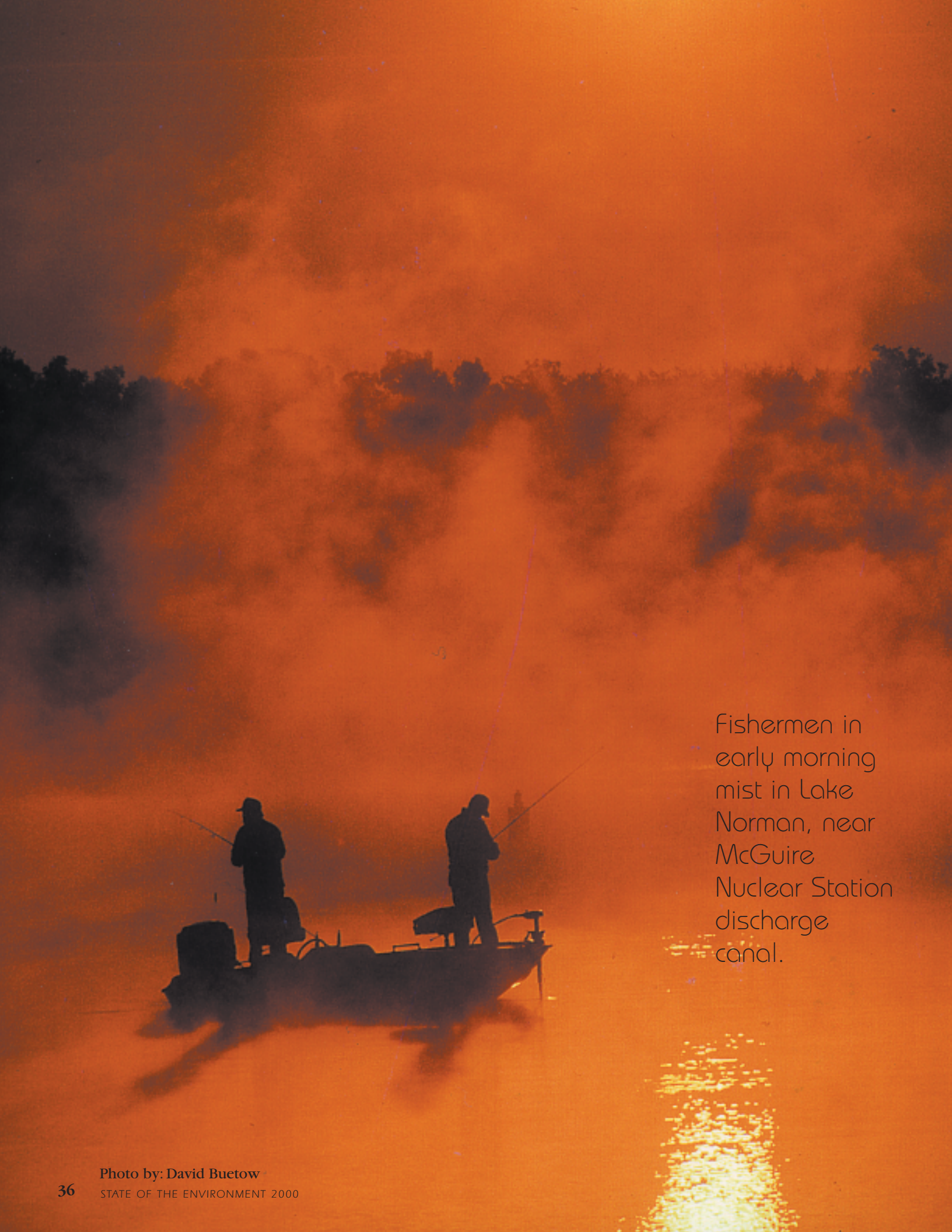


Fishermen in early morning mist in Lake Norman, near McGuire Nuclear Station discharge canal.

Photo by: David Buetow

Those Delightsome Rivulets

A young Englishman by the name of John Lawson was the earliest explorer to venture into the interior of North Carolina. His travels carried him across the lower edge of Mecklenburg County in 1700. In his journal, Mr. Lawson noted concerning Mecklenburg County that it was "abounding in many and delightsome rivulets." As a matter of fact, Mecklenburg County has over 2000 miles of "delightsome rivulets" or streams which lace across its rolling landscape. Mecklenburg County sits on the drainage divide between the Catawba and Yadkin River Basins with two-thirds of its streams draining west toward the Catawba and the remaining one-third draining east to the Yadkin. The western edge of the County is formed by 190 miles of shoreline along portions of three of the eleven lakes which comprise the Catawba River system including Lake Norman, Mountain Island Lake and Lake Wylie. It is a foregone fact that Mecklenburg County is a "water rich" community and that these abundant surface waters played a major role in its early settlement. Pioneers, many of them of Scotch-Irish descent, flocked to the banks of Mecklenburg County's streams beginning in the mid 1700's. Many of these early settlers were accomplished millwrights and it wasn't long until water mills sprang up along nearly every stream having year round flow, grinding grain into flour and powering sawmills for producing lumber. Communities developed around these mills and streams quickly became the life's blood of this area playing a vital role in the development of Mecklenburg.

