

**Table 13. Regulatory classifications for land applied biosolids.**

	<b>Exceptional Quality</b>	<b>Class A</b>	<b>Class B</b>
Metals <sup>a</sup>	Low	Low or Medium	Low or Medium
Pathogens <sup>b</sup>	Low	Low	Medium
Vector Attraction	Low	Low	Low
Odor	Low	Low	Low
Permits	None	Yes	Yes
Fertilizer	Yes	Yes	Yes
Soil Amendment	Yes	Yes	Yes
Marketable	Yes	Yes	No

<sup>a</sup> Low- Below EPA Table 3 Pollutant Concentrations

Medium- Between EPA Table 1 Ceiling Concentration Limits & Table 3 Pollutant Concentrations

<sup>b</sup> Low is <1,000 MPN/g TS

Medium is <2,000,000 MPN/g TS

(MPN/g TS = Most Probably Number per gram of Total Solids)

## 5.0 CURRENT BIOSOLIDS MANAGEMENT PRACTICES

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 section presents a brief description of each disposal process, some pros and cons of each method with regard to environmental health and economic cost, and an example of a facility in Georgia that utilizes each disposal method. An economic summary of each example will be presented at the end of the section for a collective comparison.

### 5.1 Landfilling

Landfilling is by far the most widely chosen method of disposal throughout the regions, disposing 43% or 75,750 dry tons (approximately 378,750 wet tons) of biosolids a year. There are 129 facilities in all 16 regions that utilize landfilling for disposal of biosolids. Of the facilities, 56 are small, 65 are medium and 8 are considered large.

Although there are different types of landfilling operations, the most frequent method used is that of dewatering and burial. The economics of hauling biosolids to the landfill will usually indicate the level of dewatering required. Landfill operators like to have biosolids between 15-20% solids before burial in order to maintain profile structure of the landfill. In a true sanitary landfill, the waste is deposited in a designated area, compacted in place with a tractor or roller, and covered with a 12 inch layer of clean soil (Metcalf & Eddy, 1972). Problematic odors and insects nuisances are reduced with systematic coverage of newly applied biosolids. Landfills that bury biosolids are sometimes required to install monitoring wells to monitor background conditions as indicators of leachate reaching the groundwater.

Landfilling has been utilized as the disposal catch-all for many years. If nothing else useful can be done with the material, landfilling is the choice. One of the greatest concerns with Georgia landfills is decreasing space. In 1990, the Georgia General Assembly passed the Georgia Comprehensive Solid Waste Management Act, which set a path toward improving solid waste management in the state and reducing the amount of waste being disposed of in landfills (Ga. DCA, 1998).

Modern sanitary landfills must be double-lined with heavy synthetic materials and equipped with drainage and collection systems to ensure safety, though many old landfills are not equipped with such systems. Regardless of design standards, environmental concerns of landfilling still exist. The major concerns deal with escaping leachate, gas and loss of land/natural resource. As rainwater penetrates the landfill, it mixes with the waste, and in time may penetrate the protective liners if rips or punctures occur. This leachate could pose great problems to underground water sources due to the potential high levels of ammonia, metals, pollutants and biochemical oxygen demand (BOD) concentrations.

It is difficult to quantify leachate because of varying landfill types and contents. Landfills produce gas from the decomposition of organic material that can escape and add to the local air pollution. Collection systems are often installed to capture and/or flare the gas that can be used as an alternate energy source. Wastewater facilities produce biosolids that have a solids concentration ranging from 3-50%. That means that at a concentration of 15% for every 100 tons of biosolids, 85 tons of it is water. So the majority of disposal cost is simply to haul and dump

water. Tipping fees, or the cost to dump in a landfill, is a major concern of many municipalities and industries dumping biosolids into landfill facilities. Increased cost of both production and disposal have led to the exploration of other options for waste disposal. Table 14 presents landfilling pros and cons. Landfilling does have positive results when utilized in certain situations. The capital investment is eliminated if present landfill sites are contracted. The municipality does not have the responsibility for managing another process and simply pays for someone else to manage the biosolids. Unless a new landfill needs to be constructed, public concerns with existing landfills are usually minimal. New landfills normally have monitoring systems in place to ensure no problems with the biosolids after final disposal. Many landfills in Georgia use biosolids to create “cover”.

