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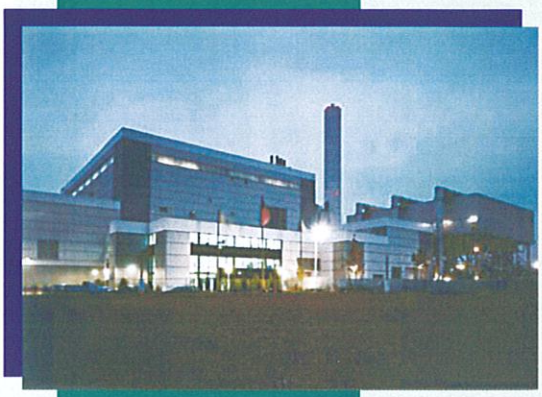

Solid Waste Management Study Update

-Draft-

City of Greensboro, North Carolina

GREENSBORO®

June 2001

Prepared by:

HDR Engineering, Inc. of the Carolinas
128 S. Tryon Street, Suite 1400
Charlotte, North Carolina 28202

HDR

City of Greensboro, North Carolina

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SOLID WASTE MANAGEMENT STUDY – UPDATE

DRAFT

June 2001

HDR

HDR Engineering, Inc. of the Carolinas
128 South Tryon Street, Suite 1400
Charlotte, NC 28202

TABLE OF CONTENTS

SECTION		PAGE
	EXECUTIVE SUMMARY	ES-1
1.0	INTRODUCTION	1-1
	1.1 Background	1-1
	1.2 1996 Solid Waste Management Study	1-1
	1.3 1997 Solid Waste Management Plan	1-2
	1.4 Scope of this Solid Waste Management Study Update	1-3
2.0	SOLID WASTE QUANTITIES AND CHARACTERISTICS	2-1
	2.1 Introduction	2-1
	2.1.1 Method for Determining Per Capita Generation Rates	2-1
	2.2 Waste Disposal at the White Street Landfill	2-2
	2.2.1 Background Information	2-2
	2.2.2 Waste Projections	2-3
3.0	REVIEW OF RESOURCE RECOVERY ALTERNATIVES	3-1
	3.1 Introduction	3-1
	3.2 Review of Resource Recovery System Options	3-1
	3.2.1 Mass-Burn Systems	3-1
	3.2.2 RDF Combustion Systems	3-2
	3.2.3 Waste Gasification Technologies	3-4
	3.2.4 MSW Composting	3-5
	3.3 Waste Diversion Potential	3-6
	3.4 Energy Recovery Potential	3-6
	3.5 Economic Considerations	3-7
	3.5.1 Mass-Burn Systems	3-7
	3.5.2 RDF Combustion Systems	3-7
	3.5.3 Waste Gasification Systems	3-7
	3.6 Regulatory and Implementation Concerns	3-8
	3.6.1 Federal Regulations	3-8
	3.6.2 Implementation Concerns	3-8
4.0	LANDFILL DISPOSAL OPTIONS	4-1
	4.1 Introduction	4-1
	4.2 Existing Waste Capacity	4-1
	4.3 Expansion Potential	4-2
	4.4 New Facility	4-2
	4.5 Out-Of-County MSW Landfill	4-8
	4.5.1 Public Facilities	4-8
	4.5.2 Private Facilities	4-8

TABLE OF CONTENTS

SECTION **PAGE**

5.0 WASTE TRANSPORTATION 5-1

5.1 Introduction 5-1
5.2 Direct Haul 5-1
5.3 Secondary Haul 5-1

6.0 COST COMPARISON 6-1

6.1 Introduction 6-1
6.2 Preliminary Waste-To-Energy Cost Analysis 6-1
6.3 White Street Landfill Expansion 6-1
6.4 New Landfill Site 6-2
6.5 Out-of-County Disposal 6-2
6.6 Conclusions 6-4
6.6.1 Resource Recovery Options 6-4
6.6.2 Landfill Disposal Options 6-4

LIST OF FIGURES AND TABLES

TITLE **PAGE**

Table 2-1	Per Capital Waste Generation	2-2
Figure 2-1	MSW Disposal of in the White Street Sanitary Landfill	2-3
Table 2-2	White Street Sanitary Landfill – Waste Disposal Projections	2-5
Table 4-1	Expansion Option	4-2
Figure 4-1	White Street Landfill – Phase IV and V Development	4-3
Figure 4-2	White Street Landfill – Ultimate Development	4-4
Figure 4-3	Incorporated Areas, Watershed Classifications and Airport Locations	4-6
Table 4-2	Subtitle D Landfill Siting Criteria	4-7

APPENDIX – COST MODELS

White Street Landfill Expansion
New Landfill
Transfer and Haul – 20 Mile One-Way
Transfer and Haul – 80 Mile One-Way

OVERVIEW

Changes to State and Federal Regulations have required the City of Greensboro (City) to continue to assess and evaluate its Municipal Solid Waste (MSW) disposal options over the past 10 years. In 1991, the North Carolina Department of Environment and Natural Resources (NCDENR) adopted the Environmental Protection Agency (EPA) "Subtitle D" regulations governing landfill design, construction, and operation. A portion of the Subtitle D regulations requires that all landfills be lined. North Carolina established January 1, 1998, as the date after which all waste in the State would be disposed of in lined landfills.

In mid-1994, the City began the permitting process for design of the lined landfill area known as Phase III. A part of the State's permitting process requires that a resolution from the local governing body be passed supporting a new landfill or landfill expansion. The Council approved such a resolution on March 20, 1995, and Cell 1 of the Phase III area was placed into operation on December 16, 1997.

1996 SOLID WASTE MANAGEMENT STUDY

One component of the March 1995 resolution included a requirement that the City evaluate alternatives on the continued use of the White Street Landfill for MSW disposal. This condition was consistent with on-going planning by staff, and in June 1995, the City coordinated the development of a Solid Waste Management Study (Study), and included representation from Guilford County (County) and the City of High Point. The scope of the Study, among other solid waste issues, included evaluation of disposal alternatives for waste generated within the County. The Study was completed in July 1996 with the following findings and recommendations.

- Use of the Greensboro White Street and High Point Kersey Valley Landfills was the least cost options and should be continued.
- Consider development of a multi-jurisdictional landfill to manage disposal of Guilford County-generated waste after the White Street and Kersey Valley Landfills are filled to capacity.
- Do not pursue resource recovery options, but continue to track developments in resource recovery technology (i.e., waste-to-energy).

1997 SOLID WASTE MANAGEMENT PLAN

North Carolina House Bill 859 was passed in the 1996 General Assembly revising the Solid Waste Management Act of 1989 and related statutes. The revised law required local governments to prepare a 10-year comprehensive plan to cover the period from July 1, 1997, to June 30, 2007. In December 1996, the City, in concert with the City of High Point and the County, formed a technical committee and began preparation of the 10-year Solid Waste Management Plan (Plan). The Plan was approved by the Greensboro City Council on June 17, 1997.

SOLID WASTE MANAGEMENT STUDY UPDATE

Significant progress was made through the preparation of the 1996 Study and 1997 Plan regarding long range disposal options for the City. Staff has continued to evaluate solid waste disposal options for the City, and contracted with HDR Engineering, Inc. of the Carolinas (HDR) to assist in preparing an update of previous studies. The 1996 Study and 1997 Plan included involvement from the County, the City of High Point, and the towns within the County. This update has been prepared for, and in coordination with, the City.

Four specific MSW disposal alternatives were reviewed as part of this update.

- Implementation of a Resource Recovery Technology.
- Expansion of the White Street Landfill.
- Siting and development of a new landfill.
- Out-of-County disposal.

SOLID WASTE QUANTITIES AND CHARACTERISTICS

Four waste streams are managed by the City at the White Street facility, including MSW, waste and land clearing inert debris (LCID), construction and demolition (C&D) wastes, and yard waste. However, this report focuses only on the MSW waste stream. Waste stream projections focus on historical MSW tonnages managed at White Street Landfill, with adjustments for population increases. The projections have been developed through the year 2027 to allow for a 20-year planning period beyond the MSW disposal capacity currently permitted for the White Street Landfill. Based on these projections, the disposal of approximately 6,000,000 tons of MSW will be required during the planning period.

Approximately 81 percent of the MSW disposed of in the White Street Landfill is comprised of waste collected within the City (61 percent by City trucks and 20 percent by private collectors). The remaining 19 percent is collected within other areas of the County.

EXISTING WASTE CAPACITY

The White Street Landfill, which is located in the northeast quadrant of the City, is used for the disposal of MSW, C&D, and LCID waste generated within the City and portions of the County.

Presently, the White Street Landfill property covers an area of approximately 850 acres. As constructed, the White Street Landfill is divided into three phases. Phase I is an 85-acre unlined site that stopped receiving waste prior to 1978. Phase II consists of approximately 120 unlined acres which closed December 31, 1997, in accordance with State requirements. The Phase III area consists of a total of 52 acres, subdivided into three cells. The first cell of 25.5 acres was placed into operation in December 1997, with an estimated capacity of 1.7 million cubic yards (CY). The second cell, with an area of 14 acres, has recently been constructed and will be placed into operation by June 2001. Construction of the 12-acre Cell 3 is scheduled for summer of 2002, with a projected operation date of March 2003. Total capacity of Phase III is approximately 4,700,000 CY of waste which, at the projected filling rate of about 265,000 tons per year, should provide for disposal through the year 2007.

DISPOSAL OPTIONS

As previously discussed, the Study concentrated on the evaluation of four specific MSW disposal options: implementation of a resource recovery technology; White Street Landfill expansion; the development and siting of a new landfill; and out-of-county disposal. The following is a summarization of conclusions associated with the disposal options.

Resource Recovery

The Study included a review of resource recovery technologies. These include mass-burn systems, refuse-derived fuel (RDF) combustion systems, gasification technologies, and composting. In reviewing technologies, the economic and environmental impacts, diversion/recovery potential, and technical feasibility were analyzed.

White Street Expansions

Through acquisition of adjacent property, there is potential for developing additional lined landfill capacity at the White Street Landfill. Preliminary estimates indicate that those areas, designated as Phases IV and V, could provide 13,000,000 CY of airspace, which would allow for more than 20-years of additional disposal capacity.

New Facility

Current efforts around the State to site new landfills have met with extensive public oppositions; therefore, the establishment of a new MSW landfill in the City/County area will require aggressive planning, design, and permitting efforts. Activities for this option should be initiated immediately to have a new facility in operation by 2007 when the Phase III MSW capacity will be exhausted. Because of the long development time associated with a new landfill, the facility size should be established to provide a minimum of 20 years of MSW disposal capacity. From the data developed by the Study, a new landfill will need capacity to dispose of approximately 6.0 million tons of waste. Using these assumptions, the total land required for the lined units was calculated to be approximately 160 acres with each cell averaging approximately five years of landfill life. To allow for buffer requirements and miscellaneous site support facilities such as leachate treatment impoundments, maintenance facilities, borrow area and storm water management facilities, a total site area of 400 acres was estimated.

Out-Of-County Disposal

For a review of an out-of-county landfill disposal scenario, HDR evaluated potential public and private landfill facilities located in the Piedmont area of North Carolina. Haul distances beyond these facilities would significantly impact the overall disposal costs.

COST COMPARISON

A comparison of capital and operating costs for the MSW disposal options was completed as part of the Study update.

Resource Recovery Options

The recovery of energy from MSW through the implementation of a waste-to-energy (WTE) facility is an option that is proven from a technical standpoint. The major concerns associated with this option involve the areas of cost, changing regulations, and public perception. The projected costs for the WTE option are significantly higher than those projected for the landfill-based options of either expanding existing landfills or developing a new multi-jurisdictional landfill.

Two different scenarios of the costs associated with the development of a WTE facility to serve the City's disposal needs have been included in the preliminary analysis. The first scenario involves the implementation of a 1,000 TPD mass-burn, waste-to-energy facility. HDR analyzed the typical development costs, operations and maintenance costs, potential revenues and financing costs. Based on the analysis, HDR estimates that a 1,000 TPD mass burn facility for the City would have a present value cost of approximately $100 per ton. The second scenario involves the implementation of a 1,000 TPD waste gasification facility. HDR once again analyzed the development costs, operations, and maintenance costs, revenues and financing costs associated with this facility. The results of this preliminary analysis indicate a present value cost of approximately $120.00 per ton.

White Street Expansion

It appears from the analysis of existing MSW landfill disposal options, continued development of additional landfill phases at the White Street Landfill is the most economical disposal option for the City. From a cost basis, the City should continue the development of the White Street Landfill including Phases IV and V with consideration towards ultimate capacity.

Based on the analysis, the cost for continued disposal at the White Street Landfill would be approximately $20.00 per ton in present value dollars.

New Landfill Site

The development of a new landfill facility will require the purchase of approximately 400 acres and will include the construction of all facilities such as roadways, scales, scalehouses, administrative offices, and maintenance facilities, in addition to the components associated with the White Street Landfill unit itself. A new facility, sized to provide MSW disposal capacity for a 20-year planning period, will require a total of 160 acres of lined areas.

HDR analyzed the typical development, operations and maintenance, closure/post-closure and financing costs. Based on the analysis, the cost per ton for disposal at a new County landfill would be approximately $25.00 per ton in present value dollars.

Out-Of-County Disposal

The evaluation of available MSW disposal alternatives located outside of the County area indicates that secondary hauling via transfer station will be required. Costs associated with secondary haul is in addition to disposal costs. As discussed previously, the options for MSW disposal at a landfill located outside the County will most likely be limited to private facilities. Publicly owned and operated landfills within a reasonable haul distance have established service areas with little incentive to expand. The exception may be a public facility that has had waste diverted by the private sector and is in need of additional revenue.

If the City elected to dispose of waste outside the County, it is unlikely that a landfill facility would be located close enough to the City for trucks to direct-haul. Considering the contractual arrangements recently negotiated by other municipalities, the transfer and disposal costs would likely range between $28.00 and $45.00 per ton, if the City was to privatize transfer and disposal of waste to an out of County facility.

1.1 BACKGROUND

Changes to State and Federal Regulations has required the City of Greensboro (City) to continue to assess and evaluate its Municipal Solid Waste (MSW) disposal options over the past 10 years. In 1991 the North Carolina Department of Environment and Natural Resources (NCDENR) adopted the Environmental Protection Agency (EPA) "Subtitle D" regulations governing landfill design, construction, and operation. A portion of the Subtitle D regulations requires that all landfills be lined. North Carolina established January 1, 1998, as the date after which all waste in the state would be disposed of in lined landfills.

The unlined Phase II area of the Greensboro White Street Landfill, had disposal capacity to go well beyond January 1, 1998. In mid 1994 the City began the permitting process for design of the lined landfill area known as Phase III. A part of the State's permitting process requires that a resolution from the local governing body be passed supporting the new landfill or landfill expansion. The council approved such a resolution on March 20, 1995. The permit to construct Phase III was received from NCDENR in early 1997, and Cell 1 of the Phase III area became operational on December 16, 1997. The second cell of the Phase III area will be placed into operation during 2001 with the third and final cell targeted for construction in 2002.

1.2 1996 SOLID WASTE MANAGEMENT STUDY

One component of the March 1995 resolution included a requirement that the City evaluate alternatives to the continued use of the White Street Landfill for MSW disposal. This condition was consistent with on-going planning by staff, and in June 1995, the City coordinated the development of a Solid Waste Management Study (Study), and included representation from Guildford County (County) and High Point. The scope of the Study, among other solid waste issues, included evaluation of disposal alternatives for waste generated within the County. An advisory committee was formed including staff from the City, High Point, and the County and disposal options for MSW, construction and demolition (C&D) waste and land clearing inert debris (LCID) waste were evaluated.

Five methods of solid waste disposal were evaluated in the Study and included.

- Continued use of the White Street and Kersey Valley (High Point) Landfills.
- Development of a new public landfill within the County.

- Development of a waste-to-energy facility to burn garbage and produce electricity or steam.
- Development of a solid waste composting facility to compost MSW, similar to yard waste composting.
- Privatization of solid waste disposal at a privately owned landfill in the region.

The options were evaluated considering both transportation and disposal cost, which were used for comparative analysis. The determination of an appropriate tipping fee (revenue) is a separate analysis and was not performed as part of the Study. The findings and recommendations of the 1996 Study are summarized below.

- Use of the White Street and Kersey Valley Landfills was the least cost option and should be continued.
- Consider development of a multi-jurisdictional landfill to manage disposal of Guilford County-generated waste after the White Street and Kersey Valley Landfills are filled to capacity.
- Do not pursue resource recovery options, but continue to track developments in resource recovery technology (i.e., waste-to-energy).

1.3 1997 SOLID WASTE MANAGEMENT PLAN

North Carolina House Bill 859 was passed in the 1996 General Assembly revising the Solid Waste Management Act of 1989 and related statues. The revised law required local governments to prepare a ten year comprehensive Plan to cover the period from July 1, 1997 to June 30, 2007. In December 1996, the City, in concert with the City of High Point and the County, formed a technical committee and began preparation of the 10-year Solid Waste Management Plan.

The goals and objectives of the Plan are summarized below:

- Development of a Plan in conformance with the State requirements and local objectives.
- Identification of any deficiencies in existing solid waste management programs in order to meet local needs and protect public health and the environment.
- Development of local reduction goals and programs for the County and encouragement of public participation in the planning process.
- Determination of the full cost of solid waste management in the County.

The Plan was approved by the Greensboro City Council on June 17, 1997. The Plan included recommended actions associated with eight areas of solid waste management: Solid waste collection services, waste reduction, reuse and recycling activities, yard waste composting and mulching operations, waste incineration, *waste transfer and disposal services*, other solid waste management activities, and financing issues associated with solid waste management services.

The Plan indicated many recommendations regarding the eight areas. Five specific recommendations were associated with the *waste transfer and disposal services*. The recommendations included, in summary:

- Renegotiate the contracts between the Cities and the County.
- Continue development and use of the White Street and Kersey Valley Landfills.
- Consider establishing a Solid Waste Authority for the County.
- Expand C&D disposal capacity within the County, and
- Discuss siting and developing a new public landfill facility to be used after the existing facilities have been filled to capacity.

