state of the Environment Report

Mecklenburg County
North Carolina

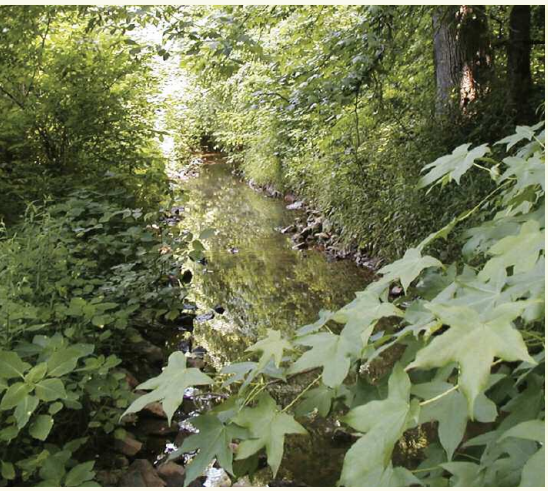
2010

Advisory Boards Need You!

By Heidi Pruess, CEP
Environmental Policy Administrator, Land Use and Environmental Services

Mecklenburg County residents have an opportunity to become a part of the decision-making for reducing impact to and improving our environment. The Mecklenburg County Environmental Policy Coordinating Council (EPCC) was established in 2003 by the Board of County Commissioners to compile and prioritize important and strategic environmental issues which the City of Charlotte, Mecklenburg County and the six towns face. In particular, the EPCC is looking at the "big picture" in an effort to identify overlaps, gaps and conflicts that occur between the various advisory boards and councils.

Andy Zoutewelle, the 2006-2009 EPCC chairman said it well: "The success of our community is due in no small part to the attentiveness and proactive nature of the members of our community. This *State of the Environment Report* reflects this attentiveness and provides a tool for our pursuit of a bright future." Further details about becoming a member of a commission or advisory board can be found in each chapter of this report.



McIntyre Natural Banks

state of the Environment Report
Mecklenburg County North Carolina 2010

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Storm Water Advisory Board	Tim Mead
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Zoning Board of Adjustment	Andy Zoutewelle
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State of the Environment Mecklenburg County 2010

Executive Summary

Can YOU help improve our environment? You might want to first understand the State of our Environment before you determine the best way to get involved. Mecklenburg County creates this State of the Environment Report to provide a tool for understanding the conditions of our environment and identifying strategies to ensure that we have clean air to breathe, clean water to drink, and healthy land on which to live and recreate. The 2008 *State of the Environment Report* found that we have made significant progress toward addressing environmental issues over the past 20 years. In the articles of this 2010 *State of the Environment Report*, you will find where environmental conditions have improved as well as those areas that continue to need our help.

Highlights of the Air, Water, Waste, and Land chapters are included in the table below. What YOU can do, as a resident of Mecklenburg County, starts with getting involved and a variety of committees and boards are active in the County. We ask you to consider doing your part to improve the state of our environment.

State of the Environment Chapter	Major Conclusion	What Can YOU Do?	Article Example
Air	Ozone pollution continues to contribute to poor air quality	Reduce mobile source air emissions	9
Water	The most common pollutants in our surface waters are sediment and fecal coliform bacteria	Protect and restore water quality conditions	37 49
Land	The public uses our parks, greenways, and nature preserves at a high rate and growth in environmentally sustainable buildings is dramatic	Utilize Park and Recreation programs improve your personal and community health Implement energy efficient and sustainable development practices	84
Waste	It is unlikely that additional landfill capacity will become available in or near Mecklenburg County	Increase residential, commercial, and construction recycling	103

Environmental Quality of Life by the Numbers:

The Charlotte Regional Indicator Project's Environmental Indicators

By Vicki Bott, Associate Director for Public Policy Research

UNC Charlotte Urban Institute

The Charlotte Regional Indicators Project is an effort launched by the UNC Charlotte Urban Institute in 2007 to monitor key measures of the region's quality of life over time. "Environment" is one of several areas covered by the Indicators Project, and includes six indicators:

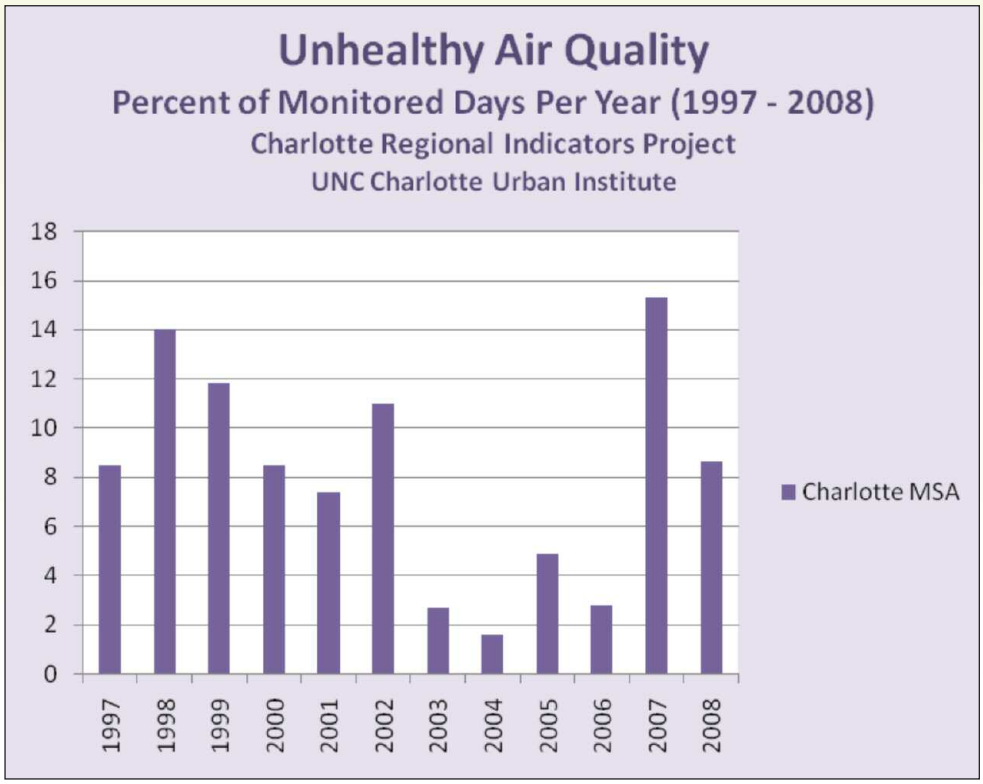
- Unhealthy Air Quality Days
- Vehicular Emissions
- Water Consumption
- Impaired Streams
- Landfill Waste Disposal
- Developed Acres Per Person

This article presents the most recent data for selected environmental indicators for Mecklenburg County and the region. Data for all but one of these indicators is compiled from state and federal agencies for the 14 individual counties in the region, including Mecklenburg. Data for the Developed Acres per Person indicator is provided by the Center for Applied Geographic Information Science at UNC Charlotte (CAGIS), through its partnership with the UNC Charlotte Urban Institute as part of the Renaissance Computing Institute at UNC Charlotte.

By examining historic trends on these indicators and monitoring progress over time, we can evaluate how well we are doing as communities and as a region in sustaining our environmental quality of life. The indicators are intended to serve as a foundation for community and regional dialogue and action. The Indicators Project Web site can be found at **http://regionalindicators.uncc.edu.**

Unhealthy Air Quality Days

This indicator looks at the number of days per year the region's Air Quality Index is rated as "Unhealthy for Sensitive Groups" or worse, as a percent of monitored days (generally 365 days). The EPA calculates a daily "Air Quality Index" (AQI) for the Charlotte-Gastonia-Rock Hill Metropolitan Statistical Area (MSA) based on the measurement of five major air pollutants regulated by the Clean Air Act, as recorded at monitoring stations. AQI measurements are rated by the EPA as "Good," "Moderate," "Unhealthy for Sensitive Groups," "Unhealthy," "Very Unhealthy," or "Hazardous." Data is currently available from 1997 through 2008, and is displayed in the chart at right.



After four years of very low percentage of unhealthy air quality days from 2003 through 2006, the region returned to higher levels of unhealthy air quality days in 2007 and 2008. In 2008, 8.6% of monitored days were rated "Unhealthy for Sensitive Groups" or worse.

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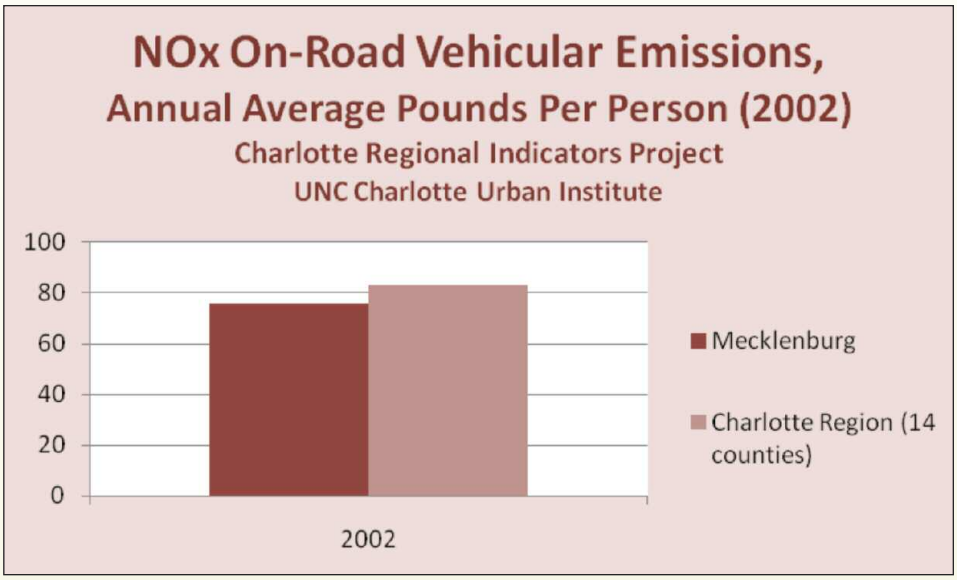
The Charlotte Regional Indicator Project's Environmental Indicators

continued

Vehicular Emissions

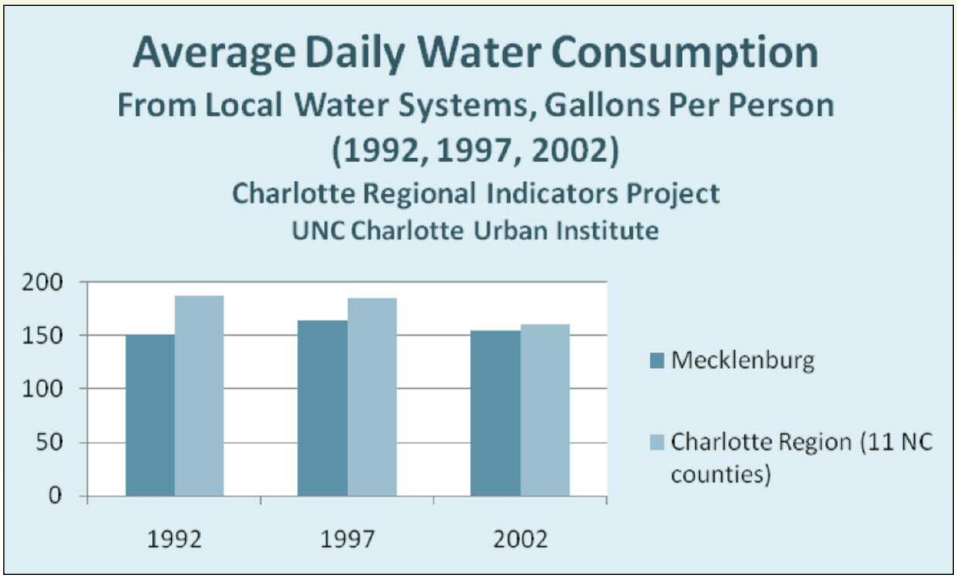
This indicator captures on-road vehicular emissions of nitrogen oxides (NOx) for each county in the 14-county region, and calculates a per person figure. States are required by the EPA to collect and report NOx emissions data. The amount of NOx in the air determines how much ground-level ozone, a harmful pollutant, is produced. Emissions of NOx are also monitored for other categories of mobile sources (such as "off-road non-vehicular" sources, e.g., lawn mowers) and for stationary sources (such as manufacturing or power plants.) Data are available for 2002, with 2007 data not available until later in 2010.



Mecklenburg County had slightly lower NOx on-road vehicular emissions per person in 2002 than the region as a whole: 76 versus 83 pounds per person.

Water Consumption

Our local water systems are the second-largest users of the region's water supplies, after power generation. This indicator measures average gallons per day of water withdrawn from water supply sources by local water systems, and reports it on a per person served basis. North Carolina requires reporting every five years of water withdrawals by all local water systems over a certain size (1,000 service connections or 3,000 people,) including municipal, county, or private systems. Reported water withdrawals include purchases of water from other systems and exclude sales of water to other systems, yielding a "local consumption" figure. The data does not include withdrawals by users other than local water systems, such as for agriculture or power generation, water drawn from individual wells, and permitted water intakes by residential or industrial water users. Data are available by county and for the region, for 1992, 1997, and 2002. Comparable data for 2007 are not yet available.

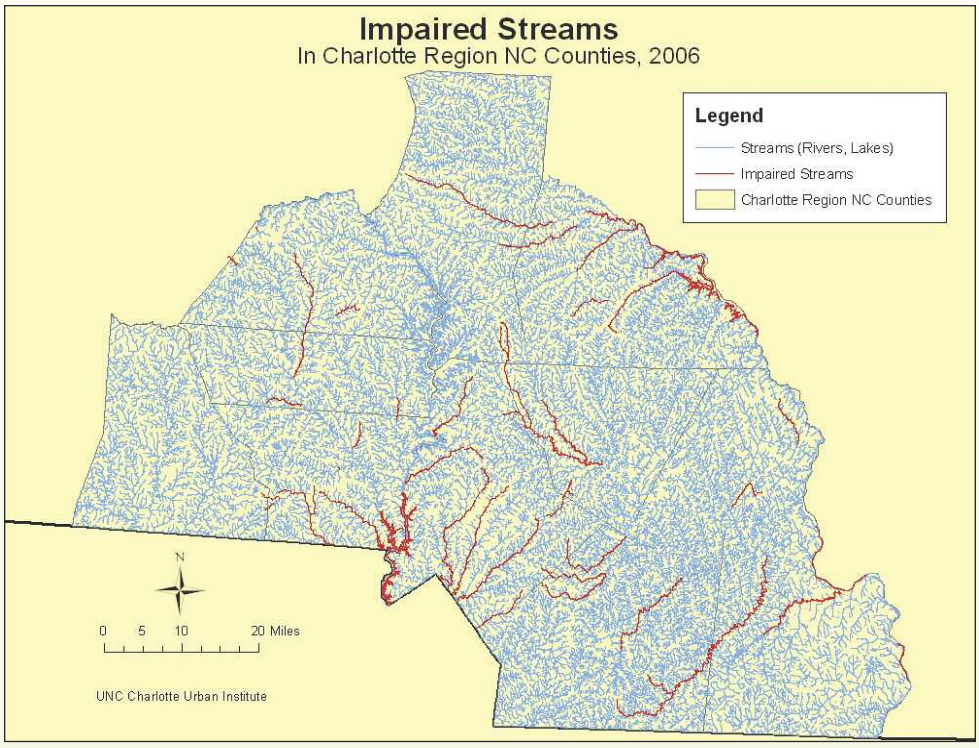


Mecklenburg County's per person water withdrawals from local water systems remained in the range of 150-165 gallons per day from 1992 to 2002. By comparison, the 11-county region was using water at the rate of 185-190 gallons per person per day in 1992 and 1997, but decreased its usage to 160 gallons per person per day in 2002.

An important point to keep in mind is that local water systems supply the water needs of some (but not necessarily all) businesses and residences within their service area, and that the nature and proportion of those categories of customers may vary from system to system and county to county. For example, one community may have more industrial companies that have their own water intake permits than another community in which most businesses are on the public water supply system. The indicator does not represent "household water usage," but rather the water usage of the combination of households and businesses on the water system.

Impaired Streams

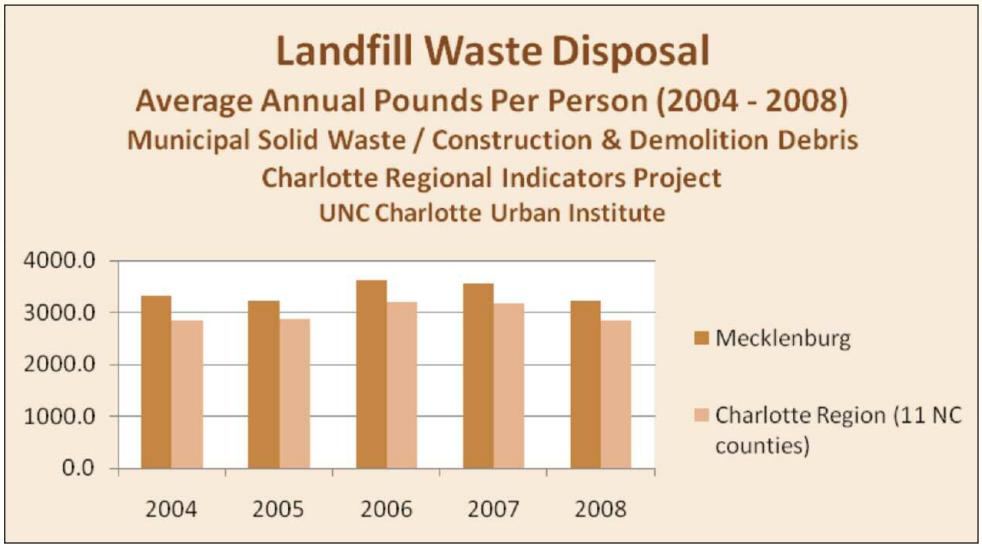
Polluted lakes, rivers and streams can negatively impact activities such as fishing and swimming, increase drinking water treatment costs, and reduce the viability of aquatic ecosystems. The federal Clean Water Act requires states to collect and report data on streams with impaired water quality by measuring pollutants that exceed standards for the stream's intended use or designation. The term "stream" encompasses all surface waters, including rivers and lakes. This indicator looks at impaired stream miles as a percentage of total stream miles in the 11 North Carolina counties in the Charlotte region. In 2006, North Carolina published for the first time a map of perennial streams, rivers and lakes in Geographic Information Systems (GIS) format showing both impaired and non-impaired stream segments, making computation of the percentage of impaired stream miles practical for inclusion in the Indicators Project. The state's Impaired Streams report for 2008 has not yet been finalized, and the 2010 GIS-formatted data are not yet available.



In 2006, the 11 NC counties including and around Mecklenburg had 16,546 stream miles, 5.6% of which were impaired.

Landfill Waste Disposal

The costs of landfill disposal are large and increasing. Reducing landfill solid waste disposal is a state goal that has not enjoyed much success, despite increases in recycling programs and other public awareness efforts. This indicator quantifies the disposal in landfills of municipal solid waste (MSW) and construction and demolition (C&D) debris on a per-person basis. North Carolina maintains annual data by county on combined MSW and C&D waste disposed at landfills. That data excludes waste "imported" from other counties and includes waste "exported" to other counties, providing a measure of waste generated from within each county that is disposed at landfills. The indicator uses the total tons per year of MSW/C&D waste disposed at landfills, divided by the county population and converted to pounds per person.



Mecklenburg County's annual landfill waste disposal rate was in the range of 3,225 to 3,325 pounds per person for most of the time period from 2004 to 2008. It rose, however, to 3,641 in 2006, and declined only slightly to 3,561 in 2007. By comparison, the 11-county region's trend followed a similar trajectory, but at lower levels in the range of 2,845 to 3,215.

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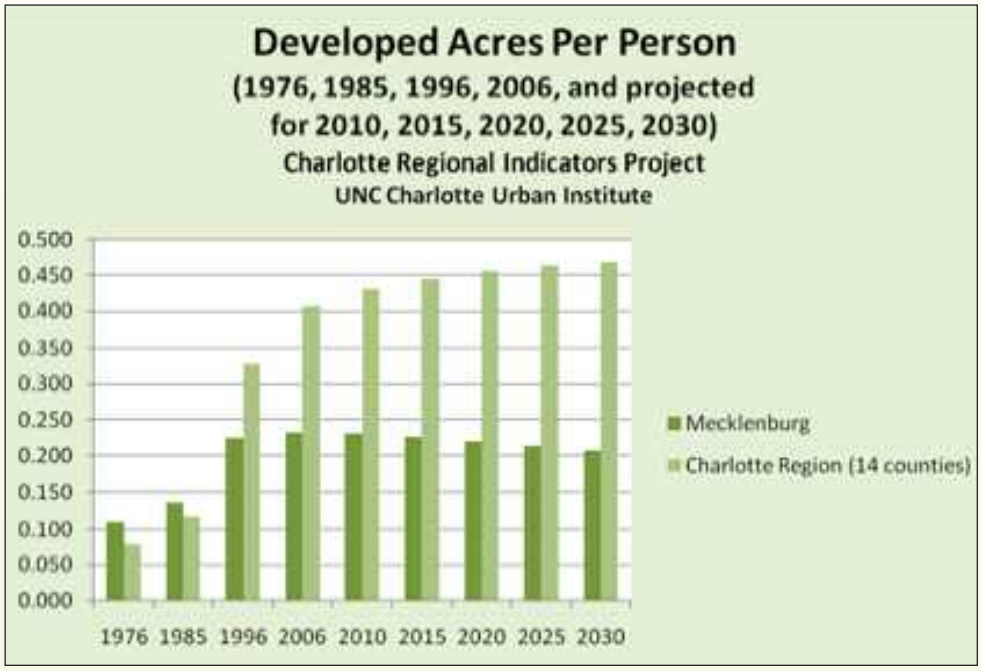
The Charlotte Regional Indicator Project's Environmental Indicators

continued

Developed Acreage

This indicator measures developed land in acres per person. Over time, it illustrates how land development is keeping pace with population growth. UNC Charlotte's Center for Applied Geographic Information Science (CAGIS) uses satellite imagery to assess the amount of developed land (*excluding agriculture*) at four time periods roughly ten year apart from 1976 to 2006. Development-related data for those four time periods (*slope, road density, location of urban centers, location of interstate interchanges, and location of existing development*) are then used to develop a predictive model of future development. When combined with population projections from the state demographer's office, the model's results yield projections for developed acres per person, by county and for the region, for 2010 through 2030.



In 1976 and 1985, Mecklenburg County residents' "development footprint" was larger than the regional average. By 1996, both the County and the region had seen significant jumps in developed acres per person, with the region now having the larger average development footprint. In 2006, Mecklenburg County's developed acres per person remained virtually unchanged at 0.23, especially compared to the region, which had increased its average developed acres per person by almost 25%, to 0.41. Looking into the future, Mecklenburg is expected to slowly decrease its development footprint even as it grows in population, reflecting a denser pattern of development through 2030. By comparison, the region is expected to continue increasing its per person development footprint as population grows.

Conclusion

On all of the environmental quality of life measures that provide breakouts by county, Mecklenburg County performs somewhat better than the region as a whole. While this is true on a per-person basis, Mecklenburg's large population means that in terms of total amounts of air pollutants or solid waste generated, total consumption of water, and total developed acreage, Mecklenburg County's is the largest contributor to these regional issues affecting our environmental quality of life.

As the region and Mecklenburg County continue to grow in population, the negative effects of these environmental concerns will grow as well, unless we can improve the efficiency with which we use our air, water, and land resources, reducing the per-person negative impacts. Each of us has a contribution to make, first in our own lives – becoming more aware of ways we can reduce, reuse, and recycle and minimize our "environmental footprint" – and then in becoming informed and engaged participants in public policy dialogue on these issues. The Indicators Project's ongoing tracking of these environmental quality of life measures will allow us to see where we are making good progress and where more improvement is needed.

Population (update)

Population

in Mecklenburg County
and the 14-county Region

	Population	
	Mecklenburg	Region
1970	354,656	1,215,422
1980	404,270	1,400,247
1990	511,433	1,620,075
2000	695,454	2,038,719
2008	877,007	2,598,084

Note: Population estimates are from the U.S. Census, except for 2008 data, which are from the NC and SC State Demographers Offices

Mecklenburg County
North Carolina

Air

Air Quality Key Findings and Recommendations

By Don R. Willard, Director, Mecklenburg County Air Quality

Key Findings

• **Ozone** pollution continues to contribute to poor air quality in Mecklenburg County. For almost 35 years, bad air quality due to ozone has plagued Charlotte, Mecklenburg and the surrounding counties and towns, endangering our health, impeding our economy and degrading our quality of life. As standards continue to be lowered, without action these conditions will persist. For 2009 the "effective" or applicable eight hour ozone standard was 0.08 ppm (< 0.085 ppm). This standard was promulgated in 1997. Compliance is required by June 15, 2010 (ozone data for 2007, 2008 & 2009). The State Implementation Plan (SIP) for ozone for this region submitted to USEPA by the North Carolina Division of Air Quality projected that we would meet the eight hour ozone standard. In 2009, the compliance value measured by Mecklenburg County monitoring network was 0.086 ppm (three year average of the fourth highest concentration). This was the lowest eight hour design value ever determined. In 2009 Mecklenburg County experienced zero (0) days when the 1997 ozone National Ambient Air Quality Standard (NAAQS) was exceeded, the least days measured above the eight hour standard since measurements began in the 1970s. Although we did not meet the standard, all monitors in the Mecklenburg County and the region measured below 0.085 ppm. These measurements allow for a one year extension of the compliance date.

In March 2008 USEPA lowered the eight hour ozone standard to 0.075 ppm. The process for implementing this new standard has begun with state recommended designations submitted in 2009. As of September 2009, USEPA began reconsidering and possibly further lowering this standard and has a new implementation schedule to complete reconsideration by August 2010, designate nonattainment areas by August 2011 and require states to submit implementation plans by December 2013.

• **Particulate Matter** also contributes to poor air quality in Mecklenburg County. The concentration measured to determine compliance with the 24-hour $PM_{2.5}$ standard in 2009 was 26 µg/m^3, well below the 24-hour standard of 35 µg/m^3. The annual compliance value for 2009 was 12.6 µg/m^3. For 2009, particulate matter concentrations continue to trend downward, measuring below the annual health-based standard of 15.0 µg/m^3.

• Many new pollution reduction efforts at the federal, state, and local levels are focused on highway and off-road vehicles. Latest calculated estimates show that mobile sources account for 59% of volatile organic compound (VOC) and 84% of nitrogen oxide emissions (NOx) in Mecklenburg County.

• The current transportation and land use planning efforts in Mecklenburg County are consistent with nationally recognized strategies to connect transportation, land use and air quality.

• Greenhouse gas emissions have become a national and international environmental issue, which is expected to translate into the need for local action in future years.

Recommendations

• While climate change and greenhouse gases get all the attention, complying with the federally mandated ambient ozone standard is our number one priority. We need to reduce locally generated air emissions, particularly mobile source emissions including non-road construction equipment. Federal and state regulations will compel needed reductions over time. Local action is needed now if we want to ensure attainment of the ozone standard and the annual particulate matter standard. Actions by business, industry, government and individuals relative to reducing per capita vehicle miles traveled, managing energy demand and making "greener" purchasing decisions must be a part of our local solution to improving our air quality.

• Regulatory, incentive-based and voluntary programs to reduce the emissions of ozone-forming pollutants from mobile sources — the dominant source of these emissions in Mecklenburg County — are needed. New programs take new funding and need new funding sources. To identify and promote programs that will achieve local and regional emission reductions, state legislation is needed to provide dedicated funding (whether from existing or new revenues) to be made available to counties for clean air programs aimed at mobile sources.

• Promote land development that reduces vehicle miles of travel and continue to support alternative forms of transportation, including mass transit.

• Identify sources and amounts of locally generated greenhouse gases and encourage and promote measures that increase energy efficiency and promote energy conservation thereby reducing greenhouse gas emissions.

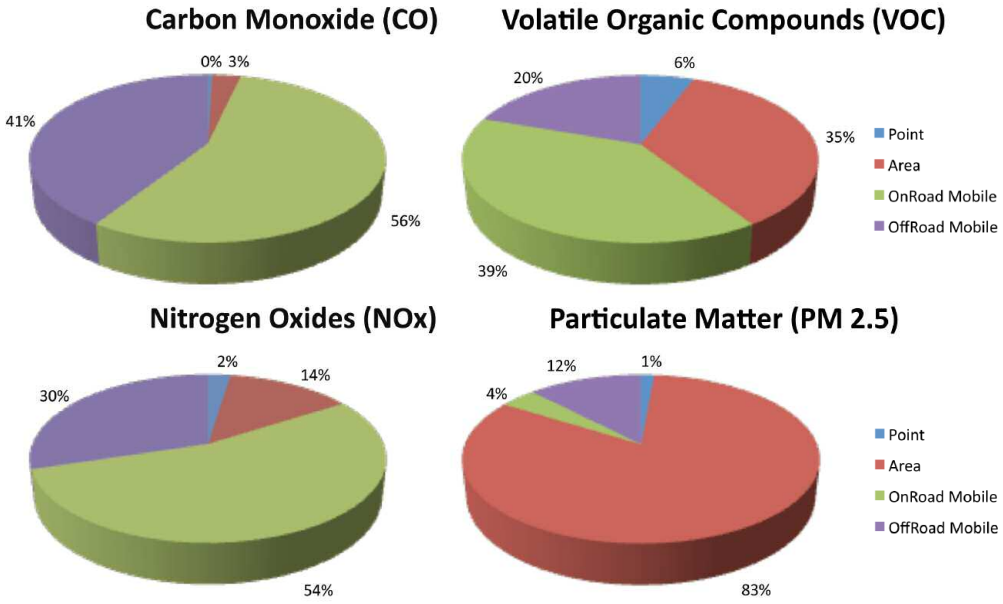
Air Quality Indicators

State of the Environment Report – 2010 Air Quality Environmental Indicators		
	2007	**2009**
Air Quality Index Designations*		
Good (Green)	189	276
Moderate (Yellow Days)	157	86
Unhealthy for Sensitive Groups (Orange Days)	17	3
Unhealthy (Red Days)	1	0
Very Unhealthy (Purple Days)	1	0
Days Over the Ambient Standard*		
Ozone: 1-hour	2	0
Ozone: 8-hour**	19	3
Carbon Monoxide	0	0
Particulate Matter < 10 microns (PM 10)	0	0
Particulate Matter < 2.5 microns (PM 2.5)	4	0
Nitrogen Oxide	0	0
Sulfur Dioxide	0	0
**The National Ambient Air Quality Standard for ground-level ozone was lowered in 2008.		
*Each year's data is reported based on the air quality standards in effect the year the measures were recorded.		
Permitted Facilities		
Major	12	11
Minor	212	221
NESHAP/MACT	20	45
Stage I	329	316
Mobile Source Activity		
Registered Vehicles	640,282	792,000
Vehicle Miles Traveled per Day	29,950,013	31,002,709^
Mass Transit Daily Ridership	73,102	90,356
^2008 figure, 2009 figure not available until April 2010		
Air Quality Violations (permitted sources)	107	66
Activity Levels		
Citizen Requests for Service	154	100
NESHAP Notifications ("Asbestos Removals")	575	290
Air Pollution (tons/yr)	**2007**	**2008†**
Carbon Monoxide (CO)	207,674	211,191
Volatile Organic Compounds (VOC)	22,064	23,585
Nitrogen Oxides (NOx)	23,196	24,333
Sulfur Dioxide (SO2)	1,644	7,776
Particulate Matter (PM 2.5)	942	4,383
†New Area Source calculation method was used for this 2008 Inventory.		

What Causes Air Pollution?

By Jason Rayfield, Air Quality Supervisor, Mecklenburg County Air Quality

The quality of our daily life depends on many modern conveniences. We all enjoy the freedom to drive cars and travel in airplanes for business and pleasure. We expect our homes to have electricity, and we use a wide variety of products made of synthetic materials. At times, we rely on services that use chemical solvents, such as the local dry cleaner and print shop. Yet availability of these everyday conveniences has a cost in terms of environmental pollution and contributes to Mecklenburg County's air quality problem. These sources of air pollution, many of which are essential to maintaining an industrialized society, can be grouped into three categories: mobile, stationary, and area sources.



Mobile Sources

A mobile source of air pollution refers to a source that is capable of moving under its own power. Within the mobile category there are two types of sources: on-road and non-road. On-road mobile sources travel on our transportation infrastructure and include vehicles such as cars, buses and trucks. Non-road, or off-road, mobile sources include equipment such as gas-powered lawnmowers and tools, farm and construction equipment, recreational vehicles, boats, planes, and trains. Pollution from these sources is mainly caused by internal combustion engines and fuel evaporation.

Mobile sources account for more than half of all the air pollution in the United States and even more in Mecklenburg County. Latest estimates show that mobile sources account for 59% of volatile organic compound (VOC) and 84% of nitrogen oxide emissions (NOx) in the County. Both of these pollutants contribute substantially to ground-level ozone, a primary component of smog. Mobile sources are also known contributors of other hazardous and toxic air pollutants, such as the recognized carcinogens benzene, formaldehyde, acetaldehyde, 1,3-butadiene, and diesel particulate matter. Emissions from mobile sources continue to increase at a faster rate than other air pollution sources due to significant increases in the number of registered vehicles within the County and associated vehicle miles traveled (VMT).

Stationary Sources

A stationary or "point" source of air pollution refers to an emission source that does not move. This category includes industrial sources like power plants, chemical plants, manufacturing facilities, and printers. Usually, there are several emission points at a stationary source of air pollution. Depending on the specific facility or industry, these sources can produce one or more criteria pollutants along with many other hazardous pollutants. At stationary sources pollutants are generally produced from the stationary combustion of fuels, like in generators or boilers, or as a by-product from industrial processes.

Many stationary sources require an air quality permit, issued locally by Mecklenburg County Air Quality. Currently, there are over 540 permitted air pollution sources within the County. Thesepermitted facilities range from large industry, such as a foundry, to smaller air emission sources like diesel emergency generator sites.

Area Sources

An area source is a collection of individually small emission sources within a single geographical area that produce similar air pollutants. Area sources are classified together by air quality control agencies to facilitate estimating emissions from their activities. Examples of area sources in Mecklenburg County include dry cleaners, parking decks, automobile refinishing operations, and gas stations. Though emissions from individual area sources are relatively small, collectively their emissions can be of concern — particularly where a large number of sources are located together in heavily populated areas.

Improving Air Quality = Reducing Emissions

In summary, Mecklenburg County has hundreds of thousands of individual sources of air pollution. Historically, efforts to reduce pollution have focused on improving control technology on vehicles and at industrial sources. But increasingly, local air quality improvements depend on individual action. The majority of local air pollution comes from mobile sources, emissions that are directly tied to driving behavior. In short, you have the power to improve the quality of air that we all breathe by changing your habits to help reduce pollution.

Achieving Ozone Attainment: 2009 State Implementation Plan Overview

By Laura Boothe, Attainment Planning Branch Supervisor
Division of Air Quality, North Carolina Department of Environment and Natural Resources

The State Implementation Plan for Air Quality, (or SIP, as it is more commonly known,) is the primary document detailing what actions a state will take to achieve or maintain compliance with the National Ambient Air Quality Standards (NAAQS) in a designated area for a specific pollutant. The North Carolina Division of Air Quality (NCDAQ), a division of the North Carolina Department of the Environment and Natural Resources (NCDENR) is the agency responsible for preparing, processing and administering the SIP.

In April 2004, the United States Environmental Protection Agency (USEPA) designated areas across the country that exceed the health based ground-level ozone standard as being in nonattainment with the Clean Air Act. These designations, which became effective on June 15, 2004, were based on the 1997 8-hour ozone NAAQS of 0.08 ppm. With a regional ozone compliance value of 0.1 ppm for 2001-2003, the Charlotte metropolitan area was classified a moderate nonattainment area. The nonattainment area, identified as "Metrolina," includes the entire counties of Cabarrus, Gaston, Lincoln, Mecklenburg, Rowan and Union; southern Iredell County (Coddle Creek and Davidson Townships); and northwestern York County, South Carolina (the Rock Hill Metropolitan Planning Organization boundary).

As a result of this nonattainment designation, the State of North Carolina was required to submit a plan demonstrating that the Metrolina area will attain the ozone standard by June 15, 2010. On June 15, 2007, the State Implementation Plan (SIP) for the Metrolina 8-hour ozone nonattainment area was submitted to the USEPA and was posted to the NCDAQ web site. A copy of the full SIP submittal can be found at **http://ncair.org/planning/CLTGastROzoneredesig.shtml**.

This SIP documented that the Metrolina ozone nonattainment area would comply with the 1997 8-hour ozone NAAQS by the 2010 deadline, fulfilling requirements of Section 172(c), 182(c), and 182(b) of the Federal Clean Air Act (CAA) as amended. Additionally, a public hearing regarding this SIP was held on April 26, 2007 at the Charlotte Mecklenburg Government Center.

On November 17, 2008 the USEPA Region 4 administrator notified the NCDENR that the USEPA intended to disapprove North Carolina's SIP based on ground-level ozone measurements from the summers of 2007 and 2008. In the USEPA's opinion, the Metrolina area would not be able to demonstrate attainment of the NAAQS by the end of 2009 and also would not meet the Clean Air Act requirements for a one-year extension of the attainment date. The administrator offered North Carolina the opportunity to voluntarily request to reclassify the North Carolina portion of the Metrolina area to a higher (serious) classification of nonattainment. If approved, this action would establish a new attainment date and require a revision of the attainment demonstration SIP to reflect the additional requirements based on the area's new classification.

On December 19, 2008, the NCDENR withdrew the Metrolina SIP, citing concerns with the reclassification option that the USEPA offered in their November 17, 2008 letter and the belief that it was possible for the region to qualify for the one-year extension of the attainment date. The state of South Carolina took the same action for the York County portion of the nonattainment area. In its withdrawal letter, the NCDENR committed to revise the modeling and submit an updated SIP by the end of November 2009.

In January 2009, the NCDAQ notified transportation partners (Metropolitan Planning Organizations, Departments of Transportation, etc.) of its intention to re-model the attainment demonstration contained in the SIP and requested revised

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Achieving Ozone Attainment: 2009 State Implementation Plan Overview

continued

Which Air Would You Rather Breathe?

While air pollution is often hard to see, these photos illustrate the decreased visibility that can be caused by poor air quality. The photo to the left shows the Charlotte skyline on a "Good" (Code Green) air quality day. The photo on the right, by contrast, shows the same skyline on a day when air quality is "Unhealthy for Sensitive Groups" (Code Orange).

data for 2011, which at that time was believed to be the projected attainment year given the 2007 and 2008 air quality data. From January to August 2009, NCDAQ worked on the remodeling demonstration in consultation with its transportation partners and USEPA

On August 14, 2009, the NCDAQ shared an internal draft of the revised attainment demonstration with the USEPA and the transportation partners for a 30-day comment period. The NCDAQ learned at the end of the comment period that the USEPA had issues with the attainment year being 2011. After several weeks of discussions within the USEPA, on November 4, 2009 the NCDAQ was given two options:

Option 1 - The State could re-submit the original attainment demonstration and then submit supplemental information. The supplemental information would include the 2009 ambient air quality data showing the area qualifies for a one-year extension and the 2011 modeling as weight of evidence that the Metrolina region would attain the standard by June 15, 2011.

Option 2 - The State could use the original 2009 modeling and the revised 2011 modeling to develop a plan to demonstrate the area would attain the standard by June 15, 2011.

The NCDAQ chose Option 1, to re-submit the original attainment demonstration SIP. On November 12, 2009, the NCDAQ re-submitted the original June 2007 attainment demonstration for the Metrolina ozone nonattainment area SIP (referenced above) to the USEPA. The NCDAQ is now in the process of coordinating with the USEPA, Region 4 staff to determine what will be needed in the supplemental information, and is working to submit this necessary information as quickly as possible. Once developed, this supplemental documentation will go through the public comment process prior to final submittal to the USEPA.

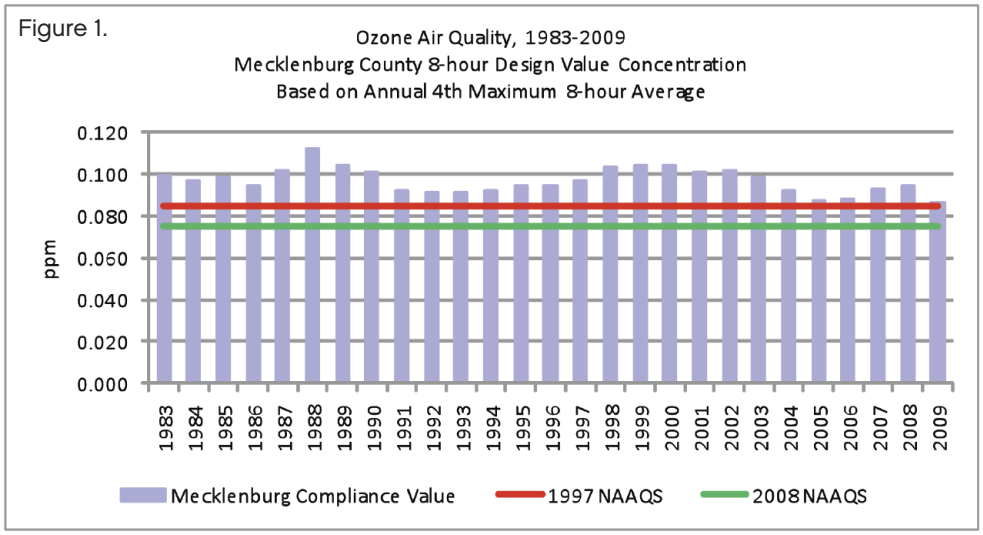
No ozone levels exceeded the 1997 ozone NAAQS (.08 ppm) during the summer of 2009, which, once the ozone attainment demonstration SIP is deemed complete by the USEPA, will qualify the Metrolina region for a one year compliance extension. The extension will be requested under separate cover, once all data has been certified.

Air Quality Status Report: Charting Our Progress

By Jeff Francis, Program Manager, Mecklenburg County Air Quality

The Environmental Protection Agency (EPA) has established national ambient air quality standards (NAAQS) for six air pollutants: ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and lead (Pb). These air pollutants are known collectively as the criteria air pollutants. **http://www.epa.gov/air/criteria.html** The most recent levels of the criteria air pollutants measured in the Mecklenburg County Air Quality (MCAQ) monitoring network are discussed below.

Figure 1.



Ozone

Ground-level ozone is the primary constituent of smog and is the criteria air pollutant of greatest concern in Mecklenburg County. Ozone is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Under the Clean Air Act, EPA has set protective health-based standards for ozone in the air we breathe. EPA and others have instituted a variety of multi-faceted programs to meet these health-based standards.

Mecklenburg County was designated as a non-attainment area for ozone in March 1978. The County remained in non-attainment of the ozone NAAQS (0.12 ppm) throughout the 1980s. Based on monitoring data collected from 1990 – 1992 Meck-lenburg County was designated as attaining the 1979 NAAQS on July 5, 1995.

In July 1997, EPA issued a revised ozone standard that was more protective of public health and welfare. Scientific information showed that ozone could affect human health at lower levels, and over longer exposure times than one hour. The revised 1997 standard was an 8-hour standard with a level of 0.08 ppm. The compliance value measured in the Mecklenburg County network from 2001-2003 was 0.098 ppm (*Figure 1*). Mecklenburg County was designated non-attainment for the 8-hour NAAQS on June 15, 2004 based upon air quality monitoring data measured during the 2001 - 2003 ozone seasons.

On March 12, 2008, EPA again significantly strengthened the NAAQS for ground-level ozone. EPA revised the 8-hour "primary" ozone standard, designed to protect public health, to a level of 0.075 parts per million (ppm). This level is noted by the green line in Figure 1 above. Mecklenburg County experienced lower ozone concentrations during the summer of 2009 than in previous years and experienced just 3 days that exceeded the revised ozone NAAQS. The 2009 compliance value for Mecklenburg County was 0.086 ppm (*Figure 1*), which continues to remain well above the level of the 2008 NAAQS.

On January 6, 2010, the U.S. Environmental Protection Agency (EPA) proposed to strengthen the national ambient air quality standards (NAAQS) for ground-level ozone, the main component of smog. EPA is proposing to strengthen the 8-hour "primary" ozone standard, designed to protect public health, to a level within the range of 0.060-0.070 parts per million (ppm). In addition, EPA is also proposing to establish a distinct cumulative, seasonal "secondary" standard, designed to protect sensitive vegetation and ecosystems, including forests, parks, wildlife refuges and wilderness areas. EPA is proposing to set the level of the secondary standard within the range of 7-15 ppm-hours. The proposed revisions result from a reconsideration of the identical primary and secondary ozone standards set at 0.075 ppm in 2008. A final rule is expected from EPA by August 2010. For the most up to date information from EPA on revisions to the ozone NAAQS visit: **http://www.epa.gov/air/ozonepollution/actions.html**.

Particulate Matter

Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller (less than 1/4th the size of a single grain of table salt) because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. EPA groups particle pollution into two categories:

• "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.

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• "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller (less than 1/30th the diameter of a human hair). These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

The nation's air quality standards for particulate matter were first established in 1971 and were not significantly revised until 1987, when EPA changed the indicator of the standards to regulate inhalable particles smaller than, or equal to 10 micrometers in diameter (referred to as PM_{10}). In 1997, EPA revised the PM standards, setting separate standards for fine particles (referred to as $PM_{2.5}$) based on their link to serious health problems.

On September 21, 2006 EPA revised the NAAQS for particulate matter. EPA strengthened the 24-hour fine particle standard from the 1997 level of 65 micrograms per cubic meter (µg/m³) to 35 µg/m³ (*Figure 2*), and retained the current annual fine particle standard at 15.0 µg/m³ (*Figure 3*). The NAAQS retained the existing national 24-hour PM_{10} standard of 150 µg/m³ (*Figure 4*). Mecklenburg County is currently in compliance with the NAAQS for PM_{10} and $PM_{2.5}$.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is one of a group of highly reactive gasses known as "oxides of nitrogen," or "nitrogen oxides" (NOx). Other nitrogen oxides include nitrous acid and nitric acid. While EPA's National Ambient Air Quality Standard covers the entire NOx group, NO_2 is the component of greatest interest and the indicator for the larger group of nitrogen oxides. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO_2 is linked with a number of adverse effects on the respiratory system.

EPA first set standards for NO_2 in 1971, setting both a primary standard (to protect health) and a secondary standard (to protect the public welfare) at 0.053 parts per million (53 ppb),

Figure 2.

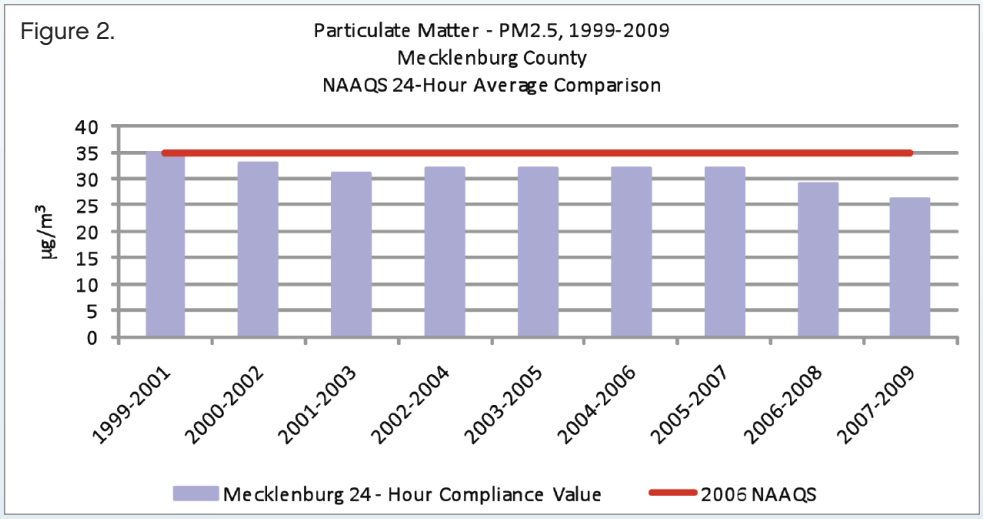


Figure 3.

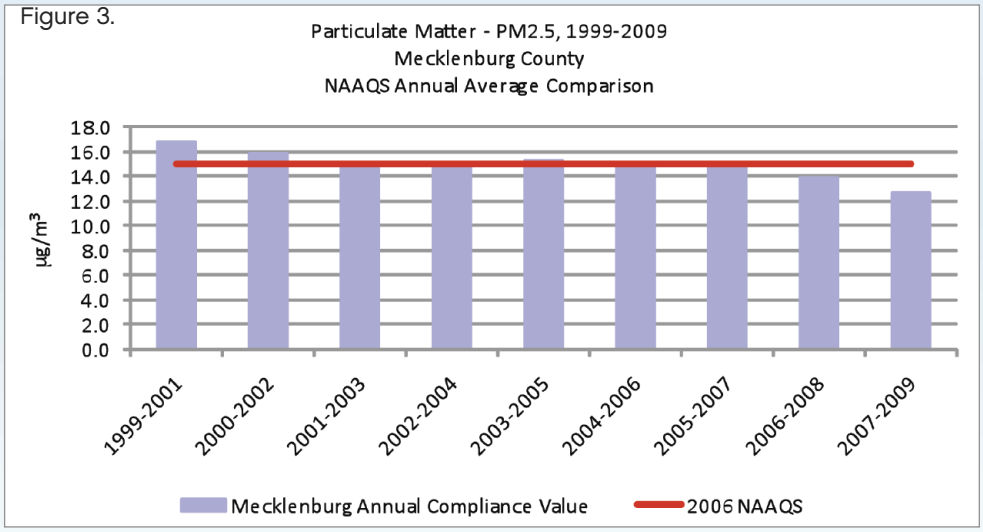
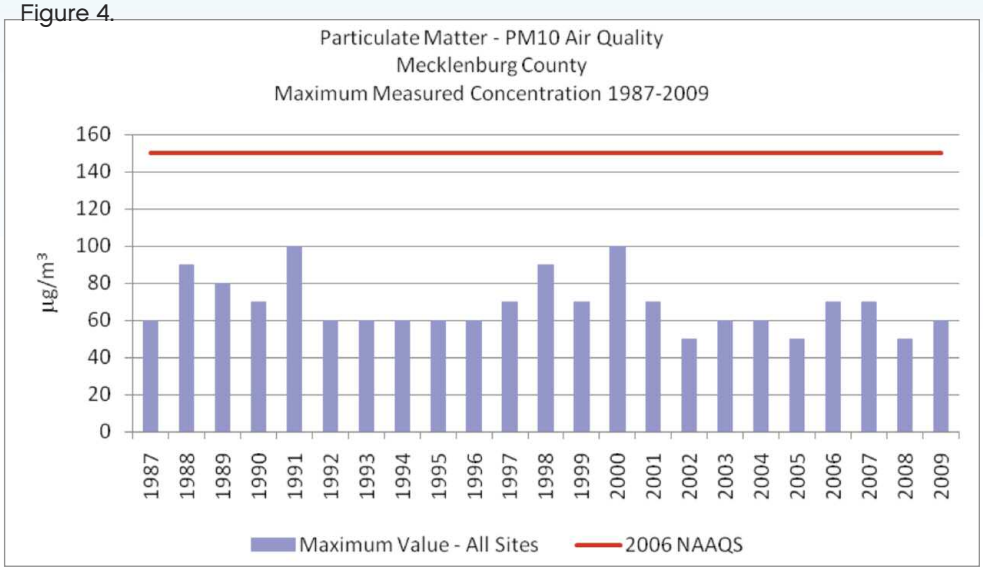


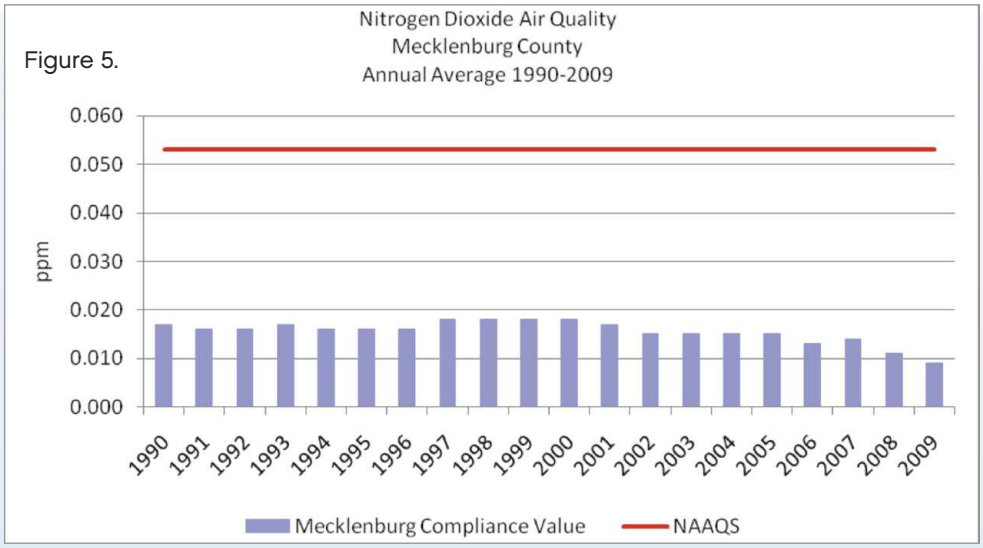
Figure 4.



averaged annually. All areas in the United States, including Mecklenburg County (*Figure 5*), meet the current (1971) NO_2 standard.

On June 26, 2009 the Environmental Protection Agency proposed revisions to the National Ambient Air Quality Standards for nitrogen dioxide. The proposed revision would apply only to the primary standard set to protect public health. A notice of final rule-making (NFR) was published in early 2010. For the most up to date information from EPA on revisions to the NO_2 NAAQS visit: **http://www.epa.gov/air/nitrogenoxides/actions.html**.

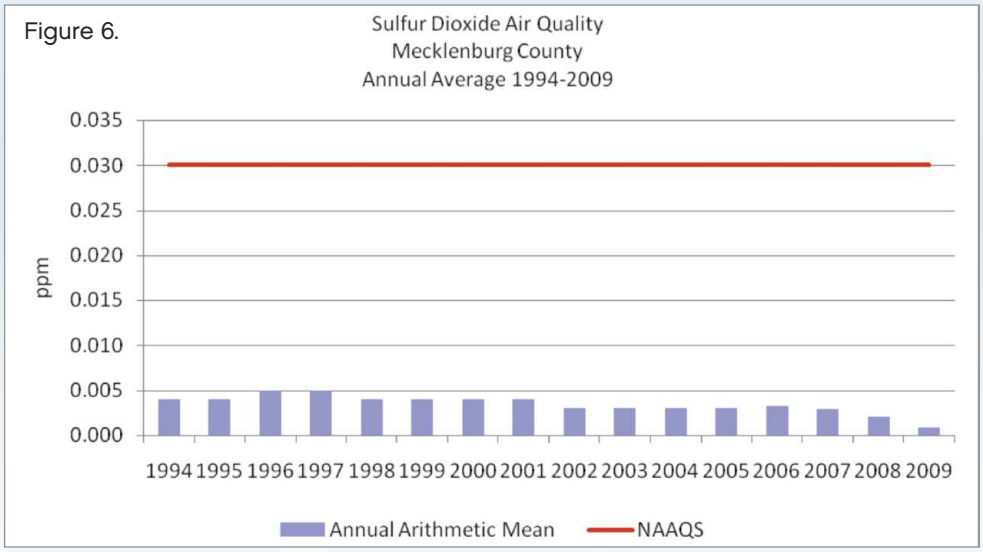
Figure 5.