**Table 14. Landfilling pros and cons.<sup>a</sup>**

Pro	Con
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

<sup>a</sup> Adapted from Kiepper (1997)

### 5.1.1 Cobb County Noonday

The Noonday Wastewater Facility, a 12-MGD activated sludge plant in Cobb County, uses landfilling to dispose of its biosolids. There are no capital costs connected with landfilling on the part of the municipality. Operational and maintenance costs exist only if the municipality performs the hauling of biosolids themselves. The Management of Noonday Facility, like that of many facilities, chose to contract out the disposal of biosolids to an independent firm that assumes responsibility for all hauling and landfilling costs. Under Noonday’s contract with *Waste Management*, the total 1998 cost to dispose of approximately 3,500 dry tons of biosolids was \$584,874, this is about \$167.00 per dry ton.

## 5.2 Land Application

Land application of biosolids is practiced in many counties. Sixty two facilities in 13 regions practice land application of biosolids. Only the Heart of Georgia Altamaha and Southwest Georgia regions utilize other disposal methods. Out of the 62-wastewater treatment plants, 27 facilities are small, 27 are medium and 8 are large. Approximately 44,000 dry tons of biosolids per year are applied to land in the state of Georgia.

Land application is the most practiced form of biosolids disposal/utilization among small and medium sized treatment facilities. Land application of stabilized municipal biosolids is defined as the spreading of biosolids on or just below the soil surface (Metcalf & Eddy, 1991). It should be kept in mind when discussing land application practices that concentrations of biosolids range from 3% solids that is sprayed on using conventional type sprinklers to 15% solids that requires special equipment for application to land or forests. The spreading of biosolids as determined by Part 503 requires that the biosolids be applied at a rate that is equal to or below that of the agronomic rate of application. The EPA states that the agronomic rate is designed to provide the amount of nitrogen needed by the crop or vegetation while minimizing the amount of nitrogen in the biosolids that will pass below the root zone of the crop or vegetation to the ground water (Stein, et al., 1995). The EPA within Part 503 regulations restricts the type of crops that can be grown on the land.

Biosolids are also applied to forestlands and used in land reclamation projects. Application of biosolids to forestlands is feasible on commercial timber and fiber production land, federal and state forests, and privately owned woodlots (Stein, et al., 1995). Similar land application standards apply to forest application in regards to the quality of the biosolids applied. Since there is relatively little human food that is produced in forests, the major concern dealing with forest biosolids application is the potential pollution of water supplies.

Land reclamation is performed primarily on land that has been disturbed as a result of mining, construction, and landfilling. Revegetation of distressed land is very difficult due to the soil and local environmental conditions. Pilot and full scale demonstration projects have shown that properly managed biosolids application is a feasible method of reclaiming disturbed land and can provide a cost-effective option for sewage biosolids use (Stein, et al., 1995).

EPA declares that land application of biosolids is safe as long as Part 503 regulations are followed. Regardless of present regulations, many voice concerns about biosolids application on agricultural land used to grow food for human consumption. Potential problems include parasites, pathogenic bacteria, viruses, chemical and metals in drinking water reservoirs, aquifers, and the food chain. The contents of metal (cadmium, nickel, lead, copper, zinc, and mercury) in soils, if allowed to build up due to repeated biosolids application, may prove damaging to crops, animals and people if released in high concentrations. Likewise, synthetic organic compounds such as dioxins and PCBs, if present, cause concern about ecological and human health impacts (Gelfand, M. et al).

The physical requirements for land applying biosolids raise other concerns. High transportation cost, high cost of special application machinery and large acreage of land that need to be properly monitored and controlled are all aspects that need to be addressed. There is a potential for incorrect application rates that could result in too much or too little nutrients for the land. Aside from regionalism, the most pervasive public concerns about biosolids land application appear to involve the release of trace pathogenic elements to soil and groundwater. Table 15 shows the pros and cons of land application.

**Table 15. Land Application pros and cons.<sup>a</sup>**

Pro	Con
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
High demand from farming community	

<sup>a</sup> Adapted from Kiepper (1997)

Regions that utilize land application techniques have many benefits for both the waste generator and crop producer. Waste generators are able to remove the product from site at reduced rates or for profit due to its demand as a soil amendment. Farmers or crop producers use it as a soil amendment to increase organic matter, improve soil fertility, increase soil structure and porosity in alkaline soils, and improve root growth and crop yields without creating negative impacts to the environment or public health. Fertilizer bills have the potential to be decreased

due to the slower release of nitrates that gives the amendments a longer acting fertilizer value and minimizes the possibility of leaching or groundwater contamination (Tong, 1994).