Progress has been made on several of the recommendations. Re-establishing the agreements between the Cities and the County was considered, but no agreement was executed. The White Street and Kersey Valley Landfills are continuing to be developed. The City has opened a C&D landfill on the closed Phase II area of the White Street Landfill. Meetings regarding possible formation of a Solid Waste Authority and development of a new public landfill have been ongoing. Discussions have been led by the County with representation from High Point, Greensboro, each of the Towns within the County, and also some surrounding Counties and private sector representatives.

1.4 SCOPE OF THIS SOLID WASTE MANAGEMENT STUDY UPDATE

Significant progress was made through the preparation of the 1996 solid waste study and 1997 solid waste plan regarding long range disposal options for the City. Staff has continued to evaluate solid waste disposal options for the City, and contracted with HDR Engineering, Inc. of the Carolinas (HDR) to assist in preparing an update of the previous studies. The 1996 study and 1997 plan included involvement from the County, the City of High Point, and the towns within the County. This update has been prepared for, and in coordination with, the City.

Four specific MSW disposal alternatives were reviewed as part of this update.

- Expansion of the White Street Landfill.
- Siting and development of a new landfill.
- Out-of-County disposal.
- Implementation of a Resource Recovery Technology.

The following sections provide the evaluations and analyses of these alternatives and the resulting conclusions and recommendations.

2.1 INTRODUCTION

Four waste streams are managed by the City at the White Street facility, including MSW, LCID, C&D wastes, and yard waste. However, this report focuses only on the MSW waste stream. Waste stream projections focus on historical MSW tonnages managed at White Street, with adjustments for population increases. The projections have been developed through the year 2027 to allow for a twenty year planning period beyond the MSW disposal capacity currently permitted for the White Street Landfill.

In preparing this section, information has been gathered from the following sources:

- Material Summary Solid Waste Management Reports generated by the White Street Sanitary Landfill, City of Greensboro
- Information provided by the United States Bureau of the Census and the NC Office of State Planning
- The Guilford County Solid Waste Management Plan Three Year Update, May 2000
- A report prepared by HDR Engineering Inc. of the Carolinas entitled White Street Sanitary Landfill; An Assessment of Scenarios Associated with the Utilization of MSW Disposal Capacity, November 1999
- Guilford County Waste Disposal Reports for Fiscal Years 96/97 through 99/00.
- Characterization of Municipal Solid Waste in the United States: 1997 Update, U.S. Environmental Protection Agency, 530-R-96-001, March 1998.
- The Guilford County Solid Waste Management Plan, June 1997

2.1.1 Methodology for Determining Per Capita Generation Rates

The methodology for determining per capita generation rates that was developed for the County's Solid Waste Management Plan in 1997 was utilized in this study. The description of that methodology follows:

At the time of the writing of County's 10-year Solid Waste Management Plan, it was estimated that the per capita generation rate for the County was 7.35 lbs/person/day (see Table 2-1).

Table 2-1
Calculation of Base Year
Per Capita MSW Generation Rate for Guilford County

Total MSW Generated (FY 1994-1995)	x	165/ton	⁄	days/year	⁄	Pop. (1995)	=	Base Year Per Capita MSW Generation Rate
486,370 TPY	x	2000 lbs/ton	⁄	365 days/yr	⁄	362,710	=	7.35 lbs/person/day

In determining what became known as the "base year" per capita generation rate, population estimates for the County for the years 1990, 2000, 2010, and 2020, were obtained from the County's Planning and Development Department. The population estimate for 1995 (362,710) was based on the straight-line interpolation of data provided for 1990 and 2000. This population estimate was then combined with solid waste generation data obtained from the County's Solid Waste Management Annual Report for the period July 1, 1994 through June 30, 1995, and from the Landfill's scalehouse records. From this information it was determined that approximately 486,370 tons of MSW was generated in the County during FY 1994 through 1995, which given the population estimate, translated into 7.35 lbs of MSW being generated by each person each day on an annual basis. This information has been used as the basis for projections presented in this study.

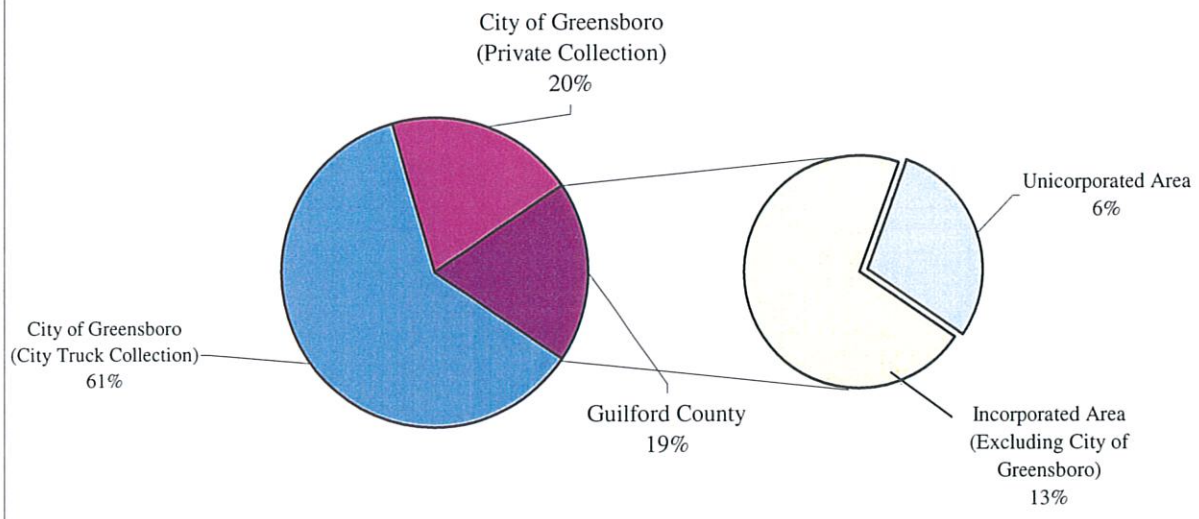
2.2 WASTE DISPOSAL AT THE WHITE STREET LANDFILL

2.2.1 Background Information

At present, approximately 81 percent of the MSW disposed of in the White Street Landfill is comprised of waste collected within the City (61 percent of this waste is collected by the public sector and 20 percent by private collectors). The remaining 19 percent of the MSW disposed of in the White Street Landfill is collected within other areas of the County. Of this other waste category, 13 percent is collected from incorporated areas (excluding the City) of the County, and the remaining 6 percent is collected from unincorporated areas of the County. Figure 1-2 illustrates the current source of MSW being disposed of at the White Street Landfill. These statistics are based on data provided to HDR by the City in 1999.

Figure 2-1

MSW Disposed of in the White Street Sanitary Landfill



Note: As indicated, of the waste disposed at White Street 81% (61% plus 20%) is generated within the City.

2.2.2 Waste Projections

The waste stream analyzed in this study is the MSW that is anticipated to be disposed of in the White Street Landfill during the planning period, if the status quo pattern of usage of this White Street Landfill remains constant. Table 2-2 presents the quantities of waste that HDR estimates will be generated annually within the County and disposed of as MSW at the White Street Landfill during the planning period.

The MSW disposal projections for the White Street Landfill for the planning period have been calculated based on the assumption that 59 percent of all MSW generated in the County is landfilled at the White Street Landfill (Guilford County Solid Waste Management Plan, Pages 3 through 10). The tonnages projected for the City are based on population projections (derived from total County population projections presented in the Guilford County Solid Waste Management Plan, June 1997, and incorporated area proportional estimates calculated from information provided by the United States Bureau of the Census and the North Carolina Office of State Planning), a constant per capita generation rate of 7.35 pounds of MSW/person/day, the assumption that all MSW which is generated in the City and requires landfilling is

disposed of in the White Street Landfill, and that the total waste stream generated in the County is comprised of 30 percent residential waste, 38 percent commercial waste, and 22 percent industrial waste (Guilford County Solid Waste Management Plan, page 1 through 11). These tonnages were then increased by 2.7 percent to reflect the tonnages reported in the NC MSW Annual Reports as having been disposed of at White Street Landfill during FY 95/96 through 99/01.

The tonnages projected for the incorporated areas are based on population projections (derived from total County population projections presented in the Guilford County Solid Waste Management Plan, June 1997, and incorporated area proportional estimates calculated from information provided by the US Bureau of the Census and the NC Office of State Planning), a constant per capita generation rate of 7.35 pounds of MSW/person/day, and the assumption that all MSW, which is generated in incorporated areas that are currently using the White Street Landfill will continue to do so throughout the planning period.

Using the assumption that 59 percent of all MSW generated in the County is landfilled at the White Street Landfill (Guilford County Solid Waste Management Plan, Page 3 through 10), any remaining MSW tonnages not indicated as being generated by an incorporated area utilizing the White Street Landfill were assumed to have been generated by the unincorporated area of the County served by the White Street Landfill.

Table 2-2
White Street Sanitary Landfill -- Waste Disposal Projections
(Municipal Solid Waste Only)

Fiscal Year	City of Greensboro			Guilford County		TOTAL (TPY)
	City Collected (TPY)	Revenue/Private Collected (TPY)	SUB-TOTAL (TPY)	Incorporated Areas Excluding City of Greensboro (TPY)	Unincorporated Areas (TPY)	
2002	161,955	53,100	215,055	34,515	15,930	265,500
2003	163,236	53,520	216,756	34,788	16,056	267,600
2004	164,517	53,940	218,457	35,061	16,182	269,700
2005	165,798	54,360	220,158	35,334	16,308	271,800
2006	167,079	54,780	221,859	35,607	16,434	273,900
2007	168,360	55,200	223,560	35,880	16,560	276,000
2008	169,641	55,620	225,261	36,153	16,686	278,100
2009	170,922	56,040	226,962	36,426	16,812	280,200
2010	172,142	56,440	228,582	36,686	16,932	282,200
2011	173,362	56,840	230,202	36,946	17,052	284,200
2012	174,643	57,260	231,903	37,219	17,178	286,300
2013	175,863	57,660	233,523	37,479	17,298	288,300
2014	177,083	58,060	235,143	37,739	17,418	290,300
2015	178,303	58,460	236,763	37,999	17,538	292,300
2016	179,523	58,860	238,383	38,259	17,658	294,300
2017	180,804	59,280	240,084	38,532	17,784	296,400
2018	182,085	59,700	241,785	38,805	17,910	298,500
2019	183,366	60,120	243,486	39,078	18,036	300,600
2020	184,647	60,540	245,187	39,351	18,162	302,700
2021	185,928	60,960	246,888	39,624	18,288	304,800
2022	187,209	61,380	248,589	39,897	18,414	306,900
2023	188,490	61,800	250,290	40,170	18,540	309,000
2024	189,771	62,220	251,991	40,443	18,666	311,100
2025	191,052	62,640	253,692	40,716	18,792	313,200
2026	192,333	63,060	255,393	40,989	18,918	315,300
2027	193,614	63,480	257,094	41,262	19,044	317,400

3.1 INTRODUCTION

The realization of additional resource recovery benefits from municipal waste, after materials recycling efforts have been maximized, can be achieved through energy conversion systems. Energy conversion systems include mass-burn systems, refuse-derived fuel (RDF) combustion systems, and gasification technologies.

An alternative to energy conversion or combustion systems is composting. Composting is a means directed at maximizing recovery and minimizing waste disposal.

The purpose of this section is to present a review of resource recovery alternatives which are available to the City. In reviewing technologies, the economic and environmental impacts, diversion/recovery potential, and technical feasibility are analyzed.

3.2 REVIEW OF RESOURCE RECOVERY SYSTEM OPTIONS

Waste-to-energy facilities are designed to combust solid waste in an environmentally acceptable manner in order to reduce the amount of material that requires landfilling and to generate energy in the form of steam, electricity, or both. Combustion technologies which have demonstrated experience include mass-burn systems and RDF combustion systems.

3.2.1 Mass-Burn Systems

Mass-Burn refers to the combustion of MSW as received with little or no processing or removal of materials. Combustion occurs in furnaces that have been specifically designed to accommodate the heterogeneous characteristics of the waste stream. Mass-burn is the waste-to-energy technology used worldwide. The principal components of a mass-burn plant include the waste storage and feeding systems, combustion grates, and combustion units (furnace and boiler).

3.2.1.1 Technical Feasibility

The technology associated with mass-burn systems has been suitably demonstrated and is commercially operational at numerous facilities in the United States and at nearly 500 facilities worldwide.

3.2.1.2 Combustion Units

Waste-to-energy combustion units generally fall into two categories; field-erected and modular systems. Field-erected systems are used primarily for large-scale facilities (250 TPD and larger), whereas modular systems are used primarily for smaller scale facilities and are normally available in module sizes of 25 to 125 TPD. As the names imply, field-erected systems are built on site, but modular systems are shop assembled and shipped to the construction site as modules for installation.

3.2.2 RDF Combustion Systems

A second approach to the recovery of energy from waste involves the processing of the waste to produce a RDF. There are four types of RDF combustion systems that can be used for processing MSW: spreader-stoker firing, suspension firing, fluidized-bed incineration, and pyrolytic conversion.

3.2.2.1 Spreader-Stoker Firing

In spreader-stoker firing, RDF is fed into the combustion unit through air-swept spouts or pneumatic distributors. Some of the RDF is burned in suspension, while the heavier particles fall onto the grate where combustion is completed.

3.2.2.2 Suspension Firing

Suspension firing involves the co-firing of RDF in suspension with pulverized coal. RDF normally supplies 10 to 20 percent of the total heat input in these applications. Suspension firing requires a more highly refined and processed RDF than spreader-stoker firing. Because of the additional problems of dealing with multiple fuels and repermitting issues, utilities have not historically expressed much interest in this approach.

3.2.2.3 Fluidized-Bed Firing

Fluidized-bed combustors have a bed of thermally inert material, such as sand and/or limestone, which is kept suspended in the combustion unit through the action of fluidizing air distributed below the bed. RDF can be introduced into or

on top of the bed, mixed by the fluidizing air and bed material, and combusted in the turbulent bed of inert material. The turbulence of the fluidized bed allows the combustion to take place at a lower temperature than in conventional combustion system without a significant effect on the combustion efficiency. This is beneficial in reducing certain air emissions, particularly sulfur dioxide and nitrogen oxides.

RDF is typically not fired alone in fluidized-bed combustion systems; coal or wood are co-fired with the RDF to help in maintaining stable firing conditions. Although fluidized-bed combustion has been used for a variety of fuels, experience with RDF is limited.

3.2.2.4 Pyrolysis

Pyrolysis systems convert organic materials in an oxygen-deficient environment into a combustible gaseous or liquid product and a solid, carbon-rich residue. Although unprocessed MSW may be subjected to pyrolytic conversion, a more homogenous feedstock is necessary to improve operation efficiency and product quality. MSW must generally be finely shredded and screened to produce a high-quality RDF material that has the majority of glass, sand, grit, and metals removed. The composition and yield of the pyrolysis products can be varied by controlling operating parameters such as feedstock composition, pressure, temperature, time, and feedstock particle sizing and by using catalysts or co-fired auxiliary fuels. The variable nature of RDF composition complicates control of the specific chemical reactions that take place. Because of the problems associated with controlling the chemical reactions and maintaining product quality, the marketing of gaseous and solid pyrolysis products has not been successful, and there are no pyrolysis systems in commercial operation in the United States.

3.2.2.5 Technical Feasibility

RDF combustion technology is commercially operational at several facilities in the United States. There have been shutdowns of earlier projects due to technical problems, including poor fuel quality, high ash quantities leading to lower boiler efficiencies and boiler fouling, and slagging and corrosion; however, these problems have been technically resolved. Presently, several facilities located in

the United States successfully process waste to produce RDF using mechanical means.

3.2.3 Waste Gasification Technologies

Over the past few years, a relatively new technology has evolved into a promising alternative for waste minimization and disposal. This technology is characterized as waste gasification. The technology is based primarily on three core processes: preprocessing, gasification, and energy generation.

MSW is mechanically separated to recover steel, aluminum, and plastics for recycling. This material is sometimes autoclaved as a means of sterilization prior to processing. A homogeneous feedstock is produced from the residual organic matter and undergoes further processing to remove glass and grit.

The organic matter is converted into a clean, dry synthesis gas (syngas) using a two-stage pyrolosis and stream reformation process. This process is environmentally sound and a superior alternative to waste combustion or other forms of incineration.

The syngas is converted, utilizing gas engine technology, into renewable energy which is supplied to the local electricity distribution network.

Some 20 percent of the waste stream can be recovered for recycling and reuse, while 70 percent is converted into renewable energy and, potentially other uses. A maximum of 10 percent will require landfill disposal at this stage, however, some technology vendors claim zero percent disposal requirements.

3.2.3.1 Technical Feasibility

There are several different gasification technologies available through vendors/developers, however, the process descriptions are very similar. Currently there are no operating facilities located within the United States. However, there are several facilities in Europe and the Far East. These facilities do not have long standing operating track records, with the longest being approximately two years. This fact is a concern when evaluating a long-term solution for waste disposal.

3.2.4.1 Technical Feasibility

There has been limited success of MSW composting systems over the past 30 years. Unfortunately, virtually all of these systems have been closed down due to problems with odor and lack of markets for the compost product.

To address the odor problem, enclosures around the process area and curing area have been utilized. Biofilters and wet scrubbing systems to treat process air have also been used for odor control.

MSW composting attracts disease vectors such as insects, predatory birds, and rodents. To mitigate these impacts, operations are usually located in enclosed buildings with leachate collection and treatment systems and odor control equipment. Typical compost operations also raise concern about airborne bacteria and fungi inherent in the feedstock waste stream and produced during the composting process. Trace metals and organic toxins such as dioxins, pesticides and PCBs in the mixed MSW feedstock can contaminate the finished compost product. Research on the environmental and health effects of compost is an on-going effort.

Even though the process itself is technically feasible, the success of an MSW composting operating is challenged by public opposition, poor market potential, potential health impacts and financial instability. Based on these issues, MSW composting is not a feasible option for the City. Therefore, no further evaluation is warranted.

3.3 WASTE DIVERSION POTENTIAL

Both mass-burn and RDF combustion options have the potential of realizing landfill diversion rates of up to 75 percent of the waste stream on a weight basis. This value is dependent on the level of pre-processing, system equipment, and operator diligence.