Sulfur Dioxide

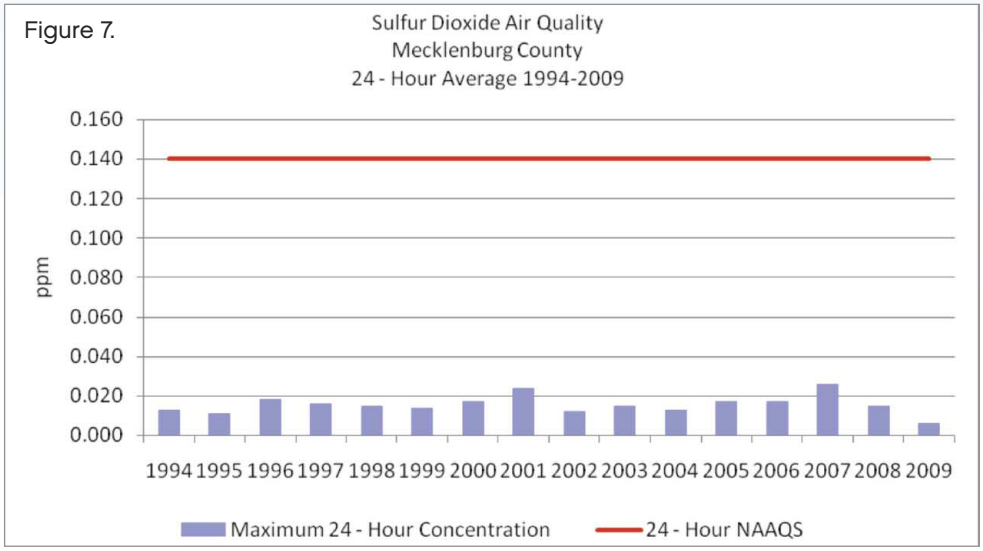
Sulfur dioxide (SO_2) is one of a group of highly reactive gasses known as "oxides of sulfur." The largest sources of SO_2 emissions are from fossil fuel combustion at power plants (66%) and other industrial facilities (29%). Smaller sources of SO_2 emissions include industrial processes such as extracting metal from ore, and the burning of high sulfur containing fuels by locomotives, large ships, and non-road equipment. SO_2 is linked with a number of adverse effects on the respiratory system.

Figure 6.



EPA first set standards for SO_2 in 1971. EPA set a 24-hour primary standard at 0.140 ppm and an annual average primary standard at 0.030 ppm (to protect health). EPA also set a 3-hour average secondary standard at 0.500 ppm (to protect the public welfare). A graph of annual average SO_2 data collected at the SO_2 site operated by Mecklenburg County Air Quality is shown in (*Figure 6*) below. Data collected by MCAQ indicates compliance with this standard as well as the 24-hour primary (*Figure 7*) standard and the 3-hour average secondary standard (*Figure 8*).

Figure 7.



On November 16, 2009, EPA proposed revisions to the National Ambient Air Quality Standard (NAAQS) for sulfur dioxide. The proposed revisions would result in strengthening the NAAQS for SO_2. For the most up to date information from EPA on revisions to the SO_2

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NAAQS visit: **http:// www.epa.gov/air/sulfurdioxide/actions.html**.

A notice of final rulemaking (NFR) for the revised SO_2 NAAQS will be published in June 2010.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes about 56 percent of all CO emissions nationwide. Other non-road engines and vehicles (such as construction equipment and boats) contribute about 22 percent of all CO emissions nationwide. Higher levels of CO generally occur in areas with heavy traffic congestion. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. The highest levels of CO in the outside air typically occur during the colder months of the year when atmospheric inversion conditions are more frequent. During an atmospheric inversion, air pollution becomes trapped near the ground beneath a layer of warm air.

Mecklenburg County was designated a non-attainment area for carbon monoxide in March 1978. During the period from 1974 – 1984 the carbon monoxide NAAQS was often exceeded more than 10 times per year. The number of exceedances per year fell dramatically beginning in the early to mid 1980s. The last recorded exceedances of the carbon monoxide standard in Mecklenburg County were measured in 1990. Automotive emission controls found on newer vehicles are the main factor accounting for the reduction in carbon monoxide concentrations. Mecklenburg County was designated by EPA as an attainment area for carbon monoxide in 1995. Carbon monoxide concentration measurements made since 1990 have remained below the NAAQS (*Figure 9*).

Figure 8.

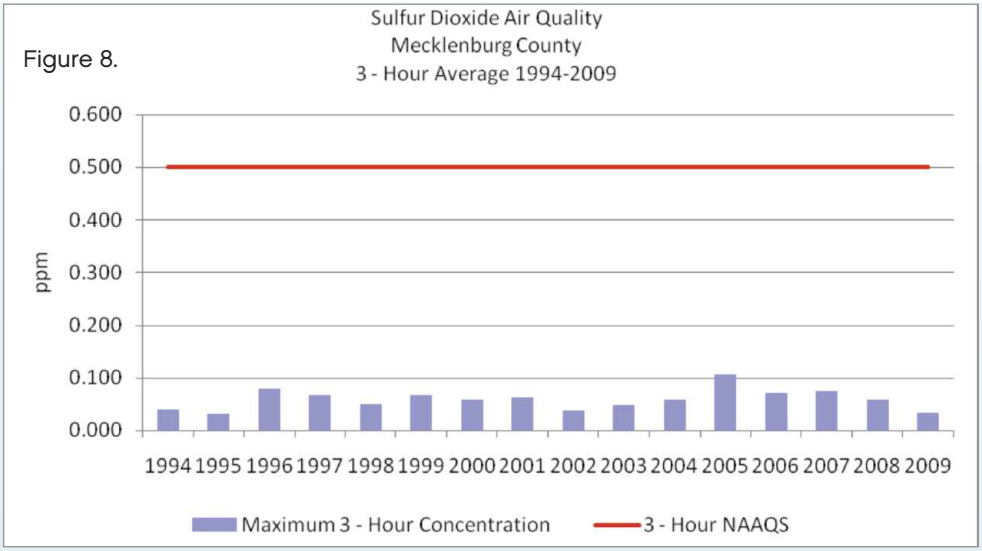
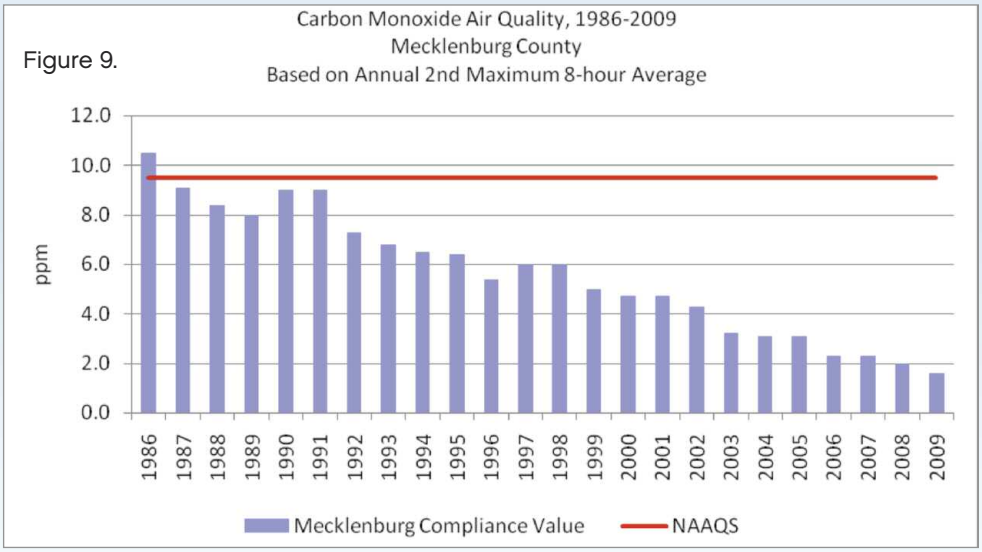


Figure 9.



Lead

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector dramatically declined by 95 percent between 1980 and 1999, and levels of lead in the air decreased by 94 percent between 1980 and 1999. Today, the highest levels of lead in air are usually found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

In a recent review of the lead NAAQS, EPA determined that the 1978 standard of 1.5µg/m^3 was not sufficient to protect public health with an adequate margin of safety. On October 15, 2008, EPA substantially strengthened the national ambient air quality standards (NAAQS) for lead. The revised standards are 10 times tighter than the previous standards.

Lead monitoring has not been routinely conducted in Mecklenburg County since 1987. Those measurements indicated levels below the 1978 NAAQS. The revised NAAQS requires lead monitoring near emission sources and population oriented monitoring. MCAQ will implement a lead monitoring network to comply with revised EPA requirements as those requirements are finalized in 2010. Monitoring to determine compliance with the revised NAAQS is scheduled to begin in 2011. For the most up to date information from EPA on revisions to the lead NAAQS visit: **http://www.epa.gov/air/lead/actions.html**.

The 2009 Ozone Season

A Balance of Continuing Emissions Reductions and Favorable Meteorological Conditions

By George Bridgers, Senior Air Quality Forecaster and Modeler
Division of Air Quality, North Carolina Department of Environment and Natural Resources

It probably went without notice in summer 2009 that the number of Code Orange and Code Red – Air Quality Action Days in the Charlotte region was at a historic low since air quality forecasts became commonplace in the late 1990s. In fact, air quality conditions -- specifically ozone concentrations -- were lower during the summer of 2009 around Charlotte and throughout North Carolina than at any point since the passage of the Clean Air Act Amendments in 1990 by Congress (*see Figure 1*). The relatively clean summertime ozone conditions were definitely a "no news is good news" situation and not something that particularly grabbed the media headlines.

With that summer now behind us, much has been discussed in the air quality community concerning atypical weather conditions across the entire eastern United States during the warm season months as the primary explanation for the dramatically improved ozone conditions. The summer of 2009 was characterized by an upper-level long-wave trough that was locked into place over the Great Lakes. This persistent trough caused much of the Midwest and Northeast to experience below-normal temperatures and above-normal precipitation over the course of the summer. The cooler and wetter weather conditions in these regions ultimately reduced the amount of transported ozone and precursor pollutants into North Carolina, but did not prohibit favorable weather conditions for ozone formation in the Southeast based on emissions sources close to home.

While meteorology does play an extremely important role in the potential for significant ozone formation and stagnation, one cannot overlook the substantial reductions in precursor pollutants that have occurred in North Carolina and surrounding states over the past ten years. Nitrogen oxides (NOx) are a pivotal precursor pollutant in the ozone formation equation across the Southeast. Starting with the passage of the United States Environmental Protection Agency (USEPA) promulgated NOx State Implementation Plan (SIP) Call in 1998 and continuing with the North Carolina General Assembly enacted Clean Smokestacks Act in 2002, NOx emissions from the coal-fired power plants in North Carolina have been reduced by over 75% since 1999; 50% of which has occurred since 2006 (*see Figure 2 on page 20*). This is a reduction of over 150,000 tons per year of NOx emissions from just the coal-fired power plants! These significant NOx emissions reductions at the power plants are in addition to the reductions realized from the 1999 North Carolina General Assembly enacted Clean Air Bill, which was a series of measures that addressed mobile source emissions, including the expansive vehicle inspection and maintenance program.

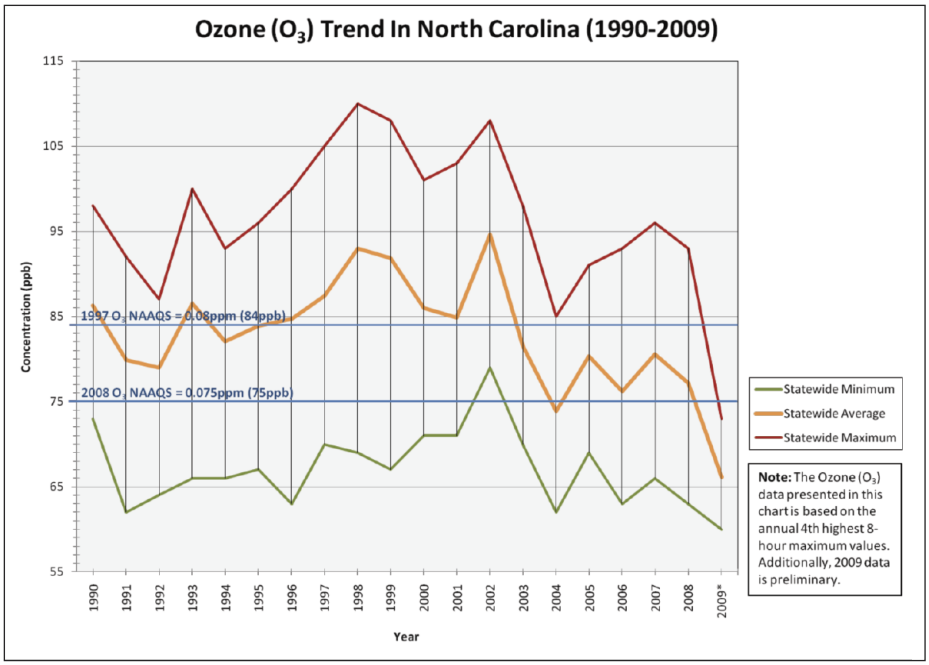


Figure 1 - 8-Hour Ozone Trend In North Carolina

To further investigate the balance between ongoing emissions reductions and meteorological conditions on the ozone concentrations during the summer of 2009, compare meteorological conditions that are typical for the most serious air quality episodes in North Carolina with the yearly number of ozone exceedances. The degree of air stagnation and afternoon high temperatures are two very important meteorological features on ozone formation. If the atmosphere is reasonably stagnant, precursor pollutants are trapped in place over the region and are readily available for formation into ozone. Hotter afternoon temperatures are also generally associated with mostly sunny and dry weather conditions that are prerequisites for rapid ozone formation. Both of these features are well-correlated with the very hot and stable high-pressure systems that are prevalent in the Southeast during the middle of summer.

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A Balance of Continuing Emissions Reductions and Favorable Meteorological Conditions

continued

Stagnation occurs when winds are light throughout the lower atmosphere for an extended period of time. Stagnation can be enhanced by temperature inversions, where temperature increases with height and vertical mixing is reduced. The trapping of precursor pollutants is further increased if there is little or no precipitation across the region on these days. *Figure 3* below presents a stagnation metric (left axis) developed by the Division of Air Quality and applied to historical summertime meteorological data relative to Charlotte compared with the annual number of ozone exceedances (right axis) in the Charlotte region. A day is defined as stagnant if the current day and the two previous days had upper level winds below 25 mph, lower level winds below 15 mph, and no precipitation. If an inversion was present, the low level wind threshold was increased by 10%. Using these criteria, the average number of stagnation days per year is around 25 with a variability of +/- 8 days.

As asserted earlier, hotter average afternoon high temperatures during the months of June through August generally result in greater numbers of ozone exceedances in any given year. *Figure 4* illustrates a 12-year comparison between high temperatures (right axis) for Charlotte and the annual number of ozone exceedance days (left axis) that are also presented in *Figure 3*. The 12-year average high temperature is 87.6°F with a range of 85°F in 2002 to approximately 90.5°F in 2008.

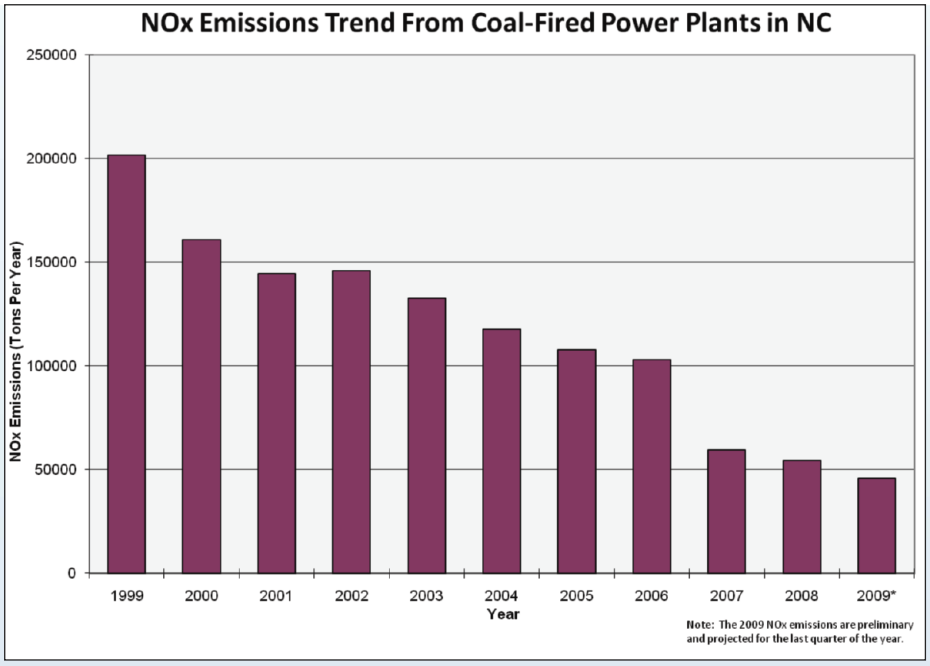


Figure 2 - NOx Emissions Trend From Coal-Fired Power Plants In North Carolina

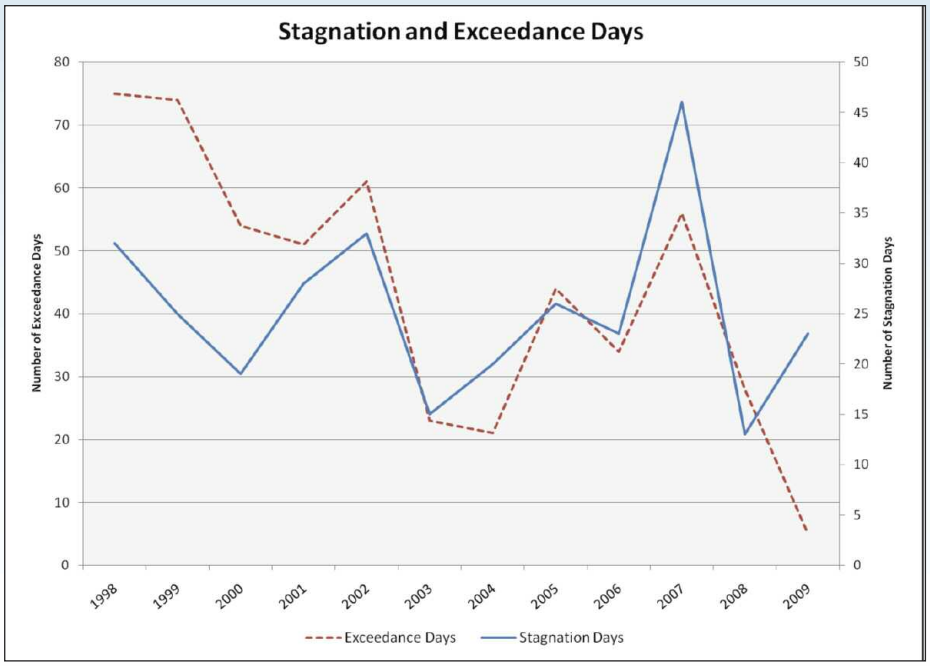


Figure 3 - Stagnation Days Compared To Ozone Exceedance Days

Both Figures 3 and 4 have a reasonable correlation between the respective meteorological metric and the number of ozone exceedances through 2007, but this correlation begins to quickly degrade by 2009. In 2009, there were a total of 23 stagnation days, which is near but slightly lower than the 12-year average presented. The number of stagnant days in 2009 was comparable to both 2005 and 2006. Also in 2009, the average mid-summer (June, July and August or JJA) high temperature was very near the 12-year average and was equally comparable with 2005 and 2006. The only discernable difference in the meteorological conditions from 2005 and 2006 to 2009 was the understanding that the weather conditions in the adjacent geographic regions of the Mid-West and Northeast were rather cool and wet this past summer. So, the dramatically improved ozone conditions throughout the Charlotte region in 2009 are not fully explained by meteorological conditions alone.

The most notable difference between the summers of 2005 and 2006 to 2009 comes back to the aforementioned substantial NOx emissions reductions made at the coal-fired power plants. The more than 50% reduction in NOx emissions from the power plants in North Carolina since 2006 appears to have played a significant role in the relatively clean summertime ozone conditions of 2009. Additional NOx emissions reductions from the industrial and transportation sectors due to the dire economic conditions throughout 2009 cannot be overlooked but do not equal the magnitude of the reductions at the power plants over the past decade.

As we move into the next decade and the USEPA further strengthens the ozone standards, we have an increasing amount of evidence that significant NOx emissions reduction strategies can have a very positive influence on summertime ozone conditions and allow us to attain the federal standards in our region. Our objective will be to develop such emissions reduction strategies to meet the future ozone standards and that can withstand summers with ozone favorable meteorological conditions, such as 2002 and 2007.

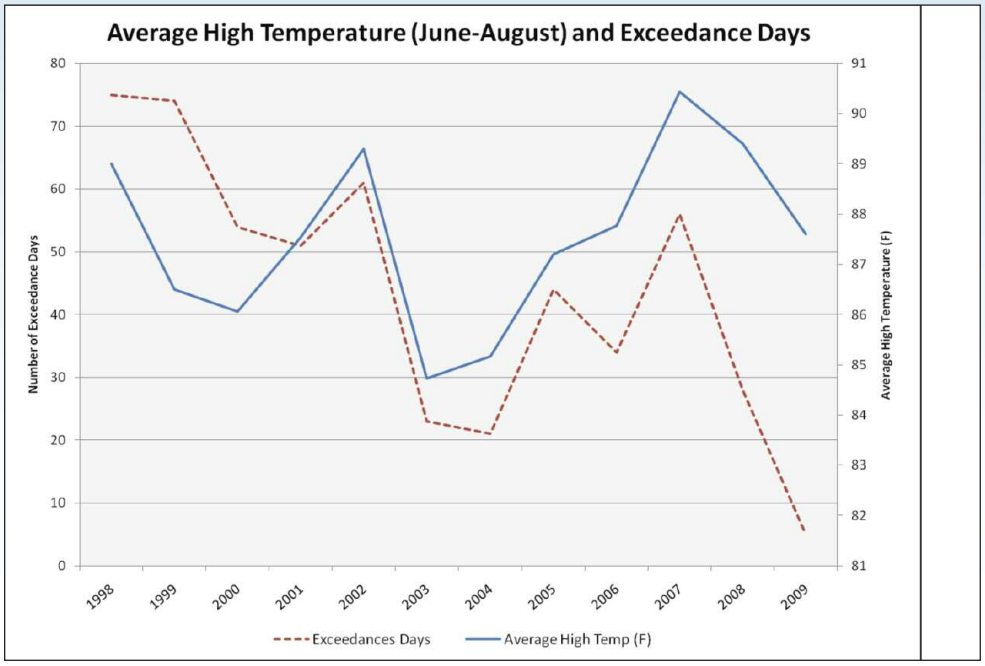
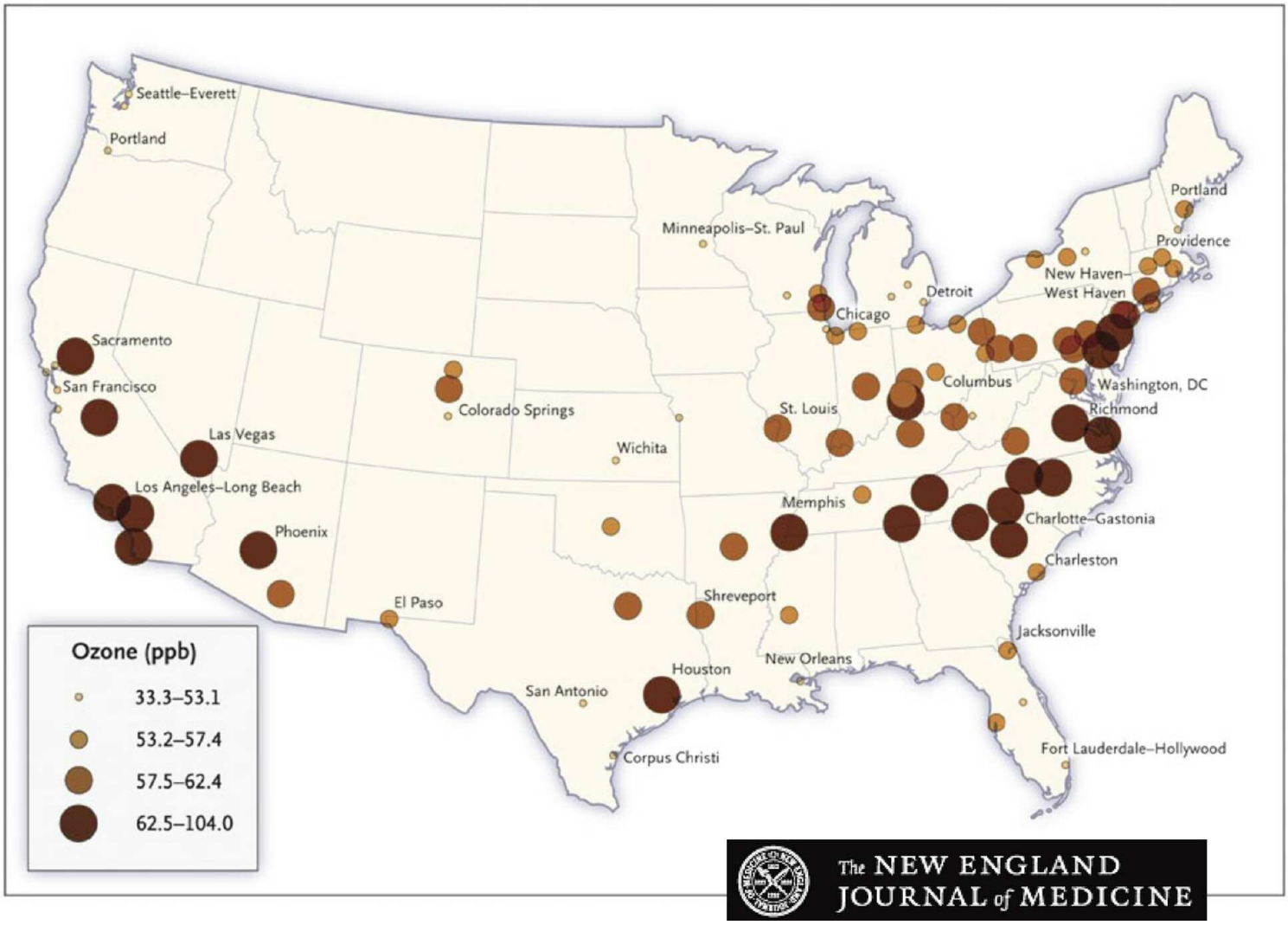


Figure 4 - Average High Temperatures Compared To Ozone Exceedance Days

Childhood Lung Development Depends on Clean Air

By Dr. Lawrence W. Raymond, Director of Occupational Medicine, Carolinas HealthCare System



Past issues of *State of the Environment Report* drew needed attention to the serious health costs of poor air quality, which have been reported from many parts of America. The Charlotte-Mecklenburg area is no exception. For example, a recent article in a leading medical journal (*Jerrett et al., 2009*) showed dramatically how our community has ranked among the worst US cities for excessive amounts of ground-level ozone.

This article also showed how the risk of dying from lung disease was directly related to such ozone exposures. As many readers know, ozone has long been considered by the U.S. Environmental Protection Agency (EPA), as well as by lung clinicians, to be a serious air pollutant. In this article, we'll consider a neglected aspect of air pollution and health: its effect on the growing lungs of our children. Some excellent research, which is describe below, has shown convincingly that poor air quality can rob children of the "spare capacity" of their lungs, by preventing the normal development of alveoli. This adverse effect lays the shaky groundwork for heart, lung and other diseases later in life. We'll use ozone and nitrogen dioxide as examples, because they've been so well studied.

But first, let's go over how our lungs develop normally. Within the first few moments after birth, they expand and begin to transfer oxygen quite nicely in normal infants. Over ensuing years, the lungs sprout additional alveoli. These microscopic air sacs literally bud off of the ends of the child's breathing tubes. They continue to do so throughout *normal* childhood and into early adulthood. Peak lung function occurs in the early 20s, all the while supporting the growing needs of the rest of the body. By then, the alveoli have increased in number to about 480 million, with a surface available for gas exchange – oxygen in, carbon dioxide out – reaching the size of a tennis court. But only if the lungs develop normally.

Air pollutants, like ozone and nitrogen dioxide for example, interfere with this normal development. In a landmark study, a researcher named Gauderman followed the lung development of over 1,700 children who lived in various parts of the Los Angeles (LA) area (*Gauderman et al.*, 2004). Different zones around LA had varying levels of air pollution. They also had differences in parental income, family nutrition and housing, and smoking, among others. Gauderman's team had to account for these differences so that the study's results could be normalized, allowing the cause and effect relationship between air quality and health to emerge. What they showed is that that bad air could cause children to lose 20 percent of their normal lung development.

Lungs that develop without substantial air pollution have a lot of reserve capacity which continues undiminished until around age 30. This extra capacity is a precious commodity, as it is what we draw upon during exercise, especially under unusual conditions such as snorkeling and diving at one extreme, and high altitude at the other extreme. But our pulmonary "bank account" can be overdrawn, both by aging and by disease processes. For example, lung specialists tell their patients that normal aging causes the lungs to lose about 10 ounces (300 ml) of lung capacity (called Forced Expiratory Volume, FEV1) every decade. Smokers lose FEV1 twice as fast. The FEV1 is measured with a device called a spirometer, and is the amount of air one can forcibly exhale in one second. Lung capacity correlates closely with how much exercise one can perform, so it is a key index of health. Although this loss of lung power – 10 ounces of lost FEV1 per decade — may not sound like much, it is nearly 10 percent of normal capacity for a person in their 30s and 40s. Other research has shown that reduced lung function is a risk factor for heart and lung disease and death, even in non-smoking adults. Thus, the harmful air pollution exposures that impair lung development in childhood can come back to haunt the lungs in later in life, and end it prematurely from cardiac or pulmonary damage. Can we extrapolate the findings in LA to our community? Probably. The developing lungs of our children are likely to suffer the same damage as the lungs of children on the West Coast, when exposed to similar levels of oxidant air pollution.

One additional factor bears emphasis in this context. We now have a life expectancy twice that of the hardy pioneers who settled this land. The latest estimates (as of 2007) found that life expectancy is now 78 years, and further increases may be possible if we can continue to improve control of blood pressure and cholesterol, for example. To enjoy these added years, it is necessary to do a better job on air quality, both for adults and for children heading for adulthood.

In conclusion, the link between air pollution and poor health is well documented. Clean air is critical in early stages of childhood development to ensure proper and full lung health and development. In Charlotte-Mecklenburg, we continue to struggle with air pollution in excess of federal health standards. Further action is needed to ensure clean air in our region, for the benefit of both our current and future citizens.

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Dr. Raymond is Director of Occupational Medicine for Carolinas HealthCare System, and Professor of Family Medicine there and at the University of North Carolina at Chapel Hill. He is also a Fellow of the American College of Occupational and Environmental Medicine and Chair of its committee on Occupational and Environmental Lung Diseases.

Transportation Conformity

Considering How Roads Will Affect Air Quality

By Eldewins Haynes, AQ Specialist
Charlotte Department of Transportation

Because Mecklenburg County is currently in violation (non-attainment) of the National Ambient Air Quality Standard for ozone. For this reason our Transportation planners must coordinate with the surrounding counties to demonstrate that transportation plans for the region will not cause the area to exceed pollution limits set in the State's plan for meeting federal air quality standards. This process is known as "conformity" and is required by the Clean Air Act. Conformity is meant to ensure that federal funding and approval goes to transportation capital projects consistent with air quality plans. If transportation plans don't "conform" to air quality plans, then the area is in danger of having federal transportation funding restricted until the plan is shown to conform.

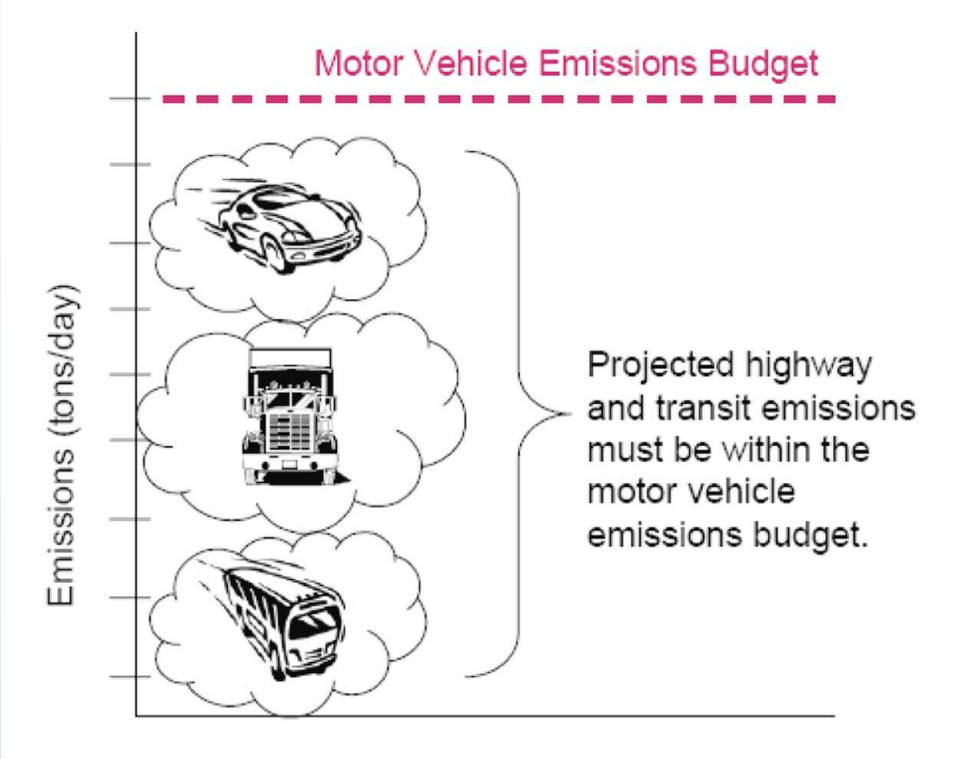
Has Charlotte-Mecklenburg Demonstrated Conformity with Air Quality Plans?

Historically, the metropolitan planning organization for Charlotte has consistently met the requirements of the conformity regulations and managed the process without delays to progress of planned roadway or transit projects in the area. However, the Metrolina nonattainment region (which includes Mecklenburg and surrounding Counties) recently entered a "conformity lapse grace period" because the requirement to demonstrate conformity was not met by the required May 3, 2009 deadline. During this one year conformity lapse grace period, roadway and transit projects currently listed in the last approved transportation plans will move forward, but cannot be amended, and no new projects can be added to the list. Transportation and air quality planners will work together over the coming months to ensure that motor vehicle budgets (pollution limits) in the state air quality plan are set at a level that will not cause a continued violation of air quality standards, but still allow much needed transportation funds to be dedicated to priority transportation projects in the region. This process of working together is also required by the Clean Air Act and is referred to as interagency consultation.

Who is Responsible for Demonstrating Conformity?

A formal interagency consultation process involving the Environmental Protection Agency (EPA), Federal Highway Administration (FHWA), Federal Transit Administration (FTA) and state and local transportation and air quality agencies is required to make conformity determinations. For the Charlotte region the following partners participate in this process:

- Cabarrus-Rowan Metropolitan Planning Organization
- Charlotte Department of Transportation
- Gaston Urban Area Metropolitan Planning Organization
- Federal Highway Administration
- Federal Transit Administration
- Lake Norman Rural Planning Organization
- Mecklenburg County Air Quality
- Mecklenburg-Union Metropolitan Planning Organization
- North Carolina Department of Environment and Natural Resources, Division of Air Quality
- North Carolina Department of Transportation
- Rocky River Rural Planning Organization
- United States Environmental Protection Agency (Region 4)



One lead agency, typically the Charlotte Department of Transportation, completes the technical report that shows local motor vehicle air pollution estimates and compares them to the state's motor vehicle emissions budgets for the area. Each metropolitan planning organization (MPO) must submit the conformity determination. Ultimately, FHWA and FTA make the final official determination that the area does have a transportation plan that conforms to the air quality plan.

How is a Conformity Demonstration Completed?

Conformity analysis involves a series of complicated calculations carried out by a computer model called a "Regional Travel Demand Model." The model uses information about roadway and transit networks, and population and employment data to calculate the expected amount of travel on the roadway network. Within the model, mathematical equations are used to represent each individual person's decision making process of: "when," "where," and "how" to make a trip, and "What" route to follow to complete the trip. The results for these individual choices are combined to estimate the total roadway vehicle volumes and transit route ridership volumes. This results in an estimate of average daily VMT (vehicle miles traveled). When subdivided by average speed categories, VMT can then be multiplied by emission factors which are estimates of the grams of air pollutants produced per mile driven. All of this information leads planners to estimate the quantity of air pollutants produced daily by drivers on the roadways in our region. This quantity must be lower than the daily motor vehicle emissions budget in our state's air quality plan for this region.

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Considering How Roads Will Affect Air Quality

continued

Who determines the motor vehicle emissions budget?

The North Carolina Division of Air Quality (NCDAQ) is responsible for the development of the state's air quality plan or SIP (State Implementation Plan). In this plan, NCDAQ identifies how pollution from all sources including on road vehicles (e.g., cars, trucks, buses), off road vehicles (e.g., construction and farm equipment), and industrial sources will be reduced sufficiently to meet the federal air quality standards. NCDAQ sets the on road motor vehicle emission budget using projected travel data provided by the local and state departments of transportation.

What happens if an area fails to demonstrate conformity?

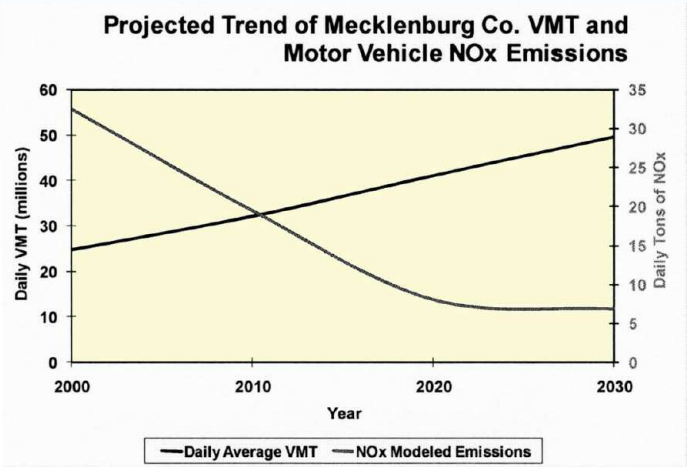
If a conformity demonstration cannot be made according to schedule, there is a lapse and federal transportation funding is restricted. Exceptions to this restriction include safety projects, certain mass transit projects, and any measures identified in the clean air plan as required. This restriction of federal funds remains in place until a conformity demonstration can be completed.

How is air quality improved through the process of conformity?

Conformity has resulted in more planning and cooperation between transportation and air quality engineers, thereby ensuring that more consideration is given to how we choose to build our transportation system.

However, the most significant way to reduce emissions in the transportation sector is to have newer vehicles on the road. Newer vehicles are required to have more advanced emission reduction technology. The graph below shows that in Mecklenburg County, average daily VMT is projected to double between 2000 and 2030, from 25 million miles to 50 million miles, yet the emissions resulting from the VMT are projected to decrease from 33 tons per day to 7 tons per day. That reduction is projected primarily due to cleaner vehicle engines.

So as transportation and air quality engineers work together to plan a roadway and transit network that does not conflict with air quality goals, businesses and individuals have a major part to play in reducing the total pollution from automobiles. Driving choices that reduce VMT, like alternative commuting or trip-chaining, and including air pollution criteria in vehicle purchasing decisions can help ensure that our local air quality continues to improve and that highway funding continues to flow freely into our region.



GRADE+: A Local Solution to a Local Problem

By Eric Moore, Air Quality Specialist
Mecklenburg County Air Quality

In 2008, mobile sources (cars, trucks and off-road equipment) contributed more than 94% of the nitrogen oxide pollution in Mecklenburg County. Nitrogen oxide (NOx) is the primary pollutant responsible for the region's high concentrations of ground-level ozone. To ensure clean air for us all, it is important for Mecklenburg County and the region to develop and support strategies to reduce the amount of NOx emitted into our air.

Mecklenburg County Air Quality (MCAQ) adopts and enforces regulations for industrial sources of NOx within the County through the Mecklenburg County Pollution Control Ordinance. However, U.S. Supreme Court decisions prevent local governments from regulating mobile sources. Therefore, MCAQ is limited to promoting voluntary actions to reduce pollution from cars, trucks and off-road equipment. For this reason, local air quality agencies have had to refocus their efforts and think creatively about how to address this growing segment of air pollution sources. In order to motivate companies and individuals to upgrade or replace their high emissions trucks and off-road equipment, MCAQ has designed a local incentive-based program to reduce ground-level ozone called GRADE+ (Grants to Replace Aging Diesel Engines).

GRADE was first launched in 2007 in a seven-county region to provide incentive funding to organizations that help improve air quality by replacing or repowering Heavy Duty Non-Road Construction Equipment. Renamed to GRADE+ in 2009, the program now includes 13 counties in North and South Carolina and has been expanded to include construction, agricultural, industrial and commercial sectors operating non-road diesel, on-road heavy duty diesel and stationary diesel equipment.

GRADE+ focuses on ways to reduce and eliminate sources of NOx by providing incentive money to public and private entities for equipment upgrades and improvements. Individual businesses that have recognized the need to improve the environment as well as make their business more profitable by reducing repair and maintenance cost associated with older equipment can apply for a GRADE+ grant. To apply for a grant, each organization completes an application detailing the project scope by providing information such as engine horsepower, annual hours of operation, annual miles driven, percentage of time operating within our 13 county region, and project costs.

Thanks to a GRADE+ grant, Storm Water Services was able to replace the 1983 loader (**above**) with the 2008 loader (**top**) This replacement will reduce almost 6 tons of NOx over the next five years.

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GRADE+: A Local Solution to a Local Problem

continued

Potential GRADE+ projects are then evaluated based on cost effectiveness (the amount of money it costs to reduce one ton of NOx from the project). The amount of pollution each GRADE+ project will reduce is the difference between the amount of pollution produced by the current equipment and the amount of pollution produced by the new equipment, if they were operated the same way for the same amount of time. The total amount of NOx reduced is then divided by the amount of funding requested to get the project cost effectiveness. Once the projects are ranked by cost-effectiveness, an independent selection committee comprised of state air quality officials, local industry air quality representatives, community college representatives, and Mecklenburg County staff, meet to review each project and make the award selections.

GRADE, GRADE+ Project Activity
Grants to Replace Aging Diesel Engines

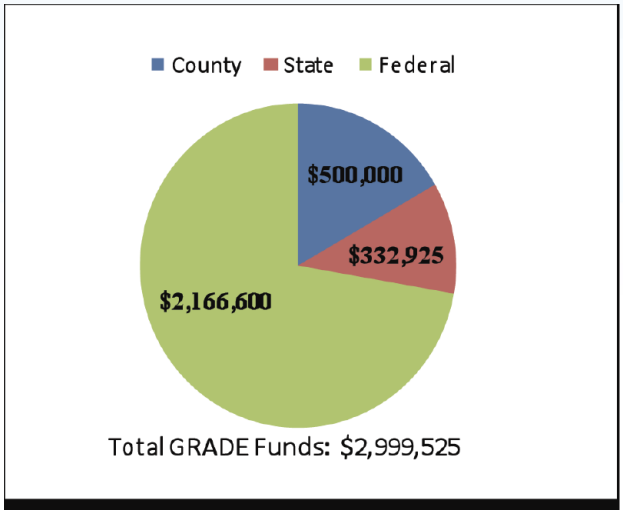
Call for Projects	Number of Projects Awarded	Number of Projects Implemented	Number of Projects Completed	Annual NOx Reduction Expected	Total NOx Reduction Expected over Project Life	Actual NOx Reduction Achieved through 12/31/2009
GRADE 2007	9	9	9	5.94 tons	38.30 tons	3.51 tons
GRADE 2008	35	27	25	21.59 tons	111.97 tons	2.69 tons
GRADE 2009	13	13	12	9.88 tons	97.52 tons	No Report
GRADE+ 2009	104	66	4	42.88 tons	329.74 tons	No Report
GRADE+ 2010	4	0	0	1.357 tons	6.84 tons	No Report
Total	165	115	50	81.65 tons	584.37 tons	6.20 tons

While past programs and regulations have successfully reduced air pollution from stationary sources, mobile source air pollution remains a growing problem in the region with limited solutions available to local governments. GRADE+ is a first-of-its-kind local solution to a regional air quality problem, ground-level ozone. Through this highly successful incentive-based program, Mecklenburg County and grant participants have the opportunity to demonstrate local and regional leadership, avoid burdensome regulations, involve the private sector in a solution, and successfully improve the quality of our air.

The money used to fund GRADE+ project grants comes from three sources:

1. Federal grant awards from the U.S. Environmental Protection Agency (most recently $1.1 million in funding from the American Recovery and Reinvestment Act);
2. State grants from the NC Division of Air Quality; and
3. Local tax dollars from the Mecklenburg Board of County Commissioners.

see chart below



Sources of GRADE Funding
As of December 2009

Area Source MACTs:

Changing Regulations Could Affect a Business Near You

By Dan Hardin, Air Quality Specialist, Mecklenburg County Air Quality

Traditionally, air quality regulations have been designed to restrict the amount of air pollution emitted from large industrial sources like power plants, foundries and factories. In general, these regulations have done a good job of decreasing the amount of air pollution generated by these stationary sources. In fact, these regulations have done such a good job that air quality agencies have had to look at new, previously unregulated sources to generate further reductions in air pollutions, and protect public health. One area where regulations are being expanded is for smaller sources of hazardous air pollutants. These expanding regulations, while ultimately creating cleaner air for us all, will in the short term expose many local businesses to new air quality requirements.

The 1990 Clean Air Act Amendments ("the Act") reinvigorated the U.S. Environmental Protection Agency (EPA) efforts to develop and implement federal rules addressing the emissions of hazardous air pollutants (HAPs), also known as air toxics, from stationary sources. HAPs are pollutants known or suspected to cause cancer or other serious health effects such as reproductive or birth defects, or adverse environmental effects. Initially EPA focused its rule making efforts on large or "major" HAP emissions sources. The Act required that for each type of HAP emitting process at a major source, EPA develop emission control standards based on the best practices currently used by industry. These best practices are referred to as Maximum Achievable Control Technology (MACT), and the rules have generally become known as MACT standards. In Mecklenburg County, these major source MACT standards affect facilities such as large printing and coating facilities and chemical manufacturing plants.

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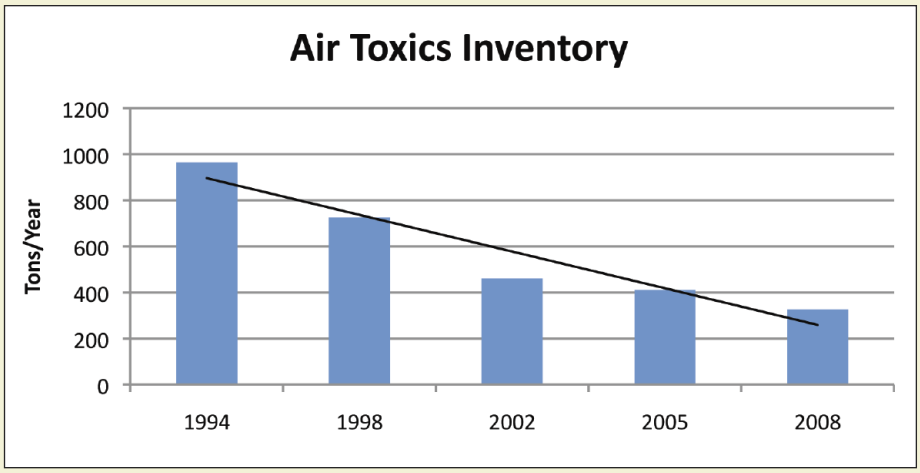
Air Toxics: 2008 Emission Inventory

By S. David Ross, Sr. Air Quality Specialist
Mecklenburg County Air Quality

Every three years, Mecklenburg County Air Quality (MCAQ) collects emissions data from 194 facilities holding Air Quality Permits about their toxic air pollutant (TAP) and hazardous air pollutant (HAP) emissions. The information then is reported to the United States Environmental Protection Agency (EPA). This data is used for evaluation of health impacts by MCAQ and EPA, and for regulation development by EPA.



Between the years of 2005 and 2008, Mecklenburg County saw a 21% (85 tons) decrease of TAP and HAP emissions. The pollutants with the greatest emissions decrease were:

Emission type	Amount decreased	Percentage reduced
Glycol ethers	19 tons	5%
Hexane isomers (excluding n-hexane)	14 tons	3%
Toluene	13 tons	3%
Methyl ethyl ketone	10 tons	2%
Ethyl acetate	8 tons	2%
Methylene chloride	8 tons	2%
Methanol	6 tons	1%
Ammonia	6 tons	1%
Hexane	4 tons	1%
Benzene	4 tons	1%

There are a number of factors that led to the decrease in air toxics emissions over the past three years:

1. Businesses have made internal changes to try to become more "green."
2. The economic downturn that has impacted production at various facilities.
3. Facilities, and their material suppliers, have made changes to comply with environmental regulations.

Area Source MACTs:

Changing Regulations Could Affect a Business Near You

continued

The Act also recognized that while HAP emissions from small or "area" sources of HAP emissions (such as gasoline stations and auto body shops) individually may not be significant, when taken collectively their combined impact on public health can be comparable to that of a larger HAP source. With this in mind, in 2006 EPA began to issue area source standards to address HAP emissions from these smaller sources. Unlike the major source MACT standards that typically require the installation of emission control equipment for compliance, these area source rules can require a range of control technologies and techniques that are more generally used in the industry. These commonly used practices are referred to as Generally Available Control Technologies (GACT) and can include management controls and work practice standards. The rules are often referred to as area source MACT standards, or alternately GACT standards.

By the end of 2010 EPA plans to have issued all of the area source MACT standards required by the Act. Table 1 lists some of the sources in Mecklenburg County, subject to, or likely to be subject to, an area source MACT.

Table 1: Mecklenburg County Sources Potentially Subject to an Area Source MACT Standard

Facility Type	Mecklenburg County Businesses Impacted
Electric Arc Furnace Steel Making	1
Gasoline Terminals	9
Iron and Steel Foundries	1
Dry Cleaners	300
Stationary Reciprocating Internal Combustion Engines (RICE)	To Be Determined
Gasoline Dispensing Facilities (i.e. gas stations)	500-550
Auto Body Shops	100-200
Plating and Polishing Facilities	6
Metal Fabrication Facilities	70-80
Chemical Manufacturing Facilities	30-40
Paint and Allied Product Manufacturing Facilities	20-30

A few of the rules, such as the area source MACTs for electric arc furnace steel making, gasoline terminals, and iron and steel foundries, affect a only small number of facilities currently permitted by Mecklenburg County Air Quality (MCAQ). MCAQ has worked with these facilities to implement the new rules and has incorporated the requirements into each facility's air quality permit. Others, like the area source MACTs for auto body shops and the stationary Reciprocating Internal Combustion Engines (RICE), have the potential to impact a large number of businesses in the County, many of which are not currently permitted by MCAQ. In several cases MCAQ has attempted to identify businesses to which these new rules may apply, and notify them through targeted mailings, telephone calls, site visits and Web postings of the new requirements. MCAQ is also planning to hold a training workshop in early 2010 to further explain rules which will have a significant impact in the County.

In addition to developing and implementing HAP emission standards, the Act requires that every 8 years thereafter EPA is to conduct a risk and technology review (RTR) for each rule. The purpose of this review is to determine if the rule has done an adequate job of protecting public health. After facilities have implemented the requirements of the rule, EPA is required to estimate the level of remaining, or "residual," health risk from HAP emission levels and determine if additional control measures are needed. To date, 16 of the RTRs have been completed and, in general, EPA has found that those rules have done a good job in protecting public health. RTR is an ongoing EPA effort and MCAQ is following these reviews, ready to implement any new requirements that may result from the review at subject facilities in the County.

For additional information about hazardous air pollutants see the following:

http://www.epa.gov/ttn/atw/

http://www.epa.gov/ttn/atw/educout.html

http://www.epa.gov/ttn/atw/urban/urbanpg.html

http://yosemite.epa.gov/oar/CommunityAssessment.nsf/Welcome?OpenForm

Indoor Air Quality

By Ruth Jacquot, Air Quality Specialist
Mecklenburg County Air Quality

Most Charlotteans are aware of our region's outdoor air quality problems. However, indoor air pollution – in homes and businesses – is also a major concern.

Radon, mold and asbestos are common sources of indoor air pollution. Asbestos that has been incorporated into manmade materials has strict rules governing its handling and disposal, but currently there are no enforceable federal or state regulations that address naturally occurring indoor air pollutants.

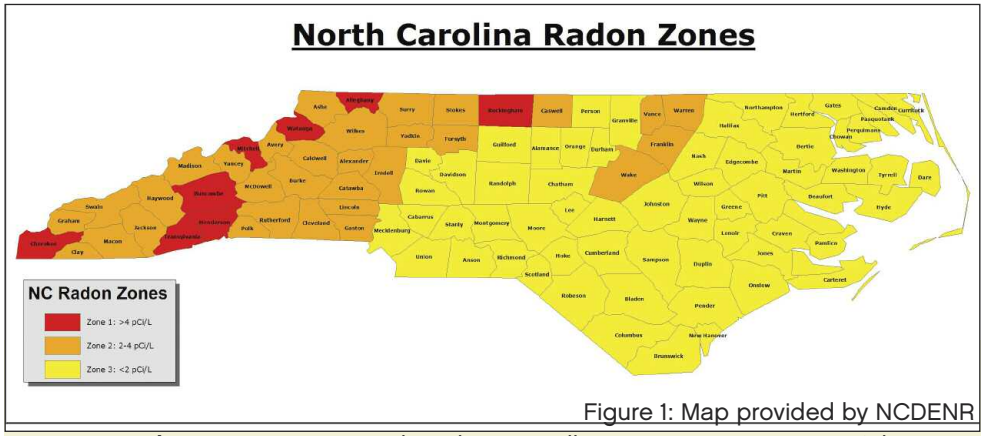


Figure 1: Map provided by NCDENR

- **Zone 1: Red counties** are areas where houses will on average test over 4 pCi/L (The level at which EPA recommends home mitigations);
- **Zone 2: Orange counties** are areas where the average house will test between 2-4 pCi/L (Home mitigations could be considered); and
- **Zone 3: Yellow counties** are areas that homes will on average have less than 2 pCi/L (No home mitigations are needed).

Radon

Radon is a natural gas created by the radioactive decay of radium, which in turn is created from the decay of uranium. In any geological formation where uranium is present, radon can occur. Under certain geological conditions, naturally occurring radon may become trapped indoors when warm air rises in a structure and a vacuum is created in lower levels. Radon gas can enter a structure by seeping through crevices in the foundation floor or walls, hollow-block walls, openings around floor drains, heating and cooling ductwork, pipes, and sump pumps. Once inside, the radon gas settles and may concentrate indoors. While geological conditions are the primary and most likely source of radon, sometimes it can be attributed to building materials, such as concrete, brick, granite, and drywall.

