An Update
of the
North Carolina
Solid Waste Management Plan
2003 to 2013

Chapter One: Overview

INTRODUCTION

The past fifteen years have brought tremendous change to how North Carolina manages solid waste. Many changes were positive and helped the state reduce and better manage its solid waste. Some changes brought challenges. Ensuring the safe disposal of waste, reducing illegal dumping and litter, increasing recycling and composting, and providing the public with information about solid waste facilities are just a few of these challenges. North Carolina is well prepared to meet them by building on its current successes, learning from past shortcomings, and acting on the input sought from the public it proudly serves.

The Solid Waste Management Act of 1989 created the state's first 10-year plan. The plan, which was completed in 1991, provided guidance on solid waste issues to the General Assembly, state and local government agencies, commercial, industrial and institutional enterprises, and the public. The Act also requires updates to the original 10-Year Plan.

This document is both an update of the original Plan and a compilation of public input regarding North Carolina's next 10 years of waste management. Because the public plays such a vital role in successful solid waste management, input from North Carolina residents has informed and been incorporated throughout this Plan. The input was derived from a wide range of people – solid waste professionals, waste management organization representatives, elected local government officials, and individual citizens. This input, coupled with analyses of the previous plan's successes and shortcomings, yielded this Plan's goal statements and recommended actions. In keeping with the Plan's 10-year span, all five goals have a deadline of 2013. The five goals are:

1. Ensure long-term environmental protection by improving future landfill technology and addressing public health and environmental concerns associated with closed landfills.
2. Substantially increase the amount of waste recycled and composted.
3. Reduce litter and illegal disposal by 50 percent from 2003-2004 levels.
4. Implement policies and procedures to provide information to the public and ensure public participation throughout the decision-making process regarding waste management facilities.
5. Create and continually maintain 20 years of landfill capacity in the state.

Because the goals are interrelated and mutually supportive, many of the Plan's recommended actions are designed to achieve more than one goal.

One important conclusion from the public participation process should be noted: a goal without the means to achieve that goal is unacceptable. Consensus held that key actions to achieve the desired goals must be developed and implemented in tandem. Mandates were identified as the most essential tool for goal achievement.

Despite the public consensus on mandated goals, some of the actions needed to achieve the goals represent a challenge. Some recommended actions do not have universal support and several are quite controversial. With these issues in mind, the Plan presents an array of action steps. If implemented, these steps will allow North Carolina to achieve its solid waste management goals.

KEY FINDINGS ON THE STATUS OF SOLID WASTE MANAGEMENT

Changing economic, social and political conditions have brought new tasks and considerations. Some major components in the solid waste sector transformed, shifted or matured. A summary of these changes, along with their accompanying impacts, is provided below.

Increased disposal

Landfill disposal of solid waste continues to increase both in absolute amounts and on a per capita basis. Significant economic and population growth, and its accompanying dramatic increase in total waste disposal, show no signs of abatement. Since disposal record-keeping began 13 years ago, the amount of waste disposed of in landfills in North Carolina has increased almost 40 percent. The 1990 total of approximately 7.2 million tons grew to more than 10 million tons by 2002. Contrary to expectation, the increase continues despite an economic recession and the state's remarkable recycling and composting accomplishments. North Carolina's waste stream has also changed in composition. Rapid growth in the disposal of construction and demolition wastes, electronics, household hazardous wastes, and tourism waste are major factors. As overall disposal rates increase, the need to ensure statewide disposal capacity remains a concern.

Recycling

North Carolina can claim exceptional growth and success in recycling, which has increased dramatically since 1989. Statewide disposal bans have proven very effective at diverting particular materials from North Carolina's landfills. Despite this progress, North Carolina has yet to reach its potential. Recycling markets, though expanding and widely available, continue to be affected by price swings, global commodity trading cycles, competition with virgin materials, and economic competition with disposal. These factors affect the willingness and ability to recover additional volume or types of materials. However, demand for materials appears strong, and economic development opportunities are available for North Carolina through the greater recovery of recyclables.

Reliance on Tip Fees

The financing, ownership and economics of solid waste disposal facilities experienced a major paradigm shift in the last decade. Formerly, most solid waste was disposed in landfills owned and operated by local governments. General fund (i.e., property tax) resources financed most of those facilities. Today, many North Carolina landfills are privately owned and generally rely on tipping fees to support facility operation. At private facilities, tipping fees typically cover operating costs, retire debt and generate profit. At local government-owned facilities, tipping fees typically cover operating expenses and funds to retire landfill construction debt and, in many cases, also support additional solid waste programs such as recycling or a litter/illegal dumping enforcement officer. Because of the debt burden and other items tipping fees support, local governments with landfills become concerned about revenue loss when waste disposed of at their facility is less than needed to support revenue needs.

North Carolina currently hosts nine private, regional landfills. A number of out-of-state private facilities also serve the state. Competition between landfills has helped keep tipping fees relatively low. This change in the market has created a conflict: the private sector needs waste to generate income, but the

public sector may or may not have an incentive to reduce waste. Where landfills are owned and operated by local governments, reducing the amount of waste disposed of in landfills reduces the funds needed to support a comprehensive solid waste management program. However, local governments that do not own MSW facilities typically use transfer stations to ship waste elsewhere. These local governments may save money when the amount of waste generated is reduced. Depending on landfill ownership, local governments may be motivated or demotivated to reduce waste for financial reasons. The conflict between long-term waste reduction benefits and immediate fiscal goals for both public and privately owned landfills is a complicated and difficult problem.

The impact of private operations on local government is multi-faceted. The loss of flow control may reduce the waste disposed in a particular facility and its associated revenue. This loss may affect local government's role in solid waste planning and enforcement. Regional landfills have spawned the growth of interim solid waste facilities or transfer stations. A significant portion of the state's waste is being shipped further distances. Because these facilities do not generate the profit of a landfill, many counties do not have a source of income to support comprehensive waste management programs other than from their general fund. Thus, the paradigm shift in landfill funding mechanisms – from general fund support to tipping fees – has generated a wide range of factors that are considered in this Plan.

Diverse County Situations

At one time, local government waste management situations were very similar; now a variety of scenarios exist. The 10 largest counties have approximately 43 percent of the state's population and produce nearly 50 percent of the state's waste. Conversely, the fifty smallest counties have only 12 percent of the population and only produce approximately 12 percent of the waste. The past decade has seen some counties grow and expand while others experienced very little economic development or increase in population. The differences in size and waste generation demand different approaches – thus, the differences noted between counties.

Wide discrepancies also exist in the effectiveness of local waste reduction efforts. Some programs – even those operated by small rural governments – are highly effective, comprehensive programs. Others – some in larger and more affluent areas – endeavor only to satisfy minimum standards. Clearly, effectiveness is not based on county size, population or economics.

Public Perception of Solid Waste Facilities

Public concern about landfills is growing. Efforts to site new facilities meet strong opposition and many recent permit decisions granted by the state's Solid Waste Section have been challenged in court. To date, all Section decisions have been upheld.

The resistance to new landfills is partly connected to concerns about old, closed landfills, which are perceived as public health and environmental threats. All of the state's unlined municipal solid waste (MSW) landfills are closed to MSW, though several still receive construction and demolition (C&D) waste at these facilities. The focus now rests on monitoring and managing their long-term care. However, operating C&D landfills and open, lined, municipal landfills also require monitoring. Unlined landfills must be monitored – particularly for their effects on groundwater supplies. Lined landfills, while offering more groundwater protection, inhibit the natural breakdown of waste materials. C&D landfills historically operate at lower standards than MSW landfills due to their contents. A multipronged approach is needed to address the different concerns and safeguard the communities that neighbor these facilities.

Summary

North Carolina has reached a crossroads in solid waste management. Significant progress has been made to reduce the environmental impacts of disposing waste in landfills and to encourage disposal diversion since passage of the Solid Waste Management Act of 1989. Despite impressive strides, new challenges have arisen and the future will bring more. Uncertainty regarding the amount of available, long-term disposal capacity in North Carolina is only one example. Key actions need to be taken to fulfill the goals of safe and efficient solid waste management. These actions are briefly described in this chapter under each specific goal. They are discussed at greater length in the subsequent chapters.

ACCOMPLISHMENTS & CHALLENGES IN SOLID WASTE MANAGEMENT

Looking back at previous improvements and their common denominators helps explain current solid waste management conditions. Some North Carolina accomplishments include:

- Closing unlined municipal solid waste landfills resulted in all municipal solid waste being exclusively disposed in lined facilities. The "98 Rule," supported by U.S. EPA's Subtitle D landfill regulations, required all operational municipal solid waste facilities to be lined by January 1998.
- Increasing waste diversion through recycling. Growth in available curbside and drop-off recycling programs, development in the private recycling sector, and state agency 'buy recycled' efforts helped recycling markets mature. Capturing previously unrecovered materials and enhancing the state's recycling infrastructure led to economic growth and job creation in the recycling sector.
- Implementing statewide solid waste disposal bans on certain products in landfills (lead acid batteries, white goods, tires and yard wastes) dramatically lowered disposal rates. Self-sufficient programs like those created for scrap tires and white goods are widely recognized for successfully regulating difficult-to-manage wastes.
- Local disposal diversion ordinances on materials such as corrugated cardboard were imposed by a number of city and county governments. Recycling rates for these materials significantly increased.
- Requiring local government units to create solid waste management plans allowed cities and counties to develop and monitor long-term structured goals. The plans improve local solid waste management and allow for comprehensive state planning.
- Establishing the Solid Waste Management Trust Fund made possible a number of effective waste reduction initiatives across the state. Adequate resources allowed successes that would not have been achieved otherwise.

Despite these past efforts and successes, challenges remain. Some of these include:

- Reducing waste disposal in landfills on a per capita basis. Waste disposal continues to rise, both on a per capita basis and in absolute tons disposed.
- Continuing recycling development. Many commodities have not met their full recovery potential. Recovery of other commodities is stymied by competition with low tipping fees, ease of disposal and – in some cases – a lack of viable use for the recovered material.
- Developing, implementing and disseminating effective educational programs. Though many successful programs exist, informing the public will remain a constant solid waste

management goal. Strong public education and awareness are associated with many successful solid waste management improvements, from facility siting to recycling.

- Reducing illegal dumping and litter. These problems continue to frustrate many residents and government officials.
- Monitoring and capturing landfill gas emissions. Some areas use landfill gas extraction programs to generate energy and make a positive economic impact on a local basis. These programs could be applied statewide.
- Managing closed MSW landfills and pre-regulatory abandoned dumpsites. The facilities are no longer operating, but concerns remain that they threaten public health and the environment.
- Reducing landfill waste toxicity. Materials containing toxics, such as electronics and household hazardous waste, make up an increasingly larger portion of the waste stream.
- Identifying long-term funding strategies. The state and its communities need adequate resources to afford progressive solid waste management programs.

When solid waste management successes are compared to unachieved goals, the differences become obvious. Accomplishments were achieved through unambiguous mandates, as opposed to recommendations or voluntary directives. A clear distinction exists between the efficiency and success of programs with access to funding and those without. Programs funded through state or local grants, or those with self-financing mechanisms, succeed more often than programs without funding or infrastructure.

Keeping the public aware of solid waste management issues is a challenge. As other environmental concerns rose in public awareness, commitment and concern to solid waste issues declined in the past 10 years. The lack of public interest has been accompanied by a lack of state and local government commitment. Without public awareness or government commitment, solid waste management improvements come more slowly.

Changes in solid waste disposal present new educational and waste management challenges. Flexibility is required to adjust to changes in the solid waste management sector. This plan was created to address both new challenges and those that remain from the past decade. It recognizes and applies the ingredients that led to previous success (i.e., mandates, funding, public awareness, etc.), while realizing that dynamic policies and actions are needed to advance future goals. Acknowledgment exists that many actions will be difficult or unpopular to implement. Before calling for these actions, they were closely examined to ensure their necessity for continued improvement.

For this and many other reasons, leadership from both government and private industry – particularly the recycling sector – is vital. Commitment to support and manage public and private programs has a significant impact. Management efforts must have solid administration and guidance or they will not succeed. Such leadership often results in strong public education and awareness, which are associated with solid waste management improvements ranging from facility siting to recycling.

Recognizing the ingredients for success allows continued achievement. By applying elements with a proven track record in the right combinations to both new and continuing goals, this plan builds on past success to bring future improvement to solid waste management in North Carolina.

GOALS & OBJECTIVES

Five goals were created after analyzing old and new solid waste management challenges. The analysis incorporated an overview of the status of solid waste management, a review of the previous plan's met and unmet goals, and – most importantly – it incorporates input from the public it serves. Each goal is simple, straightforward and designed to achieve its desired result by 2013.

Goal One: Ensure long-term environmental protection by improving future landfill technology and address public health and environmental concerns associated with closed landfills.

Goal One responds to two distinct concerns. The first concern is that some old, closed landfills may represent a threat to the environment. The second is that new, lined landfills use technology that may not fully protect long-term environmental security.

Research on "bioreactor" landfills that break waste down into inert material can help both municipal solid waste and C&D landfills achieve this goal. Banning specific materials from disposal helps decrease the quantity and the toxicity of landfill materials. Existing programs that divert specific toxic materials such as household hazardous waste, used motor oil, electronics and other toxics should be expanded.

Closed, unlined MSW landfills represent a different challenge because each site is unique. These landfills require risk-based analysis to determine a customized course of action. Steps could include, but are not limited to, improving landfill caps, recovering methane and conducting various groundwater cleanup procedures. A fact sheet for each closed, unlined MSW landfill should be developed. Information on the facility's location, monitoring, groundwater flow and other data should be created and made available to the public.

Objectives for Goal One:

- Research bioreactor landfill design and closure requirements; adjust regulations accordingly.
- Research existing landfill design and performance; adjust regulations accordingly.
- Reduce the disposal of material with potentially harmful components in landfills.
- Review design and monitoring requirements for C&D landfills.
- Develop and distribute action plans for closed MSW landfills and abandoned dumpsites.
- Establish a strategy to fund the long-term care and cleanup of closed, lined MSW landfills.

Goal Two: Substantially increase the amount of waste recycled and composted.

Too many resources are being disposed of in increasingly scarce and expensive landfill space. Unquestionably, increasing the levels of waste diverted to recycling or composting would be an effective way to combat the problem. Past measures to selectively ban specific materials successfully diverted materials. Bans could also be used to increase material recovery. Clean wood and pallets have strong recycling potential. Because much of the necessary infrastructure already exists, implementation would be cost-effective.

In addition to material bans, a series of programs is required to support Goal Two. Public input from statewide forums showed consistent concern about landfill capacity. The general sentiment was that local capability must be supported and recognized for communities to respond to mandates and maintain current performance levels. For example, "pay-as-you-throw" or variable rate programs should be mandated with size thresholds and performance standards. Communities whose populations fall below established size thresholds or those with extremely effective recycling access, participation rates or buy recycled programs, may qualify for exemptions from certain program requirements.

Funding waste reduction activities is critical to achieve Goal Two. Funds are needed to fill infrastructure gaps that keep recycling and composting levels stagnant, establish material recovery facilities, and establish or expand composting and construction waste recycling operations. Advance disposal fees on tires and white goods are examples of successful funding mechanisms that could be applied to electronics and other goods. Establishing a statewide surcharge on tipping fees would help many recycling programs compete with private landfill disposal; it would also fund and sustain local waste reduction initiatives.

Objectives for Goal Two:

- Enact a series of statewide disposal bans on recyclable materials, such as pallets, clean wood waste, oil filters, cardboard, newspaper, office paper and computer monitors containing cathode ray tubes.
- Require local government recycling programs to achieve per capita recovery targets for specific materials.
- Enact a statewide surcharge on tipping fees.
- Implement variable rate pricing and local mandates to increase recycling participation.
- Continue and expand North Carolina's product stewardship initiatives.
- Implement a consistent funding source to recover electronics.
- Increase public awareness and commitment to recycling.
- Increase "buy recycled" efforts by state and local agencies and the private sector.
- Increase diversion of organic materials by state agencies.
- Incorporate recycling and composting into disaster debris management plans.
- Increase grant and loan funds for source reduction, recycling and composting.

Goal Three: Reduce litter and illegal disposal by 50 percent from 2000-2001 levels.

Goal Three addresses the problem of litter and illegal dumping. Roadside litter traditionally falls outside the scope of solid waste management. However, overwhelming public comments on the topic demands its inclusion.

Litter and illegal dumping was one of the most emotional issues discussed in the statewide public forums. Many citizens expressed frustration with enforcement efforts and the legal system's seeming lack of response to the problem. The objectives proposed are a combination of programs that reduce litter and focus on stronger enforcement of existing laws. One effective method is to require local governments to measure and report on their efforts. Identifying a common means to measure litter and illegal dumping would help attain this goal.

Objectives for Goal Three:

- Document the extent and nature of littering and illegal dumping in North Carolina.
- Increase educational efforts for litter reduction and enforcement.
- Require local solid waste plans to implement a litter control element that provides measurable results.

- Require the Highway Patrol, local law enforcement agencies, and the courts to fully report their litter control enforcement efforts to the public.
- Establish an ongoing funding source to prevent and clean up litter and illegal dumpsites.
- Research bottle bills, “litter taxes" and mechanisms used by other states to prevent litter and illegal dumping.

Goal Four: Implement policies and procedures to provide information to the public and ensure public participation throughout the decision-making process regarding waste management facilities.

This goal seeks to remedy concerns that the public is not adequately involved in decisions regarding solid waste management facilities, especially landfills. The state can provide these opportunities – particularly near proposed facilities – if it gives neighboring residents adequate information and opportunities to provide early comments to the state during the initial permit review. Identifying who constitutes a “neighbor” may require different methods as each facility is unique, but common sense methods can be successfully tailored for each location. Custom public participation plans should provide those identified as “neighbors” and their communities with site-specific information and list participation opportunities.

Objectives for Goal Four:

- Ensure public involvement and education when siting new MSW landfills.
- Ensure public involvement and education when making decisions about proposed C&D, transfer and compost facilities.
- Ensure public involvement and education in decision-making for existing solid waste facilities.
- Ensure public involvement and education when making decisions about closed facilities**.**

Goal Five: Create and continually maintain 20 years of landfill capacity in the state.

This goal satisfies North Carolina’s need to have landfill disposal capacity for wastes that cannot be reduced, recycled or composted. Environmental protection, economic growth and public health protection demand the presence of landfills that safely and economically handle solid waste. At present, several regions face potential landfill closings with no assurance that future disposal capacity will be developed.

To ensure the protection of its residents and environment, North Carolina needs to determine its own landfill capacity. Capacity data should be distributed to elected officials, local government staff, and communities. The state should continue to review and improve the efficiency and effectiveness of the landfill permitting process, while ensuring that the public understands and participates in issues surrounding solid waste management. Reducing the quantity of waste disposed can prolong landfill lifetimes, so actions leading to waste reduction and increased recycling should be promoted and implemented.

Objectives for Goal Five:

- Increase waste reduction efforts.
- Develop a process to certify or identify the need for facilities.

- Provide information regarding landfill capacity need.
- Provide information to local communities regarding solid waste facilities.
- Review the public participation process.
- Improve the efficiency of permit application review.

CONCLUSION

The five goals and their associated objectives are vital to improve solid waste management in North Carolina. They are also necessary to safeguard the public health and welfare. Reviewing the previous State Plan, analyzing the status of solid waste management, and soliciting and studying stakeholder sentiments identified the goals.

The primary finding of this analysis is that goal achievement depends on whether goals are voluntary or mandatory. Mandates were identified as the most successful tool available to achieve solid waste management goals. Goal success is also affected by the amount of funds committed to their achievement. However, implementing mandates is "easier said than done." Despite their necessity, some objectives will be met with controversy or opposition. However, if one accepts the objective of maintaining and improving solid waste management, this plan offers critical guidance. Combined action from the General Assembly, DENR, local government, the private sector, and North Carolina residents will be needed to achieve the goals.

For a more thorough discussion on the status of solid waste management in North Carolina and supporting data, see Chapters Two through Four. Detailed explanations of the motivations that led to the five goals and the actions recommended to achieve them are in Chapters Five through Nine. Appendices with supporting information follow the chapters.

Chapter Two: Current Status of Solid Waste Management

This chapter uses data to present a "snapshot" of the status of waste management in North Carolina. Waste stream composition, recovery efforts, litter and illegal disposal data are included along with disposal trends, comparisons of estimated potential recovery vs. actual recovery, waste profiles and an analysis of litter clean-up efforts. These facts identify areas where current solid waste management efforts are succeeding and areas that need further development. The data were used to shape the goals and actions necessary for North Carolina to build on its successes and make future improvements possible.

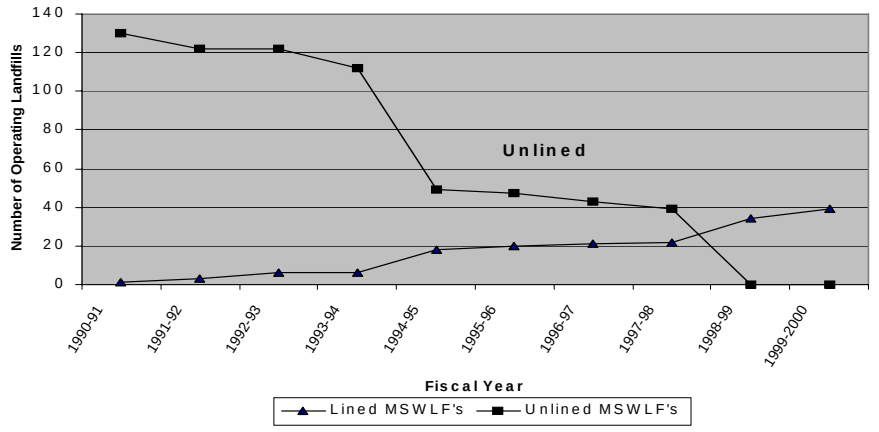
DISPOSAL OF SOLID WASTE

An overview of disposal within the state is essential to understand the current challenges. This section includes historical data from the past decade and projections for future disposal.