The Catawba River also contributed tremendously to the early development of Mecklenburg County. It served as a highway for early settlers moving into the region and was also used as a major shipping route for goods bound to Charleston for export. Beginning in the 1700's, fisheries sprang up along the banks of the river providing a food source for early settlers. Ferries were constructed along major transportation routes crossing the river followed by bridges. Another little known fact concerning the Catawba River is that it served as a barrier preventing federal forces from invading and laying waste to Charlotte during the Civil War. During the spring of 1865, federal calvary moved east toward Charlotte from the direction of Lincolnton. Confederate forces under the command of General R. D. Johnston of Lincoln County established a defensive position on the east bank of the Catawba River in Mecklenburg County adjacent to the bridge at the Rozzelle's Ferry in the area where Brookshire Freeway crosses Mountain Island Lake today. Federal forces reached the west bank of the river and fired upon the Confederate position but were unable to effect a river crossing and were thereby prevented from advancing east to Charlotte.

History of Surface Water Uses in Mecklenburg County

The streams and rivers of Mecklenburg County have been vitally important as a major source of raw drinking water since the 1800's. Charlotte's first municipal drinking water intake was located on Sugar Creek in 1881. In 1904, the water intake was moved to Irwin Creek primarily due to declining water quality conditions in Sugar Creek brought about by sewage discharges from inadequate and often nonexistent collection and disposal systems. In 1911, the Irwin Creek intake failed to provide Charlotte with the water it desperately needed during a water shortage brought on by an extreme drought and water had to be brought into town by train from the Catawba River. This near catastrophe awakened Charlotte to the growing needs of the community for abundant, clean drinking water and in 1912 the City began withdrawing its water from the Catawba River close to the current intake along Mountain Island Lake at the end of Pump Station Road in western Mecklenburg County.

By 1900, the population of Mecklenburg County had grown to 55,268. The Catawba River and the many streams in the County continued to be vitally important to area residents. At that time, Mecklenburg County was very rural in nature and the quality and useability of these waters had continued to be very good with only small, isolated pockets of pollution centered primarily in downtown Charlotte. Little Sugar and Sugar Creeks were the most polluted waters in the County due primarily to inadequate sewage disposal facilities. In the early 1900s, some areas of Charlotte were served by septic tanks but most of the town completely lacked any type of sewage treatment system and thousands of gallons of raw sewage were dumped straight to creeks until the City constructed its first modern sewage treatment plant along the banks of Sugar Creek in 1923. In the rural areas of the County, creeks remained free of pollutants and were widely used for recreation. Most residents had a favorite fishing or swimming hole near their home and in a time with limited recreational activities, these waters provided much needed relief for area residents. In 1910, a public recreational area called Camp Latta was developed along the banks of Long Creek in western Mecklenburg County and included a swimming hole formed by damming the creek.

A public swimming area on long creek at Camp Latta – circa 1910.

Beginning in 1948 during the post World War II boom, suburbs began to spring up in a ring around Charlotte. A brief lull in growth was experienced in the early fifties followed by increasingly steady growth into the 1960's. The quality and useability of Mecklenburg County's streams suffered as a result of this growth primarily due to dumping by businesses and inadequate collection and disposal systems for the community's increasing volume of sewage. These water quality problems came to head in the late 1960's. A series of articles in the Charlotte News in September 1969 brought these problems to the attention of Mecklenburg County residents which lead to a call to action resulting in the established of one of the country's first local water quality programs in 1970. Subtitles in this series of articles included "A Tip: Don't Go Near The Water" and "Catch Any Fish In Sugar? You Can Forget About It" as well as "The Creek Is Simply A Sewer." The articles featured a six week long investigation by a News reporter documenting severe pollution problems in Little Sugar Creek. The News enlisted the help of Dr. Edward F. Menhinick, an assistant professor of biology at the University of North Carolina at Charlotte, to document the impacts of this severe pollution on aquatic life in the stream. Dr. Menhinick selected three intercity locations in Little Sugar Creek for his research including Cordelia Park, Piedmont Courts and Freedom Park. After hours of seining the creek for life, Dr. Menhinick found one dead frog, one live earthworm, two beer cans and several hundred cigarette butts, but not one fish. Bacteria counts measured in the stream were 260 times the State standard. The creek was void of life and the extremely high bacteria counts made them completely unsuitable for human contact. Public outcry in response to these appalling conditions lead to the funding by the Mecklenburg County Board of Commissioners of the County's Water Quality Program at a cost of $90,604 annually effective January 1, 1970.