Land application of Class A biosolids at rates suitable for agriculture or silviculture normally does not cause problems with odors, insects (vectors), or other nuisances. Odor and insect problems generally do occur when raw, unstabilized wastes are applied without regard for permit requirements. In general, researchers agree that the effects of organic compounds, certain pesticides and metals are not dangerous when managed properly at regulated levels. However, they caution that additional study of organic compounds and long-term fate of materials is needed before unlimited application of sludge can occur safely on all lands (Gelfand, et al.).

### **5.2.1 DeKalb County Pole Bridge Creek**

Pole Bridge Creek Wastewater Treatment Facility in DeKalb County is the largest facility in the Atlanta Regional Commission to use land application of biosolids as the primary means of disposal/utilization. Pole Bridge Creek is a 20 MGD activated sludge, aerobic digestion plant that produces a 2-3% biosolids slurry that is applied to 300 acres of bermuda hay fields. The liquid sludge is pumped 6000 ft from the plant to the fields through an 8 in pipe to a suspended holding tank used to fill the application vehicles. Picture 1 shows a sludge application vehicle used at Pole Bridge Creek.



**Picture 1. Pole Bridge Creek’s biosolids application vehicle.**

After weighing the economics of the situation it was determined to contract *OMI*, an independent contracting firm, to be responsible for the hay planting and harvesting, land application of biosolids, and sale of hay for the facility. Under this agreement, *OMI* uses two sludge application vehicles that DeKalb County purchased for \$500,000 but all other farm machinery used in the operation is provided by *OMI*. In 1998, the contract price to land apply approximately 1,300 dry tons of biosolids was \$227,000, this is about \$174.00 a dry ton.

### **5.3 Incineration**

Incineration is practiced in many of the larger municipal and industrial wastewater treatment plants and accounts for 24% of Georgia's biosolids disposal. Six facilities in two regions utilize incineration for disposal/utilization of biosolids. Atlanta Regional Commission has four facilities (91% of total) and Coastal Georgia has two facilities (9% of total). One facility is classified as medium and five are large. Approximately 41,300 dry tons (approximately 206,500 wet tons) are incinerated each year.

To reduce the weight and volume of biosolids and to produce an odorless and inert residue for final disposal, incineration of biosolids is practiced in many of the larger municipal wastewater treatment plants (Metcalf & Eddy, 1972). The incineration process is dependent on the characteristics of the biosolids prior to combustion. The moisture content is of primary significance because it dictates whether the combustion process will be self-supporting or whether supplemental fuel will be required (Eckenfelder, 1980; Kerri, 1994). Self-supporting incineration can be achieved once the supplemental fuel raises the burning temperature to the ignition point. The need for constant supplemental fuel dramatically increases the cost of the operation.

The products of incineration are inert ash and gas emissions. Regulations deal mainly with the gas emissions, specifically concerned with the fate of metals and certain organics as they pass through the incineration process (Kerri, 1994). Meeting compliance with such regulations is accomplished through gaseous emission scrubbing systems. These systems consist of a wet or dry scrubber that removes most of the contaminated organic particulate matter and suspended solids that could pose health and odor problems.

Ash handling usually begins with an ash collector located beneath the incinerator. In some systems, ash is combined with the water from the scrubbers to prevent caking before being conveyed to a holding pond or tank. The water is removed and the ash, if found environmentally safe, can be disposed of through land application processes, landfilling, or used in the production of building products. Some systems recycle portions of the ash to their biosolids handling facility to help in the dewatering process.

Incineration, though it significantly reduces large volumes of biosolids relatively quickly, has some disadvantages. The large initial capital to build an incineration facility coupled with high operating and maintenance costs are two drawbacks. The large investment normally limits the feasibility to major cities. A highly trained and skilled staff is required in order to properly operate and maintain the facility. Public concerns consist of the visual aesthetics of “smoke stacks” and the effects any residual air pollutants may have on the local environment. Overcoming negative public opinion may prove the greatest obstacle in establishing a new facility. The final disposal of ash and residue, which may be high in metal concentrations, may be difficult due to the possibility that the material may be considered hazardous waste. Table 16 shows a list of pros and cons of incineration. Although the list of advantages of incineration is not quite as extensive, volume reduction of biosolids waste is the highest of all disposal methods. This reduction leads to less material actually being committed to landfills. Additionally, pathogens and toxic compounds found in sludge are eliminated. Though the requirement for energy to run such an operation is great, there is a potential to recover this energy to be used in other operations (Metcalf & Eddy, 1991). With the growing awareness of air pollution, the incineration of refuse and sewage sludge have become less popular even though the gases from incineration include mainly water vapor and small amounts of particulate solids (Gray, 1989).