The health risk from radon occurs when it is inhaled. Radon gas decays or breaks down to form radioactive particles. Lung cells can be damaged, and lung cancer can result. A person's risk of developing lung cancer from radon exposure increases with the number of years of exposure, along with the greater the level of radon. No short-term health effects (such as shortness of breath, coughing, headaches, or fever) result from exposure to radon gas.

The U.S. Environmental Protection Agency (EPA) evaluates radon potential based on five factors: geological conditions; indoor radon measurements; aerial radioactivity; soil permeability; and, foundation type. The map above, provided by the NC Division of Environmental and Natural Resources, illustrates where one might expect to see low or moderate concentrations of radon.

According to the EPA's evaluation, Mecklenburg County is classified as Zone 3 – "Low Probability" for radon. While this map is helpful in identifying parts of the state that are more likely to have homes with high radon, any structure has the potential for elevated levels of radon. Should you having concerns of elevated radon levels in your home, testing is as simple as opening a package, placing a radon detector in a designated area, and after the prescribed number of days, sealing the detector back in the package and mailing it to a lab for evaluation. Radon test kits can be purchased from the North Carolina Radon Program; the North Carolina Department of Environment and Natural Resources should be contacted for more information **http://www.ncradon.org**.

Mold

Another common indoor air quality concern is mold. For sensitive people, mold can act as an allergen or irritant. In some cases, it runs the risk of being a toxic substance. The development of mold indoors requires the presence of moisture and often occurs after significant water damage such as flooding, toilet overflows, water heater failures, plumbing leaks, roof leaks, AC unit condensate leaks, and dishwasher or clothes washer hose or seal failures. In order to prevent the development of mold, possible sources of moisture should be monitored regularly and properly maintained to prevent water damage. If mold is already present, the mold should be properly cleaned and the source of moisture corrected. A mold issue will reoccur unless the source of water is eliminated.

Mold growth after residential flood.

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While there are no enforceable federal or state regulations that address mold, MCAQ does respond to calls from County residents and businesses requesting information on mold, mold remediation and other issues associated with mold. In 2009, more than 290 calls from residents were handled directly by MCAQ; this number is reduced from previous years because CharMeck 311 now handles calls regarding mold that do not require a more involved response from MCAQ. Most citizen inquiries result in providing information regarding mold, its causes and prevention, and how to deal with rental unit issues when mold results from water damage. In addition, there are many professional consultants with expertise in evaluating and solving mold and other indoor air quality problems. More information on household mold can be found at **http://www.epa.gov/mold/moldguide.html**.

Asbestos

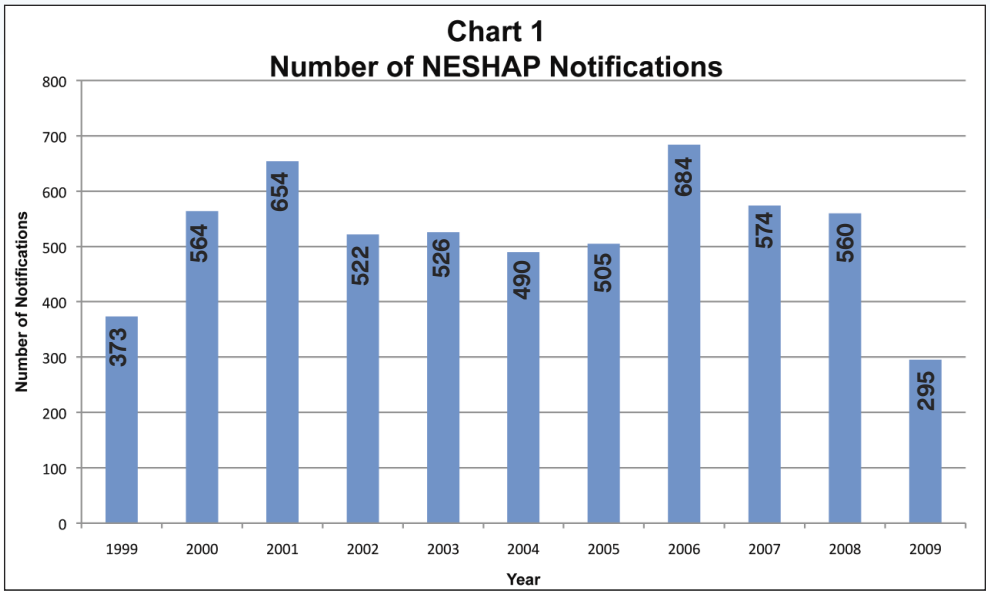
Asbestos is a naturally occurring fibrous mineral which has been used for centuries because of its intrinsic properties. In more recent times, it had been recognized for its strength and fire-resistance capabilities, and has been incorporated into building materials, fire proofing insulation, flooring materials, electrical insulation, etc. The EPA began regulating the use of asbestos in the late 1970s due to growing concerns over asbestos-related diseases, such as asbestosis, lung cancer and mesothelioma. The EPA banned most asbestos-containing products in 1989; that ban was overturned in 1991. Asbestos has since been banned from use in "new" products in which it had not previously been used. The effects of this ban eventually resulted in the end of the production of asbestos-containing products in the United States. However, asbestos still continues to be mined and used to manufacture products in other countries around the world.

Due its vast popularity during the early to mid-1900s and its continued use in some products today, the potential for exposure to asbestos-containing material is still a concern. Asbestos can be present in commercial, industrial, and residential settings and becomes a concern when individuals may be exposed to asbestos-containing material due to its removal or if it is in poor or degraded condition. The Clean Air Act addresses this concern through the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Asbestos. MCAQ enforces this regulation to protect the community at large by regulating demolitions and renovations, including the collection, processing, packaging, and transportation of asbestos–containing waste materials from these operations. In 2009, MCAQ reviewed and processed 295 asbestos NESHAP notifications for renovation or demolition.

Green linoleum asbestos-containing floor tiles

Asbestos-containimg exterior siding removed during a renovation

As depicted in the chart below, the total number of notifications for 2009 is nearly 50% less than the previous year, most likely due to the economic downturn. Also in 2009, MCAQ performed 322 NESHAP compliance inspections or re-inspections at renovation and demolition facilities, four of which resulted in additional enforcement action. For more information on Asbestos and the Asbestos NESHAP Regulation, please visit **http://www.charmeck.org/Departments/LUESA/Air+Quality/Permitting+Regulations/Asbestos-NESHAP.htm**.



A Look at U.S. Environmental Protection Agency Climate Change Regulations

By Kenneth L. Mitchell, Ph.D., Senior Climate Change Advisor, U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) has been working to create an efficient, clean energy future—one that creates jobs, reduces greenhouse gas emissions, and ends our country's dependence on foreign oil. EPA is providing technical assistance to help Congress draft a strong climate and energy bill, while working under its existing laws to make progress to reduce greenhouse gas emissions (GHGs).

GHGs endanger the health and welfare of Americans:

EPA's first action was to fulfill the mandate of the 2007 U.S. Supreme Court decision that GHGs are a pollutant under the Clean Air Act, and that EPA must determine whether or not GHG emissions from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make that decision.

In December 2009, after a thorough examination of the scientific evidence on the causes and impacts of climate change, and after careful consideration of public comments, EPA found that greenhouse gases (GHG) in the atmosphere threaten public health and welfare. EPA finds that GHG emissions from on-road vehicles also contribute to that threat.

EPA's finding was based on rigorous, peer-reviewed scientific analysis of six gases – carbon dioxide, methane, nitrous oxide, hydro- fluorocarbons, perfluorocarbons and sulfur hexafluoride – that have been the subject of intensive analysis by scientists around the world.

The science clearly shows that concentrations of these gases are at unprecedented levels as a result of human emissions, and these high levels are causing changes in the climate. The final decision does not itself impose any requirements on industry or other entities, but it does pave the way for the regulation of GHG emissions from automobiles under the Clean Air Act.

Reducing GHG emissions from motor vehicles:

In September 2009, EPA and the U.S. Department of Transportation proposed a national program that would reduce greenhouse gas emissions and improve vehicle fuel economy for new cars and trucks (model years 2012-2016). The proposed program would require these vehicles to meet an estimated combined average emissions level of 250 grams per mile of carbon dioxide in model year 2016, equivalent to 35.5 miles per gallon if all the reductions were achieved through fuel economy improvements.

This program would conserve 1.8 billion barrels of oil, increase fuel economy by an average of five percent each year and reduce 950 million of tons of GHGs over the lifetime of model year 2012-2016 vehicles.

Setting new thresholds to control GHG emissions:

In mid-September 2009, EPA announced that – for the first time ever – the United States' largest sources of GHGs (power plants or large industrial source for example) will be required to report their emissions. Starting in 2010, this new regulation requires facilities that emit over 25,000 metric tons of carbon dioxide equivalent to report their emissions to EPA annually. This will allow EPA to track approximately 85 percent of total U.S. emissions while only requiring a small percentage of facilities – about 10,000 out of tens of millions of American businesses – to report. EPA will now know with greater accuracy how much GHGs are in our atmosphere and where energy efficiency investments and new technologies may be particularly effective at reducing GHGs.

Installing GHG control technologies:

In late-September 2009, EPA proposed a rule that requires the nation's largest industrial facilities to adopt the best, most efficient technologies available when they are constructed or upgraded, helping us minimize GHGs from sectors that account for nearly 70 percent of non-vehicle emissions. This is a common-sense measure, strategically tailored to facilities emitting more than 25,000 tons of carbon dioxide equivalent each year. The proposed regulation would minimize emissions, drive technology innovation, and protect the environment – all without placing an undue burden on the businesses that make up the better part of our economy.

Promoting renewable fuels and geosequestration:

In May 2009, EPA proposed its strategy for increasing use of renewable transportation fuels in the U.S., which would reach 36 billion gallons by 2022, including 21 billion gallons of advanced biofuels such as cellulosic biofuel. When fully phased in, use of these fuels is estimated to reduce U.S. dependence on foreign oil by more than 297 million barrels a year and reduce U.S. GHG emissions by an average of 160 million tons a year.

In July 2008, EPA proposed new federal requirements for the underground injection of carbon dioxide for long-term underground storage, or geologic sequestration. This action provides the regulatory framework for safe deployment of geologic sequestration, an important technology in the fight against climate change. In August 2009, EPA released supplemental information on this action.

In the coming months, EPA will continue to work with international partners, states and localities, as well as Congress, to put climate solutions into action. We will explore cost-effective ways to expand the reach of energy efficiency and innovation to key sectors of the economy, where opportunities to reduce greenhouse gas emissions are very real. We will also work closely with our domestic partners, through programs like ENERGY STAR, a program that helps consumers and

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GHG Emissions in Mecklenburg County

By Chuck Greco, Supervisor, Mecklenburg County Air Quality

Within Mecklenburg County a major source of man-made greenhouse gas (GHG) emissions is the combustion of fossil fuels like coal, fuel oil, gasoline, diesel, or natural gas. These emission sources include everything from industrial and commercial boilers, to home heating systems and the cars we drive every day. Anticipating new GHG rule-making by the U.S. Environmental Protection Agency (EPA), Mecklenburg County Air Quality (MCAQ) began in 2009 to collect GHG emissions data for large stationary sources and mobile sources in the county. For stationary sources MCAQ requested that the largest permit-holding facilities in the county voluntarily report their 2008 GHG emissions. In this group are facilities such as steel mills, chemical manufacturers and food manufacturers. The total GHG emissions reported by these facilities for 2008 are given in *Table 1* below.

Table 1. 2008 GHG Emissions From Nine Title V Facilities in Mecklenburg County

Green House Gas	Annual Emissions (Metric Tons)	CO2 Equivalent (Metric Tons)
Carbon Dioxide	179,572.9	179,572.9
Methane	5.7	131.9
Nitrous Oxide	2.8	827.7
Total	179,581.4	180,532.4

MCAQ also developed estimates for the 2008 carbon dioxide (CO_2) emissions from mobile sources for both on-road sources (cars, trucks, buses, etc.) and non-road sources (construction equipment, airplanes, and lawn maintenance tools, etc.). Estimates were calculated using EPA models that incorporated vehicle miles traveled estimates from the City of Charlotte's Department of Transportation. The total mobile source GHG emission estimates for the county for 2008 are given in *Table 2* at right.

How will the new GHG rules impact facilities in Mecklenburg County?

EPA's new GHG Reporting rule requires stationary sources with actual annual emissions greater than 25,000 metric tons of CO_2 equivalent in 2010 to report those emissions to EPA in 2011. In addition, the rule has specific monitoring and recordkeeping requirements based on the type and size of the facility. Facilities in Mecklenburg County likely subject to the rule are primarily those with large combustion sources. These will include permitted industrial facilities, such as steel and chemical plants, but may also include some of the larger heating plants associated with commercial and office complexes and buildings, which are not currently required to have an air quality permit. In early 2010 MCAQ will work to identify facilities that may be subject to the reporting rule in order to provide guidance to these facilities on the new monitoring, recordkeeping and reporting requirements. MCAQ anticipates there will be an increase in the number of facilities in the County required to have an air quality permit as a result of this new rule.

Table 2. 2008 GHG Emissions From Mobile Sources in Mecklenburg County

Emission Source	CO2 Emissions (Tons)
On-Road Mobile Sources	5,049,688
Non-Road Mobile Sources	985,136
Total	6,034,824

A Look at U.S. Environmental Protection Agency Climate Change Regulations

continued

businesses choose energy efficient products and practices, and Climate Leaders, a program that helps businesses reduce their greenhouse gas emissions and their impact on the environment. Each of these actions is helping EPA ensure economic and environmental sustainability for generations to come.

EPA's Climate Change Web site **www.epa.gov/climate change** offers comprehensive information on these and other regulatory actions, as well as additional climate change topics in a way that is accessible and meaningful to all parts of society – communities, individuals, business, states and localities, and governments. EPA's climate change contact for the Southeastern U.S. is Dr. Ken Mitchell (**mitchell.ken@epa.gov**).

Creating a Clean Air Community

By Alan Giles, Senior Air Quality Specialist
Mecklenburg County Air Quality

Federal, state and local programs have lead to significant improvements in local air quality, yet additional actions are needed and must be taken to bring our region into compliance with standards that continue to become more stringent.

In recent years, the focus from the federal, state, and local regulation has shifted from stationary "smokestack" sources to efforts aimed at mobile "on-highway" and "off-road" vehicles. Most officials agree that aggressive voluntary action will be required in combination with regulatory actions to bring our region into compliance with federal air quality standards.

Mecklenburg County government is committed to finding creative ways to improve local air quality, both within our organization and in the community at-large. Current Mecklenburg County air quality improvement efforts include:

• **Best Workplaces for Commuters:** The "Best Workplaces for Commuters" (BWC) is a USEPA voluntary business-government program that distinguishes and provides national recognition to employers offering outstanding commuter benefits such as free or low cost bus passes, strong telework programs, carpool matching and vanpool subsidies to reduce the number of employees that drive to work in single occupancy vehicles. Several areas businesses including Duke Energy, Mecklenburg County, the Charlotte Chamber of Commerce, the Centralina Council of Governments and the City of Charlotte are members of BWC.

• **GRADE+ (Grants to Reduce Aging Diesel Engines plus):** This incentive program provides grants to repower or replace old, dirty diesel engine with newer, cleaner engines. Any construction, agricultural, industrial or commercial company that operates non-road diesel, on-road heavy duty diesel and stationary diesel equipment in the bi-state Charlotte region is eligible to apply for funding to clean up that equipment. This project specifically targets nitrogen oxides (NOx) that contribute to the ozone problem in the Charlotte region. Through the end of 2009, GRADE+ had funded 158 projects expected to reduce 124 tons of NOx annually.

• **Fleet Inventory:** Mecklenburg County Air Quality (MCAQ) will assist businesses that operate private fleets by completing an emissions inventory (analysis) of their fleet. The inventory can be used to demonstrate the benefits of fleet turnover, right sizing and improved purchasing decisions. This process allows MCAQ staff to work with business leaders to identify ways that they can reduce the air quality impacts of their fleet. Please contact MCAQ directly if you are interested in having a fleet inventory performed at your business.

• **Gas Cap Replacement:** MCAQ operates a regional gas cap testing and replacement project. Since its inception over 21,000 vehicles have been tested and replaced 950 leaky gas caps replaced, which prevented 190,000 pounds (95 tons) of evaporative emissions. Businesses in the region can host a gas cap check event at their worksite to test both company fleet and employees' personal vehicles.

• **Smoking and Choking:** Through the smoking vehicle reporting program, you are able to help clean the air and help fellow drivers avoid costly repairs or ticketing by police. Please report vehicles with smoking tailpipes by calling 311 (*CharMeck government services hotline*) or online at the MCAQ homepage listed below.

Mecklenburg County will continue to concentrate on pollution reductions that target NOx emissions and will explore areas of possible reductions from stationary sources, businesses, governments and major fleets in 2010 and beyond. Identifying additional sources of funding for successful projects, such as GRADE+, will be a priority for MCAQ's effort to meet current and future air quality standards. To learn more about specific MCAQ programs please visit **www.charmeck.org/Departments/LUESA/Air+Quality/Home.htm**.

Other organizations in this region that are implementing actions to help combat ozone pollution includes both state and local government entities as well as non-profit organizations:

• **Air Quality Forecasting:** The Charlotte region's air quality forecast is developed daily by staff meteorologists at the North Carolina Division of Air Quality (NCDAQ). You can use this forecast to plan your daily activities and protect your health. Sign up to receive the forecast via email at **www.enviroflash.info**.

• **NC LEADER (Leading to Early Adoption of Diesel Emission Reductions):** NCDAQ operates this grant program to fund equipment replacements, engine repowers or engine upgrade solutions for diesel construction engines. **www.ncair.org/motor/LEADER**

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Creating a Clean Air Community

continued

NC Air Awareness: A public outreach and education program sponsored by NCDAQ. The goal of the program is to reduce air pollution though voluntary actions by individuals and organizations.

Clean Air Works!: a Charlotte region program dedicated to working with employers to improve air quality and providing solutions to employees' commutes. Since the inception of Clean Air Works! in 2006, approximately 4.8 million vehicle miles traveled have been avoided with approximately 280,000 lbs. of NOx emissions avoided.

Charlotte Area Transit System (CATS): Clear the Air Campaign promotes clean commute alternatives in the region by encouraging commuters to get out of the car and on board a CATS bus, train, vanpool or carpool.

City of Charlotte: Energy Efficiency & Conservation – the City of Charlotte has received Federal Block Grants which will provide funding for the reduction of fossil fuel emissions created as a result of activities within the community, reduce total energy use, or improve energy efficiency in the transportation, building, and other sectors.

Clean Air Carolina: A nonprofit initiative working to restore clean and healthy air to the Central Carolinas region by raising awareness, building partnerships, advocating stronger clean air policies, and partnering with other organizations committed to cleaner air and smarter practices.

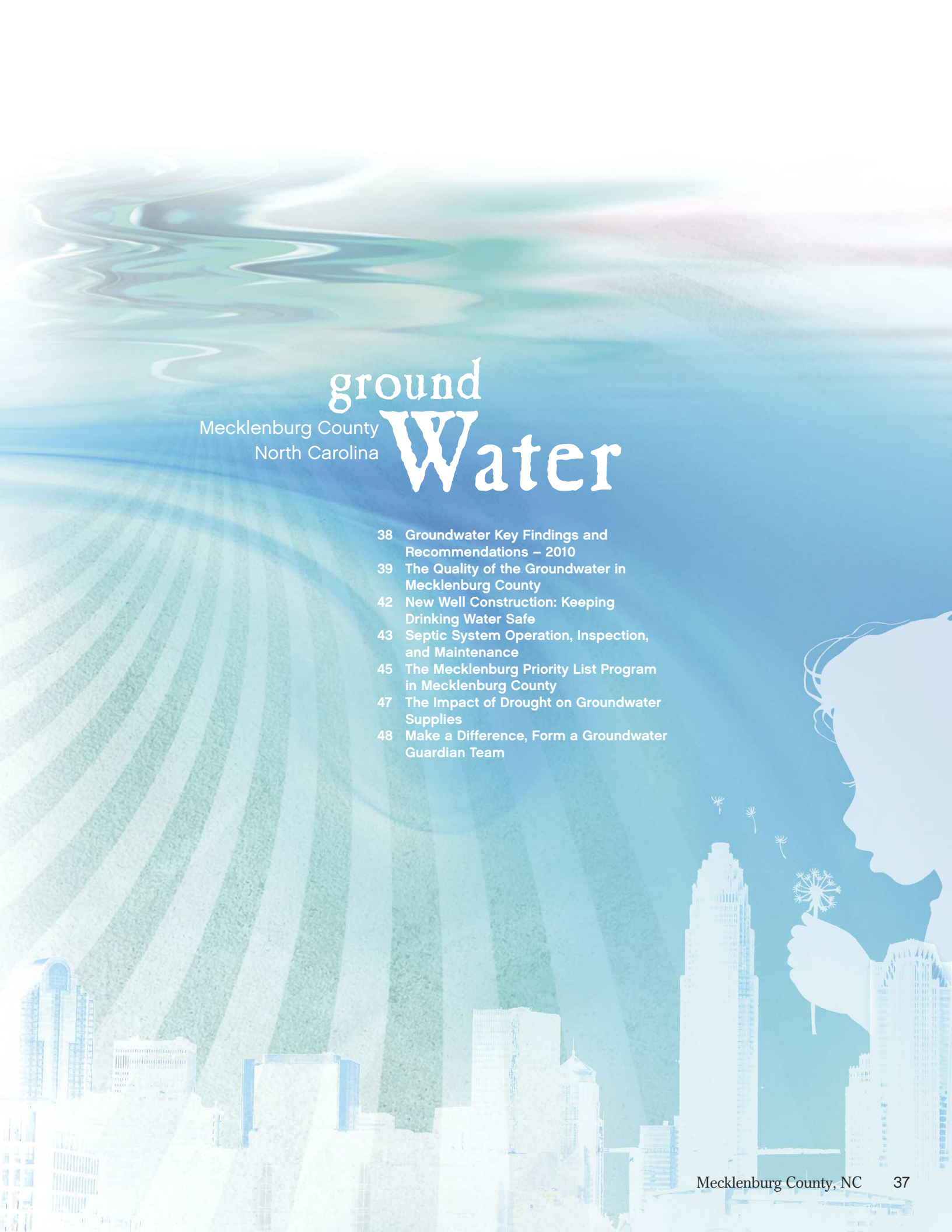
Centralina Council of Governments: The state-designated lead regional organization for the area in and around Charlotte analyzes multiple air quality issues simultaneously, including ozone, particulate matter, and air toxics while also addressing transportation, water, land use, energy use, and economic development.

While locally, there are many partners working to provide clean air for us all, individuals and businesses still have a role to play. Below is a list of suggested voluntary actions that will help improve the air quality in this region.

What You Can Do To Help Clear The Air	
Businesses	Individuals
• Get a fleet inventory, provided by Mecklenburg County Air Quality • Promote employee alternatives to drive alone commuting • Become an EPA "Best Workplaces for Commuters" business • Provide commuter benefits (transit and vanpool benefits) • Notify employees of upcoming Air Quality Action Days • Obtain and promote transit maps and schedules • Identify possible business-related emission reduction opportunities	• Conserve Energy – at home, work and everywhere • Keep your car, boat and other engines properly tuned • Carpool, use public transportation, bike or walk whenever possible • Avoid unnecessary idling of your vehicle • Refuel your vehicle after 6 pm • Delay using gas powered lawn equipment until after 6 pm • Delay or postpone trips on predicted Air Quality Action Days • Know the Air Quality Forecast

ground Water

Mecklenburg County
North Carolina



Groundwater Key Findings and Recommendations – 2010

By Lisa Corbitt P.G., REHS, Mecklenburg County Program Manager
Groundwater & Wastewater Services

Key Findings

• Groundwater continues to be a vital resource for Mecklenburg County that typically requires minimal to no treatment to be used as a water supply. Approximately 15% of Mecklenburg County residents use groundwater as their source of drinking water.

• Groundwater can be a reliable option, along with wise resource management, to meet our community's demand for water. Groundwater is used throughout Mecklenburg County for residential drinking water, irrigation, and industrial purposes.

• There are more than 1,370 known groundwater contamination sites in Mecklenburg County. Investigations of these sites have identified 250 contaminated private wells.

• Sites with contaminated soil and groundwater continue to be identified throughout Mecklenburg County. The problem is often the result of old, leaking underground storage tanks or chemical residue from factories that closed long ago. Removing the contaminated soil can be expensive but ignoring it may risk public and environmental health.

• Septic systems that are properly installed, maintained, and operated can function for many years providing an environmentally-sound method of wastewater treatment and disposal.

Recommendations

• Continue to effectively enforce the Mecklenburg County Groundwater Well Regulations to protect the groundwater quality and public health.

• Expand the Ambient Well Network to accurately track how changes in precipitation affect the quantity and quality of our groundwater system

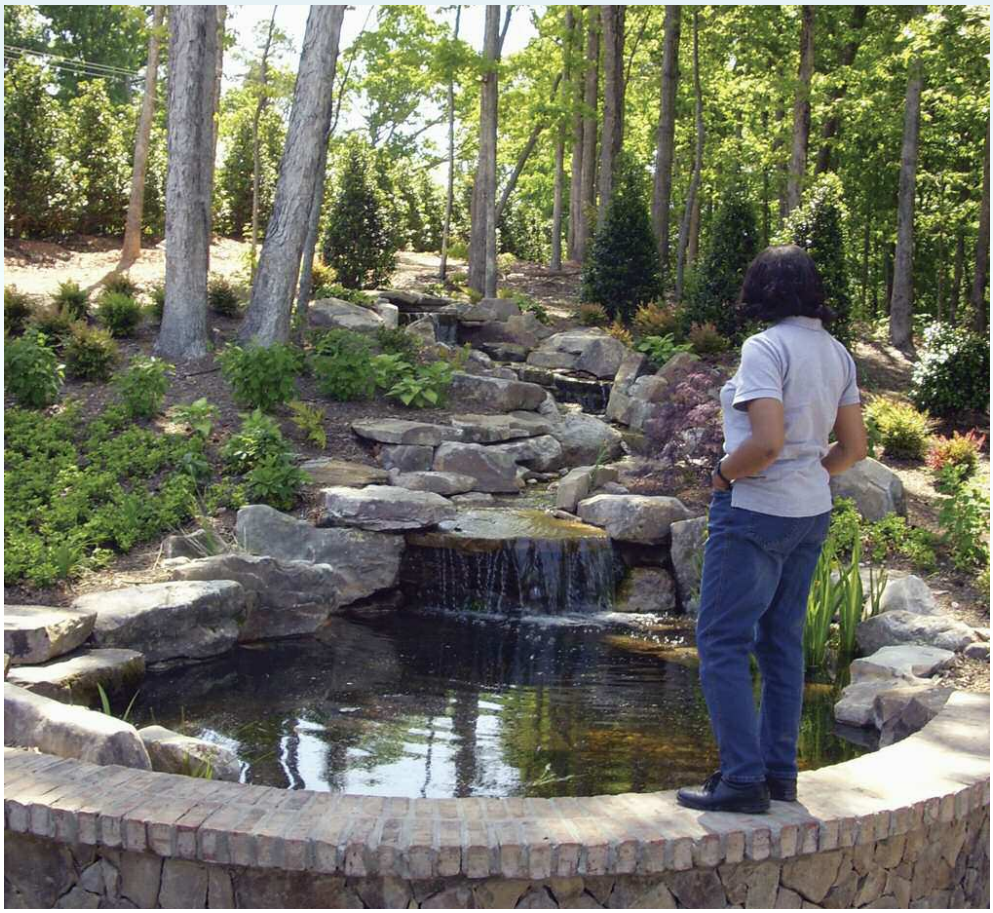
• Continue to aggressively identify and track contamination sites, and the location of wells, and to support the enforcement of the Groundwater Well Regulations to ensure safe drinking water throughout Mecklenburg County.

• Continue to enforce the North Carolina Onsite Wastewater Rules to ensure that septic systems are properly installed.

• Develop information for homeowners on the maintenance, and operation of septic systems to promote an environmentally-sound method of wastewater treatment and disposal.

• Maintain a geographical public interface to provide timely information on the location of groundwater contamination sites and the quality of the groundwater in Mecklenburg County.

• Promote the development and support of Groundwater Guardian Teams and Groundwater Guardian Green Sites within Mecklenburg County.



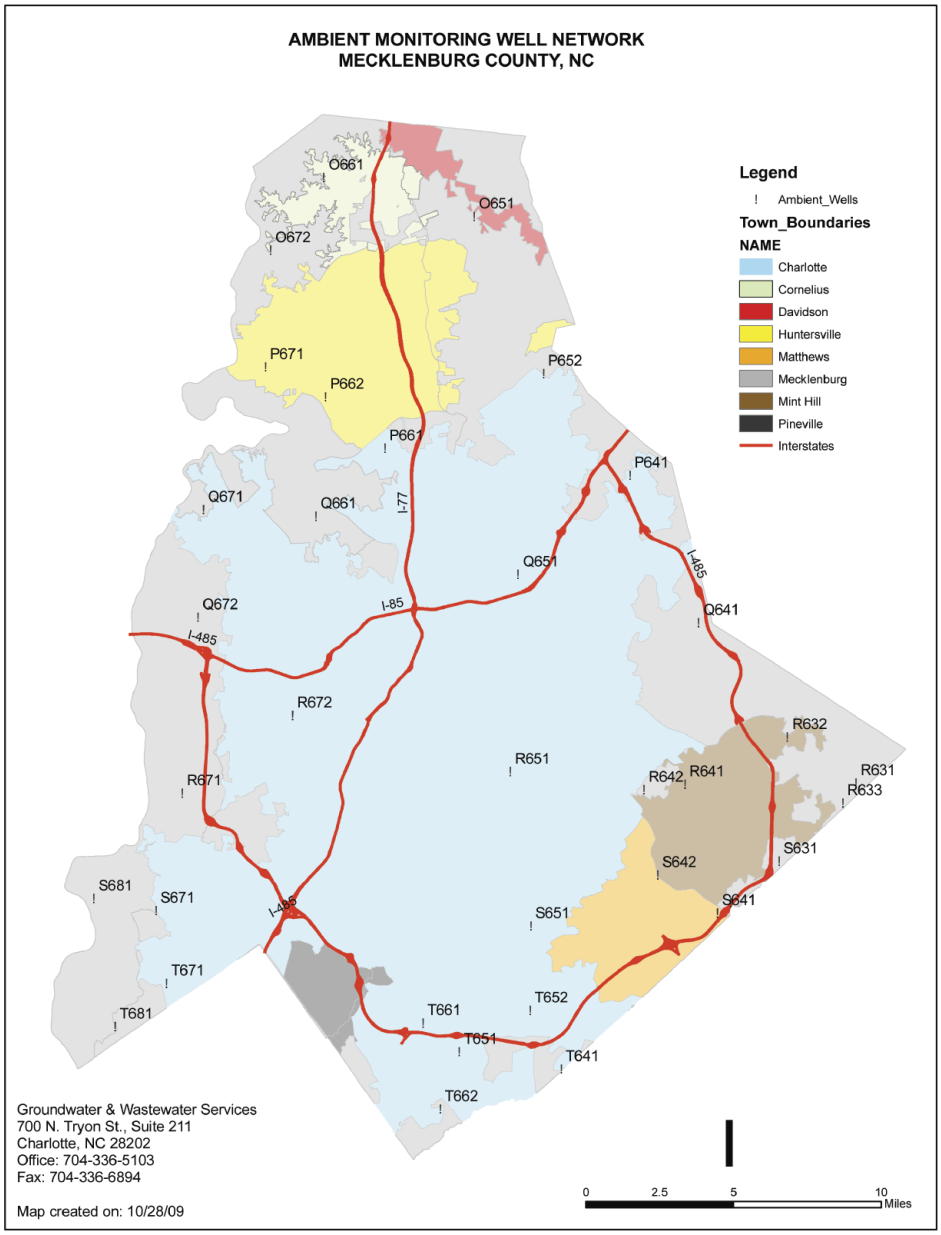
The Quality of the Groundwater in Mecklenburg County

By Lisa Corbitt P.G., REHS, Program Manager
Mecklenburg County Groundwater & Wastewater Services

The groundwater in Mecklenburg County is used for drinking water, irrigation and manufacturing. If managed and protected properly, groundwater is a viable resource that requires minimal or no treatment prior to use.

When a well is placed in service or it is repaired the water should be sampled to ensure that it is suitable for the intended use. The quality of the groundwater varies depending on the characteristics of the water and geologic conditions of the aquifer. What is the natural quality of the groundwater in Mecklenburg County? To answer this question, Mecklenburg County has been monitoring the ambient quality of the groundwater system since 1993 through a network of water supply wells in Mecklenburg County (*see map at right*). Twenty-nine potable wells were initially selected based on the following criteria: geographic location, rock type and hydrogeologic settings. Additional wells were added over time to provide more comprehensive coverage of the ambient water quality. Currently there are 35 water supply wells within the ambient groundwater quality network.

To ensure that the samples reflect the background conditions and not outside contaminants, the wells selected for sampling meet basic construction standards such as having a sanitary seal and are properly grouted. The wells range between 100-300 feet deep, and have no source of known contamination within 50 feet of the wellhead. The wells are analyzed annually for the following parameters: pH, alkalinity, chloride, fluoride, hardness, nitrate, total dissolved solids, calcium, copper, iron, magnesium, manganese, potassium, sodium, sulfate, total coliform bacteria, E. coli bacteria and volatile organic compounds.



In Mecklenburg County, the average values for manganese and iron are above the United States Environmental Protection Agency (USEPA) Secondary drinking water standards. Manganese averages 0.1 mg/l in Mecklenburg County. The USEPA secondary standard is 0.05 mg/l. Manganese in concentrations in excess of 0.2 mg/l tends to precipitate and form noxious deposits on foods during cooking and leaves black stains on plumbing fixtures and laundry. Manganese in concentrations greater than 0.05 mg/l may cause food and water to have a metallic taste. The presence of Manganese

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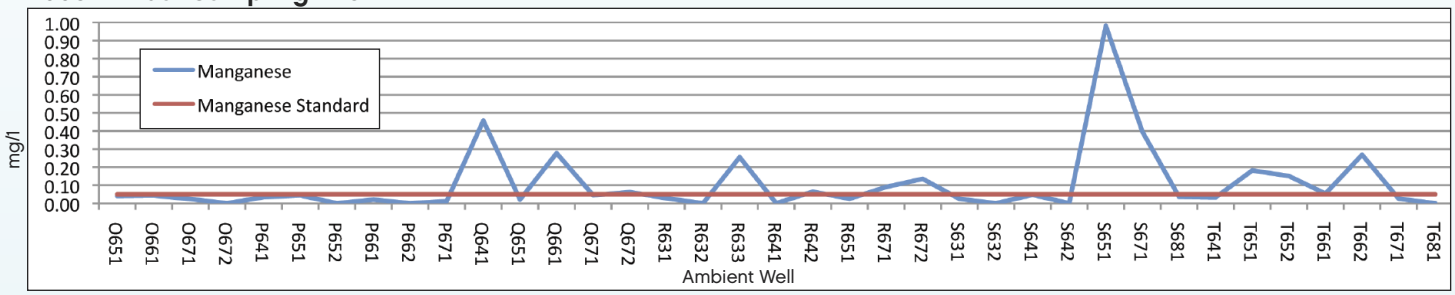
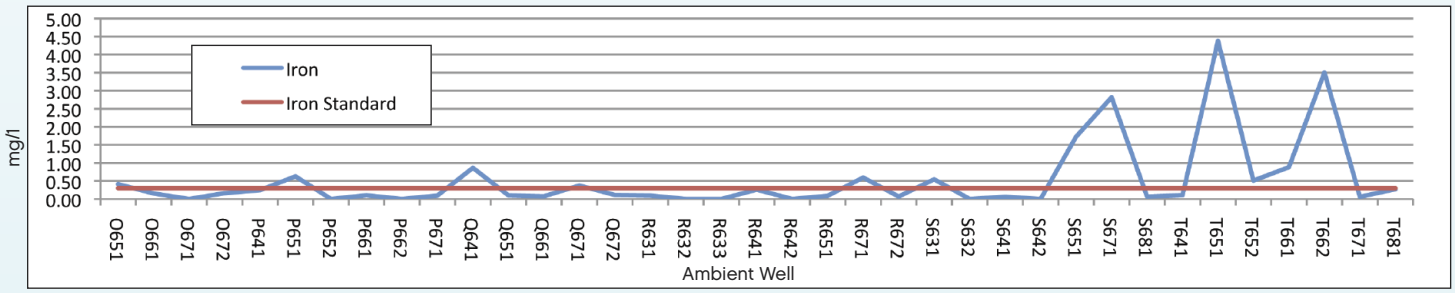
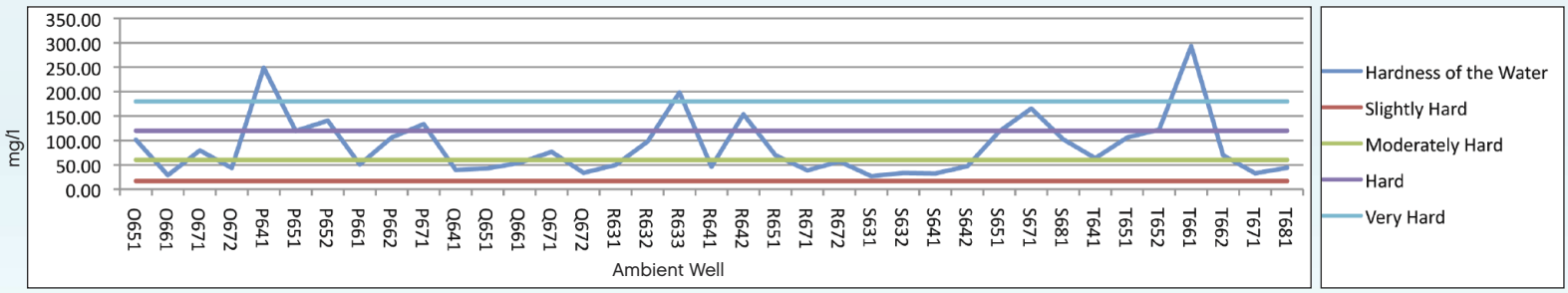
The Quality of the Groundwater in Mecklenburg County

continued

2008 Annual Sampling Event







may stimulate the growth of bacteria in reservoirs, filters and distribution lines (*see chart on page 41*).

Iron averages 0.52 mg/l in Mecklenburg County ambient wells. The USEPA secondary standard for iron is 0.30 mg/l. Reddish or orange staining or sediment may occur when iron is present in concentrations greater than 0.30 mg/l. A metallic taste may occur with iron concentrations as low as 0.1 mg/l. Elevated iron levels may cause well components to become incrusted with iron deposits (*see the chart on page 41*).

There are several different treatment methods to remove manganese and iron depending on the concentrations. At low levels a water softener may be sufficient if designed for this purpose. Green sand filters and some synthetic filter are also designed to remove both high and low levels of manganese and iron.

The average groundwater values for copper, nitrates, total dissolved solids, pH, fluoride, chloride, and sulfate are all below the USEPA drinking water standards (*see chart on page 41*). Calcium, potassium, magnesium sodium and hardness do not have established drinking water standards.

Water hardness is a typical water quality issue for homeowners in some areas of Mecklenburg County. Hard or soft water is a relative term. What is considered "hard water" for Mecklenburg County may be considered soft water in other parts of the country (*see chart above*). There are some typical scales used to define the water hardness. Hardness is associated with the reaction of soap when it is used in conjunction with water. Soap does not clean efficiently in hard water. Hard water can also leave an insoluble residue in bathtubs, sinks, toilets and clothing. In addition it can cause water heaters, boilers and pipes to become encrusted, thereby reducing their capacity and heat transfer properties. The concentrations of calcium and magnesium in the water directly correlate to the hardness of the water. Hard water is typically treated through a water softener where the calcium and magnesium ions are exchanged for sodium ions.

The seventeen years of sampling data, between 1992 and 2009, have provided a baseline for the groundwater quality in Mecklenburg County. There does not appear to be a single controlling factor, such as geology, that determines the quality of the groundwater in Mecklenburg County. How-

	1996-2008	USEPA Drinking Water Standards			
	Average Value (mg/l)	Primary (mg/l)	Potential Health Affects	Secondary (mg/l)	Noticable Effects
Calcium	21.91	No Established limits			
Copper	0.07	1.3 mg/l	Short term exposure: Gastrointestinal distress Long term exposure: Liver or kidney damage	1.0 mg/l	metallic taste; blue-green staining
Iron	0.52			0.30 mg/l	rusty color; sediment; metallic taste; reddish or orange staining
Potassium	1.98	No Established limits			
Magnesium	8.1	No Established limits			
Manganese	0.1			0.05 mg/l	black to brown color; black staining; bitter metallic taste
Sodium	10.22	No Established limits			
TDS	161.7			500mg/l	hardness; deposits; colored water; staining; salty taste
Nitrates	1.11	10 mg/l	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.		
pH	6.68			6.5-8.5	*low pH:* bitter metallic taste; corrosion High ph: slippery feel; soda taste; deposits
Fluoride	0.09	4.0 mg/l	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	2.0 mg/l	*tooth discoloration*
Chloride	8.4			250 mg/l	Salty Taste
Hardness	88.37	No Established limits			
Sulfate	9.44			250 mg/l	Salty Taste

ever, the analytical results provide valuable information on what a homeowner may expect to find when they access the groundwater resource in a given area of the county. Sampling data for a particular well (*see the map on page 39*) can be obtained by contacting Groundwater & Wastewater Services at **704-336-5103**.

The ambient well network should be expanded, as funding allows, in the future to accurately track the changes in the groundwater system, especially during periods of drought. Expanding the ambient monitoring well network would give Mecklenburg County a clearer understanding of how changes in precipitation affect the quantity and quality of our groundwater system. In order to accurately acquire this information, the network will need to be expanded to include monitoring wells to measure the impact of changes in precipitation on the groundwater system.

New Well Construction:
Keeping Drinking Water Safe

By Jack Stutts P.G., REHS, Supervisor
Mecklenburg County Groundwater & Wastewater Services

Groundwater is a safe drinking water source in most of Mecklenburg County. How is the quality of that resource assured for residents who wish to use groundwater? Since 2005, the county has had regulations governing construction of water supply wells. This article will review some of these requirements and how they work to protect groundwater quality and public health.

Figure 1

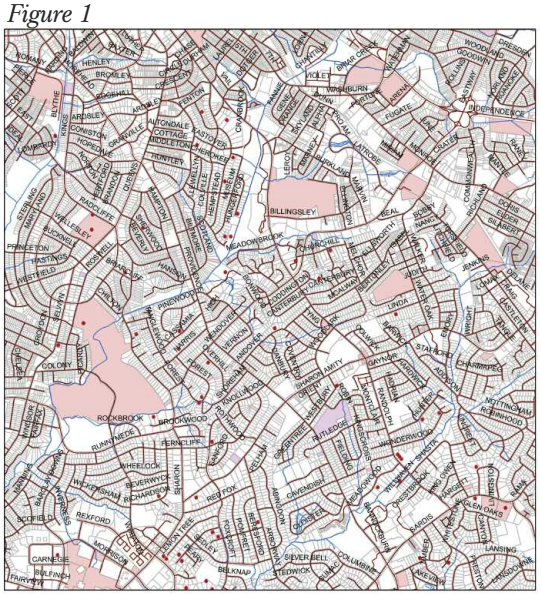
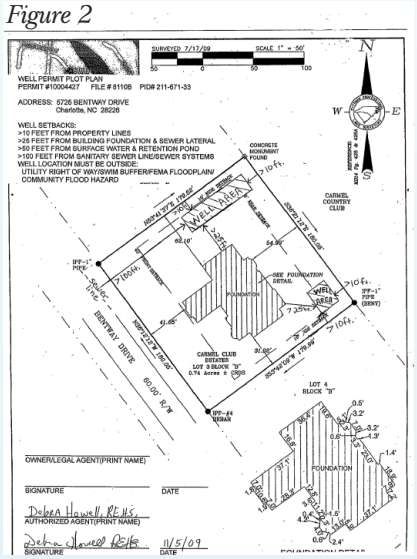


Figure 1: Red dots represent well applications that underwent review because of nearby contamination. Properties with known contamination incidents are shown in light red.

When a resident applies for a new well permit, the first action taken is a review of the proposed well location for known sources of contamination nearby (*see Figure 1*). The contamination often comes from leaking underground storage tanks, or industrial and commercial activities that used and spilled potentially harmful chemicals. The initial review for nearby contamination is an automated process taking advantage of digital databases and geographic information systems to reduce the length of time and cost needed to produce a permit. Once that information is reviewed by a geologist experienced with soil and groundwater contamination issues, their recommendations are forwarded to a Mecklenburg County Environmental Health Specialist (EHS) for incorporation into the permit. Recommendations may include limiting the area available for drilling, stricter construction requirements such as extra grout, or special water testing before the well is placed into use.

Figure 2



Armed with this information, the EHS visits the site to determine the available area for drilling based on distances from buildings, infrastructure, and topography. (*see Figure 2*) These "minimum horizontal separation" requirements, commonly referred to as setbacks, are designed to establish minimum allowable distances between potential sources of groundwater contamination and a water supply well. Required setbacks include 25 feet from building foundations, 100 feet from septic systems or public sewer lines, 50 feet from home heating oil tanks, 50 feet from surface water bodies and 500 feet from certain types of landfills. Water supply wells are specifically prohibited from being constructed in areas generally subject to flooding. In addition to horizontal distance requirements, minimum requirements have been established for the depth of the first water producing zone (greater than 40 feet), depth of casing (40 feet), and amount of grout (minimum of 20 feet).

Since 2005, when Groundwater & Wastewater Services (GWS) began keeping records of construction parameters, the average total depth of wells drilled is 361 feet. Average depth of casing is 77 feet and the average well yield is 29 gallons of water per minute. Wells permitted in areas deemed higher risk, because of the presence of known contamination, have similar construction details: average total depth 379 feet, average depth of casing 87 feet and an average yield of 32.5 gallons per minute.

There is more to ensuring a safe water supply than meeting the setback restrictions and construction requirements. Mecklenburg County GWS test the water prior to well approval to be sure the water is fit to use. Minimum testing requirements include total and fecal coliform bacteria, nitrate and nitrite, and several metals including arsenic, lead,chromium, and mercury. Testing for additional specific contaminants may be required if deemed necessary to protect public health.

Total coliform bacteria is the most commonly found contaminant, present in 34.5 percent of all new well samples, probably because it occurs naturally in the environment. Although the bacteria typically do not cause significant illness, total coliform can indicate that the well may not be properly sealed or thoroughly chlorinated. Fecal coliform, a subset of total coliform and found only when mammal fecal waste has entered the well, is found in less than two percent of new wells sampled. Fecal coliform's ability to cause acute and potentially life threatening illness makes it a high priority contaminant. Fortunately, coliform bacteria can be eliminated by chlorination and generally prevented with regular well head maintenance.

Mecklenburg County has an abundant and useful groundwater resource. With well location review and proper construction, our groundwater resource can be kept safe for our use.

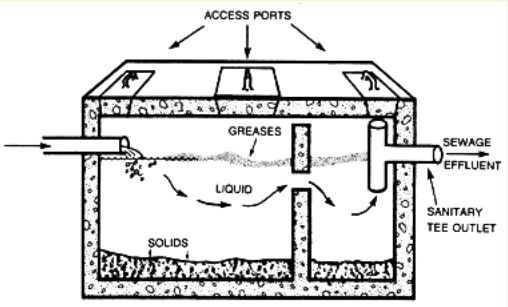
Septic System Operation, Inspection, and Maintenance

By Trevor Thomason REHS, Environmental Analyst
Mecklenburg County Groundwater & Wastewater Services

20-foot sections of 6-inch diameter PVC casing lying on the ground in front of an operating drill rig.

Casing is pipe, typically made from PVC plastic or steel, that is installed in the borehole of the well. Casing protrudes above the ground surface a couple of feet and extends downward to the top of bedrock. It acts to protect the borehole from collapse and provides a secure conduit for piping and wiring to enter and exit the well. It also provides protection from surface water or shallow groundwater, both of which are prone to have bacterial contamination, from entering the well and causing potentially serious health problems.

You may be surprised to learn that about 45,000 homes in Mecklenburg County use an On-Site Wastewater Treatment & Disposal System commonly called a septic system. In areas of the county where municipal sewer is not available, septic systems offer a viable solution for development. Even in areas of the county with municipal sewer lines, some homeowners prefer to use a septic system for wastewater treatment and disposal. Septic systems that are properly installed, maintained, and operated can function for many years providing an environmentally sound method of treating and disposing of wastewater.



Residential systems typically consist of a 1500 gallon, two-compartment septic tank, a distribution device, and a drain field. Household wastewater flows into the septic tank for collection, settling, and primary treatment. Inside the septic tank, bacteria excreted from the human gastrointestinal tract work to break down and digest the solid portion of the waste. This process is very similar to a centralized municipal treatment system in that solids are converted to liquid form for treatment and disposal. A baffle wall located inside the septic tank prevents large solids from entering the second compartment of the tank. As the wastewater flows into the second compartment, further separation and settling of the solids occurs. At this point, the partially treated wastewater flows out of the septic tank to the distribution device. The distribution device directs the wastewater to the drain field for tertiary treatment. The drain lines are located in the soil horizons where the final portion of treatment takes place. It is critical that the drain lines are installed in soil that is able to receive and properly treat the wastewater in a sanitary manner. During the final phase of treatment, bacteria present in the soil work to break down and digest the remaining harmful bacteria in the wastewater. Gravity moves the wastewater down through the soil. The treated wastewater eventually is returned to the groundwater or taken up by plant roots.

Septic system diagram.

Adjusting the system pressure.

North Carolina sewage rules require that certain types of septic systems be inspected by Mecklenburg County Groundwater & Wastewater Services (GWS) on a routine basis. These systems use an effluent pump to deliver wastewater to the drain field and are more complex than conventional gravity systems. Between 2007 and 2009, GWS issued 564 operation permits for new septic systems to be placed into service. 245 or 43 percent of these systems require routine

continued on page 44

Septic System Operation, Inspection, and Maintenance

continued

inspection by GWS. There are approximately 850 septic systems in Mecklenburg County that GWS inspects on a routine basis. GWS completes an average of 150 of these inspections per year. In addition to these types of inspections, GWS also performs inspections on existing septic systems where building permits are required for remodels and additions. Prior to receiving a building permit the septic system must be determined to be operating properly. GWS completes an average of 205 of these inspections per year. It is important to note that while on average GWS conducts required inspections for over 350 systems a year there are far more systems in operation that have no inspection requirement due to their age or system type.

In March 2009, GWS teamed with County staff of Charlotte-Mecklenburg Storm Water Services' Water Quality Program (WQ) to begin inspecting all active septic systems located in the Goose Creek watershed. This watershed in the Mint Hill area has been identified as impaired (polluted) by the N.C. Department of Environment and Natural Resources (DENR) due to elevated bacteria levels. The purpose of these inspections is to identify failing septic systems and have them repaired in order to reduce the bacteria levels in the creek and restore water quality conditions in compliance with DENR's requirements. A Goose Creek watershed pilot program was completed in May 2009 that included 178 system inspections by GWS. During the pilot, 3 failing systems were identified. GWS worked with the system owners to expedite the septic system repairs. Water samples collected by WQ from November to December of 2009 indicate an 82 percent reduction in the fecal coliform concentration in Goose Creek downstream of the pilot inspection area. Work continues in the watershed and more that 350 additional inspections have been completed since May 2009. GWS anticipates that all 2,800 septic systems in the Goose Creek watershed will be inspected by 2012.

System failure: sewage surfacing on the ground and running along the property line.

GWS is responsible for enforcing state laws for septic systems and their operation. If left unaddressed, failing septic systems can negatively impact human health and the environment. The most common type of malfunction observed is sewage effluent surfacing on the ground over the drain field area. The problem area typically remains saturated, is surrounded by lush vegetation, and may have an odor. In cases where a system is determined to be failing, GWS issues a Notice of Violation (NOV) to the system owner. The system owner typically has 30 days to bring the system into compliance. If possible, the owner may elect to connect to municipal sewer and abandon their septic system to correct the problem. In cases where municipal sewer is not available or where the system owner chooses to repair their system, GWS issues a permit for the repair work. GWS must inspect and approve the repaired system before it is determined to be in compliance. GWS issued 191 NOVs from 2007 through 2009. During that time, 72 percent of the failures identified were brought into compliance by repairing the system. The remaining 28 percent of failures were corrected by connecting the home or business to municipal sewer.

Septic tank pump truck

Proper maintenance and operation play a vital role in how long and well a septic system functions. A system that does not work properly can cause wastewater to back up inside the building or surface on the ground outside. Malfunctioning systems may also allow untreated wastewater to contaminate the groundwater with bacteria such as E. coli. Most septic systems do not require extensive or costly maintenance. Generally, routine

Recommended Minimum Pumping Frequency (in years) for Septic Tanks

Tank Size (gallons)	Number of persons using the septic system				
-	1	2	4	6	8
1,000	12	6	3	2	1
1,500	19	9	4	3	2

Source: Adapted from "Estimated Setic Tank Pumping Frequency," by Karen Manci, 1984, Journal of Environmental Engineering, Vol. 110(1):283-285.

pumping of the septic tank is all that is required to maintain the system. Pumping costs typically range from $300 to $400. Please refer to the table at the bottom of page 44 for pumping frequency time frames. System operation directly affects system performance. Improper use may result in serious damage to the system and costly repairs for the system owner. All systems are designed for a daily design flow (DDF) based on the number of people that could potentially use the system. If the system DDF is routinely exceeded it is likely that the drain field will become saturated and fail. Improper disposal of items into the system that do not readily break down or that contain hazardous chemicals may also lead to problems. Below is a list of the top five things every septic system owner should know and do:

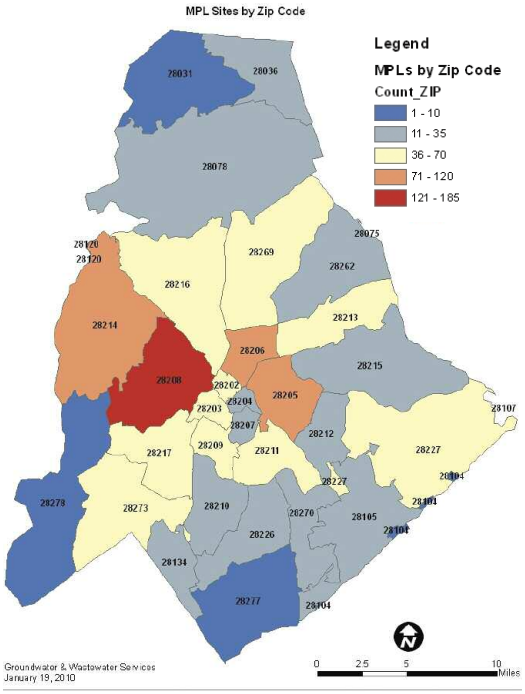
1. Have a basic understanding of how your septic system works and know where all the components of your system are located including tank(s), distribution device, drain field, and repair area.
2. Use sound waste disposal practices. Items that do not readily break down in the septic tank should NOT be introduced into the system (plastic, greases, solvents, etc.).
3. Have your septic tank pumped out on a routine basis.
4. Know that excessive water flow into the system on a repeated basis will likely damage the system. You can reduce water use by installing water saving fixtures and appliances.
5. Protect the system area from vehicular traffic, construction activities, improper site drainage and landscaping.