Orange blossom deodorant dripping to mask odor of creek.

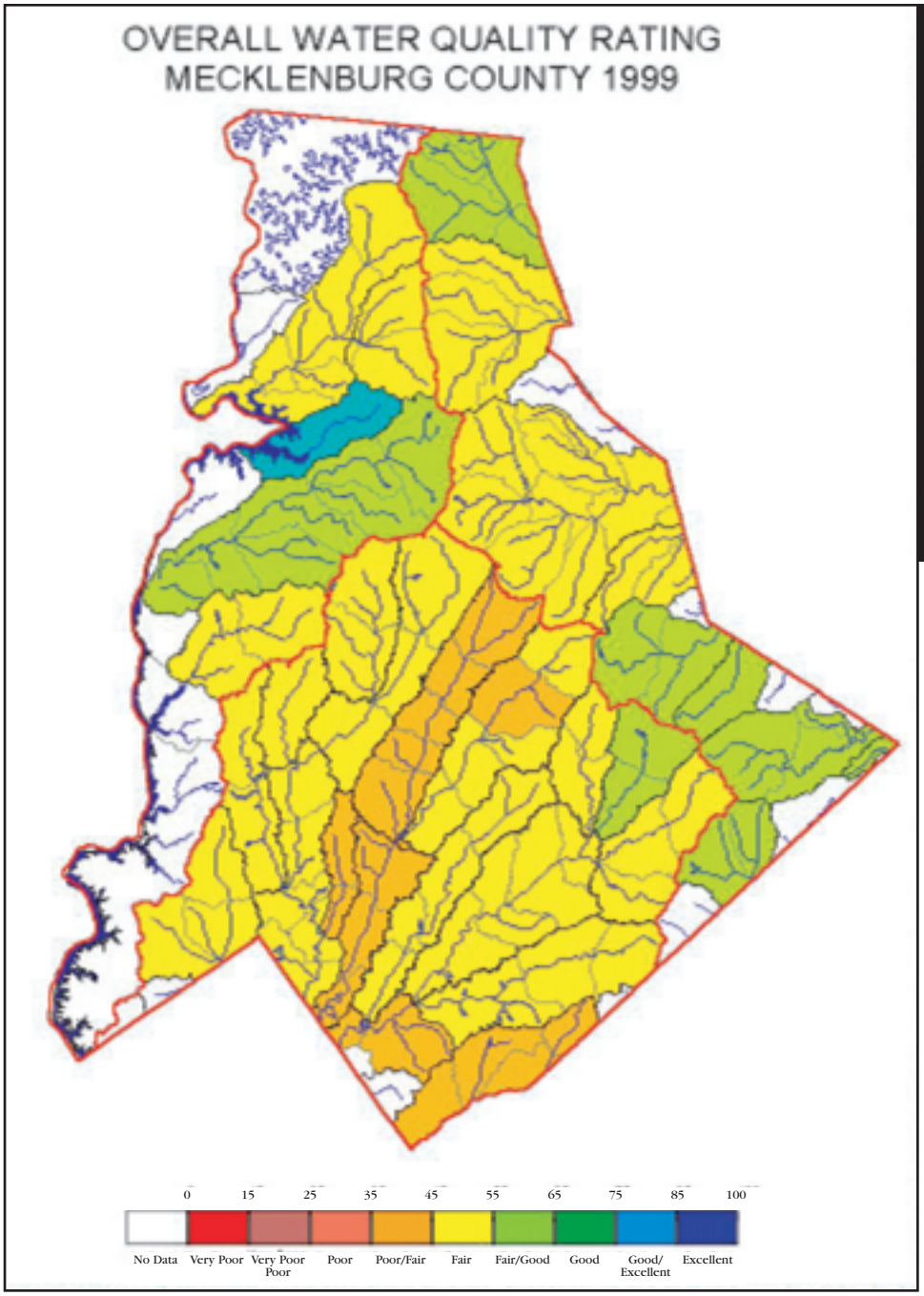
Changing Waters

A lot has changed with regards to water quality conditions in Mecklenburg County over the past thirty years, for both the better and worse. Improvements in water quality have been documented in the inner city streams draining areas of "Old Charlotte" such as Little Sugar Creek in the area that Dr. Menhinick surveyed 30 years ago. The illegal dumping by businesses and the discharges from inadequate sewer collection and treatment systems have been significantly reduced. This is largely due to improved regulations such as the enactment of the Federal Clean Water Act in 1977 as well as enhancements to the municipal sewer system by Charlotte-Mecklenburg Utilities. Mecklenburg County's Water Quality Program has also contributed significantly toward this improvement in water quality conditions. From January through September 1970, the newly formed Water Quality Program, operating under the Division of Environmental Health of the Health Department, had identified and eliminated over 300 pollution sources through their successfully completion of a preliminary survey of the County's streams. This effort continued for years until most of the chronic dumping into Mecklenburg County streams had been brought under control. On June 16, 1998, the County's Water Quality Program which is now part of the Mecklenburg County Department of Environmental Protection performed a fish survey in the same section of Little Sugar Creek studied by Dr. Menhinick 30 years earlier. This time fish were detected in healthy numbers, a total of 796 to be exact. Unfortunately bacteria counts measured in these streams continued to be high and the waters remained unsuitable for prolonged human body contact. Today, the average bacteria count in the County's urban streams is one-third what it was 30 years ago but continues to exceed the State standard. Compared to 1969, the score has improved in favor of cleaner waters but County residents are still the losers as the streams remain unsuitable for wading or swimming.

The story for the outlying areas of the County is somewhat different. As this community has urbanized, the waters of the streams in these once rural outlying areas have become increasingly polluted. Streams that were once suitable for swimming only a few years ago are experiencing significant water quality degradation to the point where they are no longer safe for human contact. McDowell Creek in northern Mecklenburg County is a good example. This once rural area of the County has increased in population by over 300% since 1980 putting it among the fastest growing areas in North Carolina. During the 10 year period from 1988 through 1998, there were 138 exceedances of the State's water quality standards in McDowell Creek which has been degraded to the point that it is no longer suitable for prolonged human contact. Of particular concern is that McDowell Creek lies upstream of Mecklenburg's drinking water intake in Mountain Island Lake. The water quality in McDowell Creek Cove where the creek flows to the lake is among the poorest in the County. This problem must be checked before negative water quality impacts are experienced at Mecklenburg's water intake. A special initiative launched in 1999 by the Mecklenburg County Department of Environmental Protection referred to as Water Improvements Now (WIN) seeks to involve the community in efforts to reverse the negative water quality trends in McDowell Creek and restore its quality and useability.