3.4 ENERGY RECOVERY POTENTIAL

Energy from mass-burn systems or RDF combustion in conventional boilers is generally recovered in the form of hot water, steam, or electricity. Hot water is used primarily in district heating application; steam may be used in various industrial processes (including heating and cooling) or passed through a conventional turbine-generator to produce

electricity. There is limited experience with the energy recovered from biological and chemical processes such as anaerobic digestion or pyrolysis. As stated previously, syngas from waste gasification processes is combusted in gas engines generating renewable energy.

3.5 ECONOMIC CONSIDERATIONS

3.5.1 Mass-Burn Systems

Because of the high capital costs of mass-burn systems, consistent waste flows and energy market security are vital to the long-term viability of such projects. Therefore, energy markets should be carefully evaluated for the price offered for the energy, willingness to negotiate long-term purchase contracts, and their long-term viability as a business enterprise. In certain cases, cogeneration systems can be utilized which generate both steam and electricity, which provides the most efficient use of the energy created. Energy revenues may be used to offset some of the construction and operating costs associated with the system.

3.5.2 RDF Combustion Systems

As is the case with mass-burn projects, RDF combustion systems are capital intensive. The initial capital investment required to purchase combustion systems used for RDF are generally lower than combustion systems required for mass-burn projects. However, these initial expenses may be offset by higher maintenance costs for both the process system and boilers.

The capital costs of RDF systems can be divided into two major components: 1) the RDF production facility, and 2) the RDF combustion facility. Historically, when compared with mass-burn systems, savings achieved by building smaller combustion facilities to burn RDF are more than offset by the added costs (both capital and O&M) of the RDF production facility.

3.5.3 Waste Gasification Systems

Waste gasification systems are also capital intensive, with an estimated cost of $180,000 per ton throughout. The economic feasibility of these systems is strictly related to variable, long-term energy sales.

3.6 REGULATORY AND IMPLEMENTATION CONCERNS

3.6.1 Federal Regulations

Municipal waste combustion is an effective method of reducing the volume of generated waste, producing useful energy and extending the lives of waste landfills. However, the combustion of MSW results in the release of various combustion products that are potentially toxic. Congressional passage of the Clean Air Act Amendments (CAAA) of 1990 required the EPA to develop more stringent emission standards and guidelines for new and existing municipal waste combustors (MWCs). As a result, the EPA promulgated new regulations to reduce the potential effects on the public health and welfare effects caused by the regulated pollutants.

Included in these regulations are emission requirements for particulates, fugitive ash, opacity, hydrogen chloride (HCl), sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), dioxins/furans and trace metals including lead (Pb), cadmium (Cd) and mercury (Hg). In addition to the emission limits, there are requirements for operating practices and emission monitoring and reporting of these named pollutants.

3.6.2 Implementation Concerns

3.6.2.1 Flow Control

In order to ensure the economic viability of waste-to-energy systems, mechanisms need to be put into place (such as long-term contracts with MSW haulers) to assure that daily MSW throughput goals are met. Such flow control mechanisms should be discussed during the design phase of the facility, and implemented by the time the new incineration facility becomes operational.

3.6.2.2 Social/Political Considerations

Focused opposition can make it difficult for decision makers which are in favor of waste-to-energy systems to stand their ground. The concerns raised have included: negative environmental impacts; facility shutdowns due to new environmental regulations and/or flow control; and the oversizing of some earlier facilities which created a disincentive for materials recycling.

Section 4.0
Landfill Disposal Options

4.1 INTRODUCTION

The purpose of this section is to present and analyze the existing MSW disposal capacity available at the White Street Landfill and to determine the potential capacity should the adjacent property be utilized for expansion. The requirements for a new lined landfill owned and operated by the City has also been reviewed, as well as landfill disposal options not controlled by the City.

This section has been prepared to provide the City with an evaluation of landfill options that can meet the MSW disposal needs for a minimum 20 year period following closure of Phase III of the White Street Landfill. For this report, Phase III is assumed to reach capacity in 2007.

4.2 EXISTING WASTE CAPACITY

The White Street Landfill, which is located in the northeast quadrant of the City, is used for the disposal of MSW, C&D, and LCID waste generated within the City and portions of the County. The lined Phase III unit, which is currently operating under Solid Waste Permit No. 41-12, is permitted to receive solid waste as defined in 15A NCAC 13 B .0101 (36).

At present, the facility property covers an area of approximately 850 acres and is divided into three phases. Phase I is an 85-acre unlined site that stopped receiving waste prior to 1978. Phase II consists of approximately 120 unlined acres which closed December 31, 1997, in accordance with State requirements. The Phase III area consists of a total of 52 acres subdivided into three cells. The first cell of 25.5 acres was placed into operation December 1997 with an estimated capacity of 1.7 million cubic yards (CY). The second cell, with an area of 14 acres has recently been constructed and will be placed into operation by June 2001. Construction of the 12 acre Cell 3 is scheduled for summer of 2002, with a projected operation date of March 2003. Total capacity of Phase III is approximately 4,700,000 CY of waste, which, at the projected filling rate of about 265,000 tons per year (reference Section 2) should provide for disposal through the year 2007.

Recorded waste density in Phase III has substantially exceeded original estimates. Recent evaluations indicate densities averaging over 1,180 pounds per ton. At this higher density, Phase III may reach capacity as late as 2009. Due to the many variables

associated with landfill life calculations (waste type, daily tonnage, compaction equipment, etc.), 2007 has been used as the year when Phase III will reach capacity.

Future MSW disposal requirements projected for the City during the planning period are approximately 6,000,000 tons of disposal capacity as indicated in Table 2-2 of Section 2.0. In light of these future disposal projections, it is evident that maintaining the status quo associated with landfilling activities within Phase III will not suffice in meeting the future landfill disposal requirements for the City. Three scenarios which could provide for the future MSW disposal needs of the City are described below.

4.3 EXPANSION POTENTIAL

Through acquisition of adjacent property, there is potential for developing additional lined landfill capacity at the White Street Landfill. Preliminary estimates indicate that the areas, designated as Phases IV and V (see Figure 4-1) could provide 13,000,000 CY of airspace, which would allow for more than 20 years of additional disposal capacity. Figure 4-2 depicts potential ultimate development of the White Street Landfill, achieved by combining the waste areas of Phases III, IV, and V into one large waste unit.

As is shown in Table 4-1, the expansion option has the potential for providing the City with adequate disposal capacity for the entire planning period.

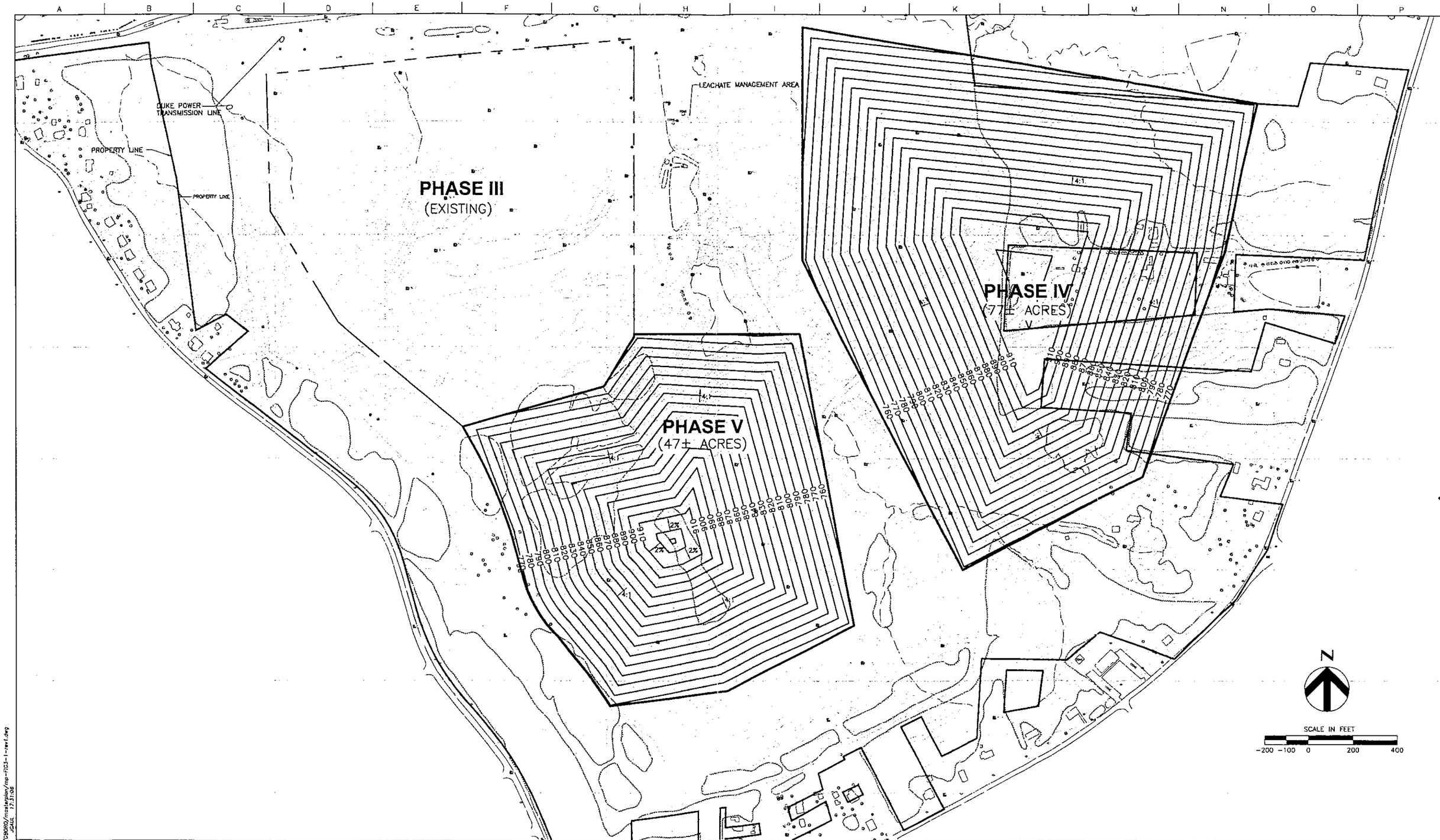
Table 4-1
Expansion Option

Phase	Airspace (CY)	Waste Tonnage [1]
IV	8,000,000	4,720,000
V	5,000,000	2,950,000
Total	13,000,000	7,670,000

(1) Based on 1,180 lbs of MSW per cubic yard of airspace (1999 calculation)

4.4 NEW FACILITY

Current efforts around the State to site new landfills have met with extensive public oppositions, therefore, the establishment of a new MSW landfill in the City/County area will require aggressive planning, design, and permitting efforts. Activities for this option should be initiated immediately to have a new facility in operation by 2007 when the



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Issue No.	Description	Date	Drawn	Chkd.	Resp. Engr.	Proj. Mgr.

HDR

HDR Engineering, Inc. of the Carolinas
Suite 1400
128 S. Tryon Street
Charlotte, NC 28202-5001
(704) 338-6700

BAR LENGTH OR TRIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY.

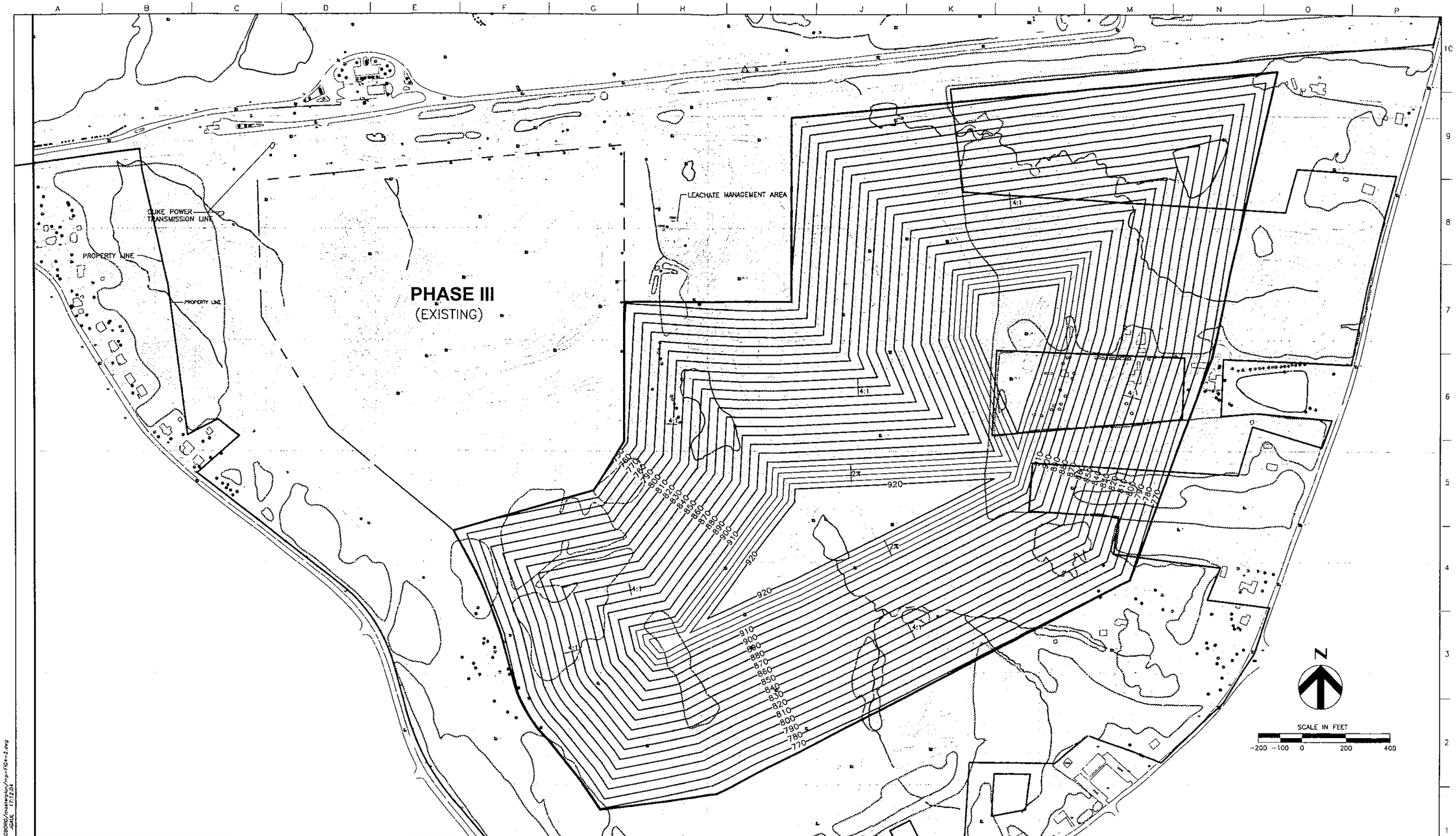
Project Manager: J.C. READLING, P.E.
Designed: E.L. SHUFFLER, P.E.
Designed:
Checked:
Drawn: J. GAUL

WHITE STREET SANITARY LANDFILL
PHASE IV AND V EXPANSION
SOLID WASTE MANAGEMENT
STUDY-UPDATE

CITY OF GREENSBORO NORTH CAROLINA

PHASE IV AND V
CONCEPTUAL FINAL GRADE

Date: APRIL 2001
Scale:
Project No.: 06770-060-018-02
File Name: mp-FIG3-1-rev1.DWG
Drawing No.: FIG. 4-1
Issue: A



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Issue No.	Description	Date	Drwn.	Chkd.	Resp. Engr.	Proj. Mgr.

HDR

HDR Engineering, Inc. of the Carolinas
Suite 1400
128 S. Tryon Street
Charlotte, NC 28202-5001
(704) 338-6700

THE LENGTH OF ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY.

Project Manager: J.C. READLING, P.E.
Designed: E.L. SHUFFLER, P.E.
Designed:
Checked:
Drawn: J. GAUL

WHITE STREET SANITARY LANDFILL
PHASE IV AND V EXPANSION
SOLID WASTE MANAGEMENT
STUDY - UPDATE

CITY OF GREENSBORO NORTH CAROLINA

ULTIMATE DEVELOPMENT
CONCEPTUAL FINAL GRADES

Date	Project No.	Drawing No.	Issue
APRIL 2001	06770-060-018-02	FIG. 4-2	A
Scale	File Name: MP-FIG4-2.DWG		

Phase III MSW capacity will be exhausted. Because of the long development time associated with a new landfill, the facility size should be established to provide a minimum of 20 years of MSW disposal capacity. From the date provided in Section 2.0, a new landfill will need capacity to dispose of approximately 6.0 million tons of waste.

To determine the amount of land required for a new, 20-year facility, the following assumptions were made:

- The new landfill would be developed in a series of four cells.
- Each cell would have a square shape at ground level.
- Each cell would be constructed as truncated pyramids on level ground with no excavation. The flat peak would be 2 acres in size.
- The sideslopes of each cell would be 4 horizontal to one vertical above ground (4:1).
- Final cover airspace requirements were neglected.

Using these assumptions, the total land required for the lined units was calculated to be approximately 160 acres with each cell averaging approximately 5 years of landfill life. To allow for buffer requirements and miscellaneous site support facilities such as leachate treatment impoundments, maintenance facilities, borrow area and storm water management facilities, a total site area of 400 acres was estimated.

The landfill siting criteria as outlined in the NCDENR regulations are summarized in Table 4-2. Figure 4-3 indicates the incorporated municipalities, and airport locations with the County.