Phase-out of Unlined Landfills

North Carolina was one of the first states in the nation to phase-out old, unlined disposal facilities and replace them with lined landfills. Lined landfills better protect human health and the environment. As Figure 2.1 shows, North Carolina began exclusively disposing of its municipal solid waste in lined landfills in 1998. Many unlined landfills closed because of the transition. These closed facilities present long-term concerns for the state's groundwater, which is used by more than half of North Carolina's population for drinking water. It is important to note that the state does not require C&D landfills to be lined.

Figure 2.1. Number of Lined and Unlined Landfills Operating in North Carolina



Increasing Disposal Trends

Despite recycling increases and the establishment of a statewide waste reduction goal, disposing of waste in landfills remains North Carolina predominant solid waste management method. Figure 2.2 below shows a statistical history of disposal in North Carolina. This table presents an upward trend in solid waste disposal.

Figure 2.2

HISTORIC WASTE DISPOSAL

Fiscal Year	Tons Disposed	Population	Per Capita Disposal Rate	Change from 1991-1992
2002-2003	10,236,960	8,323,375	1.23	14%
2001-2002	9,999,284	8,188,008	1.22	13 %
2000-2001	9,752,510	8,049,313	1.21	12%
1999-2000	(adjusted*) 9,937,355	7,938,062	1.26	16 %
1999-2000	10,267,137	7,938,062	1.30	20 %
1998-1999	9,214,323	7,797,501	1.19	10 %
1997-1998	8,607,578	7,645,512	1.13	5 %
1996-1997	(adjusted*) 8,041,734	7,490,812	1.08	0 %
1996-1997	8,741,727	7,490,812	1.17	8 %
1995-1996	7,722,795	7,336,228	1.06	-2 %
1994-1995	7,624,144	7,180,525	1.07	-1 %
1993-1994	7,038,505	7,036,927	1.00	-7 %
1992-1993	6,890,818	6,892,673	1.00	-7 %
1991-1992	(managed**) 7,257,428	6,781,321	(Base Year Rate) 1.08	
1991-1992	6,822,890	6,781,321	1.01	
1990-1991	7,161,455	6,632,448	1.08	

*The 1996-1997 and 1999-2000 fiscal years are adjusted by subtracting the tonnage estimated to have been created by Hurricanes Bertha, Fran (1996-1997) and Floyd (1999-2000).

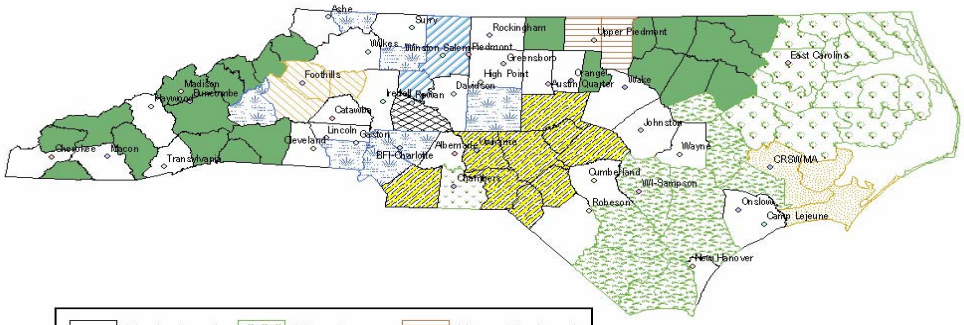
**The tons managed figure was determined by adding the total amount of municipal solid waste disposed in landfills and incinerators to the amount of waste managed through local governments' recycling, composting and mulching efforts in FY 91-92. Recycling, composting and mulching were added to the tons disposed in recognition of the fact that some local governments had begun waste reduction before 1991.

Formula: Total Tons Disposed ÷ Population = Per Capita Disposal Rate

Map 2.1 matches primary facilities with the counties that use them. Primary facilities are those that receive 50 percent or more of a county's waste. As noted earlier, wide reliance on regional landfills is a new trend. As facilities close and new ones open, distribution patterns may change significantly.

Map 2.1 MSW Landfills Used by N.C. Counties According to Primary Facilities Used FY 2001-2002

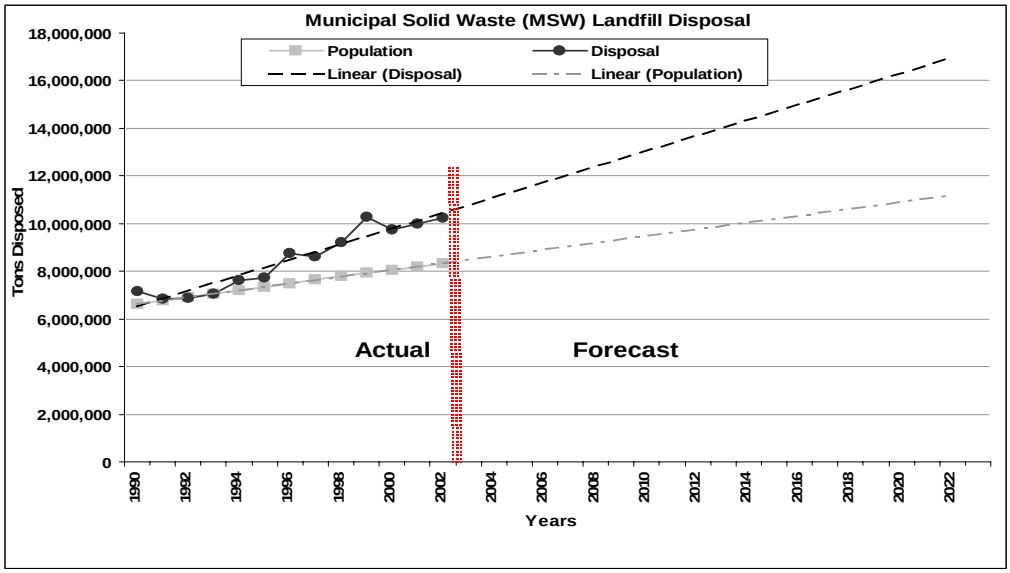
Primary = > 50% of Tons



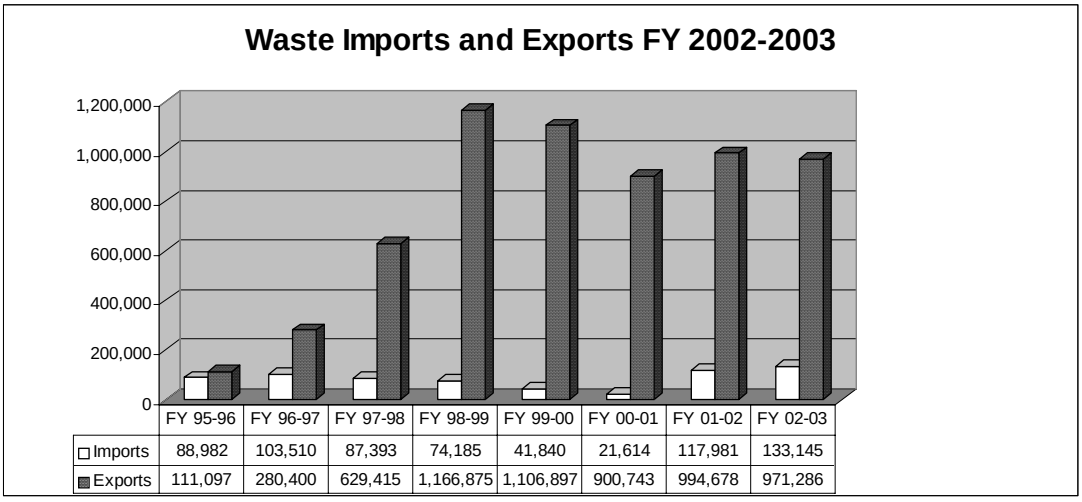
Map Creator: Erin Reiney
Source of Data: NCDENR Division of Waste Management

Figure 2.3 shows a projection of disposal trends through 2022. Even if the current per capita disposal rate holds steady, the total of tons requiring disposal will rise. The state disposed of more than 10 million tons of solid waste during the 2002-2003 fiscal year. Current projections place solid waste disposal close to 18 million tons annually in 20 years.

Figure 2.3



Fiscal Year 1998-1999 was the first year North Carolina's waste exports exceeded one million tons. Figure 2.4 shows it was the same year that waste imports declined. If future disposal capacity in adjoining states becomes too scarce or too costly for North Carolina generators or haulers, imports from neighboring states may rise. Although imports declined over the period from 1995-1996 to 2000-2001, imports for Fiscal Year 2002-2003 are the highest in eight years. Imports have continued to increase, partly due to the proximity of North Carolina landfills to state borders. Continual increases in import totals could cause additional stress on North Carolina's disposal capacity.

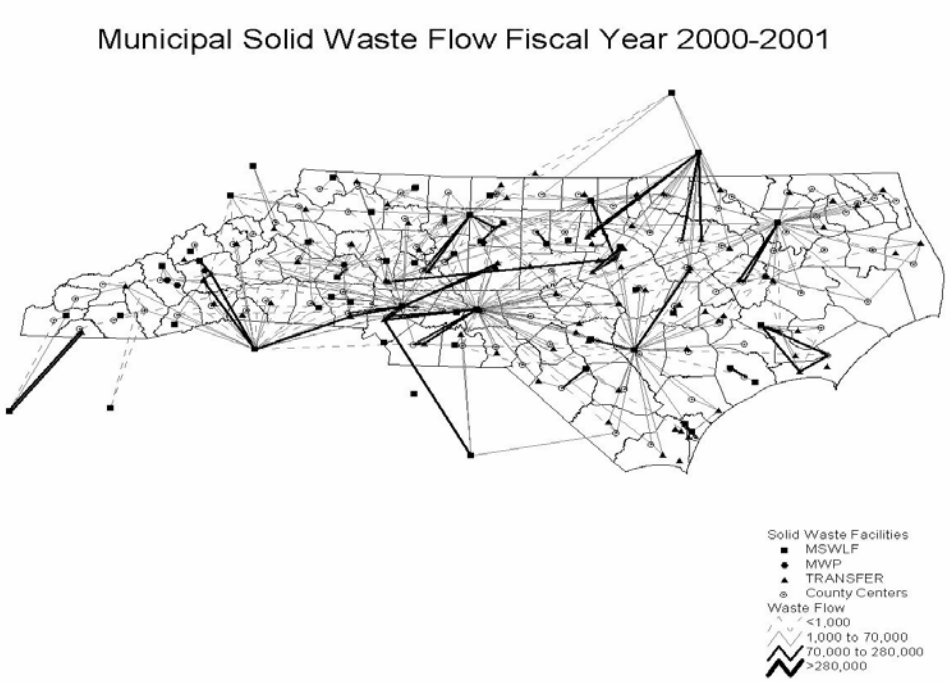


	FY 95-96	FY 96-97	FY 97-98	FY 98-99	FY 99-00	FY 00-01	FY 01-02	FY 02-03
Imports	88,982	103,510	87,393	74,185	41,840	21,614	117,981	133,145
Exports	111,097	280,400	629,415	1,166,875	1,106,897	900,743	994,678	971,286

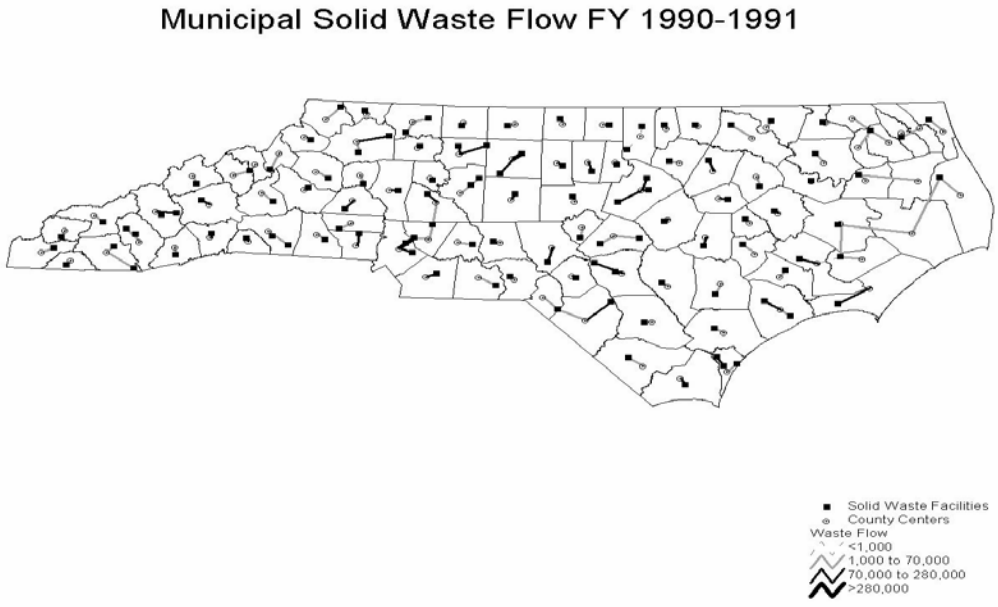
In the past 10 years, North Carolina has changed the way it disposes of waste. The state has moved away from a system where local, government-operated facilities dispose of waste within county boundaries. Large amounts of waste now move through transfer stations to landfills outside the area of its origin.

Map 2.2 indicates the use of in-county facilities, while 2.3 indicates the increased distance and mobility of waste before being disposed.

Map 2.2



Map 2.3



Waste Stream

Significant composition changes have taken place. Construction and demolition debris now constitutes a much larger portion of the waste stream. Materials such as food wastes have also grown in proportion to other materials with higher recycling rates, such as paper. An estimate of the state's waste stream, divided by material, appears in Figure 2.5. The estimate is based on a 1998 market assessment analysis.

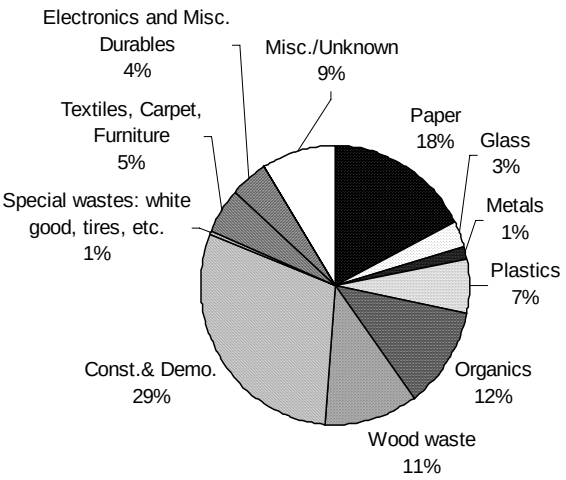


Figure 2.5. Estimated Breakdown of North Carolina's Waste Stream.

Figure 2.6 compares North Carolina's 1991 and 1999 waste streams. The breakdown by source sector shows changes since the state's first State Solid Waste Management Plan in 1991. The share of C&D waste has likely grown by more than 20 percent. The statistical uncertainty is due to the fact that C&D waste was often combined with other waste streams or went undercounted in 1991. At that time, there were very few separate facilities for C&D waste. Counties used to place C&D waste in MSW landfills. Separate C&D facilities were developed in the mid-1990s when unlined MSW landfills closed and were replaced by lined MSW facilities that often charged higher tipping fees. The separate facilities made data collection easier and more accurate. Because the 1991 Plan consultants did not have accurate C&D data, a backward extrapolation was used to create the charts below.

Figure 2.6

WASTE STREAM COMPARISONS

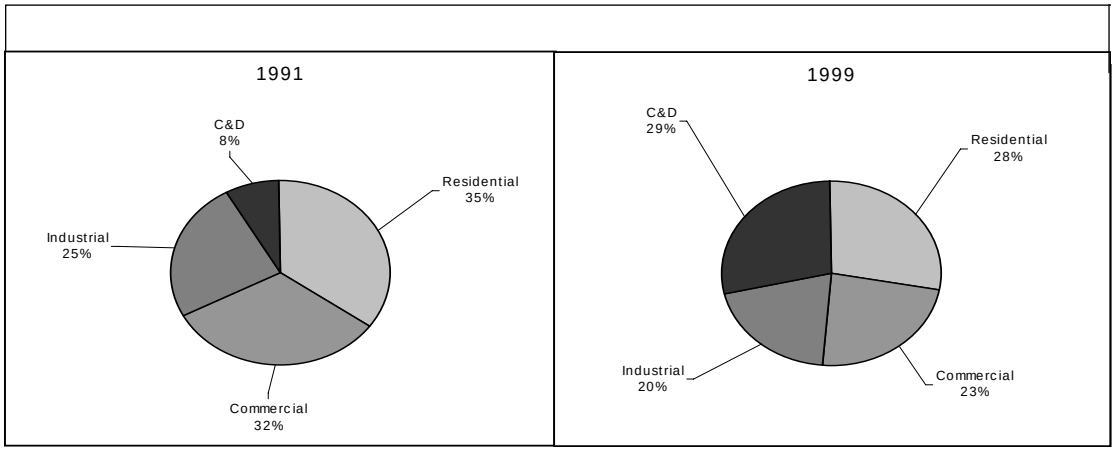


Figure 2.7 provides a more in-depth analysis of the change in county landfill waste composition when separate C&D facilities opened. The comparison shows that MSW portions of county waste decline in association with the rise of tons reported at new C&D landfills.

Figure 2.7. County Landfill Tonnage Samples Before and After C&D Openings.

Facilities	1992-93 tons	1993-94 tons	1994-95 tons	1995-96 tons	% MSW decline when C&Ds open
Iredell Co. MSW landfill	NA	85,180	125,741	103,585	-18%
Iredell Co. C&D unit				24,278	
Rutherford Co. MSW	64,894	77,057	69,039	50,076	-27%
Rutherford Co. C&D				12,104	
Madison Co. MSW	NA	7,411	10,773	9,954	-8%
Madison Co. C&D				1,062	
Orange Co. MSW	125,452	121,345	124,611	*57,889	*-54%
Orange Co. C&D				31,342	
Alamance Co. new MSW	NA	NA	77,253	67,484	-13%
Alamance Co. C&D unit				9,299	
Dare Co. MSWLF/ Transfer	50,101	52,052	40,747	40,633	-22%
Dare Co. C&D			16,649	14,638	

*** 1995-1996 - UNC-CH coal ash was diverted from the local waste stream, further decreasing the total MSW disposed.**

Because C&D debris is a rapidly increasingly waste stream, it needs innovative disposal and reduction strategies. However, other waste streams close in size to C&D also need to be addressed with appropriate programs and policies. Because of their relatively even distribution, North Carolina should apply waste reduction strategies to every sector.

Each source sector has a different waste "profile." As once was the case with C&D, some waste profiles need better documentation. Characterizing waste streams helps target strategies for source reduction and recycling. Here is a general profile for each sector's waste.

- **Residential** – This sector contains common household recyclables and disposables, ranging from newspapers to drink and food containers, food wastes and household hazardous wastes (cleaners, paints, etc.). The vast majority of recyclables collected by local governments come from this waste stream. As an example of this waste stream's profile, an assessment conducted by Wake County in 1998 ranked the largest material categories. At 33.3 percent, paper made up the largest category, followed by food waste (11.6 percent), plastic (10.4 percent) wood (9.5 percent), metal (5.8 percent) and textiles (4.7 percent). Approximately three million households contribute to North Carolina's residential waste stream.
- **Commercial** – Transport packaging, used for retail and wholesale products such as corrugated cardboard, film wrap and pallets, make up the bulk of this sector. Waste streams similar to households (newspaper, drink containers, etc.) and heavy food waste components from restaurants, cafeterias and grocery stores are also included. A large portion of the state's discarded office paper, from places like banks and law and accounting firms, also falls into this sector. The origins for this waste stream range from hundreds of large retail establishments (e.g., malls, shopping centers, grocery stores, etc.) to thousands of small business and office buildings. In 1998, the state Employment Security Commission database listed 59,066 wholesale and retail businesses of all kinds in North Carolina. For example, there are 4,485 grocery stores and 1,478 department and general merchandise stores. There are also 1,829 accounting and bookkeeping offices, 4,503 automotive repair shops, and 1,482 hotels and motels. Other generators include institutions such as state and local governments, hospitals, schools and universities.

- **Industrial** – This sector has three basic categories. The first category is transport packaging wastes (pallets, cardboard, film wrap, drums and barrels) followed by byproduct waste streams, which vary per manufacturing facility, and thirdly general office and administrative wastes (office papers, toner cartridges, etc.). For example, tire manufacturing plants produce rubber, metal and fabric waste streams, including "off-spec" and un-sellable end products. Textile plants create fabric waste streams; furniture plants produce wood wastes, and so on. In 1998, the Employment Security Commission listed 11,604 manufacturing facilities.
- **Construction and Demolition –** Cut-offs, residues and leftover items from residential and commercial construction processes, including entire demolished buildings, make up this sector. Common materials include wood, brick, gypsum wallboard, metal, vinyl siding and shingles. A fair amount of packaging wastes (cardboard boxes and pallets) is also found in this waste stream, as well as potentially toxic materials like leftover paints, glues, caulking and treated lumber. The 1998 North Carolina Recycling Market Assessment report broke down C&D generation into categories. Construction debris, at 18.6 percent, was one of the smaller groups, but renovation discards accounted for 43.5 percent and demolition wastes for 37.9 percent. An estimated breakdown of the overall C&D waste stream yielded these totals: wood (27.5 percent) concrete and brick (23.2 percent), drywall (13.4 percent), roofing (12 percent) and metal (8.8 percent).