Current Conditions

Based on 1999 water quality data, the poorest water quality conditions in Mecklenburg County continue to be found in Little Sugar and Sugar Creeks draining the most urbanized areas of the County. Water quality conditions in streams improve slightly toward the outlying areas of the County but overall only 15% of Mecklenburg's streams are considered suitable for human contact. All the waters in the County are supportive of aquatic life to varying degrees. The lakes on the County's western border typically exhibit good water quality conditions and are suitable for swimming and supportive of aquatic life. Overall Lake Norman has the best water quality conditions followed closely by



"The lakes are our drinking water supply and we can spend millions now to preserve land and protect our waters or we can allow them to be polluted and spend billions in the future to ?try? and clean them up. Our lakes are important, economically and for our quality of life, as nature preserves and recreation areas for all of us, not just those who happen to live there."

Mary McDaniel
Mountain Island Lake Resident

Mountain Island Lake. Of the three lakes, Lake Wylie has seen the most significant water quality degradation in the past 20 years but overall its water quality is considered good. Currently, the most prevalent pollutants in Mecklenburg County's surface waters are bacteria, sediment and a variety of contaminants carried in storm water run off. Elevated bacteria levels originate primarily from failing sewer systems. Construction site runoff is the most common source of sediment in the County's surface waters.

The source of pollutants in storm water runoff is much more difficult to pinpoint and is therefore the most difficult to control. As the number of parking lots, roads, roof tops and other impervious surfaces increases due to urbanization, less precipitation is allowed to filter naturally through the soil and the volume of runoff increases. This storm water runoff flows directly to the County's surface waters carrying with it pollutants deposited on the impervious surfaces such as oil dripped from automobiles as well as iron, zinc, copper, chromium, lead and a variety of other toxic metals from automobile wear and a variety of other sources. These are called nonpoint source pollutants and are estimated to account for half of the pollution problems found in streams nationwide. Control of these nonpoint source pollutants was nonexistent until 1987 amendments to the Clean Water Act required that measures be taken to control the most severely contaminated storm water discharges. These control measures were required for all cities in the country with populations greater than 100,000, which included Charlotte. In November 1993, Charlotte launched its Storm Water Pollution Prevention Plan, a comprehensive and proactive approach toward reducing the discharge of pollutants in storm water runoff. After seven years of implementation tremendous strides have been made toward identifying the sources of these pollutants and initiating actions necessary to restore water quality conditions. Since 1995, storm water data reveals a 50% average reduction in total suspended solid (TSS) concentrations in Mallard Creek. The most sig-

nificant improvement has been observed in McAlpine Creek which has experienced a 90% average reduction in TSS levels. Positive trends have also been recorded in Sugar, Little Sugar and Long Creeks which have experienced 37, 61 and 50 percent reductions respectively in TSS levels measured in storm water data since 1995.

