1,438.83	0.00	0.00	0.00	1,491.57
Lower Chattahoochee	0.00	0.00	41.06	5,256.91	0.00	0.00	5,297.98
McIntosh Trail	0.00	0.00	159.69	466.65	0.00	0.00	626.34
Middle Flint	3.10	0.00	168.27	719.96	0.00	0.00	891.33
Middle Georgia	0.00	0.00	717.96	15,808.33	0.00	0.00	16,526.29
North Georgia	0.00	0.00	517.21	2,779.11	0.00	0.00	3,296.32
Northeast Georgia	0.00	0.00	3,233.35	781.65	0.00	0.00	4,015.00
South Georgia	0.00	0.00	1,156.14	1,794.52	0.00	0.00	2,950.66
Southeast Georgia	63.51	0.00	578.34	58.04	0.00	0.00	699.89
Southwest Georgia	0.00	0.00	3,756.95	0.00	137.06	0.00	3,894.00

There are two parameters that need to be considered when analyzing the disposal/utilization methods: the number of facilities disposing/utilizing biosolids in a particular manner, and the quantity of biosolids these facilities are processing. As an example, although incineration disposes 24% of Georgia biosolids, only six of the 216 reported wastewater treatment facilities incinerate their biosolids and all are located in high population areas. On the other hand land application is more widely used (29% of treatment plants), but this method utilizes virtually the same amount of biosolids as incineration. The table below shows both the number of facilities and the quantity of biosolids disposed/utilized by each method:

Biosolids production in Georgia

	1994 Facility		2000 Facility		1994 Biosolids		2000 Biosolids	
	Count		Count		Disposed (dry tons/yr)		Disposed (dry tons/yr)	
Landfilling	120	71%	129	60%	56713.10	37%	75749.73	43%
Land Application	36	21%	62	29%	33066.86	22%	44166.28	25%
Incineration	5	3%	6	3%	53522.06	35%	41359.25	24%
Composting	6	4%	14	6%	2524.75	2%	5660.42	3%
Pelletizing	2	1%	1	0.46%	6048.00	4%	5245.96	3%
LA/LF Combined		0%	4	2%	0.00	0%	3039.9	2%
Totals	169	100%	216	100%	151874.78	100%	175221.5	100%

The 1994 study only included the 169 most significant facilities, while the 2000 study included all of them.

Included in the report Appendices are copies of the regulations that apply to each disposal method, a simple check list of necessary tasks and procedures for each permitting process and all the forms needed to fulfill permit requirements for each disposal method, excluding incineration. Contact names and phone numbers are also included.

Present options used for biosolids disposal in Georgia fall under five main categories: landfilling, land application, incineration, composting, and pelletizing. With each disposal method comes a collection of benefits and drawbacks. Depending on the point of view, benefits to one interest group may be seen as detrimental to another. The following table contains a condensed listing of some of the pros and cons of each disposal method used in Georgia.

Method	Pro	Con
Landfilling	Little to no capital investment	High tipping fee cost, subject to increase
	No land required by municipality	Limited resource
	Virtually no public relations problems	No environmental value
	Minimal environmental monitoring	Dewatered sludge is approx. 80% water
Land Application	Low-moderate cost per dry ton	Large amount of land required
	High capital investment for transportation	High administrative cost
	High capital investment for equipment	Weather sensitive operation
	Very good environmental value	Public relations intensive
Incineration	High demand from farming community	
	Minimal land required	Very high capital investment
	Great volume reduction	Need for highly skilled operators to operate
	Able to handle large volumes of sludge	Air quality issues & public relations concerns
Composting (in-vessel)	Complete pathogen and toxics reduction	Need for air permits and monitoring required
	Minimal land requirement	Large system needed to be cost effective
	End product available to public	Low environmental value
	Very good environmental value	
Composting (windrow and static pile)	Positive public relations if operated properly	Very high capital investment
	Minimal environmental monitoring	Very high production costs
	Low capital cost if land already available	Very operational and maintenance intensive
	End product available to public	Highly skilled operators required
Pelletizing	Very good environmental value	Process subject to strong odor problems
	Easy to operate, moderate in maintenance	
	Minimal environmental monitoring	Sufficient land available for long term
	Positive public relations if operated properly	Need for steady source of mixing materials
Pelletizing	Product available to public	Odor, dust and noise problems
	Very good environmental value	Weather sensitive operation
	Minimal land requirement	Some expensive equipment needed
	Product available to public	Very high capital investment
Pelletizing	Very good environmental value	Very high production costs
	Positive public relations if operated properly	Very operational and maintenance intensive
	Minimal land requirement	Highly skilled operators required to maintain
	Product available to public	End product suitable for commercial use only

Recommendations

As was previously stated, the goal of this report was to characterize and quantify the municipal biosolids produced in Georgia and discuss the current and possible future disposal methods. In the generation of this report, Georgia Environmental Partnership personnel have developed various ideas and recommendations that would be of benefit to the wastewater industry as a whole. Recommendations are organized in the following manner; general, educational, policy related and research based.