Figure 2.8 uses data estimates from the 1998 Recycling Market Assessment to show disposal and recovery rates for the most common materials. The data helps define approaches for waste reduction.

Figure 2.8. - 1998 Estimated Disposal and Recovery Rates *

Material	Recovery Rate %	Estimate Tons Disposed
Construction & Demolition Debris	6	2,672,154
Electronics	0	50,328
Total Glass	16	237,171
Aluminum Cans	49	21,815
Steel Cans	11	69,475
Yard Waste	90	77,535
Food Residuals	2	848,838
Total Paper	35.6	1,394,418
Newsprint	56.5	122,818
Cardboard	49.8	428,314
Office Paper	29.3	132,051
Magazines & Catalogs	11.4	122,363
Mixed Paper	17	563,202
Total Plastics	5	523,049
PETE (#1 plastic)	29	33,691
HDPE (#2 plastic)	6	107,397
PVC (#3 plastic)	5	32,652
LDPE (#4 plastic)	2	137,056
PP (#5 plastic)	0	71,513
PS (#6 plastic)	1	54,950
Other Plastics	1	86,076
Carpet	0	48,447
Post-Consumer Textiles	8.2	159,007
Scrap Tires	45	52,250

White Goods	81	19,075
Total Wood	74	782,004
Pallets	35	282,004
Secondary Mfr. Waste	81	500,000
Other	0	726,246
Diapers	0	83,400
Furniture & Furnishings	0	203,496
Miscellaneous Durables	0	305,522

* From 1998 North Carolina Markets Assessment of the Recycling Industry and Recyclable Materials

The data show North Carolina has far to go before it reaches its maximum potential in the recovery of recyclable materials. Some waste streams would clearly benefit from having recovery efforts developed or enhanced. End-use markets exist for most of the materials, but additional processing capacity needs to be developed for recovery to expand dramatically.

SPECIFIC RESIDENTIAL AND COMMERCIAL WASTE STREAM DATA

In FY 2003 the state disposed of 10,236,960 tons of waste. Using the pie chart factor in Figure 2.6, approximately 2.8 million tons came from residential disposal, making it the state's second largest waste stream. Additional information from annual local government reports can help refine this estimate of the volume of residential waste. The data on residential solid waste collection programs produces an average of .92 tons per year disposed per household. Multiplying this tonnage with the U.S. Census figure of 3,132,013 households in North Carolina yields an annual estimate of 2,891,783 tons of residential waste disposed per year statewide. This estimate falls within three percent of the 2.8 million figure above.

No parallel reporting system is available to estimate the generation of commercial wastes. However, applying the assumed percentage of commercial discards in Figure 2.6 to the state waste stream yields annual tonnage figure of about 2.3 million tons.

Waste stream composition studies from three North Carolina communities and other states illustrate how much recyclable material remains in both residential and commercial waste streams. The three in-state communities were Winston-Salem (2000), Orange County (1995 and 2000) and Wake County (1999). The out-of-state studies came from Iowa (1998), Wisconsin (2002), Minnesota (2000) and Pennsylvania (2002). Both the communities and states have relatively mature public recycling programs. Some have policies that help achieve high recycling rates (e.g., Iowa's bottle bill). Most North Carolina communities and many other states do not enjoy such high recovery levels, and using this set of waste composition studies may actually underestimate the presence of recyclables in the waste stream. However, residential and commercial waste streams do not differ widely across North Carolina and the United States. As the table below shows, commodity estimates are similar across this sample group.

Figure 2.9. Specific Commodities as a Percentage of Disposed Residential Waste									
	Winston-Salem (2000)	**Orange County (2000)**	**Orange County (1995)**	**Wake County (1999)**	**IA 1998**	**WI 2002**	**MN 2000**	**PA 2002**	**Straight Avg.**
Newspaper	5.25	4.80	5.30	7.30	4.20	3.80	5.00	5.20	5.11
Cardboard	4.66	4.70	4.50	3.70	4.10	2.40	3.20	5.30	4.07
Office Papers	0.64	6.50	1.70	2.30	1.80	1.60	1.40	2.20	2.27
Magazines	N/A	4.40	6.10	3.20	3.20	1.90	2.40	2.90	3.44
Paperboard	N/A	5.10	N/A	2.50	N/A	1.40	3.10	N/A	3.03
Mixed Paper	21.99	N/A	N/A*	5.30	6.10	6.70	6.20	4.80	8.51**
Paper Subtotal	32.53	25.5	17.6	24.3	19.4	17.8	21.3	20.4	26.43
Glass (all colors)	6.12	4.20	5.80	3.60	2.10	1.50	2.40	3.20	3.61
Steel cans	1.75	1.80	2.70	1.10	1.30	0.90	0.90	1.40	1.48
Aluminum Cans	0.71	N/A	N/A	0.50	0.30	0.50	0.70	0.60	0.55
PETE	1.66	1.60	1.30	1.00	0.50	0.60	0.90	1.00	1.07
HDPE	1.88	1.30	1.30	1.00	0.90	0.70	0.60	0.90	1.07
Containers Subtotal	12.12	8.9	11.1	7.2	5.1	4.2	5.5	7.9	7.78
Food wastes	28.93	17.80	11.20	11.60	10.80	13.40	12.00	12.20	14.74
Textiles/ Leather	3.01	5.40	3.30	4.70	5.50	3.60	3.50	4.40	4.18

* The 1995 Orange County study assigned 23.9 percent for "other paper," which presumably includes office and mixed papers included in other studies.

** The mixed paper tonnage figures on recoverable materials - e.g., Winston-Salem's high percentage may include some unrecyclable fibers.

A number of conclusions become apparent when examining Figure 2.9:

- Recoverable paper still constitutes between 20 and 25 percent of disposed residential waste. This category includes commonly collected fiber grades, including newspaper and magazines. It also includes grades increasingly accepted by mills, material recovery facilities, and other processing centers. Recyclable residential paper is a decidedly under-recovered commodity.
- Food wastes follow paper as the second largest "untapped" recoverable material in residential waste. Its disposal rate of close to 15 percent exceeds the combined total for newsprint, cardboard and magazines. There is considerable opportunity for recovery, but the infrastructure needed to divert residential food waste is immature. Backyard composting diverts some waste and a few commercial composting facilities are equipped to process the material. At present, North Carolina does not have a single community that actively collects separated food waste.
- Containers (bottles and cans) make up a smaller percentage of disposed waste, but still represent as much as one in 10 pounds of household waste. Container recycling rates have not been optimized.
- Textiles/leather is one waste stream with increased diversion potential if recycling markets stabilize and community textile recycling programs can be redeveloped. Promoting reuse (through charities such as Goodwill and community swap shops) may boost diversion.

Figure 2.10 below shows data from commercial waste composition studies. Many commodities from residential waste streams also appear here.

Figure 2.10 Specific Commodities as a Percentage of Disposed [Residential] Waste								
	Winston-Salem (2000)	**Orange County (2000)**	**Orange County (1995)**	**Wake County (1999)**	**WI 2002**	**MN 2000**	**PA 2002**	**Straight Avg.**
Newspaper	3.39	6.10	4.70	2.20	1.60	2.40	3.00	3.34
Cardboard	19.97	3.50	10.70	8.10	5.70	9.90	11.80	9.95
Office Papers	2.90	5.80	3.30	5.40	1.80	4.30	5.20	4.10
Magazines	N/A	2.50	2.80	1.40	0.90	2.50	2.40	2.08
Papers Subtotal	26.26	17.9	21.5	17.1	10	19.1	22.4	19.47
Glass (all colors)	*2.13*	*3.80*	4.00	*2.00*	0.90	*1.50*	*10.00*	3.48
Steel cans	0.74	1.20	1.60	0.60	0.50	0.60	0.70	0.85
Aluminum Cans	0.39	1.20	0.70	0.40	0.40	0.50	0.40	0.57
PETE	1.23	2.00	1.00	0.40	0.50	0.50	0.90	0.93
HDPE	0.98	1.40	1.20	0.50	0.40	0.40	0.50	0.77
Containers Subtotal	5.47	9.6	8.5	3.9	2.7	3.5	12.5	6.6
Food wastes	26.24	20.40	12.20	10.00	13.20	11.80	11.80	15.09

As with the residential analysis, a number of conclusions become apparent when examining commercial waste stream data.

- Recyclable paper grades make up a large quantity of the commercial waste stream. Cardboard offers a particularly good opportunity for substantial diversion. Office paper makes up twice the total here as in residential waste. The data also show the effectiveness of local cardboard disposal bans. Wake and Orange counties, which have cardboard bans, recover a much greater quantity of material compared to Winston-Salem, which does not ban the material.
- Compared to residential waste, containers make up a smaller percentage of the commercial waste stream. Communities seeking higher commercial diversion levels would be better served by recovering fibers instead of containers.
- Just like residential waste, commercial food waste is the second largest category, although at a slightly higher level. Centralization makes commercial food waste an easier recovery target than residential food waste. A smaller number of generators produce larger amounts, often in concentrated geographic clusters (e.g., restaurants and grocery stores in commercial zones). There are a small but growing number of recovery programs and private recovery services in North Carolina. They offer models for developing additional efforts.

LOCAL GOVERNMENT RECYCLING EFFORTS

Many local governments (counties and municipalities) actively divert waste from landfills and recover recyclable commodities. Figure 2.11 shows that local governments regularly divert around one million tons of material annually. Per capita recovery rates have grown over the last 10 years, but the lackluster ratio of recovery to disposal indicates local recycling efforts have stagnated since FY 1994-1995.

Figure 2.11. Local Government Diversion of Materials from Disposal FY 1992-1993 to FY 2001-2002										
Material	**FY 92-93**	**FY 93-94**	**FY 94-95**	**FY 95-96**	**FY 96-97**	**FY 97-98**	**FY 98-99**	**FY 99-00**	**FY 00-01**	**FY 01-02**
Total Paper	151,676	164,806	185,270	212,577	228,025	216,121	233,339	241,859	263,365	267,840

Total Glass	32,611	37,537	38,088	49,601	44,978	43,449	41,623	41,826	46,936	49,891
Total Plastics	9,264	9,797	12,339	16,253	13,699	14,399	14,835	14,474	15,062	17,269
Total Metal*	44,302	51,468	59,483	65,977	77,252	81,262	77,564	86,480	92,634	114,786
Total Organics**	378,516	350,142	495,034	498,583	640,410	504,554	525,033	638,757	540,582	468,901
Special Wastes***	1,715	2,106	2,466	3,212	3,230	3,527	3,817	4,709	4,947	5,426
C & D Debris	N/A	N/A	N/A	N/A	N/A	N/A	N/A	59,598	15,406	17,648
Other	4,272	16,387	5,987	333	12,762	35,977	63,794	5,329	6,120	5,896
Total	**622,356**	**632,243**	**798,667**	**846,536**	**1,020,356**	**899,290**	**960,005**	**1,093,032**	**985,052**	**947,657**
Per Capita Recovery (lbs.)	**182.17**	**182.00**	**226.19**	**235.59**	**279.19**	**242.03**	**254.40**	**285.61**	**243.66**	**231.47**
Recovery Ratio (Recycling : Disposal)	**0.09**	**0.09**	**0.10**	**0.11**	**0.13**	**0.11**	**0.10**	**0.11**	**0.10**	**0.10**

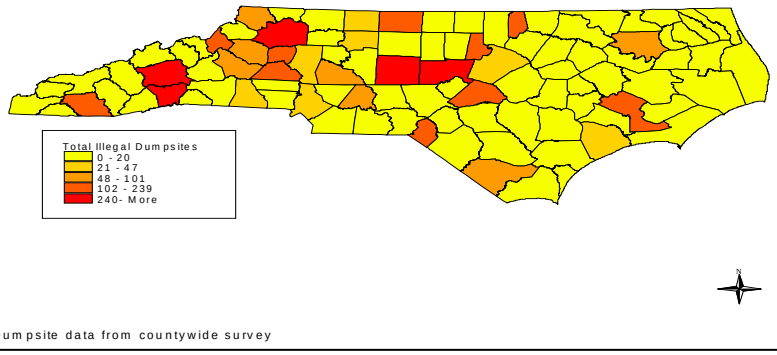
* Includes white goods, aluminum cans, steel cans and other metals.
** Includes yard waste, pallets and wood waste.
*** Includes used oil, oil filters, antifreeze and batteries.

ILLEGAL DISPOSAL AND LITTERING

Illegal dumping and litter place waste in inappropriate and often harmful places. The issues are attracting growing public concern in North Carolina. Misplaced waste affects the appearance of North Carolina's roadsides and communities and negatively impacts wildlife, water and land quality. Anti-littering agencies point out that litter clean-up campaigns costs tax dollars and that litter can sometimes be a factor in traffic accidents.

Illegal dumping haunts North Carolina ravines, farmland, abandoned and unsecured lots, private and public property, country dirt roads, and dead-end roads. Construction, demolition or land-clearing contractors create the vast majority (76 percent) of illegal dumpsites. Illegal dumping affects human and environmental health, aesthetics, tourism, property values and economic development. Clean-up efforts and their attendant costs can be extensive and resource intensive. At a minimum, 960 illegal dumpsites exist in 97 counties, while roughly 3,551 closed[1] dumpsites linger in 90 counties. On average, 45 open and closed sites exist per county.[2] Figure 2.12 graphically depicts these estimates.

Figure 2.12. Estimated Total Number of Illegal Dumpsites in North Carolina
(From Countywide Survey Reports)



The N.C. Department of Transportation is the state's lead agency in addressing litter clean-up on state roadsides. The N.C. DOT reports spending $15.4 million in 2002 to remove litter, a 50 percent increase

[1] Closed dumpsites have acceptable material buried in place and are recorded in the county Register of Deeds office.
[2] This figure is likely an underestimate. Many counties do not actively search for illegal dumpsites, due to a lack of resources, time, desire and/or an environmental enforcement officer.

from the $10 million spent in 2001, and 200 percent over the $6.38 million in 2000. Inmate labor is used to pick up most litter. In 2002, a total of 858,243 hours of inmate labor was used. It would take 412 full-time employees to cover this commitment. N.C. DOT also manages the Adopt-A-Highway volunteer litter clean-up program. In 2002, 150,000 Adopt-A-Highway volunteers devoted 377,576 hours – the equivalent of 181 full-time staff – to clean up 4.2 million pounds of litter. The volunteers saved the state $3.8 million in clean-up costs. The N.C. DOT also conducted fall and spring "Litter Sweep" drives in 2002. Volunteers, inmates, DOT staff and community service workers removed a total 2.6 million pounds of litter[3] in both sweeps.

In 2001, the court system produced 2,219 litter convictions from 4,059 charges. That same year, North Carolina strengthened its litter laws by passing Senate Bill 1014. The legislation was designed to discourage further litter offenses, enhance and streamline litter enforcement, and to require enforcement agencies to improve enforcement tracking.

WASTE DISTRIBUTION

Waste generation is not evenly distributed in North Carolina. In fact, 10 of the state's counties hold 43 percent of the state's population and generate approximately 50 percent of the state's waste stream. See Figure 2.13 below.

Figure 2.13.
Percentage of Contribution of Total N.C. Waste FY 2002-2003 for the 10 highest waste-producing counties

County	Tons Disposed FY 99-00	Tons Disposed FY 00-01	Tons Disposed FY 01-02	Tons Disposed FY 02-03	Percent of NC Waste	Cumulative Percent 02-03	Change from 2001-2002	Percent Change
MECKLENBURG	1,282,196	1,233,824	1,279,090	1,278,129	12.49%	12.49%	(961.16)	-0.1%
WAKE	958,832	926,504	880,136	856,043	8.36%	20.85%	(24,093.20)	-2.8%
GUILFORD	756,755	730,012	758,566	709,579	6.93%	27.78%	(48,986.94)	-6.9%
FORSYTH	422,828	465,134	447,508	501,034	4.89%	32.68%	53,526.58	10.7%
CUMBERLAND	389,287	351,620	403,476	337,375	3.30%	35.97%	(66,101.53)	-19.6%
DURHAM	267,300	238,894	260,680	298,420	2.92%	38.89%	37,740.13	12.6%
BUNCOMBE	247,300	251,472	247,830	255,112	2.49%	41.38%	7,282.25	2.9%
NEW HANOVER	275,930	259,305	241,951	250,327	2.45%	43.83%	8,375.90	3.3%
CABARRUS	160,186	187,508	203,981	250,162	2.44%	46.27%	46,181.50	18.5%
GASTON	260,383	215,226	214,185	216,267	2.11%	48.38%	2,081.99	1.0%

The per capita disposal rate in FY 2002-2003 was 1.45 tons per person for the top 10 counties, approximately 22 percent higher than the rest of the state. Conversely, the per capita rate for the lowest 50 waste-producing counties was .87 tons per person, 36 percent lower than the rest of the state. Figure 2.13 ranks the 10 counties highest in waste disposal for FY 2002-2003. The data suggest North Carolina counties have a wide range of situations to consider when making solid waste management decisions.

[3] North Carolina Department of Transportation, N.C. DOT's Anti-Litter Efforts (2002).
< http://www.doh.dot.state.nc.us/operations/dp_chief_eng/roadside/beautification/antiLitter/> [22 August 2003].

Chapter Three: Accomplishments in Solid Waste Management in North Carolina

Despite dynamic changes since the late 1980s, North Carolina can claim many notable accomplishments. The following section summarizes those successes and the factors that contributed to their achievement. Public input and a review of achievements were used to determine the common denominators of success.

SUCCESS STORIES

The findings in Figure 3.1 provide a foundation for this plan's goals and recommendations. The most notable conclusion is that strong mandates are an essential tool to achieve solid waste goals. Other tools play an important role as well. The findings are discussed in detail below.

Figure 3.1. Specific Accomplishments and Reasons for Success

Accomplishment	Reason for Success
Unlined MSW landfills closed	Clear and enforced statutory mandate Long preparatory time before mandate was enforced
Recycling increased and recycling markets developed	Public demand Encouragement from state law Generators responded to rising disposal costs Profit-making businesses entered the market
Statewide disposal bans and local disposal diversion ordinances	Clear and enforced statutory mandates Local incentives
Local governments began solid waste planning	Clear and enforced statutory mandate
Waste reduction grant program created	Availability of state funding Grantees provided fundable proposals
Tire program began (includes clean-up of nuisance scrap tire sites)	Program was provided a strong statutory basis Availability of state funding through advance disposal fee
White goods program implemented	Clear and enforced statutory mandate (on the disposal ban) Availability of state funding through advance disposal fee
State agency efforts to buy recycled began	Clear statutory and executive order mandates
Landfill operators certified	Clear and enforced statutory mandate Cooperation and support from landfill operators

Moving from Unlined to Lined Landfills

As Chapter Two described, one of North Carolina's most significant solid waste management accomplishments in the past decade was the closure of unlined, municipal solid waste landfills. By January 1, 1998, all municipal solid waste went to lined facilities for disposal. The change was an important step in the plan to protect North Carolina's groundwater resources.

Although met with initial resistance, the mandate to close unlined landfills was enforced without exception after a long preparation period. The mandate was promulgated in 1991 and enforced beginning January 1998. Support of the "98 Rule" by EPA's Subtitle D landfill regulations also played an important role. Success is clearly attributable to the mandate and the preparatory period that preceded it.

Increased Recycling & Recycling Market Development

Since 1989, North Carolina has made remarkable progress in the diversion of waste through recycling. Local and state programs, coupled with private initiatives, contributed to the dramatic increase in recycling and composting programs.

Municipal curbside recycling programs increased nearly threefold between 1990 and 2000 and the number of programs rose from 88 to more than 260. At the same time, more than 90 percent of North

Carolina's counties established recycling drop-off programs. Many counties also developed staffed "convenience centers" to service solid waste from unincorporated areas without curbside programs. Consequently, local programs increased total material recovery from 244,000 tons to more than 1.09 million tons between 1990 and 2000, a 346 percent increase. By the year 2000, almost every North Carolinian had access to a public recycling program.

At the same time, private sector recycling expanded rapidly. Although there are less data available from private efforts, elevated recovery rates for materials such as corrugated cardboard, office paper and pallets indicate a healthy rise in commercial and industrial recycling. Anecdotal information gathered from the state's industrial waste assessments also indicates increased recycling of byproduct wastes and general packaging discards.

North Carolina's recycling market infrastructure expanded as new companies began recycling un-recovered waste streams. In 1991, the *Directory of Markets for Recyclable Materials* listed 382 companies accepting recyclable materials; the 1999 version contained 564 companies - a 48 percent increase in just eight years.[1] New markets also appeared in the 1990s. For the first time, materials like fluorescent lights, vinyl siding, computers, gypsum wallboard, oil filters and a host of industrial byproducts became marketable.

This market development is partially attributable to the state's establishment of the Recycling Business Assistance Center (RBAC). Created in 1994 with EPA funding, it develops recycling markets by providing business management, technical and financial assistance to businesses. To date, it has assisted more than 600 businesses and helped create more than 200,000 tons of new recycling capacity.