Like with so many things, "*an ounce of prevention is worth a pound of cure.*" Septic systems are no different. With a basic understanding of how your system works and by maintaining it correctly, your septic system can provide years of environmentally friendly, trouble-free service.

The Mecklenburg Priority List Program in Mecklenburg County

By Shawna W. Caldwell, P.G., Hydrogeologist,
Mecklenburg County Groundwater and Wastewater Services

More than 100,000 people in Mecklenburg County use groundwater as their source of drinking water. Wells that access the groundwater supply are found at individual homes, businesses, churches and neighborhoods. In general the quality of Mecklenburg County's groundwater resource is good, but growth and development have increased the potential for groundwater contamination. The Mecklenburg County Priority List (MPL) was established in 1989 to identify and assess the groundwater usage in specific areas where the soil or groundwater may be polluted. Because of the MPL program, residents are far less likely to drink contaminated groundwater or be exposed to it. In addition to identifying polluted wells, the MPL program addresses health effects of contaminated water and gives the public information about alternate safe drinking water sources. The program also includes continued monitoring of groundwater used for drinking from wells not currently affected by pollution, but located within areas of concern.



MPL sites include areas of groundwater or soil pollution originating from gasoline stations, petroleum pipelines and storage facilities, dry cleaners, old industrial sites, accidental spills, and unlined landfills. Residential sites are also commonly included due to leaking heating oil tanks. Contaminants in soil and groundwater can include toxic metals, volatile organic compounds, chlorinated solvents, fertilizers and pesticides.

Currently, at least 1,370 MPL sites are located in Mecklenburg County. That is more than twice as many sites as were

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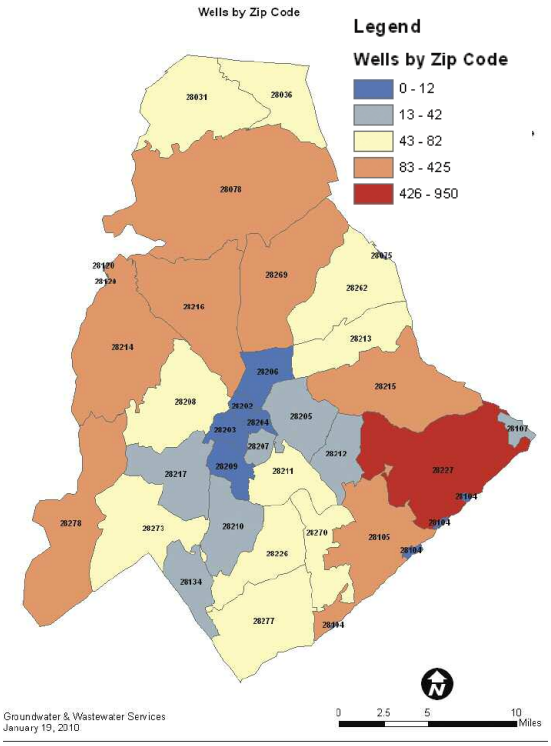
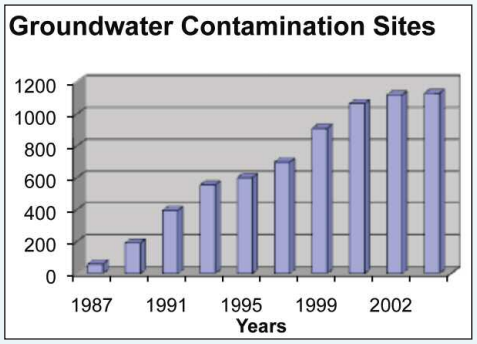


The Mecklenburg Priority List Program in Mecklenburg County

continued

identified 15 years ago. This is due not only to more releases of contamination, but because there is a better system to identify, analyze and track the contamination sites.



A site is added to the MPL when contamination of soil or groundwater is reported by sources such as the North Carolina Department of Environment and Natural Resources, US Environmental Protection Agency and Mecklenburg County Land Use and Environmental Services. Once a site becomes a MPL, county staff conduct a field investigation to identify nearby water supply wells. Selected wells within 1,500 feet are sampled to determine if any might be contaminated. Wells that are deemed threatened may be scheduled for periodic resampling. If contamination is identified in a water supply well, county staff will help the owner find an alternate water supply or treatment system to make the water potable.

All MPL sites are tracked using sophisticated data management software and mapped electronically using a Geographic Information System. New sites are added as new pollution incidents occur or are discovered. Some sites are removed from the MPL system as clean-up of contaminated soils and groundwater is completed. Electronic mapping of these sites allows Mecklenburg County Groundwater and Wastewater Services (GWS) to review proposed water supply well locations and identify nearby known sources of contamination. This also allows GWS to identify residents already using groundwater for drinking near contamination sites.

The MPL program is the only program of its kind in the state that actively investigates contaminated sites to ensure that residents are not drinking or at a risk of drinking contaminated groundwater. The program does not address the clean-up of contaminated sites, which is regulated by state and federal agencies. MPL sites are designated as active, inactive and unknown. Active sites have wells within 1,500 feet; inactive sites do not have wells within 1,500 feet and unknown sites have not been investigated. From the beginning of the MPL program until July 2009, almost 1,300 pollution incidents have been evaluated for the presence of water supply wells within 1,500 feet. From July 2008 through June 2009, 148 sites were evaluated and 12 affected wells were identified, 11 with chlorinated solvent contamination and one with contamination from petroleum constituents.

The staff of Mecklenburg County GWS works with well owners and with local, state and federal agencies to see that all citizens have a safe permanent drinking water source. Contaminated wells can be resolved by using a municipal water supply, if available, or by treatment of the well water. Mecklenburg County water supply well regulations do require that contaminated wells must be treated or abandoned. The public can get more information about MPLs and wells through the Geospatial Portal **http://maps.co.mecklenburg.nc.us/geoportal** and the Well Information System **http://maps.co.mecklenburg.nc.us/wells/**.

Mecklenburg Priority List Sites Evaluated

July 2008 through June 2009

No. Sites Evaluated	No. of Inactive Sites	Potentially Affected Population	No. of Wells Identified	No. of Wells Sampled	No. of Wells Impacted
148	68	2295	765	110	12

The Impact of Drought on Groundwater Supplies

By Lisa Corbitt, P.G. REHS, Program Manager
Mecklenburg County Groundwater & Wastewater Services

In both 2002 and 2007 Mecklenburg County recorded drought conditions. However, the impacts of these two droughts were very different. In 2002 the drought resulted in a significant drop of the groundwater table which affected shallow and deep wells across the region. In 2007, the groundwater system was minimally impacted but area lake levels dramatically dropped and many creeks stopped flowing. What is a drought? What was the difference between the two droughts and how can we prepare for future droughts in our region?

A drought occurs when there is less precipitation for an extended period of time than is typical for a given climate. Drought conditions vary from place to place based on the geographical features and how the community uses water. In Mecklenburg County where the majority of the population is dependent on surface water, no or little rainfall during the growing season (*spring and summer*) along with the increased demand for water to sustain residential and business landscaping, rapidly depletes the surface water resource. This non-sustainable cycle of increased demand and little to no replenishment accelerates the impact to the surface water resulting in a dramatic drop in lake levels and dry creek beds. While a drought certainly affects the groundwater system, the impact is sometimes less dramatic than it is on the surface water. This is because the groundwater system in Mecklenburg County is primarily accessed through wells that reach down to fractures or cracks in the bedrock. These wells are typically greater than 100 feet deep. As the wells pump water out of the bedrock fractures, that water is replenished by water in the weathered material above the bedrock. Little or no rainfall over several months will result in a drop in the water table and may impact shallow wells less than 80 feet deep, but typically will have little or no impact on wells greater than 100 feet deep. In addition, the amount of ground-water pumped each day by well users in Mecklenburg County is far less than the amount of surface water used each day by the municipal water system.

Mecklenburg County lake and stream levels dropped considerably during the 2007 drought, but groundwater supplies were not as severely affected.

Both surface water and groundwater supplies are affected when rainfall amounts are low. However, surface water supplies in lakes and creeks are especially at risk when rainfall amounts drop suddenly and dramatically. This is especially true if the drought occurs during the spring and summer, when additional water is often used for lawns, gardens and swimming pools.

Conversely, groundwater supplies often show little effect from a short but intense drought. Instead, the water table is most at risk when a rainfall amounts are less than expected for a year or more. If the groundwater supply is not replenished by precipitation, a prolonged drought may affect both shallow and deep wells.

When water demand exceeds supply, the best response is conserving water. That reduces demand until the supply increases.

In 2002 the drought was a direct result of low precipitation over several years. Gradually, there was less water available in the weathered material above the bedrock, and the groundwater table dropped. The drop in the groundwater table meant there was less storage capacity to replenish the bedrock fractures. In Mecklenburg County, both shallow and deep wells had impacts from the 2002 drought. In 2007 the drought was direct result of little to no rainfall over several months. There were only seven shallow water supply wells documented to have gone dry during the 2007 drought in Mecklenburg County. In 2007, there was public concern that the utilization of the groundwater would reduce water levels in Mountain Island, Lake Wylie and Lake Norman. However, using the groundwater has no effect on the amount of water in the lakes. As the groundwater supplies drop during drought conditions there may be an impact to the creeks that rely on groundwater for their base flow. However, the drop in the water table would result from the lack of precipitation, not a direct response to the utilization of the groundwater resource. The volume of water being removed through private and public water supply wells in Mecklenburg County is small compared to the amount of groundwater available.

Groundwater is a viable resource that could be used to reduce the demand on the surface water resource in Mecklenburg County. Using irrigation wells during times of high water demand, such as spring and summer in Mecklenburg County, is an appropriate option for managing our water resources. The utilization of groundwater for irrigation would decrease the demand on surface water most of our residents rely on for drinking water. The groundwater system is able to support both irrigation and water supply wells in Mecklenburg County due to the natural controls of low yielding wells.

As we saw in 2007, an intense drought can dramatically deplete surface water supplies without causing similar problems to our groundwater supply. When that happens, groundwater can be a reliable option, along with wise resource management, to meet our community's demand for water.

Make a difference: Form a Groundwater Guardian Team

By Lisa Corbitt P.G. REHS, Program Manager
Mecklenburg County Groundwater & Wastewater Services

In Mecklenburg County, groundwater is used throughout the County in individual homes, neighborhoods, churches, schools and businesses for their primary drinking water, process water or for irrigating the landscape. Since 2005, Mecklenburg County Groundwater and Wastewater Services (GWS) has been permitting new wells and identifying existing wells during routine investigations or through voluntary registration.

Typically the groundwater is being utilized for a drinking water source in areas where Charlotte Mecklenburg Utilities (CMU) does not provide municipal water lines or the water service became available after the home or neighborhood was constructed. Since 2005 GWS has identified 2,443 private residences that depend on the groundwater for their drinking water supply. Private wells drilled prior to 2005 are only identified during a groundwater investigation or if the homeowner registers their well. In addition, there are 74 churches or businesses and 54 neighborhoods that rely on groundwater for their drinking water supply.

Irrigation wells are found throughout the county and appear to be independent of the availability of CMU service. Since 2005, GWS has identified or permitted 528 irrigation wells. Like the drinking water wells, irrigation wells drilled prior to 2005 are only identified during a groundwater investigation or if the owner registers the well.

The Groundwater Foundation of Nebraska created a national program known as Groundwater Guardian to protect and improve groundwater through the involvement of interested citizens. The purpose of Groundwater Guardian is to empower and educate communities to protect groundwater through increased awareness and publicity, to improve groundwater through voluntary actions of citizens and to support and encourage the formation and maintenance of citizen lead groundwater programs.

Elementary School students contaminate and clean up the groundwater system model at the Groundwater Guardian Water Festival

All it takes to form a Groundwater Guardian team are four interested and concerned citizens. There needs to be at least one representative from the following categories **1)** *a civic group or concerned citizen* **2)** *government representative* **3)** *educator* **4)** *business or agriculture*. Once the four representatives have been named, the team will meet to learn and plan the goals for the coming year. The five steps to a successful Groundwater guardian team are learn, plan, act, designate, and maintain.

Mecklenburg County GWS has been an affiliate with the Groundwater Guardian program since 1998. GWS will work with interested groups to help them establish a team by guiding them through the reporting process, providing a government representative if needed and help the group to identify result oriented activity for the upcoming year. Typical projects may be locating and registering existing wells, educating homeowners on wells, identify and educate neighborhoods on conserving groundwater, maintaining wellheads, educating youth through hands on science activities at a scout meeting or a classroom, providing teachers hands on science training, organizing a water festival for the community or school. For all teams that complete the yearly activities there is an opportunity to participate in a national and local designation ceremony. More importantly there is an opportunity to make a difference in the community by protecting the groundwater resource.

A new program through the Groundwater Foundation is the Groundwater Guardian (GG) Green Site program. This program recognizes good stewards of groundwater by encouraging managers of highly-managed green spaces such as golf courses, ball fields, education campuses and parks, to implement, measure, and document their groundwater-friendly practices related to chemical use, water use, pollution prevention, water quality, and environmental stewardship.

Historically, Groundwater Guardian teams have been active in Mint Hill, Steele Creek and Lake Norman East. Mecklenburg County and Orange County are the only counties in NC that received national designation in 2009. To learn more about the Groundwater Guardian program or the Groundwater Guardian Green sites program, go to the Groundwater Foundation web site at **http://groundwater.org**. To start your own team or become involved locally contact GWS at **704-336-5103**.

Mecklenburg County
North Carolina

surface Water

Surface Water Key Findings and Recommendations – 2010

By Rusty Rozzelle, Mecklenburg County Water Quality Program Manager
Charlotte-Mecklenburg Storm Water Services

Key Findings

Water pollution can be grouped into two categories: point and non-point sources. Point sources of pollution originate from a fixed location such as a pipe, whereas non-point sources are unfixed and usually originate in storm water runoff. As has been the case for the past 40 years, the most common pollutants in Charlotte-Mecklenburg's surface water are sediment and fecal coliform bacteria from both point and non-point sources.

Since the mid-1980s, there have been significant declines in fecal coliform bacteria, total phosphorus, and turbidity levels in Mecklenburg County streams measured during base-flow conditions indicating significant improvements in water quality conditions. This is particularly noteworthy considering the tremendous increase in Charlotte-Mecklenburg's growth and development in the past 25 years. Simply maintaining the existing pollutant levels would have represented an accomplishment.

Lake Norman typically has the best water quality conditions followed by Mountain Island Lake and Lake Wylie. Water quality conditions in the coves are typically poorer than in the main channel particularly when the contributing watershed has been significantly developed.

Since the implementation of the Surface Water Improvement and Management (SWIM) Program in 1997, there has been a 42.5% increase in the number of stream miles in Mecklenburg County that are suitable for human contact. Today, 67% of stream miles are considered safe for human contact, up from 47% a decade ago. This is measured when it is not raining and streams are not subject to storm water flow and non-point source pollution.

Although point sources of pollution in Mecklenburg County have decreased in the past 20 years, rapid growth has resulted in a tripling of the amount of developed land that has subsequently resulted in an estimated 55% increase in non-point source pollution contained in storm water runoff from these developed areas.

Over the past 20 years, Mecklenburg County has experienced a 70% decrease in treed and naturally vegetated groundcover, which serves to filter storm water pollution and protect water quality.

Based on N.C.'s 2008 listing of impaired streams, an estimated 202 miles or 77% of the 263 assessed stream miles in Mecklenburg County are impaired or not meeting their designated uses. This represents a 4% increase in impaired stream miles since N.C.'s 2006 listing.

Recommendations

Continue the effective implementation of the Post-Construction Storm Water Ordinances adopted by the City of Charlotte, six Towns and Mecklenburg County by ensuring adequate funding and support of plan reviews, inspections, enforcement, and maintenance activities, so that the intent and goals of the ordinances are met. Evaluate these ordinances and the accompanying Design Manual on a regular basis to determine their effectiveness and modify as necessary to ensure that established water quality goals are fulfilled.

Develop and fund implementation of watershed management plans to restore those watersheds that have been identified as impaired or not meeting their designated uses and to protect those that have remained fully supporting of their uses.

Expand efforts to acquire open space, which is becoming increasingly scarce as the community continues to grow. Target the purchase of this open space where it will have the greatest benefit to water quality such as areas where best management practices can be installed to achieve the pollutant removal targets specified in the watershed management plans.

Intensify efforts to protect the lakes from pollution, particularly sediment, which is becoming an increasing threat as the areas around the lakes continue to experience rapid development.

Develop and implement efforts to increase volunteerism in protecting and restoring water quality conditions. Encourage and offer incentives for "green development." Promote environmental stewardship on a countywide level by recognizing and rewarding the good work and accomplishments of both the public and private sector.

Support the growth of environmental education in the schools by providing special programs and resources that encourage students to be proactive in the protection of the environment. Continue to raise environmental awareness among the general public through volunteer programs, educational presentations and media campaigns so that citizens adopt behaviors that protect water quality.

The Catawba River system is the sole source of drinking water for more than 85% of the population of Mecklenburg County. As the watershed area of the Catawba River upstream of Mecklenburg County continues its rapid development, the quality and quantity of the water for use by our area will be increasingly threatened. Efforts are underway to develop a regional Catawba River planning group. Charlotte-Mecklenburg should become actively engaged in these efforts and support upstream communities as they work to protect the region's drinking water supply.

Trends in Biological Indicators of Water Quality

By Anthony J. Roux, County Senior Environmental Specialist
Charlotte-Mecklenburg Storm Water Services

1. Mayfly (Ephemeroptera) larvae.
2. Stonefly (Plecoptera) larvae.
3. Caddisfly (Trichoptera) larvae.

Scientists in Charlotte-Mecklenburg Storm Water Services have been studying the water quality of Mecklenburg County's streams since 1969. The most common method of measuring stream water quality has been to take water samples and analyze them for specific physical and chemical parameters. Unfortunately, relying only on water chemistry analysis to determine stream water quality has limitations that can affect the interpretation of stream water quality conditions.

Water sample analysis is limited by the number of test that can economically be run. Also, the timing of the sampling can miss a pollutant by hours or days. To complement the stream water chemistry analysis, stream ecologists have developed another method of monitoring water quality that looks at the aquatic life in the stream. These biological surveys focus on bottom-dwelling aquatic organisms such as insects, crayfish and clams. Known as benthic macroinvertebrates, these stream communities are excellent indicators of water quality.

Changes in the composition of the benthic macroinvertebrate community in a given stream can reflect changes in water quality caused by pollution or alterations in the aquatic habitat due to stream bank erosion and sedimentation from construction sites. Each benthic macroinvertebrate species has a unique tolerance to specific pollutants. Benthic macroinvertebrates are ideal water quality indicators because they are sensitive to changes in water quality, found in all types of aquatic habitats, less mobile than fish and large enough to be easily collected. While chemical and physical parameter sampling may miss occasional pollutant discharges, benthic macroinvertebrates are exposed to everything that enters the streams and lakes. Using benthic macroinvertebrates, the stream water quality classification is determined by EPT Taxa Richness, or the total number of different species of three pollution-sensitive aquatic insect orders: Mayflies (*Ephemeroptera*), Stoneflies (*Plecoptera*), and Caddisflies (*Trichoptera*) (*Pictures 1, 2 and 3*). The greater the taxa richness the better the stream water quality.

Storm Water Services' Water Quality Program (WQP) began monitoring the benthic macroinvertebrates of Mecklenburg County's streams in 1994. Approximately 40 sites throughout the County have been monitored. A review of the past 15 years of benthic macroinvertebrate data has revealed a number of interesting trends that reflect not only the tremendous growth that Mecklenburg County has experienced in the past 40 years, but significant events including the droughts of 2002-2003 and 2006-2008.

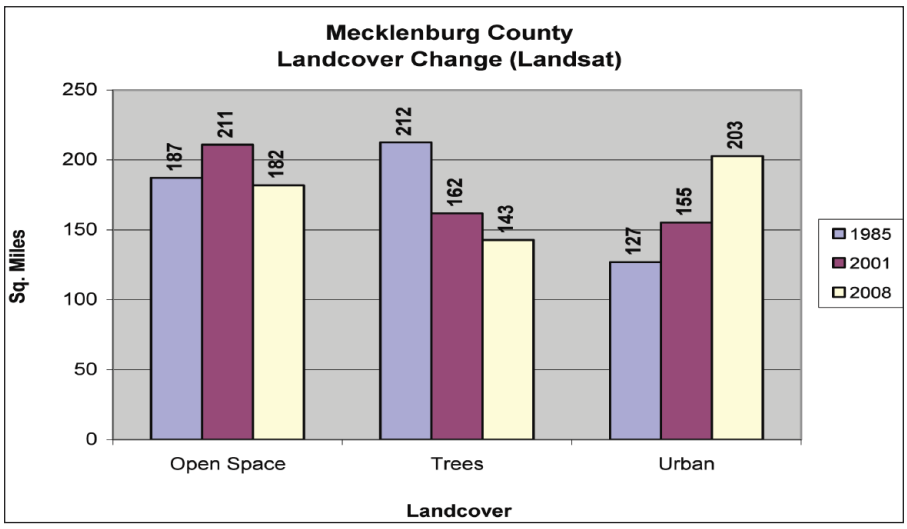


Figure 1. Mecklenburg County 1985-2008 Land Cover Changes in Square Miles (Landsat) - American Forest 2010.

Trend Analysis

A recent American Forest study of Charlotte and Mecklenburg County reported that between 1985 and 2008, Mecklenburg County lost 33% of tree canopy and 3% of open space, while gaining 60% of urban area (*Figure 1*). During the same time, the City of Charlotte lost 49% of tree canopy and 5% of open space, while gaining 39% of urban area (*Figure 2*). The loss of trees and the increase of urban area may have negative effects on the benthic macroinvertebrate and fish communities of the County's streams. A recent study by Tom Schueler, Metropolitan Washington Council

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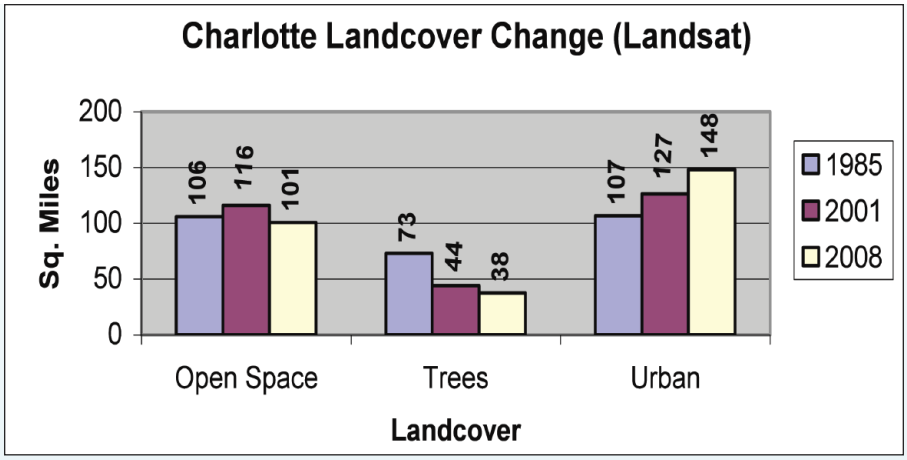


Figure 2. Charlotte 1985-2008 Land Cover Changes in Square Miles (Landsat) - American Forest 2010.

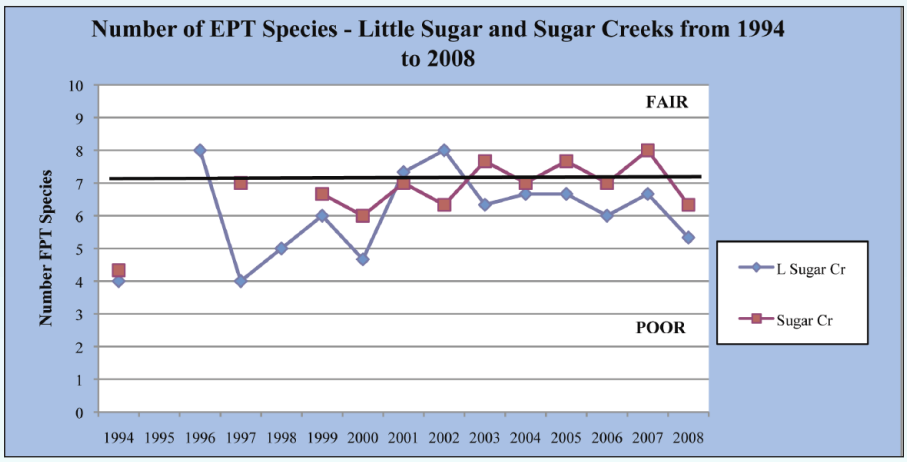


Figure 3. Number of EPT Species in Little Sugar and Sugar Creeks from 1994 to 2008.

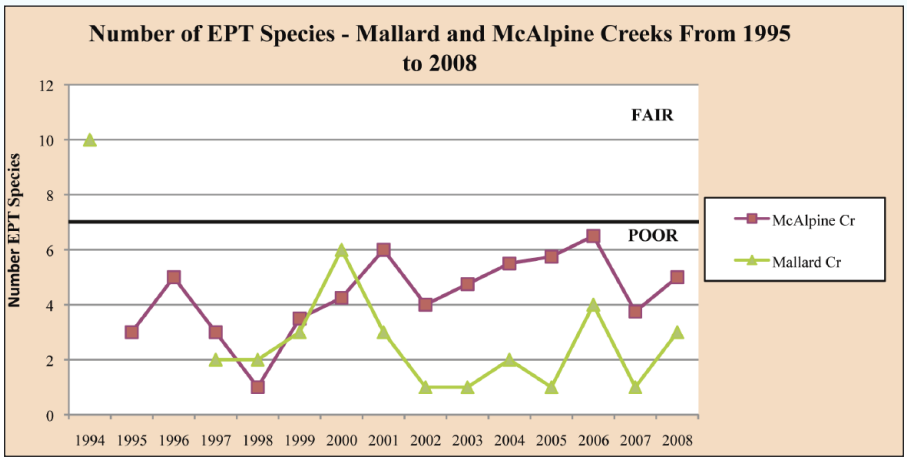


Figure 4. Number of EPT Species in Mallard and McAlpine Creeks from 1995 to 2008.

of Governments, warned that when the percent impervious cover in a watershed exceeded 10%, streams will begin to degrade. The stream banks become unstable and erosion begins, which then results in the degrading of the benthic macro-invertebrate habitat. The majority of Charlotte-Mecklenburg's urban streams have exceeded the 10% impervious threshold.

Urban Streams

Little Sugar and Sugar Creeks, urban streams flowing through the City of Charlotte, have shown improvements in the EPT Taxa Richness (*Figure 3*). The EPT counts have been fairly consistent since 2000 and have approached levels which would receive a Bioclassification of Fair. This improvement is a reflection of the combined efforts of the City and County to stabilize stream channels and improve in-stream habitats through Storm Water Services' projects on Little Sugar Creek such as the Hidden Valley Ecological Garden and the Westfield Stream Restoration.

Suburban Streams

McAlpine and Mallard Creeks are typical suburban streams draining watersheds that are predominantly residential. The EPT counts in these streams have consistently remained at levels which would receive Bioclassifications of Poor (*Figure 4*). These streams are subject to a wide variety of storm water pollutants including lawn fertilizers and pesticides. The stream channels of these streams have become unstable resulting in very wide stream channels with fairly shallow stream flows. The stream beds are also fairly unstable sand substrates that provide poor habitat for benthic macroinvertebrates. From 1997 to 1999, McAlpine Creek showed the impact of increased runoff and sedimentation due to the construction of I-485.

Developing Watersheds

McDowell, Sixmile and Steele Creeks flow through areas that have experienced heavy development and have transformed from rural watersheds in the 1980s to high density residential/commercial watersheds today. The EPT counts have dropped to levels that would receive Bioclassifications of Poor (*Figure 5*). Both Sixmile and Steele Creeks are small streams and were significantly impacted by the droughts of 2002-2003 and 2006-2008. Neither stream has recovered from the most recent drought. McDowell Creek, a larger stream, was not significantly impacted by either drought. A number of smaller streams, like McMullen and Stoney Creeks,

Low Water in McMullen Creek During the 2006-2008 Drought

were impacted by the droughts and experienced periods with little or no water during the droughts.

Reference Streams

Two Mecklenburg County streams support a very high diversity of benthic macroinvertebrates and have received Bioclassification ratings of Good (*Figure 6*). Gar Creek, near Huntersville, and Clear Creek, near Mint Hill, flow through fairly rural and lightly developed watersheds. The Clear Creek watershed is currently experiencing some development. Both streams were impacted by the droughts of 2002-2003 and 2006-2008. Gar Creek appeared to be recovering from the 2002 drought when the second drought hit. In 1998, Clear was impacted by the construction of I-485 and has yet to recover. The increased storm water runoff due to I-485 and the development that followed has brought urban type problems to Clear Creek as it is now experiencing the type of stream bank degradation that is commonly seen in more developed areas.

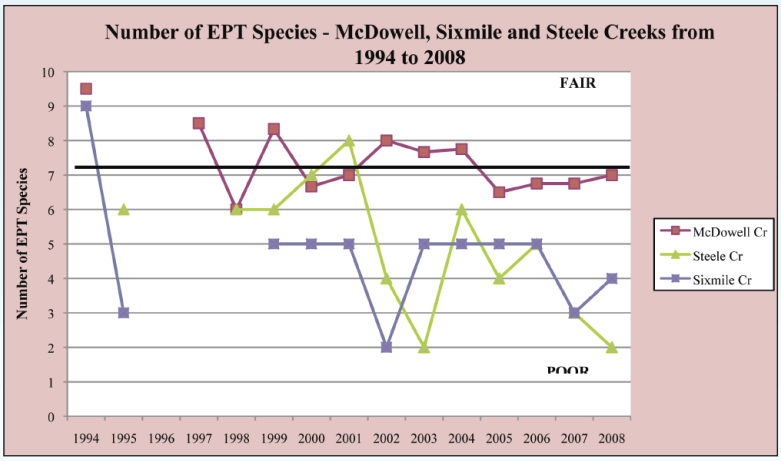


Figure 5. Number of EPT Species in McDowell, Sixmile and Steele Creeks from 1994 to 2008

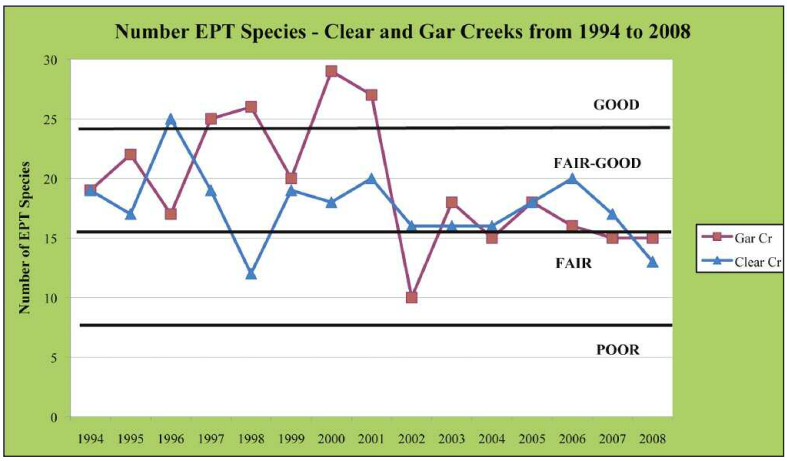


Figure 6. Number of EPT Species in Clear and Gar Creeks from 1994 to 2008.

Stream Bank Erosion in Clear Creek Downstream of I-485.

Conclusions

Storm Water Services' projects to restore sections of Charlotte-Mecklenburg's urban streams have had a positive effect on the benthic macroinvertebrate community of those streams. Streams that are experiencing significant development are showing signs of the degradation associated with watersheds with greater than 10% impervious cover. Natural events like droughts have had a significant negative impact on the benthic macroinvertebrate community and it will take several years for those streams impacted by the droughts to recover.

Trends in Lake Water Quality

By David H. Buetow, County Senior Environmental Specialist
Charlotte-Mecklenburg Storm Water Services

above Mecklenburg County Storm Water Services lake monitoring boat. **middle right** Taking field measurements with a water quality multiprobe instrument. **far right** Measuring water clarity using a Secchi disk. **at right** Pouring lake water into sample bottles.

Mecklenburg County has conducted water quality monitoring on the three Catawba lakes bordering the county (Lake Norman, Mountain Island Lake and Lake Wylie) since 1978. Currently, Charlotte-Mecklenburg Storm Water Services' Water Quality Program (WQP) has 28 sites on these three lakes that are sampled every other month.

WQP staff uses a boat to visit the sites where they measure water quality in the field and collect water samples. Field measurements include physical-chemical data such as temperature and dissolved oxygen collected using a calibrated instrument. Water clarity is also measured in the field by submerging a circular black and white disk called a Secchi disk in the water until it disappears to the eye. Water samples are either grabbed directly from the lake surface or collected at various depths using a sampler. Those samples are poured into bottles and all samples are brought back to the lab for analysis.

The data collected during routine lake monitoring are first screened for exceedances of state water quality standards, or locally established "Action" and "Watch" levels. If exceedances are found, the sites are immediately investigated to determine the cause and to fix the problem. The second major purpose of the data is to determine short-term and long-term trends in water quality. This is now done using the new Lake Use Support Index or LUSI (*see LUSI article*) which replaced Fusilier's Lake Water Quality Index (LWQI) used by Mecklenburg County for over 20 years. Since LUSI is so new, historical data for our lakes using this index are not available. As a consequence, at least for the near future, discussion of long term trends in the data will refer to the LWQI or the individual parameters themselves.

Fusiliers' Lake Water Quality Index

Fusiliers' LWQI uses scores from nine parameters: temperature, dissolved oxygen, pH, Secchi disk depth, alkalinity, nitrate, total phosphorus and chlorophyll to rate water quality from Very Poor to Excellent on a scale from 1 to 100.

Differences between Lakes

Looking back over the past 15 years

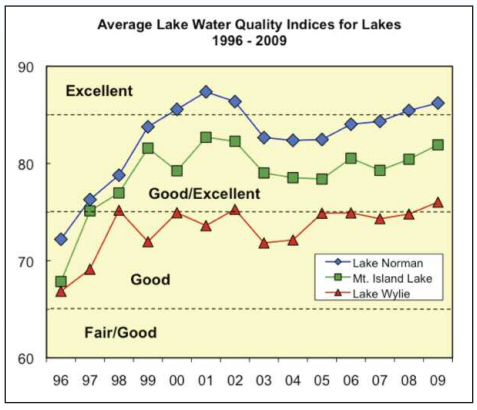


Figure 1. Historical comparison of LWQIs for Lake Norman, Mt. Island Lake and Lake Wylie.

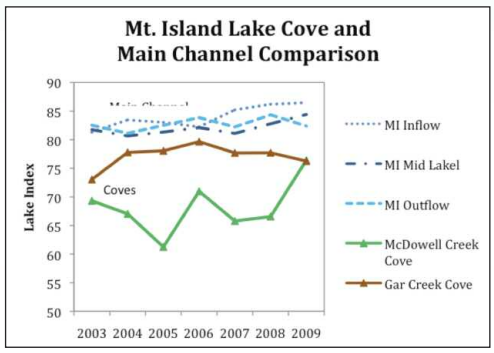


Figure 2. Differences in cove and main channel water quality for Mt. Island Lake.

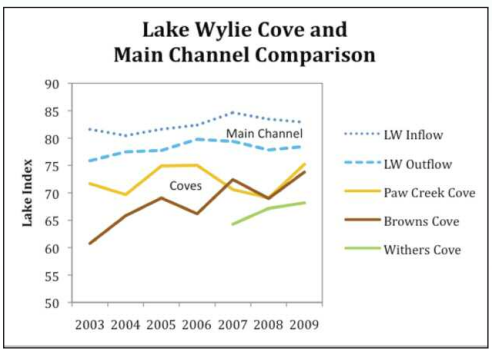


Figure 3. Differences in cove and main channel water quality for Lake Wylie.

there are obvious water quality differences between the three lakes (*see Figure 1*). Water quality in Lake Norman consistently rates the highest, Lake Wylie the lowest with Mountain Island Lake falling in between. Lake Norman generally has very good to excellent water quality due in part to the long retention time of the reservoir (>200 days). This length of time that the water sits in the reservoir allows for sediment to settle out and nutrients to be used up in the upper part of the lake. While Mountain Island Lake has a much shorter retention time (12 days), most of its water comes from Lake Norman so water quality generally rates well here as well. However, influences from McDowell and Gar Creek watersheds affect the water quality in these coves and lowers the overall average for the lake somewhat. Lake Wylie historically has lower overall water quality due to inflows from other watersheds such as the South Fork of the Catawba River as well as Long Creek and Paw Creek in Mecklenburg County.

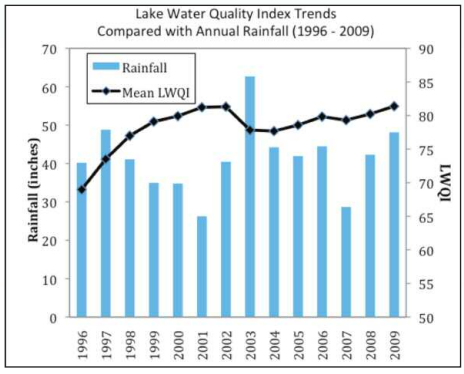


Figure 4. Lake Water Quality Indices related to average annual rainfall.

Coves

Water quality is not uniform throughout the lakes and can be quite different in sheltered bays or coves set off from the main lake. These coves generally show poorer water quality than in the main channel especially where streams enter the cove. Coves are often where pollutants such as sediment, nutrients and fecal coliform bacteria first enter the lakes from the local watersheds. A comparison of LWQI values between main stem and cove sites in Mt. Island Lake and Lake Wylie for the past seven years show how water quality rates poorer in the coves (*see Figures 2 and 3*). Looking at long term trends in the coves themselves, it appears that water quality has begun to improve in Browns Cove and has declined slightly in Gar Creek in the past few years.

Drought Effects on Long-Term Trends

Weather extremes, from excessive rainfall to extended periods of drought, have an impact on lake water quality. The relatively high LWQI values in 2001 and 2002 were likely due to a drought during that time (see Figure 4). By the late summer of 2002, lake levels were very low and local creeks were also very low or dried up completely. While droughts are generally not a good thing, the lack of rainfall meant less pollution washing off the surface of the land into creeks, then to lakes which improved the index. In 2003, local rainfall was more than double than of 2001 and lake water quality indices dropped (*see Figure 5*). This general pattern that lake water quality tends to improve during droughts and worsen in years with above-average rainfall can be seen by plotting annual LWQI values against total annual rainfall in Charlotte for a twelve year period (1997 to 2008.)(*see Figure 5*). The trend line on the graph shows LWQIs decreasing as rainfall increases.

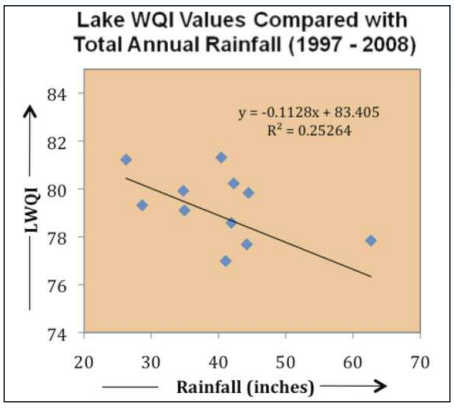


Figure 5. Correlation of LWQIs with average annual rainfall.

Fecal Coliform Bacteria

Fecal coliform bacteria is not included with Fusilier's LWQI. However, this is the parameter monitored by the WQP to determine whether or not it is safe to swim. Average and median fecal coliform data going back to 1985 were plotted to look for long-term trends. Fecal coliform levels appeared to increase in the early 1990s with consistently lower values since about 1997. While the increase in 1990 and 1991 is puzzling it does appear that fecal coliform levels in the lakes have remained consistently low for about the past 15 years. The values are well below North Carolina's state standard of 200 colonies/100 ml (*see Figure 6*).

Trends are often difficult to decipher especially over a long period of time. Factors such as excessive rainfall or drought can complicate the search for manmade pollution problems or interpretation of long term trends. However, it appears that overall water quality in Mecklenburg County's lakes has improved somewhat over the past 10 to 15 years although problems continue to be found in many coves. The WQP will continue to keep a close eye on water quality in our lakes and use the data in efforts to keep the water clean and usable for the residents of Mecklenburg County.

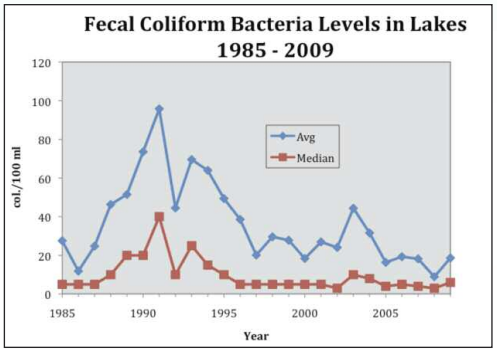


Figure 6. Historical trends of mean and median fecal coliform bacteria levels, 1985-2009.

Trends in Stream Water Quality; 1985-2009

By Jeff Price, County Environmental Analyst
Charlotte-Mecklenburg Storm Water Services

Since the 1970s, Charlotte-Mecklenburg Storm Water Services (CMSWS) has monitored stream water quality conditions throughout the City of Charlotte and Mecklenburg County using a network of long-term monitoring sites. During this time, some of the monitoring site locations may have been relocated within a watershed to accommodate changing stream conditions, development, and various programmatic needs. However, the network has been managed so that active monitoring sites continue to represent the major drainage areas of the county.

CMSWS has monitored fecal coliform bacteria, total phosphorus and turbidity at many of these long-term sites since the beginning of the program. These three analytes represented primary water quality concerns in the past and continue to be of concern today. Long term monitoring of these pollutants at fixed sites offers the opportunity to investigate changes and trends in stream water quality over time. In order to determine if observed changes or trends in the data are real, and not simply coincidental, there must be an associated test of statistical significance. The outcome of such tests is often defined simply by two terms, the p-value and R^2.

A p-value in statistics is simply the probability of drawing a false conclusion. The lower the p-value, the more likely observed trends or changes are in fact real. Typically, test results with p-values less than 0.05 are considered statistically significant. Complimentary to the p-value in statistical trending is the R^2, or the coefficient of correlation. R^2 is a measure of how well a predicted model fits the observed data. R^2 values range from 0 to 1, with 1 representing a perfect fit. Higher the R^2 values indicate a better the fit and increase the likelihood that a predicted relationship is meaningful.

Fecal Coliform

The term "fecal coliform" identifies a group of naturally occurring bacteria that are commonly found in the intestinal tracts of mammals and some birds. Fecal coliform is an indicator bacteria typically utilized to gauge the impacts affects of sanitary sewer overflows, failing septic systems, agricultural (livestock) runoff, improperly disposed pet wastes, and wildlife waste to surface waters.

Since 1985, there has been an overall decline in median baseflow (greater than 72 hours with <0.10 inches of rainfall) fecal coliform observations (*see Figure 1*) across the county-County. Year to year the observations vary considerably, however the general downward trend in values over the long-term is evident, and statistically significant (R^2 0.53, $p<0.0001$).

There has also been a corresponding decline in the percentage of fecal coliform observations, collected in a given year, that exceed the State of North Carolina standard of 400 colonies/100 ml sample (*see Figure 2*). The long-term declining trend is statistically significant (R^2 0.67, $p<0.0001$). There have been no significant short-term trends in fecal coliform evident in the last 10 years ($R^2=0.00$; $p=0.9962$).

Total Phosphorus

Total phosphorus is a quantitative measurement of a primary plant nutrient that occurs naturally in soil. As a pollutant, phosphorus contributes to algal growth in lakes and impoundments. The Piedmont of North Carolina is considered to be a phosphorus limited system, due to the low phosphorus concentrations in local soils. However, other sources of phosphorus include sanitary sewer overflows, agricultural runoff, lawns and landscaping, soil disturbance and land clearing activities.

Total phosphorus has been sampled across the Charlotte-Mecklenburg monitoring network since 1998. However, data from some years cannot be compared to accurately determine trends. From 1990-1997 the laboratory Method Detection Limit (MDL) for total phosphorus increased from 0.01 mg/l to 0.05 mg/l (*see Figure 3*). Much of the baseflow data collected during this time was reported as "<MDL", especially data collected from monitoring sites that were located upstream of the major Municipal Wastewater Treatment Plant (WWTP) discharges. Because of this laboratory quantification shift, there is no simple way to directly compare the 1990-1997 Total Phosphorus data with data from other years of record. Any data sets generated under the elevated MDL would be biased high. Therefore, it is necessary to focus only on the data years that are directly comparable.

Wastewater treatment plant (WWTP) systems remove nutrients from wastewater with relative inefficiency, especially total phosphorus. Several of the Charlotte-Mecklenburg Utilities WWTPs are currently expanding their operations to improve their nutrient removal capabilities. Because WWTP discharges are characteristically high in total phosphorus, monitoring sites located downstream must be considered separate from sites located upstream (*see Figure 4*). Based on the data collected since 2000, grouped upstream sites have significantly lower total phosphorus concentrations ($p<0.0001$) when compared to the downstream sites.

Since 2000, there appears to be a decline in the in-stream total phosphorus concentrations both upstream and downstream of WWTP discharges. This trend does not appear to be statistically significant for the upstream sites ($R^2=0.14$; $p=0.2876$) (*see Figure 5*). However, downstream of the WWTP discharges, the decrease in the in-stream total phosphorus concentration is statistically significant ($R^2=0.47$; $p=0.0285$) (*see Figure 6*).

Turbidity

In simple terms, turbidity is how cloudy or muddy the water is. From a scientific perspective, turbidity is a qualitative measurement of the light scattering effects of suspended sediment in water. In this way, turbidity can be used as a surrogate for suspended sediment and therefore used to gauge the impact of development and erosion associated with increased amounts of storm water runoff.

Since 1988, there has been a significant decline in turbidity across Mecklenburg County (*see Figure 7*). The year to year variability in observations is considerable, however the general downward trend in values over the long-term is statistically significant (R^2=0.65; p<0.0001).

There has also been a slight decline in the percentage of baseflow turbidity observations, collected in a given year, that exceed the standard set by the State of North Carolina standard of 50 NTU (*see Figure 8*). The long-term declining trend is statistically significant (R^2 0.26, p=0.0194). There have been no significant short-term trends in turbidity evident in the last 10 years (R^2=0.16; p=0.2577).

Conclusions

Since the mid-1980s, there have been significant declines in baseflow fecal coliform, total phosphorus and turbidity throughout the county. This is particularly noteworthy considering the tremendous increase in Charlotte-Mecklenburg's growth and development in the past 25 years. Simply maintaining the existing pollutant levels would have represented an accomplishment.

No significant short-term trends (10-year) were evident in fecal coliform or in turbidity; only in Total Phosphorus downstream from WWTP discharges.

The observed trends of declining pollutant concentrations are likely attributed to various programs implemented by agencies, including: North Carolina Department of Environment and Natural Resources – Division of Water Quality (DWQ), Charlotte Mecklenburg Utilities, and Charlotte-Mecklenburg Storm Water Services.

DWQ has likely contributed to the successful reduction of baseflow pollutants over time through the tightening regulatory controls on National Pollutant Discharge and Elimination System (NPDES) permitted dischargers. The City of Charlotte has an NPDES permit, as does Mecklenburg County, which includes the

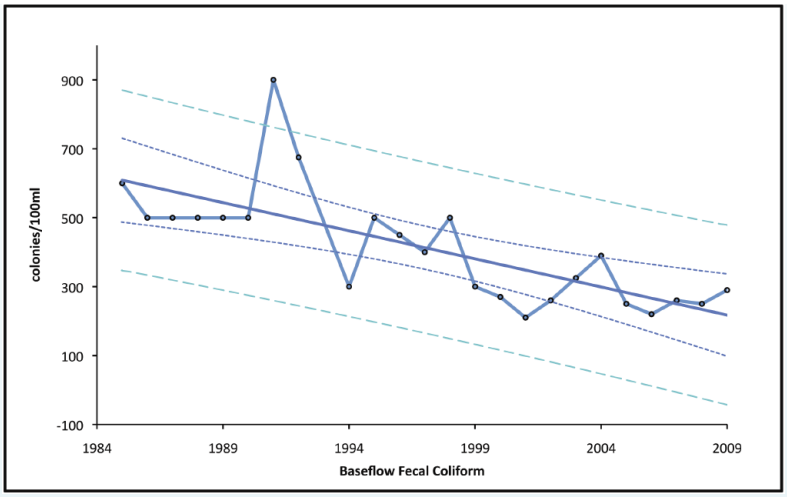


Figure 1. Decline in overall Fecal Coliform counts since 1985

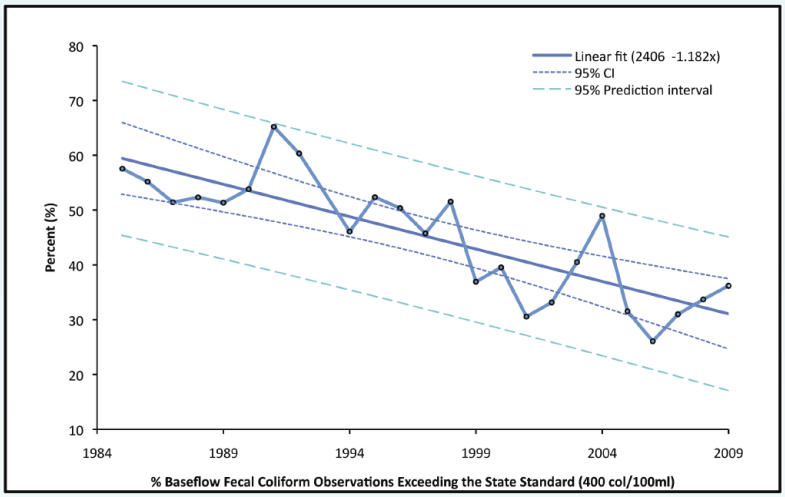


Figure 2. Decline in % Fecal Coliform observations exceeding the State standard since 1985

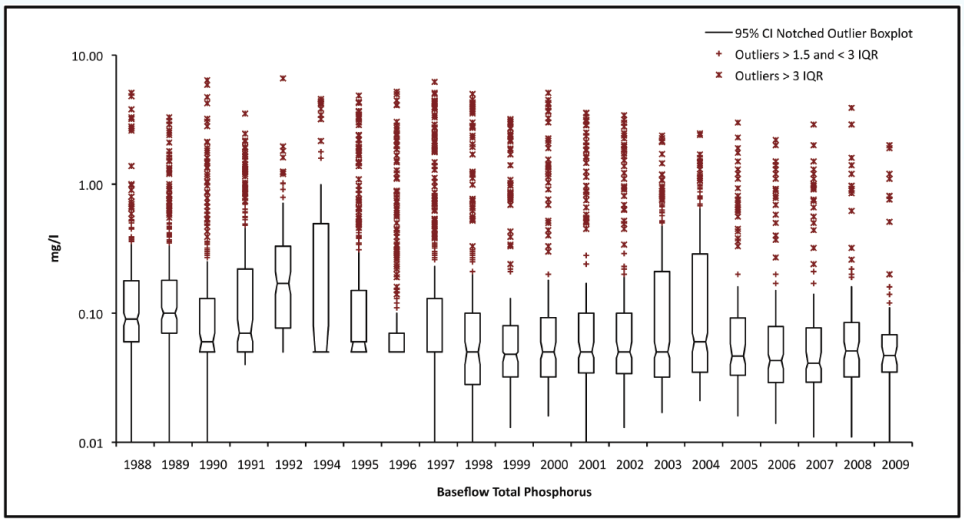


Figure 3. Baseflow Total Phosphorus levels since 1988

continued on page 58

Trends in Stream Water Quality; 1985-2009

continued

Figure 4. Comparison of baseflow Total Phosphorus levels above and below WWTP discharges since 1988

Figure 5. Baseflow Total Phosphorus levels upstream of WWTP discharges since 2000

Figure 6. Baseflow Total Phosphorus levels downstream of WWTP discharges since 2000

Figure 7. Decline in baseflow Turbidity levels since 1998

Figure 8. Decline in % baseflow Turbidity observations exceeding the State Standard since 1998

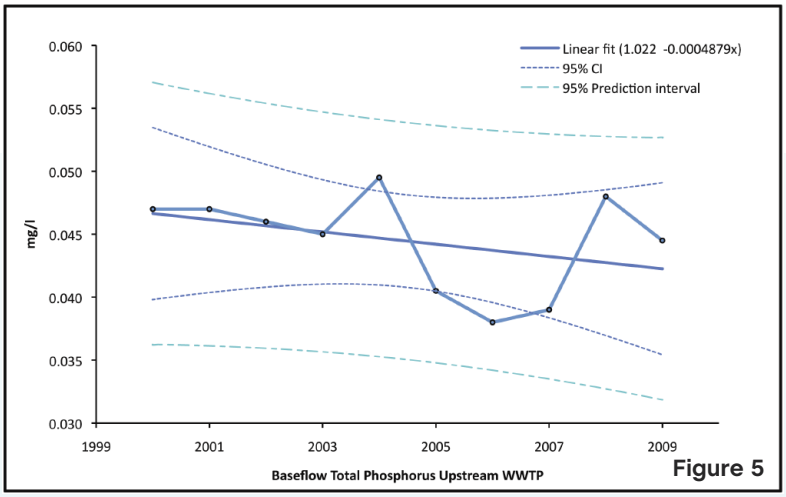


Figure 5

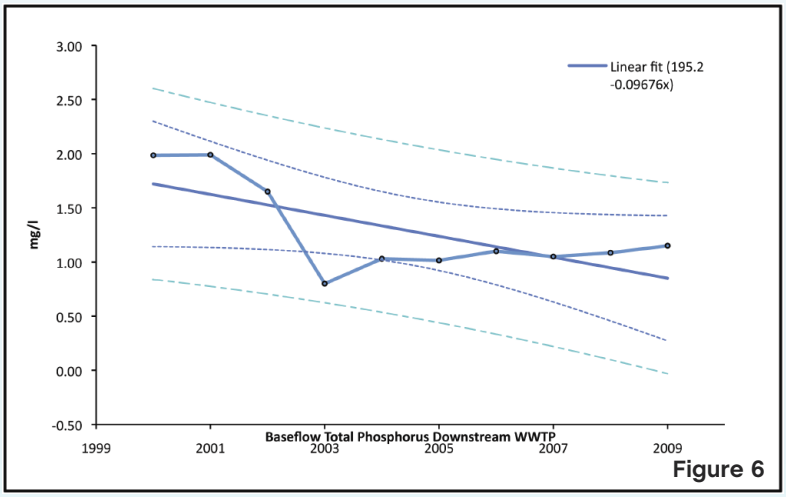


Figure 6

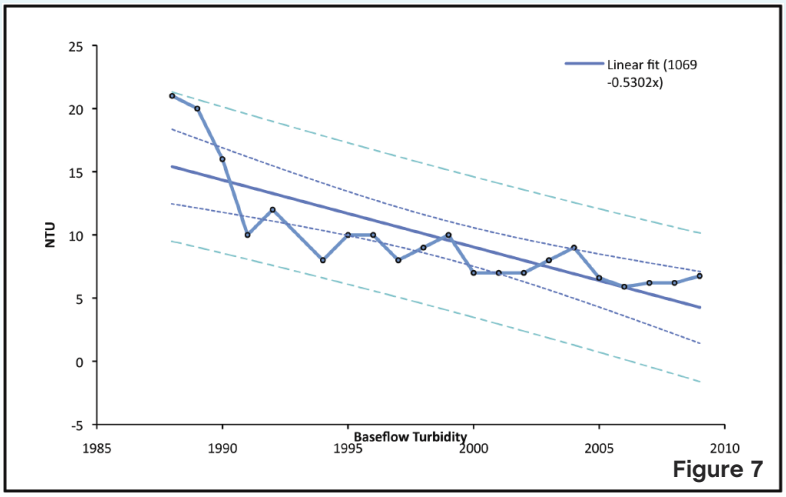


Figure 7

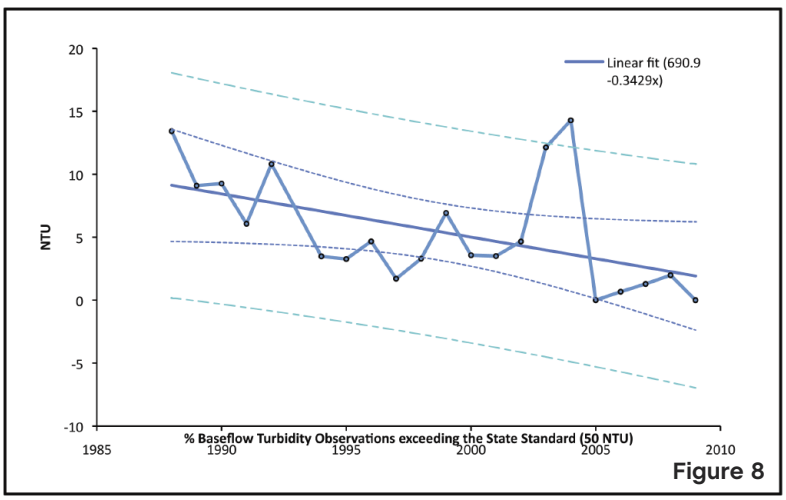
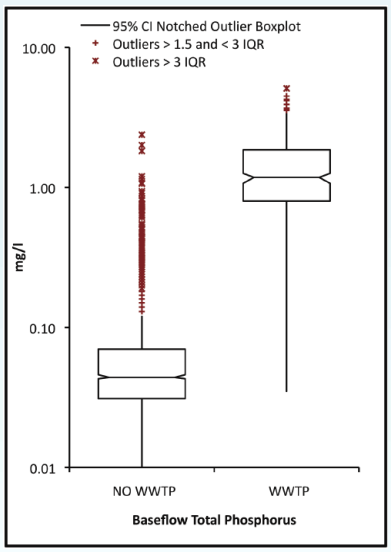


Figure 8

Figure 4



six Towns. Each permit renewal cycle opens the possibility of new or lower discharge limits on pollutants of interest. Lowering permitted discharge concentrations of pollutants to receiving streams has the potential to significantly improve in-stream water quality.