S.W.I.M.

Another significant step toward improving the quality and useabiltiy of Mecklenburg's surface water resources was taken by the Mecklenburg County Board of Commissioners (Board) on October 15, 1996 with the adoption of the County's first "Creek Use Policy." The Board recognized the continuing degradation of the quality and useability of the County's surface waters in the face of increased growth and the spread of urbanization. They unanimously agreed that having only 15% of the County's surface waters suitable for prolonged human contact was unacceptable and decreed in a bold and progressive policy statement that "....all Mecklenburg waters shall be suitable for prolonged human contact, and recreational opportunities and shall be suitable to support varied species of aquatic vegetation and aquatic life." In effect, the Board acted to turn back the hands of time and restore the quality and useability of Mecklenburg's most precious and abundant natural resource, its surface waters. Staff was directed to develop for the Board a "list of alternatives and potential costs" for fulfilling this policy statement. Recognizing the daunting nature of this task, staff requested that the Board appoint a citizen's stakeholder group to assist them in this endeavor. The group comprised of thirteen Mecklenburg County citizens and seven City and County staff met for the first time in February 1997. The initiative soon became known as Surface Water Improvement and Management or S.W.I.M. and the group of stakeholders and staff as the S.W.I.M. Panel. The S.W.I.M. Panel was a very diverse group including an even split between "environmentalists" and "developers." The Panel met on seventeen occasions from February 1997 through April 1998 and successfully formulated a plan they called S.W.I.M. Phase I, which was a nine part strategy aimed at controlling the worst pollution problems in the County, sediment and bacteria, and initiating the steps necessary to protect the communities drinking water supply and move forward toward fulfilling the Board's Creek Use Policy. The Board unanimously approved S.W.I.M. Phase I and provided the necessary funding for implementation effective July 1, 1998.

A key component of S.W.I.M. Phase I was the establishment of stream buffers county wide. The S.W.I.M. Panel had emphasized that these buffers were perhaps the best tool in protecting the County's surface waters. The Board assigned the development of a buffer plan to the S.W.I.M. Panel and meetings continued. In April 1998 after 23 meetings, 3 workshops and 4 public hearings, the Panel came to consensus on a S.W.I.M. Stream Buffer Plan which was unanimously approved by the Board. The Buffer Plan was developed into an ordinance and subsequently unanimously adopted by Charlotte and Mecklenburg County effective November 1999.

The Future?

The development and implementation of S.W.I.M. Phase I continues with significant and measurable success. Both sediment and bacteria levels in Mecklenburg County streams are on the decline, some by as much as 90%, but a tremendous amount of work remains before Mecklenburg County can herald the fulfillment of the Board's Creek Use Policy. Future phases of S.W.I.M. will be required aimed at addressing increased pollution from new developments and implementing measures to address pollutants from existing development. Recent amendments to the Clean Water Act require the County and all six of Mecklenburg's towns to implement a storm water pollution prevention program similar to Charlotte's by March 2003. Despite the tremendous amount of change in water quality requirements to date, even more significant changes lie in Mecklenburg's future.

Everyday those "delightsome rivulets" of Mecklenburg are crossed by thousands of citizens hurrying to fulfill their appointed tasks with little or no thought being given to the tremendous role these flowing streams have played in the development of the place they call home. Even less thought is given to the steps necessary to protect these waters from destruction and total loss of useability. But maybe, after having read this article, you will find cause to reflect on the past and contemplate the future of our precious water resources and take the actions necessary to prevent their demise. SOER

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PUZZLE PIECES OF WATER QUALITY

When putting together a puzzle, each puzzle piece adds to the puzzle's picture. Alone, each piece of the puzzle does not look like much more than a blob of color. The more pieces added to the puzzle, the clearer the picture becomes. Like putting together a puzzle, Mecklenburg County Department of Environmental Protection (MCDEP) uses a number of different water quality puzzle pieces to develop a picture of the overall water quality conditions of the County's lakes and streams. Like the pieces of a puzzle, each water quality puzzle piece alone does not provide enough information to assess the overall water quality conditions of the County's surface waters. The water quality puzzle pieces can be referred to as indicators of water quality.

MCDEP uses four different physical, chemical, and biological indicators of water quality. They include the Water Quality Index (WQI), the Lake Water Quality Index (LWQI), Biosurveys of Benthic Macroinvertebrates and Fish, and the Overall Water Quality Rating Index (WQR), a combined physical, chemical and biological index. These water quality indicators enable MCDEP to communicate a more complete picture of the water quality conditions of the County's lakes and streams, to identify and eliminate sources of pollution, to determine lake and stream water quality trends over time and to evaluate the success of efforts to improve lake and stream water quality.