To strengthen support for new recycling businesses, the RBAC developed an alliance with the Community Center of Self-Help, a private institution that specializes in small business lending. In 1999, this public/private alliance created a recycling business loan fund. The fund, supported in part by an EPA grant, offered approximately $660,000 in loans to recycling businesses in North Carolina. By early 2003, Self-Help had closed on $306,300 in DENR-reimbursable loans to recycling companies. An additional $237,810 in funds has been leveraged on those projects. The projects created or retained 31 jobs and produced 12,798 tons of recycling capacity. In addition to its DENR-reimbursable loans, Self-Help provided two loans valued at $380,000 to recycling companies through its Small Business Assistance program. An additional $670,000 has been leveraged on those two loans. These projects created or retained 16 jobs and produced 5,920 tons of recycling capacity.

Market expansion created a number of jobs in the state's recycling sector, showing that recycling contributes to the state's economic growth. A study conducted in FY 99-00 by the state's Division of Pollution Prevention and Environmental Assistance documented a 12 percent employment increase in private sector recycling over five years. More than 12,000 jobs statewide now rely on recycling, making its economic value equal or greater than traditional sectors such as crop agriculture and livestock operations.[2]

Calculating overall recovery rates and rates for certain commodities illustrates recycling growth during the last decade. For example, between FY 90-91 and FY 97-98, newsprint recovery more than doubled – from 53,000 tons to more than 122,000 tons. This helped North Carolina achieve a 57 percent recovery

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[1] In 1998, the Division of Pollution Prevention and Environmental Assistance placed a searchable database on the Internet at www.p2pays.org/dmrm/. In the beginning of calendar year 2001, the Directory was searched 1,800 times per month.

[2] N.C. Department of Environment and Natural Resources, State Recycling Business Employment Numbers Increase, (21 November 2000). < http://www.p2pays.org/news/press_releases/112100.pdf > [August 2003].

rate for that commodity. Glass bottle recycling increased from 17,000 tons to 44,000 tons. Moreover, by FY 97-98, more than half of North Carolina's corrugated cardboard was recovered, an increase boosted by local ordinances that discouraged its disposal. The 1998 *State Assessment of Recycling Markets* estimated four million tons of material was recycled in 1997. When compared to the 1995 estimate, the statewide recycling rate was only 22 percent (2.1 million tons recycled and 7.6 million tons disposed) compared to 1998's 34 percent. Going back even further, the 1991 State Solid Waste Plan estimated the state's recycling rate at 17 percent. Had recovery rates not doubled throughout the 1990s, North Carolina's per capita disposal rate would be 1.5 tons instead of its current rate of 1.23 per capita. Instead of taking up scarce and increasingly costly landfill space, recycled materials were used to create jobs and economic value.

Progress in recycling and composting can be attributed to a variety of factors: public awareness and demand, state mandates and economic opportunity and efficiency. As recycling came to the forefront of environmental issues in the late 1980s and early 1990s, public demand led to government action on both state and local levels. Mandates directed action and proper funding supported operations. As disposal costs rise, recycling becomes more cost-efficient for many materials. Market development led the way for more economic opportunities that simultaneously reduced the amount of solid waste disposed in landfills.

Statewide Solid Waste Disposal Bans and Local Disposal Diversion Ordinances

The 1989 Solid Waste Management Act banned certain recyclable materials from disposal in municipal solid waste landfills. The bans that took effect in the early 1990s were supplemented by local ordinances that discouraged the disposal of additional materials. Figures 3.2A and 3.2B clearly show the effectiveness of these diversion efforts and bans. Without them, North Carolina's per capita disposal rate for 1998 would have been seven percent higher.

Figure 3.2A. Effect of Statewide Material Disposal Bans in North Carolina by 1998

Material*	Tons Diverted Annually	Percentage of Waste Stream Increase Without Diversion	Per capita Disposal Rate Increase without Diversion
Lead Acid Batteries**	51,300	0.55	.007
White Goods***	81,320	0.87	.011
Tires****	47,000	0.51	.006
Yard waste*****	515,083	5.29	.068
TOTAL	694,703	7.00	.092

* Aluminum cans, used oil and antifreeze also have disposal bans. They are not included here due to the difficulty assessing the effect of their diversion.

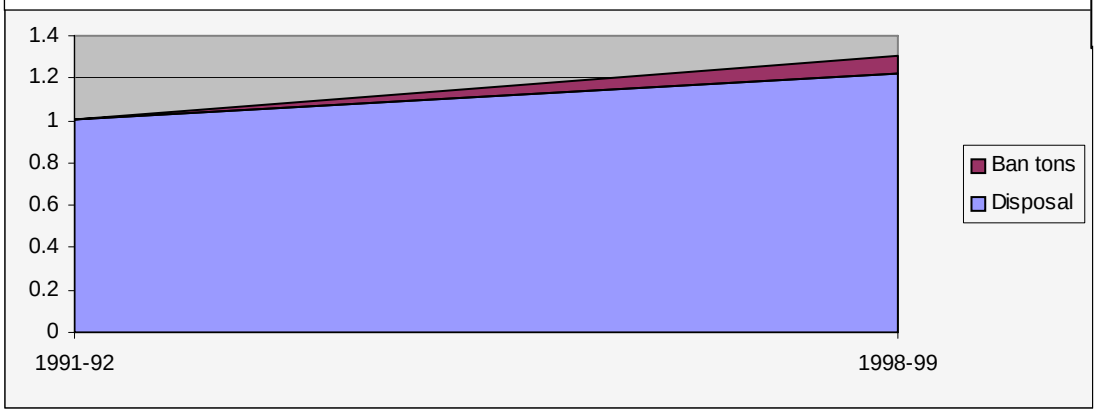
** Calculation based *Assessment of the Recycling Industry and Recycling Markets in North Carolina*, 1995 Update. It assumes a 90 percent recovery rate using projected 1997 generation levels.

*** Data from 1998 *Recycling Markets Assessment*, N.C.DENR. Assumes an 81 percent recovery rate using 1997-estimated generation.

**** Data from 1998 *Recycling Markets Assessment*, N.C.DENR. Assumes a 55 percent recovery rate of 1997-estimated generation. Whole tires are banned from disposal, but many chopped or sliced tires are disposed of in tire "monofills."

***** Data from 1998-99 *Local Government Solid Waste Annual Reports*.

Figure 3.2B. **Effect of Statewide Material Disposal Bans in North Carolina**



Local diversion ordinances have supplemented statewide bans to North Carolina's to boost waste reduction efforts. Throughout the 1990s, a number of North Carolina cities and counties passed local disposal diversion measures placing a tipping fee surcharge on loads containing specified recyclables. By FY 1999-2000, 31 counties and five municipalities enacted similar measures, making North Carolina a national leader in this innovative strategy. Although a few communities targeted a broad range of materials, most focused on corrugated cardboard. Estimates show these measures diverted at least 80,000 tons of cardboard above normal, annual recovery rates. Communities with ordinances saw local disposal rates decrease by as much as four to five percent.

Advance Disposal Fees for Tires and White Goods

The statewide disposal bans on tires and white goods have been effective for two reasons. First, they are clear, enforceable, statutory mandates; second, they have included funding. Thanks to this combination of strong mandates and advance disposal fees, North Carolina continues its successful diversion of whole tires and white goods from disposal.

As part of the disposal ban, counties must offer separate collection points for tires and white goods. It is easier to divert separated materials to recyclers. Advance disposal fees facilitated diversion by providing funds for local management programs. Funds are also used to develop recycling markets and clean up illegal dumpsites with these materials.

Used Tires. Before the Solid Waste Management Act passed in 1989, scrap tires were one of North Carolina's more serious solid waste management problems. Tire disposal posed large problems for tire dealers and a number of illegal dumps existed – some containing hundreds of thousands of scrap tires – which helped the spread of Asian Tiger mosquitoes.

Funds from the Scrap Tire Disposal Account were used to clear approximately 7.3 million tires from 353 sites and fund numerous countywide cleanups. County collection programs now receive approximately nine million scrap tires each year and recycle nearly 65 percent of that total.

There are currently 42 sites with approximately 133,000 tires due for cleanup, but additional sites continue to be discovered. Figures 3.3A and 3.3B show the growth in tires managed by North Carolina counties and the number of tire dumpsites cleaned between 1990 and 2000. These charts reflect the success of the tire program and show a decrease in illegal dumping.

Figure 3.3A. **North Carolina's Used Tire Program**

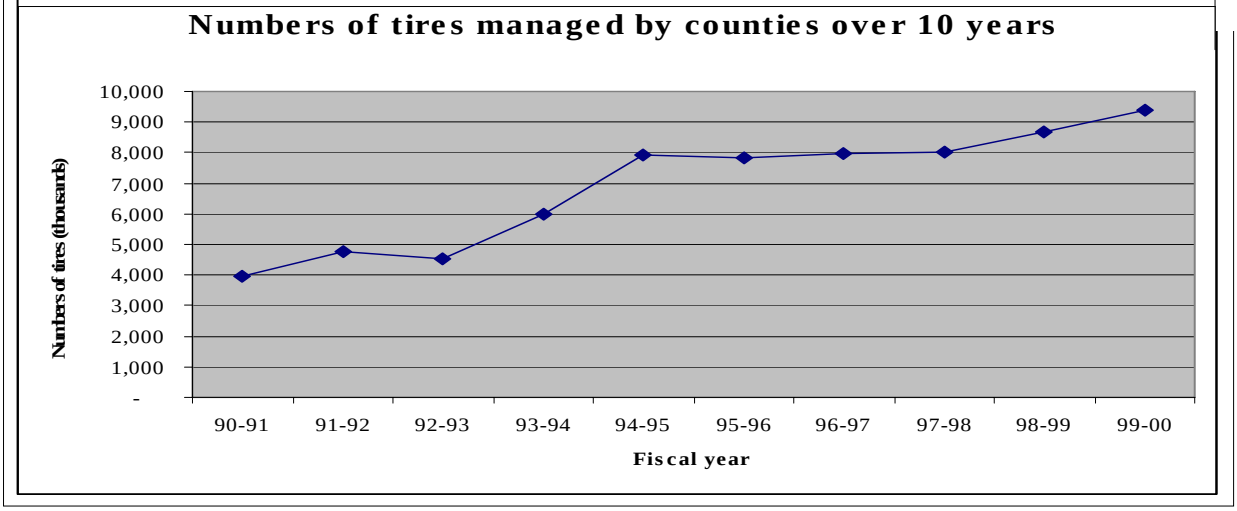


Figure 3.3B.	Number of Tire Sites Cleaned Up in North Carolina			
Status	Number of Sites	Total Known Tires	% Total Tires	Cleared Tires
Cleaned Up	324	6,490,573	87	6,490,573
Under Cleanup	21	257,366	3	133,566
Countywide Cleanup	--	697,357	9	679,357
Remaining Sites	8	27,500	1	0
TOTAL	**353**	**7,454,796**	**100%**	**7,303,496**

White goods. White goods are another difficult-to-manage waste that was successfully addressed by advance disposal fees. Counties use the fees to support free disposal sites, clean up illegal dumpsites, and collect Freon gas from refrigerators and air conditioners. This program significantly reduced illegal dumping of white goods.

Medical Waste Management

The Solid Waste Management Act required the state to develop regulations to govern medical waste. In the late 1980s, medical waste became a national issue when it began washing up on beaches. In North Carolina, the health care industry had considerable influence on medical waste management levels. The regulations adopted require medical waste to be treated and processed. It also requires that certain medical wastes be rendered non-infectious before disposal and allows the use of approved alternative treatment technologies. North Carolina is a medical waste management leader with one of the nation's first microwave medical waste treatment processes and 14 approved alternative technologies.

Local Government Solid Waste Planning

The State Solid Waste Management Act requires that every North Carolina county and municipality either complete or participate in an approved a local solid waste management plan. The mandate gives communities the opportunity to assess their current solid waste management status and develop goals and programs for future improvement. Changes in the law allowed local governments to set individual waste reduction goals that were separate from the state's 40 percent per capita reduction goal. Local solid waste planning spurs communities to think long-term about solid waste management goals and objectives. Local plans play an essential role in meeting the state's goals.

Waste Reduction Grant Program

The Solid Waste Management Act established the Solid Waste Management Trust Fund to provide resources for a range of waste management activities. Research, recycling market development, public education, technical assistance and demonstration projects are just a few of its demonstrable successes.

After its initial appropriation of $300,000 from the General Assembly, the Trust Fund largely depends on a fraction of the revenues generated by the tire and white goods advance disposal fees.[3] On average, the Trust Fund dispenses $500,000 through annual competitive grant cycles for waste reduction projects around the state. Other grant cycles were conducted over the years. Some have targeted specific commodities (e.g., plastics, paper and wood waste) and waste streams (e.g., C&D, industrial wastes); others have supported management methods (pay-as-you-throw). The Trust Fund helped finance successful research on projects ranging from illegal dumping to the use of discarded shingles in road building and mixed paper for animal bedding. Since it began, the Fund has awarded more than 300 grant and service contracts. The results are critical infrastructure, demonstrated new techniques, technologies and answers to pressing waste management research questions.

[3] More specific information about the Trust Fund is provided by the Division of Pollution Prevention and Environmental Assistance in reports submitted to the General Assembly in January of each year.

Secondary, long-term and indirect benefits from funded projects make estimating the Trust Fund's impact on disposal diversion efforts difficult to measure. However, analysis of a typical year indicates that at least 10,000 to 12,000 tons of solid waste are directly diverted through annual grant distributions. In the past few fiscal years, the Trust Fund targeted higher generation waste streams, such as wood waste, C&D and organics. Consequently, an estimated 40,000 tons or more of these wastes were diverted annually. The diversions are sustainable, permanent additions to the state's waste reduction programs. The total estimated diversion achieved with Trust Fund grants is more than 200,000 tons. Without these diversions, the state waste stream would be two percent higher.

The Fund's success lies in its ability to provide adequate resources to achieve solid waste management goals and objectives. Goals and objectives lose their effectiveness without funds to build programs or institute reduction measures.

Certification of Landfill Operators

The mandate requiring all landfill operators to be certified was a vital step toward professional landfill management. Training programs and continuing education provided by the North Carolina Chapter of the Solid Waste Association of North America have helped maintain high compliance levels with this requirement.

Positive Effects from Educational Efforts

Education and promotional campaigns have also affected levels of waste diversion. Public sector recycling programs are not successful without educational programs that help residents understand and participate in reduction activities. Figure 3.5 shows examples of past campaign effectiveness. It also shows that rejuvenating educational efforts would increase North Carolina's recycling efforts.

Figure 3.5. Recovery from Curbside Recycling Programs With and Without Education Programs

Local Government Recycling Program	# of Programs	Participation % (weighted avg.)	Pounds per Household Participating	Pounds per Household Served
Curbside w/ education	117	64	532.01	340.40
Curbside w/o education	145	53	433.83	230.11

CONCLUSION

The solid waste accomplishments share common threads of success. Mandates, as opposed to recommendations or voluntary directives, generate positive results. Funding availability, or a mechanism that generate funds, give programs the means to achieve planning goals and objectives. Public education and its resulting awareness raise participation in solid waste management goals and programs. Planning leads to well-defined goals and objectives and provides impacted parties ample time to prepare for difficult-to-implement policies and programs. Economic incentives spur innovation, entrepreneurship and leadership among public and private organizations that manage and reduce solid waste. Identifying solid waste management successes allows future strategic plans to build on effective measures while incorporating new approaches to address future challenges.

Chapter Four: Facing Old and New Challenges

On March 22, 1987, the Mobro garbage barge left New York City for North Carolina where it sought to unload its cargo—some 3,000 tons of solid waste. After docking in Morehead City, the barge was prohibited from unloading. For the next three months, the Mobro wandered the Gulf Coast and Caribbean looking for a place to unload. Eventually, the barge returned to New York where the waste was incinerated at a Long Island facility. This episode became a symbol of the growing disposal crisis in the United States and brought solid waste to the forefront of the nation's issues.[1]

In the late 1980s, North Carolina and many other states experienced a short-term disposal capacity crisis. The federal government changed landfill regulations and state law set a new course for North Carolina's waste management future.

The review of accomplishments allowed common ingredients for success to be identified. Reviewing North Carolina's less successful efforts over the past 15 years allows the identification of common factors that inhibit progress. Both methods yield data essential for successful strategic planning, especially for the partially or unaccomplished goals from the last 10-year Plan. In addition to carry-over goals, this chapter examines new situations that arose in the last decade and challenges they present.

THE TRANSFORMATION OF THE ROLE OF LOCAL GOVERNMENTS

Forty years ago, most of the waste generated by North Carolina households, businesses and industries went to "town dumps." These uncontrolled and unregulated facilities were phased out in the 1970s and replaced by "sanitary landfills." The new landfills were required to cover wastes, control vectors and divert rainwater to reduce leachate. Throughout the 1960s and 1970s, local governments took on the increasing needs of solid waste management. Waste generation exploded as increasingly affluent American cities and counties became stewards of the new generation of sanitary landfills. The term the U.S. EPA began using for waste in the 1970s, "municipal solid waste," reflected the philosophy that cities and counties were responsible for ensuring safe and adequate disposal.[2] Almost every North Carolina county and many larger cities owned and operated one or more sanitary landfills, making local governments the state's primary waste managers.

In the early 1990s, rising disposal costs spurred many governments to charge "tipping fees" based on the weight or volume of materials to be disposed of in landfills. The fees coincided with the increasing use of "enterprise funds" for solid waste management. Over time, many solid waste programs no longer relied on property taxes, becoming self-reliant through the collected fees.

Regulations such as North Carolina's 1989 Solid Waste Management Act and the Federal RCRA "Subtitle D" rules placed broad responsibility on localities. Local governments faced increasing responsibility to make landfill disposal safer and reduce waste disposal to the extent possible. Because many counties found the new requirements too costly, they abandoned landfill management. Today, most North Carolina counties do not operate landfills. Many opt to transfer waste to larger, often privately owned, regional landfills outside their jurisdictions. This transformation changed local government's role from a primary solid waste manager to one of many players.

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[1] Essential Action, Philadelphia Ash Dumping Chronology, (2003). http://www.essentialaction.org/return/chron.html [6 August 2003].

[2] The term is still used today and reflects the inaccurate view that the only materials going into landfills come from household garbage cans.

By the late 1990s, for-profit companies developed a number of large, regional landfills across the state. Some partnered with a county "host" that received a portion of the tipping fees. By FY 99-00, North Carolina shipped almost half of its waste to large, private landfills. Many shipments from county-owned transfer stations travel miles to reach a landfill. Between 1990 and 2000, the number of North Carolina landfills fell dramatically, the size of existing landfills rose, and ownership shifted from public to private. Exports also rose as large, private landfills in South Carolina and Virginia attracted North Carolina waste through county transfer station contracts and direct private hauling.

The old paradigm of locally owned and operated landfills funded through the general tax revenue is obsolete. Today, larger landfills – both privately and publicly owned – rely on tipping fees to operate. The shift presents a host of challenges that affect modern solid waste management.

Lack of Flow Control

The movement to tipping fees as a primary funding source for solid waste facilities and the emergence of privatized disposal create a disincentive for communities that planned to build and operate larger, more expensive landfills. Their inability to control the flow of local waste to their facilities played a major factor.

The U. S. Supreme Court expressly forbids some types of flow control because it violates the federal Interstate Commerce Clause. The lack of flow control reduced the amount of waste coming to landfills, so competition began and tipping fees dropped. The need for fees to pay down the debt created by expensive landfill development discourages many local governments that own landfills to divert waste through reduction and recycling. Local governments that began using transfer stations were more motivated to reduce waste, but without strong commitment from local officials many North Carolina's solid waste management initiatives failed.

Changing Types of Solid Waste Management Facilities

As counties left the landfill business, they began using publicly or privately owned transfer facilities. Waste is transferred from garbage trucks to tractor-trailers at these facilities, which are often owned by private haulers. The haulers transport the waste to landfills either in North Carolina or out-of-state.

Private transfer stations are often established in urban areas. Private operations successfully compete for waste. The development of transfer stations and large, regional landfills creates many local and private alternatives for waste disposal. Where waste once went to the local landfill by default, it now travels to any number of disposal facilities that may be located miles away.

In FY 1999-2000, 76 transfer stations operated in North Carolina and waste became a portable "commodity." Tipping fee competition that increased amounts at facilities with lower rates instigated the loss of flow control. The practice caused local governments to "lose" waste and the revenues it generates to privately owned landfill companies. Many local governments cannot compete effectively because they need the revenue from tipping fees to pay down their landfill debt and support additional solid waste programs such as recycling. Moreover, facilities offering lower rates need large volumes of waste to remain profitable. This need for waste reduces any incentive to reduce the waste stream through recycling. The need for waste conflicts with the desire to reduce it. This conflict creates a predicament for local government solid waste management.

In addition to transfer stations, C&D landfills have also grown in number and size. In general, C&D wastes are difficult to transfer because they are bulky, hard to compact, and cost more per ton to manage. Because C&D is the fastest growing waste sector, demand for disposal capacity grew rapidly. This spurred the development of a number of local and private C&D landfills through the 1990s. By FY 99-00,

61 C&D landfills operated in North Carolina. The large number of facilities, coupled with less stringent operating requirements, have kept disposal prices for C&D waste relatively low. At present, there is no research proving that this waste does *not* pose a long-term environmental threat. Consequently, the adequacy of C&D landfill regulations face increasing scrutiny.

Low Cost of Disposal and Long-term Effects on Capacity

In the 1980s, landfill fees were projected to reach $50 or higher by the year 2000—high enough to help solid waste incineration and aggressive recycling programs compete as serious management alternatives. However, the "economies of scale" of large landfills, competition for tonnage among private and public landfills, and the increasing mobility of solid waste has kept statewide tipping fees in the $30-$35 range. This low disposal cost sometimes "out-competes" recycling options.