Charlotte-Mecklenburg Utilities (CMU) has undoubtedly contributed to the successful reduction of baseflow pollutants through various infrastructure expansion projects as well as improved maintenance and spill response. These impacts are not only realized below WWTP discharge points, but at all points throughout the watershed where CMU's infrastructure intersects surface water.

Finally, Charlotte-Mecklenburg Storm Water Services has implemented various programs designed specifically to identify and eliminate pollution sources. Active programs include the Illicit Discharge Detection and Elimination program, stream walks to identify piped infrastructure and dry-weather flows, erosion control and developer education programs as well as responses to citizen's Requests for Service.

Each of these agencies and programs have worked cooperatively to eliminate identified pollutant sources and to reduce overall pollutant input to Mecklenburg County's creeks and lakes. Because of continued effort, levels of key pollutants in Charlotte-Mecklenburg surface water have gone down in the past 25 years.

Lake Use Support Index (LUSI)

By David Buetow, County Senior Environmental Specialist
Charlotte-Mecklenburg Storm Water Services

How good is the water quality in Mecklenburg County lakes? Is the water quality in our lakes getting better or worse? These are some of the questions that citizens often ask about the nearby water bodies that they use and enjoy for recreation. To answer these questions accurately it is necessary to sample and test the waters in the local reservoirs.

In 1978, the Mecklenburg County Water Quality Program (WQP) began a monitoring program to test the water in the three reservoirs that border the county: Lake Norman, Mountain Island Lake and Lake Wylie. Merely collecting water quality data is not enough, however, as the data needs to be summarized and interpreted in such a way to make it understandable to the general public. One way to do this is by using an index, which can reduce a large amount of complex information down into a single number that is placed on a quality rating scale.

In 1988, the WQP lake monitoring program chose the Fusiliers' Lake Water Quality Index (LWQI) as a way to rate water quality. Additional water quality parameters were tested to calculate this nine parameter index that rated water quality from Very Poor to Excellent. Fusiliers' LWQI served the county's lake monitoring program well for over 20 years, but recently local officials decided that there was room for improvement. In particular, there were certain disadvantages to Fusiliers' as an index that made Water Quality staff decide on a change. These were:

1) The rating curves were not directly related to North Carolina water quality standards,

2) The index did not include fecal coliform bacteria, an important human health indicator of whether the lake is safe for swimming, and

3) It was impossible to achieve a rating of 100 with our detection limits for certain parameters.

In 2009, a team from Charlotte-Mecklenburg Storm Water Services' Water Quality Program began developing an index

to replace the Fusiliers' LWQI. The task was made somewhat easier because a joint city-county team had already developed a water quality rating index for streams in 2006. Based on the experience and success of using the SUSI (Stream Use Support Index), it was decided to use this index as the basis to structure a new index for lakes. Since the lake index would be similar to SUSI it was named the Lake Use Support Index or LUSI.

While some of the water quality challenges of lakes and streams are similar, there are enough differences in these water bodies that the stream index by itself was not suitable for lakes. For example, eutrophication is a major water quality concern in lakes not found in streams. Eutrophication is where nutrients such as nitrogen and phosphorus can stimulate algae growth that potentially can cause fish kills. Also, state standards for some water quality parameters are different for lakes than for streams. For example, the North Carolina turbidity standard for lakes (25 ntu) is one-half of the standard for streams (50 ntu). These differences acknowledge the reality of what is achievable in these systems and puts tighter standards on lakes where many people recreate.

Like the stream index, LUSI is primarily a pass/fail index based on whether the measured lake water quality parameters meet North Carolina standards. If these standards are met, surface water quality is considered to be supportive of its designated use, hence the name Lake Use Support Index.

Table 1. LUSI Rating Scale

LUSI Score	Narrative	Map Color
>95	Supporting +	Blue
90 – 95	Supporting	Green
70 – 89	Partially Supporting	Yellow
50 – 69	Impaired	Orange
<50	Degraded	Red

LUSI Rating Scale

Water Quality Concerns in Lakes

LUSI is based on five categories of parameters called sub-indices that Water Quality staff has determined to be most important for assessing the quality and usability of Mecklenburg County's lakes. The most important one is human health or the safety of swimming which is determined by measuring fecal coliform levels. Fecal coliform bacteria are found in the digestive tract of warm-blooded animals and are an indicator of the possible presence of organisms that cause disease.

continued on page 60

Lake Use Support Index (LUSI)

continued

Sediment discharge into a cove.

The other pollutants of concern measured by the index include sediment, nutrients and metals along with physical-chemical data collected in the field such as dissolved oxygen which shows if the waters are suitable for aquatic life.

The five sub-indices for LUSI with their associated parameters are:

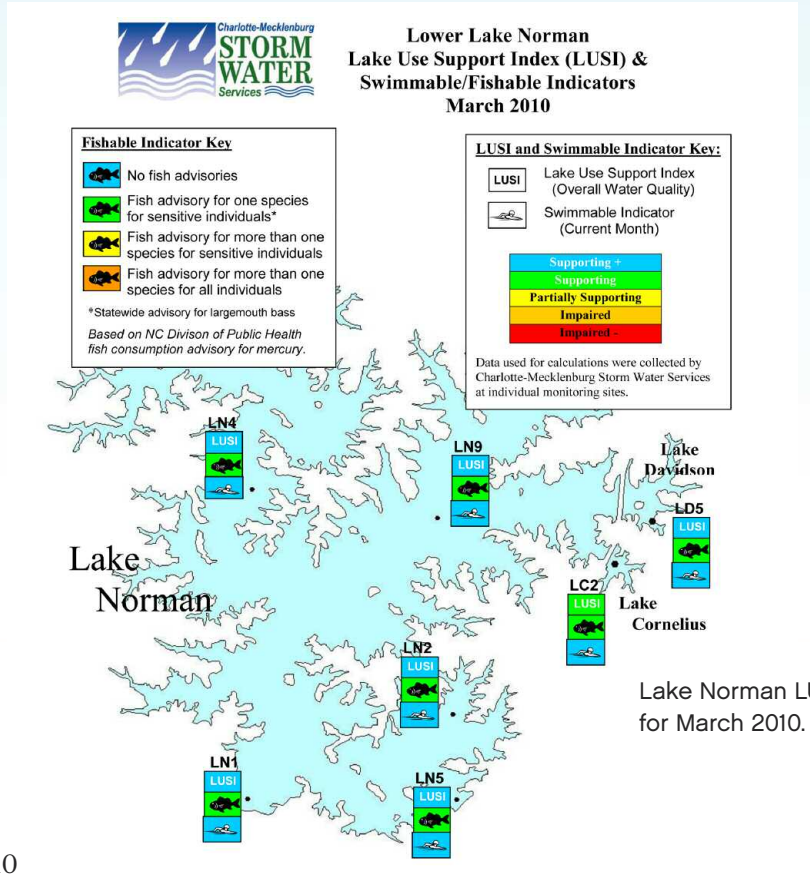
1. Human health - fecal coliform bacteria
2. Sediment - turbidity
3. Eutrophication (algae growth) - North Carolina Trophic State Index (NCTSI)
4. Physical/Chemical - field data (temperature, dissolved oxygen and pH)
5. Metals - 12 mineral and toxic metals

LUSI scores are based on data collected from six sampling events over the previous 12 months (every other month starting in July) at 28 sites in the three lakes. All LUSI sub-index scores are calculated by totaling the scores from the six sampling events and applying the rating scale described in Table 1 on page 59. If the water quality standard is met for all six sampling events the maximum LUSI sub-index score of 100 is achieved. If the standards are not met a score of 0 is assigned in most cases. In some cases, like fecal coliform bacteria and the NCTSI, there are intermediate levels with scores between 0 and 100. The five sub-index scores are combined equally to arrive at the overall LUSI score. For more details about how the index is calculated visit LUSI **http://www.charmeck.org/Departments/StormWater/Lakes/What%27s+the+WQ+of+Meck.+Co.+Lakes%3f.htm**.

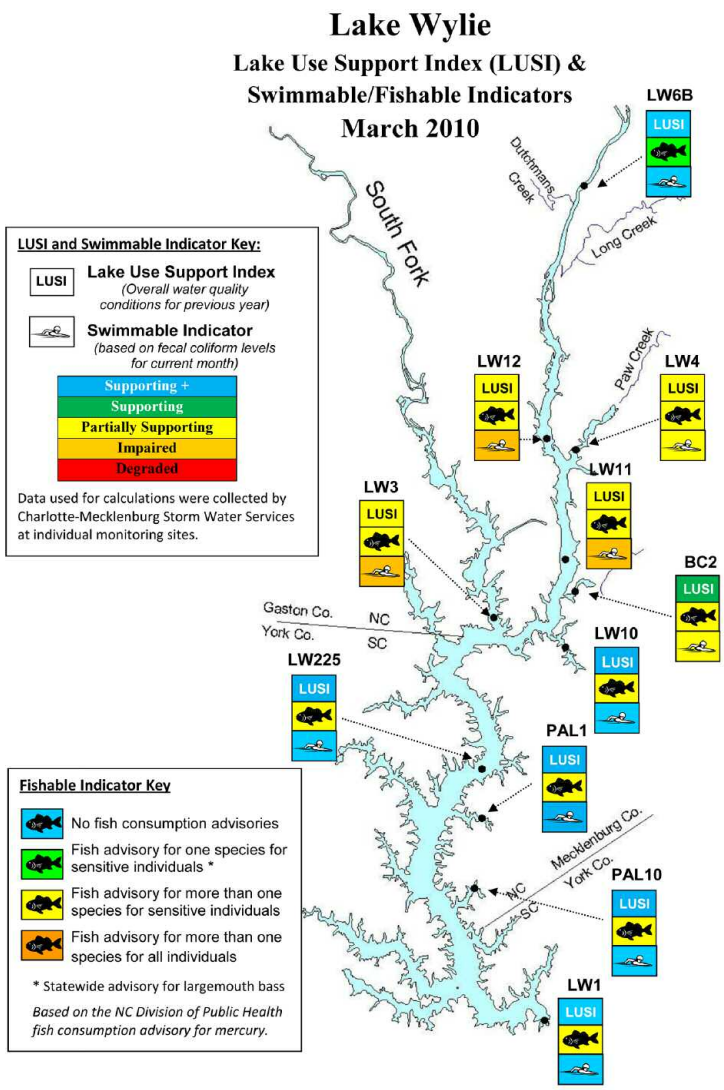
LUSI Maps

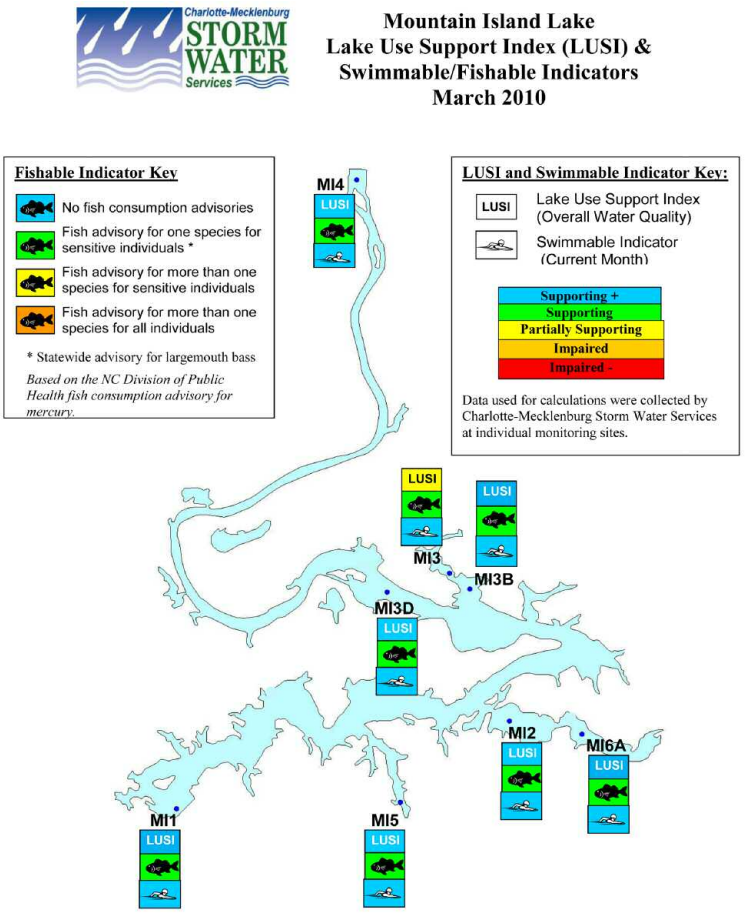
After developing the index, the team's final task was deciding how to inform the public about lake water quality. As was done with Fusiliers LWQI values, one of the primary reporting tools for the LUSI system is the use of the color coded LUSI index scores for lake monitoring sites. In addition to LUSI scores, the suitability for human consumption of fish in the lakes is now reported as a "fishable" indicator at each of the monitoring sites. This indicator is based on mercury data collected from fish tissue by the North Carolina Division of Public Health and is described on page 73. A "swimmable" indicator is also reported on the map based on bacteriological data collected by WQP for each month sampled. The figures below show recent LUSI maps for each of the three lakes.

LUSI is now the official index for the WQP lake monitoring program and becomes our newest tool in the water quality tool kit. As with any index LUSI has its limitations but the Water Quality Program staff believes it is a big step forward in efforts to track long-term trends and improve the water quality in the lakes bordering Mecklenburg County.



Lake Norman LUSI map for March 2010.





at left Lake Wylie LUSI map for March 2010.
above Mt. Island Lake LUSI map for March 2010.

It All Started When Little Sugar Creek Wasn't So Sweet

Charlotte-Mecklenburg's Water Quality Program Celebrates 40 Years of Service to a Growing Community

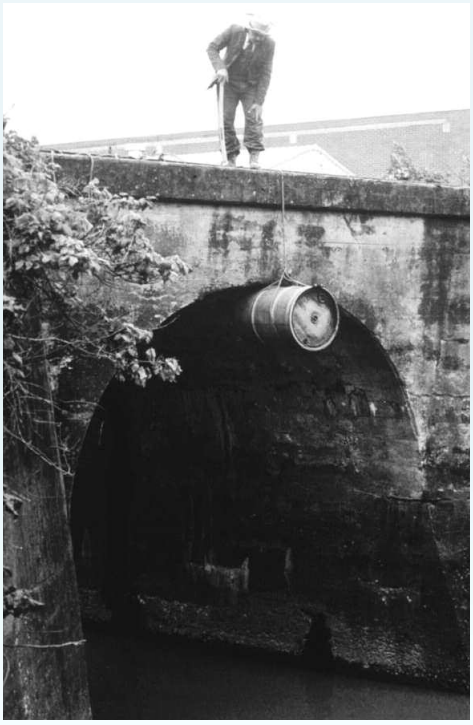
By Rusty Rozzelle, Mecklenburg County Water Quality Program Manager
Charlotte-Mecklenburg Storm Water Services

Throughout the 20th century, Mecklenburg County experienced significant population growth resulting in varying degrees of environmental degradation. The two most significant growth periods were from 1960 through 1970 and 1990 through 2000, when Mecklenburg County's population increased by 30% and 36%, respectively.

During both these growth periods, Charlotte-Mecklenburg took the initiative to implement proactive measures to address the resulting water quality degradation. In the 1960s, the most significant negative water quality impact originated from the sewer collection and treatment system serving Charlotte's inner city, which was significantly undersized and inadequately operated and maintained. As the population increased, the volume of wastewater discharged to the system exceeded its capacity. That caused sewage to spill over into nearby creeks resulting in significant water quality and nuisance problems.

The most significant of these impacts was in Little Sugar Creek running next to uptown Charlotte. In addition, during the 1960s, it was common for commercial and industrial facilities to discharge their wastewater straight to Little Sugar Creek instead of to a sewage treatment system. As a result, Little Sugar Creek was reduced to nothing more than an open sewer, reeking with odors and full of all manner of filth and vermin.

These conditions were most notable where Morehead Street crosses Little Sugar Creek near its intersection with Kings Drive. This was the location of the old Center Theater, the largest theater in Charlotte during the 1960s. Movie-goers waiting in line outside the theater were appalled at the disgusting condition of the creek, wondering how this could happen in a civilized society. Complaints poured into the offices of City and County elected officials and staff regarding the embarrassing condition of Little Sugar Creek and other inner city streams suffering from a similar plight. In response, Mecklenburg County's Health Director attempted to abate the nuisance odors by applying orange blossom deodorant to creeks using drums hanging from bridges. As could be expected, the effort had no effect and the odors and pollution problems persisted.



Drum of orange blossom deodorant hanging from bridge

By 1969, the problems had grown so severe that they attracted a great deal of media attention. Between Monday, September 15, and Thursday, September 18, 1969, the Charlotte News, (*which at that time was the largest evening newspaper in the Carolinas,*) ran a series of articles highlighting the severe water quality problems in Little Sugar Creek. The staff writer responsible for these articles was Pat Stith, who had investigated the matter for over six weeks, which included walking 19 miles from the headwaters of Little Sugar Creek to where the creeks exits Mecklenburg County into South Carolina just south of Pineville. His findings were alarming. Stith noted in his articles that scores of pipes jutted through the bank, dumping industrial pollutants and raw sewage into the creek. To determine the impacts of the pollutants on aquatic life, Stith enlisted the help of Dr. Edward Menhinick, assistant professor of biology at the University of North Carolina at Charlotte, and Wayne Chapman, fishery biologist with the N.C. Wildlife Resources Commission. For an entire day in September 1969, Stith and the two biologists attempted to collect fish at different locations in Little Sugar Creek near uptown Charlotte using a 10-foot fish net (called a "seine") and a small dip net. All they had to show for their effort was one dead frog, one live earthworm, two beer cans, and several hundred cigarette butts, but not one fish.

During their fishing expedition, they noted a strong sewer odor at several locations and a layer of sewage sludge along the creek bottom. Based on these alarming results, Dr. Menhinick and Chapman agreed that Little Sugar Creek was very badly polluted and unfit for human contact. Stith's week-long series of articles included some very telling captions such as: "Catch Any Fish In Sugar? You Can Forget About It," "A Tip: Don't Go Near the Water," "Will City, County Clean Up Sugar," and "Pollution's Cheaper Than Cleanup."

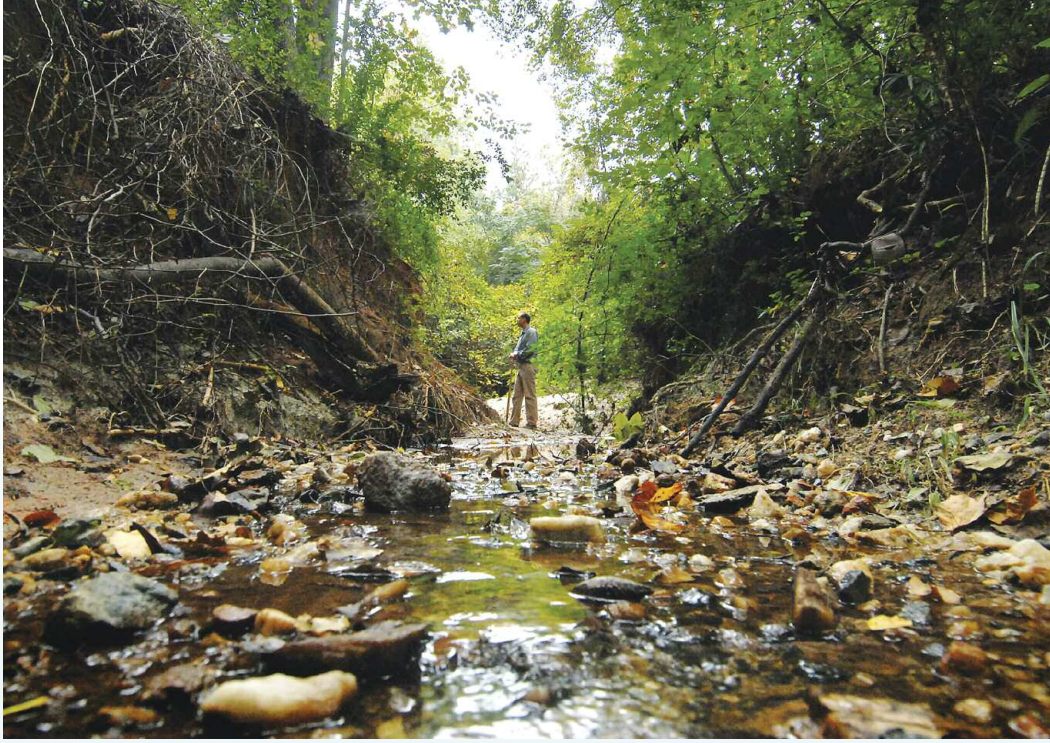
In response to the community outcry, the Mecklenburg County Board of County Commissioners (Board) requested that the Health Department propose a solution to the pollution problems plaguing Little Sugar Creek and the other inner city creeks. On September 24, 1969, in a memo to the Board, the County Health Director proposed the adoption of

new laws prohibiting the discharge of pollutants to Mecklenburg County creeks and additional staff to ensure that the laws were upheld.

The resulting Water Quality Program had a first-year price tag of $90,000, including a staff of seven and the establishment of a water quality laboratory. In November 1969, the Board approved the Health Director's proposal and by January 1, 1970 the staff had been hired and the necessary equipment obtained. The first task at hand was to walk the creeks in Mecklenburg County to identify the sources of pollution. At the top of the list was Little Sugar Creek. Within a year, a new water quality ordinance had been adopted and efforts were initiated to eliminate confirmed pollution sources and restore water quality conditions. In addition, a water quality monitoring program was established to measure the effectiveness of program activities at restoring water quality. Another significant step toward restoring inner city water quality conditions was taken in 1972 with the establishment of Charlotte-Mecklenburg Utilities, resulting in major improvements in the maintenance and operation of the City's sewer system and the elimination of numerous sewer discharges to creeks. As a result of these and other actions, hundreds of pollution problems were eliminated and water quality conditions were greatly improved in the inner city streams by the early 1980s.

Discharge of raw sewage to Little Sugar Creek in 1972

During the 1990s, Mecklenburg County experienced one of its largest increases in population focused predominantly in the suburbs around Charlotte and in the outlying Towns. The 36% population jump was matched by an estimated 35% increase in impervious cover, such as roads, parking lots and roof tops, and a corresponding decrease in tree cover and natural "green" landscapes. The increase in impervious surface led to an increase in pollutants carried to creeks and lakes in storm water runoff. The growth spurt also increased the amount of storm water runoff and the speed at which that water flows. The surge in volume and velocity of storm water runoff eroded creek channels and degraded water quality in the streams, leaving them inadequate to support aquatic life. In response, the Board adopted a creek use policy in 1997 calling for all the County's surface waters to be suitable for human contact and supportive of aquatic life.



Eroded creek channel caused by storm water runoff

This policy led to the County's Surface Water Improvement and Management or SWIM initiative that brought about countywide stream buffers and other specific actions for protecting and restoring water quality conditions. Charlotte-Mecklenburg Storm Water Services (CMSWS) was established in 1993 for the purpose of addressing negative water quality and quantity impacts associated with increased storm water flows. In 2001, the County's Water Quality Program was incorporated into CMSWS. Under the leadership of CMSWS, the City of Charlotte, Mecklenburg County and the Towns adopted local regulations in 2007 and 2008 requiring most new developments to install measures to address negative impacts associated with increased impervious cover.

Over the past 40 years, Mecklenburg County has experienced a number of improvements in water quality conditions despite a three-fold increase in population and significant increases in pollutants carried to creeks in storm water runoff from developed areas. For example, Little Sugar Creek is no longer an open sewer and the location of the old Center Theater at Morehead Street, where in 1969 the conditions in the creek were considered appalling, is now the location of a very popular greenway corridor along the creek bank. Abundant fish populations have returned to Little Sugar Creek and the other inner city streams where Stith's team of biologists found no aquatic life in 1969.

Since the mid-1980s, there have been significant declines in a number of water quality pollutants, including bacteria, total phosphorus and turbidity, demonstrating a countywide improvement in general water quality conditions when creeks are not impacted by storm water flow. However, controlling the impacts to water quality during storm water flows continues to be a major challenge and addressing this challenge will require far greater expenditures of time and money than anything experienced over the past 40 years. How well we meet this challenge will be the ultimate test of this community's resolve for protecting and restoring its precious water resources.

How the Continuous Monitoring and Alert Notification Network (CMANN) Protects Water Quality

By Olivia Edwards, County Senior Environmental Specialist
Charlotte-Mecklenburg Storm Water Services

The Continuous Monitoring and Alert Notification Network (CMANN) consists of 37 automated monitoring sites located throughout the City of Charlotte and Mecklenburg County.

Every CMANN site has a multiparameter probe submerged in the stream or lake which collects water quality data for five parameters: dissolved oxygen, pH, specific conductivity, temperature, and turbidity. The CMANN probes operate every hour, 365 days a year, providing 1.62 million data points annually. The data is stored in a data logger, which is housed on the stream bank in an enclosure box. The data is then sent via a wireless modem to a computer server, and the data is viewable on the CMANN Web site within minutes of being collected.

Charlotte-Mecklenburg Storm Water Services' Water Quality Program (WQP) staff review data for negative water quality impacts on a daily basis. If predetermined water quality thresholds are exceeded, an e-mail is sent to specific staff for the initiation of the necessary follow up activities and corrective actions. The multiparameter probes are calibrated every three weeks to ensure that data collected is of highest quality.

The purpose of the CMANN monitoring program is to evaluate water quality throughout the City of Charlotte and Mecklenburg County. The specific goals of the program include:

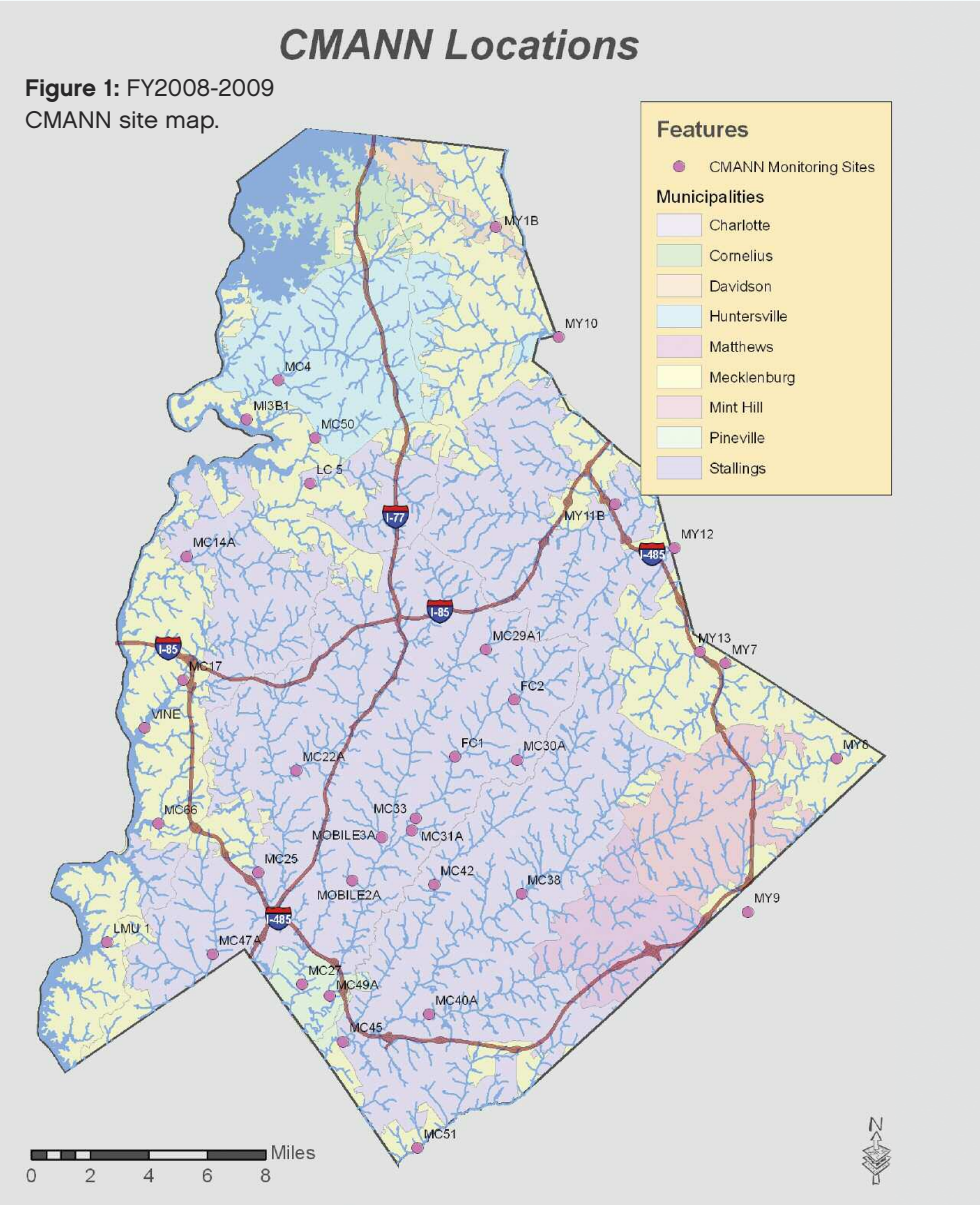


Figure 1: FY2008-2009 CMANN site map.

- Protect water quality within the monitored watersheds by quick identification and elimination of pollution sources
- Assess compliance with the Charlotte-Mecklenburg Soil Erosion and Sedimentation Control Ordinance at construction sites
- Identify illicit discharges
- To assess long-term water quality trends within the monitored watershed
- Collection of data used in the calculation of the Charlotte/Mecklenburg Stream Use Support Index (SUSI).

The automated monitoring program began in 1999, when WQP received a federal Environmental Protection Agency grant for the Surface Water Improvement and Management (SWIM) program. A portion of the grant funds were used to purchase three automated monitoring units. These units were mobile and were placed in-stream to detect illicit connections and other pollution sources. Data from these units was manually

Figure 2: CMANN site photo.

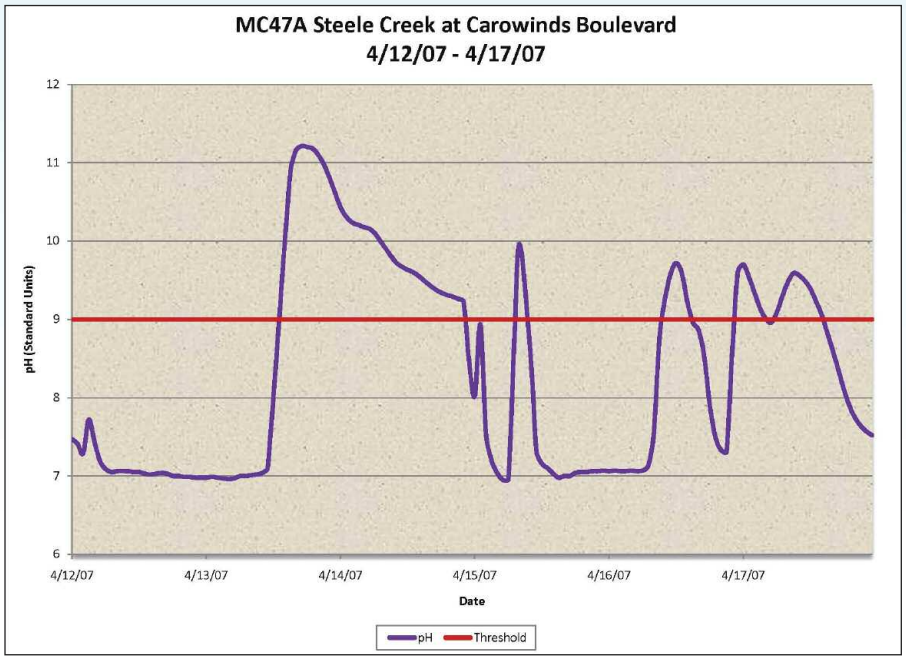
downloaded onto a laptop computer in the field a few weeks after data collection. In 2002, WQP partnered with the North Carolina Department of Transportation to monitor the I-485 construction project in the Long Creek watershed. This program was comprised of fifteen automated monitoring units that quickly identified and eliminated pollution sources originating from construction activities. Because of the success of this program, WQP partnered with Storm Water Services staff from the City of Charlotte in 2004 to create the CMANN program. During the last five years, numerous sites have been added to the program resulting in a state-of-the-art network with 37 monitoring sites.

By having access to this real-time water quality data, WQP has identified and eliminated pollution problems that otherwise might have gone undetected. One such problem occurred in April 2007. From April 13-17, 2007, a wastewater discharge occurred from a chemical distribution facility. The discharge was discovered as a result of exceedance alerts for pH received from the CMANN probe known as MC47A located in Steele Creek at Carowinds Boulevard. The State of North Carolina surface water quality standard for pH is 6.0 to 9.0 Standard Units (SU).

The first exceedance alert e-mail received was for an in-stream pH reading of 10.9 SU. WQP staff immediately conducted an investigation and isolated the discharge to a storm water outfall coming from the chemical plant draining the facility. pH readings in the outfall were documented at 12.9 SU. To note, the facility was located approximately two miles upstream of site MC47A. A State Notice of Violation with Recommendation for Enforcement was issued and an $8,500 fine was assessed. *Graph 1* illustrates a date range that encompasses data points taken before, during, and after the wastewater discharge. When the discharge began, there was a significant increase in pH. Throughout the duration of the discharge, MC47A demonstrated fluctuations in pH particularly after a rain event that occurred on April 15, 2007.

Without the CMANN unit at MC47A, this discharge would likely have continued for a prolonged period of time thus increasing the detrimental impacts to water quality. Instead, the problem was identified and eliminated quickly, and negative water quality impacts were minimized.

The public can view real-time CMANN data by accessing the Web site located at **http://www.ysieconet.com/public/WebUI/Default.aspx?hidCustomerID=75**.



Graph 1: pH data collected from site MC47A, Steele Creek at Carowinds Blvd, during a wastewater discharge from a chemical distribution facility.

Stream Use-Support Index (SUSI)

By Jeff Price, County Environmental Analyst
Charlotte-Mecklenburg Storm Water Services

An index is a communication tool that allows for the simplification of complex information. Think of the Dow Jones Industrial Average (DJIA or Dow), as an example. The DJIA is an index, based on price-weighted stock sales, reported as a single number. You may not know exactly what 10,000 means, but you know that usually a lower Dow is bad and higher is good. The obvious advantage of such an index is greatly simplified communication for a general audience. Many folks get all they need to know from one number. However, those who want to play the stock market need to dig deeper for greater understanding.

In the late 1980s, Charlotte-Mecklenburg Storm Water Services (CMSWS) identified the need to communicate simplified water quality information to other departments, elected officials, and the general public. In response, the program adopted a widely recognized index developed by the National Sanitation Foundation (NSF). The NSF index was developed in the 1970s as a management tool for Wastewater Treatment Plant (WWTP) operators, and was designed to represent receiving stream water quality.

CMSWS modified the NSF index in 1988 to increase the importance of fecal coliform bacteria and later incorporated benthic macroinvertebrate (stream biology) scores. These were early efforts to recognize local and regional water quality concerns in a customized index. The modified NSF index became known as the Water Quality Rating (WQR) index.

Over the years, CMSWS identified several shortcomings of the WQR index and eventually recognized the need for a replacement. The identified shortcomings of the WQR would eventually be used as design tenets for a new index. For example, several parameters that were included in the WQR no longer provided critical information for CMSWS use. These would be excluded from a new index and additional parameters of interest would be incorporated.

above In-stream grab sample collection **below** Qualitative stream biology sample collection **at right** Continuous automated in-stream monitoring

Parameter acceptance levels in the WQR were based on a consensus of professional judgment. Although there is merit in this approach, a new index would preferably be based on parameters that had corresponding standards from the State of North Carolina. Where no State standards exist, federal Environmental Protection Agency protocols for developing local threshold values would be followed.

The WQR represented stream dry weather (baseflow) conditions only. Therefore, the WQR was inherently biased toward low flow, cleaner conditions. In contrast, a new index would represent both baseflow and stormflow conditions. This design change was expected to result in a poorer picture of stream water quality than was previously seen in the WQR simply because stormflow conditions tend to have higher pollutant concentrations than baseflow. However, the new index would almost certainly be more representative of the "average" or typical in-stream condition.

Finally, the new index would be designed to include all of the major data

sources routinely collected by CMSWS. Data sources include in-stream grab samples for laboratory analysis, continuous automated monitoring for in-stream physical parameters, and qualitative assessments of benthic macroinvertebrates and in-stream habitat surveys. Data consolidated from various sources would provide the most comprehensive representation of in-stream water quality conditions possible.

As a result of the identified shortcomings in the WQR, CMSWS developed the Stream Use-Support Index (SUSI) in 2006. The new "use-support" index was based on surface water classifications, water quality standards established for those classifications and the designated uses of the named water bodies. Surface water classifications and designated uses are assigned to each named water body in the state by the North Carolina Division of Water Quality (DWQ). With only a few exceptions, streams in Charlotte-Mecklenburg are designated a Class C receiving waters by the DWQ. These streams are protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. For additional information concerning surface water classifications and designated uses, consult the DWQ Classifications and Standards Unit Home Page, at: **http://h2o.enr.state.nc.us/csu/index.html**.

The Stream Use-Support Index is scored monthly by watershed on a 0-100 point scale. There are narrative categorical descriptions associated with score ranges, and each categorical narrative is associated with a particular color (*see Figure 4*). This was also true for the WQR; however the SUSI scale and colors were reduced to only 4 categories. Using this structure, SUSI can be mapped, providing simple but effective water

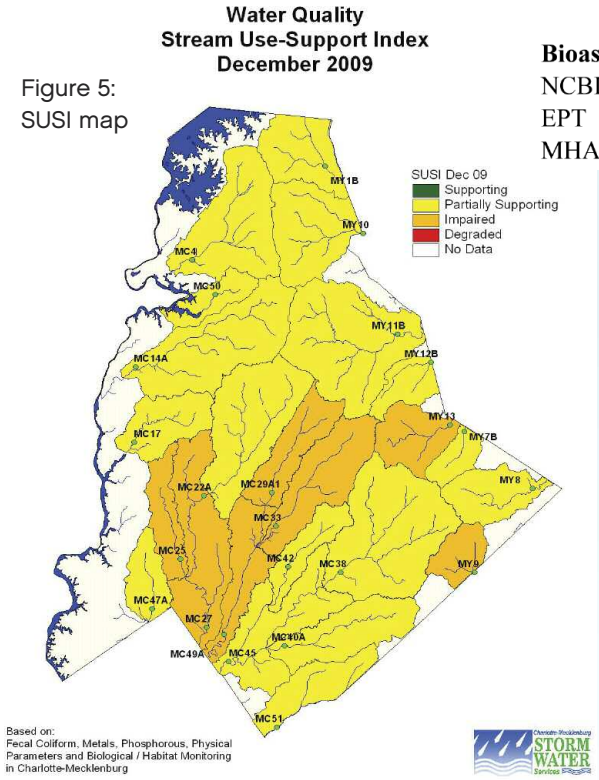
Figure 4 SUSI Rating Scale

SUSI Score	Narrative	Map Color
90 – 100	Supporting	Green
70 – 89	Partially Supporting	Yellow
50 – 69	Impaired	Orange
<50	Degraded	Red

SUSI categorical descriptions (map legend)

quality information by watershed. Looking at monthly maps in sequence can also be an effective way to see changes in water quality and trends over time.

Figure 5: SUSI map



Much like the DJIA, a SUSI score provides general water quality information at a glance, but the information conveyed may be oversimplified for some purposes. For example, many watersheds are scored as "Partially Supporting" and mapped in yellow each month (*see Figure 5*). However, watersheds in this category are not all the same and may have differing water quality impacts or stressors. One watershed coded "Partially Supporting" may be impacted by fecal coliform bacteria, whereas another may be impacted by nutrients. The SUSI scores of both may be identical, or they may vary by almost 20 points. To determine the actual stressor and the degree of impact, it is necessary to look deeper into the workings of SUSI.

SUSI sub-index parameters

Figure 6 SUSI Sub-Indices (State Standard)

Bacteria	**20%**
Fecal Coliform	(400 col/100ml)
Nutrients	**20%**
Total Phosphorus	(0.05, 0.10, 0.20 mg/l)
Metals	**20%**
Copper	(7 mg/l)
Chromium	(50 mg/l)
Lead	(25 mg/l)
Zinc	(50 mg/l)
Physical	**20%**
Temperature	(32 C)
Dissolved Oxyge	(4.0/5.0 mg/l)
pH	(6.0-9.0)
Turbidity	(50 NTU)
Bioassessment	**20%**
NCBI	(Narr)
EPT	(Narr)
MHAP	(Narr)

SUSI was built upon five categories of water quality parameters identified as most important to the Charlotte-Mecklenburg region: bacteria, nutrients, metals, physical, and bioassessment. Each of these categories may represent one or more related water quality parameters (*see Figure 6*) and each category was developed into an individual sub-index. The sub-indices are scored separately using the 0-100 scale, and combined equally (20% each) to create the overall SUSI score.

Each sub-index score is calculated monthly by watershed based on the data collected in relation to the State standard for the parameter of interest. For example, fecal coliform counts at a given site are compared to the State single-sample maximum (400 colonies/100ml sample) for a 12 month period. Based on State guidance, if ≥90% of

continued on page 68

Stream Use-Support Index (SUSI)

continued

the samples collected are in compliance, the site is considered to be "Fully Supporting" for that parameter. The bacteria, nutrients and metals sub-indices are each calculated in this manner. However, the physical parameter sub-index is based on one month of data collected 24 hours each day of that month, and the bioassessment scores for each watershed are determined annually.

Each of the five SUSI sub-indices are groups of related water quality parameters and represent an overall area of water quality concern. Therefore, the water quality stressors for a given watershed can be ascertained by simply looking at the sub-index maps (*see Figures 7-11*). The sub-index maps offer management implications for the monitored watersheds and represent the real value of SUSI.

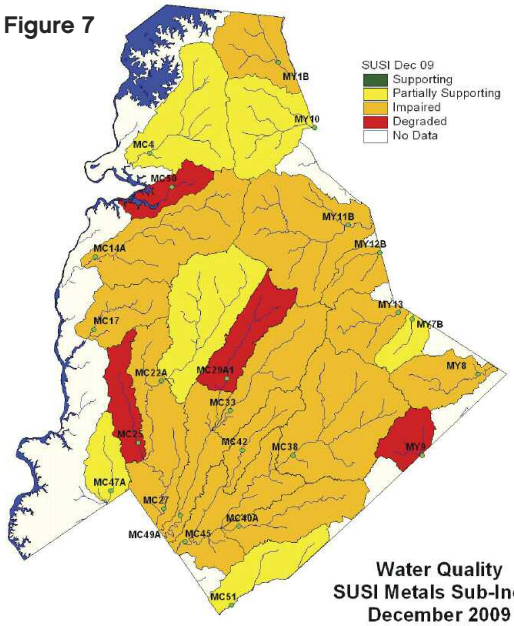
SUSI has been used in Charlotte-Mecklenburg for more than two years, and is proving to be an effective tool for presenting water quality data to elected officials, to the general public and to water quality staff. SUSI can be quickly and effectively communicated and is easily understood. SUSI represents a significant improvement over the WQR and will hopefully serve as an effective tool for evaluating and communicating water quality data for many years to come.

SUSI Maps and supporting information can be found at the following website: **http://www.charmeck.org/Departments/Storm Water/Report Pollution/StreamUse-SupportIndex.**

SUSI Score	Narrative	Map Color
90 – 100	Supporting	Green
70 – 89	Partially Supporting	Yellow
50 – 69	Impaired	Orange
<50	Degraded	Red

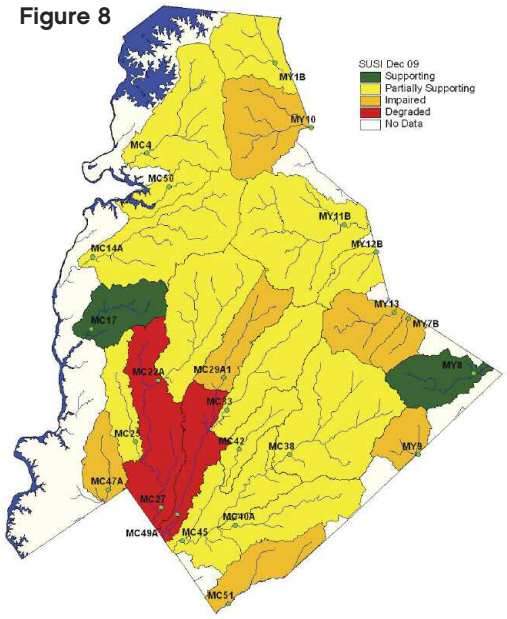
Water Quality
SUSI Fecal Coliform Sub-Index
December 2009

Figure 7



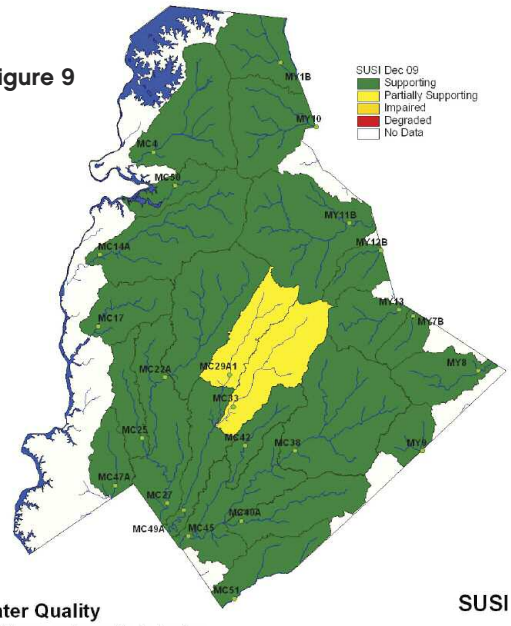
Water Quality
SUSI Phosphorous Sub-Index
December 2009

Figure 8



Water Quality
SUSI Metals Sub-Index
December 2009

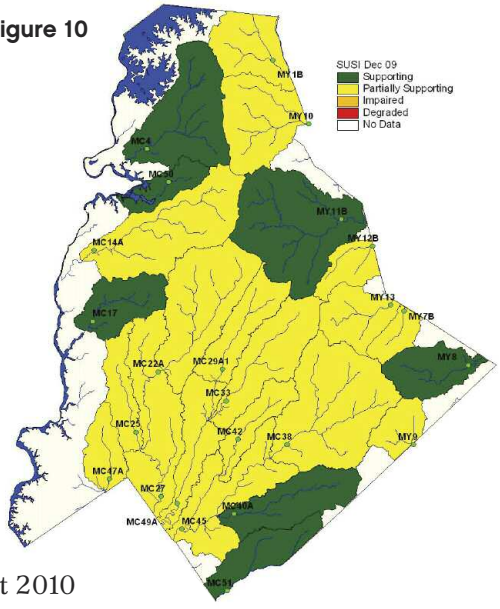
Figure 9



SUSI Figure 7. Fecal sub-index map
SUSI Figure 8. Phosphorus (nutrient) sub-index map
SUSI Figure 9. Metals sub-index map
SUSI Figure 10. Physical parameters (CMANN) sub-index map
SUSI Figure 11. Stream biology and habitat (Bioassessment) sub-index map

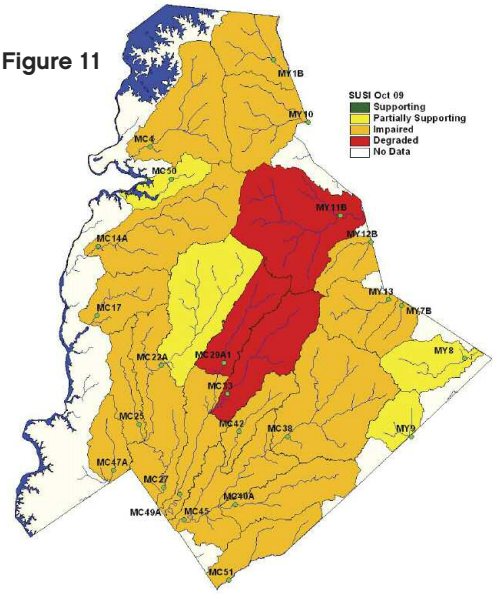
Water Quality
SUSI Physical Parameters Sub-Index
December 2009

Figure 10



Water Quality
SUSI Bioassessment Sub-Index
2008-2009

Figure 11



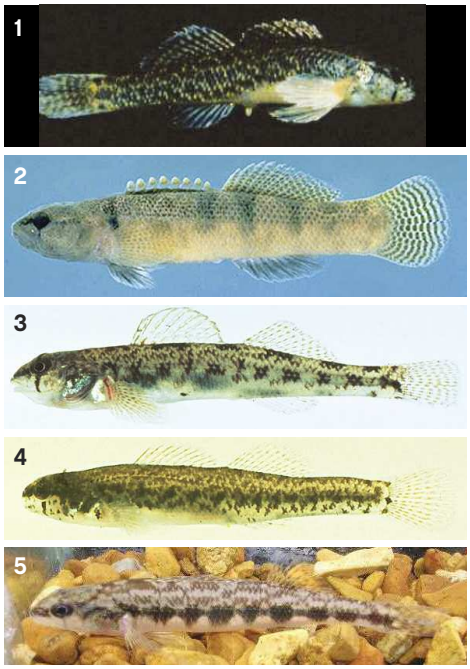
The Return of Darters to Mecklenburg County Streams

By Anthony J. Roux, County Senior Environmental Specialist
Charlotte-Mecklenburg Storm Water Services

The fish communities in Mecklenburg County streams have been studied since the mid 1950s. In 1979, Don Cloutman and Larry Olmsted, local fisheries biologists, summarized the results of the studies conducted in the 1950s, 1960s and 1970s. Forty-two species of fish were reported to have been found in Mecklenburg County streams. Urban streams like Sugar and Little Sugar Creeks had poor fish communities with low numbers of both individuals and species diversity. Only 10 species of fish were reported to have been found in the Little Sugar Creek watershed and 13 species were found in the larger Sugar Creek watershed. Cloutman and Olmsted reported that the major reason for the poor fish communities found in the urban streams was the poor water quality found in those streams. An article in the September 15, 1969 *Charlotte News* reported the results of fish sampling efforts in Little Sugar Creek conducted by Dr. Edward Menhinick. Dr. Menhinick searched the entire stream and found very few fish in Little Sugar Creek.

Read more about the 1969 newspaper article on page 62.

The fish communities in Mecklenburg County's urban streams were in poor condition in the 1970s. Fortunately, the combined efforts of Charlotte-Mecklenburg Storm Water Services and Charlotte-Mecklenburg Utilities have resulted in significant improvements in the fish communities of local streams. Forty-nine species of fish have been found in the County's streams since 1995, including seven species not reported in Mecklenburg County by Cloutman and Olmsted's report. Fish species new to Mecklenburg County streams since the 1970s include the American eel (*Anguilla rostrata*), snail bullhead (*Ameiurus brunneus*), black bullhead (*Ameiurus melas*), yellow bullhead (*Ameiurus natalis*), Piedmont darter (*Percina crassa*), swamp darter (*Etheostoma fusiforme*) and white perch (*Morone americana*).



1 Carolina Darter (Etheostoma collis), **2** Fantail Darter (Etheostoma flabellare), **3** Tessellated Darter (Etheostoma olmstedi), **4** Swamp Darter (Etheostoma fusiforme) and **5** Piedmont Darter (Percina crassa)

The total number of species found since 1995 in several urban streams, including Irwin/Sugar and Little Sugar creeks and their tributaries, showed significant increases over the species total reported in 1979. However, a number of streams that were predominantly rural prior to 1979, including Long and Fourmile creeks have shown decreases in the total number of species found since 1995. This may be due to the increased pollution from storm water runoff since 1979 because of significant development in these watersheds.

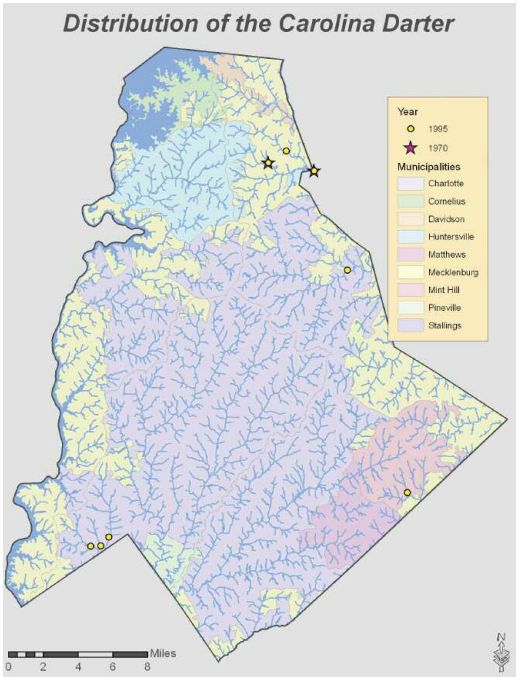
The Return of the Darters to Mecklenburg County Streams

The improvement in the Mecklenburg County stream fish communities can be illustrated by looking at the improvement in the distribution of the darters found in the County's streams. Dr. Robert E. Jenkins, Fisheries Biologist at Roanoke College in Virginia, described darters as fish that generally thrive only in streams of good quality and are useful as indicators of the health of aquatic ecosystems. Darters are small fish about two to three inches in length.