Water Quality Classification	Water Quality Indices			
	Lake & Stream WQI	EPT Taxa Richness	NCIBI	Overall WQR
Excellent	85 - 100	< 27	57 - 60	85 - 100
Good/Excellent	75 - 84	26 - 27	53 - 56	75 - 84
Good	65 - 74	22 - 25	47 - 52	65 - 74
Fair/Good	55 - 64	18 - 21	45 - 46	55 - 64
Fair (Average)	45 - 54	14 - 17	39 - 44	45 - 54
Poor/Fair	35 - 44	10 - 13	35 - 38	35 - 44
Poor	25 - 34	6 - 9	27 - 34	25 - 34
Very Poor/Poor	15 - 24	3 - 5	23 - 26	15 - 24
Very Poor	0 - 14	0 - 2	0 - 22	0 - 14

Physical and Chemical Indicators of Water Quality

The first water quality puzzle piece, the WQI, was developed by NSF International (formerly the National Sanitation Foundation). The WQI is a water quality indicator that measures physical and chemical water quality parameters of streams. Each of the parameters measured reflect different types of possible pollutants in a stream. Parameters measured for the WQI include pH, Biochemical Oxygen Demand (BOD), Nitrate, Total Phosphorus, Turbidity, Total Solids, Fecal Coliform Bacteria, percent saturation of Dissolved Oxygen (DO), and change in Temperature from upstream to downstream. The LWQI, a lake water quality puzzle piece, is an adaptation of the WQI developed by William Fusilier where several of the parameters used to determine stream water quality have been replaced by those more indicative of water quality conditions in lakes. Parameters measured for the LWQI include pH, Nitrate, Total Phosphorus, percent saturation of DO, Temperature, Conductivity, Secchi Disk Depth, Alkalinity, and Chlorophyll-a. Any significant change in the parameters measured may indicate that a pollution problem exists. For example, a low DO and high BOD and nutrients concentrations may indicate organic pollution, and if accompanied by a high fecal coliform count may indicate a sewer discharge to a stream. Both indexes provide an indication of how safe it is for people to be in a lake or stream.

Biological Indicators of Water Quality

The third water quality puzzle piece, biological surveys of the Benthic Macroinvertebrate (bottom dwelling aquatic organisms such as insects, crayfish

Water Chemistry Parameter	Description
pH	A measure of the Hydrogen ion concentration in water. Changes in pH can increase the toxicity of certain pollutants in water.
Biochemical Oxygen Demand	A measure of the amount of oxygen required for the breakdown of organic materials and the oxidation of inorganic materials as ferrous iron and sulfides. The higher the BOD, the greater the presence of organic pollution.
Nutrients: Nitrate and Total Phosphorus	Concentrations of nitrogen and phosphorus compounds are measurements of nutrient enrichment and serve as indicators of problems such as leaking sewer lines and septic fields, discharges from wastewater treatment plants, and pollutants in storm water such as lawn fertilizers and sediment from construction sites.
Chlorophyll a	A measure of the algae community in a lake or stream. Higher levels indicate greater algal populations, suggesting possible nutrient enrichment.
Turbidity	A measure of the clarity of water. Turbidity is caused by suspended matter such as clay, silt, fine particles of organic and inorganic compounds and indicate nutrient enrichment, erosion or sedimentation problems.
Total Solids	A measure of the concentration of matter suspended and dissolved in water.
Secchi Disk Depth	A measure of the clarity of water in lakes. The Secchi Disk Depth decreases as the concentrations of inorganic (sediment) and organic (algae) solids increases.
Dissolved Oxygen	A measure of the amount of oxygen available to aquatic organisms such as fish. Concentrations below 5.0 parts per million are stressful or deadly to most fish and other aquatic organisms.
Temperature	Temperature directly or indirectly impacts many physical, chemical and biological components of water. Dissolved oxygen is inversely related to temperature. High temperatures indicate thermal discharges.
Conductivity	A measure of the ability of water to conduct an electric current which is dependent on the concentration dissolved ions. As the pollutant load increases, the concentration of dissolved ions increases causing the conductivity to increase. Conductivity is used as an indicator of industrial pollution.
Alkalinity	A measure of the buffering capacity of surface water which is important to water quality as pH has a direct effect on freshwater organisms and on the toxicity of various pollutants in water.
Fecal Coliform Bacteria	Bacteria belonging to the Family Enterobacteriaceae that are generally associated with human and/or animal fecal wastes and are used to indicate the possible presence of fecal discharges and sewage in surface waters.