Growth in the state's waste stream, disincentives to reduce waste, and increased difficulties to site landfills create a scenario where less space will be available for solid waste disposal. The consequences could be wide-ranging. Sudden increases in regional disposal costs affect state and local government economies and the environment. Because it is unlikely that state residents will experience uniform hardships, some areas may remain unaffected. However, other areas – typically urban with larger waste volumes – may well experience increased disposal or transportation costs, surges in illegal dumping, and other economic or environmental hardships.

Long-range and Interstate Movement of Waste

As waste has become more portable, state and county boundaries become increasingly irrelevant to its disposal. North Carolina now exports more than 10 percent of its waste stream. In 2001, most North Carolina counties sent municipal solid waste to another county or state, often 50-90 miles away.

Addressing the Challenges of the Paradigm Shift

The shift in solid waste management from locally owned and operated landfills funded through the general fund revenue to larger, often privately-owned landfills that rely on tipping fees affected local governments' ability to undertake solid waste initiatives. However, local governments must renew and increase their solid waste management roles to meet this plan's goals and objectives. Waste reduction, recycling and other disposal initiatives cannot succeed without the leadership and commitment of North Carolina's local governments.

"Top-down" state measures are often viewed locally as "unfunded mandates." To establish local, integrated solid waste management programs and initiatives, adequate support, guidance, technical assistance and sufficient funding must be available. Programs on source reduction, reuse, recycling and composting practices, as well as technical assistance on full cost accounting, enterprise funds and alternative financing programs are a few examples of this necessary support. County and municipal solid waste plans must establish strategies to implement integrated solid waste management programs that guide solid waste management within their jurisdiction.[3]

Clear outlines between local and state government authority to manage solid waste management would increase local government participation. Local governments now have the authority to pass ordinances, contract waste management services, delegate waste management responsibilities and establish local

[3] It should be noted that some of the 1992 Solid Waste Management Plan goals addressed these considerations. Some objectives were partially accomplished; others remain unaccomplished. Other objectives require ongoing effort, beyond the scope of the 1992 Plan. These objectives are incorporated into the goals of this Plan.

programs.[3] However, increased leadership on the local level – supported by the programs described above – would improve solid waste management initiatives.

Finally, a need exists to monitor local governments' capacity to implement solid waste mandates and requirements and assess their progress.[3] At present, local governments and private facilities measure progress and describe activities on an annual basis. Their reports are used to create an annual report on solid waste management efforts that is presented to the Governor and General Assembly. Goals are tracked by a database management system, but the resources, needs and ability to meet mandates are not currently monitored. To properly address local governments' needs, data on local solid waste management efforts must be identified, cataloged and evaluated.

RISING DISPOSAL RATES

In the late 1980s, the General Assembly set a 25 percent reduction goal for per capita waste by 1993. Goal Two of the 1992 State Solid Waste Management Plan aimed to reduce 1991 base levels of per capita waste disposal by 40 percent before 2001. These goals were not accomplished. After limited progress in the early 1990s, the disposal rate in North Carolina grew on both a per capita basis and in absolute amounts. Disposal has increased from 1.08 tons per capita in FY 1991-92 to 1.22 tons in FY 2001-02. This 45 percent increase in tonnage over eight fiscal years leads to projection of more than 18 million tons *per year* by 2020. Various factors, often interrelated, have kept North Carolina from achieving its waste reduction goal. These factors are discussed below.

Loss of flow control by local governments and incentives to dispose

The paradigm shift described in the previous section resulted in the privatization of waste. Local governments that own solid waste facilities rely on tipping fees to fund disposal facilities and operations, while private landfills seek profit. Both entities have little current incentive to decrease the flow of waste. Local governments that must pay to transport waste through transfer stations have a higher economic incentive to reduce waste generation.

Lack of development of large-scale alternative disposal solutions

Alternative disposal solutions have not been developed as expected. Incineration has not expanded, primarily due to the greater expense required to develop an incinerator and the uncertainty of waste flow.

Mixed waste composting and other technologies that treat or modify waste to render it beneficial or less potentially harmful have proven unsuccessful. A number of "magic box" options have been proposed over the years, but none have proven viable over time.

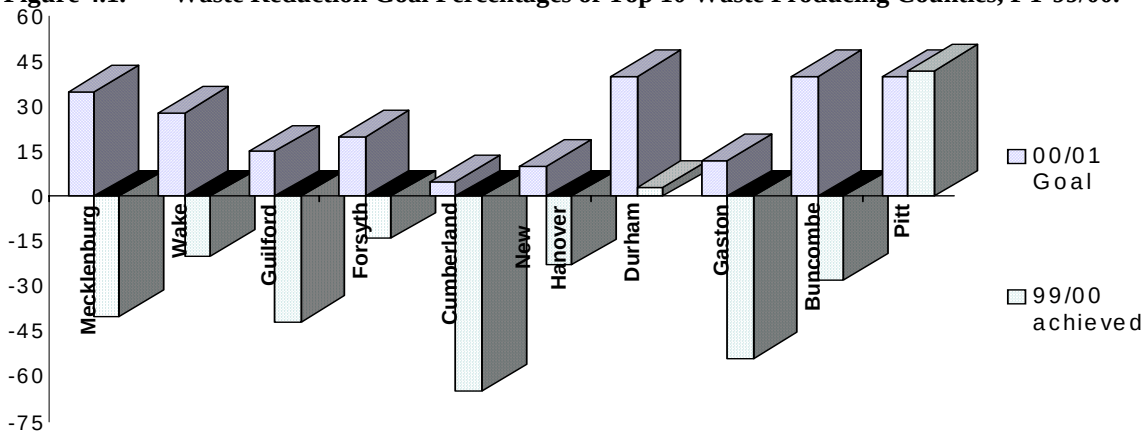
Lack of commitment by local and state agencies

The general increase in environmental awareness and ethics that gained momentum in the late 1980s and early 1990s did not significantly reduce waste generation in North Carolina. Recycling rates rose, but were outpaced by disposal increases. Without sufficient mandates, resources or support, the ability to develop the infrastructure needed to combat increasing waste was limited. Additionally, other environmental issues garnered the attention that solid waste once received. The movement to lined landfills also created the false sentiment that the solid waste "problem" was solved.

Legislation established in 1996 allowed local governments to use "good faith" efforts to create individual waste reduction goals instead of embracing the state's 40 percent reduction goal to be achieved by 2001. Compared to the state's goal of 40 percent (using an average weighted relative to population), local plans only achieve a 27 percent reduction. Local solid waste management plans show a decrease in commitment

and funding to solid waste reduction and programs that maintain or enhance programs and initiatives. A sample of 28 counties (the top 20 waste-producing counties, plus every ninth county ranked by the amount of waste produced) shows that only five achieved their waste reduction goal in FY 99-00. Of the state's 100 counties, fifteen met their FY 99-00 waste reduction goal, but 52 *decreased* their future goals. Only two of the top 10 waste-producing counties made progress towards waste reduction.

Figure 4.1. Waste Reduction Goal Percentages of Top 10 Waste Producing Counties, FY 99/00.



Some counties, such as Mecklenburg, Orange and Chatham, increased their future waste reduction goals and continued expanding programs to address them. However, few counties plan innovative programs and several have merely extended the implementation dates for initiatives they have yet to operate. For example, plans developed in 1997 that stated, "beginning in 1997 this county will..." were simply modified to read "beginning in 2000 this county will…".

The lack of commitment is not without reason. As local economies and populations grow, county funding priorities turned to building or sustaining infrastructure such as roads, sewer and water capacity, and capital improvements. Because solid waste reduction goals are established on a local level without a state mandate, other local needs have taken precedence.

Economic growth

North Carolina's economy has boomed since the last 10-year State Plan was released. Increasing affluence allowed households and businesses to replace and buy more products, which increased discards. Since 1990, North Carolina's employed population rose over 25 percent and the gross product nearly doubled. Annual retail sales and construction of dwellings soared. In 1991, total dwellings constructed in the state equaled 39,034; in 1998, the total rose to 80,514. Single-family dwellings alone saw an increase of 30,671 during this period. With each house built yielding four tons of disposed waste, the building increase created an extra 122,684 tons of construction waste annually. The share of waste streams associated with economic growth (electronics and disposable products) also increased.

Minimal source reduction efforts

The 1992 State Plan goal to implement source reduction programs and increase recycling in state government was only partially accomplished. The fourth annual *Report of State Agency Purchases of Recycled Products and Reduction of Solid Waste Disposal* (FY 96-97) shows that 89 percent of state agencies practice some level of source reduction. Developing and maintaining current programs will require training courses, workshops, sample planning documents and manuals, fact sheets, on-site and on-call assistance, along with financial support. Expanding these efforts could reduce the waste stream.

Waste generation from tourism

Tourism has grown into one of the state's largest industries. More than 44 million people visit North Carolina and spend nearly $12 billion dollars each year.[4] The 10 largest waste-producing counties are in the top 25 percent of counties generating tourist dollars. With more than half of North Carolina's domestic travel expenditures in the food service and lodging industries, both sectors generate large amounts of waste that have yet to be targeted by aggressive recycling programs.

Waste Stream Composition

In addition to disposal increases, the types of waste disposed have changed. New disposables have been added to the household waste stream. Some new materials have limited recycling markets and programs (e.g., construction wastes); others pose more complex challenges. A few of the materials posing challenges include:

- **Household Hazardous Wastes**. In FY 1999-2000, 24 programs provided HHW collection for roughly 30 percent of the population. These programs collected just under 1,000 tons of HHW, providing a glimpse into the amount of HHW currently disposed in landfills. Assuming the programs capture 10 percent of locally disposed HHW and factoring in non-program counties creates a projected total of more than 33,300 tons of HHW entering North Carolina landfills and transfer stations each year.
- **Used Motor Oil.** Approximately 500,000 gallons of oil enter landfills in North Carolina annually as residue in disposed filters and bottles.[5] While HHW and oil contribute little to the overall volume, they significantly affect its overall toxicity.
- **Electronics Disposal.** Obsolete electronic products such as computers, televisions and radios are one of the nation's fastest growing and most complicated waste streams. The products contain a variety of materials, including some hazardous elements. Increased consumption and high turnover contribute to the continued growth of this stream. The 1998 North Carolina Recycling Market Assessment estimated 53,398 tons of electronic discards would be generated in 2002.

  The state's recovery infrastructure for these materials is immature, so the vast majority of electronics are disposed in landfills or stockpiled in homes and businesses. For North Carolina to successfully divert these products and their hazardous elements, it needs to fund a collection infrastructure and education program for residents and businesses. If local funding is used for electronics as it has been with HHW, the infrastructures created are likely to be similar. Recovery efforts will develop slowly and concentrate in more affluent urban areas. A statewide funding source, such as an advance disposal fee, would assure a more equitable infrastructure and education programs.

DISPOSAL CAPACITY AND THE DIFFICULTY OF SITING NEW LANDFILLS

The disposal capacity crisis of the 1980s was created when small landfills filled up and newly imposed regulations closed other facilities. The ensuing development of larger, lined landfills gave the false impression the capacity crisis was solved. However, the late 1990s saw public and private entities experience increased public opposition and greater difficulty to site new facilities and maintain operating

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[4] North Carolina Department of Commerce, Tourism (2003). http://www.nccommerce.com/tourism/ [4 August 2003].

[5] N.C. Division of Pollution Prevention and Environmental Assistance, "Oil-Related: Used Oil Commodity Profile" in Markets Assessment (1998). http://www.p2pays.org/ref/02/0162212.pdf and http://www.p2pays.org/ref/02/0162213.pdf> [4 August 2003].

facilities. The combination of higher disposal rates and insufficient disposal alternatives support a concern for North Carolina's ability to create future landfill capacity.

Public response to landfill proposals has been intensely negative, especially from the communities neighboring potential sites. Recently issued permits are often met with legal challenges and local elected officials cite negative public response as their primary reason for not giving local government approval for proposed landfills. A partial list of recent landfill permitting battles includes:

- **Durham County.** After a lengthy siting process, Durham decided in 1998 to transfer waste to a Virginia facility rather than build a new local landfill.
- **Wake County.** Despite purchasing the property well in advance and securing local government support, Wake fought an extensive battle with residents from the town of Holly Springs over a planned landfill near the town.
- **Orange County.** Attempts to site both municipal solid waste and C&D facilities have met with strong resistance.
- **Mecklenburg County.** The new solid waste facility located near the South Carolina border took more than a decade to develop. The facility only accepts C&D waste and has yet to accept municipal solid waste.
- **Guilford County.** A C&D landfill near High Point shut down after public controversy about the materials accepted at the facility. Subsequent attempts to build another landfill in Guilford County have failed. When a C&D landfill closed and the materials came to the city of High Point's landfill, that city banned C&D materials from its municipal solid waste landfill.
- **Forsyth, Franklin and Halifax counties.** A private landfill in Forsyth County has unsuccessfully sought expansion. Proposals for a landfill in Franklin and Halifax counties were withdrawn after citizens objected.
- **City of Greensboro.** With a projected 2007 closure date, the potential expansion of its municipal solid waste landfill met with strong opposition. Various alternatives are currently being considered.
- **Chatham, Duplin and Lee counties.** Planned MSW or C&D landfills were withdrawn in the face of local public opposition.

Because many of the new landfill battles occurred in urban areas where growth helps limit local options, new disposal capacity appears most likely to develop in rural areas. The fact that one million tons of North Carolina's exported waste goes to landfills in rural areas of Virginia and South Carolina lends weight to this prediction.

FACTORS INFLUENCING LANDFILL CAPACITY

Although landfill capacity is a poorly understood concept, the resource is a public health necessity. Municipal solid waste landfills provide a controlled, monitored environment for solid waste that requires disposal. North Carolina now has 41 MSW landfills in operation, but all will "fill up" or reach their full capacity. The ability to understand and measure current and future landfill capacity is necessary for the welfare of North Carolina's residents.

The rate of solid waste disposal in North Carolina has increased over the last decade in both absolute and per capita amounts. Despite the 40 percent per capita reduction goal, rates continue to rise since record-keeping began in FY 1990-91. The increases continued during times of economic growth and recession, refuting theories that waste disposal decreases during economic downturns. Reasons for the increase

include loss of local government flow control, a reduced commitment to waste reduction by state and local government agencies, economic and population growth, and changes to the waste stream. As disposal rates rise, landfill lifetimes become shorter.

Rising disposal rates could be curbed with increased recycling and composting efforts. Markets and opportunities to engage in recycling programs exist, but the alternatives are initially more expensive than landfill disposal for some waste streams. Additionally, communities that rely on tip fees have little incentive to divert materials. While recycling markets developed significantly since the late 1980s, recovery levels have not kept pace. Increasing the availability of disposal alternatives and reducing waste creation could extend landfill capacity statewide. Reducing waste by only five percent a year through source reduction, recycling and other mechanisms would extend North Carolina's landfill capacity by nearly 60 percent.

Landfill capacity largely depends on the state's ability to open and maintain solid waste facilities. Obviously, closing landfills reduces capacity while opening landfills enlarges capacity. At present, public sentiment towards landfills is negative. New facilities are sometimes prevented from establishment and operating facilities are occasionally closed before they reach maximum capacity. In many cases, public fears could be labeled as "misconceptions." The facilities do not pose the risk to public health and the environment that some citizens may perceive. Public education may minimize such fears and may reduce some of the opposition to solid waste facilities. Education efforts could preserve operational facilities and aid the development of new sites. Both results are needed for North Carolina to maintain and expand its landfill capacity.

In addition to public opposition, the intensive permitting process poses another hindrance to siting new facilities. Improving the permit review process may also help new landfills be sited and increase prospects for landfill capacity.

MEASURING LANDFILL CAPACITY

The concept of 'landfill capacity' can be defined in different ways. A landfill is a three dimensional volume of space filled by tons of waste over a period of time. Thus, landfill capacity can be measured in three particular aspects:

- *(i)* The remaining *volume* of cubic space in a landfill,
- *(ii)* The remaining *capacity* for tonnage of waste in a landfill, or
- *(iii)* The remaining amount of *time* before a landfill is "full."

Measuring Landfill Capacity by Volume

In North Carolina, landfills are permitted with a specific total design capacity and operating capacity. Both describe the volume of air space available for use and both are measured in cubic yards (yds^3). Total design capacity equals the absolute maximum of useable air space at a particular site. The measurement is planned by landfill engineers at the outset of the permit process. Some landfills seek additional capacity through permitted site expansion, but it happens rarely because the permitting process is lengthy and complex. Total design capacity is generally determined before operations begin.

Operating capacity is the amount of air space that a given landfill operator is permitted to use. Operating capacity is generally permitted in "phases" that are periodically increased until total design capacity is met or the landfill closes for other reasons. A landfill's total design capacity may never be realized due to additional permit requirements, owner and operator choice, or other reasons.

Landfill space volume is measured by aerial or ground survey. Once the "used airspace" is determined, the remaining total capacity is calculated by subtracting that figure from the landfill's total design capacity. For example, a hypothetical landfill may be designed with a total capacity of 5 million yds^3 with operations scheduled to begin in July 1998. A survey conducted in June 2003 shows that 1 million yds^3 have been used. The remaining volume of capacity for that landfill is the original permitted 5 million yds^3 minus the 1 million yds^3 used. In this case, the landfill has 4 million yds^3 of remaining space for disposal.

Measuring Landfill Capacity in Mass

All waste is weighed before it is placed into any municipal solid waste landfill. The weight and county of origin, along with other facts, are recorded by landfill operators for annual reports. The data are used to calculate the ratio of tonnage to used airspace, also known as the *utilization factor*. The figure gives insight into how efficiently airspace is utilized. The greater the amount of waste that can be fit into a cubic yard, the more efficient a landfill will be. Different waste types, compaction rates, daily covers and landfill age all influence utilization factors.

Utilization factors can be used to project future waste tonnage capacity. To return to the example above, the landfill had received 600,000 tons of waste since July 1998 that the survey indicated used 1 million yds^3 of airspace. The landfill's utilization factor can be calculated using the equation below:

$$\text{Utilization Factor} = \frac{\text{Tons Disposed}}{\text{Airspace Used by Tonnage}} = \frac{600{,}000 \text{ tons}}{1{,}000{,}000 \text{ yds}^3} = 0.60 \text{ tons / yds}^3$$

The results show the landfill operated at a rate of 0.60 tons (or 1,200 pounds [.60 x 2,000]) of waste per cubic yard used. Compared to most North Carolina landfills, this utilization factor is high.

The equation below shows how the data can be used to calculate any landfill's remaining tonnage capacity. Assuming the landfill utilization rate remains stable, multiplying a landfill's remaining airspace (determined in the first hypothetical equation) by its utilization factor yields the landfill's remaining capacity for tonnage.

$$\text{Remaining Capacity for Tonnage} = \text{Remaining Airspace} \times \text{Utilization Factor} = 4{,}000{,}000 \text{ yds}^3 \times 0.60 \text{ tons/yds}^3 = 2{,}400{,}000 \text{ tons}$$

In this case, the hypothetical landfill's projected remaining capacity is 2.4 million tons of waste before it reaches maximum design capacity.

Measuring Landfill Capacity in Time

The figures above can also be used to calculate a landfill's remaining lifetime. Assuming landfill operations remain the same, its remaining capacity can be calculated by dividing the remaining capacity for tonnage by the average monthly tons of disposal. To calculate the remaining lifetime of the hypothetical landfill, use the equation below.

$$\text{Remaining Capacity in Months} = \frac{\text{Remaining Capacity for Tonnage}}{\text{Average Tons Disposed Per Month}} = \frac{2{,}400{,}000 \text{ tons}}{10{,}000 \text{ tons/month}} = \begin{matrix}240 \text{ months} \\ \text{or } 20 \text{ years}\end{matrix}$$

This formula is based on the assumption that past practices predict future actions. However, if the annual disposal rate rises to 15,000 tons per month, the landfill's life drops to 13 years. The time remaining is

directly related to the rate of tons received per month. Lifetimes can be extended or shortened depending on landfill operators' actions, the surrounding community, or other related circumstances.

For example, we now know increased disposal rates lessen a landfill's remaining lifetime. We also know that unpredictable catastrophic events, such as hurricanes, stress landfill capacity. Political circumstances such as public opposition can also shorten landfill lifetimes when facilities close before they reach total capacity. Conversely, other actions like increased recycling, waste reduction efforts, and more efficient landfill operations can lengthen a landfill's remaining lifetime.

NORTH CAROLINA'S LANDFILL CAPACITY

North Carolina currently has approximately 206 million cubic yards of landfill capacity. The state utilization factor of .57 shows these cubic yards can reasonably be expected to house nearly 118 million tons of MSW waste. Assuming the state's landfill use rate remains the same as last year's (2002-2003) rate of 605 thousand tons per month, the state has a capacity of 16 years (see Figures 4.2 and 4.3 below). This projection does not include waste exported to other states.

The capacity figure is misleading. A great deal of the capacity is not available due to permit conditions, franchise arrangements, political decisions and distance. To illustrate the limiting factors, consider that the Camp Lejeune landfill only accepts waste from the Marine Corps base, the Alamance County landfill is only permitted to accept waste from Alamance County, and the Upper Piedmont landfill has a permitted limit of 600 tons per day. Many landfills have franchise agreements that only allow waste from a particular distance from the landfill. Other landfills have permits and franchise that allow them to accept waste from other jurisdictions, but they chose not to do so. Landfill owner/operators are also free to choose not to use all permitted space.