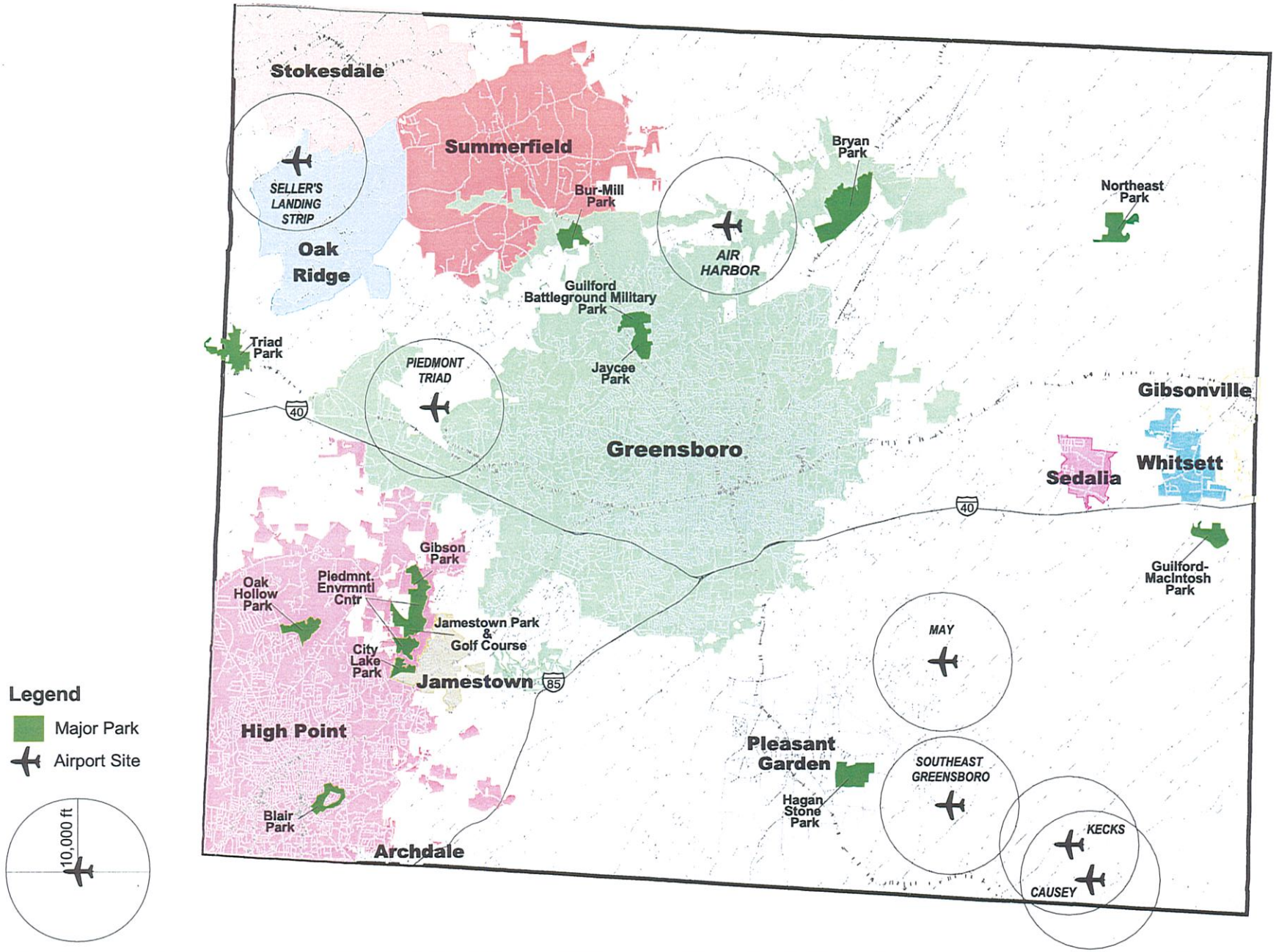

Figure 4-3

Data Sources:
Guilford County
(County Boundary, Municipal Boundaries, Roads)
US Bureau of the Census, 2000
(Rail Roads)
Bureau of Transportation Statistics , 2000
(Airport Sites)

Preliminary Criteria
Solid Waste Management Study

HDR Engineering, Inc. of the Carolinas

Table 4-2
Subtitle D Landfill Siting Criteria

Category	Requirements
Airport Safety	Greater than 5,000 feet (FT) from runway used by piston aircraft. Greater than 10,000 FT from runway used by turbo-jet aircraft. Five-Mile Notification Zone.
Floodplains	Must not restrict flow of 100-year flood.
Wetlands	New landfills are prohibited in wetlands.
Fault Areas	Greater than 200 FT from fault displaced in Holocene time.
Seismic Zone	Must be designed to withstand maximum horizontal acceleration expected from the seismic impact zone.
Unstable Areas	Measures required to ensure structural integrity of the landfill components.
Cultural Resources	Cannot damage or destroy an archaeological or historical property.
State Nature and Historic Preserve	New MSWLF units may not have an adverse impact on any lands included in the State Nature and Historic Preserve.
Water Supply Watersheds	New MSWLF units are prohibited in the critical area of a water supply watershed or in the watershed for a stream classified as WS-1, in accordance with the rules codified at I5A NCAC 2B .0200- "Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina." New MSWLF units that will discharge leachate to surface waters at the facility and must obtain a NPDES permit shall not be located within watersheds classified as WS-II or WS-III, in accordance with the above mentioned rules.
Endangered and Threatened Species	New MSWLF units shall not jeopardize the existence of endangered or threatened species or result in the destructions or adverse modification of a critical habitat.
Vertical Separation Requirements	New MSWLF units shall be constructed so that the post settlement bottom elevation of the base liner system is a minimum of four FT above seasonal high groundwater table and/or bedrock.
Horizontal Separation Requirements	More than 300 FT from property line. More than 500 FT from private residences and wells. More than 50 FT from any stream, river, or lake.

4.5 OUT-OF-COUNTY MSW LANDFILL

Under this scenario, it is assumed that all public MSW landfill disposal operations at the White Street Landfill will cease upon completion of the Phase III area, after which time all of the City's MSW requiring landfill disposal would be hauled to a landfill facility located out of the County. The following sections provide a listing of public and private landfill facilities located in the Piedmont area of North Carolina.

4.5.1 Public Facilities

- Kersey Valley Landfill, High Point, NC owned and operated by the City of High Point.
- Hanes Mill Road Landfill, Winston-Salem, NC owned and operated by the City of Winston-Salem.
- The Rockingham County Landfill, Wentworth, NC owned and operated by Rockingham County.
- The Davidson County Landfill, Lexington, NC owned and operated by Davidson County.
- The Austin Quarters Landfill, Saxapahaw, NC owned by Alamance County and operated privately.

4.5.2 Private Facilities

- The Charlotte Motor Speedway Landfill, Concord, NC operated by Allied/BFI Waste.
- The Uwharrie Environmental Regional Landfill, near Troy, NC is owned by Montgomery County and operated by Uwharrie Environmental.
- The Upper Piedmont Regional Landfill is located in Person County, owned and operated by Addington Environmental.

The Piedmont Landfill in Kernersville did not receive local government approval for expansion and will not be able to accommodate the City's waste throughout the planning period.

5.1 INTRODUCTION

This section reviews the hauling options associated with the various disposal alternatives reviewed. For disposal sites in close proximity to the City, direct haul in packer trucks is possible. Long-haul options would utilize Transfer Station(s) with large capacity transfer trucks.

5.2 DIRECT HAUL

Direct haul, or what is sometimes referred to as primary haul, is defined as hauling waste from the point where the generator passes (transfers) waste to a hauler directly to the management or disposal site. Direct haul systems utilize the original collection vehicle (often a packer truck) to transport the collected materials directly to their final destination point. Direct haul systems which utilize packer truck collection vehicles have, on average, the capacity to move a 5 to 10 ton payload of waste from the point of collection directly to the management or disposal site. Direct haul is a term that is also used when generators of waste take their waste directly to the management or disposal site (i.e. there is no transfer of waste from generator to hauler). When the one-way hauling distance to the management or disposal site is twenty miles or less, direct haul is likely to be the most cost effective transfer system available.

5.3 SECONDARY HAUL

Secondary haul is defined as hauling waste in a vehicle which can accommodate more than one collection vehicle's payload; secondary haul systems therefore involve the transfer of waste from the original collection vehicles to vehicles which have the capacity for carrying larger payloads of waste.

When secondary haul is the method utilized to move waste to its final destination, facilities are needed where the wastes can be transferred from the primary collection vehicle to the secondary haul vehicle; such facilities are known as transfer stations. Transfer stations are centralized facilities where waste is unloaded from several small collection vehicles and loaded into a larger vehicle for hauling.

Transfer stations have been used for several decades. The number of transfer stations has increased substantially in recent years because landfill sites are located at greater distances away from collection areas. Transfer stations have gained widespread acceptance as a method of reducing transport costs. Other potential advantages include the following:

- Better haul roads for collection vehicles,
- Greater traffic control,
- Fewer trucks on the landfill haul route, and
- Improved landfill-operating efficiency.

A transfer station can be an effective means of lowering overall haul costs when sanitary landfill locations are remote. Most transfer stations are designed to handle municipal solid waste hauled by private or municipal collectors. A variety of collection vehicles may use a transfer facility, and station design features must be tailored to accommodate the types of vehicles expected. Transfer station operation may also be integrated with other waste management options, such as recycling and composting operations.

Highway transportation is the most common route utilized for transporting waste from a transfer station to its final destination point. Transfer station systems which utilize semi-tractor and trailer vehicles have, on average, the capacity to move a 20-ton payload of waste from the transfer station site to the management or disposal site.

Rail haul of waste is a concept which is gaining more attention, and there are now a number of rail served transfer station and disposal site combination projects underway. Transfer station systems which utilize specially adapted box cars have, on average, the capacity to move a 100-ton payload of waste from the transfer station site to the management or disposal site. Hauling distance, the quantity of wastes to be transported, and accessibility to existing transportation infrastructures are all factors which can impact both the cost effectiveness of a secondary haul transfer system.

6.1 INTRODUCTION

The purpose of this section is to provide a comparison of capital and operating costs for the MSW disposal alternatives described previously. Costs associated with the disposal of C&D, LCID, and yard wastes have not been considered in the comparison of alternatives.

6.2 PRELIMINARY RESOURCE RECOVERY COST ANALYSIS

Two different scenarios have been included in the preliminary analysis of the costs associated with the development of a resource recovery facility to serve the City's disposal needs. Both scenarios involve sizing the facility to accommodate only the publicly-controlled portion of the MSW.

The first scenario involves the implementation of a 1,000 TPD mass-burn, waste-to-energy facility. It was assumed that the facility would be financed with publicly-issued revenue bonds but would be designed, constructed and operated (under a 20-year operating contract) by a full service vendor. To estimate the "tipping fees" that would be charged by a full service vendor, HDR analyzed the typical development costs, operations and maintenance costs, potential revenues and financing costs. Based on the analysis, HDR estimates that the tipping fee for a 1,000 TPD mass burn facility for the City would have a present value cost of over $100 per ton.

The second scenario involves the implementation of a 1,000 TPD waste gasification facility. In this case, it was assumed that the system would also be designed, constructed, and operated by a full-service vendor. To estimate the potential tipping fees associated with this scenario, HDR once again analyzed the development costs, operations, and maintenance costs, revenues and financing costs associated with this facility. The results of this preliminary analysis indicate a present value cost in excess of $120.00 per ton.

6.3 WHITE STREET LANDFILL EXPANSION

The expansion of the White Street Landfill includes the development of an approximate 80 acre unit designated Phase IV and an approximate 50 acre unit designated Phase V. Existing facilities including roadways, scales, scalehouse, administrative offices, and maintenance facility will be utilized in the operation of Phases IV and V. MSW will be direct hauled to the facility from the waste generation areas.

To estimate the cost for MSW disposal on a per ton basis, HDR analyzed the typical development costs, operations and maintenance costs, closure/post-closure costs and financing

costs. Based on the analysis, the cost for continued disposal at the White Street Landfill would be approximately $20.00 per ton in present value dollars.

6.4 NEW LANDFILL SITE

The development of a new landfill facility will require the purchase of approximately 400 acres and will include the construction of all facilities such as roadways, scales, scalehouses, administrative offices, and maintenance facilities in addition to the components associated with the landfill unit itself. A new facility sized to provide MSW disposal capacity for a 20-year planning period will require a total of 160 acres of lined areas. For the cost models, it was assumed that the new facility would be located within the County; therefore, not requiring a transfer station and secondary hauling. It is also assumed that the White Street Landfill facility will remain open for the disposal of C&D and LCID wastes, and for the processing and disposal of yard wastes.

To estimate the cost for MSW disposal on a per ton basis, HDR analyzed the typical development costs, operations and maintenance costs, closure/post-closure costs and financing costs. Based on the analysis, the cost per ton for disposal at a new landfill in the County would be approximately $25.00 per ton in present value dollars.

6.5 OUT-OF-COUNTY DISPOSAL

The evaluation of available MSW disposal alternatives located outside of the County area indicates that secondary hauling via transfer station will be required. Cost associated with secondary haul is in addition to disposal costs. As discussed previously, the options for MSW disposal at a landfill located outside the County will most likely be limited to private facilities. Publicly owned and operated landfills within a reasonable haul distance have established service areas with little incentive to expand. The exception may be a public facility that has had waste diverted by the private sector and is in need of additional revenue.

In order to estimate the cost of out of County disposal, a cursory review of other communities' disposal contracts was performed. The following information relates to private disposal contracts of some municipal and county governments within the Piedmont area of North Carolina. This information was derived from discussions with the respective City or County staff and not taken from the actual contract.

- Mecklenburg County – Mecklenburg County contracts for disposal at the privately owned Charlotte Motor Speedway (CMS) Landfill. The current tipping fee paid by the County is $34.50 per ton for the first 300,000 tons with a 25 percent reduction in tipping fee for

additional tonnage. The County is currently renegotiating the disposal contract. The future contract may be as low as $18 per ton. Waste is direct-hauled to the landfill. The anticipated low tipping fee is a result of the County's recent permitting of a new MSW landfill facility. If the existing contract with BFI cannot be successfully renegotiated, the County will begin MSW disposal operations at their new facility.

- City of Durham – The City of Durham pays about $25.50 per ton to a private company to transfer and dispose of their waste in a private landfill in Virginia. An additional fee of approximately $4.00 per ton is paid to the contractor for operating the City-owned transfer station. Therefore, their total disposal cost is in the range of $29.00 per ton, not including the capital cost of the transfer station.

- Wake County – The North Wake Landfill is publicly owned and privately operated. The County pays $29.00 per ton for waste direct-hauled to the landfill. Much of the waste collected in southern Wake County is not direct hauled to the landfill. Instead, it is hauled to a transfer station in Feltonsville where a private company transfers it to the North Wake Landfill. Wake County pays an additional $12.00 per ton for waste hauled through the transfer station. The $12.00 per ton does not include operating or capital cost of the transfer station.

- City of Gastonia – The City of Gastonia pays about $28.00 per ton for waste hauled to a privately owned transfer station. The private contractor then transfers the waste to a landfill in South Carolina for disposal.

- Moore County – The tipping fee for waste hauled to the privately owned transfer station within Moore County is approximately $31.00 per ton. The waste is then hauled by private contractor to a privately operated landfill in Montgomery County. Some of the waste managed in Moore County is direct-hauled to the landfill. The tipping fee at the landfill for direct-hauled waste is about $23.50.

If the City elected to dispose of waste outside the County, it is unlikely that a landfill facility would be located close enough to the City that trucks would direct-haul. Considering the contractual arrangements above, the transfer and disposal costs would likely range between $28.00 and $45.00 per ton were the City to privatize transfer and disposal of waste to an out of County facility.

Estimates were also prepared to evaluate City-owned transfer station(s) and secondary hauling. For the purpose of comparison to the other disposal options, it has been assumed that a tipping fee between $16.00 and $25.00 per ton could be negotiated with a private facility. The cost per ton associated with transferring waste to a disposal facility approximately 80 miles from Greensboro would be approximately $18.00 per ton in present value dollars. Therefore, the total cost for transfer and disposal would likely range between $34.00 and $43.00 per ton ($16 to $25

disposal cost plus ~$18 transfer cost). This range is consistent with the range cited above for other communities.

6.6 CONCLUSIONS

6.6.1 Resource Recovery Options

The recovery of energy from municipal solid waste through the implementation of a waste-to-energy facility is an option that is proven from a technical standpoint. The major concerns associated with this option involve the areas of cost, changing regulations, and public perception. The projected costs for the waste-to-energy option are significantly higher than those projected for the landfill-based options of either expanding existing landfills or developing a new multi-jurisdictional landfill.

Changing regulations continue to hamper the implementation of new facilitates and have caused a number of existing facilities to close in recent years. Flow control regulations promulgated by the US Supreme Court have caused a number of facilities to close due to reduced waste volumes and increased tipping fees (due to lack of flow control) and increased capital costs (due to the need for additional air pollution control equipment).

Finally, waste-to-energy facilities continue to have a negative public perception despite the obvious natural resource, economic, and environmental benefits they provide by displacing imported non-renewable fossil fuels burned in less efficient, more polluting industrial boilers.

6.6.2 Landfill Disposal Options

It appears from the analysis of existing MSW landfill disposal options, continued development of additional landfill phases at the White Street Landfill is the most economical disposal option for the City. From a cost basis, the City should continue the development of the landfill including Phases IV and V with consideration towards ultimate capacity.

In addition to the higher costs associated with out-of-county disposal option, there are uncertainties regarding the availability of future private MSW landfill capacity in or near the City. The City could obtain more accurate information regarding

the long-term availability of disposal capacity, as well as the tipping fees that would be charged, through the development and issuance of a Request for Proposals.