**Table 16. Incineration pros and cons.<sup>a</sup>**

Pro	Con
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 and public relations concerns
Complete pathogen and toxics reduction	Need for air permits and monitoring required
	Large system needed to be cost effective
	Low environmental value

<sup>a</sup> Adapted from Kiepper (1997)

### 5.3.1 Cobb County R.L. Sutton

R.L. Sutton Wastewater Treatment Facility in Cobb County is the third largest municipal wastewater system in Georgia that incinerates biosolids. R.L. Sutton is a 40 MGD activated sludge plant located along the Chattahoochee River that uses a centrifuge for sludge thickening (of the activated sludge) and for dewatering the biosolids before sending over 12,000 dry tons a year to the twin multiple hearth incinerators. Only one incinerator is used at a time while the other one is receiving routine general maintenance (Picture 2).



**Picture 2. R.L. Sutton Wastewater Facility of Cobb County.**

**Twin multi hearth incinerator.**

The biosolids are carried up a steep conveyor belt to the top hearth for a time before it is raked to the center and drops down to the second hearth. After eliminating much of the moisture contained in the biosolids, they are again raked to the center and dropped to the third hearth where most of the biosolids are incinerated. Air is blown up through the center column to dissipate the heat off the shaft and then wasted to the atmosphere. Some of this warmed air is recirculated through the hearths and is mixed with the evaporated water gases and sent through a scrubbing unit before reaching the atmosphere. The volume of ash produced from the incinerators is approximately 10-12% of the incoming biosolids. Water is added to the ash for cooling and to increase the handling capability before it is moved to a dumpster and transported to the landfill.

Capital cost for the onsite incineration facility was 4 million dollars. The 1998 operational and maintenance cost to dispose of over 12,000 dry tons of biosolids was \$506,818. Of the total cost of operation, 37.8% is the fuel (natural gas) required to operate the incinerators, while only 5.13% of the total cost is ash tipping fees. This operation may have the potential to reduce costs by adjusting the fuel value and water content of the incoming sludge to promote a more self-sustaining burn and by instituting some kind of heat recovery system. There has been no ash market established for this particular facility.

#### **5.4 Composting**

In Georgia, fourteen facilities in six regions compost 3% (dry weight) of all biosolids as a means for disposal. Eight of the fourteen are from the Atlanta Region with the remaining five coming from the Coastal, Georgia Mountains, Chattahoochee Flint, Middle Flint, Heart of Georgia Altamaha and Southeast Georgia regions. Using the previous flow classification, five facilities are small, eight are medium and one is considered a large facility. Approximately 5,660 dry tons (approximately 28,300 wet tons) are utilized through composting efforts each year.

Composting is the aerobic decomposition by bacteria and fungi of the organic material in dewatered sludge, creating a stable product (ASCE & WEF, 1992). Since the mid-1970's, composting has received increased attention as a cost-effective and environmentally sound alternative for the stabilization and ultimate disposal of wastewater biosolids (Metcalf & Eddy, 1972). Biosolids composting is the biological decomposition of biosolids under conditions that allow development of thermophilic microorganisms resulting in biologically produced heat (Reynolds and Richards, 1996). The heat produced while decomposing pasteurizes and destroys the pathogenic organisms that might be present. There are three main types of composting systems. These include windrows, static pile and in-vessel reactors.

For windrows, the material is placed in long rows and is frequently mixed or turned over to allow more surface area to come in contact with the air. Static pile composting systems simply have the composting material placed in a pile and air is drawn through the pile either naturally or by mechanical devices. In-vessel composting facilities make compost in vertical tanks or silos that reduce odor and climate problems associated with other composting methods.

Pilot studies have demonstrated that a wide variety of materials can be used in the recipe for Class A compost. Biosolids composting using woodchips has the potential of producing a high quality compost with relatively high nutritional value which could increase soil organic matter and supply nutrients in a slowly available form (Shelton and Tate, 1999). Under properly managed systems, Class A products that are stable, sanitary, safe and aesthetically pleasing can be produced and economically marketed as soil conditioners or fertilizers.