Cloutman and Olmsted reported that prior to 1979, only three species of darters were found in Mecklenburg County streams: Carolina darter (*Etheostoma collis*), fantail darter (*Etheostoma flabellare*) and Tessellated darter (*Etheostoma olmstedi*). Since 1995, two additional species of darters have been found in Mecklenburg County streams, bringing the total of local darter species to five.

Prior to 1979, the Carolina darter, a federal and North Carolina Special Concern Species, was found only in Clarke Creek near Huntersville (*Map 1*). Since 1995, the Carolina darter has been found in Clarke Creek, Steele Creek near Carowinds, Mallard Creek near UNC-Charlotte, and in Goose Creek near Mint Hill.

The fantail darter is limited to the Yadkin River Basin streams located in the eastern part



Map 1 Distribution of Etheostoma collis in Mecklenburg County, North Carolina

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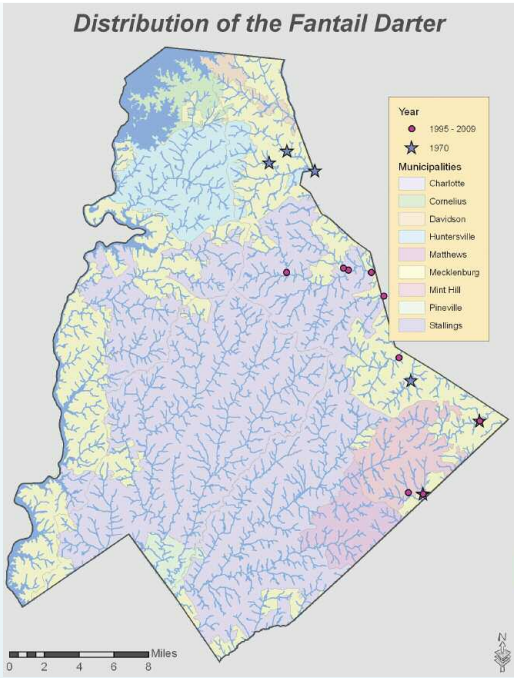
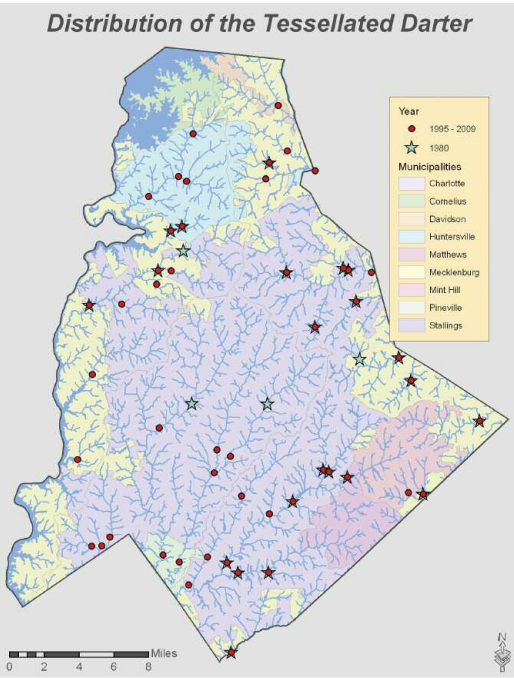
The Return of Darters to Mecklenburg County Streams

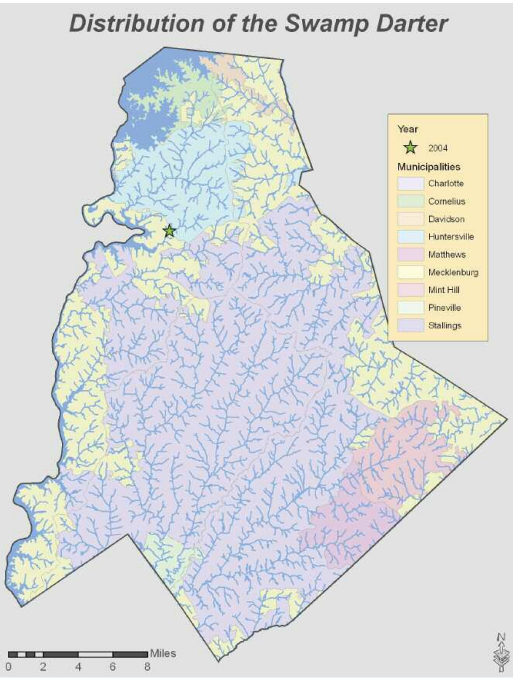
continued



Map 2 Distribution of Etheostoma flabellare in Mecklenburg County, North Carolina



Map 3 Distribution of Etheostoma olmstedi in Mecklenburg County, North Carolina

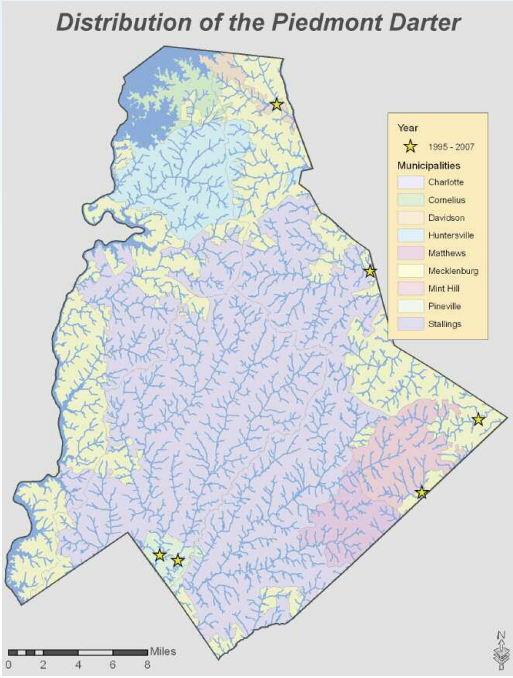


Map 4 Distribution of Etheostoma fusiforme in Mecklenburg County, North Carolina

of Mecklenburg County (*Map 2*). Prior to 1979, the Fantail darter was reported to be found in Clarke, McKee, Clear, and Goose Creeks. Since 1995, the Fantail darter has been found in Mallard, Back, Reedy, Clear, and Goose Creeks.

The Tessellated darter is the most common darter in Mecklenburg County Streams (*Map 3*). The Tessellated darter was found in nearly all of the streams prior to 1979 with the exception of McMullen, Little Sugar and Irwin/Sugar Creeks. No darters were found in these three urban streams. The Tessellated darter was first collected from Sugar Creek at NC Highway 51 west of Pineville in 2003. By 2006, it had become well established in Irwin/Sugar Creek when it was found in large numbers above the Irwin Creek Wastewater Treatment Plant. The Tessellated darter was first seen in Little Sugar Creek in 2006 and in McMullen Creek in 2007 at NC Highway 51. By 2009, the Tessellated darter had moved up Little Sugar Creek as far as Freedom Park and has been found in Briar Creek above Providence Road.

Two of the darters, the Swamp darter and the Piedmont darter, were not reported to have been found in Mecklenburg County streams prior to 1979, although the Swamp darter was commonly found in the coves of Lakes Wylie and Norman and Mountain Island Lake, reservoirs in the Catawba River adjacent to Mecklenburg County. The Swamp darter was found in Gar Creek below Beatties Ford Road in 2004. Gar Creek is a tributary to Mountain Island Lake (*Map 4*). The Swamp darter was probably a wayward individual that wandered up Gar Creek during the drought of 2002-04. The Piedmont darter, rated by the North Carolina Division of Water Quality as a *pollution intolerant* species, has been found in West Prong Rocky River and Mallard, Clear and Goose Creeks in the Yadkin River Basin (*Map 5*). By far, the most surprising collections of the Piedmont darter have been from Little Sugar Creek in 2006 and from Sugar Creek in 2007 at NC Highway 51. To find a *pollution intolerant* species in these two urban streams was quite unexpected, but was also an significant indication of the improvements made in the water quality of these urban streams.



Map 5 Distribution of Percina crassa in Mecklenburg County, North Carolina

Conclusion

The fish data collected by Charlotte-Mecklenburg Storm Water Services' Water Quality Program has shown that the water quality of Mecklenburg County streams has improved over the past 40 years. The species richness in Mecklenburg County streams has generally increased, especially in Sugar and Little Sugar Creeks

How Trees Improve Water Quality and how the Community Can Save This Dwindling Resource

By Richard Roti, Esq., Chairman, Charlotte Public Tree Fund, Inc.
rick@charlottetreefund.org

Trees, open space and other vegetated areas provide valuable ecosystem services that enhance our quality of life. For air quality these include removal of harmful air pollutants, storage and sequestration of carbon which reduces greenhouse gases, air cooling through water evaporation and shading, and oxygen production. The ecosystem services that trees provide for water quality include reduction of the velocity and volume of storm water entering our streams and lakes, absorption of pollutants contained in storm water runoff, improved infiltration of rainwater into our soil, groundwater and streams, anchoring of soil and stream banks to reduce erosion and sedimentation, shading to cool the stream network, and providing leaf litter as a food source for aquatic organisms.

Our community realizes financial, health and ecological benefits from these ecosystem services. When there is an increase in urban area and a corresponding loss of green infrastructure such as trees and open space these benefits are substantially reduced. As natural areas are replaced by roads, buildings, and other urban surfaces our community also experiences increased costs associated with trying to replicate the natural ecosystem services through expensive manmade devices. Increased costs to comply with environmental protection laws and regulations also occur.

To maximize the benefits we receive from our ecosystems and minimize these increased costs, it is necessary that we plan and manage growth such that our loss of trees and other natural assets is minimized, that we preserve and maintain our existing natural assets to the fullest extent we can, and that we plant trees in urban areas and reforest in stream buffer areas to add new canopy. If not, our stream network and the entirety of our natural ecosystem and related service benefits will continue to degrade.

A scientific study known as an Urban Ecosystem Analysis (UEA) can be undertaken to enable communities to obtain the tools necessary to quantify the benefits provided by natural area ecosystem services, to understand impacts to their green infrastructure due to urban area growth, and to plan for and manage growth in a sustainable fashion. This past February, American Forests, Inc. completed an analysis of Charlotte and Mecklenburg County, including the County's entire stream network and buffer areas thanks to major funding from the Women's Impact Fund and additional financial support from the Blumenthal Foundation, Charlotte and the County.[1]

The UEA measured land cover change from 1985 to 2008 in four land cover types (trees, open space, water and urban area) and quantified some of our community's ecosystem service benefits. The UEA report reveals the sobering fact that during this time period the County lost 33% of its tree canopy, 3% of its water, and 3% of its open space while urban area grew by 60%. The McDowell Creek watershed area, home to one of the most polluted streams in the County, lost an astonishing 44% of its tree canopy. Satellite imagery depicting these changes is shown in *Figures 1 and 2*.

As a result of these changes Mecklenburg County lost ecosystem services that:

- Removed approximately 3.8 million pounds of air pollutants annually, valued at $8.8 million per year.

- Stored 192 million pounds of carbon in trees and sequestered 1.5 million pounds of carbon annually.

- Reduced storm water runoff volume by 252 million cubic feet, valued at $504 million and removed very significant quantities of pollutants from runoff before it entered our streams and lakes.

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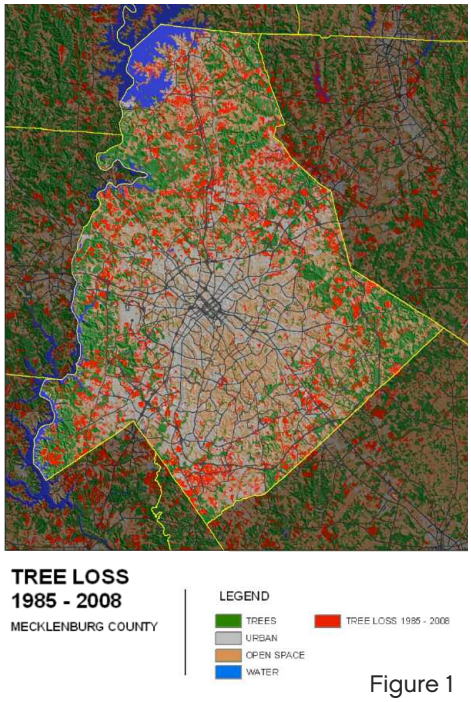

Figure 1

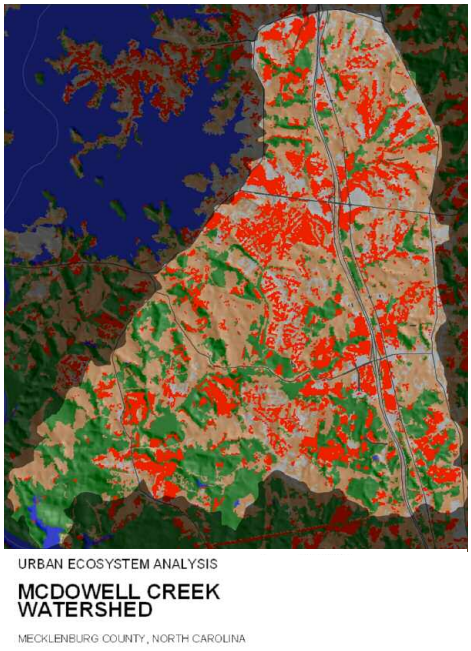

Figure 2

How Trees Improve Water Quality and how the Community Can Save This Dwindling Resource

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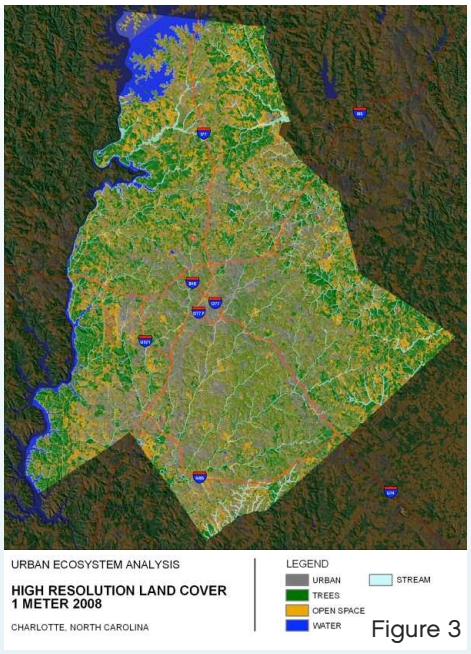


Figure 3

These changes left Mecklenburg County with land cover consisting of 50% trees, 26% open space, 5% water, and 19% urban area. High resolution aerial imagery depicting our County's land cover and stream network in 2008 is shown in Figure 3.

As the imagery shows, our County is a giant watershed, filled with nearly 3,000 miles of streams. As pointed out in the State of the Environment Report published in 2008, more than 73% of these streams have been designated by the federal Environmental Protection Agency as impaired or not meeting their designated uses due to increased land development activities.[2] This estimate is based on data contained in N.C.'s 2006 listing of impaired streams. When impacted by storm water flows, the majority of our streams are also unfit for prolonged human contact. The main cause of impairment comes from increased volumes of polluted storm water runoff from the ever increasing urban areas we develop as we grow. As the County's growth and development continues, unless the trend of tree and open space loss is altered, it may be difficult for our stream network to recover.

The good news is that we can alter this trend and strides are being made to improve the health of our streams. The Surface Water Improvement and Management (SWIM) ordinance was adopted in 1998 and the Post Construction Ordinance in 2007, both designed to protect our stream network and surface water from harmful development impacts. Programs for volunteers such as Adopt-a-Stream, Big Sweep and Creek Releaf® have been successfully launched. Adoption of tree ordinances have occurred, including a new one for Charlotte underway as this article was written. Additionally, the County has begun using the Urban Ecosystem Analysis data and CITYgreen® software to target stream buffer areas for reforestation to further enhance our water quality.

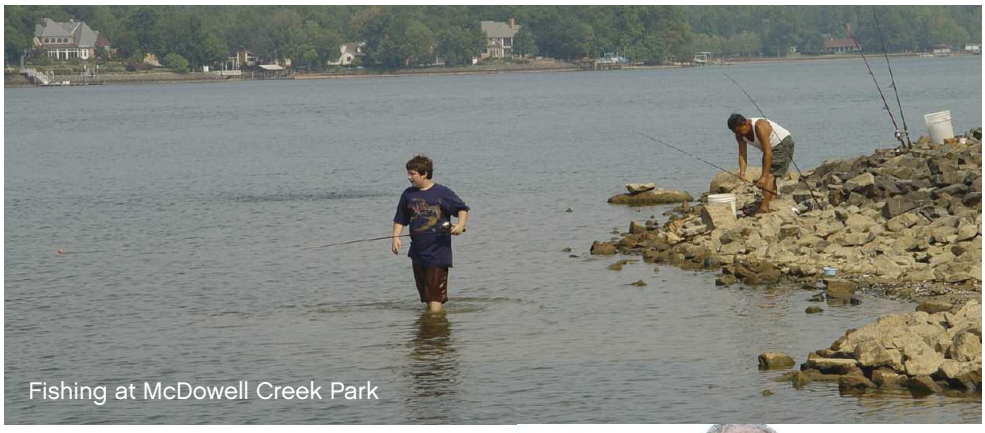
To further reverse this trend, American Forests recommends the following for Charlotte- Mecklenburg: **1)** The community should integrate the new land cover data provided by the UEA into its planning processes so that impacts from future growth and development can be anticipated and managed to preserve tree canopy wherever possible; **2)** Once integrated, additional and more detailed analysis of Mecklenburg communities' natural assets using CITYgreen® software should be completed while factoring in the community's land use plans, zoning categories, transportation plans, etc.; **3)** Guided by this additional analysis the community should establish tree canopy goals that can be attained within various zoning categories and key watershed areas; **4)** Significant efforts to both preserve and plant trees throughout Charlotte-Mecklenburg should be undertaken on a continuing basis until a suitable and sustainable level of tree canopy is assured.[3]

Protection of our natural assets and associated ecosystem services cannot be accomplished by government action alone. Protecting our water quality will require more preservation of existing trees and increased planting of additional trees all over the County until significant tree canopy can be sustained for the long term. This effort will require significant volunteer support.

[1] *The full Urban Ecosystem Analysis report can be found at www.americanforests.com/ resources/urbanforests/analysis.php*
[2] *See State of the Environment Report 2008, Surface Water section page 11 at http://www.charmeck.org/Departments/LUESA/SOER+2008.htm*
[3] *Interview with Gary Moll, Senior Vice President, Urban Forest Center, American Forests, Inc., January 11, 2010.*

Are Fish Caught in Mecklenburg County Surface Waters Safe to Eat?

By John R. McCulloch, County Water Quality Supervisor
Charlotte-Mecklenburg Storm Water Services


Fishing at McDowell Creek Park

There's nothing better than spending a the day fishing with family or friend. Whether you fish on one of the three lakes bordering Mecklenburg County or a deep hole along our 3,000 miles of free flowing streams, chances are, you can catch a mess of fish with a little know-how, patience, and some good ol' old-fashioned luck.

Fishing is a very popular pastime in our region. There are currently 857,301 active freshwater fishing licenses in the State of North Carolina of which 31,534 are issued to Mecklenburg County residents. Local fishermen occasionally contact Charlotte-Mecklenburg Storm Water Services' Water Quality Program to ask if fish they catch are "safe" to eat. In general, the answer to this question is yes. However, just as in the rest of the nation, certain fish species in North Carolina contain elevated levels of contaminants that may pose a risk to human health. The same is true for some fish species purchased at the supermarket.

The North Carolina Department of Environment and Natural Resources routinely monitors water quality and fish tissue to identify potential problems. Utilizing this data, the North Carolina Department of Health and Human Services issues fish consumption advisories as necessary to protect public health. Currently, there are no site-specific fish consumption advisories for Mecklenburg County; however, we do fall under the statewide advisory for mercury in certain fish species.


Nice catch!

Mercury occurs naturally at low levels in rock, soil, and waters throughout North Carolina. Mercury is also released to the air, water, and land when fossil fuels such as coal, oil, and natural gas are burned, as the result of forest fires, and during some manufacturing processes. The mercury that is released into the air eventually falls back to earth, either directly into surface waters or on the land surface where it later washes into surface waters during storm events. Once mercury enters the water, bacteria can change it into a form called methylmercury, which is absorbed by tiny aquatic organisms. When small fish eat these tiny organisms, the mercury begins to build up in their bodies. Larger fish then feed on the smaller fish and the mercury levels continue to increase up the food chain to potentially harmful levels through a process called bioaccumulation. Because the mercury binds to proteins in the fish's muscle tissue or meat, it cannot be removed by cleaning or cooking the fish.

When ingested, mercury primarily affects nerve cells in the brain and spinal cord and is most harmful to developing fetuses and young children. Therefore, certain population groups are more at risk from exposure to mercury. In addition, certain species of fish contain higher mercury levels resulting from their status in the food chain. The table below summarizes current advice on fish consumption based on mercury exposure risks and fish species.

In summary, fish is an excellent source of low-fat protein and other nutrients and is an important part of a healthy, balanced diet. Individuals in high risk categories should use discretion when selecting the type of fish to eat and frequency of meals including fish. Continue to enjoy the abundant surface water resources within Mecklenburg County and the fisheries they support and remember to do your part as an individual to make sure that our creeks, ponds, and lakes remain safe and clean.

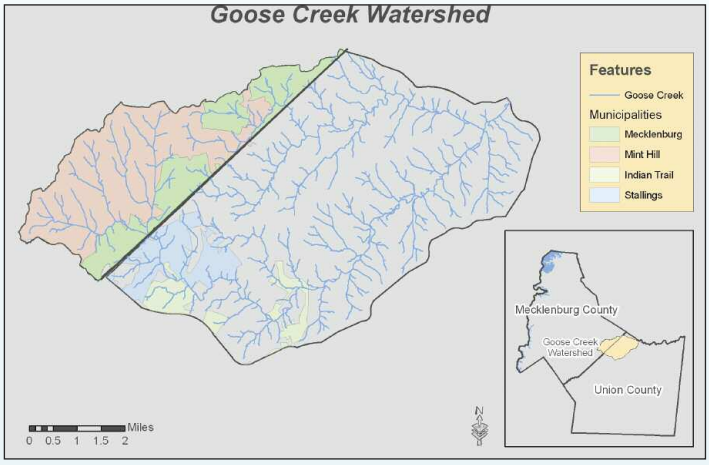
Population	Fish Low in Mercury (Bluegill/Bream)	Fish High in Mercury (Largemouth Bass, Bowfin)
Women of childbearing age, pregnant women, nursing mothers, children under age 15	Eat up to 2 meals per week	Do not eat
All other people	Eat up to 4 meals per week	Only 1 meal per week

To check on advisories for fish species not listed above including those that are purchased at the market, refer to or call **(919) 707-5900**.

A serving/meal size is 6 ounces of uncooked fish for adults and 2 ounces of uncooked fish for children under 15.

Restoring Goose Creek

By David Kroening, County Watershed Manager
Charlotte-Mecklenburg Storm Water Services



Map of the Goose Creek Watershed in Mecklenburg and Union counties.

Unhealthy segment of Goose Creek. Not the severe erosion and significant loose sediment deposits.

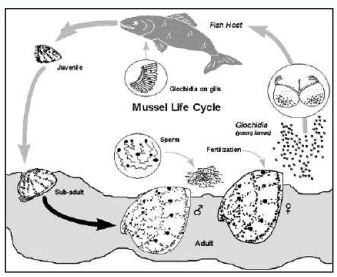
The Goose Creek Watershed is located in the Yadkin/Pee Dee River Basin in southeastern Mecklenburg County and northwestern Union County. The headwaters of the Goose Creek Watershed originate in Mecklenburg County and flow to Union County where the creek discharges to the Rocky River. The main channel of Goose Creek has a length of approximately 16.3 miles.

Stevens and Duck creeks, which originate in Mecklenburg County, are both tributaries to Goose Creek. Stevens Creek flows to Goose Creek at the Mecklenburg-Union County line west of Stevens Mill Road while Duck Creek joins Goose Creek just upstream of Brief Road in Union County. The watershed has been designated as habitat for the federally listed endangered Carolina heelsplitter mussel. This designation has brought about the implementation of a Site Specific Management Plan regulating new development in the watershed. In addition to the issues surrounding the Carolina heelsplitter, the municipalities within the watershed were required to develop a Water Quality Recovery Program for fecal coliform bacteria by the North Carolina Division of Water Quality (DWQ).

Specimen of a mature Carolina heelsplitter mussel

In response to these management issues, Charlotte-Mecklenburg Storm Water Services' Water Quality Program developed the Goose Creek Watershed Management Plan in October 2009. The plan is similar to the McDowell Creek Watershed Management Plan however it has been customized to address the specific regulatory and management needs of Goose Creek.

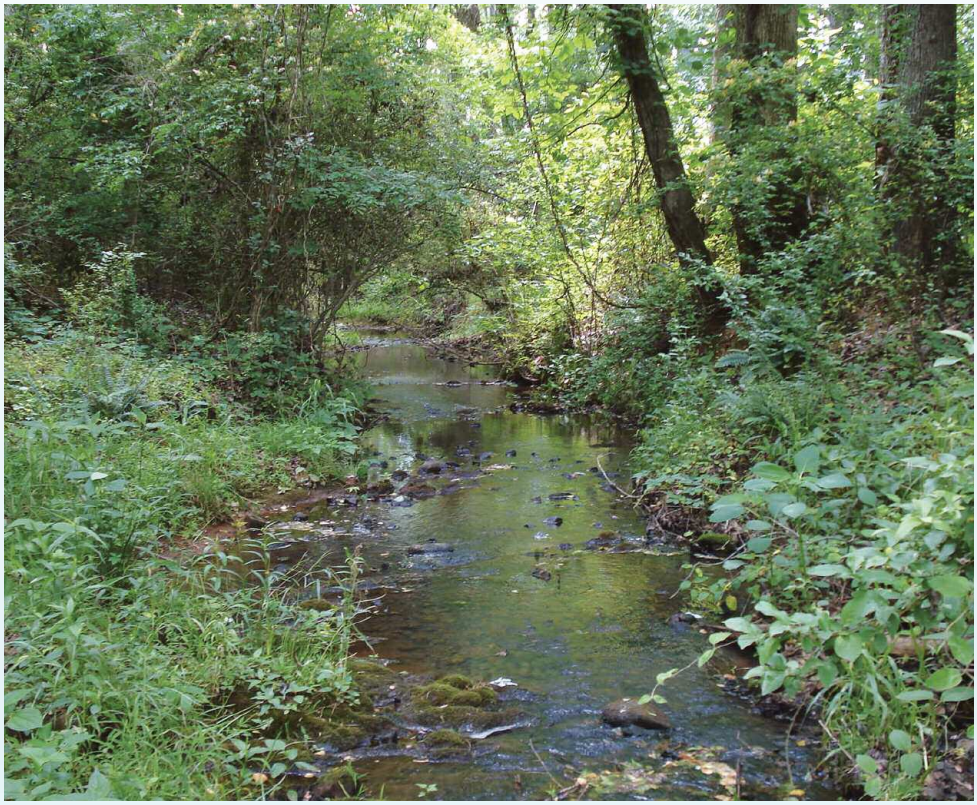
The Carolina heelsplitter is a freshwater mussel. Mussels are mollusks — soft-bodied animals enclosed by a shell. They are benthic, or bottom dwelling, anchored to the streambed by their foot. They strain out and digest decayed plants and other matter. This removes organic material from the water and prevents an unhealthy build-up of nutrients in the water. The life cycle of freshwater mussels is complex and unique. The whole process revolves around the fertilization of the female brought about by water currents.



Life cycle of the Carolina heelsplitter mussel.

After weeks later, the female releases the young larvae (*or glochidia*) which attach to a fish host. They remain attached for several weeks, getting nourishment from, but not hurting their host. The juvenile mussel then drops from the fish and if it finds suitable waters free of pollutants it will continue to develop to adulthood. Because of the complexity of the life cycle of the Carolina heelsplitter, including the need for a fish host, water quality management strategies must focus upon several key concepts: 1) because the Carolina heelsplitter is a filter feeder the water in the stream must be free from pollution, particularly ammonia and dissolved metals, such as copper or lead; 2) the heelsplitter attaches itself only to coarse bottom substrate which can be smothered by turbid water from untreated development sites; and, 3) the heelsplitter uses decaying leaf matter as a food source, which necessitates wooded buffers adjacent to the stream.

The presence of the Carolina heelsplitter and subsequent litigation brought about the implementation of the Goose Creek Site Specific Management Plan on February 1, 2009. It applies to the entire Goose Creek Watershed. The expressed purpose of the ordinance is to protect the endangered Carolina heelsplitter mussel. The ordinance places specific controls on all new develop-



Healthy segment of Goose Creek. Note the intact forested buffer and stable stream bank.

ment in the watershed including the widest stream buffers in North Carolina: 100 feet on streams outside of the 100-year floodplain and 200 feet on streams within the 100-year floodplain. It also requires storm water runoff rates be capped at pre-development levels and also requires control of sediment, which can smother heelsplitter habitat, and ammonia, which can be toxic to the heelsplitter. Furthermore, the ordinance prohibits permitting any new wastewater treatment plant discharges, which effectively requires that the wastewater from all new development be treated using septic systems.

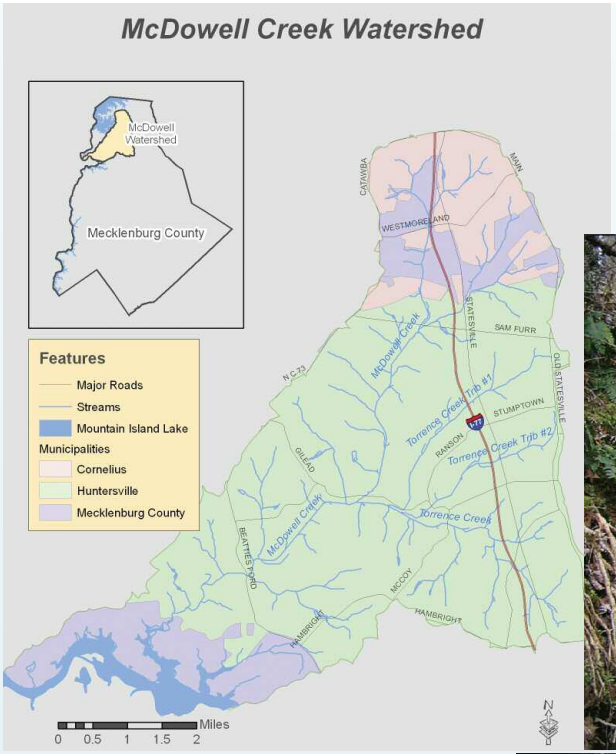
On August 10, 2006, the North Carolina Division of Water Quality (DWQ) initiated a provision in the storm water permit for Mecklenburg County and the Town of Mint Hill that they were subject to the reduction requirements in the Goose Creek Fecal Coliform TMDL. TMDL stands for Total Maximum Daily Load and limits the level of a specific pollutant in a water body so that it will meet its designated use. DWQ specified that a Water Quality Recovery Program (WQRP) be developed for fecal coliform in the Goose Creek Watershed. Subsequent to the August 10, 2006 letter the requirements for the WQRP were received on October 12, 2007. This document was used as a guide by Mecklenburg County and Mint Hill to develop a program to meet the pollutant limits identified in the TMDL and included requirements addressing sources of fecal coliform, such as storm water runoff, as well as staff and public education and specific reporting requirements. These requirements were incorporated into the Watershed Plan.

The Goose Creek Watershed Management Plan was structured to address the specific water quality concerns in Goose Creek. Three broad characteristics were assessed throughout the watershed: storm water pollution, in-stream channel degradation, and condition of the riparian buffer. The current conditions were then compared to the management objectives for the watershed and goals were assigned. Once the goals were assigned, each part of the watershed was ranked for each category and priority areas were identified. Subsequently, individual projects were compiled for each priority area that would produce the most benefit for the watershed as a whole.

Currently, several projects have been implemented and others are in the planning stages. Of particular note is a project to inspect all of the individual septic systems in the Goose Creek Watershed. Septic systems are the dominant form of wastewater disposal and treatment in that watershed, however a complete accounting of the systems was not available. Storm Water Services along with Mecklenburg County Groundwater & Wastewater Services staff initiated a program to survey all properties in the watershed for a septic system and to inspect each system. In one area of the stream with persistent fecal coliform bacteria, two septic systems were found to be failing. Upon the systems being repaired, follow-up monitoring was conducted and an 80% reduction in the in-stream bacteria levels was documented. Similarly, Storm Water Services is pursuing partnerships to implement various projects with the North Carolina Department of Transportation, the Town of Mint Hill and the Ecosystem Enhancement Program. Additionally, Storm Water Services is pursuing a cost share initiative with the North Carolina Agriculture Cost Share Program to fence cattle out of Goose Creek.

Restoring McDowell Creek

By David Kroening, County Watershed Manager
Charlotte-Mecklenburg Storm Water Services



left Map showing the location of the McDowell Creek Watershed in Mecklenburg County.
below Highly degraded and straightened stream channel.

The McDowell Creek Watershed is located in northwest Mecklenburg County and drains portions of the towns of Huntersville and Cornelius. McDowell Creek empties into Mountain Island Lake at McDowell Creek Cove, which is just upstream of a drinking water intake owned and operated by Charlotte Mecklenburg Utilities that supplies an average of 80 million gallons of drinking water a day for the citizens residents of Charlotte-Mecklenburg.

Historically, the watershed was used for agriculture and to maximize the tillable area, McDowell Creek and its tributaries were straightened and wetlands either drained or filled in. Spoils from the straightening of the creek were piled along to the stream channel, resulting in a noticeable "hump" at the top of bank. As the watershed developed, fields and forest were transformed into hard surfaces such as asphalt and rooftops. These straightened streams lined with piles of dirt were exposed to ever-increasing volumes of storm water runoff at ever-increasing velocities. This increased storm water flow easily eroded the straightened stream channel and associated spoils piles, transporting many thousands of tons of sediment downstream to McDowell Creek Cove.

Sediment deposited in McDowell Creek Cove.

Current Conditions

Historically, water samples collected from McDowell Creek do not typically exhibit high levels of pollutants found in other urban or suburban watersheds. These pollutants include parameters such as fecal coliform bacteria, nutrients and metals. These results tend to support the belief that the cause of the poor biological conditions in the watershed is not due to toxic levels of pollution but rather lack of habitat. Without these aquatic organisms, the stream is not meeting its State designated use of supporting a diverse group of aquatic organisms. Furthermore, organisms further up the food chain do not have a source of food and therefore are less plentiful than they should be. In response to the degraded conditions, several ordinances have been implemented to protect and restore the water quality conditions in McDowell Creek:

1. Watershed Protection Ordinance. This ordinance included caps on development density, requirements for stream side buffers and land-use provisions. The ordinance only applied to the most downstream portion of the watershed.

2. Surface Water Improvement and Management (SWIM) Buffer Ordinance. This ordinance required undisturbed buffers on all streams in the watershed.

3. Huntersville Water Quality Ordinance. This ordinance placed highly protective requirements on all new development and required the use of Low Impact Design (LID) practices throughout Huntersville's jurisdiction.

Stream restoration in Freedom Park.

Volunteers planting trees near McDowell Creek.

4. Post Construction Ordinance. This ordinance, which was required by the State of North Carolina, essentially reproduced the requirements of the Huntersville Water Quality Ordinance. A similar ordinance was adopted by the Town of Cornelius and all of the towns in Mecklenburg County. In recent years, post-construction ordinances took effect in all of Charlotte-Mecklenburg.

These ordinances, which have prevented further degradation of water quality conditions, have not led to improvements in the biological health of the watershed. To improve the overall water quality conditions, projects that treat previously untreated areas (also known as retrofits) must be implemented along with projects that stabilize and restore the stream channel itself. To identify the projects that needed to be completed, Charlotte-Mecklenburg Storm Water Services prepared the McDowell Creek Watershed Management Plan and the associated Capital Improvement Plan (CIP) for the McDowell Creek Watershed. The plans identified the sources of pollution and identified goals that when attained would result in a fully supporting biological community in McDowell Creek and its tributaries.

The amount of sediment in a creek is a good indicator of biological health. If as sediment loading increases beyond four pounds per acre per year, biological populations typically decline. The McDowell Plans set goals for reducing sediment levels. The sources were categorized into upland sources, or sediment washed off the surface of the land; and in-stream sources or sediment coming from the stream itself, primarily channel erosion. After the sources were categorized and assessed, a mass balance calculation was performed to better identify the relative importance of each source. The results of the assessment were that the small tributaries contributed approximately 40% of the sediment, the major creeks contributed approximately 20% of the sediment and the upland areas contributed 20%. Using this information and the aforementioned goals it was established that an 83% reduction in sediment would result in a fully supporting biological population.

A cost analysis was also prepared that compared the cost of removing sediment from the small streams, large streams, and upland areas. It was estimated to cost an average of $1.00 per pound to remove sediment from the major streams, 60 cents per pound from the smaller streams, and $6.00 per pound from the upland areas. Sediment removal in upland areas would require the use of structural engineered devices know as structural Best Management Practices (BMPs). From the cost analysis, it was clear that addressing the in-stream sources of sediment was much more cost effective than the upland areas. In addition to addressing sources of sediment, the plan also identified stream buffers for reforestation. Biological communities not only need habitat but also sources of woody debris for food, and shade to keep water temperatures cool in the summer.

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Restoring McDowell Creek

continued

Path Forward

Charlotte-Mecklenburg Storm Water Services has begun implementation of the Watershed and CIP Plans for the McDowell Creek Watershed in cooperation with the Towns of Huntersville and Cornelius. Implementation has been initiated in each of the three project areas: buffer reforestation, stream restoration, and BMP retrofit. Each of these project areas requires the cooperation of Mecklenburg County, Huntersville, Cornelius, private land owners, and homeowners associations.

Tree Planting

Mecklenburg County in cooperation with the Creek ReLeaf organization has planted more than 5,000 trees over the course of three planting events in the last three years. More than 1,000 volunteers have contributed their time to this effort.

Stream Restoration

Several stream restoration projects are nearing the construction phase in the McDowell Creek Watershed. Nearly three miles of stream in the Town of Huntersville will be restored through federal stimulus funding. Stream restoration typically includes altering the shape and path of a stream to stabilize the banks, improve vegetation and restore habitat for aquatic organisms. These activities include widening the streams, adding meanders, and alternating the stream's flow between deeper pools and areas of faster moving water. Additional restoration is ready for construction in both Cornelius and Huntersville. Several other projects are currently in the planning or easement acquisition stage.

Best Management Practice Retrofit

Since 2007 Storm Water Services has successfully implemented 15 rain gardens and two wetlands in the McDowell Creek Watershed that are designed to capture and remove pollutants from storm water runoff and encourage infiltration. This equates to 37 acres of newly treated impervious surface (parking lots/roof tops) that previously drained to McDowell Creek. A greater accomplishment is that 12 of the 15 devices are on private commercial properties who donated 153 parking spaces for the benefit of water quality improvement. In addition, new design techniques were utilized and will be monitored for improvements/cost savings regarding future projects and ordinances. All associated projects were funded in partnerships through state and federal grants of $700,000 with Mecklenburg County match of $500,000.

top Rain garden near Lowe's in Huntersville. **at left** Rain garden at Mecklenburg County Solid Waste facility in Huntersville.

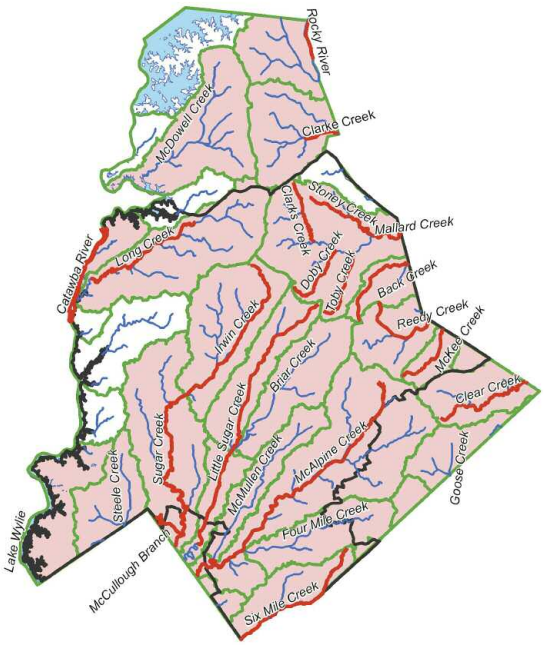
What is the Post Construction Controls Ordinance and Why Do We Need It?

By Mike MacIntyre, P.E., City Senior Project Manager, Charlotte-Mecklenburg Storm Water Services
Daryl Hammock, P.E., City Water Quality and Environmental Permitting Manager, Charlotte-Mecklenburg Storm Water Services
Rusty Rozzelle, Mecklenburg County Water Quality Program Manager, Charlotte-Mecklenburg Storm Water Services

Mecklenburg County, the City of Charlotte, and the six incorporated towns are required by federal and state laws to have Post Construction programs to address pollution contained in storm water runoff from new development and redevelopment projects. Post Construction programs are needed because land development and urbanization result in an increase of impervious or hardened surfaces, which causes an increase in the volume and velocity of storm water runoff entering surface waters.

In Mecklenburg County, even with our relatively impermeable clay soils, an inch of rainfall on an acre of forest does not generate any storm water runoff. Instead, the rainwater is absorbed into the soil and taken up by plants or provides recharge to groundwater. If the trees are removed and replaced with one acre of impervious asphalt, a total of 27,000 gallons of storm water runoff is generated from the same inch of rainfall. In addition, this runoff typically enters surface water through the piped storm drainage system instead of flowing over the land. As the amount of storm water increases, it flows faster. This increased volume and velocity of storm water runoff entering streams causes their banks to erode. The sediment and silt degrades water quality and destroys aquatic habitat. In Mecklenburg County, streams degraded in such a manner are commonplace in urbanizing areas.

The increase in developed land in Mecklenburg County has also resulted in an increase of pollutants in storm water runoff such as oil, antifreeze, metals from tires and brake pads, pesticides, fertilizers and a variety of other chemicals. These sources of pollution are called non-point sources because there is not one specific location that is the cause of the pollution.



Streams shown in red are considered by the state to be impaired by pollution. Areas in pink are developed areas that contribute to this impairment.

The combined effects of increased non-point source pollution, decreased natural ground cover, and increased stream erosion have resulted in significant degradation of surface water resources in Mecklenburg County. Almost all of Mecklenburg County drains to a stream that is listed on the State's list of impaired streams. Storm water runoff is listed as the primary source of this impairment.

Elected officials in Mecklenburg County, the City of Charlotte, and the six incorporated towns cast their vision for environmental stewardship by adopting ordinances that not only meet the state-minimum Post Construction requirements, but also address pending regulatory mandates and flooding. As part of its Environmental Focus Area, the City of Charlotte has committed itself to "become a national leader in environmental initiatives to preserve our natural resources while balancing growth with sound fiscal policy." The city will do this by taking "a proactive leadership role in modeling best practices for its citizens. The city recognizes that conscientious environmental stewardship and concern for the public interest requires more than meeting mandates and minimum

Years after this west Charlotte parking lot was built, rain gardens were added. These devices filter pollution from storm water runoff to help meet federal regulations.

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What is the Post Construction Controls Ordinance and Why Do We Need It?

continued

standards." As part of the Mecklenburg County's Environmental Leadership Policy statement, the future and existing resources of the County should be used "wisely for the benefit of the citizens."

Rather than developing ordinances to meet only the minimum state requirements, local surface water quality needs were evaluated to determine if multiple goals could be met through development of a post construction program. The following goals were developed during a public stakeholder involvement process:

• Meet the requirements of federal and state laws.

• Address impacts to aquatic life and water quality in watersheds with endangered species.

• Minimize additional impaired stream listings, which are streams classified by the EPA as not meeting their intended uses.

• Address detention to reduce flooding.

Through the process, it was determined that meeting the minimum requirements would not improve impaired streams enough to meet water quality regulatory requirements, nor address flooding. Because existing impervious cover creates many of our storm water problems, it was also decided that the ordinance would apply to sites being redeveloped, not just new development. Some jurisdictions in NC are now being required to install storm water controls on existing development to meet new regulatory requirements. Local ordinances, by gradually reversing the historic storm water impacts as sites redevelop, proactively allow redeveloped areas to become compliant with new standards, and ultimately save future public expense when restoration becomes mandatory. In a statement within the City's Environmental Focus Area: "By always being conscious of the need to meet regulatory compliance standards and the needs of future generations, the City will avoid costly remedial action."

top New developments use bioretention areas, or "rain gardens," to detain, clean, and slowly release runoff. The result is cleaner water and reduced flood risks.
above This publicly funded retrofit in Charlotte is an attractive amenity that helps reduce water pollution.

The entire community benefits because of additional aspects of the Post Construction programs across Mecklenburg County. The City of Charlotte has a policy to take over functional maintenance of water quality structures in residential neighborhoods. This is to ensure that the storm water management devices continue to serve their intended function without being a burden on neighborhood associations. There are also various mitigation options written into the ordinances, such as off-site mitigation options, fee-in-lieu options, and provisions for other design standards in transit station areas and distressed business areas in the City of Charlotte. These mitigation options help control the costs of compliance for qualifying sites, thereby encouraging redevelopment in these areas and complementing related City goals.

Much has been said about the costs of this type of local regulation and its effect on economic development and home sales, as well as comparisons to towns across the state that adopted regulatory minimums. A strong argument can be made that this ordinance is preferred not only environmentally, but also economically. Each year the City and County spend millions of dollars of storm water fee revenue to correct the environmental damage of urbanization that occurred without protective measures in place. These watershed rehabilitation programs are needed to meet ever-increasing regulatory pressures, and to recover the full use of our streams and lakes. Without adequate programs in place, the costly trend of damage repair will continue. The result will be raising storm water fees to address mandates, fewer creeks that are adequate to fish and swim in, and a lowered quality of life for our citizens. The Post Construction programs to manage storm water are a proactive approach by elected leaders to balance growth with both strong fiscal policy and changing water quality regulations. This balance protects and improves the quality of life for all residents of Charlotte-Mecklenburg.

Easy as One, Two, Three

How You Can Improve Water Quality

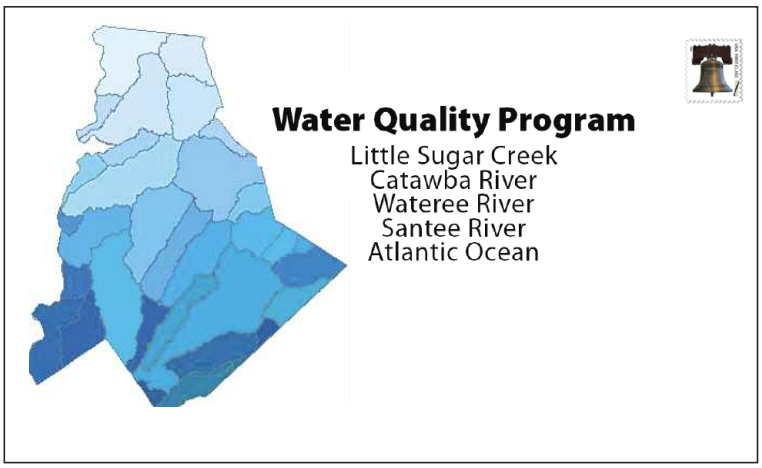
By Erin Oliverio, County Water Quality Educator
Charlotte-Mecklenburg Storm Water Services

1

Find your watershed address

Do you know what watershed you live in? With nearly 3,000 miles of creeks in Mecklenburg County your home is closer to a creek then you might think. What you and those around you do on the land impacts the quality of our water. To understand how easily we can affect our water, it is helpful to understand how water collects. Water runs downhill and drains into creeks, lakes, and rivers. The area of land that all drains to one point is known as a watershed. Watersheds are the places we call home, where we work and where we play.

What does that have to do with you? It means stopping pollution before it begins in your own backyard.



2

Change one behavior that affects water quality.

How could what you do in your yard affect water quality? At any point along its journey rain or runoff can be contaminated by everyday activities. Consider your daily habits and choose one that you could change to protect water quality.

- How do you maintain your lawn and garden?
- Do you change your own oil in your car?
- How do you dispose of cooking grease?
- How many pets do you have and where is their waste deposited?

Yard Care
- Soil test before applying fertilizers and lime
- Call **704-336-2455** to request a free soil test kit

Car Care
- Collect used oil in a reusable, resealable container
- Take used oil and filters to a recycling center
- Visit **www.wipeoutwaste.com** for a location near you

Grease
- Freeze animal fats in a can and dispose of in a trash receptacle
- Mix liquid vegetable fats with an absorbent material, such as cat litter or coffee grounds, and place in a lidded container and dispose of in a trash receptacle

Pet Waste
- Pick up after your pet every single time
- Throw away pet waste in the garbage; never wash it into the gutter or storm drain

Once you have made a change in a daily habit, consider taking a leap to volunteer your time to protect local creeks and lakes.

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How You Can Improve Water Quality

continued

3

Get Your Hands Dirty

Citizen involvement is an integral part of our program; one Storm Water Services could not do without. With so many creeks and lake shorelines in Mecklenburg County, we rely on citizens to be our eyes in the field. Storm Water Services has six volunteer programs available to citizens, offering opportunities to make a long term commitment to your neighborhood creek. Volunteer a couple of hours a year or simply take the time to report unusual stream conditions. Whichever you choose, your actions are helping to protect our region's most valuable natural resource.

The newly established **Creek ReLeaf** Program is a collaborative effort of Charlotte-Mecklenburg Storm Water Services, Charlotte Public Tree Fund, the Center for Sustainability at Central Piedmont Community College, and the Sierra Club Central Piedmont Group to plant trees in floodplain and stream buffers of Mecklenburg County. In the past two years, over 800 volunteers have planted 5,000 tree seedlings in the McDowell Creek floodplain in Huntersville.

Find out how you can participate in the 2010 tree planting by visiting **www.creekreleaf.com**.

Big Sweep is another one day event that encourages wide scale participation. On the first Saturday of October each year volunteers spend four hours pulling trash out of local waterways. Big Sweepers cleaned sections of six local creeks and miles of Mecklenburg shoreline of Mountain Island Lake in 2009. They removed over 7 tons of trash, including 39 tires, 1 refrigerator, 7 shopping carts, and 1 TV.

In its pilot stage, volunteer monitoring began in 2009. This program includes the collection of qualitative and quantitative water quality data by volunteer groups at specific stream segments to monitor and assess local stream health. To date, this program has three groups participating, and is taking off very well. Local schools are very interested in the program, and those involved plan to have a panel of students present their results to Water Quality staff at the end of the school year.

In 2009, volunteers completed 119 clean-ups removing over 20,000 pounds of trash from local waterways.

The **Adopt-a-Stream Program** is Storm Water Services' longest running volunteer program. Since 1989, volunteers have been getting in the creeks to remove the most visible type of water pollution, trash! Individuals, families, organized groups, schools, businesses and industry "adopt" their favorite stream sections and are responsible for walking these sections a minimum of two times a year. The Adopt-A-Stream program has become a major community education and involvement activity and has proven to be tremendously effective at protecting and improving the water quality and aesthetic conditions of Charlotte's streams.

The **Storm Drain Marking Program** is a reMARKably easy way for residents of all ages to get directly involved in reducing the amount of pollution in our streams and lakes. Volunteers receive a kit with markers, instructions and all the supplies needed to mark the storm drains in their neighborhood with the message of "Do Not Dump, Drains to Creek." While it won't solve all our water pollution problems alone, the highly visible marker is a practical and easy first step toward public education and active involvement in storm water pollution prevention. **In 2009 volunteers marked over 2,500 drains!**

Storm Water Services relies on citizens to alert us of unusual conditions in our creeks and lakes. Most of you live near a creek or drive past one every day on your way to work. Be a Water Watcher. If you notice a strange odor or color in the creek, you can call 311 to alert of us of the problem. A staff member will go investigate your complaint and find the source of the pollution.

To find out more about each of the above programs, visit **http://stormwater.charmeck.org** and click on Volunteer.

Mecklenburg County
North Carolina

Land

Land Key Findings and Recommendations

By Michael Kirschman, Division Director Nature Preserves and Natural Resources
Mecklenburg County Park and Recreation

Key Findings

• There is strong public support for open space preservation and parkland acquisition. During a declining economy in 2008, the public passed a $250 million park and recreation bond issue, the largest ever. Of the $250M, $60M is earmarked for land acquisition. This public approval followed a $35.6M land bond issue in 2007. In fact, the past four Park & Bond issues going back to the year 1999 have all passed with a majority vote ranging from 62-69%, regardless of economic climate or other social issues. This indicates strong and lasting public support for open space and recreational issues in our community.

• The public uses our parks, greenways, and nature preserves at a high rate. Results from a 2008 study found 76% of residents used a county park that year. This is above the national average of 72%.

• Our parks are well-maintained. Of the residents that visited a park in 2008, 90% of them rated them as either excellent or good. Over 60% of residents do not feel there is sufficient parks and green space within walking distance of their homes.

• The three actions that over 55% of respondents were very supportive of include: developing new walking/biking trails and connecting existing trails, using floodplain greenways to develop trails and amenities, and purchasing land to preserve open space.

• Although there is strong public support for open space preservation, Mecklenburg County continues to lag other cities of comparable population and density. The 2008 Trust for Public Lands survey reveals the total parkland as percent of city land area for Mecklenburg County to be only 5.3%. The national average for cities of similar population density is 9.9%. When compared with 77 cities nationwide, Mecklenburg County provides 20.2 acres per 1,000 residents. The national average is 40.2 acres per 1,000 residents. Not surprisingly, spending for parks in Mecklenburg County is below the national average as well. The park-related expenditure per resident in 2008 was $69, well below the national average of $100 per resident.

• Park and Recreation has utilized GreenPrint software extensively in the past year and developed a prioritized land acquisition plan that will guide all future land acquisition efforts.

• North Carolina boasts 866 Leadership in Energy and Environmental Design (LEED) commercial building registered projects. 314 of those are in the Charlotte region and the growth of LEED certified projects since 2000 has been dramatic.

• Mecklenburg County's Green Permit Rebate has been expanded from recognition of LEED certification to include recognition of a variety of residential home certification programs.

Recommendations

• Implement the Mecklenburg County Park and Recreation 2008 Comprehensive Master Plan calls for the acquisition of more than 6,000 acres of nature preserves and active recreational parklands, as well as acquiring land and developing 42 miles of new greenway trails.

• Continue to look for partnerships with entities like the Thread Trail and surrounding Towns as well as investigate new funding opportunities to help the Comprehensive Master Plan a reality.