APPENDIX

Cost Models

White Street Landfill Expansion

City of Greensboro, North Carolina
Subtitle D Landfill Expansion
Cost Estimate (Avg 285,000 TPY)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
City Tonnage	168,360	169,641	170,922	172,142	173,362	174,643	175,863	177,083	178,303	179,523	180,804	182,085	183,366	184,647	185,928	187,209	188,490	189,771	191,052	192,333
Non-City Tonnage	107,640	108,459	109,278	110,058	110,838	111,657	112,437	113,217	113,997	114,777	115,596	116,415	117,234	118,053	118,872	119,691	120,510	121,329	122,148	122,967
Total Tonnages	276,000	278,100	280,200	282,200	284,200	286,300	288,300	290,300	292,300	294,300	296,400	298,500	300,600	302,700	304,800	306,900	309,000	311,100	313,200	315,300
CAPITAL COSTS																				
Pre Development Costs	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400
Site Development Costs	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300
Equipment Costs	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300
Cell Costs																				
Cell 1 Construction Cost	2,618,200	2,618,200	2,618,200	2,618,200	2,618,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell 1 Closure	969,200	969,200	969,200	969,200	969,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell 2 Construction Cost	0	0	0	0	0	2,138,700	2,138,700	2,138,700	2,138,700	2,138,700	0	0	0	0	0	0	0	0	0	0
Cell 2 Closure	0	0	0	0	0	749,100	749,100	749,100	749,100	749,100	0	0	0	0	0	0	0	0	0	0
Cell 3 Construction Cost	0	0	0	0	0	0	0	0	0	0	3,307,500	3,307,500	3,307,500	3,307,500	3,307,500	0	0	0	0	0
Cell 3 Closure	0	0	0	0	0	0	0	0	0	0	1,203,500	1,203,500	1,203,500	1,203,500	1,203,500	0	0	0	0	0
Cell 4 Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,874,200	2,874,200	2,874,200	2,874,200	2,874,200
Cell 4 Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,036,900	1,036,900	1,036,900	1,036,900	1,036,900
OPERATING COSTS																				
Landfill Operation Costs	3,561,600	3,668,500	3,778,500	3,891,900	4,008,600	4,128,900	4,252,800	4,380,300	4,511,800	4,647,100	4,786,500	4,930,100	5,078,000	5,230,400	5,387,300	5,548,900	5,715,400	5,886,800	6,063,400	6,245,300
Post Closure Sinking Fund	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300
TOTAL COSTS																				
Annual Costs	8,737,300	8,844,200	8,954,200	9,067,600	9,184,300	8,605,000	8,728,900	8,891,100	9,022,600	9,157,900	10,920,500	11,064,100	11,212,000	11,364,400	11,766,600	11,328,300	11,494,800	11,666,200	11,842,800	12,024,700
Cost/Ton	$31.66	$31.80	$31.96	$32.13	$32.32	$30.06	$30.28	$30.63	$30.87	$31.12	$36.84	$37.07	$37.30	$37.54	$38.60	$36.91	$37.20	$37.50	$37.81	$38.14
PRESENT VALUE COSTS																				
Annual Costs	7,025,900	6,858,200	6,695,700	6,538,600	6,386,400	5,770,100	5,644,400	5,544,100	5,425,400	5,310,200	6,106,400	5,965,900	5,830,000	5,698,400	5,689,500	5,282,200	5,168,600	5,058,500	4,951,800	4,848,500
Cost/Ton	$25.46	$24.66	$23.90	$23.17	$22.47	$20.15	$19.58	$19.10	$18.56	$18.04	$20.60	$19.99	$19.39	$18.83	$18.67	$17.21	$16.73	$16.26	$15.81	$15.38
Avg Cost/Ton	$19.59																			

City of Greensboro, North Carolina Subtitle D Landfill Expansion Cost Estimate (Avg 285,000 TPY)	Unit	13-Jun-01 No. Units	06:05 PM Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Site Information																										
Landfill Capacity (TPD)																										
Total Site Acreage (Site AC)																										
Landfill Unit Acreage (AC)	100																									
Distance To Leachate Tmt Facility (Miles)	2																									
Site Life (Yrs)	20																									
Cell Life (Yr 1)	1	Cell Life (Yrs 3-20)		5																						
Equipment Life (Yrs 1-14)	7	Equipment Life (Yrs 15-20)		7		10																				
Equipment Salvage Value (%)	20.00%	Yrs. for financing Pre-Dev. Costs		23																						
Average Fill Rate (TPD)		Yrs. for repayment Pre-Dev. Costs		20																						
Assumed Inflation Rate	3.00%	Yrs. for financing Site-Dev. Costs		21																						
Assumed Borrow Rate	6.00%	Yrs. for repayment Site-Dev. Costs		20																						
Assumed Discount Rate	3.70%	Yrs. for financing Cell 1 Const.		5																						
Assumed Invest. Rate (sinking fund)	5.75%	Yrs. for repayment Cell 1 Const.		5																						
Financing Cost Factor (%)	10.00%	Yrs. for financing Cells 2 Const.		5																						
		Yrs. for repayment Cells 2 Const.		5																						
Contingency	10.00%	Yrs. for financing Cell 3 Const.		5																						
		Yrs. for repayment Cells 3 Const.		5																						
		Yrs. for financing Cell 4 Const.		5																						
		Yrs. for repayment Cells 4 Const.		5																						
Pre Development Costs																										
Land	AC	40	25000	1,000,000	1,159,300																					
Engineering, Legal & Administrative	LS	1	500000	500,000	579,600																					
Permitting and Licensing	LS	1	500000	500,000	579,600																					
Sub-Total Pre Development Costs				2,000,000	2,318,500																					
Contingency				200,000	231,900																					
Total Pre-Development Costs				2,200,000	2,550,400																					
Debt Service						238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400	238,400
Site Development Costs																										
Site Clearing & Grubbing	AC	10	3,500	35,000	40,600																					
Water Supply Well	LS	0	10,000	0	0																					
Fuel Tanks	LS	0	50,000	0	0																					
Buildings				0	0																					
Scalehouse/Office	LS	0	300,000	0	0																					
Maintenance Facilities	SF	0	200	0	0																					
Stormwater Management																										
Storm Drainage System	LS	1	60,000	60,000	69,600																					
Sedimentation Basin	LS	1	40,000	40,000	46,400																					
Leachate Management																										
Leachate Pretreatment System	LS	1	500,000	500,000	579,600																					
Pump Station To Tank	LS	0	15,000	0	0																					
Pump Station To WWTP	LS	0	25,000	0	0																					
Force Main	LF	0	10	0	0																					
Scale (100,000 lb cap. and rel. controls)	EA	0	50000	0	0																					
Site Improvements																										
Access Road (Gravel)	LF	2500	40	100,000	115,900																					
Perimeter Fence w/ Gate	LF	5000	7.5	37,500	43,500																					
Landscaping Entrance	LS	0	0	0	0																					
Subtotal - Landfill Development Construction Costs				772,500	895,600																					
Design/Construction Management	% Constr. Costs	772,500	12%	92,700	107,500																					
Subtotal Initial Landfill Development Costs				865,200	1,003,100																					
Total Initial Landfill Development Costs				865,200	1,003,100																					
Landfill Development Costs+Contingency				951,700	1,103,400																					
Financed Landfill Development Costs				1,046,900	1,213,700																					
Debt Service						108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300	108,300

City of Greensboro, North Carolina
Subtitle D Landfill Expansion
Cost Estimate (Avg 285,000 TPY)

13-Jun-01 06:05 PM

	Unit	No. Units	Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Equipment Costs																										
Landfill Equipment																										
Caterpillar 836 Compactor	EA	3	325,000	600,000		716,400							881,100							1,083,700						
Caterpillar D400D Off Road Truck	EA	3	196,000	500,000		597,000							734,300							903,100						
Caterpillar D8R Dozer	EA	1	426,000	426,000		508,700							625,600							769,400						
Caterpillar D6R Tractor	EA	1	272,000	272,000		324,800							399,400							491,300						
Caterpillar 140H Grader	EA	1	200,000	200,000		238,800							293,700							361,200						
Caterpillar 320 Excavator, Track	EA	1	205,000	205,000		244,800							301,000							370,300						
Caterpillar 214 Excavator, Wheel	EA	0	145,000	0		0							0							0						
Caterpillar 936 Loader, Wheel	EA	1	245,000	245,000		292,500							359,800							442,500						
Caterpillar 631 Scraper	EA	2	700,000	1,400,000		1,671,700							2,055,900							2,528,600						
Industrial Wheel Tractor	EA	0	30,000	0		0							0							0						
Mowing Tractor	EA	1	15,000	15,000		17,900							22,000							27,100						
Truck w/ Hydro-Seeder	EA	1	75,000	75,000		89,600							110,100							135,500						
Water Truck	EA	1	50,000	50,000		59,700							73,400							90,300						
4" Water Pump	EA	1	15,000	15,000		17,900							22,000							27,100						
Maintenance Equipment																										
Fuel and Service Truck	EA	1	50,000	50,000		59,700							73,400							90,300						
Power Sweeper	EA	0	16,000	0		0							0							0						
Shop Tools and Equipment	LS	2	20,800	41,600		49,700							61,100							75,100						
Landfill Vehicles																										
Four Wheel Drive	EA	1	30,000	30,000		35,800							44,100							54,200						
Pick-up Truck	EA	2	25,000	50,000		59,700							73,400							90,300						
Utility vehicle (Kaw. mule)	EA	1	5,000	5,000		6,000							7,300							9,000						
Tractor Trailer	EA	1	80,000	80,000		95,500							117,500							144,500						
Subtotal Equipment Costs				4,259,600		5,086,200							5,256,960							6,465,980						
Contingency	% of Equip. Costs	4,259,600	10%	426,000		508,600							525,700							646,600						
Total Equipment Costs				4,685,600		5,594,800							5,782,700							7,112,600						
Debt Service					1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300	
Landfill Operation Costs																										
Labor:																										
Landfill Manager		1	60,000	60,000																						
Asst. Landfill Manager		1	50,000	50,000																						
Shop Mechanic		2	45,000	90,000																						
Equipment Operator		9	40,000	360,000																						
Scale Operator		3	30,000	90,000																						
Laborer/Spotters		1	29,500	29,500																						
Litter Control		2	25,000	50,000																						
Caretaker		0	25,000	0																						
Office Staff		1	40,000	40,000																						
Total Staff		20		769,500																						
Employee Benefits	% of Labor Costs	769,500	40%	307,800																						
Equipment O&M	% of Equip. Costs	4,685,600	30%	1,405,700																						
Utilities (Electricity, Water)	LS	1	15,000	15,000																						
Groundwater Monitoring	LS	1	30,000	30,000																						
Leachate Management																										
Leachate Monitoring	LS	1	4,000	4,000																						
Leachate Pump	GAL	4,500,000	0.01	45,000																						
Leachate Treatment	1,000 GAL	4,500	3.25	14,600																						
Aerators O&M	LS	1	20,000	20,000																						
Misc. O&M	FILL AC	100	1,000	100,000																						
Subtotal Operation Costs				2,711,600																						
Contingency	% of Op. Costs	2,711,600	10%	271,160																						
Total Operation Costs				2,982,800																						
Annual Cost					3,561,600	3,668,500	3,778,500	3,891,900	4,008,600	4,128,900	4,252,800	4,380,300	4,511,800	4,647,100	4,786,500	4,930,100	5,078,000	5,230,400	5,387,300	5,548,900	5,715,400	5,886,800	6,063,400	6,245,300	

City of Greensboro, North Carolina
Subtitle D Landfill Expansion
Cost Estimate (Avg 285,000 TPY)

13-Jun-01 06:05 PM

	Unit	No. Units	Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cell 1 Construction Cost	30	Acres																								
Site Clearing & Grubbing	Fill AC	0	3,500	0	0																					
Earthwork and Embankment	CY	300,000	6.00	1,800,000	2,086,700																					
Subgrade Preparation	Fill AC	30	10,000	300,000	347,800																					
Clay Liner (10^(-7): 2 Ft)	CY	96,800	15.00	1,452,000	1,683,300																					
HDPE Liner - Single 60 mil	SF	1,306,800	0.50	653,400	757,500																					
Leachate Collection System	AC	30	11,500	345,000	399,900																					
Drainage Layer (Geonet)	SF	1,306,800	0.50	653,400	757,500																					
Liner Cover (2 Ft)	CY	96,800	13.00	1,258,400	1,458,800																					
Perimeter Road (Gravel)	LF	6,000	40	240,000	278,200																					
Seeding/ E&S Controls	AC	30	1,800	54,000	62,600																					
Storm Drainage System	LS	1	216,000	216,000	250,400																					
Miscellaneous	LS	1	750,000	750,000	869,500																					
Subtotal - Direct Construction Costs				7,722,200	8,952,200																					
Design/Construction Management	%	7,722,200	6%	463,300	537,100																					
QA/QC	%	7,722,200	6%	463,300	537,100																					
Subtotal Cell-1 Construction Cost				8,648,800	10,026,400																					
Contingency				864,900	1,002,600																					
Total Cell-1 Construction Cost				9,513,700	11,029,000																					
Debt Service						**2,618,200**	**2,618,200**	**2,618,200**	**2,618,200**	**2,618,200**																
Cell 1 Closure	30	Acres																								
Closure Preparation	FILL AC	30	4,000	120,000							166,100															
Clay Liner (1.5 Ft)	CY	72,600	10.00	726,000							1,005,000															
Synthetic Liner	SF	1,306,800	0.40	522,700							723,500															
Native Soil - 1 ft	CY	48,400	3.50	169,400							234,500															
Topsoil - 1 ft.	CY	48,400	6.00	290,400							402,000															
Seeding	FILL AC	30	1,800	54,000							74,700															
Gas Collection/Flaring System	FILL AC	30	13,500	405,000							560,600															
Site Drainage	FILL AC	30	10,000	300,000							415,300															
Miscellaneous	LS	1	600,000	600,000							830,500															
Subtotal - Direct Construction Costs				3,187,500							4,412,245															
Design/Construction Management	%	3,187,500	6%	191,300							264,800															
QA/QC	%	3,187,500	6%	191,300							264,800															
Subtotal - Cell 1 Closure Costs				3,570,100							4,941,853															
Contingency				357,000							494,200															
Total Cell 1 Closure Costs				3,927,100							5,436,000															
Sinking Fund					**969,200**	**969,200**	**969,200**	**969,200**	**969,200**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Cell 2 Construction Cost	20	Acres																								
Site Clearing & Grubbing	Fill AC	0	3,500	0						0																
Earthwork and Embankment	CY	200,000	6.00	1,200,000						1,612,700																
Subgrade Preparation	Fill AC	20	10,000	200,000						268,800																
Clay Liner (10^(-7): 2 Ft)	CY	64,500	15.00	967,500						1,300,200																
HDPE Liner - Single 60 mil	SF	871,200	0.50	435,600						585,400																
Leachate Collection System	AC	20	11,500	230,000						309,100																
Drainage Layer (Geonet)	SF	871,200	0.47	409,500						550,300																
Liner Cover (2 Ft)	CY	64,500	13.00	838,500						1,126,900																
Perimeter Road (Gravel)	LF	12,000	40	480,000						645,100																
Seeding/ E&S Controls	AC	20	1,800	36,000						48,400																
Storm Drainage System	LS	1	144,000	144,000						193,500																
Miscellaneous	LS	1	500,000	500,000						672,000																
Subtotal - Direct Construction Costs				5,441,100						7,312,400																
Design/Construction Management	%	5,441,100	6%	326,500						438,800																
QA/QC	%	5,441,100	6%	326,500						438,800																
Subtotal Cell-2 Construction Cost				6,094,100						8,190,000																
Contingency				609,400						819,000																
Total Cell-2 Construction Cost				6,703,500						9,008,900																
Debt Service											**2,138,700**	**2,138,700**	**2,138,700**	**2,138,700**	**2,138,700**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

City of Greensboro, North Carolina Subtitle D Landfill Expansion Cost Estimate (Avg 285,000 TPY)	Unit	13-Jun-01 No. Units	06:05 PM Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cell 2 Closure	20	Acres																								
Closure Preparation	FILL AC	20	4,000	80,000																						
Clay Liner (1.5 Ft)	CY	48,400	10.00	484,000												128,400										
Synthetic Liner	SF	871,200	0.40	348,500												776,700										
Native Soil - 1 ft	CY	32,300	3.50	113,100												559,200										
Topsoil - 1 ft.	CY	32,300	6.00	193,800												181,500										
Seeding	FILL AC	20	1,800	36,000												311,000										
Gas Collection/Flaring System	FILL AC	20	13,500	270,000												57,800										
Site Drainage	FILL AC	20	10,000	200,000												433,300										
Miscellaneous	LS	1	400,000	400,000												320,900										
Subtotal - Direct Construction Costs				2,125,400												641,900										
Design/Construction Management	%	2,125,400	6%	127,500												3,410,700										
QA/QC	%	2,125,400	6%	127,500												204,600										
Subtotal - Cell 2 Closure Costs				2,380,400												204,600										
Contingency				238,000												3,819,900										
Total Cell 2 Closure Costs				2,618,400												381,900										
Sinking Fund																4,201,800										
											749,100	**749,100**	**749,100**	**749,100**	**749,100**											
Cell 3 Construction Cost	30	Acres																								
Site Clearing & Grubbing	Fill AC	0	3,500	0											0											
Earthwork and Embankment	CY	300,000	6.00	1,800,000											2,804,300											
Subgrade Preparation	Fill AC	30	10,000	300,000											467,400											
Clay Liner (10^(-7): 2 Ft)	CY	64,500	15.00	967,500											1,507,300											
HDPE Liner - Single 60 mil	SF	1,306,800	0.50	653,400											1,018,000											
Leachate Collection System	AC	30	11,500	345,000											537,500											
Drainage Layer (Geonet)	SF	1,306,800	0.47	614,200											956,900											
Liner Cover (2 Ft)	CY	64,500	13.00	838,500											1,306,400											
Perimeter Road (Gravel)	LF	18,000	40	720,000											1,121,700											
Seeding/ E&S Controls	AC	30	1,800	54,000											84,100											
Storm Drainage System	LS	1	216,000	216,000											336,500											
Miscellaneous	LS	1	750,000	750,000											1,168,500											
Subtotal - Direct Construction Costs				7,258,600											11,308,600											
Design/Construction Management	%	7,258,600	6%	435,500											678,500											
QA/QC	%	7,258,600	6%	435,500											678,500											
Subtotal Cell-3 Construction Cost				8,129,600											12,665,600											
Contingency				813,000											1,266,600											
Total Cell-3 Construction Cost				8,942,600											13,932,300											
Debt Service																**3,307,500**	**3,307,500**	**3,307,500**	**3,307,500**	**3,307,500**						
ell 3 Closure	30	Acres																								
Closure Preparation	FILL AC	30	4,000	120,000																						
Clay Liner (1.5 Ft)	CY	48,400	10.00	484,000																				223,200		
Synthetic Liner	SF	1,306,800	0.40	522,700																				900,400		
Native Soil - 1 ft	CY	48,400	3.50	169,400																				972,400		
Topsoil - 1 ft.	CY	48,400	6.00	290,400																				315,100		
Seeding	FILL AC	30	1,800	54,000																				540,200		
Gas Collection/Flaring System	FILL AC	30	13,500	405,000																				100,500		
Site Drainage	FILL AC	30	10,000	300,000																				753,400		
Miscellaneous	LS	1	600,000	600,000																				558,100		
Subtotal - Direct Construction Costs				2,945,500																				1,116,200		
Design/Construction Management	%	2,945,500	6%	176,700																				5,479,500		
QA/QC	%	2,945,500	6%	176,700																				328,700		
Subtotal - Cell 3 Closure Costs				3,298,900																				328,700		
Contingency				329,900																				6,136,900		
Total Cell 3 Closure Costs				3,628,800																				613,700		
Sinking Fund																								6,750,600		
																1,203,500	**1,203,500**	**1,203,500**	**1,203,500**	**1,203,500**						