Part 503 specifies rules for the composting industry that includes pollutant criteria, pathogen reduction and vector reduction (Fremante and Janes, 1997). Monitoring is essential in any composting facility to ensure efficient operations and a quality final product. Critical parameters to be determined are moisture content, metals and toxics, pathogens, pH, temperature and oxygen. If high concentrations of metals or other toxic compounds are present, use of the final commodity may be greatly restricted (Reed, Crites et al., 1995).

Composting large quantities of biosolids in windrows and static piles requires large amounts of land while vertical in-vessel operations require significantly less as shown in Table 17. Composting facilities, in general, are labor intensive and demand high start-up capital for expensive equipment and structures. For in-vessel composting in particular, startup and production costs can be considerable. Most municipal biosolids are too wet to be effectively

**Table 17. Composting (windrow and static pile) pros and cons.<sup>a</sup>**

Pro	Con
Low capital cost if land already available	Sufficient land available for long term
End product available to public	Need for steady source of mixing materials
Very good environmental value	Odor, dust and noise problems
Easy to operate, moderate in maintenance	Weather sensitive operation
Minimal environmental monitoring	Some expensive equipment needed

<sup>a</sup> Adapted from Kiepper (1997)

composted alone and may require detailed management plans in order to obtain necessary amendments such as wood chips, bark, leaves, paper, hay, or sawdust to add to the compost. The need for 1-3 parts of bulking agent increases the material that has to be handled (compared to the quantity of original waste) which in turn can increase the cost of production. Odors from windrows and static piles are a major concern in populated areas surrounding existing facilities.

In some instances, composting is not used as extensively as other methods primarily due to the lack of demand for the end product. In many states, large scale agricultural operations are located more than 50 miles from probable compost sources, resulting in high transportation costs affecting the potential size of the market (Shiralipour, et al., 1993). Table 18 lists the pros and cons of in-vessel composting systems.

The benefits from using biosolids compost are far reaching. If land is available, the major portion of start up cost is eliminated. One major benefit from the application of compost to soil is derived from the improved physical and chemical properties related to the increased organic matter content rather than its value as a fertilizer (Shelton and Tate, 1999). Soils conditioned with compost have increased water and nutrient holding capacity. Compost is an excellent

**Table 18. Composting (in-vessel) pros and cons.<sup>a</sup>**

Pro	Con
Minimal land requirement	Very high capital investment
End product available to public	Very high production costs
Very good environmental value	Very operational and maintenance intensive
Positive public relations if operated properly	Highly skilled operators required
Minimal environmental monitoring	Process subject to strong odor problems

<sup>a</sup> Adapted from Kiepper (1997)

source of nitrogen, phosphorous and other nutrients necessary for plant growth and development. The application of compost has been shown to improve soil properties and plant productivity, as well as to reduce dependence on inorganic fertilizers. Environmental monitoring requirements when the final product is applied to land are minimal or non-existent. Another added benefit of composting that it also help deal with these potential waste streams as well. Moreover, applying compost in accordance with Part 503 poses little risk to the environment or public health (Fremante and Janes, 1997). The final product is available to the general public at a reasonable price thus establishing positive public relations with communities. The marketing potential includes landscape material, soil amendment for public lands, erosion reduction projects, and potting material for gardeners. Compared to other processes, composting is a fast, simple, and safe approach to the bulk treatment of organic wastes that is becoming more publicly accepted than other methods of disposal (Gray, 1989).

### 5.4.1 Clayton County Northeast

Two facilities are included as examples for Georgia's composting facilities. Clayton County Water Authority's (CCWA) Northeast Facility utilizes an in-vessel operation to accomplish its composting goal of Class A compost. Glynn County in the Coastal Georgia Region has an in-house, 12 bay, aerated windrow/bay composting operation that also produces a Class A compost.

The CCWA's Northeast Facility is a 6 MGD activated sludge plant with no primary clarification or digestion that currently operates at 4.4 MGD. The sludge goes through a dissolved air floatation (DAF) operation (exiting at about 5% solids) before entering a belt filter press which further increases the solids content to between 15-20%. Clean wood waste brought into the facility is ground into chips using a 150-hp hammermill that is operated 6 hrs/day. The sludge is then mixed with the wood chips or sawdust at a 1:3 ratio and sent to vertical bioreactors where it is retained and "turned" for a period between 20-25 days. There are three vertical silos; two bioreactors that are 400m<sup>3</sup> and one cure reactor that is 900m<sup>3</sup>. Five, 50-hp blowers supply air to the reactors, aerating the "cooking" compost, while two 75-hp and one 125-hp blowers pull exhaust air from the reactors. Information concerning all aspects of the composting operation is monitored with an extensive computer system that allows for "easy" adjustment of parameters to accommodate varying needs. Exhaust gases are captured and routed to a nearby detention pond where they are allowed to bubble up to the surface, cleaning the exhaust gas and reducing odors. The finished compost is augured out of the silos and transported by truck to a 3-sided, concrete pad enclosure. A front-end loader is used to handle the compost. Inmate labor is used to bag the compost into 40 lb (1.5ft<sup>3</sup>) bags so it can be easily sold to the public.