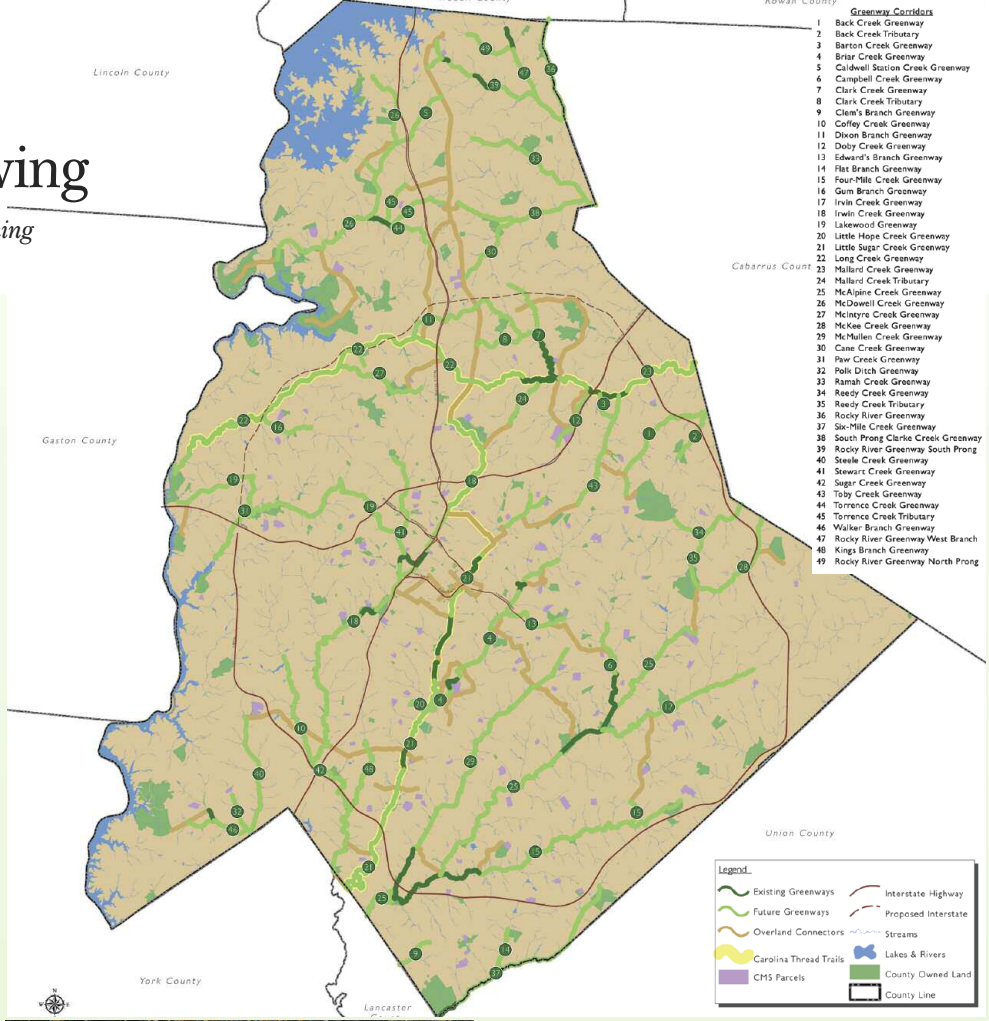
• Continue using the greenprint software program for all future land acquisition needs identification and analysis, allowing the County to objectively and strategically make best use of available tax dollars.

• Expand education efforts to make residents aware of the variety of energy efficiency incentives and programs available.

• Continue to encourage citizen involvement with Park and Recreation programs like community gardens.

Greenways are Growing

By Julie Clark, Division Director, Greenway Planning
Mecklenburg County Park and Recreation



Greenways are linear corridors of land and water designed to conserve floodplains for the purpose of improving water quality, mitigating the impact from seasonal flooding, providing habitat for native plants and animals, and maintaining public access to the County's natural resources. Greenway trails within and outside of the floodplain corridors are developed to support recreation, health and fitness, and alternative transportation.

Mecklenburg County citizens have continually supported Park and Recreation bonds targeting both land acquisition and greenway facility development. In 1999, the voters approved a bond for $220 million for land and $7 million for greenway trail development. In 2004, voters approved a $69 million dollar bond that included $25 million for greenway trail development, and in 2008, voters approved a $250 million bond that included over $40 million for greenway trail development and $60 million for land acquisition.

Greenways and Trails Master Plan Update: A Call to Action

The Mecklenburg County Greenways & Trails Master Plan was updated as part of the Comprehensive Park and Recreation Master Plan adopted by the Board of County Commissioners in May 2008. Results of surveys associated with the master plan concluded there was a clear need and desire for greenways and trail development in the County. A community survey conducted found that greenways and trail development was the number-one desired amenity in the County and the majority (93%) of County residents felt the role of greenways as a connected network of walking, biking and nature trails was important.

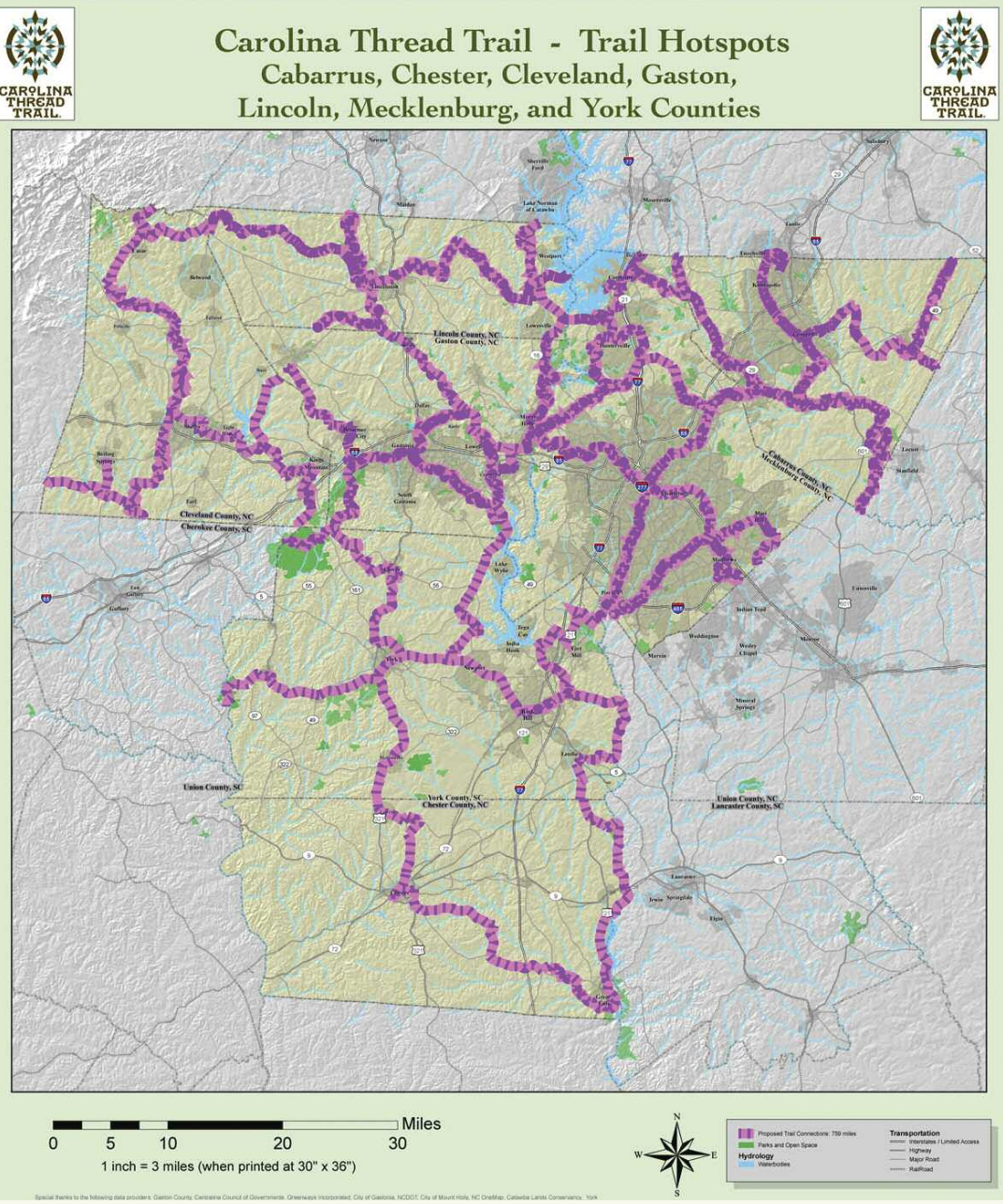
The master plan emphasized the development of an interconnected network of trails that provide County residents opportunities for recreation, alternative transportation, health and fitness, environmental education, and social engagement.

The plan focused on the implementation of an overall trail system with recommendations to improve policies, programs, and activities of the greenways and trails program, to accelerate development of the trails network and to improve the function and operation of the greenways and trail program. The plan outlined an ambitious five- and 10 year action plan and called for the development of nearly 100 miles of trail. The plan was also coordinated with the Charlotte Department of Transportation's Bicycle Master Plan update, so that the two plans referenced each other's efforts and when implemented, will help create a viable alternative transportation network.

The five-year action plan identified practical trail corridors to construct that will serve County residents and fulfill their need for additional hiking and biking trails. The 10-year development plan focused on connecting trail systems that create significant linkages, enhance the regional trail network, and provide more residents with access to the growing trail system.

Carolina Thread Trail: A Vision for Regional Connectivity

As part of the master plan update, the initial routing of the Carolina Thread Trail through Mecklenburg County was adopted along Little Sugar, Long, Irwin and Mallard Creek greenways. The Thread Trail is a 15-county regional trail system that will link communities across North and South



Carolina. It will create a permanent legacy of conservation for more than two million people by linking communities and attractions in North and South Carolina. The Thread Trail will be a catalyst for economic development, land preservation, and healthier communities. The actual location of the Carolina Thread Trail will be determined over time as communities plan their trails and work with neighbors to target points of connection. The Thread Trail concept map provides a vision for the project, but will change as these conceptual lines become actual trails. The Thread Trail will leverage private and public funding and help communities implement trail systems that focus on regional connections.

In 2009, Mecklenburg County was awarded a planning grant to finalize the route of the Thread Trail through the County. Led by a steering committee composed of stakeholders representing Charlotte and the surrounding towns as well as general biking, walking and conservation interests, a network of 145 miles of trails was drafted, that, if adopted, will link together Charlotte and all six towns as well as neighboring Gaston, York, Lancaster, Iredell, Lincoln, Cabarrus and Union counties. Over half the mileage, 91 miles, is proposed to be located within greenway corridors.

Currently, Chester, Gaston and York counties have adopted countywide greenway master plans, designating corridors for the Carolina Thread Trail. The planning process is underway in Catawba, Cleveland, Mecklenburg and Stanly counties, and the Thread Trail staff is conducting outreach in Anson,

Cherokee, Iredell, Lancaster, Rowan and Union counties. The Carolina Thread Trail plan for Mecklenburg County is about to enter the adoption phase of the process. The Board of County Commissioners will be asked to adopt the Thread Trail Master Plan which will then be an appendix to the Greenway Master Plan.

Moving Forward

Despite a significant economic downturn in late 2008 and through 2009, the construction of trails throughout the County continues in an effort to meet the goals set forth in the master plan. Mecklenburg County Park and Recreation has worked hard to secure outside funding sources to leverage the design and construction of greenway trails. Since 2004, just over 8.5 million dollars have been awarded for the planning, design and construction of greenway trail in Mecklenburg County. Over 13 miles of greenway trail were constructed between 2004 and 2009.

A new trail was constructed along McDowell Creek links the towns of Huntersville and Cornelius – the first trail in the County to connect two jurisdictions. Construction began on Four Mile Creek Greenway, the first greenway trail in the town of Matthews, in November 2009 and is expected to be completed in November 2010. Work continues on the new section of Little Sugar Creek Greenway near Uptown Charlotte. The project, from 7th St. to Morehead St. is in various stages of construction, with trail completed near the new Metropolitan development as well as near the new Central Piedmont Culinary Arts Institute. Irwin Creek Greenway was completed through the Revolution Golf Course – linking Clanton Park and surrounding neighborhoods to the new Revolution Sports Academy.

The Greenway program was also awarded over $2 million from the American Recovery

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Greenways are Growing

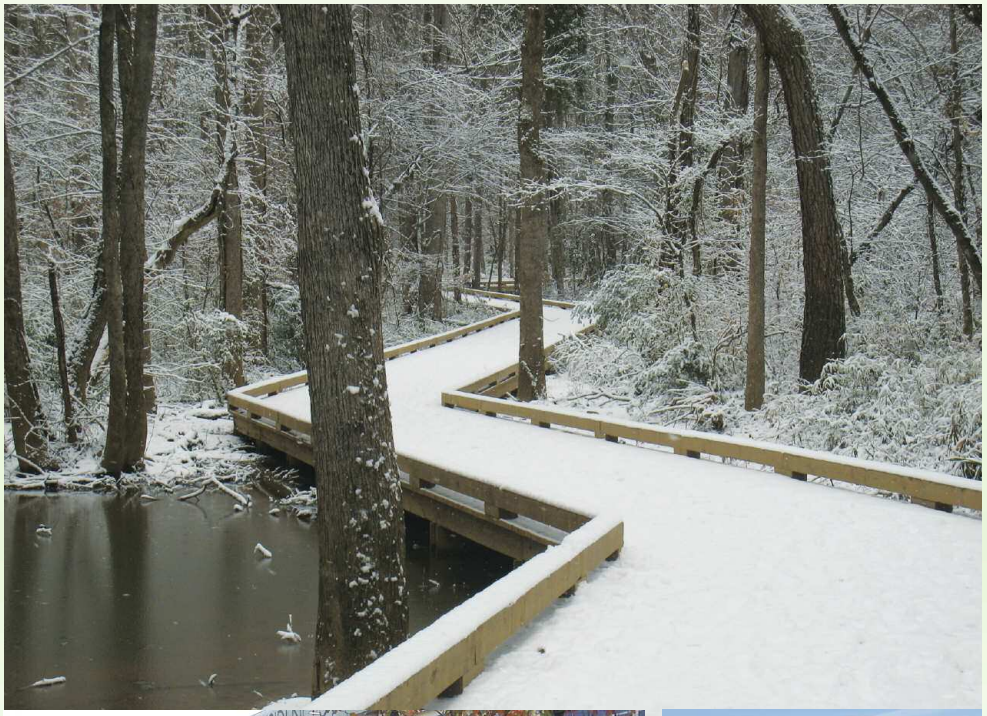
continued

and Reinvestment Act (ARRA) passed in February 2009. The funds will cover most of the construction costs for both Toby Creek Greenway and West Branch Rocky River Greenway trail projects. The funding, through the North Carolina Department of Transportation (NCDOT) Transportation Improvement Program, was competitive and required the project adhere to state/federal standards in order to qualify. The Mecklenburg Union Metropolitan Planning Organization (MUMPO) ranked both road and bicycle/pedestrian facilities and projects were submitted to the NCDOT for consideration in a priority order.

Toby Creek Greenway will connect to seven miles of existing trail. The two-mile trail will link residents to the University campus and surrounding retail and residential areas. The trail will provide an opportunity for faculty, students and staff who live in nearby neighborhoods to use the trail for transportation both to work and play. The trail network also ties to the University Place shopping center and retail district and will link to the future Northeast light rail extension from downtown Charlotte. The trail will also be part of the Carolina Thread Trail, a planned 15-County Regional Trail System that will link over two million residents in counties in both North and South Carolina.

West Branch Rocky River Greenway is a one mile trail that connects different phases of the River Run neighborhood and will tie into the Town of Davidson's existing greenway system. The existing greenway system links to schools, residential areas and the downtown. West Branch Rocky River Greenway is also part of the Carolina Thread Trail, a planned 15-County Regional Trail System that will link more than two million residents in counties in both North and South Carolina.

The Greenway program will continue to look for partnerships with entities like the Thread Trail and surrounding Towns and new funding opportunities to get trails on the ground so that Mecklenburg County residents have access to a trail system network that provides the transportation, health and wellness benefits as desired and delineated in the master plan.



top a snowy day on the greenway **bottom** Little Sugar Creek Greenway near downtown

Greenprint Modeling Program for Land Acquisition Identification and Prioritization

By C. Blaine Gregory, Senior Park Planner
Mecklenburg County Park and Recreation

In late 2007, Mecklenburg County Park and Recreation embarked on its first Park Master Plan Update since 1989. Included in this comprehensive look at park and recreation needs for the next 10 years (2008-2018) was a section devoted to land acquisition. As part of the master plan update, the County consulted with Fore Site Consulting Inc. from Loveland, CO for a Greenprint software program uniquely adapted to Mecklenburg County and our own park and recreation land needs (*For more information on Greenprinting follow this link* **http://www.charmeck.org/Departments/Park+and+Rec/10YrPlan.htm**.

Fore Site Consulting had previously developed similar programs for more than 40 national agencies and local governments by working with the national Trust for Public Land (TPL) organization. Working in conjunction with the County's Geospatial Information Services (GIS) Department staff, Fore Site Consulting developed a modeling program which allows all of Park and Recreation's land acquisition needs (*Nature Preserves, Greenways, and Parks*) to be identified and prioritized. This process has been and continues to be used for ongoing land identification needs.

Greenprinting Overview

Greenprinting uses GIS to make informed, strategic decisions about land conservation and resource protection priorities as well as parkland needs and identification. The process applies a systematic approach to translate regional values into objective metrics for modeling. As part of the master plan update, key staff and community based focus groups provided input via workshops, interviews and surveys in developing the overall greenprint program objectives for our County's parkland:

- **Meet the active and passive park and recreation needs of all citizens**
  - ◦ Create a balance of park types (*classifications*) and amenities tied to the demographics of the area
  - ◦ Consider parks, open space and greenway needs
  - ◦ Incorporate factors such as density, active/passive use, health/fitness, appropriateness of land for construction, amenities, income, and joint/shared use (*for example, with Charlotte-Mecklenburg Schools*)

- **Increase greenway connectivity and trail usability**
  - ◦ Identify key destinations to provide linkages to schools, parks, population centers, nature preserves, historic sites, and neighboring county and/or regional trail systems
  - ◦ Identify opportunities and partnerships for proposed greenway trails such as utility corridors, railway corridors, road right of ways, and sidewalk tie-ins
  - ◦ Identify impediments such as interstate highways, railroads, and ecological considerations

- **Identify and protect critical habitat**
  - ◦ Natural communities **http://www.charmeck.org/Departments/Park+and+Rec/10YrPlan.htm**
  - ◦ Nature heritage sites
  - ◦ Buffer zones adjacent to identified unique/rare habitats and natural heritage sites (NHS)
  - ◦ Wildlife corridors
  - ◦ Endangered, rare, and species of concern and associated habitats
  - ◦ Forested areas with high tree canopy remaining
  - ◦ Early successional habitat *(fields and meadows)*
  - ◦ Critical watersheds
  - ◦ Large un-broken natural areas

- **Protect water resources and enhance water quality**
  - ◦ Wetlands, stream buffers, water bodies, natural cover, floodplains, headwaters, drinking water and state designated impaired waters

- **Maintain cultural landscapes**
  - ◦ Farmland, historic sites, cemeteries, native lands, and archeological sites

Greenprint Methodology

As described above, greenprinting utilizes the referenced goals to guide individual parcel identification. This process is based on specific criteria uniquely developed for each of our land acquisition needs (nature preserves, greenways and parks). Point values were established for each of these land categories and a scoring system was incorporated. A few examples of these criteria include:

Parkland
- Residential population within the park's service radius (*points given for each 1,000 persons*)
- Mass transit (is the property within 0.5 miles of public transportation)

Nature Preserves
- Critical habitat protection
- Partnership opportunity

Greenways
- Existing greenway corridor mileage (*what percentage of planned miles in the given Park District have been constructed*)
- Is the greenway listed in other adopted plans and/or studies

Once the greenprint software model is "run" a spreadsheet is produced with a scored value (point total) for each parcel. These scores are automatically ranked from highest to lowest and provide staff with a

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Greenprint Modeling Program for Land Acquisition Identification and Prioritization

continued

very objective tool. This process is not definitive but does provide an extremely resourceful and objective methodology to gauge numerous parcels one against the other.

Park and Recreation has utilized this software extensively in the past year and developed a prioritized land acquisition plan that will guide all future land acquisition efforts. This data will be used to strategically achieve the goals outlined for land acquisition needs based on the 2008 Park Master Plan.

At the end of Fiscal Year 2009, Mecklenburg County had over 18,000 acres of parkland as listed in *Figure 1*.

The updated park master plan also identified land acquisition shortfalls per land classification and compared them to national standards. A summary of those goals is included in *Figure 2*.

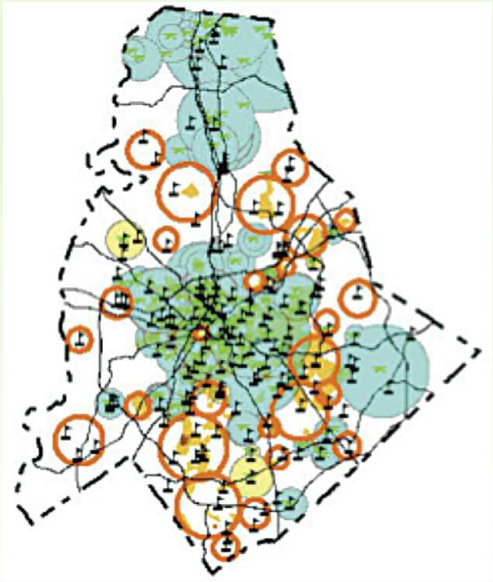
Another very interesting and important feature of the greenprint software program Mecklenburg County uses is the ability to graphically explain land acquisition strategies. Based on the criteria established, the software program has the capability of producing mapping that clearly identifies needs, service gaps and priorities. Examples of these maps are shown at right.

Park Classification Type	Total	Developed	UnDeveloped
Neighborhood Parks	711.15	611.69	99.46
Community Parks	2,172.12	1,733.70	438.42
Regional Parks	3,990.32	2,864.87	1,125.45
Recreation Center	23.17	23.17	
Nature Preserves	6,248.41	5,160.13	1,088.28
Greenways	3,764.57	215.53	3,549.04
Golf Courses	1,176.15	1,176.15	
GRAND TOTAL	18,085.89	11,785.24	6,300.65

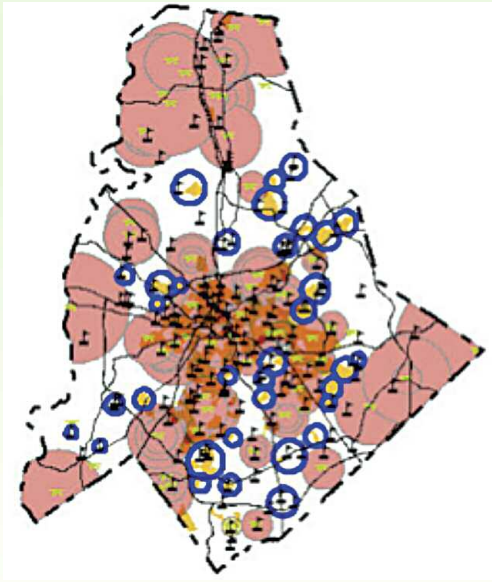
Figure 1

Parkland Classifications	**10-Yr. Acquisition Goal**
Neighborhood Parks	2,215 ac.
Community/Regional Parks	3,838 ac.
Greenways	1,053 ac.
Nature Preserves	5,871 ac.
Total Acreage	**12,977**

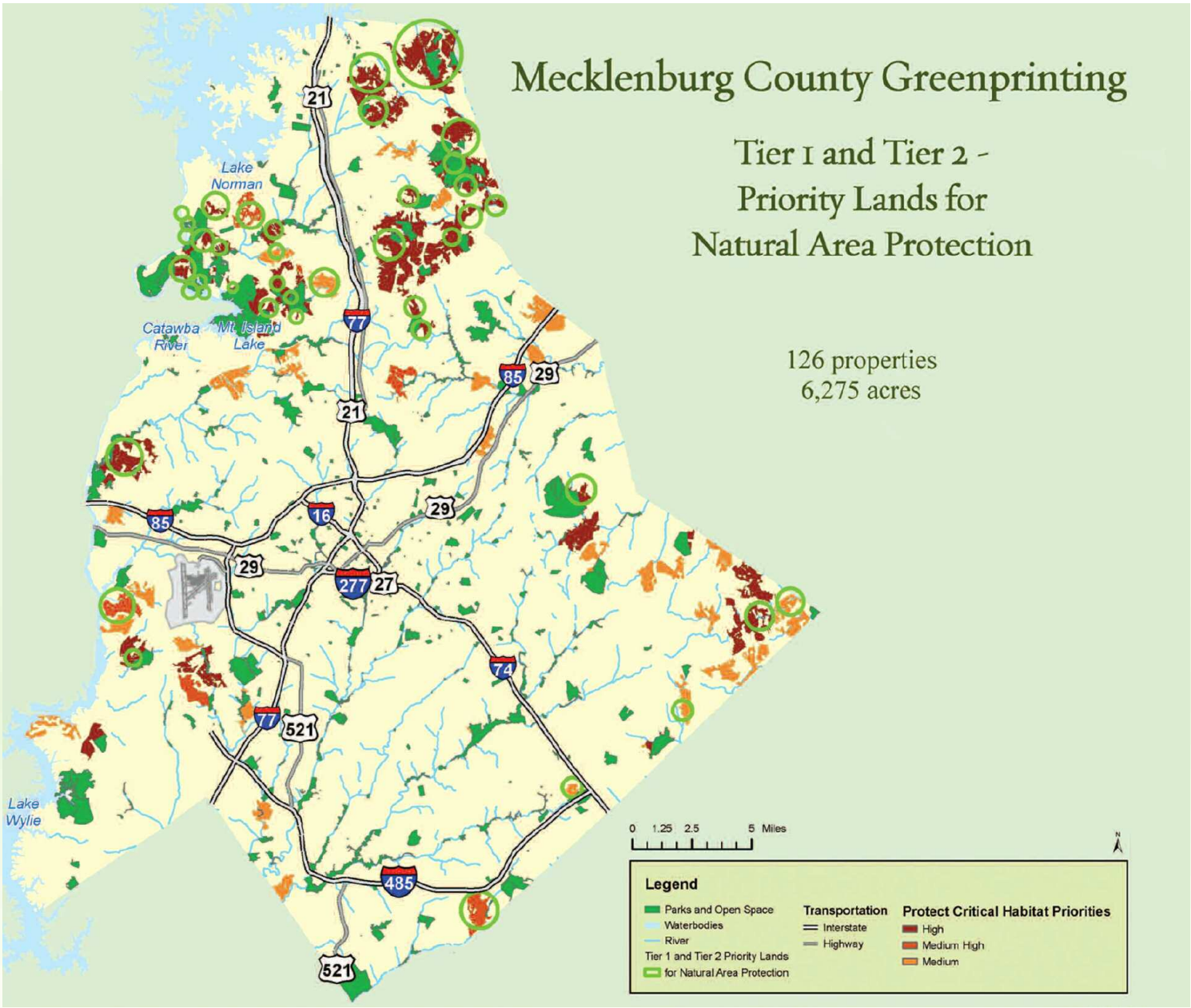
Figure 2



Neighborhood Park gap analysis map with CMS school locations and population density applied



Community Park gap analysis map with service radius and population density applied


Mecklenburg County Greenprinting
Tier 1 and Tier 2 -
Priority Lands for
Natural Area Protection
126 properties
6,275 acres
Lake Norman
Catawba River
Mountain Island Lake
Lake Wylie
21
77
85
29
16
277
27
74
521
485
0 1.25 2.5 5 Miles
N
Legend
Parks and Open Space
Waterbodies
River
Tier 1 and Tier 2 Priority Lands for Natural Area Protection
Transportation
Interstate
Highway
Protect Critical Habitat Priorities
High
Medium High
Medium

Mecklenburg County's Natural Heritage

By Natural Resources Team, Mecklenburg County Park and Recreation

Mecklenburg County is home to a diverse array of natural communities, including isolated upland depression swamp forests, fire-adapted Piedmont prairies, rich upland forests and moist floodplain forests dominated by the forces of rivers and streams. These diverse habitats provide food, cover and breeding sites for all our wild animals, colorful blankets of wildflowers in the spring and the orange, red and golden hues characteristic of our fall.

Our quality of life and many aspects which we hold dear — such as clean air and water — are dependent on preserving these natural communities. Yet, Mecklenburg County is a center of great population increase and growth in the Carolinas. Development over the past two decades has led to the conversion of most of our natural areas for residential, industrial and commercial uses and for roads, utility corridors, and other public infrastructure.

In 1992, Mecklenburg County Park and Recreation Department partnered with the North Carolina Natural Heritage Program to conduct the County's first formal inventory of natural areas. During the inventory, the department worked with the public and consulting biologists to identify areas throughout the County that contained ecologically significant plant species, animal species or natural communities.

The initial survey was completed by 1995, and a report was published in 1998 — identifying 27 biologically important natural areas and the species and natural communities present. Each site was ranked as being of national, state, regional or county significance. These sites were then targeted for conservation. Of the initial 27 sites identified, 15 (56%) are now protected, four (15%) have been lost and eight (29%) are still in need of protection. Several of the "protected" properties have now been affected by human encroachment and development and have declined in functional quality.

Natural Communities

Fifteen natural community types have been documented in Mecklenburg County. In some instances (*marked with an* *), there are no protected communities of a particular natural community type remaining in Mecklenburg County.

Mecklenburg County Natural Communities

Upland Forests
- Dry-Mesic Oak-Hickory Forest
- Dry Oak-Hickory Forest
- Basic Oak-Hickory Forest
- Xeric Hardpan Forest

Mesic Forests
- Mesic Mixed Hardwood Forest
- Basic Mesic Forest

Floodplain Forests
- Piedmont Levee Forest
- Piedmont Bottomland Forest
- Piedmont Alluvial Forest
- Piedmont Semipermanent Impoundment

Rock Outcrops
- Piedmont Acidic Cliff*

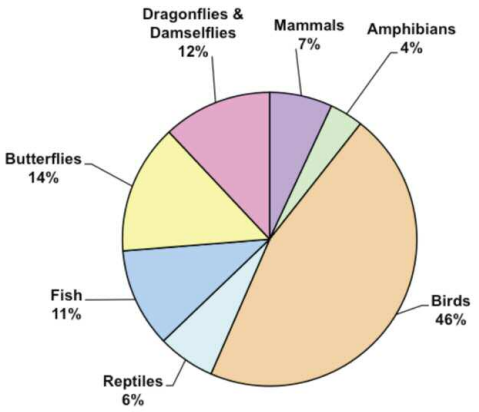
Isolated Wetlands
- Upland Depression Swamp Forest
- Low Elevation Seep*

Early Successional Habitats
- Piedmont Prairie
- Piedmont Grasslands

Biodiversity

Surprisingly for an urban Piedmont community, Mecklenburg County's wildlife diversity still remains rich with over 650 wild animal species formally documented as of 2010. Some species such as loggerhead shrike, queen snake, and Carolina darter may now be extirpated and some historic species such as the passenger pigeon are extinct. The great majority of animal species in Mecklenburg County are the hundreds of interesting creatures such as spiders, crayfish, insects, and mussels – most of which have not been formally documented at this time.

Mecklenburg County Animal Diversity



45	documented species of mammals
299	documented species of birds
41	documented species of reptiles
24	documented species of amphibians
71	documented species of fish
93	documented species of butterflies
78	dragonflies and damselflies

More than 1,500 vascular plant species – ferns, native grasses, wildflowers, shrubs and trees have been documented in Mecklenburg County. These plants were identified by botanists from the University of North Carolina at Charlotte, Davidson College, and the University of North Carolina at Chapel Hill during surveys conducted over the last 40 years. Hundreds of nonvascular plant species, such as mosses and liverworts, grow in Mecklenburg County but they have yet to be formally documented.

The Division of Natural Resources has developed and implemented the Mecklenburg County Wildlife Identification and Location Database (WILD) program to identify, track, and record data on all wild species throughout the county. Staff, academic partners, and volunteers have been compiling historical data and collecting current data on the presence, status, and abundance of species since 1997. You can help! Report your observations to the **Conservation Science Office, 9401 Plaza Road Extension, Charlotte, NC 28215**. Remember to include your contact information as well as the date, time, and specific location of your wildlife sighting. Photos are especially appreciated.

Dr. James F. Matthews Center for Biodiversity Studies

The Dr. James F. Matthews Center for Biodiversity Studies, located at the Reedy Creek Nature Preserve, protects more than 45,000 historically important plant and animal specimens and associated biological data collected primarily from Mecklenburg County and the 14-county surrounding region. This valuable data aids government officials in their conservation efforts within this region and assists researchers and students in studying and protecting our regional biological heritage.

Natural resource professionals, students and researchers now have a place to share their data locally and the opportunity to learn more about the documented plants and wildlife found in the central Carolinas. The center provides researchers and students the opportunity to formally document (*voucher*) biological data and specimens in a single location so that the information and specimens can be easily located and also so that the records and data will be scientifically defensible. An historical record of our region's biological heritage is vital for future reference and for the long-term management of our natural resources.

The center is a unique facility that will become more important over time as Mecklenburg County strives to protect the County's natural resources and to assist other regional county governments in protecting their resources. Protection of our natural heritage for the health and benefit of our future generations is of vital importance and the activities supported by the Center for Biodiversity Studies aid in that protection.

Protected Natural Areas

Mecklenburg County began working towards the preservation of its natural areas more than thirty years ago. It established the Mecklenburg County Park and Recreation Department in 1974 to properly manage our natural assets and to ensure the health of these areas for the benefit of future generations.

During the 1970s and 1980s, Mecklenburg County obtained grants from the federal Land and Water Conservation Fund (LWCF) to purchase and protect several park and nature preserve areas. McDowell Nature Preserve and Latta Plantation Nature Preserve were acquired during this period. In the early 1990s, Mecklenburg County utilized voter approved bonds to purchase Cowan's Ford Wildlife Refuge from Duke Power, to help protect the Mountain Island Lake watershed, Charlotte's primary drinking water source. In 1992, the City of Charlotte Park and Recreation Department was consolidated within Mecklenburg County Park and Recreation Department. This merger resulted in the addition of Reedy Creek Nature Preserve to the list of protected natural areas managed by Mecklenburg County. This early land preservation helped form the foundation for today's Mecklenburg County Nature Preserve System.

In 1993, Mecklenburg County Park and Recreation Department created the Division of Natural Resources to manage these special natural areas and to educate the public about our county's unique natural heritage. The first Nature Preserve Master Plan was adopted by the Mecklenburg Board of County Commissioners in 1997. A complete updated plan was adopted in 2008 as part of the Park and Recreation Department's 2008 10-Year Master Plan. Nature preserves were defined as "sites encompassing unique qualities that exemplify the natural features, the diverse land formations, and the variety of vegetation and wildlife found in the region." The primary objectives for purchasing and limiting development of these sites, which could be of any size, are to protect water quality, wildlife habitat, and any ecological, geological, or archaeological resource, and to provide sites for educational activities, outdoor recreation, wildlife observation, and nature appreciation. Nature preserves maintain the unique features and natural beauty of Mecklenburg County for future generations to enjoy.

The Nature Preserve System has now grown to 21 preserves, encompassing 6,867 acres. This acreage totals more than 1/3 of the nearly 18,000-acre overall park system, but it only represents less than one percent of all Mecklenburg County land. Preserves range in size from 19-acre Shuffletown Prairie Nature Preserve to 1,343-acre Latta Plantation Nature Preserve. If properly managed, our nature preserves have the potential to provide long-term protection for many of our natural communities and common, rare, threatened, and endangered species. The preserves can serve as vital hubs for a regional system of connected natural areas providing vital connections for wildlife and plant movement throughout the region, as well as providing endless recreation and educational opportunities to millions of visitors.

Park and Open Spaces: Our Community Needs You

By Michael Kirschman, Division Director Nature Preserves and Natural Resources
Mecklenburg County Park and Recreation

The benefits of providing adequate and high quality parklands are becoming clearer. Research shows these benefits include increased physical fitness and better health, lower stress, lower levels of behavioral conduct disorders, ADHD, anxiety and depression, higher property values, significant tourism impacts, cleaner air and water resources, better social cohesion, higher family satisfaction and interaction, and greater creativity. Incredibly access to public parks and recreational facilities has been strongly linked to reductions in crime, and in particular to reduced juvenile delinquency.

Our parks and open spaces need your support, and the needs of our residents are many. According to a 2008 random household survey conducted as part of the department's 10-year master plan:

1) The top two reasons people visit parks are: to enjoy the outdoors and they are close to home,

2) The top three needs by the public are: walking and biking trails, nature centers and nature trails, and community gardens,

3) The most popular programs residents have a need for include: special events/ festivals, adult fitness and wellness programs, and outdoor adventure programs.

Based on these results, the department will focus its resources and services and these key areas. You, too, can reap the benefits by living in a county with high quality parks, nature preserves, greenways, and recreational facilities. See at right for just some of the ways you can get involved.

What Can You Do?

Recreate! Visit any of the County's 200+ parks, nature preserves, recreation centers or greenway trails. For more information go to **www.parkandrec.com**.

Get involved. Apply to serve on a Park and Recreation Advisory Council. Over twenty councils provide input to the Park & Recreation Commission, which in turn provide recommendations to the Board of County Commissioners regarding parks and open space. Or attend an Advisory Council meeting and share your thoughts, concerns or suggestions regarding our parks, nature preserves, greenways and open spaces.

Volunteer. In 2009, over 16,900 volunteers contributed over 27,250 hours at a park, nature center, recreation center or special event. Volunteer activities vary greatly, ranging from assisting natural resource as a Citizen Science Volunteer, to assisting with youth camps and programs in the recreation centers. You can also Adopt a Trail/Park or become a Park or Greenway Ambassador. Contact the Park & Recreation Department for more information.

Learn. Become familiar with the many benefits and ways open space and parklands improve our quality of life.

Speak out. Let your elected officials know what you think about preserving open space and parkland. Tell your neighbors about the County's parks, greenways, nature preserves and recreation centers.

Environmentally Friendly Buildings and Development

By Mark Hahn, Director, Mecklenburg County Real Estate Services
Tom Crow, Senior Project Manager Mecklenburg County Real Estate Services

The 2006 edition of Mecklenburg County's State of the Environment Report described a single project that utilized the US Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating system. In 2006, there were very few buildings in North Carolina that were built using this system. The founders of USGBC had a vision of transforming the marketplace, making "Green" a standard way of building. Fast forward to 2010: Mecklenburg County has been awarded LEED Gold for the new Medical Examiner's Office. Numerous other County buildings are registered with USGBC pursuing LEED certification. Local governments, like Mecklenburg County, can be a catalyst in the transformation of a regional market.

Similar to the LEED rating systems for commercial buildings, there are also LEED systems for homes, and neighborhood development. As proof of a changing marketplace, let's look at the statistics for North Carolina. In January 2010, there were 25,608 LEED registered projects nationwide. North Carolina boasts 866 LEED commercial registered projects. Three hundred fourteen of those are in the Charlotte region and the growth of LEED certified projects since 2000 has been dramatic (*see Figure 1*). Of the six residential LEED projects in NC, one of those is in Mecklenburg County. Neighborhood Development is a newly released LEED system and there is one LEED neighborhood development in North Carolina. This is evidence that the marketplace is definitely changing in Mecklenburg County and North Carolina.

In 2009, Mecklenburg County Real Estate Services initiated Performance Contracting on numerous County facilities. Performance Contracting is a process through which Energy Service companies (ESCOs) make building improvements that they project to save energy, and building owners pay for the work from the energy savings.

In November 2009, Mecklenburg County was awarded an Energy Efficiency and Conservation Block Grant as part of the federal stimulus package. The County decided to use the money to install solar hot water systems on six buildings that use large quantities of hot water, including a Charlotte-Mecklenburg school, and a Central Piedmont Community College facility. In addition, County staff has been exploring the use of County property for production of electricity with solar panels.

Mecklenburg County goes beyond supporting its own environmentally friendly buildings and reaches into the community by offering a Green Permit Rebate. This fee rebate program was expanded in 2009 from to solely commercial to include residential construction, for those homes that meet one of the recognized green construction standards.

Business owners or home owners can get involved with making buildings more sustainable. There are a number of resources out there to make commercial buildings more energy efficient. Government agencies, and commercial building owners and operators can take advantage of a number of programs designed to make saving energy more affordable. They will identify and help implement energy initiatives for North Carolina business. There are revolving loan funds to assist in project implementation. Duke Energy also has a Smart Saver Program. Smart Saver offers rebates for lighting improvements, HVAC systems and equipment upgrades, and food service equipment upgrades. Piedmont Natural Gas offers incentives for installing instantaneous water heaters.

On the residential side, the North Carolina energy office offers partial payments for home energy audits, and has identified partners to help implement these audits. Duke Energy's residential Smart Saver program offers rebates on high efficiency, and geothermal HVAC systems. They also offer home energy assessments. Piedmont Natural Gas offers incentives for the installation of high efficiency furnaces and water heaters, and instantaneous water heaters.

The federal Energy Policy Act of 2005 is still in effect and offers incentives for energy efficiency, and renewable energy (*for example, solar panels*) for both commercial and residential properties. North Carolina offers significant incentives as well. For more information on incentives, visit **DSIRE Home http://www.dsireusa.org**.

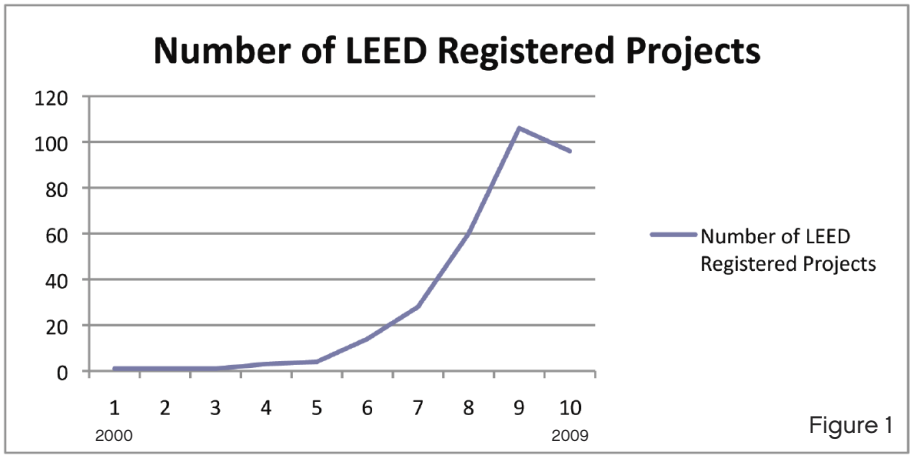


Figure 1

Green Development: More Than Just Buildings

By Lauren Blackburn, Davidson Town Planner
Rodney Graham, John Marshall Custom Homes

Green development, a popular trend with its roots in community planning, is multi-faceted. A truly green building should be built to maximize energy-efficiency, limit water consumption, depend on local and renewable building materials, last many generations, and afford occupants the opportunity to walk or bike to daily destinations. However, many "green" houses are built far from work and schools; and some "green" commercial buildings lack important architectural detail.

Are home-buyers no longer as interested in reducing reliance on the motor vehicle and preserving open space as they are interested in saving money on energy bills? Is the architectural legacy of commercial buildings not as important as using renewable and energy-efficient materials? The Town of Davidson, as well as many other municipalities in the region, believes smart growth and quality urban design are priority considerations for environmental stewardship because these principles conserve valuable open space, promote a more car-free lifestyle, and improve quality of life.

Local governments should continue to encourage smart growth as the key to holistically green development. If a house is energy-efficient but located far from schools or jobs, its measure of sustainability should not be considered equal to building in a compact, mixed-use neighborhood. Or if a commercial building produces minimal stormwater runoff but displays an uninspired façade, its lifespan will be short. A business or home is not sustainable if does not evoke community character and is either vacated or demolished within 50 years.

Citizens and environmental advocates should continue to encourage their neighbors and local leaders to seriously consider energy efficiency in all new construction. As part of Davidson's comprehensive planning process in 2009, residents proposed hundreds of innovative sustainable practices. Residents suggested energy audits of government buildings, educational programs about composting, financial assistance for home weatherization, and water conservation demonstration projects.

A local home builder in Davidson, Rodney Graham of John Marshall Custom Homes, is committed to remodeling and building homes on infill lots within a walkable distance to local services and jobs. "Look for ways to recycle materials and purchase materials that utilize recycled content," says Graham. One way Graham supports this philosophy is by using local drywall made from calcium carbonate, a byproduct of scrubbers on Duke Energy's coal-fired plants. The materials and systems used to build houses and commercial buildings must be an equal consideration to successful sustainable development.

Graham believes design is also important to the energy efficiency of a building, including compact plumbing systems and smartly sized homes. "It is greener to build a well-designed 2500 square foot house using conventional methods than to build a 5,000 square foot house with a bunch of wasted space and solar panels on the roof," he says. Graham also says that green building doesn't have to be "fancy, but the results are remarkable." It isn't necessary to spend much more on the building costs on expensive features such as solar panels to make a real difference in the long-term affects of a building on the environment.

Fortunately, the same organizations that first developed and promoted green building are now considering the context in which the buildings are placed. The American Society of Landscape Architects, in conjunction with other natural resource advocates, has begun The Sustainable Sites Initiative to create the nation's first rating system for sustainable landscapes. The United States Green Building Council has also just completed the pilot program for a LEED-ND (Neighborhood Development) designation, also demonstrating that good site selection of building development is critical.

Truly sustainable development is a team-effort. Developers must consider the longevity, sense of place and building materials when planning their projects. Local governments must continue to encourage compact and mixed-use development in order to promote walkable lifestyles. Citizens and property owners are the market for new technology, development patterns and building types. Just as the natural environment is an integrated system of resources, organisms and landscapes, the green movement is an ecosystem of stakeholders.

The Green Challenge in Cornelius

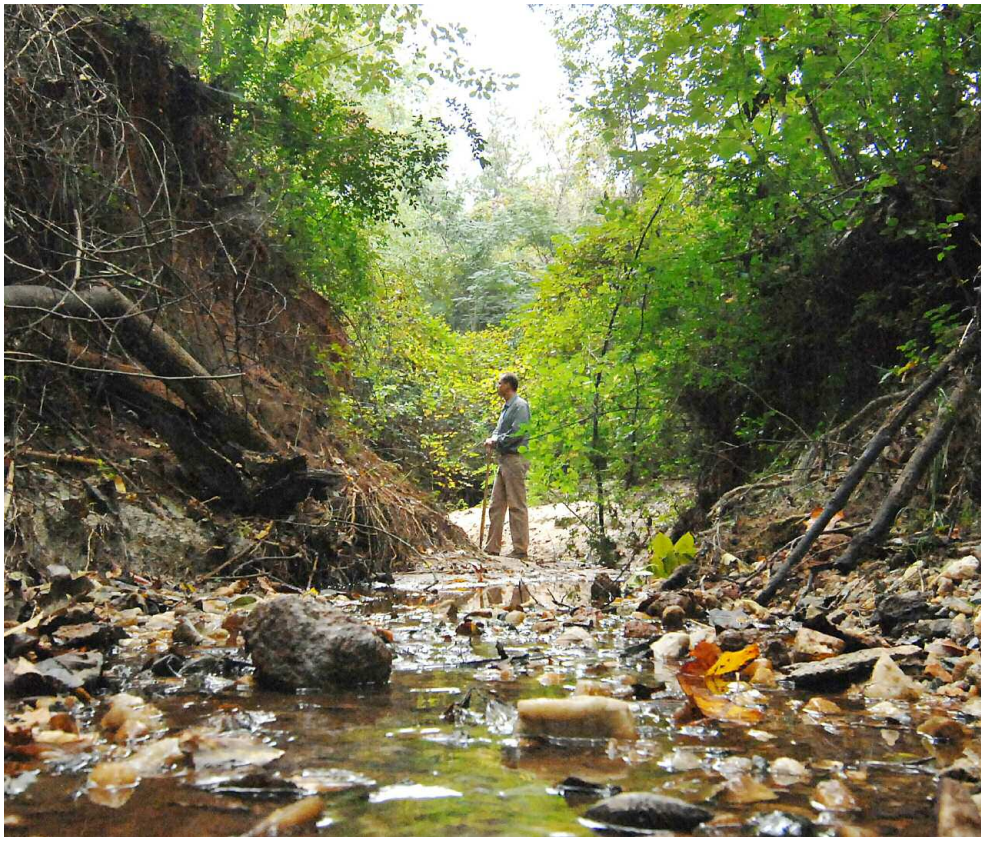
The town of Cornelius has joined in the "Green Challenge" program to help save energy, money and natural resources, and improve our environment. The Green Challenge is a program through the North Carolina League of Municipalities (NCLM) that recognizes member cities and towns for their efforts to protect the environment, save energy, and preserve natural resources.

Out of 542 league members, Cornelius was one of 20 municipalities to reach the advanced level of the Green Challenge, and was recognized at the NCLM's annual conference in Greenville in October 2009.

The town has implemented short-term and long-range actions that conserve resources and save money, helping to protect the environment and operating municipal government in a more cost-effective, energy-efficient and environmentally friendly manner. Take a look at the following initiatives and actions that have occurred over the past two years in Cornelius:

Vehicles: Three GEM (fully electric vehicles) were purchased through a grant, two Toyota Prius Hybrid Investigative Police vehicles, and one Honda Civic hybrid, fleet vehicle have contributed to fuel reducing costs. The Public Works Department has applied for heavy equipment diesel engine retrofits.

Energy: Two different kinds of LED streetlights have been installed to monitor energy efficiency and work has begun on researching acreage for a solar farm. The town-owned electric company offers incentives for commercial and industrial companies to encourage energy efficiency.



David Kroening of Charlotte-Mecklenburg Storm Water Services in a highly eroded tributary of McDowell Creek located in Cornelius, NC. Restoration of the tributary is underway as of June 2010.

Energy audits for town hall and police department facility have been completed with up-fits starting soon. The town participated in the national "Lights Out" night initiative.

Development: The town has advocated for legislative authority: **1)** to enable a stronger tree ordinance to reduce clear-cutting, and **2)** to enable incentives for developers who build "green." The town was awarded funding to upfit several head water streams that have degraded significantly due to erosion.

Recycling: The town has a strong recycling program and is considering offering larger containers starting July 2010. The Parks, Arts, Recreation & Culture (PARC) Department secured a donation to outfit all parks with recycling containers capturing 65% more recycling material.

Town of Huntersville – Advancing Environmental Stewardship

By Bobby Williams, Management Assistant, Town of Huntersville and Whitney Hodges, Senior Planner, Town of Huntersville

In 2008, the Town of Huntersville was one of 80 North Carolina communities recognized for completing Phase I of the North Carolina League of Municipalities (NCLM) Green Challenge. The town was recognized for zoning that encourages open space and low-impact development standards, performing energy audits of three main facilities to identify energy consumption and prioritize improvements, and its partnering with Charlotte-Mecklenburg Utilities to promote CMU's WaterSmart water conservation program.

In 2009, the town was one of 13 across the state who achieved Intermediate Level status of the NCLM Green Challenge. Again, Huntersville was recognized for its zoning and adoption of land use plans that encourage higher density development near public transit nodes and requiring set asides of open space with residential development, continued energy audits of facilities, a community-wide recycling program, planned work through the Energy Efficiency Community Block Grant (EECBG) Program to retrofit field lighting in North Mecklenburg Park and implementation of an internal recycling program at town hall.

New rain gardens in Northcross Shopping Center in Huntersville, completed May 2008.

Water Quality

Water quality continues to be a focus in land development practices for the Town of Huntersville. All new projects include water quality best management practices that reduce stormwater run-off and treat pollution prior to reaching our creeks and streams. Additionally, the town has worked with Mecklenburg County on two retrofit stormwater projects. One project saw the town and Mecklenburg County partner with American Asset Corporation and Lowe's Home Improvement to add rain gardens into the parking lot of Northcross Shopping Center. The second retrofit project involved County owned property at the North Mecklenburg Recycling Center.

Greenways

The Town of Huntersville continues to work with the County in implementing the County's Master Greenway Plan and the Town of Huntersville Master Greenway and Bikeway Plan. In 2009, the County completed work on portion of the Upper McDowell Creek Greenway that connects Birkdale Village to Westmoreland Road in Cornelius.

Recycling

Since March, Huntersville Town Hall has recycled approximately 50 bins of paper and about13 bins of aluminum cans and plastic bottles. The second number is lower as the Huntersville Fire Department has been collecting aluminum cans since June 2009 at Town Hall to benefit the Burned Children's Fund.

The Huntersville effort is a volunteer program, started by internal staff. Volunteers in the office take the bins to the North Mecklenburg Recycling Center on Statesville Road to be recycled on their lunch breaks, or on the way to meetings.

Bins are placed in convenient locations (*bins for paper in office areas, bins for plastic and aluminum near the kitchen and drink machines*) to make sorting recyclables easier.

The Future: Single Stream Recycling

Town Hall and all residents of Huntersville will soon begin using one single roll-off container for all their recyclables as the town joins others in Mecklenburg County in switching to single-stream recycling. This service becomes effective on July 1, 2010 when Huntersville's new solid waste/recycling/yard waste contract with Advanced Disposal begins.

The goal of a single-stream program is to make it easier for residents to recycle as it allows them to mix paper, aluminum, glass and plastic containers in a single roll-off container. These items are sorted after collection rather than before. The County recently retrofitted their Materials Recovery Facility (MRF) for this purpose.

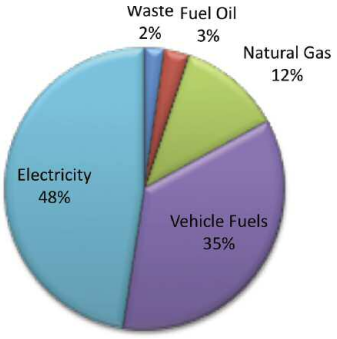
What You Can Do To Help Reduce Greenhouse Gas

By Justin Stritch, Engineering, City of Charlotte

The City of Charlotte is a leader in environmental issues for the region and is working on an initiative to reduce the Charlotte community's greenhouse gas (GHG) emissions. In 2009, the federal government began funding the Energy Efficiency and Conservation Block Grant (EECBG) Program. The EECBG program provides federal grants to local governments for projects that increase energy efficiency so as to decrease total energy consumption and decrease fossil fuel emissions, thus reducing GHG emissions. The federal government allocated $6.7 million for energy projects, which would be released to the City upon the Department of Energy's (DOE's) approval of a City-prepared Energy Efficiency and Conservation Strategy.

The City used some of its initial EECBG allocation to prepare an Energy Efficiency Community Strategy (EECS), which included the development of a GHG emissions inventory for City operations and the Charlotte community. The base year for these inventories is calendar year 2006, and the City collected data from Duke Energy, Piedmont Natural Gas, the U.S. Energy Information Administration and the Charlotte Department of Transportation to complete the inventories. In 2006 the City's GHG emissions were 10,446,000 metric tons. The following chart and graph demonstrate the 2006 community GHG emissions by source:

Metric Tons of Carbon Dioxide Emissions by Source



Carbon Dioxide Emissions by Source

Source	*Metric Tons of Carbon Dioxide Emissions*	*Percent of Total*
Waste	237,153	2.3%
Fuel Oil	304,127	2.9%
Natural Gas	1,244,830	11.9%
Vehicle Fuels	3,691,969	35.3%
Electricity	4,967,813	47.6%

The City's EECS consists of 18 projects the City will fund using the aforementioned EECBG money that will have an immediate impact on GHG emissions in our community. Both the EECS and the GHG emissions inventory results will be used in developing a long term strategy to continue to reduce the GHG emissions in the Charlotte community. While the City is doing their part to reduce community GHG emissions, there are simple measures residents can do to reduce GHG emissions. Here are seven simple steps that can be taken to reduce GHG in our community.