City of Greensboro, North Carolina Subtitle D Landfill Expansion Cost Estimate (Avg 285,000 TPY)	Unit	13-Jun-01 No. Units	06:05 PM Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cell 4 Construction Cost	20	Acres																								
Site Clearing & Grubbing	Fill AC	0	3,500	0																0						
Earthwork and Embankment	CY	200,000	6.00	1,200,000																2,167,300						
Subgrade Preparation	Fill AC	20	10,000	200,000																361,200						
Clay Liner (10^(-7): 2 Ft)	CY	64,500	15.00	967,500																1,747,400						
HDPE Liner - Single 60 mil	SF	871,200	0.50	435,600																786,700						
Leachate Collection System	AC	20	11,500	230,000																415,400						
Drainage Layer (Geonet)	SF	871,200	0.47	409,500																739,600						
Liner Cover (2 Ft)	CY	64,500	13.00	838,500																1,514,400						
Perimeter Road (Gravel)	LF	12,000	40	480,000																866,900						
Seeding/ E&S Controls	AC	20	1,800	36,000																65,000						
Storm Drainage System	LS	1	144,000	144,000																260,100						
Miscellaneous	LS	1	500,000	500,000																903,100						
Subtotal - Direct Construction Costs				5,441,100																9,827,100						
Design/Construction Management	%	5,441,100	6%	326,500																589,700						
QA/QC	%	5,441,100	6%	326,500																589,700						
Subtotal Cell-4 Construction Cost				6,094,100																11,006,500						
Contingency				609,400																1,100,600						
Total Cell-4 Construction Cost				6,703,500																12,107,300						
Debt Service																					2,874,200	2,874,200	2,874,200	2,874,200	2,874,200	
Cell 4 Closure	20	Acres																								
Closure Preparation	FILL AC	20	4,000	80,000																						177,700
Clay Liner (1.5 Ft)	CY	48,400	10.00	484,000																						1,075,100
Synthetic Liner	SF	871,200	0.40	348,500																						774,100
Native Soil - 1 ft	CY	32,300	3.50	113,100																						251,200
Topsoil - 1 ft.	CY	32,300	6.00	193,800																						430,500
Seeding	FILL AC	20	1,800	36,000																						80,000
Gas Collection/Flaring System	FILL AC	20	13,500	270,000																						599,700
Site Drainage	FILL AC	20	10,000	200,000																						444,300
Miscellaneous	LS	1	400,000	400,000																						888,500
Subtotal - Direct Construction Costs				2,125,400																						4,721,100
Design/Construction Management	%	2,125,400	6%	127,500																						283,200
QA/QC	%	2,125,400	6%	127,500																						283,200
Subtotal - Cell 4 Closure Costs				2,380,400																						5,287,500
Contingency				238,000																						528,700
Total Cell 4 Closure Costs				2,618,400																						5,816,200
inking Fund								0	0	0											1,036,900	1,036,900	1,036,900	1,036,900	1,036,900	
Post Closure Sinking Fund																										
Years 1-5				2001																						
Groundwater Monitoring	LS	1	35,000	35,000																						
Leachate Monitoring	LS	1	15,000	15,000																						
Leachate Pump/Treatment	GAL	0.012	4,000,000	48,000																						
Aerator O&M	LS	0	34,040	0																						
Miscellaneous O&M	LS	1	54,000	54,000																						
Subtotal Post Closure				152,000																						
Contingency	%	152,000	10%	15,200																						
Total Post Closure				167,200																						
ears 6-30				2001																						
Groundwater Monitoring	LS	1	20,000	20,000																						
Leachate Monitoring	LS	1	10,000	10,000																						
Leachate Pump/Treatment	GAL	0.012	2,000,000	24,000																						
Aerator O&M	LS	0	34,040	0																						
Miscellaneous O&M	LS	1	54,000	54,000																						
Subtotal Post Closure				108,000																						
Contingency	%	108,000	10%	10,800																						
otal Post Closure				118,800																						
Sum of PV Annual Cost in 2027				7,493,900																						
Sinking Fund Factor (I = 5.75%, n = 20)				0.028																						
				209,300																						
iking Fund																										

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
360,600	371,400	382,500	394,000	405,800	297,000	305,900	315,100	324,600	334,300	344,300	354,600	365,300	376,200	387,500
360,600	358,100	355,700	353,300	350,900	247,700	246,000	244,300	242,700	241,100	239,400	237,800	236,200	234,600	233,000

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
399,200	411,100	423,500	436,200	449,300	462,700	476,600	490,900	505,600	520,800	536,400	552,500	569,100	586,200	603,800
231,500	229,900	228,400	226,800	225,300	223,700	222,200	220,700	219,200	217,800	216,300	214,800	213,400	212,000	210,500

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	

NOTES:

Totals rounded to the nearest hundred

New Landfill

City of Greensboro, North Carolina
New Subtitle D Landfill
Cost Estimate (Avg 285,000 TPY)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
City Tonnage	168,360	169,641	170,922	172,142	173,362	174,643	175,863	177,083	178,303	179,523	180,804	182,085	183,366	184,647	185,928	187,209	188,490	189,771	191,052	192,333
Non-City Tonnage	107,640	108,459	109,278	110,058	110,838	111,657	112,437	113,217	113,997	114,777	115,596	116,415	117,234	118,053	118,872	119,691	120,510	121,329	122,148	122,967
Total Tonnages	276,000	278,100	280,200	282,200	284,200	286,300	288,300	290,300	292,300	294,300	296,400	298,500	300,600	302,700	304,800	306,900	309,000	311,100	313,200	315,300
CAPITAL COSTS																				
Pre Development Costs	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900
Site Development Costs	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900
Equipment Costs	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300
Cell Costs																				
Cell 1 Construction Cost	3,082,500	3,082,500	3,082,500	3,082,500	3,082,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell 1 Closure	1,130,600	1,130,600	1,130,600	1,130,600	1,130,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell 2 Construction Cost	0	0	0	0	0	2,708,600	2,708,600	2,708,600	2,708,600	2,708,600	0	0	0	0	0	0	0	0	0	0
Cell 2 Closure	0	0	0	0	0	936,200	936,200	936,200	936,200	936,200	0	0	0	0	0	0	0	0	0	0
Cell 3 Construction Cost	0	0	0	0	0	0	0	0	0	0	3,984,100	3,984,100	3,984,100	3,984,100	3,984,100	0	0	0	0	0
Cell 3 Closure	0	0	0	0	0	0	0	0	0	0	1,420,700	1,420,700	1,420,700	1,420,700	1,420,700	0	0	0	0	0
Cell 4 Construction Cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,640,100	3,640,100	3,640,100	3,640,100	3,640,100
Cell 4 Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,295,900	1,295,900	1,295,900	1,295,900	1,295,900
OPERATING COSTS																				
Landfill Operation Costs	3,587,900	3,695,500	3,806,400	3,920,600	4,038,200	4,159,300	4,284,100	4,412,700	4,545,000	4,681,400	4,821,800	4,966,500	5,115,500	5,268,900	5,427,000	5,589,800	5,757,500	5,930,200	6,108,100	6,291,400
Post Closure Sinking Fund	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300
TOTAL COSTS																				
Annual Costs	11,023,400	11,131,000	11,241,900	11,356,100	11,473,700	11,026,500	11,151,300	11,314,600	11,446,900	11,583,300	13,483,700	13,628,400	13,777,400	13,930,800	14,334,200	14,028,200	14,195,900	14,368,600	14,546,500	14,729,800
Cost/Ton	$39.94	$40.33	$40.73	$41.15	$41.57	$39.95	$40.40	$40.99	$41.47	$41.97	$48.85	$49.38	$49.92	$50.47	$51.94	$50.83	$51.43	$52.06	$52.70	$53.37
PRESENT VALUE COSTS																				
Annual Costs	8,864,300	8,631,400	8,406,400	8,188,800	7,978,400	7,393,900	7,210,700	7,055,300	6,883,100	6,716,600	7,539,600	7,348,600	7,163,900	6,985,200	6,931,000	6,541,100	6,383,100	6,230,200	6,082,300	5,939,200
Cost/Ton	$32.12	$31.27	$30.46	$29.67	$28.91	$26.79	$26.13	$25.56	$24.94	$24.34	$27.32	$26.63	$25.96	$25.31	$25.11	$23.70	$23.13	$22.57	$22.04	$21.52
Avg Cost/Ton	$24.44																			

Development of 4 Lined Cells

City of Greensboro, North Carolina
New Subtitle D Landfill
Cost Estimate (Avg 285,000 TPY)

13-Jun-01 06:04 PM

	Unit	No. Units	Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Site Information																										
Landfill Capacity (TPD)																										
Total Site Acreage (Site AC)	400																									
Landfill Unit Acreage (AC)	120																									
Distance To Leachate Tmt Facility (Miles)	2																									
Site Life (Yrs)	20																									
Cell Life (Yr 1)	1	Cell Life (Yrs 3-20)		5																						
Equipment Life (Yrs 1-14)	7	Equipment Life (Yrs 15-20)		7		10																				
Equipment Salvage Value (%)	20.00%	Yrs. for financing Pre-Dev. Costs		23																						
Average Fill Rate (TPD)		Yrs. for repayment Pre-Dev. Costs		20																						
Assumed Inflation Rate	3.00%	Yrs. for financing Site-Dev. Costs		21																						
Assumed Borrow Rate	6.00%	Yrs. for repayment Site-Dev. Costs		20																						
Assumed Discount Rate	3.70%	Yrs. for financing Cell 1 Const.		5																						
Assumed Invest. Rate (sinking fund)	5.75%	Yrs. for repayment Cell 1 Const.		5																						
Financing Cost Factor (%)	10.00%	Yrs. for financing Cells 2 Const.		5																						
		Yrs. for repayment Cells 2 Const.		5																						
Contingency	10.00%	Yrs. for financing Cell 3 Const.		5																						
		Yrs. for repayment Cells 3 Const.		5																						
		Yrs. for financing Cell 4 Const.		5																						
		Yrs. for repayment Cells 4 Const.		5																						
Pre Development Costs																										
Land	AC	400	25,000	10,000,000	11,592,700																					
Engineering, Legal & Administrative	LS	1	1,500,000	1,500,000	1,738,900																					
Permitting and Licensing	LS	1	1,000,000	1,000,000	1,159,300																					
Sub-Total Pre Development Costs				12,500,000	14,490,900																					
Contingency				1,250,000	1,449,100																					
Total Pre-Development Costs				13,750,000	15,940,000																					
Debt Service						1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900	1,489,900
Site Development Costs																										
Site Clearing & Grubbing	AC	100	3,500	350,000	405,700																					
Water Supply	LS	1	10,000	10,000	11,600																					
Fuel Tanks	LS	1	50,000	50,000	58,000																					
Buildings				0	0																					
Scalehouse/Office	LS	1	300,000	300,000	347,800																					
Maintenance Facilities	SF	4,000	200	800,000	927,400																					
Stormwater Management																										
Storm Drainage System	LS	1	60,000	60,000	69,600																					
Sedimentation Basin	LS	3	40,000	120,000	139,100																					
Leachate Management																										
Leachate Pretreatment System	LS	1	500,000	500,000	579,600																					
Pump Station To Tank	LS	1	15,000	15,000	17,400																					
Pump Station To WWTP	LS	1	25,000	25,000	29,000																					
Force Main	LF	10,560	10	105,600	122,400																					
Scale (100,000 lb cap. and rel. controls)	EA	2	50000	100,000	115,900																					
Site Improvements																										
Access Road (Paved)	LF	8,000	100	800,000	927,400																					
Perimeter Fence w/ Gate	LF	22,000	7.5	165,000	191,300																					
Landscaping Entrance	LS	1	100,000	100,000	115,900																					
Subtotal - Landfill Development Construction Costs				3,500,600	4,058,100																					
Design/Construction Management	% Constr. Costs	3,500,600	12%	420,100	487,000																					
ubtotal Initial Landfill Development Costs				3,920,700	4,545,100																					
otal Initial Landfill Development Costs				3,920,700	4,545,100																					
Landfill Development Costs+Contingency				4,312,800	4,999,600																					
Financed Landfill Development Costs				4,744,100	5,499,600																					
bt Service						490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900	490,900

Development of 4 Lined Cells

City of Greensboro, North Carolina
New Subtitle D Landfill
Cost Estimate (Avg 285,000 TPY)

13-Jun-01 06:04 PM

	Unit	No. Units	Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Equipment Costs																										
Landfill Equipment																										
Caterpillar 836 Compactor	EA	3	325,000	600,000		716,400							881,100							1,083,700						
Caterpillar D400D Off Road Truck	EA	3	196,000	500,000		597,000							734,300							903,100						
Caterpillar D8R Dozer	EA	1	426,000	426,000		508,700							625,600							769,400						
Caterpillar D6R Tractor	EA	1	272,000	272,000		324,800							399,400							491,300						
Caterpillar 140H Grader	EA	1	200,000	200,000		238,800							293,700							361,200						
Caterpillar 320 Excavator, Track	EA	1	205,000	205,000		244,800							301,000							370,300						
Caterpillar 214 Excavator, Wheel	EA	0	145,000	0		0							0							0						
Caterpillar 936 Loader, Wheel	EA	1	245,000	245,000		292,500							359,800							442,500						
Caterpillar 631 Scraper	EA	2	700,000	1,400,000		1,671,700							2,055,900							2,528,600						
Industrial Wheel Tractor	EA	0	30,000	0		0							0							0						
Mowing Tractor	EA	1	15,000	15,000		17,900							22,000							27,100						
Truck w/ Hydro-Seeder	EA	1	75,000	75,000		89,600							110,100							135,500						
Water Truck	EA	1	50,000	50,000		59,700							73,400							90,300						
4" Water Pump	EA	1	15,000	15,000		17,900							22,000							27,100						
Maintenance Equipment																										
Fuel and Service Truck	EA	1	50,000	50,000		59,700							73,400							90,300						
Power Sweeper	EA	0	16,000	0		0							0							0						
Shop Tools and Equipment	LS	2	20,800	41,600		49,700							61,100							75,100						
Landfill Vehicles																										
Four Wheel Drive	EA	1	30,000	30,000		35,800							44,100							54,200						
Pick-up Truck	EA	2	25,000	50,000		59,700							73,400							90,300						
Utility vehicle (Kaw. mule)	EA	1	5,000	5,000		6,000							7,300							9,000						
Tractor Trailer	EA	1	80,000	80,000		95,500							117,500							144,500						
Subtotal Equipment Costs				4,259,600		5,086,200							5,256,960							6,465,980						
Contingency	% of Equip. Costs	4,259,600	10%	426,000		508,600							525,700							646,600						
Total Equipment Costs				4,685,600		5,594,800							5,782,700							7,112,600						
Debt Service						1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,032,300	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,067,000	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300	1,312,300	
Landfill Operation Costs																										
Labor:																										
Landfill Manager		1	60,000	60,000																						
Asst. Landfill Manager		1	50,000	50,000																						
Shop Mechanic		2	45,000	90,000																						
Equipment Operator		9	40,000	360,000																						
Scale Operator		3	30,000	90,000																						
Laborer/Spotters		1	29,500	29,500																						
Litter Control		2	25,000	50,000																						
Caretaker		0	25,000	0																						
Office Staff		1	40,000	40,000																						
Total Staff		20		769,500																						
Employee Benefits	% of Labor Costs	769,500	40%	307,800																						
Equipment O&M	% of Equip. Costs	4,685,600	30%	1,405,700																						
Utilities (Electricity, Water)	LS	1	15,000	15,000																						
Groundwater Monitoring	LS	1	30,000	30,000																						
Leachate Management																										
Leachate Monitoring	LS	1	4,000	4,000																						
Leachate Pump	GAL	4,500,000	0.01	45,000																						
Leachate Treatment	1,000 GAL	4,500	3.25	14,600																						
Aerators O&M	LS	1	20,000	20,000																						
Misc. O&M	FILL AC	120	1,000	120,000																						
Subtotal Operation Costs				2,731,600																						
Contingency	% of Op. Costs	2,731,600	10%	273,160																						
Total Operation Costs				3,004,800																						
Annual Cost						3,587,900	3,695,500	3,806,400	3,920,600	4,038,200	4,159,300	4,284,100	4,412,700	4,545,000	4,681,400	4,821,800	4,966,500	5,115,500	5,268,900	5,427,000	5,589,800	5,757,500	5,930,200	6,108,100	6,291,400	

Development of 4 Lined Cells

City of Greensboro, North Carolina
New Subtitle D Landfill
Cost Estimate (Avg 285,000 TPY)