Accessibility is the primary factor limiting full utilization of the state's capacity. In North Carolina the maximum distance large quantities of waste are currently transferred is a little less than 100 miles. There are some exceptions, but this holds true when factoring in the concept of waste sheds or service areas. Map 2.1 gives a graphic depiction of this average using data from 2001-2002.

Because accessibility varies across the state, some regions have less capacity than the state average. This is especially true if out-of-state capacity is not considered. Statewide capacity does not appear to be a problem at this time. However some regions within the state will experience disruptions and additional costs as arrangements change, including the possibility that waste may travel further than it currently does.

The last new permitted landfills that were operational in 2002 are located in Anson, Sampson and Mecklenburg counties. Since 2000, no landfill permits have been issued that resulted in a landfill being constructed and operating. One landfill permitted in 2003 is under construction in Lenoir County, but the facility is not yet in operation.

Figure 4.2: Calculation of Statewide Monthly Disposed Tonnage

Volume Airspace Used (yd^3)	83,439,238.00
Tons Disposed	47,936,314.57
2002-2003 Tons Disposed	7,258,143.68
Months of Operation	
Utilization Factor ($tons/yd^3$)	0.57
Lifetime Avg. Tons Disposed Per Month	537,311.92
2002-2003 Avg. Tons Disposed Per Month	604,845.31

Figure 4.3: Calculation of Available Statewide Disposal Airspace and Capacity

	Permitted	Total
Original Available Airspace (yd^3)	125,748,044.00	289,211,652.00
Remaining Airspace (yd^3)	42,308,806.00	205,772,414.00
Remaining Capacity for Tonnage (tons)	24,306,648.55	118,217,416.69
Remaining Capacity in Months	40.19	195.45
Remaining Capacity in Years	3.35	16.29

Notes on Calculations in Figures 4.2 and 4.3:

- Avg. Tons Disposed Per Month = Tons Disposed/Months of Operation
- 2002-2003 Avg. Tons Disposed Per Month = 2002-2003 Tons Disposed/12 months
- Utilization Factor = Tons Disposed/Volume of Airspace Used
- Remaining Airspace = Original Available Airspace – Volume of Airspace Used
- Remaining Capacity for Tonnage = Remaining Airspace x Utilization Factor
- Remaining Capacity in Months = Remaining Capacity for Tonnage/02-03 Avg. Tons Disposed Per Month
- Remaining Capacity in Years = Remaining Capacity in Months/12 months

LONG-TERM CARE OF LANDFILLS

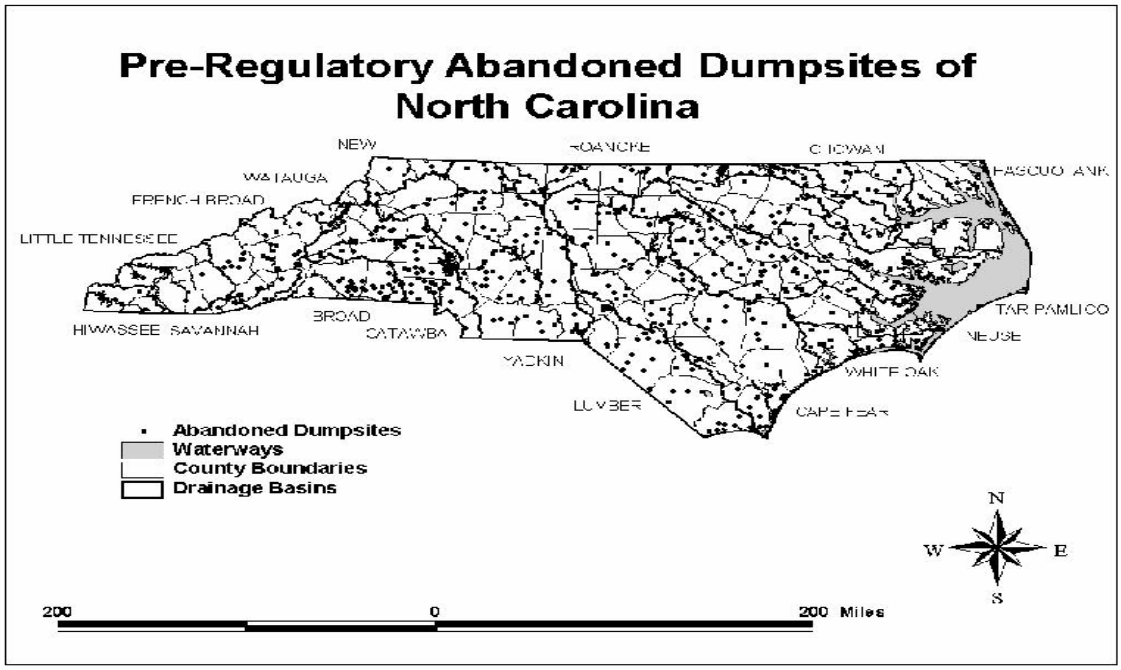
The Legacy of Closed Landfills

North Carolina communities have growing concerns about groundwater contamination from leachate leaving closed unlined landfills. Leachate is any liquid, or suspended components in liquid, which has percolated through or drained from solid waste. Leachate often contains potentially toxic chemicals. Leachate from municipal solid waste can contaminate groundwater and render it unusable or undesirable. Contaminated groundwater can reduce the service life of appliances and fabrics due to the presence of harmful or undesirable chemicals. More than 90 percent of the state's 126 closed municipal solid waste landfills show some evidence of degraded groundwater quality.

Little is known about the abandoned dumpsites because no record-keeping regulations existed at the time. Exact locations are not available for the majority of these dumpsites. Unlike today, pre-regulatory dumpsites had no environmental monitoring requirements. The N.C. General Assembly appropriated $1.9 million after Hurricane Floyd to determine the exact location, surface conditions and ownership of approximately 280 abandoned dumpsites in 37 flood-prone counties. No groundwater, surface water or soil samples have been collected from these sites to determine their environmental impacts. Map 4.1 shows the locations of the pre-regulatory abandoned dumpsites identified so far in North Carolina.

Because many old, unlined MSW landfill facilities and dumpsites were located in relatively remote areas, the potential threat to surrounding communities was minimized. However, these communities have grown and continue to grow. New development around closed landfills and dumpsites may expose residents to environmental risks that were once considered "taken care of." Groundwater supplies may be contaminated and render well water useless. Methane gas could migrate into a structure and create the risk of inhalation or explosion. Some communities have taken corrective action to mitigate those risks again. Many more communities will need to do so in the future.

Map 4.1



In 1993, North Carolina changed its Solid Waste Management Rules. Spurred in part by the U.S. EPA's RCRA 40 CFR Part 258 Solid Waste Disposal Facility Criteria (Subtitle D), the legislation significantly improved groundwater monitoring programs for active municipal solid waste landfills. The changes included increased sampling frequency, routine detection monitoring for an expanded contaminant list, statistical analysis of water quality data, and an automatic elevation to Appendix II assessment monitoring when significant contaminant increases are detected. The rules formalized procedures for groundwater assessments and corrective action, and provided for at least 30 years of post-closure monitoring.

Corrective action can include many approaches. Improving landfill caps, adding buffers to control land use, supplying public water for areas neighboring landfills, voluntarily restricting deeds on contaminated property, sampling groundwater quarterly for state toxicologist review, replacing contaminated wells, and active cleanups are just a few. The highest priority is given to the landfills with documented water quality impacts to potable wells in order to minimize potential health threats.

Long-term Care of Lined Landfills

The fact that North Carolina now disposes of municipal solid waste only in lined landfills designed to keep leachate out of groundwater is an unqualified success. Because lined facilities reduce the infiltration of water that helps waste breakdown, they will probably contain degradable waste long after they close. This time may exceed the 30-year post-closure monitoring period currently required. The facilities' ability to protect human health and the environment while the waste degrades requires continuously operating control systems until the process is complete. Although landfill owners are responsible for a 30-year post-closure period, long-term management for these facilities is not completely defined.

Long-term Effects of Construction and Demolition Landfills

C&D landfills are permitted, constructed and operated at lower standards than North Carolina's municipal solid waste landfills. The distinction comes from the general perception that C&D waste is potentially less harmful and does not warrant stringent environmental controls. As the number of C&D landfills has grown, concern has increased over their environmental impacts and long-term care requirements. Some C&D waste contains potentially harmful components. A 1995 EPA study identified seven "potentially problematic" constituents of concern from C&D leachate sampling.[6,7,8]

RECYCLING DEVELOPMENT

Paper fiber, plastic resins, glass, textiles, rubber, organic materials and metals enter North Carolina landfills daily. This is an enormous waste of potential manufacturer feedstock. Many mainstream end-use markets exist for these materials, and many North Carolina companies increasingly rely on supplies of recyclables. Furthermore, using recycled materials is a proven way to reduce the use of virgin materials, save energy and water, and reduce pollution.

As shown in Chapter Two, ample potential exists to increase the amount of materials already widely recycled. Despite available curbside and drop-off services, a strong private recovery infrastructure and adequate end-use demand, recovery rates for PETE, HDPE, aluminum and glass containers remain very low (e.g., 16 percent for PETE and 49 percent for aluminum cans). End-use demand and the value of newspaper, corrugated cardboard and office paper show that higher recovery rates for these materials are possible. Pallets and clean wood also have a wide range of potential markets and uses to complement viable source reduction. Material recovery for these items grew in the past decade then slowed over the past few years. Measures that increase the recovery of these materials would reduce the state's disposal burden and the value added would benefit the industrial economy.

Recycling Markets

Recycling programs surged immediately after the 1980s disposal crisis. The resulting supply often overwhelmed manufacturing demand. For example, in 1990 many local governments temporarily stopped collecting newspapers – a mainstay of public recycling programs – because Southeast mills could not absorb the supply. "Demand crises" are periodic and have affected plastics and other materials.

The rapid rise in recycling put many local governments and private waste generators in the unfamiliar role of interacting with commodity markets. Commodity markets are notoriously volatile due to shifts in the national and global economy and changes in the complex feedstock needs of individual product manufacturers. However, the 1990s brought unprecedented market development. The U.S. paper industry alone added 10 million tons of demand capacity for recovered fiber. The increase was partially motivated by state laws mandating recycled content standards in published newspapers and government-procured paper. Markets for more traditionally recyclable materials have also increased dramatically over the past decade. However, the state needs to increase the volume, affordability and accessibility of its infrastructure for recycling and composting to reduce the state's disposal rate. Some materials in particular – such as electronics, organic wastes and construction debris – have adequate end-use markets but underdeveloped collection and processing infrastructures.

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[6] U.S. Environmental Protection Agency, Construction and Demolition Waste of Landfills, (February 1995). < http://www.epa.gov/epaoswer/hazwaste/sqg/const/cdrpt.pdf> [4 August 2003].

[7] Florida Center for Solid and Hazardous Waste Management, Characteristics of Leachate from Construction and Demolition Waste Landfills, Timothy Townsend, (August 1998).< http://www.floridacenter.org/publications/const_demo_pubs.htm [4 August 2003].

[8] Florida Center for Solid and Hazardous Waste Management, The Management and Environmental Impacts of Construction and Demolition Waste in Florida, Timothy Townsend (June 1998). <http://www.floridacenter.org/publications/const_demo_pubs.htm> [4 August 2003].

Recycling markets remain subject to price swings as the supply-demand balance seeks stability in a dynamic economy. Markets may seem to occasionally "disappear" due to changes in locally accessible processing capacity, global transportation or a global recession. However, some markets have shown responsiveness to statutory action. For example, Southeast newspaper markets stabilized after North Carolina and other states passed minimum content laws. Unfortunately, the last 15 years demonstrated that low tipping fees can slow recycling market development. They also showed that buy recycled programs, legislative mandates and disposal price competition positively affect recycling markets. North Carolina's state agency buy recycled programs have been relatively successful. State and executive policy [G.S. 143-58.2 and Executive Order (E.O.) No. 8 (superseded in 1999 by E.O. No. 156)] direct state agencies, public universities, community colleges and public school systems to purchase and use products that contain recycled material. These measures also establish goals for the proportion of expenditures agencies must make on paper products with recycled content.

The past decade showed that recycling depends on manufacturer feedstock shifts from virgin to recycled materials. These shifts depend on the development of new products made from recycled materials, "buy recycled" efforts and programs that "close the recycling loop." In 1989, it was impossible to recycle fluorescent lights, textiles, carpet, oil filters, gypsum wallboard and computers. Recycling market expansion has made it feasible to recycle these and other discards. The "recycling economy" is growing. In addition to providing viable disposal alternatives, it has created a number of jobs.

Recycling Infrastructure

Physical and economic gaps exist between collection points and end-use facilities (e.g., a newsprint or glass plant). The paper, glass, plastic and metal industries all indicate a willingness and ability to pay for more recovered materials. However, processing and transportation to end-users can cost more than sale revenues. This makes recycling appear to be a "money-loser." However most profit calculations only compare recycling profits to tipping fees, making this a short-term and incomplete calculation.

If local processing capacity is developed so materials can be consolidated and transported in large quantities, efficiency and recycling effectiveness will improve. Material recovery facilities (MRFs) and local baling or stockpiling operations for specific materials are good examples of what is needed. Figure 4.3 lists population centers served and not served by MRFs for FY 1999-2000. While some communities have other types of processing infrastructure, the absence of an MRF often means recyclables must be transported 80 miles or more.

Figure 4.3. Areas Served by MRFs in North Carolina

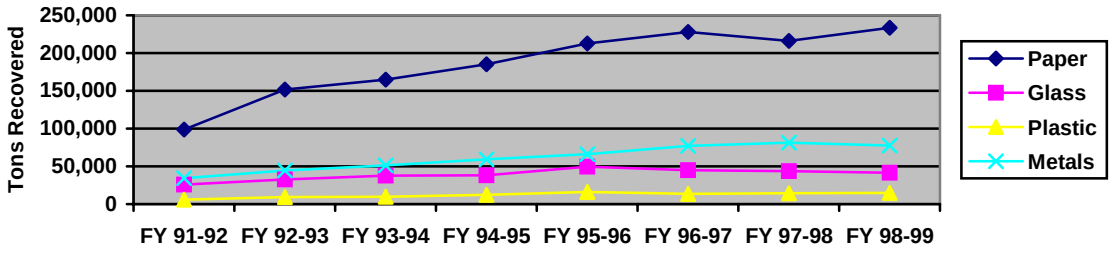
Major Population Centers Served by MRFs	Major Population Centers Not Served by MRFs
Greensboro	Asheville
High Point	Fayetteville
Charlotte/Mecklenburg	Burlington/Alamance Co.
Winston-Salem	Wilmington
Raleigh/Cary/Wake Co.	Chapel Hill/Orange Co.
Durham	Kannapolis/Concord/Salisbury
Greenville	Gastonia/Shelby
Catawba County	Wilson/Rocky Mount
New Bern/Craven	Goldsboro
Davidson Co./Lexington/Thomasville	Statesville/Mooresville
Jacksonville	Most rural counties in the state

Recycling costs often exceed relatively low disposal costs. Leveling the economic playing field would help recycling markets for many materials. A surcharge on local tipping fees would make recycling more competitive, reduce waste and extend the state's landfill capacity. It would also provide a funding mechanism for solid waste management programs. Incentives, public support and access to private capital are proven ways to effectively build recycling collection, processing and end-use capacity. Recycled content mandates and "buy recycled" programs also strengthen markets and add capacity. The promotion of full cost accounting, a partially accomplished goal of the 1992 State Plan, can help improve recycling program efficiency.

Local Recycling Programs

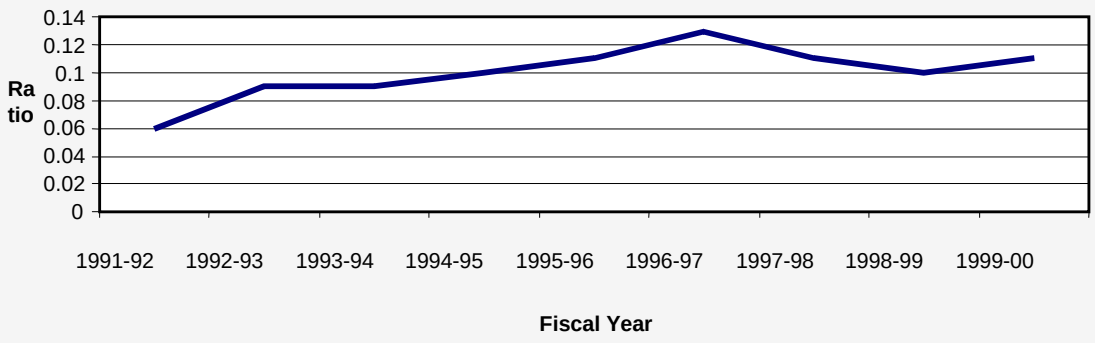
Figure 4.4 shows that local recycling programs experienced tremendous growth in the early to mid-1990s, and then slowed considerably.

Figure 4.4. Recovery of Recyclable Materials.



Annual reports from local governments show recycling participation rates have leveled off around 50 percent. Local recovery efforts have failed to keep pace with dramatic increases in disposal. Figure 4.5 shows how the ratio of local recovery to disposal rose during the early part of the decade then declined.

Figure 4.5. Ratio of Local Recovery to Disposal.



A number of factors contributed to the drop in program development. A certain degree of slowed growth is typical as programs begin and mature. However, low participation and recovery indicate considerable room for program expansion and efficiency. Public interest and participation has waned, which slowed local recovery rates. Local governments do not consider recycling as a high priority now. Few recycling budgets expanded in the late 1990s and there were few attempts to boost participation and recovery with

policy incentives.[9] In fact, some local governments that own disposal facilities deliberately slowed recycling to keep tonnage and tipping fees flowing to their landfills. Major, new local recovery investments were rare in the late 1990s and early 2000s. The change reflected overall fiscal constraints and recycling's falling importance in local budgetary priorities.

When compared to other states with large grant programs, North Carolina has not provided local governments with financial support like grants, loans or other distributions. The Solid Waste Management Trust Fund has annual revenues of only about 12 cents per capita. The state revolving loan fund to capitalize solid waste facilities, which was specified in Senate Bill 111, was never funded.

Educational Campaigns

Developing and implementing educational programs is an ongoing process. Brochures and program materials continue to be produced and distributed. DPPEA currently promotes solid waste education with the successful *Recycle Guys* series. Continuing these efforts increase awareness and participation levels throughout the state. However, local communities must increase their efforts to educate residents about waste, reduction, recycling and general solid waste issues. Their efforts are also needed to reverse declining participation rates and increase collection efficiency.

ILLEGAL DISPOSAL AND LITTER

Illegal dumping is handled most effectively and efficiently at the local level. North Carolina counties have been granted the authority to draft and enforce ordinances that address illegal disposal. Many local governments have some type of prevention program, though many counties have no programs at all. Local governments claim they have insufficient resources (time, funds, staff and equipment) and commitment to develop comprehensive programs. Surveys show that 50 percent of the counties without an illegal disposal ordinance feel their jurisdiction has a moderate to severe problem with illegal dumping.

Perhaps no waste issue attracts as much public anger as litter. No one can dispute that North Carolina has a pervasive litter problem. N.C. Department of Transportation statistics indicate as much as 38,000 tons of materials were discarded on state highways and waterways.

Current clean-up programs, penalty systems and educational efforts do not adequately address the litter problem. One possible solution is a bottle bill. Bottle bills are a proven way to increase recycling and reduce litter. Data from the Container Recycling Institute shows that deposits reduce litter by around one-third or higher.[10]

Figure 4.6. Effects of Bottle Bills in Various States

State	Beverage Container Litter Reduction	Total Litter Reduction
Iowa	77%	38%
Maine	69-77%	35-65%
Massachusetts	N/A	30-35%
Michigan	80%	38%
New York	70–80%	N/A
Oregon	83%	47%
Vermont	76%	35%

[9] Durham's mandatory recycling ordinance is an exception. Recovery rates doubled immediately when it was enforced in January 2000.

[10] Container Recycling Institute, Environmental Benefits of Bottle Bills (2003). <http://www.container-recycling.org> [4 August 2003].

However, container-related litter is only part of the problem. Anecdotal observation suggests construction wastes and materials, fast food packaging, plastic bags and film, and other miscellaneous debris make up a large part of the litter found on North Carolina roadsides.

Like public education, the goal to reduce illegal dumping and litter is continuous by nature. Some measures include an increase in monetary fines and community service for offenders, but more resources are needed. Funds to implement and improve local prevention and enforcement programs must be provided for communities to see further benefits.

CLIMATE CHANGE & NATURAL DISASTERS

The Effects of Natural Disasters

Climate change or global warming continues to be debated in many arenas. While no universal consensus exists, there is growing evidence that human activities contribute to a rise in the overall temperature of the planet. Warming effects are difficult to model, but one common prediction is an increase in extreme weather events. Hurricanes, ice storms and other natural disasters stress local disposal capacity and the state's solid waste infrastructure. In 1996, Hurricane Fran generated 700,000 tons of disposed material that increased the state's total of waste disposed by nine percent. Hurricane Floyd increased disposal by an estimated 329,782 tons and caused scattered construction debris crises. In the next decade of solid waste management, the state must consider and prepare for large-scale disasters.

Addressing Climate Change Through Waste Reduction and Methane Recovery

Increased publicity about climate change over the last decade has brought greenhouse gas emissions to state, national and international attention. Municipal solid waste landfills are a source of the greenhouse gas methane. Monitoring and reducing emissions are likely to be a future concern. A number of successful methane recovery programs exist at North Carolina landfills, but more are needed. Communities could use their landfill to harness an untapped source of energy for steam or electricity production. Adding methane recovery infrastructure will reduce the amount of greenhouse gases emitted by facilities.