The capital cost for the compost facility was 2.6 million dollars in 1984 with an expansion done in 1994 when the wastewater facility was expanded to accommodate a larger flow capacity. The yearly operating cost of \$813,000 is required to dispose of approximately 1,000 tons of sludge and produce nearly 4,500 dry tons of class A compost. Total revenue for 1999 was \$79,000 from compost sales to the local public.

### 5.4.2 Glynn County Academy Creek

Glynn County, City of Brunswick Academy Creek Wastewater Treatment Facility is a 13.5 MGD pure oxygen activated sludge plant. Aerobic digestion prior to dissolved air floatation and belt filter pressing are used to treat the wastewater that is 80% municipal waste and 20% industrial. The dewatered sludge cake from the filter presses (20-25% solids) is sent along a conveyor belt and dumped into mixing trucks that hold approximately 0.7 tons of sludge. A front-end loader is used to add woodchips ground up from local yard trimmings. A tub grinder owned by the facility produces all wood chips used in the operation. The wood chips are added to the sludge at approximately a 1:1 ratio. The trucks are designed with mixers that continuously turn the sludge and chips until they are brought to the composting enclosure. The trucks unload the mixed load using an auger system built into the bed of the truck that can be seen in Picture 3.



**Picture 3. Academy Creek Wastewater Facility, Glynn County.**

**A mixing truck that transports biosolids to the composting building.**

The composting enclosure is comprised of 12-200 ft long concrete bays that are 6 ft 6 in wide and approximately 6 ft high. A computer controlled forced air blower system is installed under the bays to provide vertical air movement through the compost the entire length of the bay. Temperature probes along the length of the bay log real time temperature readings to the monitoring computer system. An extensive air emissions system is also part of the process. When the building doors are shut, the system removes exhaust air with 4 100-hp blowers and

forces the air into an underground network of perforated pipes laid out under a small plot of land. The air then travels upward through a 1 ft layer of rock, a 3 ft layer of compost, and then a 6 in layer of wood chips. This air scrubbing system is used only about 10% of the time. Picture 4 shows the composting bays, turning machines, air scrubbing system, and bobcat of the operation.



**Picture 4. Academy Creek Wastewater Facility, Glynn County, Composting machinery.**

The composting process consists of three automatic turning machines designed to move between each row and “turn” all the compost each day. It takes approximately 1.75 hrs to turn over a bay of compost. As the turner works, it moves the compost 10 ft each day towards the end of the row, thus making room at the beginning of the row to add 10 ft more of the mixture being brought in on the trucks. The sludge/wood chip mixture has a detention time within the system of 23 days until it is moved by truck to a holding pile where it is sold to the local community as Class A compost for \$5/pickup truck load.

The capital cost for the compost facility was 4.7 million dollars. This cost included the building and installation of the enclosed composting building, one pole barn, the air emission system, two mixing trucks, two bobcats, a front-end loader, a tub grinder, trommel screen and all heavy composting machinery. The sludge dewatering process is included in the yearly operating cost of \$990,000. Approximately 2,400 tons of sludge is used to produce nearly 3,750 tons of Class A compost. Total yearly revenue for the facility is approximately \$77,575.

## 5.5 Pelletizing

This method of disposal is not extensively practiced in Georgia due to the high capital and operational costs. Other methods are normally used as less expensive alternatives for ultimate disposal/utilization. Pelletizing operations require high initial capital investment for buildings and equipment and are heat intensive processes that consume large amounts of energy. Depending upon the time of year, the energy is normally supplied in the form of natural gas, diesel or wood chips. Operation and production costs are high due to the energy required and the need for highly skilled operators to manage and maintain the facilities. Presently, there is no Georgia market for pellets. Because all pellets produced are sold under contract to Florida citrus growers, opportunity for the product to reach the local market is curtailed until other facilities begin disposing of biosolids through the pelletization process. See Table 19 for a list of pros and cons of pelletizing operations. Pelletizing facilities, like in-vessel composting facilities, have minimal land requirements. Both processes produce an environmentally beneficial product that is available to the public. Public opinion is positive as long as no odor problems are encountered on a regular basis.