and clams) and Fish communities, serve as excellent indicators of water quality that complement the WQI and LWQI indicators. Changes in the composition of benthic macroinvertebrate or fish communities can reflect changes in water quality caused by pollution problems or alterations in the aquatic habitat due to streambank erosion and sedimentation from construction sites. Each fish species has a unique tolerance to pollution and to specific pollutants. For example, darter species are sensitive to excessive sedimentation and temperature changes and are not found in urban streams that have experienced severe streambank erosion and have been largely exposed to sunlight. The same can be said for benthic macroinvertebrates as tolerance to various pollutants varies greatly from species to species. 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 (total number of different species) of three pollution sensitive aquatic insect orders, Mayflies (Ephemeroptera), Stoneflies (Plecoptera), and Caddisflies (Trichoptera). The greater the taxa richness the better the stream water quality. Using fishes, the stream water quality classification is determined by using the North Carolina Index of Biotic Integrity (NCIBI) which incorporates 12 different community composition descriptors. The higher the NCIBI, the better the stream water quality.

Combined Physical, Chemical and Biological Indicator of Water Quality

The most accurate water quality puzzle piece that summarizes the stream water quality conditions in Mecklenburg County is the WQR indicator that combines the chemical, physical and biological parameters that have been measured. This rating is obtained by averaging the annual WQI with the EPT Taxa Richness value. The WQR gives a better view of the water quality conditions of the County's streams since the limitations of the chemical sampling are minimized by the EPT Taxa Richness values. The benthic macroinvertebrate community present in a stream is a reflection of the total combined effects of all pollutants, and therefore the resulting WQR more accurately reflects the true water quality conditions in those streams. The better the water quality, the better the stream will be able to support increasingly sensitive uses such as propagation of wildlife, wading and swimming.

Unlike a puzzle whose picture never changes, the water quality conditions of Mecklenburg County's lakes and streams change daily. New development, accidental spills, and storm water runoff combine to add a wide variety of pollutants to the surface waters of the County. Continued monitoring of the water quality conditions of the lakes and streams will give new data to keep the water quality puzzle pieces current, and reflect an accurate overall picture of the water quality conditions in Mecklenburg County. SOER

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Overall Water Quality Rating: Acceptable Water Uses

	Water Conveyance	Minimum Diversity of Aquatic Life	Average Diversity of Aquatic Life	Wide Diversity of Aquatic Life	Wading/Infrequent Body Contact	Swimming/Frequent Body Contact	Drinking Water Supply	Pristine
Very Poor	X							
Very Poor/Poor	X	✔						
Poor	X	X						
Poor/Fair	X		✔					
Fair	X		X					
Fair/Good	X			✔	✔			
Good	X			X	X			
Good/Excellent	X			X	X	X	X	
Excellent	X			X	X	X	X	X

X = Fully Supportive ✔ = Supportive But Threatened

Water Quality on the World Wide Web

Have you ever wondered about the water quality of your neighborhood creek? Have you ever wondered if the three lakes that border Mecklenburg county are suitable for fishing or swimming? Well, you can find out about the latest water quality conditions in Mecklenburg County, using the County's Geographic Information System (GIS), and the World Wide Web.

Mecklenburg County Department of Environmental Protection has developed a web site dedicated to displaying the most recent results of our routine water quality sampling and long term water quality trends, and lots of other useful information *(http://www.co.mecklenburg.nc.us/coenv/Water/trends/test.html)*. These pages are generally updated quarterly, but due to increased activity on our lakes during the summer, the information about the lakes is updated monthly between May and September. In addition to the Water Quality Indices for all of the major stream basins, there is plenty of other information for the curious. For example, information about the primary pollutant in each basin and the results of aquatic insect sampling from Mecklenburg County streams is located on the site.

For those wanting more site specific information about the general water quality in their area, they can visit *http://engbs.co.mecklenburg.nc.us/html/epa/epa.htm*

This page allows the user to enter any street address or a tax parcel id number and get information about the water quality in that watershed. It also allows the user to see floodplains, greenways and the regulated buffer widths for all Mecklenburg County streams.

So the next time you are surfing the web, check out the waters in your own backyard. You might be surprised. SOER