When recycled materials are used in industrial production, energy and other resource demands decrease. This further reduces the greenhouse gases emitted by fossil fuel-based power sources. Existing models were used to calculate a quantitative value for the "upstream" benefits from local government recycling efforts. In addition to saving more than one million tons of landfill space, local government recycling programs reduce greenhouse gas emissions by almost 263,000 metric tons. The reduction is comparable to removing more than 197,000 automobiles from North Carolina roads. A 50 percent increase in local recycling efforts would reduce another 131,500 tons of greenhouse emissions – the equivalent of removing an additional 98,500 cars.

MEETING FUTURE SOLID WASTE CHALLENGES

Solid waste management has improved much in the past several years; however, much remains to be done. Old practices and responses no longer are adequate to meet the current challenges. Through a series of public meetings across the state involving solid waste professionals, local elected officials, environmentalists, industrial and commercial interests, and other interested citizens, a recognition that things "ought to be different" in the future emerged.

The results of these meetings were combined with research and analysis, which resulted in the following state goals and actions steps to meet them. The five goals listed below for 2013 are discussed in more detail in chapters five through nine.

1. Ensure long-term environmental protection by improving future landfill technology and addressing public health and environmental concerns associated with closed landfills.
2. Substantially increase the amount of waste recycled and composted.
3. Reduce litter and illegal disposal by 50 percent from 2000-2001 levels.
4. Implement policies and procedures to provide information to the public and ensure public participation throughout the decision-making process regarding waste management facilities.
5. Create and continually maintain 20 years of landfill capacity in the state.

Chapter Five: Actions to Meet Goal One

Goal One of this Plan states:

> By 2013, ensure long-term environmental protection by improving future landfill technology and addressing public health and environmental concerns associated with closed landfills.

This goal seeks to protect human health and the environment by ensuring the safety of old, closed landfills and those currently in operation. The goal recognizes that updated technology, continual monitoring, the reduction of potentially harmful waste, and public education are needed to achieve this goal.

TECHNOLOGY FOR CLOSED AND OPERATIONAL LANDFILLS

North Carolina reached a major solid waste management milestone and became a national model when it closed all unlined MSW landfills. It also drastically improved disposal safety. Although the facilities are closed, they must still be monitored and managed to prevent potentially negative long-term effects on the environment and human health. North Carolina currently has 126 inactive unlined MSW facilities and more than 700 abandoned dumpsites. Studies that examine human risk from exposure to harmful contaminants created by degrading waste in unlined facilities have barely begun. Studies on the other possible effects closed landfills may have on the environment are also just getting underway. Without data, creating assured long-term planning or management strategies is a problem. Regulations must be science-based, but the need for this data has outpaced the scientific community.

Although today's municipal solid waste landfills use superior technology compared to old, unlined landfills, they still need to be monitored for long-term environmental effects. As research and development spur new technology, the level of protection they provide will increase. Just like old landfills, the risk from new landfills lies in the toxicity of the waste they hold. Landfills hold household hazardous wastes, electronics and used motor oil that contain potentially harmful components. Diverting these materials will decrease new landfills' long-term environmental effects.

C&D landfills have different requirements than MSW landfills, and generally operate under less stringent controls. C&D materials are commonly believed to pose less risk than municipal solid waste, but a recent EPA study points out areas of concern. More study on the environmental effects of C&D facilities is needed to protect human health and the environment.

KEY ACTIONS TO MEET GOAL ONE

A number of actions need to be taken to improve landfill safety. Reducing waste disposal, developing recycling programs for particular materials, and increasing public education about neighborhood solid waste facilities are priorities. Solid waste management is complex, so the actions needed to achieve one goal often contribute toward another. The key actions are outlined below.

Objective 1.1. Research bioreactor landfill design and closure requirements and adjust regulations accordingly.

New, lined landfills are designed to shield waste from water and other elements that increase leachate and landfill gases. "Dry tomb" technology uses engineered caps, leachate collection and methane recovery systems to minimize environmental impacts.

Keeping water out reduces leachate, but increases the time before waste reaches full "stabilization," or completely degrades. Monitoring should continue until waste stabilizes, as this time period may be longer than anticipated.

Current research cannot accurately predict the long-term life of landfill liners, so postponing stabilization creates uncertainty about how long the liners will continue to protect human health and the environment. Accelerated stabilization may offer better, long-term protection.

"Bioreactor" landfills speed waste degradation and reduce the time available for leachate and methane to generate. Research to modify existing liner technology in order to speed stabilization while still protecting groundwater is underway.

The following key actions contribute to this objective:

- Monitor the pilot bioreactor landfill in Buncombe County and similar projects across the United States.
- Explore streamlined permitting or provide other incentives for bioreactor projects.
- Dialogue with other states and the U.S. EPA to stay abreast of state and federal bioreactor research.
- Work with North Carolina chapters of the Solid Waste Association of America and the National Solid Wastes Management Association to conduct seminars and forums that explore research needs and share the results of completed research.
- Draft bioreactor permit guidelines for public review, as it becomes feasible.
- Work to pass funding mechanisms that help finance additional pilot bioreactor projects and continued research.

Objective 1.2. Reduce landfill disposal of material with potentially harmful components.

North Carolina landfills more than 30,000 tons of household hazardous waste and 500,000 gallons of used motor oil each year. The jump in electronic discards, C&D waste and other waste streams may increase landfill toxicity.

Reducing the flow of toxic or potentially toxic materials to MSW landfills would improve the long-term environmental health and safety these facilities offer. Reducing toxics makes bioreactor landfills safer and offers more environmental protection. Local programs successfully divert HHW, but are not widely available statewide. Creating a statewide HHW collection infrastructure with permanent collection facilities (as opposed to designated collection days) would increase the amount of HHW diverted.

The following key actions contribute to this objective:

- Establish permanent HHW collection facilities statewide in cooperation with the Carolina Recycling Association's Household Hazardous Waste Council.
- Propose disposal bans on materials with hazardous elements; e.g. oil filters and CRTs.
- Propose advance disposal fee legislation for certain products to fund increased diversion efforts.
- Promote waste-screening workshops for landfill employees in partnership with local solid waste organizations.
- Monitor hazard research on specific waste streams (e.g. construction and demolition).

Objective 1.3. Review requirements for construction and demolition landfills.

More than 60 percent of the state's C&D waste goes to C&D landfills. C&D waste contains potentially hazardous elements and may unintentionally include municipal solid waste. Disposed gypsum wallboard encourages hydrogen sulfide generation. Leftover paint, stains, water sealants and other hazardous chemicals may be present in C&D waste, along with lead-painted boards, asbestos or treated lumber. Treated lumber contains copper, chromium and arsenic that can enter leachate and make it hazardous. Objective 1.3 is designed to reduce hazards by examining how effectively current C&D landfill design and operation requirements protect human health and the environment.

The following key actions contribute to this objective:

- Review data on C&D waste streams with an emphasis on components that may pose immediate or long-term hazards.
- Review data documenting groundwater contamination or other environmental impacts caused by C&D landfills.
- Consider requiring liners and leachate collection systems at new C&D facilities as necessary.
- Consider separating and diverting some C&D waste items from C&D landfills.

Objective 1.4. Develop and distribute action plans for closed MSW landfills and abandoned dumpsites.

North Carolina's 126 closed municipal solid waste landfills pose a long-term concern. No data exists on how long the facilities can protect human health and the environment, but the fact that 90 percent of the facilities show some sign of groundwater contamination is cause for concern. Without facility-specific data, it is impossible to determine how long a given facility needs care after closure, what the total monitoring costs will be, and where often costly cleanups need to be performed. Management plans that recognize and address these uncertainties would help the state develop procedures that reduce future problems.

North Carolina has already located more than 700 pre-regulatory abandoned dumpsites, but more exist. To date, there has been no assessment of the environmental impacts these facilities pose to state residents. The state needs to locate the remainder of these sites and assess the environmental impacts they pose. The data can be used to determine if they are hazardous and where cleanups are necessary.

The following key actions contribute to this objective:

- Determine if current MSW landfill requirements for long-term care are adequate (e.g. Appendix 1 and 2 monitoring, financial assurance, etc.)
- Create and propose a long-term action plan.
- Consider adding action plans for closed unlined MSW landfills and abandoned dumpsites to 10-year local solid waste plan requirements.
- Conduct seminars and outreach efforts that encourage action plans for closed unlined MSW facilities and abandoned dumpsites.
- Establish a state-level funding mechanism to support plan development and implementation.
- Require better caps on closed unlined MSW landfills as needed to enhance environmental protection.

- Determine the locations and owners for all abandoned dumpsites. Perform environmental assessments at each dumpsite.
- Support and promote innovative and cost-effective technologies to clean contaminated groundwater at closed unlined MSWs and abandoned dumpsites.
- Propose a state-level funding mechanism to evaluate environmental impacts and clean contaminated groundwater where needed at closed unlined MSWs and abandoned dumpsites.

Objective 1.5. Establish a strategy to fund long-term care and cleanup at closed, lined MSW landfills.

More than 90 percent of North Carolina's 126 unlined MSW landfills have impacted nearby groundwater supplies with leachate. When lined MSW landfills close, they are required to use a synthetic liner in the cap. Using liners at the bottom and top of a landfill is referred to as "dry tomb" technology. Dry tombing slows waste degradation and increases the time it takes waste to stabilize. This time period may exceed the lifetime of the facility's top and bottom liners and its leachate collection system.

Predicting the cost of long-term monitoring and where cleanups are needed is almost impossible without data, but most cleanup estimates total many millions of dollars. Local governments, private landfill owner/operators, and taxpayers will probably provide these funds. However, when private owners cannot be found, are bankrupt or out of business for some reason, cleanup costs typically fall to waste generators and the state. North Carolina currently requires financial assurance mechanisms to ensure 30 years of post-closure care and management, but 30 years may be insufficient. Given this possibility, the state should be prepared to fund long-term care at some facilities.

The following key actions contribute to this objective:

- Review research on the length of time landfills may pose environmental threats.
- Investigate and estimate the cost of 50 years of landfill care, monitoring and cleanups in cooperation with the Institute of Government, the N.C. Association of County Commissioners, and the N. C. Chapter of the Solid Waste Association of North America.
- Review the adequacy of current financial assurance mechanisms.
- Develop a strategy to fund long-term care of closed landfills that includes the cost to create and implement action plans.

Chapter Six: Actions to Meet Goal Two

Goal Two of this Plan states:

Substantially increase the amount of waste recycled and composted by 2013.

The objectives below are designed to increase waste diversion. Most objectives build on proven techniques and policies, although they may be applied to new initiatives. The objectives balance the need for scarce funds vs. the unpopularity and failure rate of "unfunded mandates." The sources targeted to generate funds also provide a disincentive for less desirable waste management options[1] and selectively link higher life-cycle costs with the products that require them.

KEY ACTIONS TO MEET GOAL TWO

Objective 2.1. Enact a series of statewide disposal bans on recyclable materials like pallets, clean wood waste, oil filters, cardboard, newspaper, office paper and cathode ray tubes.

Diverting high volume, easily recognizable waste streams will attain Goal Two. North Carolina's data show that selective disposal bans effectively divert waste on both state and local levels. Bans work best when diverted materials have adequate or growing markets, or a wide range of potential end-uses. Staggering enactment and enforcement dates increases success rates because it allows time for both infrastructure and educational program to be developed.

The following key actions contribute to this objective:

- Implement a disposal ban on pallets and clean untreated and non-glued wood waste by Jan. 1, 2007. Diversion potential is 500,000 to 650,000 tons per year.
- Implement a disposal ban on oil filters by Jan. 1, 2007. Annual diversion potential is 3,500 tons of filters and approximately 250,000 gallons of residual motor oil.
- Implement a disposal ban on cathode ray tubes by Jan. 1, 2008. Potential diversion is 17,600 tons per year.
- Implement a disposal ban on corrugated cardboard by Jan. 1, 2010. Potential diversion is 172,000 to 215,000 tons per year.
- Implement a disposal ban on newspaper by Jan. 1, 2010. Potential diversion is 40,000 to 55,000 tons per year.
- Implement a disposal ban on office paper by Jan. 1, 2010. Potential diversion is 43,000 to 53,000 tons per year.

Objective 2.2. Require local government programs to achieve per capita recovery targets.

Local recycling programs are widely established, but they also vary widely in effectiveness. Some local governments have not implemented programs and others run programs that perform poorly. A per capita recycling rate of 60 pounds is highly achievable. *Counties* divert 79 pounds per capita on average, but individual county rates range from 0.22 to 368.61 pounds. For *municipalities* with populations over 5,000 that offer recycling, the average recovery rate is 92 pounds per capita. However, with individual rates ranging from a low 0.33 pounds per capita to 362.07, opportunities for improvement are abundant.

[1] N.C. G.S. 130A-309.04(a).

To encourage equity between jurisdictions and increased diversion, the state should consider setting minimal diversion standards for local government recycling programs.

The following key actions contribute to this objective:

- Require municipalities over 5,000 in population to meet a 60 pounds per capita recycling rate by June 30, 2007. Based on FY 01-02 data, this would affect 54 municipalities:
    - 33 municipalities have recycling programs diverting less than 60 pounds per capita.
    - 7 municipalities need to add recycling programs.
    - 4 municipalities need to collect data on existing programs.
    - 10 municipalities need to clarify their role in another government's recycling program.
- Require counties over 20,000 in population to meet a 60 pounds per capita recycling rate by June 30, 2007. Based on FY 01-02 data, this would affect the 41 counties that did not meet 60 pounds per capita.
- Require counties under 20,000 in population to meet a 50 pounds per capita recycling rate by June 30, 2007. Based on FY 01-02 data, this would affect 10 counties that did not meet 50 pounds per capita.
- Raise the required rate of recycling by 5 pounds per capita every two years. For example, municipalities over 5,000 would be required to achieve 65 pounds per capita by June 30, 2009, and 70 pounds per capita by June 30, 2011.

When calculating recovery rates, local governments should only claim recycling tonnages that occur through their own operations, direct contracts or franchises. Local governments could use a number of approaches to meet the requirement. The target does not prescribe specific methods, policies, programs and expenditures, so local governments have maximum flexibility to choose the methods most appropriate for their area. If implemented, these key actions would increase recycling by approximately 45,000 to 55,000 tons in the *first year alone*. Additional diversion would occur as population and per capita requirements rise.

There may be alternatives to requiring a given outcome and leaving local governments free to choose their own methods. For example, Oregon requires local governments to implement a minimum set of prescribed local programs.

All key actions would be strengthened and encouraged if local governments receive funds to support them. Objective 2.3 details a way for funds to be directly tied to local government performance.

Objective 2.3. Enact a statewide surcharge on tipping fees.

Twenty-two states apply a statewide tipping fee or surcharge. The fees support local programs, state permitting functions, household hazardous waste programs, state recycling grants, market development, cleanup efforts and landfill closures. Fees range from $.25/ton in Arizona to $8.75/ton in West Virginia.

A statewide tipping fee would provide local governments with the funds needed to help them afford the high cost of long-term closed landfill management. The fee could also encourage higher recovery levels, prevent and control litter and illegal dumping, and improve the landfill permitting process. Here is one scenario of how the funds could be applied.

- $2.50/ton automatic disbursement to local governments to achieve the per capita recovery goals described in Objective 2.2. This disbursement would make Objective 2.2 a funded mandate.
- $2/ton for a long-term landfill cleanup.
- $.05/ton to fund the state's solid waste permit program would reduce permit review time and increase compliance action.
- $.15/ton for state recycling market and infrastructure development grants.
- $.15/ton for litter and illegal dumping clean-up and abatement programs.
- $.15/ton to research and implement pilot bioreactor landfill programs, initiate landfill gas-to-energy programs, and other efforts that reduce landfills' environmental impacts.

A statewide tip fee surcharge would fund needed programs and reduce the economic gap between landfill disposal and its alternatives. Surcharges typically motivate generators to divert more waste from disposal. The surcharge would be applied across the board to both private and public facilities.

Objective 2.4 Require private waste management companies to plan and report solid waste activities.

Local governments are required to write 10-year solid waste management plans and provide updates every three years. The plans set waste reduction goals and specify activities that achieve them. They also include collection and disposal service goals for local government jurisdictions.

Privately developed and operated transfer stations and landfills diminish local government's ability to control the flow of waste. This loss of control often prevents local governments from achieving their solid waste management and diversion goals. If private haulers operating transfer stations and landfills communicated their solid waste management plans, state and local governments would have more of the data they need to set and achieve their goals.

The following key actions contribute to this objective:

- By 2006, require private haulers operating transfer stations that ship waste to other counties or states to submit solid waste plans. The plans should discuss:
    - If the hauler intends to recycle materials handled at the transfer station, and
    - How the transfer station may impact the ability of the county it operates in to meet local solid waste goals.
- As an alternative, private haulers operating transfer stations that ship waste to other counties or states could integrate their planning efforts with those of the county where they are located.
- By 2006, require private landfills receiving waste from other counties to submit solid waste plans. The plans should discuss:
    - The landfill's intentions to recycle any materials handled at its facility, and
    - How the landfill affects the ability of the counties that generate the waste it receives to meet their locally adopted solid waste goals.
- As an alternative, private landfills could integrate their planning efforts with the counties from which they receive waste.

Objective 2.5 As an alternative to parts of Objective 2.1, Objectives 2.2 and 2.4 require all public and private household solid waste collection providers to offer separate services to collect common recyclables.

Wisconsin reached high recovery targets when it passed a mandatory recycling law that applied to a range of materials. North Carolina has both the need and the ability to recover higher levels of common recyclables like newspapers, bottles and cans. Many households statewide enjoy some sort of solid waste collection service but do not receive comparable recycling services. When communities mandate material separation, recovery rates rise almost immediately (e.g., Durham, N.C.). Requiring both public and private sector haulers to meet minimum performance standards would equitably increase diversion rates of recyclable materials.

The following key actions contribute to this objective:

- By 2006, require all collection service providers to offer separate recycling services for newspaper, magazines, high-grade paper, aluminum cans, steel cans, glass bottles, #1 and #2 plastic bottles.

Objective 2.6. Implement variable rate pricing and local mandates that increase recycling participation.

Variable pricing increases waste reduction program participation and establishes equitable and stable financing. Twenty-five North Carolina communities currently operate variable rate pricing programs. Because user fees are based on the amount of waste disposed, generators are financially motivated to reduce waste, recycle and compost.

Recycling mandates are an alternative method to increase participation in local waste reduction programs. Mandates vary greatly, but most require residents to separate certain materials from the waste stream. Mandated materials are typically commodities with historically stable market conditions (e.g., glass containers, newsprint, etc).

A number of states and North Carolina communities have successfully mandated recycling. Mandates increase participation and recovery, which increases programs' cost-effectiveness. The city of Durham is a prime example of a successful recycling mandate. Just six months after enforcement began, per capita recovery rates increased 27 percent and participation rates jumped from 60 to 80 percent. As with any successful mandate, Durham's program has an enforcement component.

If more communities used variable rate pricing or mandated local recycling, their programs would reduce more waste and be more cost-effective.

The following key actions contribute to this objective:

- Require municipalities over 15,000 in population to implement residential variable rate pricing programs or adopt mandatory residential recycling ordinances by 2010. Based on FY 01-02 data, this action would affect 50 municipalities.

- Require counties over 100,000 in population to implement variable rate pricing programs or adopt mandatory recycling ordinances by 2010. This action should be limited to county-controlled residential waste. Based on FY 01-02 data, 23 counties would be affected.

- Require municipalities over 5,000 in population to implement residential variable rate pricing programs or adopt mandatory residential recycling ordinances by 2012. Based on FY 01-02 data, this action would affect 64 municipalities.

- Require counties over 50,000 in population to implement variable rate pricing programs or adopt mandatory recycling ordinances by 2012. Action should be limited to county-controlled residential waste. Data from FY 01-02 show 27 counties would be affected.

Objective 2.7. Maintain and expand North Carolina's participation in product stewardship initiatives.

Product stewardship is a growing movement to expand the responsibility of manufacturers and other parties to manage end-of-life products. The current model of using tax-funded government programs to recycle many waste streams has reached a plateau. It has been difficult to start recycling other discards, so the environmental impacts that these products pose continues with little intervention. Product stewardship's goal is an alternative to tax-funded government programs. It uses a model of "shared responsibility" where manufacturers and retailers expand their role to finance, expand and improve recovery infrastructure.

DENR participates in the national effort to promote product stewardship. DENR is a formal member of the Product Stewardship Institute (PSI), and is helping to implement the Carpet America Recovery Effort. North Carolina is also helping to conduct a national beverage container product stewardship process. Through PSI, DENR participates in the National Electronics Product Stewardship Initiative. If this effort fails to produce an adequate infrastructure to divert electronic wastes, North Carolina should pursue Objective 2.8 below. DENR is also working with paint manufacturers through PSI to target old paint for recovery.

The following key actions contribute to this objective:

- Continue to participate in and support national, multi-state initiatives that implement product stewardship practices for as many products as possible.

- Promote existing private product stewardship programs – e.g., the national recycling services for rechargeable household batteries.

- Encourage local governments to participate in the PSI and in other product stewardship initiatives to increase the national number of jurisdictions supporting these efforts.

- Look for opportunities to introduce product stewardship principles into proposed recycling legislation.

Objective 2.8. Implement a consistent funding source to recover electronics.