### 5.5.1 Clayton County W. B. Casey

Pelletizing of biosolids is used mainly in medium and large wastewater facilities. In Georgia, one facility located in the Atlanta Regional Commission pelletizes. The Clayton County Water Authority leads the way in Georgia's pelletizing operations, marketing their finished product to commercial users in Florida and Alabama. The on-site pelletizing plant handles waste sludge from the W.B. Casey (15 MGD) and R.L. Jackson (4.5 MGD) activated

**Table 19. Pelletizing pros and cons.<sup>a</sup>**

Pro	Con
Minimal land requirement	Very high capital investment
Product available to public	Very high production costs
Very good environmental value	Very operational and maintenance intensive
Positive public relations if operated properly	Highly skilled operators required to maintain
	End product suitable for commercial use only

<sup>a</sup> Adapted from Kiepper (1997)

sludge plants that have no primary clarification or digestion. The sludge goes through a dissolved air floatation thickener process before being sent to a belt filter press to increase the solids content to between 15-20%. The sludge is then fed through pug mill mixing chambers to break up the sludge into a more porous mass and mix it with pellets made in previous batches. Polymers and chemicals such as sodium hydroxide and chlorine are added to help condition and control odor. The solids are then fed into two large rotating kiln dryers where they are heated and dried for a specified detention time. The two fuels that can be used in the process are natural gas (3500 therms/day) and wood chips (35 tons/day) with natural gas being the primary source of fuel. The completed pellets are stored in a large covered storage facility where a frontend loader is used to load transfer trucks.

The system is operated six days a week by a supervisor, foreman, and five operators. Inmates are also utilized on a regular basis. Capital cost for the pelletizing facility was initially 3.9 million dollars with an additional capital cost of 2.7 million dollars in later years for the ability to incinerate and store wood chips. The 1999 yearly operational and maintenance cost to dispose of approximately 4,700 dry tons of biosolids was 1.18 million dollars. The final product is sold to commercial markets in Florida and Alabama at approximately \$30 /ton. Table 21 presents the information in more detail.

## **5.6 Economic Comparison of Disposal/Utilization Methods**

There are many factors to consider when determining the disposal/utilization method used for biosolids. Although cost is often seen as the only factor that needs to be considered, other factors play equal roles in determining which methods or combination of methods are ultimately used in a specific area. Some concerns that must be addressed on an individual basis include willingness of local government leaders to be involved, willingness by local citizens to have something in “my back yard”, and the availability of resources that include skilled labor, land, and capital.

There has been a major attempt to make a generalized comparison of biosolids based on comparing disposal costs. In theory, this is the ideal way to compare processes and results if all the parameters were the same. Unfortunately, this is not the case due to the different factors

affecting each individual wastewater treatment facility. It is necessary to back away and look at the entire picture in order to assess the best method of operation and/or disposal for the resources available to the municipality or county.

This section presents such a comparison on an economic basis. The reader is responsible for utilizing the information in the previous sections that describe the pros and cons attributed to each disposal method, in conjunction with addressing the specific needs and situations of the community served.

The Atlanta Region, by far, produces the largest amount of biosolids in the state. This is to be expected due to the high concentration of people and industries in this area. It was decided to use wastewater facilities within the Atlanta Region as the primary examples of disposal methods. Since the population of Atlanta is expected to increase, addressing the existing waste management practices of this area can be beneficial to establishing and creating plans that may better prepare this region for the future.

Since biosolids in these examples can vary from 3-20% solids, disposal costs are based on a dry ton (2,000 lbs) of biosolids. In some instances, such as for composting and pelletizing, when value is added to the biosolids to produce a marketable product, the costs of production and sales are also shown. In order to be consistent with the various accounting methods used by municipalities throughout the state, all capitalization costs are presented as a fixed annual payment based on the initial capital cost at an assumed fixed percentage rate (8%), for an assumed life of the facility (20 years for structures and 10 years for vehicles). Capitalization costs do not include inflation. The financial information on cost of production (beneficial final product) and disposal/utilization of a dry ton of biosolids is broken down into two parts:

- 1) The cost of production and disposal considering only operational and maintenance (O&M) costs.
- 2) The cost of production and disposal considering O&M and estimated capitalization costs.