	Unit		13-Jun-01 No. Units	06:04 PM Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cell 1 Construction Cost	35	Acres																									
Site Clearing & Grubbing	Fill AC		35	3,500	122,500	142,000																					
Earthwork and Embankment	CY		350,000	6.00	2,100,000	2,434,500																					
Subgrade Preparation	Fill AC		35	10,000	350,000	405,700																					
Clay Liner (10^(-7): 2 Ft)	CY		112,933	15.00	1,694,000	1,963,800																					
HDPE Liner - Single 60 mil	SF		1,524,600	0.50	762,300	883,700																					
Leachate Collection System	AC		35	11,500	402,500	466,600																					
Drainage Layer (Geonet)	SF		1,524,600	0.50	762,300	883,700																					
Liner Cover (2 Ft)	CY		112,933	13.00	1,468,100	1,701,900																					
Perimeter Road (Gravel)	LF		6,000	40	240,000	278,200																					
Seeding/ E&S Controls	AC		35	1,800	63,000	73,000																					
Storm Drainage System	LS		1	252,000	252,000	292,100																					
Miscellaneous	LS		1	875,000	875,000	1,014,400																					
Subtotal - Direct Construction Costs					9,091,700	10,539,600																					
Design/Construction Management	%		9,091,700	6%	545,500	632,400																					
QA/QC	%		9,091,700	6%	545,500	632,400																					
Subtotal Cell-1 Construction Cost					10,182,700	11,804,400																					
Contingency					1,018,300	1,180,400																					
Total Cell-1 Construction Cost					11,201,000	12,984,800																					
Debt Service							3,082,500	3,082,500	3,082,500	3,082,500	3,082,500																
Cell 1 Closure	35	Acres																									
Closure Preparation	FILL AC		35	4,000	140,000							193,800															
Clay Liner (1.5 Ft)	CY		84,700	10.00	847,000							1,172,400															
Synthetic Liner	SF		1,524,600	0.40	609,800							844,100															
Native Soil - 1 ft	CY		56,467	3.50	197,600							273,500															
Topsoil - 1 ft.	CY		56,467	6.00	338,800							469,000															
Seeding	FILL AC		35	1,800	63,000							87,200															
Gas Collection/Flaring System	FILL AC		35	13,500	472,500							654,100															
Site Drainage	FILL AC		35	10,000	350,000							484,500															
Miscellaneous	LS		1	700,000	700,000							969,000															
Subtotal - Direct Construction Costs					3,718,700							5,147,550															
Design/Construction Management	%		3,718,700	6%	223,100							308,800															
QA/QC	%		3,718,700	6%	223,100							308,800															
Subtotal - Cell 1 Closure Costs					4,164,900							5,765,196															
Contingency					416,500							576,500															
Total Cell 1 Closure Costs					4,581,400							6,341,700															
Sinking Fund							1,130,600	1,130,600	1,130,600	1,130,600	1,130,600																
Cell 2 Construction Cost	25	Acres																									
Site Clearing & Grubbing	Fill AC		25	3,500	87,500						117,600																
Earthwork and Embankment	CY		250,000	6.00	1,500,000						2,015,900																
Subgrade Preparation	Fill AC		25	10,000	250,000						336,000																
Clay Liner (10^(-7): 2 Ft)	CY		80,700	15.00	1,210,500						1,626,800																
HDPE Liner - Single 60 mil	SF		1,089,000	0.50	544,500						731,800																
Leachate Collection System	AC		25	11,500	287,500						386,400																
Drainage Layer (Geonet)	SF		1,089,000	0.47	511,800						687,800																
Liner Cover (2 Ft)	CY		80,700	13.00	1,049,100						1,409,900																
Perimeter Road (Gravel)	LF		15,000	40	600,000						806,300																
Seeding/ E&S Controls	AC		25	1,800	45,000						60,500																
Storm Drainage System	LS		1	180,000	180,000						241,900																
Miscellaneous	LS		1	625,000	625,000						839,900																
Subtotal - Direct Construction Costs					6,890,900						9,260,800																
Design/Construction Management	%		6,890,900	6%	413,500						555,700																
QA/QC	%		6,890,900	6%	413,500						555,700																
Subtotal Cell-2 Construction Cost					7,717,900						10,372,200																
Contingency					771,800						1,037,200																
Total Cell-2 Construction Cost					8,489,700						11,409,400																
Debt Service												2,708,600	2,708,600	2,708,600	2,708,600	2,708,600	0	0	0	0	0	0	0	0	0	

Development of 4 Lined Cells

City of Greensboro, North Carolina
New Subtitle D Landfill
Cost Estimate (Avg 285,000 TPY)

13-Jun-01 06:04 PM

	Unit	No. Units	Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cell 2 Closure	25	Acres																								
Closure Preparation	FILL AC	25	4,000	100,000																						
Clay Liner (1.5 Ft)	CY	60,500	10.00	605,000												160,500										
Synthetic Liner	SF	1,089,000	0.40	435,600												970,800										
Native Soil - 1 ft	CY	40,300	3.50	141,100												699,000										
Topsoil - 1 ft.	CY	40,300	6.00	241,800												226,400										
Seeding	FILL AC	25	1,800	45,000												388,000										
Gas Collection/Flaring System	FILL AC	25	13,500	337,500												72,200										
Site Drainage	FILL AC	25	10,000	250,000												541,600										
Miscellaneous	LS	1	500,000	500,000												401,200										
Subtotal - Direct Construction Costs				2,656,000												802,400										
Design/Construction Management	%	2,656,000	6%	159,400												4,262,100										
QA/QC	%	2,656,000	6%	159,400												255,800										
Subtotal - Cell 2 Closure Costs				2,974,800												255,800										
Contingency				297,500												4,773,700										
Total Cell 2 Closure Costs				3,272,300												477,400										
Sinking Fund																5,251,100										
											936,200	**936,200**	**936,200**	**936,200**	**936,200**											
Cell 3 Construction Cost	35	Acres																								
Site Clearing & Grubbing	Fill AC	35	3,500	122,500											190,900											
Earthwork and Embankment	CY	350,000	6.00	2,100,000											3,271,700											
Subgrade Preparation	Fill AC	35	10,000	350,000											545,300											
Clay Liner (10^(-7): 2 Ft)	CY	80,700	15.00	1,210,500											1,885,900											
HDPE Liner - Single 60 mil	SF	1,524,600	0.50	762,300											1,187,600											
Leachate Collection System	AC	35	11,500	402,500											627,100											
Drainage Layer (Geonet)	SF	1,524,600	0.47	716,600											1,116,400											
Liner Cover (2 Ft)	CY	80,700	13.00	1,049,100											1,634,500											
Perimeter Road (Gravel)	LF	21,000	40	840,000											1,308,700											
Seeding/ E&S Controls	AC	35	1,800	63,000											98,200											
Storm Drainage System	LS	1	252,000	252,000											392,600											
Miscellaneous	LS	1	875,000	875,000											1,363,200											
Subtotal - Direct Construction Costs				8,743,500											13,622,100											
Design/Construction Management	%	8,743,500	6%	524,600											817,300											
QA/QC	%	8,743,500	6%	524,600											817,300											
Subtotal Cell-3 Construction Cost				9,792,700											15,256,700											
Contingency				979,300											1,525,700											
Total Cell-3 Construction Cost				10,772,000											16,782,400											
Debt Service																**3,984,100**	**3,984,100**	**3,984,100**	**3,984,100**	**3,984,100**						
Cell 3 Closure	35	Acres																								
Closure Preparation	FILL AC	35	4,000	140,000																					260,400	
Clay Liner (1.5 Ft)	CY	60,500	10.00	605,000																					1,125,500	
Synthetic Liner	SF	1,524,600	0.40	609,800																					1,134,400	
Native Soil - 1 ft	CY	56,500	3.50	197,800																					368,000	
Topsoil - 1 ft.	CY	56,500	6.00	339,000																					630,600	
Seeding	FILL AC	35	1,800	63,000																					117,200	
Gas Collection/Flaring System	FILL AC	35	13,500	472,500																					879,000	
Site Drainage	FILL AC	35	10,000	350,000																					651,100	
Miscellaneous	LS	1	700,000	700,000																					1,302,200	
Subtotal - Direct Construction Costs				3,477,100																					6,468,400	
Design/Construction Management	%	3,477,100	6%	208,600																					388,100	
QA/QC	%	3,477,100	6%	208,600																					388,100	
Subtotal - Cell 3 Closure Costs				3,894,300																					7,244,600	
Contingency				389,400																					724,400	
Total Cell 3 Closure Costs				4,283,700																					7,968,900	
Sinking Fund																**1,420,700**	**1,420,700**	**1,420,700**	**1,420,700**	**1,420,700**						

Development of 4 Lined Cells

City of Greensboro, North Carolina
New Subtitle D Landfill
Cost Estimate (Avg 285,000 TPY)

13-Jun-01 06:04 PM

	Unit	No. Units	Unit Cost	2001 Total Cost	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Cell 4 Construction Cost	25	Acres																								
Site Clearing & Grubbing	Fill AC	25	3,500	87,500																158,000						
Earthwork and Embankment	CY	250,000	6.00	1,500,000																2,709,200						
Subgrade Preparation	Fill AC	25	10,000	250,000																451,500						
Clay Liner (10^(-7): 2 Ft)	CY	80,700	15.00	1,210,500																2,186,300						
HDPE Liner - Single 60 mil	SF	1,089,000	0.50	544,500																983,400						
Leachate Collection System	AC	25	11,500	287,500																519,300						
Drainage Layer (Geonet)	SF	1,089,000	0.47	511,800																924,400						
Liner Cover (2 Ft)	CY	80,700	13.00	1,049,100																1,894,800						
Perimeter Road (Gravel)	LF	15,000	40	600,000																1,083,700						
Seeding/ E&S Controls	AC	25	1,800	45,000																81,300						
Storm Drainage System	LS	1	180,000	180,000																325,100						
Miscellaneous	LS	1	625,000	625,000																1,128,800						
Subtotal - Direct Construction Costs				6,890,900																12,445,800						
Design/Construction Management	%	6,890,900	6%	413,500																746,800						
QA/QC	%	6,890,900	6%	413,500																746,800						
Subtotal Cell-4 Construction Cost				7,717,900																13,939,400						
Contingency				771,800																1,394,000						
Total Cell-4 Construction Cost				8,489,700																15,333,300						
Debt Service																					3,640,100	3,640,100	3,640,100	3,640,100	3,640,100	
Cell 4 Closure	25	Acres																								
Closure Preparation	FILL AC	25	4,000	100,000																						222,100
Clay Liner (1.5 Ft)	CY	60,500	10.00	605,000																						1,343,900
Synthetic Liner	SF	1,089,000	0.40	435,600																						967,600
Native Soil - 1 ft	CY	40,300	3.50	141,100																						313,400
Topsoil - 1 ft.	CY	40,300	6.00	241,800																						537,100
Seeding	FILL AC	25	1,800	45,000																						100,000
Gas Collection/Flaring System	FILL AC	25	13,500	337,500																						749,700
Site Drainage	FILL AC	25	10,000	250,000																						555,300
Miscellaneous	LS	1	500,000	500,000																						1,110,600
Subtotal - Direct Construction Costs				2,656,000																						5,899,700
Design/Construction Management	%	2,656,000	6%	159,400																						354,100
QA/QC	%	2,656,000	6%	159,400																						354,100
Subtotal - Cell 4 Closure Costs				2,974,800																						6,607,900
Contingency				297,500																						660,800
Total Cell 4 Closure Costs				3,272,300																						7,268,700
Inking Fund								0	0	0											1,295,900	1,295,900	1,295,900	1,295,900	1,295,900	
Post Closure Sinking Fund																										
Years 1-5				2001																						
Groundwater Monitoring	LS	1	35,000	35,000																						
Leachate Monitoring	LS	1	15,000	15,000																						
Leachate Pump/Treatment	GAL	0.012	4,000,000	48,000																						
Aerator O&M	LS	0	34,040	0																						
Miscellaneous O&M	LS	1	54,000	54,000																						
Subtotal Post Closure				152,000																						
Contingency	%	152,000	10%	15,200																						
Total Post Closure				167,200																						
Years 6-30				2001																						
Groundwater Monitoring	LS	1	20,000	20,000																						
Leachate Monitoring	LS	1	10,000	10,000																						
Leachate Pump/Treatment	GAL	0.012	2,000,000	24,000																						
Aerator O&M	LS	0	34,040	0																						
Miscellaneous O&M	LS	1	54,000	54,000																						
Subtotal Post Closure				108,000																						
Contingency	%	108,000	10%	10,800																						
Total Post Closure				118,800																						
Sum of PV Annual Cost in 2027				7,493,900																						
Sinking Fund Factor (I = 5.75%, n = 20)				0.028																						
				209,300																						
Sinking Fund					209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	209,300	

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
360,600	371,400	382,500	394,000	405,800	297,000	305,900	315,100	324,600	334,300	344,300	354,600	365,300	376,200	387,500
360,600	358,100	355,700	353,300	350,900	247,700	246,000	244,300	242,700	241,100	239,400	237,800	236,200	234,600	233,000

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
399,200	411,100	423,500	436,200	449,300	462,700	476,600	490,900	505,600	520,800	536,400	552,500	569,100	586,200	603,800
231,500	229,900	228,400	226,800	225,300	223,700	222,200	220,700	219,200	217,800	216,300	214,800	213,400	212,000	210,500

NOTES:
Totals rounded to the nearest hundred

Transfer and Haul – 20 Mile One-Way

Greensboro, North Carolina
**** Transfer Station ****
Cost Estimate (500 TPD)
One way Haul of 20 miles

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tonnages	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000
CAPITAL COSTS																				
Pre Development Costs	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400
SITE AND BUILDINGS	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409
EQUIPMENT COSTS																				
Transfer Station EQUIPMENT	101,211	101,211	101,211	101,211	101,211	101,211	101,211	153,096	153,096	153,096	153,096	153,096	153,096	153,096	231,548	231,548	231,548	231,548	231,548	231,548
OTR EQUIPMENT	191,187	191,187	191,187	191,187	191,187	191,187	191,187	191,187	270,606	270,606	328,368	328,368	328,368	328,368	328,368	328,368	409,983	409,983	409,983	409,983
Annual Debt Service Subtotal	579,207																			
OPERATING COSTS																				
EQUIPMENT COSTS	466,000	480,000	494,400	509,300	524,500	540,300	556,500	573,200	590,400	608,100	626,300	645,100	664,500	684,400	704,900	726,100	747,900	770,300	793,400	817,200
Operation Costs (Facilities)	855,700	881,300	907,800	935,000	963,100	991,900	1,021,700	1,052,400	1,083,900	1,116,400	1,149,900	1,184,400	1,220,000	1,256,600	1,294,300	1,333,100	1,373,100	1,414,300	1,456,700	1,500,400
TOTAL COSTS																				
Annual Costs	1,900,907	1,940,507	1,981,407	2,023,507	2,066,807	2,111,407	2,157,407	2,256,692	2,384,811	2,435,011	2,544,473	2,597,773	2,652,773	2,709,273	2,845,926	2,905,926	3,049,340	3,112,940	3,178,440	3,245,940
Cost/Ton	$12.19	$12.44	$12.70	$12.97	$13.25	$13.53	$13.83	$14.47	$15.29	$15.61	$16.31	$16.65	$17.00	$17.37	$18.24	$18.63	$19.55	$19.95	$20.37	$20.81
2001 PRESENT VALUE COSTS																				
Pre Development Costs	34,700	33,700	32,700	31,700	30,800	29,900	29,000	28,200	27,400	26,600	25,800	25,000	24,300	23,600	22,900	22,300	21,600	21,000	20,400	19,800
SITE AND BUILDINGS	205,500	199,500	193,700	188,100	182,600	177,300	172,100	167,100	162,200	157,500	152,900	148,500	144,200	140,000	135,900	131,900	128,100	124,300	120,700	117,200
Transfer Station EQUIPMENT	84,800	82,300	79,900	77,600	75,300	73,100	71,000	104,300	101,200	98,300	95,400	92,600	89,900	87,300	128,200	124,500	120,800	117,300	113,900	110,600
OTR EQUIPMENT	160,100	155,500	150,900	146,500	142,300	138,100	134,100	130,200	178,900	173,700	204,600	198,700	192,900	187,300	181,800	176,500	214,000	207,700	201,700	195,800
EQUIPMENT COSTS	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300	390,300
Operation Costs (Facilities)	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600	716,600
Total Annual Costs	1,592,000	1,577,800	1,564,100	1,550,800	1,537,900	1,525,300	1,513,200	1,536,700	1,576,600	1,562,900	1,585,600	1,571,700	1,558,200	1,545,100	1,575,700	1,562,100	1,591,400	1,577,300	1,563,600	1,550,300
Cost/Ton	$10.21	$10.11	$10.03	$9.94	$9.86	$9.78	$9.70	$9.85	$10.11	$10.02	$10.16	$10.08	$9.99	$9.90	$10.10	$10.01	$10.20	$10.11	$10.02	$9.94
Cost/Ton Average	$10.01																			

Greensboro, North Carolina
** Transfer Station **
Cost Estimate (500 TPD)