General

- 1) *The establishment of a Georgia Office of Biosolids Resource Management.* Such an office should be developed within Georgia to act as a central location for industry support, research management and technology transfer related to proper handling and utilization of biosolids. Informational databases, both hard and electronic versions, would be developed, maintained and made available for distribution to the general public. One of the responsibilities of the Office of Biosolids Resource Management would be to develop a state supported systematic program to classify biosolids. This program's personnel would do the initial site assessments, biosolids sampling, laboratory testing and data reporting for all applications.

Education

- 2) *Training and educational courses taught to local government leaders.* As discussed in this report, the development and delivery of training courses for local government leaders is a prime opportunity to provide an education that is unbiased and scientifically based. These biosolids training courses will be provided in conjunction with the normal environmental classes presently offered by the University of Georgia's Carl Vinson Institute of Government to all newly elected city and county governmental leaders.

Policy

- 3) *Economic incentives to facilities that beneficially utilize biosolids.* Economics is a major driving force behind almost all decisions concerning biosolids disposal/utilization options. Many facilities choose to landfill over other methods of sludge processing since landfilling presents few regulatory hurdles and in most cases is less expensive. Changing an existing disposal/utilization method is difficult, especially when the economics are not in favor of beneficial reuse alternatives. Until beneficial reuse technologies develop further and become more economically competitive with landfilling, it is suggested that Georgia give economic incentives for facilities to beneficially utilize biosolids. These incentives may come in the form of tax breaks, low or no interest capital loans and may be given to biosolids generators and/or consumers.

- 4) *Investigation into the development of a centralized cogeneration facility in the Atlanta Region.* The Atlanta Region has the greatest need of disposal/utilization because it produces the largest amount of biosolids. The synergistic results of high biosolids production, low land availability, and high potential for public disapproval lead to the recommendation for a central large scale electric energy cogeneration system. The benefits of a self sustaining cogeneration system in which biosolids are incinerated to produce electric energy, are biosolids volume reduction rate of 90% and the ability to produce marketable energy, making this option a feasible alternative. Georgia's municipal wastewater treatment facilities landfill approximately 43% of the biosolids produced in Georgia. The Atlanta Region alone accounts for 75% of all landfilled biosolids within the state. A large cogeneration facility would generate all the energy needed to operate the cogeneration facility and provide excess energy that could be sold. The ash by-product could be incorporated into construction materials thus eliminating further waste going to landfill. An adequately designed centralized cogeneration facility located in the Atlanta Region would have the single largest impact on Georgia's landfill reduction goal.

- 5) *Establishment of a committee to review and streamline biosolids permitting processes.* Obtaining permitting and procedural information is sometimes laborious due to the difficulty in locating the right person in the correct state regulatory department that can and will answer questions. There is a great need to have all information, forms and requirements be easy to read and accessible. This can be accomplished using a central web based system where each disposal/utilization option's application and information can be accessed and downloaded.

- 6) *Increased training and resources made available to the Georgia EPD to adequately monitor and enforce regulations.* Public perception can and does affect biosolids disposal/utilization. As discussed earlier, education is a key that may help dispel many negative connotations that are commonly applied when sewage is mentioned. The lack of adequate information to provide better understanding among the public is causing high-level concern and rejection of beneficial reuse (EPA Audit Report, 2000). Some of the negative feelings are rooted in media coverage over poorly managed biosolids programs without any attention to programs that are performing well. This also contributes to a public perception that there is a lack of regulatory oversight associated with biosolids. Conversations with informed individuals across the state confirm that the public believes there is a major lack of oversight by the EPD. EPD provides oversight but does not have adequate personnel and resources necessary to pro-actively monitor each biosolids handling operation.