If a more detailed assessment needs to be made for comparison purposes utilizing exact capitalization costs, individual specific accounting numbers for facilities can be used. Table 20 shows the production cost of final products and disposal costs of biosolids with and without

capital costs. All final products, whether in a solid, liquid, fertilizer or ash form, must meet certain standards for pollutants and metals set by the EPA. Table 21 shows the analysis of the final product for each facility. Every facility is well within the necessary regulations. Cost

**Table 20. Cost comparison of facilities within Georgia (dry tons).**

<b>Fiscal Year 1998 Operating Cost</b>	<b>Clayton County Composting<sup>c</sup> (In Vessel)</b>	<b>Glynn County Composting</b>	<b>Clayton County Pelletizing<sup>c</sup></b>	<b>Cobb County Incineration</b>	<b>DeKalb County Land Application</b>	<b>Cobb County Landfilling</b>
Contracting Costs	None	None	None	None	\$ 227,000	\$ 584,874
Salaries & Benefits	\$ 252,221	\$ 266,938	\$ 341,494	\$ 75,556		
Utilities & Supplies	\$ 366,032	\$ 161,501	\$ 552,030	\$ 224,636		
Maintenance & Repair	\$ 96,695	\$ 163,920	\$ 135,769	\$ 17,260		
Outside Maintenance Services	\$ 44,613	-	\$ 129,979	\$ 154,227		
Other Fees	\$ 53,553	\$ 398,107	\$ 24,089	\$ 35,140		
<b>Total</b>	<b>\$ 813,114</b>	<b>\$ 990,466</b>	<b>\$1,183,361</b>	<b>\$ 506,818</b>	<b>\$ 227,000</b>	<b>\$ 584,874</b>
Dry tons of final product produced <sup>a</sup>	4,556	3,744	4,731	1343	1,314	3,499
Dry tons of sludge utilized in process	1,034	2,400	4,731	12209	1,314	3,499
Production Cost of Final Product	\$ 178.47	\$ 264.55	\$ 250.13	\$ 377.37	\$ 172.75	\$ 167.17
Disposal Cost of Sludge	\$ 786.38	\$ 412.69	\$ 250.13	\$ 41.51	\$ 172.75	\$ 167.15
Approximate Sale Cost Final Product <sup>a</sup>	\$ 17.38	\$ 3.50	\$ 30.00	\$ -	\$ -	\$ -
Total Revenue from Final Product <sup>d</sup>	\$ 79,185	\$ 13,100	\$ 141,930	\$ -	\$ -	\$ -
Total Revenue for Facility	\$ 79,185	\$ 77,575	\$ 141,930	\$ -	\$ -	\$ -
<b>Estimated Capital Costs<sup>b</sup></b>						
Yearly Capital Cost	\$ 264,816	\$ 468,520	\$ 397,224	\$ 407,409	\$ 74,515	\$ -
Total Production Cost Final Product	\$ 237	\$ 390	\$ 334	\$ 681	\$ 229	\$ 167
Total Disposal Cost of Sludge <sup>a</sup>	\$ 1,042	\$ 608	\$ 334	\$ 75	\$ 229	\$ 167

<sup>a</sup> Calculations are in Appendix

<sup>b</sup> Located in Appendix, Capitalization cost are not adjusted for inflation but represent actual costs

<sup>c</sup> 1999 FY Financial figures are used

<sup>d</sup> Revenue not included in production or disposal costs.

calculations are located in Appendix A.

**Table 21. Metal concentrations of residuals (mg/kg).**

	503 Pollutant Concentration	Clayton Co. (In Vessel) Composting	Glynn County Composting	Clayton Co. Pelletizing	Cobb Co. Incineration	DeKalb Co. Land Ap.	Cobb Co. Landfilling
Arsenic	41	7.23	1.36	2.06	0.115	<2	5.90
Cadmium	39	1.70	0.56	2.46	0.005	3.00	1.96
Chromium	1200		9.40	31.70	0.005	15.66	62.60
Copper	1500	72.70	53.30	235.00		176.00	134.34
Lead	300	7.07		48.90	0.010	14.00	14.56
Mercury	17	0.54	0.02	1.15	0.001	<1	3.28
Molybdenum*	18	6.70	1.77	5.79		10.00	
Nickel	420	3.90		26.70		9.00	29.98
Selenium	36	6.17	0.99	1.65	0.033	<2	7.87
Zinc	2800	125.00	148.00	1049.00		423.22	337.22

\* EPA has suspended the Molybdenum pollutant concentration limit