1) Carpool to reduce the number of gas emitting GHG
2) Try to plan your daily trips to reduce the total number of miles you drive
3) Replace old light bulbs with high efficiency lighting
4) Make sure that your home is properly insulated to avoid wasting electricity
5) Turn the lights off when you leave a room
6) Unplug household appliances when you leave your house
7) Turn down level at which you either heat or cool your home when you are not home

The City of Charlotte's Policy for Sustainable Facilities

By Justin Stritch
City of Charlotte, Engineering

In September 2009, the City of Charlotte adopted its first "Policy for Sustainable City Facilities" intended to "…direct city staff to design, construct, and operate sustainable City facilities which meet the functionality and service delivery needs of the citizens of Charlotte while minimizing environmental impacts and conserving and protecting all resources." The sustainable priorities reflected in the policy are: the preservation of land and trees; the conservation of clean water resources; reduction of energy use and carbon footprint; maximization of transportation alternatives; setting an example for the community; and protecting the health of occupants in facilities.

The City had several objectives in formulating this policy. First, staff recognized the need to balance "environmental" and "economic" considerations. Second, there was the need for the policy to be applicable to all building types. Third, maintain sensitivity toward neighborhood character. Fourth, incorporate decision making tools such as LEED, EnergyStar, etc., when it is appropriate. Finally, staff felt that it was important to include mechanisms that can verify sustainable decision making.

The new policy will apply to every new facilities and major renovations projects over 5,000 square feet of internal space that the City develops. The impetus for this action comes from the City of Council's Focus Area Plan The focus area plan demonstrates the City's leadership and continued commitment to protecting the environment that makes Charlotte such a great place to work and live.

What Can the People of Matthews Do for the Environment?

By S. David Ross, Matthews Environmental Advisory Committee

Before asking what new or additional things the citizens and Town of Matthews can do for the environment, we must examine what is being done.

In 1989, the Town developed the Solid Waste Management Committee. This committee was responsible for preparing the first compliance plan with the State of North Carolina's mandate to divert 40% of solid waste from landfills. Shortly thereafter, the bidding for the first solid waste contract that included recycling and yard waste collection began. In order for the successful bidder, the old BFI, to get the contract, they were required to start a yard waste management process (*composting process*). Not only was this process used by the Town until the Town joined Mecklenburg County's Solid Waste collective in 2009, which requires the waste be taken to Compost Central, but other towns whose yard waste was collected by BFI and their successors, Allied Waste Industries and Republic Waste Services, also had their yard waste become part of this process.

The residents of Matthews have exceeded the state's goal of a 40% diversion of waste from reaching our landfills.

The Town of Matthews joined the State of North Carolina's Air Awareness Program when it began in the late 1990s. During the ozone season, the town and its Environmental Advisory Committee members maintain signs along thoroughfares (*major roads*) so people coming into Matthews can see what the Air Quality Color Code is for that day. With this information, citizens can decide if it is a good day to cut the grass, run and play outside, or take appropriate precautions. People now count on these signs to be kept updated, which is a positive response.

The Town of Matthews developed and implemented a Storm Water Ordinance to protect the streams that receive water from storm drains. With the help of Mecklenburg County's Land Use and Environmental Services Agency's Surface Water Quality Program, many violators of this ordinance have been caught. The town found many painters discharging their paint wash water into the storm drains, and restaurants dumping their grease traps into the storm drains. By assessing penalties that included a financial component and community notification essentially saying, "I got caught doing this. Please learn from my mistake," few violators have been found recently.

For town vehicles that use diesel fuel, the town successfully has switched to bio-diesel. The town has performed an initial Greenhouse Gas emission inventory.

Now to answer the question: "What can the people of Matthews do for the environment?"

One new thing that citizens can do is adopt a storm drain in their neighborhood. While there is no formal program for this, residents can check the storm drain in front of their house, or in front of their neighbor's house. If there are piles of leaves next to this storm drain, or atop the grate, move the leaves onto the grass so that they will not fall into the storm drain and form a clog. Clogged storm drains can lead to flooding and black ice. Along with this, if citizens see that a storm drain is clogged, call the Town Public Works Department and they will cleanout the storm drain. Everyone pays for storm drain maintenance as part of their monthly water bill.

As citizens continue to do their part through recycling, placing their solid waste containers on the house/grass side of the curb — not in the street — would be helpful. Not only can containers placed in the curb of the street block the flow of storm water; containers placed on the road partially block the flow of traffic.

Questions about the town's environmental activities can be addressed to the Environmental Advisory Committee through the town's Department of Public Works.

Eating Locally is Healthy and Easy

By Allison Mignery, MS, RD, LDN
Mecklenburg County Health Department Nutritionist

Science proves high-quality soil can generate healthy food. Science also proves eating healthy food can lead to healthy people. Eating healthy is important for your body because it ensures adequate nutrient intake from a variety of food choices, and can lower risk for diet-related diseases, such as diabetes and heart disease.

For these reasons, we should all place a high value on eating healthy. The Dietary Guidelines for Americans give science-based advice on food choices for good health. According to this advice, a healthy diet is one that:

- Emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products;

- Includes lean meats, poultry, fish, beans, eggs and nuts; and

- Is low in saturated fats, trans fats, cholesterol, salt (sodium) and added sugars.

How easy is it to get healthy food and eat a healthy diet? As of 2008, a report from Food Marketing Institute shows we have approximately 35,394 traditional supermarkets in the US, with an average of 46,852 items carried in each supermarket. For that reason, it appears we have plentiful access to food, but is the food offered in grocery stores always good for us? It can be if we keep an eye out for buying seasonal produce, reading labels to avoid foods high in fat and sugar, and becoming familiar with where food originates (e.g., buying local).

One specific way to assure you are eating good quality food is to harvest your own fruits and vegetables. We are fortunate to live in central North Carolina where the weather is warm enough to have three growing seasons: spring, summer and fall. Each season brings a wide variety of produce for trying new recipes and flavor combinations. For example, try eating a mixed baby greens salad in spring, strawberries and blueberries with yogurt in summer and butternut squash soup in fall. Fresh produce from the garden tastes better, is more nutritious, and is a better economical value for your pocketbook.

Growing your own produce in a garden and preparing it at home is just one way to eat healthy, locally-grown food. Here is a list of four other ways to enjoy nutritious food year long:

1) Join one of the many community gardens and rent a plot for yourself or split one with a friend. Check out the Mecklenburg County Park and Recreation's list of community gardens at: **http://www.charmeck.org/Departments/Park+and+Rec/Facilities/Community+Gardens.htm**

2) Visit a farmers market around town. Most markets run from April through October, but some are open year-round. Check out the North Carolina Farm Fresh Web site which allows you to search for farmers' markets in your county: **http://www.ncfarmfresh.com/farmmarkets.asp**

3) Preserve fruits or vegetables (canning, freezing or drying) to enjoy later during the winter months.

4) Join a CSA (Community Supported Agriculture) and buy a share of a farmer's produce for the growing season and receive a box each week of what has been harvested.

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Eating Locally is Healthy and Easy

continued

It is easy to see the value in eating locally-grown and seasonal foods. Preparing these foods can also be easy and fun for the whole family. Check out these Web sites for recipes and cooking tips associated with eating locally grown foods:
http://harvesteating.com/default.aspx
http://seasonalcooking.suite101.com/
http://www.mostlyeating.com/

How You Can Get Involved in the Local Food Movement

Food Policy Networks are being formed around the country as a comprehensive approach to understanding, organizing and becoming more strategic in thinking about food in local communities. In the Charlotte/Metro Region, many agencies, organizations and interested individuals have worked independently for years to create a healthy, sustainable food system for our citizens. In 2009, the **Charlotte-Mecklenburg Food Policy Council (CMFPC)** was formed. The CMFPC includes a wide range of people who have an interest in our local food system including local farmers, community gardeners, government officials, health educators, non-profits, universities, Slow Food Charlotte, religious institutions, and chefs.

The CMFPC Mission Statement: is: Maximize the availability, affordability, quality, safety, sustainability and economic viability of our food system in Charlotte-Mecklenburg by bringing together a diverse array of stakeholders to influence community and government policy.

The Environmental Policy Coordinating Council recommended the County support large farms in and around Mecklenburg County. Gathering and analyzing data through a Community Food Assessment may reveal ways in which farms can be preserved, allowing for a more sustainable environment and community. A Community Food Assessment has the potential to be a reproducible tool throughout our region that would allow discovery of large farm value and needs for their preservation into the future. The CMFPC has started data collection for a Community Food Assessment that would include:

i. Socioeconomic and demographic characteristics of the community,
ii. Existing community food resources,
iii. Household food security (insufficient budget or supply of food),
iv. Food resource accessibility,
v. Food availability and affordability, and
vi. Community food production.

If you would like to get involved with the CMFPC, contact the group through their Facebook page at: **www.facebook.com**.

Resources:
Food Marketing Institute, Industry Overview 2008 http://www.fmi.org/facts_figs/?fuseaction=superfact
Dietary Guidelines for Americans 2005, U.S. Department of Health and Human Services, U.S. Department of Agriculture

solid Waste

Mecklenburg County
North Carolina

Solid Waste Key Findings and Recommendations

By Bruce Gledhill, PE, Director, Mecklenburg County Solid Waste

Key Findings

• In Fiscal Year 2008, the most recent year for which complete waste management data has been compiled, Mecklenburg County residents and businesses disposed of 1,442,987 tons of solid waste in landfills, a decline of approximately 100,000 tons from the preceding year. Of the total disposed, approximately 52% was generated by businesses, 25% by residences, and 23% by construction and demolition related activities.

• By the State's and the County's standard method of waste disposal measurement, the County's per capita landfill disposal rate for FY 2008 was 1.67 tons/person/year. This represents a 15% reduction from the base year of measurement a decade ago. Following a two-year spike, the per capita disposal rate is again on a downward trend consistent with the County's 10-Year Solid Waste Management Plan. Generally, this downward trend is attributable to a recent decline in construction activity and the related reduction in construction and demolition waste generation.

• The quantity of recyclables collected in the residential curbside programs throughout the County has continued to increase, now at approximately 12% by weight recycled of the total residential waste collected. This is still less than the approximate 13% achieved at the beginning of the decade. Residential recycling rates remain well below that which has been demonstrated in similar successful programs across the country.

• On Oct. 1, 2009, the State of North Carolina expanded the list of materials banned from landfills to include motor oil filters, wooden pallets, and recyclable rigid plastic containers with a neck smaller than the body. Adequate public and private infrastructure exists to readily recycle the oil filters and wooden pallets. Local infrastructure is currently inadequate to handle some of the newly regulated recyclable plastics.

• Recycling of cardboard and office paper has been required by ordinance of larger businesses in Mecklenburg County since 2002. While compliance rates with the ordinance are high, per capita disposal rates for commercial waste have remained relatively constant as the growth rate in business activity has exceeded the growth rate in population. In addition, there is limited applicability of the ordinance to small and mid-size businesses.

• Construction and demolition (C&D) waste disposal rates have also seen small reductions in the past five years, but this segment of the waste remains the least recycled. Waste diversion and recycling gains have been made through the growth of "green building" practices which encourage waste minimization. Tied to these changed building practices are increased recycling opportunities for source separated recyclables such as cardboard, concrete and drywall and the growing establishment of private firms that can process unseparated materials for recycling.

• In the near term there is adequate public and private landfill capacity to meet the County's waste disposal needs. However, given current land use and population density, it is unlikely that additional landfill capacity will become available in or near Mecklenburg County.

• The County's recycling processing facility, the Metrolina Recycling Center, is currently undergoing a major capital modernization, scheduled to be completed by July 2010. This retrofit will convert the facility from dual-stream processing (*commingled containers and paper products collected and processed separately*) to single-stream processing (*all collected material collected and processed together*). With this conversion, greater recovery rates are achievable and recyclable collection costs are reduced.

• With the Metrolina Recycling Center processing more than 55,000 tons of recyclables per year, Compost Central processing over 90,000 tons of yard waste per year into mulch and compost, and four full-service and nine self-service recycling convenience centers, the County's infrastructure for providing waste diversion opportunities is the most comprehensive in the state.

Recommendations

• Maximize the residential recycling opportunities presented by the single stream conversion of the Metrolina Recycling Center. Increase the public awareness and program participation in residential recycling by educating on the advantages of this new collection and processing approach. With the availability of improved processing technology, expand the number of recyclable materials, especially plastics, to increase recovery rates and address the addition of recyclable rigid plastic containers to the list of materials banned from landfills.

• Grow recycling in the small business community. Smaller businesses typically do not meet the minimum quantity threshold requiring them to recycle under the County business recycling ordinance and are underserved by private recyclers. Consider lowering the ordinance quantity thresholds to more broadly apply to small businesses. This would encourage development of economical private and public recycling collection infrastructure.

• Facilitate the development of alternatives to the disposal of construction and demolition (C&D) wastes. This should be a two-pronged approach: (1) increasing the number of C&D waste constituents recycled at the County's Foxhole Landfill, and (2) encouraging the development of private collection and processing capacity to handle separated and unseparated C&D wastes.

• Continue to investigate emerging alternative waste management technologies as a means of reducing the total environmental impact of our solid waste management system and of preserving the landfill capacity that is now available to us.

• Continue to invest in the County's recycling infrastructure to ensure the capacity to service citizen needs in the future. Invest in technological advances to improve the recyclable recovery rates and operational efficiencies of that infrastructure.

How Much and What Types of Waste are Generated in the County?

By Joe Hack, Solid Waste Senior Project Manager, Mecklenburg County Solid Waste

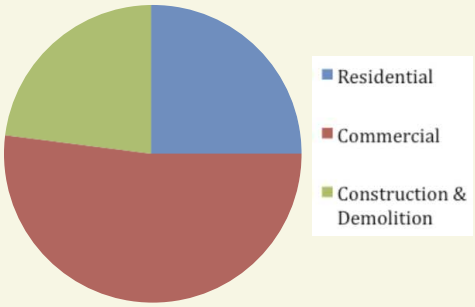
In Fiscal Year 2008, the most recent year for which complete waste management data has been compiled, Mecklenburg County residents and businesses disposed of 1,442,987 tons of solid waste in landfills, a decline of approximately 100,000 tons from the preceding year. Of the total disposed, approximately 52% was generated by businesses, 25% by residences, and 23% by construction and demolition related activities.

By the State's and the County's standard method of waste disposal measurement, the County's per capita landfill disposal rate for FY 2008 was 1.67 tons/person/year. This represents a 15% reduction from the base year of measurement a decade ago. Following a two-year spike, the per capita disposal rate is again on a downward trend consistent with the County's 10-Year Solid Waste Management Plan.

To put the number in perspective, the citizens of Mecklenburg County disposed of an average of 9.2 pounds of waste per person per day. This per capita disposal rate represents an 11% reduction in waste disposed when compared to the preceding year. To better understand the nature of the sources generating this waste, the County divides the total waste stream into three components; residential, commercial, construction and demolition (C&D). Commercial waste is the largest component consisting of 52% of the total waste stream, while C&D is 23% and residential is 25%. These numbers only represent waste that is disposed and do not include the waste that is diverted at the source or recycled. (*see the Solid Waste Component pie chart at top right*)

Waste that is generated by households, both single-family and multi-family, is referred to as residential waste. There were more than 382,000 tons of residential waste generated in Mecklenburg County during

Solid Waste Component



Fiscal Year 2008. This represents about 25% of the County's total waste stream. This amount equates to about 3,358 pounds per person per year. These statistics reflect only that waste that is actually disposed of and do not include waste that is recycled through curbside collection and drop-off programs.

Fiscal Year	lbs/person/day
1999	10.7
2000	11.0
2001	9.7
2002	9.8
2003	9.5
2004	9.4
2005	9.2
2006	10.4
2007	10.2
2008	9.2

Commercial waste is waste that is generated by businesses. It may come from manufacturers, office buildings, restaurants or the neighborhood grocery store. These businesses in Mecklenburg County generated more than 734,949 tons of waste, by far the largest component of the total. According to the United States Environmental Protection Agency and studies done here in North Carolina, about half of this waste stream is comprised of cardboard

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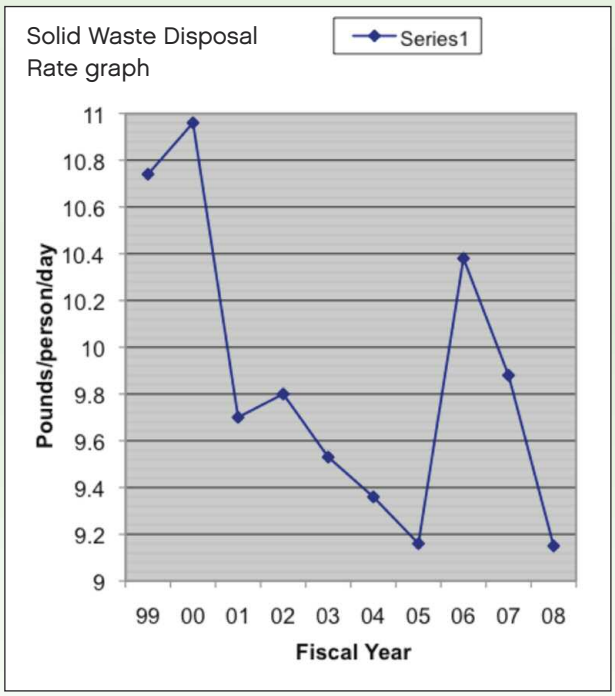
How Much and What Types of Waste are Generated in the County?

continued

and paper. Because commercial waste is the largest portion of the County's waste stream and because a large portion of this waste stream is easily recyclable, Mecklenburg County adopted an ordinance in 2002 requiring applicable businesses to separate cardboard and paper from their other wastes. For more information about this ordinance and compliance assistance, please see our web page **www.wipeoutwaste.com**.

Construction & demolition (C&D) waste includes waste that is generated from commercial and residential, building, renovation, construction and demolition activities C&D activities generated more than 325,979 tons of waste or about 23% of the total waste stream in Fiscal Year 2008. A local study suggests that wood accounts for about 34% of this waste stream, with materials such as gypsum wallboard, masonry and roofing materials also being major constituents. Efforts are underway to reduce C&D waste disposal through education of builders in alternative building techniques and separation of the recyclable components at the source.

A great deal of waste is generated within Mecklenburg County, but not all of this waste is generated by County residents. Many people enter this County everyday to work, shop and play and through each of these activities generate waste. Even with the wastes generated by non-residents, the County's per capita disposal rate has decreased over the past several years. Since Fiscal Year 1999 we have realized a 14% reduction in the waste disposed per citizen of Mecklenburg County. Efforts as outlined in the County's 10-Year, Solid Waste Management Plan (2009 – 2019) will continue to reduce the amount of waste disposed.



Where do our Waste and Recyclables go Once They are Collected?

By Joe Hack, Senior Project Manager
Mecklenburg County Solid Waste

Recyclables collected from homes are taken to the County-owned Metrolina Recycling Facility located off North Graham Street in Charlotte. Here the recyclables are sorted, baled, and sold as raw material to be reused to make other products. Recyclables from businesses are taken to various privately owned facilities to be baled and sold as raw materials in the manufacture of new products. Yard waste collected from homes is taken to the County-owned Compost Central facility located near Charlotte Douglas International Airport. This material is used to produce mulch, compost, and boiler fuel.

When recyclables are collected at the curb, the driver of the collection truck separates the material into two streams, fiber (*newspaper, cardboard, junk mail, etc.*) and commingled containers (*bottles, cans, and other plastic or glass containers*). These materials are delivered to the Metrolina Recycling Facility where they are separated, primarily by hand, into the different types of plastic, glass, aluminum, tin, newspaper or cardboard. Then the separated recyclables are formed into bales, each weighing as much as 1,500 pounds. These bales are then sold to manufacturers of different products. For example, newspaper can be used to produce insulation, plastic can be made into carpet, and aluminum can be used to make new aluminum cans. All of the recyclables placed at the curb ultimately end up as new products.

The quantity of recyclables collected in the residential curbside programs throughout the County has continued to increase, now at approximately 12% by weight recycled of the total residential waste collected. This is still less than the approximate 13% experienced at the beginning of the decade. Residential recycling rates remain well below that which we have identified as achievable here in Mecklenburg County.

The County's approach to handling recyclables will change when the Metrolina Recycling Facility begins operation as a Single Stream Recycling facility. The recyclables collected at the curb will then be collected in one large roll-out container containing the commingled and fiber materials. The material will then be delivered to the Metrolina Recycling facility where the material will be mechanically sorted into the different commodities.

The County's recycling processing facility, the Metrolina Recycling Facility, is currently undergoing a major capital modernization, scheduled to be completed by June 30, 2010. This retrofit will convert the facility from dual-stream processing (*commingled containers and paper products collected and processed separately*) to single-stream processing (*all collected material collected and processed together*). After the conversion, the County will expand the type of plastic materials processed by the facility. With this conversion, greater recovery rates are achievable and recyclable collection costs are reduced.

Recyclables from internal County recycling programs are also taken to the Metrolina Recovery Facility. Business recyclables are taken to various facilities owned by private companies to be baled and sold as raw materials to make other products as well. The recyclables collected from businesses typically consist of office paper and cardboard. This material can be reused to make additional paper and cardboard. By recycling this material, it allows the paper-making process to use less virgin material such as pulp from trees that will

be reprocessed into paper, cardboard or home insulation.

The internal recycling rate at County-served governmental facilities increased 2% in Fiscal Year 2009, reaching 16.1% by weight of total materials handled. County partners in this recycling program include the Charlotte-Mecklenburg Schools, Central Piedmont Community College, and the Mecklenburg County ABC Board. Contributing to this increase has been a pilot can and bottle roll-out collection serving more than 100 locations.

Construction and demolition (C&D) waste recycling rates have also seen small increases in the past five years, but this segment of the waste remains the least recycled. Recycling gains have been made through the growth of "green building" practices which encourage waste minimization. Tied to these changed building practices are increased recycling opportunities for source separated recyclables such

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Where do our Waste and Recyclables go Once They are Collected?

continued

as cardboard, concrete and drywall and the growing establishment of private firms that can process unseparated materials for recycling.

Recyclables generated from the construction or demolition of buildings usually consist of wood, metal, cardboard, brick or concrete. This material is also taken to privately owned facilities to be recycled or reused. There has been an increase in the number of facilities that receive and process C&D waste in the local area. Concrete and brick can be crushed and reused as gravel or landscaping material. The wood can be ground into mulch and dyed for landscaping material. The metal and cardboard are recycled into new metal or cardboard materials.

Yard waste collected at the curb is loaded by hand into the collection truck. The material is then delivered to Compost Central where it is ground up for processing. Once the material is ground, it can be used as mulch, boiler fuel, or composted. Composting is a process in which the material is put into rows or piles and allowed to decompose. Turning the material occasionally accelerates the decomposition process. Once the material has decomposed it can be used in yards or gardens to promote growth of plants and vegetables.

Garbage from homes is taken to the Charlotte Motor Speedway Landfill, while garbage from business may be taken there as well or to various other landfills within the region. Though reusing or recycling waste has the most benefit, the majority of waste is not currently recyclable and is buried in a landfill. Many safeguards are built into the landfill to prevent any negative impacts to the environment. The technology involved in developing landfills has come a long way in the past decade. The gas produced from the decomposition of the garbage can be used to generate electricity or used in greenhouses. Once landfills are closed they can be utilized for various activities such as golf courses like Charles T. Myers Golf Course or Renaissance Golf Course. They can also be utilized as nature preserves and walking trails after closure.

In the near term, there is adequate public and private landfill capacity to meet the County's waste disposal needs. However, given current land use and population density, it is unlikely that additional landfill capacity will become available in or near Mecklenburg County.

top caption to come
above Charles T. Myers Golf Course
at left Charlotte Motor Speedway Landfill

Less Waste in the Landfills Means a More Livable Community for You

By Laurette Hall, Environmental Manager, Mecklenburg County Solid Waste

Mecklenburg County has programs to reduce the amount of waste going into landfills and protect the environment – land, air and water. Protecting the environment protects the health of residents seeking to enjoy a more livable community. Reducing waste also has many other very important beneficial effects including reuse of materials and resources, lessening the need for raw materials, energy conservation, reduction in greenhouse gases, and job creation and revenue into local economies. Reducing waste is a very important aspect of "greening" our daily habits.

As a county, we have made strides in reducing the amount of waste landfilled by the planning, development and implementation of programs that find alternative processes to manage our waste and divert it from landfills. Our principal planning tool is *The Mecklenburg County Solid Waste Management 10-Year Plan (FY2009-2019)* that serves as a guiding document for waste reduction; identifying strategies and accompanying programs needed to reach reduction goals. This plan also describes how waste will be managed in Mecklenburg County. It includes programs for unincorporated Mecklenburg County, the City of Charlotte, and towns of Huntersville, Davidson, Cornelius, Mint Hill, Pineville and Matthews. It establishes a 34% per capita reduction goal by the Fiscal Year 2018/19 for the commercial waste stream, a 27% per capita reduction goal for the residential waste stream, and a 45% per capita reduction goal for the construction and demolition waste stream. These reduction goals are measured from the baseline year of Fiscal Year 1998/99 (FY 1998/99). In FY2008/09, the overall waste stream was reduced by 11% which can be attributed to a large and diverse infrastructure for recovering materials and economic conditions. An 11% waste stream reduction is a positive step toward meeting our 34% reduction goal for FY 2018/19.

So how do communities successfully reach such ambitious goals? The Environmental Protection Agency recommends that communities implement programs that put source reduction, recycling (*includes composting*), combustion and landfilling as core components in managing waste.

Reducing waste at its source

Today, residents are very interested in properly disposing of their batteries, medical waste and computer waste. If waste is not created, it does not have to be managed. The concept of "source reduction is defined as a reduction in the amount and/or toxicity of waste entering the waste stream or waste prevention." The approach to reducing waste at its source includes a menu of programs that can be used both internally and externally for homes and/or businesses. These programs teach donating rather disposing; the diversion of food waste through donations and composting; purchasing practices that generate less waste through packaging; the reduction of junk mail; the proper recycling and disposing of waste that may be hazardous to human health; the reduction of waste during the holiday seasons and the composting of food waste and yard waste.

Residents choose to participate in recycling programs

In Mecklenburg County, residents voluntarily participate in recycling programs at the curb, in their apartments/condominiums, and at recycling centers. In a 2009 survey of residents throughout the County, the vast majority of residents strongly agreed that recycling is the right thing to do, it is good for the environment and it is good for their communities. The study found that more than half of residents set out their recyclables at least once every two weeks. The study also notes that this type of self-reporting may yield results that demonstrate the positive social desirability of recycling.

Residential waste represents approximately 25% of the total solid waste in the County, and can generally be thought of as the waste produced from the home. The municipalities have increased the amount of education to their customers in the area of waste reduction and recycling. Communication between municipalities has also increased as programs such as "Recycle and Win," a joint public/private partnership launched throughout the County in 2009 to increase the recovery of recyclables. The municipalities are approaching the largest change to household recycling since its inception in our county by a change in the collection system which will allow for a larger container and more materials that can be recycled. Added together, the City and towns recycled more than 50,836 tons of waste in FY 2008/09.

Recycling Drop-Off Centers - a valuable resource for recovering recyclables

For more than 25 years, County residents have been provided with an additional option of taking their materials to staffed and unstaffed recycling centers. Staffed recycling centers provide a six-day work week for customer convenience and expanded material recovery. You may recycle beverage containers and fibers at any time at an unstaffed center, which is simply a collection of recycling containers at a designated location. These centers are conveniently located throughout the County and serve both the residential and business communities.

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Less Waste in the Landfills Means a More Livable Community for You

continued

In FY 2008/09 there were 4,589 tons of beverage containers and fiber materials recycled through the full-service and self-service centers. In addition to the traditional beverage containers and fiber, the full-service centers also provide services for the proper handling and disposal of household hazardous waste, such as paints, household cleaners, and batteries. Approximately 467 tons of household hazardous waste material were collected and properly recycled or disposed of in FY2008/09. Residents also recycled 622 tons of computers, computer related materials, and other electronics at the full-service centers in FY08/09. Residents also delivered 2,484 tons of construction and demolition materials to the full-service recycling centers. Appliances and scrap metal accounted for 2,725 tons of material in FY08/09, and 16,234 tons of scrap tires were also collected through this program.

Reducing waste and increasing recycling at work

For more than 10 years, Mecklenburg County has been working with local businesses to reduce the amount of waste they generate and increase the amount of materials they recycle. Strategies to accomplish this task include: a mandatory source separation ordinance that strongly encourages recycling through separation of recyclable materials from other waste, enforcement of the law, recognition programs, education and training, and leading by example. The City/County internal program for recycling, which includes the Charlotte-Mecklenburg School System, collected 3,338 tons of recyclables.

Surveys conducted within the business community indicate their desire to participate in business recycling, but challenges remain in finding economical collection services for small businesses that recycle voluntarily. New laws enacted to ban beverage containers for ABC permitted facilities and plastic bottles from the landfill have generated renewed interest in recycling from the business community. In FY 2008/09, Mecklenburg County reduced the amount of commercial waste disposed by 5% compared to the previous year.

Reducing waste and increasing recycling during construction and demolition

When you mention construction and demolition (C&D) activities, you may be asked, "Have you heard about LEED?" LEED (Leadership in Energy and Environmental Design) is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies aimed at improving performance that will protect the environment. This system has spurred a movement in the building industry that recognizes the need for waste minimization and the proper disposal of this waste stream. In spite of this movement and increased education, C&D waste remains the most unrecovered material in the overall waste stream of the county.

The County's strategy to reduce the C&D waste stream has been a program of outreach and education accompanied by recovery of material at the landfill. Mecklenburg County experienced growth and then a more recent decline in development due to economic conditions. In FY 2008/09, 325,979 tons of C&D waste was landfilled in the County.

The crushing of concrete, brick and block for reuse of the aggregate, the grinding of clean wood waste for sale as boiler fuel, and the recovery of gypsum continue at the County's Foxhole Landfill. The County has future plans to recover asphalt shingles. The number of private companies that can provide recycling and reuse services for construction and demolition waste has grown within the County.

Composting reduces waste going into landfills

Greens, browns, water and light make compost. Backyard composting classes remain a viable mechanism for teaching residents methods to manage their yardwaste and kitchen scraps and reduce the amount of waste placed at the curb. Classes are taught at two-hour, four-hour and 16-week increments. Through compost bin sales on the Internet and at sale events, residents can purchase commercial bins throughout the year. Partnerships are developing through community gardens, school habitats, and neighborhood associations to spread the educational infrastructure throughout the county.

Yard Waste Management

By Darren Steinhilber, P.E., Project Manager, Mecklenburg County Solid Waste

Ever wonder what happens to your Christmas tree once the holidays are over and that perfect tree that you worked so hard to find has fulfilled its purpose? What about all those bagged leaves that had fallen from their trees during the autumn months to cover your entire lawn and that are now, through your tireless weekend raking, left on the curbside for the City to pick up?

Once those leaves and that Christmas tree are collected by city/town services, they are considered "yard waste". As defined by the Solid Waste Management Act of 1989 (North Carolina General Statute 130A) "yard waste" means solid waste resulting from landscaping and yard maintenance (*for example: brush, grass, tree limbs*), and land-clearing debris, (*including: stumps, limbs, leaves, grass and untreated wood*). Yard waste is generated by the development and maintenance of lawns by single-family households, multi-family households, businesses and governmental entities. Yard waste is also generated as a result of changes in land use and storm debris.

Residential Curbside Yard Waste Collection

Yard waste such as leaves, grass clippings, and brush are no longer permitted to be placed in municipal solid waste (MSW) landfills, being banned from MSW landfills by the State of North Carolina in 1993. Nationally, it is estimated that yard waste represents 19-21% of the total municipal solid waste stream. During Fiscal Year 2008/09, Mecklenburg County processed approximately 93,000 tons of yard waste. In addition, through education and compost bin sales, as many as 27,000 households may be composting at home, potentially reducing the annual yard waste and food waste stream by a ton per year per household.

As a result of the yard waste ban, each Mecklenburg County municipality provides weekly curbside yard waste collection service to the same set of households that receive other curbside solid waste collection services.

Materials accepted and guidelines for setting out yard waste in the city and towns vary and are provided by each municipality.

Residential yard waste is typically hand loaded into the collection truck. This hand-loading process makes it important to limit the size of individual pieces so that the yard waste is not too big for the driver to handle. Some municipalities alternatively provide containerized yard waste collection, which also limits the size of the yard waste collected.

Most of the yard waste collected is then delivered to the County's Compost Central facility located near the Charlotte Douglas International Airport. About 62,000 tons of yard waste were handled there in Fiscal Year 2008/09. At Compost Central the yard waste is ground by large tub grinders into pieces about one inch in size. Once the material is ground, it is either saved for industrial use or composted, a process in which the material is put into rows or piles and allowed to decompose. The decomposed material becomes a valuable soil additive and can be used in yards or gardens to promote growth of plants and vegetables. Those materials that are saved for industrial use are turned into boiler fuel – where it replaces fossil fuels in local paper mills.

In addition to the Compost Central facility, residents may also take yard waste materials directly to one of three Full-Service Drop-Off centers owned by Mecklenburg County. These three facilities include the Foxhole, Hickory Grove, and North Mecklenburg facilities, which are small yard waste collection and grinding points only, integrated into the full-service recycling center operations. In addition to the permitted yard waste sites, the County maintains several locations to handle vegetative debris from storm events.

Commercial Sector Yard Waste

Generally, multi-family households and businesses receive yard waste services through private contractors (landscapers) that may use County facilities or private processing facilities in the county. Private contractors utilizing non-county facilities for yard waste management are not required to report tonnage to the County. Likewise, private processors of yard waste are not required to report their tonnage to the County. Consequently, complete data regarding commercial sector generation of yard waste is not available. However, a few landscaping companies do bring materials to Compost Central or one of Mecklenburg County's three other staffed drop-off centers. Private contractors utilizing private facilities for yard waste and land clearing debris management can bring materials to any one of 10 Land Clearing and Inert Debris (LCID) landfills, two LCID treatment and processing facilities or one commercial composting facility located in Mecklenburg County.

The County yard waste program is diverting a large quantity of materials from disposal. Lot size, weather (rainfall), wind, and storm activity all influence the amount and kind of yard waste materials generated. For this reason, as well as possible data reporting deficiencies in regards to commercial sector yard waste, it is not known how much more can be diverted. However, the residential yard waste diversion program is generally regarded as a very successful program.

Litter

A National Issue and a Local Problem

By Jake Wilson, Senior Environmental Specialist, Mecklenburg County Solid Waste, and Executive Director, Keep Mecklenburg Beautiful

Mecklenburg County's litter prevention and education efforts are focused through Keep Mecklenburg Beautiful.

Keep Mecklenburg Beautiful

Certified in 2004, Keep Mecklenburg Beautiful (KMB) meets monthly and has an active board of directors of 20 members. In addition to required Keep America Beautiful, Inc. program participation, KMB develops signature programs such as removal of campaign election signs. KMB staffs booths at public venues, speaks to civic groups and private sector audiences, and works closely with all organizations in designing and implementing year-long litter prevention activities.

Annually, KMB participates in the Great American Cleanup™ (GAC) from March 1 through May 31, involving an estimated 3 million volunteers and attendees. The hardworking volunteers donated more than 5.2 million hours in 2009 to clean, beautify and improve more than 32,000 communities during more than 30,000 events in all 50 states and beyond. The GAC is the signature program of Keep America Beautiful.

Recently Keep America Beautiful announced the results of its comprehensive study of litter and littering behavior.

"Our research clearly shows that while major progress has been made in reducing litter, more remains to be done," said Matthew M. McKenna, president and CEO of Keep America Beautiful, Inc. "By combining strong, targeted public education and outreach with a better infrastructure of trash, ash and recycling receptacles, communities can reduce litter and its costly impact."

In the past 40 years, since 1968, the amount of litter in America has decreased by 61% nationwide, a change attributed to aggressive, long-term public education and cleanup programs. Yet litter remains a costly and often underestimated problem for the environment and quality of life.

Litter conservatively costs our nation $11.5 billion per year. These are direct costs, including cleanup and prevention programs, and are carried largely by businesses and taxpayers. Not included in this figure are significant indirect costs:

- Decreased property values - 93% of homeowners, 55% of real estate agents and 90% of property appraisers surveyed stated that a littered neighborhood would decrease their assessment of a home's value.
- "Opportunity Costs" such as decreased commerce and tourism in blighted areas
- Health effects and related costs of littered environments.
- The study concludes that at least 51.2 billion pieces of litter are left on roadways in the U.S.; an average of 6,729 pieces of litter per mile.
- Cigarette butts comprise 38% of all items littered on the highways, streets, parks and playgrounds (*in urban, suburban and rural areas of America*).
- **People matter.** Most littering observed in the study – 81%– was committed "with intent" by the individual, and was mainly attributable to lack of individual awareness or sense of obligation. The study showed that 17% of all observed disposals were classified as "improper" or littering.
- **Context matters.** Fifteen percent of all littering can be attributed to context. The strongest contextual contributor to littering is the prevalence of existing litter. Other contextual variables affecting litter are the number of trash or ash receptacles present, and the distance between receptacles.
- **Age matters.** Older individuals (*30 and over*) littered less than younger individuals, but gender was surprisingly not related to litter rates.

While conducted at a national level the results of this study are relevant to our local observations and experiences.

What can we do in Mecklenburg County?

Swat-A-Litterbug

Keep Mecklenburg Beautiful administers this program through the North Carolina Department of Transportation. It is an effective tool whereby individuals can report incidents of litter law violations from vehicles to KMB by calling **704-432-1772**, mailing the Swat cards or submitting them electronically through **www.swatalitterbug.com**. A letter is sent to the owner stating that littering violations can result in a monetary penalty if witnessed by a law enforcement officer. The letter is signed by the commanding officer of the North Carolina Highway Patrol. KMB reports that more than 3,500 letters are sent to litter offenders annually. All pertinent information must be an exact match before a letter can be sent. In accordance with NC stalking laws, information is not shared nor retained. All records are destroyed at month end. This program empowers the public to take action in a non-confrontational manner and it has a strong participation history.

Adopt-A-Highway

Created in 1988, by the NC DOT Office of Beautification, the volunteer-based program of Adopt-A-Highway has saved taxpayers millions of dollars annually in roadside cleanup costs. Each section of adopted highway is approximately two miles long and requires cleaning four times per year. Fiscal Year 2007/08 data from NC DOT reports that there are 1028.95 miles of state maintained roads in Mecklenburg County. Roads can be adopted by businesses, churches, civic organizations, schools, professional organizations, individuals, and family groups. Mecklenburg County is allocated one NCDOT Adopt-A-Highway (AAH) Coordinator to manage the program locally. For safety reasons, interstate highways are excluded from the program. Keep Mecklenburg Beautiful began a partnership with the local AAH Coordinator to assist in promotion of the program and to conduct outreach efforts to encourage renewed interest in participation. To Adopt-A-Highway visit **www.swatalitterbug.com**.

Adopt-A-City-Street

"Adopt-A-City Street is wholly coordinated and managed by Keep Charlotte Beautiful. There are currently 83 actively adopted City streets and City street clusters within the City of Charlotte. Upon approval by the Keep Charlotte Beautiful executive director, Charlotte DOT posts two signs for each street adopted in excess of one mile. The signs have the Keep Charlotte Beautiful logo, along with the name of the group or individuals adopting the street. According to their agreements with Keep Charlotte Beautiful, participants clean their adopted street or cluster once every quarter. Keep Charlotte Beautiful provides supplies such as bags, gloves, vests, and trash grabbers. **www.swatalitterbug.com**

Neighborhood Improvement

The City of Charlotte Code Enforcement Division is responsible for enforcing the City's Health and Sanitation Ordinance, Zoning, Minimum Housing Standards and other local ordinances. A variety of nuisances are handled by Charlotte Code Enforcement such as junk and hazardous vehicles, illegal dumping, graffiti, unauthorized accumulations of litter, illegal curbside bulky items, signs placed in the City right of way, tall weeds and grass, and others. Keep Charlotte Beautiful is a part of Charlotte Code Enforcement Division. Charlotte Code Enforcement Officials and Keep Charlotte Beautiful have established networks and resources for nuisance abatement within City limits.

Litter Index Scores

The first Mecklenburg County Litter Index was conducted in 2001 as part of certification into the Keep America Beautiful organization for Keep Mecklenburg Beautiful. This snapshot is conducted annually in June to measure and evaluate the litter data throughout the County. The scores have gradually improved over the years starting at 2.6 in 2001 and improving to 1.47 in 2009. The most recent scores have exceeded expectations. (*Rankings 1=No Litter. 2=Slightly Littered. 3= Littered. 4=Extremely Littered.*)

Hazardous Waste in Mecklenburg County

By Darren Steinhilber, P.E., Project Manager
Mecklenburg County Solid Waste

For 14 years, throughout the late 80s and 90s, Mecklenburg County industries had the dubious distinction of generating more hazardous wastes than those in any other county within North Carolina. In 1995, the County led the state in hazardous waste generation with approximately 9,900 tons of hazardous waste generation, which accounted for almost 20% of the total amount of hazardous waste generated in North Carolina.

However, according to the most recent data available as provided by the United States Environmental Protection Agency (USEPA), Mecklenburg County industries produced approximately 7,800 tons of hazardous wastes in 2007, a 37% decrease from the 12,500 tons reported in 2005. This amount is equal to 8.1% of the total amount of hazardous waste generated in the state during 2007. Though this percentage is slightly higher than the same percentage two years prior (3.3%), overall hazardous waste generated in North Carolina has decreased 75% from 2005, from over 384,000 tons in 2005 to 96,000 tons in 2007.

A waste may be considered to be hazardous if it is ignitable, corrosive, reactive, or toxic. In addition to these characteristic wastes, the EPA has also developed a list of over 500 specific hazardous wastes referred to as listed wastes. Hazardous wastes may be solid, semi-solid or liquid. The hazard to human health or the environment caused by exposure to these substances can occur immediately or over an extended period of exposure, depending on the substance.

In 1965, Congress passed the Solid Waste Disposal Act. Five years later, in 1970, Congress realized that there was great potential value to be found in materials, which were commonly disposed of as municipal solid waste (MSW). This gave birth to the Resource Recovery Act, which was passed that same year. In 1976, this act was amended and resulted in the Resource Conservation and Recovery Act (RCRA), which continues to be the primary legislation governing the management of hazardous wastes. This series of laws placed the government of the United States firmly in the arena of waste management and also gave the federal government the ability to regulate solid waste within the United States. Congress gave the EPA the authority and responsibility to act as the regulating agency for these laws.

For the purposes of the RCRA, household hazardous wastes and municipal solid wastes are excluded from the definition of hazardous waste. RCRA categorizes for regulation the industries that generate, transport, store, dispose of, or handle hazardous wastes as part of their business enterprises.

Large quantity generators are those generators producing more than 1,000kg (2,200 lbs.) of hazardous waste per month or 1kg of acutely hazardous waste per month. Large quantity generators are required to track and report annually the amounts of wastes generated. Large quantity generators may store their wastes on site for up to 90 days from when the accumulation began. There are currently 48 large quantity generators in Mecklenburg County (there were 44 in 2005).

Small quantity generators are those generators producing between 100 kg (220 lbs.) and 1,000kg (2,200 lbs.) of hazardous waste per month. These generators are not required to report annually and may store their wastes on site for up to 180 days from when the accumulation began. There are currently 227 small quantity generators in Mecklenburg County (*there were 246 in 2005*).

Conditionally exempt generators are those generators that produce less than 100 kg (220 lbs.) of hazardous waste per month. Because conditionally exempt small quantity generators typically generate very low quantities of waste and may do so sporadically, small quantity generators may store wastes on site for up to 270 days from when the accumulation began. There are 1,147 conditionally exempt generators in Meck-lenburg County (*there were 1,045 in 2005*).

Any facility used for the treatment, storage and/or the ultimate disposal of hazardous wastes must be registered as a Treatment, Storage or Disposal Facility (TSD). There are currently nine TSD facilities in Mecklenburg County.

Hazardous Waste Transporters are not regulated by the RCRA but are regulated by the Hazardous Waste Transportation Act and by the Emergency Preparedness and Community Right to Know Act. Although 13 hazardous waste transporters are registered in Mecklenburg County, no firm numbers exist on how much hazardous waste material is transported through Mecklenburg County.

Contaminated Sites

When accidental releases and spills occurred prior to the laws passed by Congress, the contamination was not always properly cleaned up. This led to the creation of many contaminated sites across the country, including sites throughout North Carolina and Mecklenburg County. These sites are regulated under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), which is commonly referred to as the Superfund Act. Sites in need of clean up, as deemed by the USEPA, are placed on the National Priority List (NPL). These sites are attended to only as funds become available. There are currently two NPL sites in Mecklenburg County.

Hazardous Material Spills

Despite current regulations, accidental releases and spills do still occur. When a spill or accidental release of hazardous material occurs in Mecklenburg County, emergency personnel respond to the scene in accordance to the County's All Hazards Plan. The All Hazards Plan is a prepared emergency response protocol that satisfies the mandate in the Superfund Amendment and Reauthorization Act (SARA) that communities plan for potential responses to large-scale emergencies and disasters. Emergency responders include Police and Fire Department units with special hazardous materials units of the fire department, Mecklenburg County Land Use and Environmental Services Agency (LUESA), and elements from either the North Carolina Department of Environment and Natural Resources (NCDENR) or EPA. Last year LUESA's Emergency Response Team responded to 32 incidents that had the potential to release hazardous wastes into the environment.

Hazardous waste is ultimately a byproduct of modern society. It is incumbent upon industries and consumers to minimize the amounts of hazardous wastes they create. The proper management and reduction of hazardous materials and wastes can reduce the detrimental effects these materials have on the public health and the environment.

What Happens to our Radioactive Waste?

By Changfuh D. Lan, CHP, Senior Scientist, Duke Energy

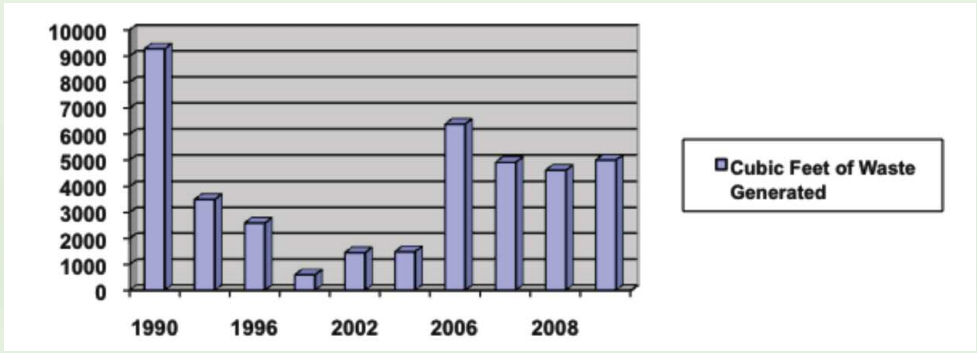
Radiation occurs naturally in our environment. Radioactive material comes in many forms. It is naturally occurring and found around all of us every day. It is energy that travels in waves and in the form of high speed particles emitted during the natural decay process (*ionizing radiation*). When we think of radiation, we usually think of nuclear power plants, X-rays, nuclear weapons, or radiation treatments for cancer. But, most of us benefit every day from a product or service made possible by radioactive materials. Thanks to these materials, we enjoy a safer food supply, clean electricity from nuclear power plants, advanced medical testing and treatment options, and many other benefits.

A byproduct of using radioactive materials is radioactive waste. Radioactive wastes are the "leftovers" from the use of nuclear materials for the production of electricity, diagnosis and treatment of disease, and other purposes. The commercial radioactive waste that is regulated by the U.S. Nuclear Regulatory Commission (NRC) and the State of North Carolina is of two basic types: low-level waste and high-level waste.

People often have misconceptions about radioactive waste. They may think of it as a liquid substance contained in piles of old drums. But, it's not like that at all.

Low-Level Waste

Low-level waste includes items that have become contaminated through contact with radioactive materials or exposure to neutron radiation. This waste typically consists of contaminated protective shoe covers and clothing, wiping rags, mops, filters, nuclear reactor water treatment residues, equipment and tools, luminous dials, medical tubes, swabs, injection needles, syringes and laboratory animal tissues. The radioactivity can range from just above background levels found in nature to very highly radioactive man-made sources. It can be generated at a variety of places such as medical facilities, universities, manufacturing facilities and laboratories.



At a nuclear power plant, this waste is typically contaminated protective shoe covers and clothing, wiping rags, mops, filters, nuclear reactor water treatment residues, equipment and tools, etc. Low-level waste does not include used fuel from nuclear power plants. And, it does not include byproducts of uranium mining or long-lived materials. Low-level waste is always disposed of as a solid. It is packaged in secure, sturdy containers, and disposed of in facilities expressly designed for this purpose. Low-level waste disposal occurs at commercially operated low-level waste disposal facilities licensed by either the NRC or Agreement States.

Radioactive waste generated at medical and dental facilities accounts for a fraction of 1 percent of the total amount of low-level waste generated, and is easily disposed of after waiting for a minor amount of decay to occur at the site. All other low-level waste is generated at nuclear powered electrical generating facilities. From 2006 to 2009, Duke Energy's McGuire Nuclear Station generated approximately 5,000 cubic feet of low-level radioactive waste for disposal per year. This is composed of items such as protective clothing, mops, filters rags and other housekeeping and protective items. The amount of waste generated on an annual basis at this facility varies as can be seen in the graph below – Low Level Radioactive Waste Generated: 1990-2009. This radioactive waste, or radwaste, is currently being disposed of in a licensed facility at Clive, Utah.

High-Level Waste

High-level radioactive waste is used fuel from nuclear power plants. After uranium fuel has been used in a reactor for several years, it is no longer efficient in the fission (*splitting atoms*) process and production of heat to make electricity. It is then used or "spent" nuclear fuel. About one-third of the total fuel load is used and removed from a reactor every 18-24 months. This fuel is replaced with new fuel. The used nuclear fuel is high-level radioactive waste. High-level waste is more radioactive than low-level waste and must be isolated longer.

The only source of high-level radioactive waste in Mecklenburg County is Duke Energy's McGuire Nuclear Station. The high-level radioactive waste material is created when fuel assemblies need replacement and are removed. On removal, the used fuel assemblies are stored on site, as they are at all nuclear powered electrical generating facilities in the United States. Used fuel may be stored in either a wet or dry environment. Presently, all high-level nuclear waste generated at nuclear power plants is stored under 20+ feet of radiation-shielding water or in dry storage containers or "casks." Dry container storage allows used fuel that has been stored in the used fuel pool for a period of years, and is less radioactive (decayed), to be placed inside rugged, steel/concrete, welded or bolted containers filled with inert gas. This is the method of storage until a long-term disposal solution is implemented in the U.S., a responsibility of the U.S. Department of Energy.

The ultimate long-term, centralized storage of high-level nuclear waste is contingent upon the licensing and construction of a federal used fuel repository. Currently, the Department of Energy is working to license a centralized disposal site at Yucca Mountain, Nevada. If this project continues to move forward and receives a license, the DOE must then complete construction of the repository and apply to the NRC for a license to begin receiving waste. Until a long-term solution is complete, high-level waste will continue to be safely and securely stored at McGuire Nuclear Station (*as it is at all other U.S. nuclear power plants*).

Nuclear Power in Mecklenburg County

McGuire Nuclear Station is located on Lake Norman in Huntersville, North Carolina. McGuire is the second of three nuclear stations designed, built and operated by Duke Energy. The company's nuclear fleet provides approximately 7,000 megawatts of electricity to the Piedmont Carolinas, roughly half the electricity consumed by Duke Energy's more than 2 million Carolinas customers.

Help Wanted!

Community Participation in the Management of Solid Waste Pays Great Rewards

By Laurette Hall, Environmental Manager, Mecklenburg County Solid Waste

Mecklenburg County Solid Waste is grateful for the numerous volunteers and countless hours that have shaped the course of our strategies to manage our waste and implement programs. Volunteers have represented their municipalities, businesses, civic organizations, schools and neighborhoods. They have helped shaped the municipal solid waste system from the development of curbside recycling programs to litter pickups, from monitoring the performance of the Foxhole Landfill to handing out bags for tailgate recycling. There are numerous opportunities to help reduce the amount of waste land filled, monitor our existing land filling efforts, and increase the amount of materials composted and recycled. Opportunities can be found below:

Waste Management Advisory Board

In 1988, the Waste Management Advisory Board (WMAB) was established by the Mecklenburg Board of County Commissioners (BOCC) to provide citizen input on solid waste management issues facing the County. The WMAB assists in solid waste planning activities, developing strategies for waste reduction and recycling, review of capital and operating budgets, and assists in the selection of consultants that will provided contracted services to the Solid Waste Division. The WMAB also hears appeals for exemptions from the Residential Solid Waste Fee and Source Separation Ordinance. Appointments to this Board are by the BOCC for two three-year terms. This board meets monthly. Information on this board can be found at www.wipeoutwaste.com.

Foxhole Landfill Advisory Council

In 2000, the Foxhole Landfill Advisory Council was established by the Waste Management Advisory Board to act as liaison to the WMAB, County staff and residents residing near the County's Foxhole Landfill. This council's main focus is the operation, maintenance, safety, education and planning activities related to the Foxhole Landfill. This board meets quarterly and appointments are made by the WMAB for three year terms.

Keep Mecklenburg Beautiful

An affiliate in good standing of Keep America Beautiful, Keep Mecklenburg Beautiful (KMB) was established in 2004 to carry out the mission to "empower the citizenry of Mecklenburg County to take greater responsibility for enhancing their environment, thereby resulting in a community of pride and choice for people to live, work and recreate." KMB Board members serve two-year terms, for no more than six years.

KMB partners with several other civic organizations that foster volunteerism in the community such as: Hands on Charlotte, Net Impact, Center City Partners, Jesus Ministries, Urban Ministries, and local community gardens. Residents may also participate in KMB supported programs such as the Great American Cleanup, Adopt-a-Highway, event recycling, Litter Sweep, and Recycle and Win.

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Community Participation in the Management of Solid Waste Pays Great Rewards

continued

Composting and Yard Waste Programs

Mecklenburg County offers classes throughout the year that educate our citizens on methods to reduce the amount of yard waste that they place at the curb for collection. These classes teach composting, mulching, gardening and various yard waste management practices. Through the class structure, volunteers plant community gardens, educate at the Southern Spring Show, teach school children how to compost with worms, remove invasive plants and educate on native plants, and teach neighborhood associations and other civic groups how to compost and recycle.

Volunteers are a vital resource for expanding the network of opportunities to educate and plan Solid Waste programs. Please visit **www.wipeoutwaste.com** for these, and other opportunities, to serve this community in advancing the proper management of solid waste and recycling.

A New Day to Recycle

Starting in July 2010, most Mecklenburg County residents will have the opportunity to expand the amount of materials that they recycle in the curbside programs and County Recycling Centers. Information on changes to these programs can be found at **www.wipeoutwaste.com** or by directly contacting your municipal government. This is a great time to re-educate yourself on the new plastics that can be recycled, along with the aerosol cans added to these programs. Placing all of your materials, paper and containers, into one larger container is designed for your convenience and ease of recycling.

You may have also noticed that it has become easier to recycle at sporting events, parks and street fairs. Many opportunities exist with event organizers to volunteer in helping to teach recycling to event goers, and help maintain the integrity of recyclables by reducing the levels of contamination.

Often times recycling on the job works best if there is a "recycling champion." The recycling champion is a person helps your organization to provide environmentally sustainable programs. Most of the garbage in our community is produced during working hours, so this is a great opportunity to reduce, reuse and recycle. Recycling is becoming more visible in our community, and this is a great time to lend a hand to the environment.

Land Use and Environmental Services Agency

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