- 7) *Encouragement and economic incentives for short term contracts with landfill disposal firms.* In a few situations, beneficial reuse opportunities have been curtailed due to long term contracts that some municipalities have with waste management contractors, i.e. landfills. It is understood that the essential nature of business contracts is to ensure quality and consistent service, but encouragement for short term contracts with landfill disposal firms could have potential benefits. Not only do shorter contracts require companies to work harder in order to keep contracts, it also opens up "release"

opportunities for municipalities if they are unhappy with services or wish to change disposal/utilization methods. This “encouragement” would need to be facilitated in conjunction with the education of the decision making bodies of the municipalities.

Research

- 8) *Industrial biosolids production and disposal/utilization options need to be studied in future projects.* This report focused on the waste generation and disposal characteristics of municipal National Pollutant Discharge Elimination System (NPDES) permitted wastewater treatment facilities. It is recognized that the scope of the study of biosolids production was limited because industrial wastes/biosolids have not been included. In an effort to encompass the spectrum of biosolids going to landfills, it is recommended that industrial waste/sludge production and disposal/utilization be studied in future projects. This is a complicated task due to the wide variations of industrial wastes produced in the state.

- 9) *Fund the development of a large scale vermicomposting research and demonstration project.* This report has shown the potential opportunities and benefits associated with vermicomposting of biosolids. Presently, vermicomposting is only being done on a very small scale by a few companies in Georgia. Previous research shows the viability of vermicomposting to stabilize pathogens and produce a Class A product meeting all Part 503 regulations. One recommendation is for Biological & Agricultural Engineering Department personnel at the University of Georgia to set up a large scale vermicomposting research and demonstration project that will show the potential of this “new” bioconversion process and the effects it can have on Georgia’s biosolids utilization.

- 10) *Development of lab scale and later full scale research projects showing the feasibility of animal feed production utilizing biosolids.* As is discussed in detail in the New Strategies for Biosolids Utilization section, the idea of using biosolids as an ingredient in the

production of feed for animals seems to be a promising avenue of exploration. This report recommends that Biological & Agricultural Engineering Department personnel at the University of Georgia to do lab scale and later full scale research projects showing the feasibility of feed production utilizing biosolids that will have the potential to be incorporated into industrial processes.

- 11) *Fund research projects to investigate the off site environmental impacts of various biosolids utilization processes.* While literature and studies are available to document the long term impacts of land application, little is known on the impacts of composting or incineration facilities. This research would provide essential data to those developing streamlined regulations and provide a basis for local leaders to base disposal decisions.
- 12) *Funding be provided to establish public educational programs for the State of Georgia.* These programs can include workshops on the potential benefits that biosolids utilization can have on Georgia's agricultural community

While recognizing the high priority on the pollution prevention efforts to reduce waste throughout industries, it should be noted that pollution prevention in wastewater treatment facilities is in the preliminary research stage for biosolids source reduction. Until more research efforts are focused on biosolids source reduction in municipal wastewater treatment facilities, the next step in the pollution prevention hierarchy "reuse" will be the focus of biosolids disposal/utilization.

The need to reduce the waste flow to Georgia's landfills is a major concern for those who understand the ramifications that limited and reduced space in landfills have on the economies of industries and individuals. Long term goals of waste reduction and alternative reuse are realized when individual decision-makers make pro-active decisions, whether economically or environmentally based, to enact, change or modify operations that positively affect the waste stream to landfills.

Such reduction goals cannot be accomplished by simply addressing one area of the problem; rather a collaborative effort is needed from each contributing factor. The Georgia Environmental Partnership is stepping forward by delivering informative reports and technical assistance that promote the adoption of pollution prevention, energy efficiency, and environmental compliance technologies throughout Georgia. The reduction of biosolids to Georgia's landfills through utilization of beneficial reuse technologies is one of the many avenues being traveled in the continuing effort for more environmentally sound by-product reduction methods.

The alternative disposal methods discussed in this report are viable options to landfilling. Although these alternatives when compared strictly on a disposal cost per ton basis are not as inexpensive as landfilling, the extraneous factors of producing marketable, beneficial products and increased positive public relations can offset the economic bias accredited to cost. An increasing percentage (presently at 43.23%) of biosolids produced in Georgia is routed to an ever-decreasing number of landfills. The rapidly expanding Atlanta Regional Commission alone accounts for 75% of all the biosolids landfilled. This fact is significant when considering the exponential growth and expansion the Atlanta region is experiencing as it incorporates the surrounding rural regions. The impending future trends of growth and accompanying factors of increased pollution, traffic, reduced land availability etc., mandates the need for implementation of alternative technological and/or techniques both in reducing biosolids production in wastewater treatment process and in expanding the use of alternate disposal methods.