Electronic waste is a fast-growing and problematic waste stream. Recovering electronic discards would help North Carolina reduce the volume and toxicity of materials disposed in landfills. If the National Electronic Product Stewardship Initiative fails to develop a national diversion infrastructure, North Carolina should establish a funded, statewide system to recover electronics.

The following key action would contribute to this objective:

- Implement a one percent advanced recycling fee (ARF) on each unit of electronics sold, such as computers and televisions. Like the white goods and tire programs, distribute most of the funds to support local government operations.

Objective 2.9. Increase public awareness and commitment to recycling.

North Carolina would benefit from increasing the current public recycling participation rate of 47 percent. A 20 percent boost would divert close to 74,000 additional tons of material through curbside and drop-off programs.

In 1999, North Carolina began using the highly effective "Recycle Guys" education campaign. The concept uses animated characters in television ads and other media. Funding partnerships were established with local governments and private entities to provide TV airtime and produce supporting materials. The campaign's proven strong appeal could serve as a foundation to increase recycling participation.

The following key actions contribute to this objective:

- Commit at least $50,000 per year from the Solid Waste Management Trust Fund to finance the Recycle Guys campaign.
- Seek annual matching funds from local government partners.
- Invite the private sector – particularly solid waste haulers and recycling companies – to join and financially support the campaign.
- Partner with the Department of Transportation and target Recycle Guys campaigns to support anti-litter efforts.
- Ask local governments to integrate the Recycle Guys with their current recycling educational campaigns.
- Provide local governments with the materials and supplies they need to support their educational and promotional on an as-needed basis.

Objective 2.10. Increase "buy recycled" efforts by state and local agencies and the private sector.

Recycled content products must be purchased to strengthen end-use markets for recyclable materials. North Carolina state agencies made great strides as they met most statutory requirements to buy recycled paper and other items. The falling price and proven quality of recycled paper, in addition to source reduction efforts, made it possible for the state to support recycling markets without significantly increasing its purchase budget. Despite tremendous progress, state government could increase its efforts and encourage local communities to begin or expand existing efforts.

The following key actions contribute to this objective:

- Eliminate the purchase of 100 percent virgin products wherever feasible and only offer recycled products in all the state term-product categories possible.
- Conduct outreach initiatives and explore local mandates and incentives to encourage local governments to add buy recycled programs to their local 10-year plans.
- Conduct outreach efforts to North Carolina businesses and industries to encourage them to purchase recycled products.

Objective 2.11. Increase the amount of organic materials diverted by state agencies.

If state and local governments divert organic materials through composting, they will significantly increase their ability to reach their waste reduction goals. Figure 2.5 in Chapter 2 showed a breakdown of North Carolina's estimated waste stream, and the heavy presence of food wastes. A portion of this organic waste stream is generated at state agency facilities. On-site university and prison composting operations have proven to be effective, so the practice should be expanded. State agencies with large organic waste

streams from food service, landscaping and other activities (e.g., produce wastes from farmers markets) should divert materials to the growing network of composting operations and service vendors.

The following key actions contribute to this objective:

- Identify best management composting practices for state agencies. Provide technical assistance to plan, implement and sustain composting operations.
- Implement plans for on or off-site composting programs at state agencies with large organic waste streams.

Objective 2.12. Add recycling and composting to disaster debris management plans.

Disaster events have a tremendous impact on local and statewide waste management infrastructures. Requiring detailed plans to handle the waste generated by a disaster would help assure adequate disposal capacity, sensible debris staging, and divert a considerable amount of waste.

The following key actions contribute to this objective:

- Require local solid waste plans to detail how local communities will conduct disaster debris management programs.
- Identify best management practices and infrastructure preparation for disaster debris and educate others through outreach efforts.
- Develop a permanent diversion infrastructure to handle large and frequently occurring disaster-related debris (e.g. mobile homes).

Objective 2.13. Increase source reduction, recycling and composting grant and loan funds.

In one decade, administering Solid Waste Management Trust Fund grants yielded an extensive, permanent waste diversion infrastructure. The grants helped create and promote effective waste diversion techniques and technologies. The revolving loan fund established in 2000 has already proven to be an effective financial mechanism to stimulate recycling infrastructure.

Because the state's waste stream has grown along with the number of grant requests, the Trust Fund is unable to meet demand. Increasing the fund would increase the amount of waste diverted through reduction–related grants and loans. Using the fund to improve the state's waste diversion infrastructure would provide more efficient and cost-effective diversion.

The following key actions contribute to this objective:

- Pursue the statewide tip fee outlined in Objective 2.3.
- Add money to the Solid Waste Management Trust Fund for waste reduction and market development grants.
- Devote a percentage of any new Trust Fund monies to build capital in the Recycling Revolving Loan Fund administered by the Community Center for Self-Help.

Chapter Seven: Actions to Meet Goal Three

Goal Three of the Plan states:

> By 2013, reduce litter and illegal disposal by five percent from 2000-2001 levels.

Littering and illegal dumping are increasingly significant issues. Few solid waste problems generate as much public furor or seem as intractable. The N.C. General Assembly has given considerable attention to the litter issue. New legislation passed in the 2001 Session requires loads to be covered and increases enforcement. Local governments pay less attention to illegal dumping despite the threat it poses to the environment and aesthetics of their community.

Effective litter and illegal dumping programs establish and maintain continuous educational campaigns. At the local level, full-time enforcement officers who report to the solid waste department increase efforts to prevent or deter illegal dumping. Durham and Mecklenburg counties have gone a step further and established environmental courts that enhance enforcement while raising the prominence of environmental crimes in their jurisdictions.

KEY ACTIONS TO MEET GOAL THREE

Objective 3.1. Document the extent and nature of illegal dumping and litter in North Carolina.

DENR and DOT cleanup and enforcement programs already collect data, but local governments are not required to do so. The data is invaluable because it helps identify problem areas and creates a baseline to measure future efforts' effectiveness.

The following key actions contribute to this objective:

- Continue collecting data and distribute it to the General Assembly, Governor's Office and the public.
- Coordinate data collection efforts and consider jointly reporting key findings.
- Work with local governments to track and report illegal dumping complaints.

Objective 3.2. Increase educational efforts about litter reduction and illegal dumping enforcement.

Most education programs help reduce litter, but programs that target the population groups most likely to litter are more efficient. Targeted campaigns increase the value of limited resources to achieve the desired result.

The following key actions contribute to this objective:

- Coordinate state-level education efforts with DOT to promote recycling and discourage litter.
- Educate and train local governments on programs to clean illegal dumpsites and litter.
- Promote a funding mechanism for educational efforts about illegal dumping and litter.

Objective 3.3. Require local solid waste plans to include measurable litter control and illegal dumping programs.

Community-based efforts to reduce litter and illegal dumping can be very effective. They identify acute litter and illegal dumpsites, and help gather local resources and volunteers to clean up those areas. Ties to

civic groups and local schools are best cultivated at the local level, so local solid waste plans offer an excellent opportunity galvanize community litter-prevention and cleanup efforts. Local programs must address illegal dumping as a priority.

The following key actions contribute to this objective:

- Require local solid waste plans to include detailed descriptions of how communities in the jurisdiction address illegal dumping and litter. The plans should establish and analyze local baseline levels, then generally describe how the problems will be addressed.
- Work with DOT, Keep America Beautiful, and the Big Sweep program to offer communities technical assistance and training on best management practices for local litter programs.
- Encourage the School of Government to assess and make recommendations to improve illegal dumping and litter enforcement authority.

Objective 3.4. Require more extensive reports on litter control enforcement efforts from the Highway Patrol, local law enforcement agencies, and the courts.

Senate Bill 1014 passed by the 2001 General Assembly session already calls for implementation of this objective.

Objective 3.5. Establish an ongoing funding source to prevent and clean up litter and illegal dumpsites.

Cleaning litter and illegal dumpsites has already cost state and local governments millions of dollars, but the problems are still pervasive. Many communities have no program at all and others have inadequate programs. New and higher levels of funding would increase the actions needed to prevent and clean up problem areas while reducing the burden on other revenue sources (e.g., General Fund tax dollars).

The following key action contributes to this objective:

- Institute a statewide tipping fee or surcharge and dedicate a portion of that fee to illegal dumping and litter clean up programs[1].

Objective 3.6. Research bottle bills, "litter taxes" and successful mechanisms used by other states to prevent litter and illegal disposal.

Other states have mechanisms that positively affect illegal dumping and litter. North Carolina should consider these mechanisms if the objectives of this plan, other actions by the General Assembly, or local programs do not succeed.

The following key action contributes to this objective:

- Respond to requests by the General Assembly or the Governor's Office to explore and recommend appropriate mechanisms for North Carolina.

[1] See Chapter Six, Objective 2.3 for additional details on the statewide tip fee.

Chapter Eight: Actions to Meet Goal Four

Goal Four of this Plan states:

> ***Implement policies and procedures to provide information to the public and ensure public participation throughout the decision-making process regarding waste management facilities by 2013.***

This goal responds to a variety of concerns raised by the public and solid waste authorities about the solid waste planning process. Increasing general education on solid waste issues with an emphasis on landfill capacity and increasing the public's involvement in decisions about solid waste facilities would address most concerns.

PUBLIC NEED FOR INFORMATION

The public currently holds solid waste facilities in negative regard. Common worries include groundwater contamination, methane-caused explosions, and developmental health defects. The concerns prompt opposition to new facilities, the expansion of operating facilities, and the continued operation of permitted facilities. Solid waste facilities must be continually monitored and managed for the health and safety of the surrounding community and environment, but many of the fears expressed could be labeled as "misconceptions." The facilities do not pose the risk that some citizens perceive. Public education would minimize these fears and may reduce the opposition to solid waste facilities the fears generate. Providing information about old, closed landfills could also address some misconceptions about landfills.

Public concern about "good neighbor" issues such as services provided, speeding garbage trucks, and site aesthetics are frequently raised in public forums. These forums are a good way for residents to express their fears and get the information or action they need to address them. For example, constructing speed bumps and enforcing speed limits can control truck traffic. Constructing berms and planting or preserving trees and shrubs to screen facilities can resolve aesthetic concerns. Ensuring good operational procedures are followed can minimize odor, dust and other aesthetic issues. It is easier to recognize and address these matters when the public has a way to voice their concerns early in the permitting process than when landfills begin operating.

Public opposition is often rooted in the "not in my backyard" or NIMBY camp. Residents often recognize the need for new facilities, but strongly feel they should be located elsewhere, preferably in rural, unpopulated areas. Existing facilities are deemed to have "been here long enough," and the thought that another neighborhood should "have a turn" is popular. Involving the public when decisions are made about new facilities allows for procedural justice by giving citizens the opportunity to express their thoughts and opinions. Public involvement also allows the concerns to be addressed through education or action steps.

KEY ACTIONS TO MEET GOAL FOUR

Landfills and other solid waste facilities provide a necessary service to North Carolina's residents. Despite efforts to reduce waste and increase recycling levels, the volume of solid waste disposed has steadily increased with no sign of short-term abatement. Because it is harder to site new landfills, it is difficult to ensure the state has sufficient disposal capacity. Reducing waste disposal and increasing recycling and diversion help maintain the state's landfill capacity. Increased public involvement and education could make siting new landfills easier and address the concerns and misconceptions about

operating facilities. The actions suggested to reach Goal Four also help achieve Goal Five because they address the state's need to ensure landfill capacity.

Objective 4.1. Ensure public involvement and education when siting new municipal solid waste landfills.

The state should distribute site-specific information about proposed municipal solid waste landfills to neighboring populations and provide them opportunities to comment early in the permitting process.

The following key actions further this objective:

- Identify communities that neighbor proposed solid waste facilities.
- Require facility applicants and affected local governments to develop and implement a community participation plan.
- Require applicants to analyze the proposed facility's affect on the community, such as additional traffic or aesthetic changes.
- Require applicants to develop public participation plans to address the effects identified.

Figure 8.1 illustrates an example of expanded public participation in the municipal solid waste landfill permitting process.

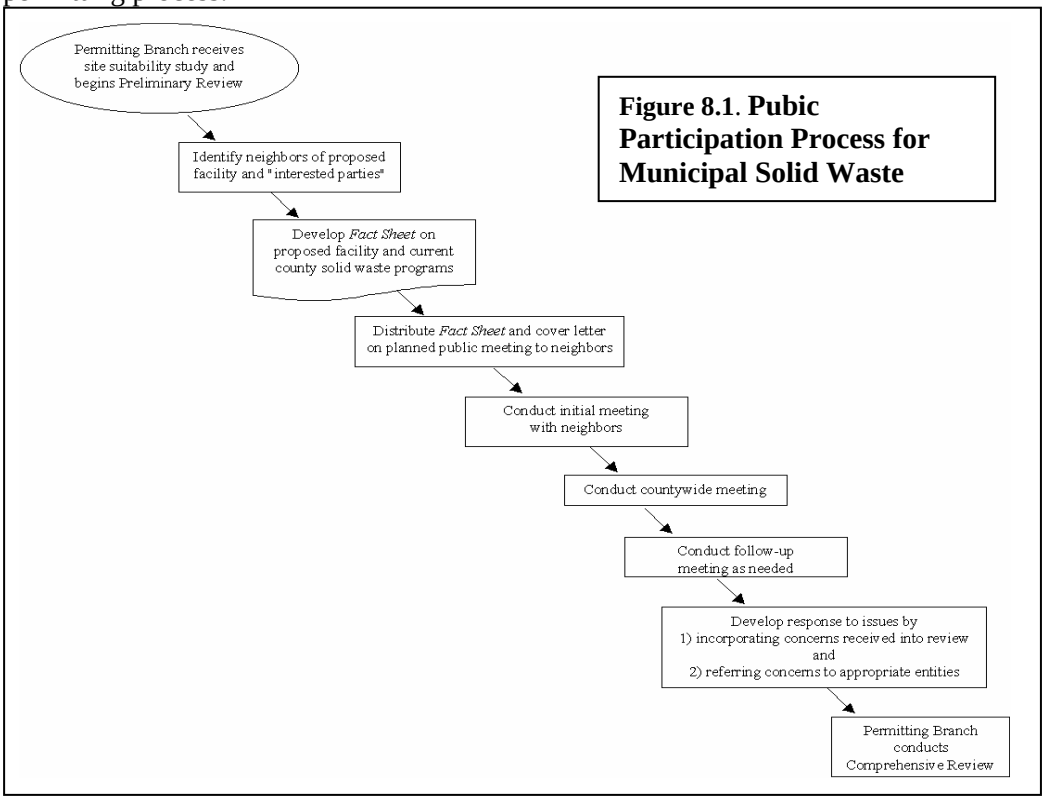


Figure 8.1. Pubic Participation Process for Municipal Solid Waste

Objective 4.2. Ensure public involvement and education when making decisions about proposed C&D, transfer and compost facilities.

The state should distribute site-specific information about proposed facilities to neighboring populations and provide them an opportunity to comment early in the permitting process.

The following key actions further this objective:

- Identify communities that neighbor proposed facilities.
- Require applicants and affected governments to develop and implement a community participation plan.
- Require applicants to analyze the proposed facility's effect on the community, such as the additional traffic or changes to the aesthetic view.
- Require applicants to develop public participation plans that address the effects identified.

Objective 4.3. Ensure public involvement and education when making decisions about existing solid waste facilities.

The state should require the distribution of site-specific information to neighboring populations and allow them an opportunity to comment during the decision-making process.

The following key actions further this objective:

- Identify communities that neighbor existing solid waste facilities.
- Develop and implement public participation plans for existing facilities.
- Provide information or "fact sheets" about existing solid waste facilities.

Objective 4.4. Ensure public involvement and education when making decisions about closed facilities.

The state should require the distribution of site-specific information to neighboring populations.

The following key actions further this objective:

- Identify communities neighboring closed solid waste facilities.
- Provide information or "fact sheets" on closed solid waste facilities.

In addition to helping achieve Goal Four, the suggested objectives in this chapter also increase the chance of achieving Goal Five, ensuring the state's landfill capacity.

Chapter Nine: Actions to Meet Goal Five

Goal Five of this Plan states:

> By 2013 the state of North Carolina shall create and continually maintain 20 years of landfill capacity in the state.

This goal is designed to be continuous. For example, by 2013 North Carolina should have enough landfill capacity for disposal through at least the year 2033. In the year 2014 there should be enough capacity to last until 2034 at minimum.

Landfill capacity is necessary to protect human health and the environment from the hazards and nuisances of improper disposal. If landfill capacity is depleted, the alternatives of long-distance shipping or incineration will increase economic burdens. Goal Five seeks to prolong the lifetime of operational landfills and ensure 20 years of future disposal capacity. The goal has multiple applications because ensuring ample space for solid waste disposal requires waste reduction, increased recycling and an improved landfill siting process.

KEY ACTIONS TO MEET GOAL FIVE

Situations vary from county to county, but overall landfill capacity is limited. The factors that prolong and expand landfill lifetimes must be addressed now. The key actions outlined to achieve Goal Five directly address the state's landfill capacity needs. Because good solid waste management is complex and multifaceted, the key actions recommended to achieve goals one through four – increasing technology, recycling, diversion, public education and involvement – also help realize Goal Five.

Objective 5.1. Increase waste reduction efforts.

The obvious way to extend the state's landfill capacity is to reduce the amount of waste disposed in its landfills. Increased efforts to reduce waste at its source, recycle and compost would decrease the amount of waste generated and disposed in the state. Without opening a single new facility, the state would be able to "buy time" from its existing landfill capacity.

The following key actions for this objective are described under Goal 3:

- Enact statewide disposal bans on recyclable materials like pallets and clean wood waste, oil filters, cardboard, newspaper, office paper and cathode ray tubes.
- Establish per capita recovery targets for local government programs.
- Enact a statewide tipping fee on solid waste disposal and transfer to help meet waste reduction goals and provide program funds.
- Implement variable rate pricing and local mandates to increase recycling participation.
- Continue and expand North Carolina's participation in product stewardship initiatives.
- Implement a consistent funding source to recover electronics.
- Increase public awareness and commitment to recycling.
- Increase "buy recycled" programs by state and local agencies and the private sector.
- Increase state agency diversion of organic materials.
- Include recycling and composting in disaster debris management plans.

- Increase grants and loans available for source reduction, recycling and composting.

Objective 5.2. Develop a process to certify facility need.

North Carolina has no formal process to document or certify the need for disposal capacity. In the past, disposal capacity developed on a laissez faire basis. Local perceived needs or private waste company efforts to increase business infrastructure have driven it. Defined planning strategies may be necessary.

The following key actions further this objective:

- Research states where a planning process that certifies disposal needs has been considered or implemented.
- Convene stakeholders (e.g., public and private landfill developers) and describe the necessity to certify landfill capacity needs and propose preliminary parameters.
- Propose a formal need certification program.
- Finalize and implement a need certification program after public review and comment.

Objective 5.3. Provide information about landfill capacity need.

As North Carolina researches and implements mechanisms that measure landfill capacity, the information should be distributed to stakeholders. The facts are invaluable to the siting process and will help the public understand disposal capacity issues.

The following key actions further this objective:

- Conduct an annual capacity analysis and project the need for MSW landfills.
- Include a synopsis of the state's disposal capacity in the Solid Waste Management Annual Report.
- Report capacity and need analysis data to the Environmental Review Commission.

Objective 5.4. Give local community groups information about solid waste facilities.

Ongoing public education efforts require the state to share data about solid waste with the public. Involving the public in decisions about solid waste facilities also requires education. The state should formalize the education process with a requirement that information should be shared with community groups.

The following key actions further this objective:

- Implement a comprehensive public participation program.
- Respond to public queries about solid waste facilities in a timely manner.
- Explore possibilities to post data about permitted solid waste facilities on the Internet.

Objective 5.5. Review the public participation process.

Public participation is a critical yet controversial element in the landfill siting process. Though difficult to achieve, efforts must be made to balance the applicant's need for a fair siting process with the public's right to be informed and involved in the decision-making process.

The following key actions further this objective:

- Analyze current public participation laws and rules to determine where opportunities exist to improve or change the process.
- Solicit stakeholder viewpoints on the public participation process.
- Propose changes to public participation laws and rules.

Objective 5.6. Improve the efficiency of permit application reviews.

The time it takes to review and issue a permit influences disposal capacity. The time period is largely governed by the current statutory process and the availability of staff and resources to review permits. Process improvements may be necessary.

The following key actions further this objective:

- Review the current permit process and identify opportunities to increase efficiency.
- Provide a funding mechanism to ensure the resources for faster permit reviews.
- Support the Professional Engineers of North Carolina, the Solid Waste Association of North America, the National Solid Waste Management Association, and other organizations that provide permitting information to consulting firms.

CONCLUSION

This update of the original 10 Year Solid Waste Plan sets a course for North Carolina's continued success in solid waste management. It also recommends the steps necessary to ensure public safety and protect the environment. Because the public plays a vital role in successful waste management, input from North Carolina residents has informed and been incorporated throughout this Plan. This input, coupled with analyses of the previous plan's successes and shortcomings, formed the basis for this 10 Year Plan's goal statements and recommended actions.

In keeping with the Plan's 10-year span, all five goals have a deadline of 2013, but successful strategic plans are inherently flexible and designed to be adapted as circumstances change. As with any plan, this Plan's effectiveness rests on the state's ability to monitor outcomes and adapt as needed.

Combined action from the General Assembly, the DENR, local governments, the private sector, and North Carolina residents will be needed to achieve the goals. The five goals and their associated objectives are vital to improve solid waste management in North Carolina. They are also necessary to safeguard the public health and welfare. North Carolina has achieved a great deal in its last 10 years of solid waste management. This Plan sets the path for another 10 years of safe and successful solid waste management.