	Unit	24-May-01 No. Units	10:40 AM Unit Cost	2001	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Site Information																								
Transfer Station Storage Capacity (TPD)	360																							
Transfer Station Througput Capacity (TPD)	500																							
Site Life (Yrs)	20																							
Equipment Salvage Value (%)	20.00%																							
Assumed Inflation Rate	3.00%																							
Assumed Borrow Rate	6.00%																							
Assumed Discount Rate	3.70%																							
Assumed Investment Rate (for sinking fund)	5.75%																							
Financing Cost Factor (%)	10.00%																							
Pre Development Costs																								
Land Aquistion	acre	5	25,000	125,000	163,097																			
DESIGN/ENGINEERING (8%)	**LS**	**6%**	2,456,760	147,406	192,331																			
PERMITTING (3%)	**LS**	**3%**	2,456,760	73,703	88,005																			
SURVEYING AND SOILS REPORT		1	15000	15,000	17,911																			
Total Pre Development Costs				361,108	431,182																			
Financed Pre-Development Costs				397,219	474,301																			
Debt Service					**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**
SITE AND BUILDINGS																								
SITEWORK																								
Earthwork																								
Excavation & Backfill-trench	cy	1,200	$8	9,600	11,463																			
General Earthwork	cy	35,000	$3	105,000	125,375																			
Finishing Grassing & Grading	Ac	3	$3,000	9,000	10,746																			
Roadways Concrete	sy	829	$40	33,160	39,595																			
Asphalt Pavement, Parking	sy	5,000	$30	150,000	179,108																			
Retaining Walls	sf	3,600	$25	90,000	107,465																			
Site Utilities																								
Fire Protection	lf	2,000	$25	50,000	59,703																			
Water Supply	lf	1,000	$25	25,000	29,851																			
Sewer System	lf	1,000	$25	25,000	29,851																			
Electrical	L.S.	1	$50,000	50,000	59,703																			
Site Drainage	L.S.	1	$30,000	30,000	35,822																			
Fencing and Gates	lf	5,000	$10	50,000	59,703																			
Landscaping (Minimal)	L.S.	1	$10,000	10,000	11,941																			
Subtotal - Sitework				636,760	760,325																			
TRANSFER BUILDING AND MANUEVERING AREA																								
Manuevering Area(concrete paved)	sy	2,500	$40	100,000	119,405																			
Metal Building (120x135)[1]	sf	16,200	$22	356,400	425,560																			
Concrete Slabwork[2]	cy	800	$120	96,000	114,629																			
Concrete Footings	cy	150	$250	37,500	44,777																			
Concrete Push Walls	cy	370	$400	148,000	176,720																			
Loadout Hopper Framing and Metals	LS	2	$40,000	80,000	95,524																			
Loadout Scales	LS	2	$60,000	120,000	143,286																			
Mechanical[3]	sf	16,200	$8	129,600	154,749																			
Electrical[4]	sf	16,200	$10	162,000	193,436																			
Subtotal -Transfer Building and Manuvering Area				1,229,500	1,468,087																			
SCALE HOUSE[5]																								
Metal Building	sf	400	$50	20,000	23,881																			
Concrete Slabwork	cy	15	$200	3,000	3,582																			
Concrete Footings	cy	10	$250	2,500	2,985																			
Interior Treatmments	sf	400	$50	20,000	23,881																			
Motor Truck Scales	LS	2	$50,000	100,000	119,405																			
Mechanical	sf	400	$12	4,800	5,731																			
Electrical	sf	400	$13	5,200	6,209																			
Subtotal - Scalehouse				155,500	185,675																			
Subtotal - SITE AND BUILDINGS				2,021,760	2,414,087																			
CONSTRUCTION INSPECTION (8%)		2,021,760	6%	121,306	144,845																			
Subtotal Initial Transfer Station Development Costs				2,143,066	2,558,932																			
Total Initial Station Development Costs				2,143,066	2,558,932																			
Financed Transfer Station Development Costs				2,357,372	2,814,826																			
Debt Service					**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**

Notes:

TRANSFER BUILDING AND MANUEVERING AREA

1 Metal building includes structural steel, column free building (long span). 30 ft. clear height, and 20 yr. warranty on roofing.
2 Assumes stable soil with load bearing capacity. Slab floor is 10 to 12" reinforced concrete.
3 Building mechanical includes drains, plumbing, air handling, fire protection, etc.
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No truck driver, facility, or adminitration activities areas are included
Assumes stable soil with load bearing capacity. Slab floor is 6" reinforced concrete.
Includes tile, painting, window covers and funiture
Building mechanical includes drains, plumbing, air handling, fire protection, etc.
Electrical includes lighting, wiring, power, communications, etc.
OTHER
6 Based on equipment vendor estimate.
7 Based on fuel consumption in Catepillar Performance Handbook.

Greensboro, North Carolina ** Transfer Station ** Cost Estimate (500 TPD)	Unit	24-May-01 No. Units	10:40 AM Unit Cost	2001	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
EQUIPMENT COSTS																								
Transfer Station EQUIPMENT																								
Front End - Loader Rubber Tire	EA	1	180,000	180,000	214,929							264,336							325,100					
Utility Tractor and Sweeper	EA	1	55,000	55,000	65,673							80,769							99,336					
Pick-up Truck	EA	1	20,000	20,000	23,881							29,371							36,122					
Tamping Crane	EA	1	180,000	180,000	214,929							264,336							325,100					
Subtotal - Mobile Equipment				435,000	519,413							638,812							785,658					
Contigency for Mobile Equip.		435,000	10%	43,500	51,941							63,881							78,566					
Financed Mobile Equip. Costs				526,400	628,500							773,000							950,600					
Debt Service					**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 231,548**	**$ 231,548**	**$ 231,548**	**$ 231,548**	**$ 231,548**	**$ 231,548**
EQUIPMENT OPERATING AND MAINTENANCE COSTS																								
Front End - Loader Rubber[6]	LS	1	$25,000	25,000	29,851																			
Utility Tractor/Sweeper	LS	1	$3,000	3,000	3,582																			
Pick-up Truck including fuel	$/mile	30,000	$0.32	9,600	11,463																			
Tamping Crane[6]	LS	1	$25,000	25,000	29,851																			
General O&M	LS	1	$40,000	40,000	47,762																			
Subtotal - Equipment Operating and Maintenance Costs				102,600	122,510																			
TS ROLLING STOCK FUEL COSTS			$/gallon																					
Front End Loader[7]	gal/hr	3	1.50	9,400	11,224																			
Utility Tractor/ Sweeper	gal/wk	30	1.50	2,300	2,746																			
Tamping Crane[7]	gal/hr	3	1.50	9,400	11,224																			
Subtotal - Fuel Costs				21,100	25,195																			
TRACTOR TRAILER COSTS		20 miles one way	5.5	Miles/gal																				
		20 tons per load	6.0	days/week																				
		30 average speed	8.0	driving hrs/day																				
		6 Loads/day/truck	25	loads/day																				
	312,000	Annual Miles	5	trucks/day																				
Tractor Trailer - Fuels and Oils	$/gallon	56,727	1.50	85,100	101,614																			
			$/miles																					
Tractor New Tires	tires/vehicle	6	0.0035	6,600	7,881																			
Trailer Retread Tires	tires/vehicle	12	0.0025	9,400	11,224																			
			$/year																					
Tractors Annual Maintenance & Repair	vehicles	5	21,600	108,000	128,958																			
Trailers Annual Maintenance & Repair	vehicles	5	7,000	35,000	41,792																			
Annual Insurance	vehicles	5	2,500	12,500	14,926																			
Annual License and Taxes	vehicles	5	2,000	10,000	11,941																			
Subtotal Tractor Trailer Costs				266,600	318,334																			
Total Annual Equipment Costs				390,300	466,039																			
Annual Cost					**466,000**	**480,000**	**494,400**	**509,300**	**524,500**	**540,300**	**556,500**	**573,200**	**590,400**	**608,100**	**626,300**	**645,100**	**664,500**	**684,400**	**704,900**	**726,100**	**747,900**	**770,300**	**793,400**	**817,200**
OTR EQUIPMENT	Units	# replacements																						
Tractors (10 year life)	5	2	109,100	545,500	651,356										875,367									
Trailers (8 year life)	5	3	72,300	361,500	431,650								546,801								692,671			
Contingency for Tractor Equip.		545,500	10%	54,550	65,136										87,537									
Contingency for Trailer Equip.		361,500	10%	36,150	43,165								54,680								69,267			
Financed Tractor Equipment Costs				660,100	788,100										1,059,200									
Financed Trailer Equipment Costs				437,400	522,300								661,600								838,100			
Debt Service					**191,187**	**191,187**	**191,187**	**191,187**	**191,187**	**191,187**	**191,187**	**191,187**	**270,606**	**270,606**	**328,368**	**328,368**	**328,368**	**328,368**	**328,368**	**328,368**	**409,983**	**409,983**	**409,983**	**409,983**
Operation Costs (Facilities)																								
LABOR	$/hr		hrs/year																					
Facility Manager	20	1	2,080	42,000																				
Administrative/Clerical	10	1	2,080	21,000																				
Scale Attendant	10	1	2,080	20,000																				
Loader Operators	15	2	2,860	87,000																				
Equipment Operators	12	1	2,860	33,000																				
Maintenance	20	1	2,080	42,000																				
Spotters/Laborers	9	1	2,080	20,000																				
Drivers	20	5	2,080	208,000																				
Dispatcher	13	1	2,080	27,000																				
Total Staff		14		500,000																				
Employee Benefits	% of Labor	500,000	30%	150,000																				
BUILDING AND SITE MAINTENANCE	(Capital Cost)	2,021,760	1.5%	30,326																				
UTILITIES - BUILDING AND SITE		1	21,200	21,200																				
ACCOUNTING, SUPPLIES, MISC. (5%)		752,600	2%	15,052																				
Subtotal Operation Costs				716,578																				
Total Operation Costs				716,600																				
Annual Cost					**855,700**	**881,300**	**907,800**	**935,000**	**963,100**	**991,900**	**1,021,700**	**1,052,400**	**1,083,900**	**1,116,400**	**1,149,900**	**1,184,400**	**1,220,000**	**1,256,600**	**1,294,300**	**1,333,100**	**1,373,100**	**1,414,300**	**1,456,700**	**1,500,400**

Transfer and Haul – 80 Mile One-Way

Greensboro, North Carolina
**** Transfer Station ****
Cost Estimate (500 TPD)
One way Haul of 80 miles

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Tonnages	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000	156,000
CAPITAL COSTS																				
Pre Development Costs	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400	41,400
SITE AND BUILDINGS	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409	245,409
EQUIPMENT COSTS																				
Transfer Station EQUIPMENT	101,211	101,211	101,211	101,211	101,211	101,211	101,211	153,096	153,096	153,096	153,096	153,096	153,096	153,096	231,548	231,548	231,548	231,548	231,548	231,548
OTR EQUIPMENT	497,107	497,107	497,107	497,107	497,107	497,107	497,107	497,107	703,608	703,608	853,762	853,762	853,762	853,762	853,762	853,762	1,065,962	1,065,962	1,065,962	1,065,962
Annual Debt Service Subtotal	885,128																			
OPERATING COSTS																				
EQUIPMENT COSTS	1,143,900	1,178,200	1,213,600	1,250,000	1,287,500	1,326,100	1,365,900	1,406,900	1,449,100	1,492,500	1,537,300	1,583,400	1,630,900	1,679,900	1,730,300	1,782,200	1,835,600	1,890,700	1,947,400	2,005,800
Operation Costs (Facilities)	1,382,800	1,424,300	1,467,000	1,511,100	1,556,400	1,603,100	1,651,200	1,700,700	1,751,700	1,804,300	1,858,400	1,914,200	1,971,600	2,030,700	2,091,700	2,154,400	2,219,000	2,285,600	2,354,200	2,424,800
TOTAL COSTS																				
Annual Costs	3,411,828	3,487,628	3,565,728	3,646,228	3,729,028	3,814,328	3,902,228	4,044,612	4,344,313	4,440,313	4,689,367	4,791,267	4,896,167	5,004,267	5,194,120	5,308,720	5,638,920	5,760,620	5,885,920	6,014,920
Cost/Ton	$21.87	$22.36	$22.86	$23.37	$23.90	$24.45	$25.01	$25.93	$27.85	$28.46	$30.06	$30.71	$31.39	$32.08	$33.30	$34.03	$36.15	$36.93	$37.73	$38.56
2001 PRESENT VALUE COSTS																				
Pre Development Costs	34,700	33,700	32,700	31,700	30,800	29,900	29,000	28,200	27,400	26,600	25,800	25,000	24,300	23,600	22,900	22,300	21,600	21,000	20,400	19,800
SITE AND BUILDINGS	205,500	199,500	193,700	188,100	182,600	177,300	172,100	167,100	162,200	157,500	152,900	148,500	144,200	140,000	135,900	131,900	128,100	124,300	120,700	117,200
Transfer Station EQUIPMENT	84,800	82,300	79,900	77,600	75,300	73,100	71,000	104,300	101,200	98,300	95,400	92,600	89,900	87,300	128,200	124,500	120,800	117,300	113,900	110,600
OTR EQUIPMENT	416,300	404,200	392,400	381,000	369,900	359,100	348,700	338,500	465,200	451,600	532,000	516,500	501,500	486,900	472,700	458,900	556,300	540,100	524,400	509,100
EQUIPMENT COSTS	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000	958,000
Operation Costs (Facilities)	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100	1,158,100
Total Annual Costs	2,857,400	2,835,800	2,814,800	2,794,500	2,774,700	2,755,600	2,736,900	2,754,200	2,872,100	2,850,100	2,922,300	2,898,800	2,876,000	2,853,900	2,875,900	2,853,700	2,942,900	2,918,900	2,895,500	2,872,800
Cost/Ton	$18.32	$18.18	$18.04	$17.91	$17.79	$17.66	$17.54	$17.66	$18.41	$18.27	$18.73	$18.58	$18.44	$18.29	$18.44	$18.29	$18.86	$18.71	$18.56	$18.42
Cost/Ton Average	$18.26																			

Greensboro, North Carolina
** Transfer Station **
Cost Estimate (500 TPD)

24-May-01 10:38 AM

	Unit	No. Units	Unit Cost	2001	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Site Information																								
Transfer Station Storage Capacity (TPD)	**360**																							
Transfer Station Througput Capacity (TPD)	**500**																							
Site Life (Yrs)	20																							
Equipment Salvage Value (%)	20.00%																							
Assumed Inflation Rate	3.00%																							
Assumed Borrow Rate	6.00%																							
Assumed Discount Rate	3.70%																							
Assumed Investment Rate (for sinking fund)	5.75%																							
Financing Cost Factor (%)	10.00%																							
Pre Development Costs																								
Land Aquistion	acre	5	25,000	125,000	163,097																			
DESIGN/ENGINEERING (8%)	**LS**	**6%**	2,456,760	147,406	192,331																			
PERMITTING (3%)	**LS**	**3%**	2,456,760	73,703	88,005																			
SURVEYING AND SOILS REPORT		1	15000	15,000	17,911																			
Total Pre Development Costs				361,108	431,182																			
Financed Pre-Development Costs				397,219	474,301																			
Debt Service					**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**	**41,400**
SITE AND BUILDINGS																								
SITEWORK																								
Earthwork																								
Excavation & Backfill-trench	cy	1,200	$8	9,600	11,463																			
General Earthwork	cy	35,000	$3	105,000	125,375																			
Finishing Grassing & Grading	Ac	3	$3,000	9,000	10,746																			
Roadways Concrete	sy	829	$40	33,160	39,595																			
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Debt Service					**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**	**245,409**

Notes:

TRANSFER BUILDING AND MANUEVERING AREA

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Debt Service					**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 101,211**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 153,096**	**$ 231,548**	**$ 231,548**	**$ 231,548**	**$ 231,548**	**$ 231,548**	**$ 231,548**
EQUIPMENT OPERATING AND MAINTENANCE COSTS																								
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Subtotal - Fuel Costs				21.100	25.195																			
TRACTOR TRAILER COSTS	80 miles one way		5.5	Miles/gal																				
	20 tons per load		6.0	days/week																				
	40 average speed		8.0	driving hrs/day																				
	2 Loads/day/truck		25	loads/day																				
	1,248.000 Annual Miles		13	trucks/day																				
Tractor Trailer - Fuels and Oils	$/gallon	226,909	1.50	340,400	406.455																			
			$/miles																					
Tractor New Tires	tires/vehicle	6	0.0035	26,200	31,284																			
Trailer Retread Tires	tires/vehicle	12	0.0025	37,400	44,658																			
			$/year																					
Tractors Annual Maintenance & Repair	vehicles	13	21,600	280,800	335,290																			
Trailers Annual Maintenance & Repair	vehicles	13	7,000	91,000	108,659																			
Annual Insurance	vehicles	13	2,500	32,500	38,807																			
Annual License and Taxes	vehicles	13	2,000	26,000	31,045																			
Subtotal Tractor Trailer Costs				834,300	996,198																			
Total Annual Equipment Costs				958,000	1,143,902																			
Annual Cost					**1,143,900**	**1,178,200**	**1,213,600**	**1,250,000**	**1,287,500**	**1,326,100**	**1,365,900**	**1,406,900**	**1,449,100**	**1,492,500**	**1,537,300**	**1,583,400**	**1,630,900**	**1,679,900**	**1,730,300**	**1,782,200**	**1,835,600**	**1,890,700**	**1,947,400**	**2,005,800**
OTR EQUIPMENT	Units	# replacements																						
Tractors (10 year life)	13	2	109.100	1,418,300	1,693,524										2,275,955									
Trailers (8 year life)	13	3	72.300	939.900	1,122,290								1,421,683								1,800,946			
Contingency for Tractor Equip.		1,418,300	10%	141,830	169,352										227,596									
Contingency for Trailer Equip.		939,900	10%	93,990	112,229								142,168								180,095			
Financed Tractor Equipment Costs				1,716,100	2,049,200										2,753,900									
Financed Trailer Equipment Costs				1,137,300	1,358,000								1,720,200								2,179,100			
Debt Service					**497,107**	**497,107**	**497,107**	**497,107**	**497,107**	**497,107**	**497,107**	**497,107**	**703,608**	**703,608**	**853,762**	**853,762**	**853,762**	**853,762**	**853,762**	**853,762**	**1,065,962**	**1,065,962**	**1,065,962**	**1,065,962**
Operation Costs (Facilities)																								
LABOR	$/hr		hrs/year																					
Facility Manager	20	1	2,080	42,000																				
Administrative/Clerical	10	1	2,080	21,000																				
Scale Attendant	10	1	2,080	20,000																				
Loader Operators	15	2	2,860	87,000																				
Equipment Operators	12	1	2,860	33,000																				
Maintenance	20	1	2,080	42,000																				
Spotters/Laborers	9	1	2,080	20,000																				
Drivers	20	13	2,080	541,000																				
Dispatcher	13	1	2,080	27,000																				
Total Staff		22		833,000																				
Employee Benefits	% of Labor	833,000	30%	249,900																				
BUILDING AND SITE MAINTENANCE	(Capital Cost)	2,021,760	1.5%	30,326																				
UTILITIES - BUILDING AND SITE		1	21,200	21,200																				
ACCOUNTING, SUPPLIES, MISC. (5%)		1,185,500	2%	23,710																				
Subtotal Operation Costs				1,158,136																				
Total Operation Costs				1,158,100																				
Annual Cost					**1,382,800**	**1,424,300**	**1,467,000**	**1,511,100**	**1,556,400**	**1,603,100**	**1,651,200**	**1,700,700**	**1,751,700**	**1,804,300**	**1,858,400**	**1,914,200**	**1,971,600**	**2,030,700**	**2,091,700**	**2,154,400**	**2,219,000**	**2,285,600**	**2,354,200**	**2,424,800**