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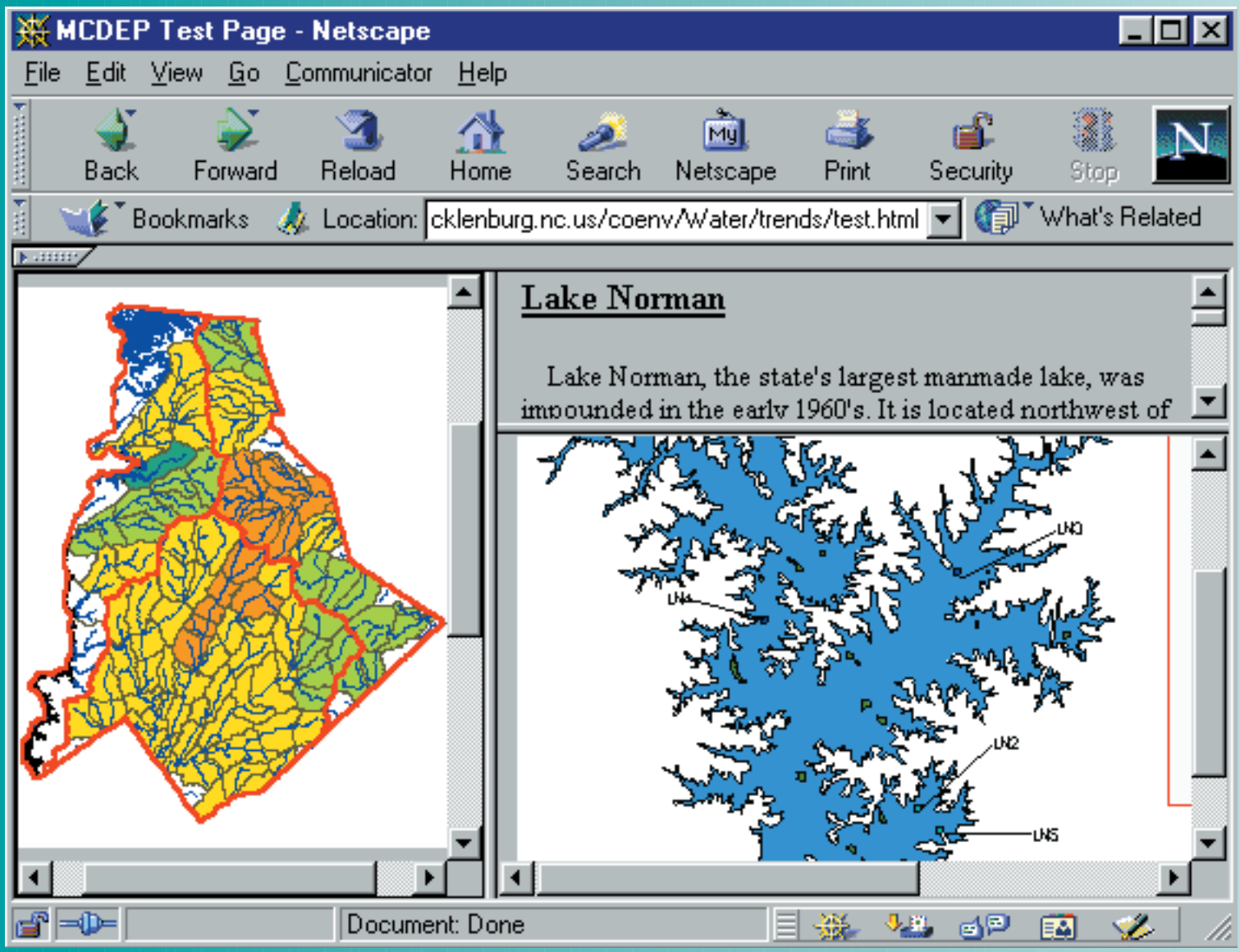


The Catawba Lakes, a Shared Resource

Growth and development along the shores of Lake Norman has provided recreational opportunities for many but has also let to congestion and water quality problems.

Flanking the western edge of Mecklenburg County, Lake Norman, Mountain Island Lake and Lake Wylie form a natural boundary with Lincoln, Gaston and York counties. These three reservoirs form the midsection of the Catawba River which flows 225 miles from the mountains near Mt. Mitchell to the Lake Wateree Dam in South Carolina where it becomes the Wateree River. Remarkably, due to its irregular shape there are about 190 miles of lake shoreline in Mecklenburg County which, if stretched out, would almost equal the entire length of the Catawba River.

The three reservoirs serve multiple uses. While formed primarily for electric power generation and flood control, they also serve as the source of our drinking water and are used extensively for recreation, boating and fishing. For example, there are currently over 57,000 registered boat owners in the six counties surrounding Lake Norman, Mountain Island Lake and Lake Wylie, 19,000 in Mecklenburg County alone. Naturally, the preservation of the water quality of these precious resources is important to the residents of Mecklenburg County and the entire region.

The Lakes are Formed

Most residents living in the area probably cannot remember a time when Mecklenburg County was not bordered by three reservoirs. The first dam on the Catawba River was built by the Southern Company, the forerunner of Duke Power Company, at the site of the present Lake Wylie Dam in 1904. It was rebuilt in 1925 to the present shoreline. Lake Wylie was named in 1950 for Dr. W. Gil Wylie, a man instrumental in the hydroelectric development of the Catawba River. Prior to 1950 this water body was called Catawba Lake, a name which can still be seen on old topographic maps. In 1923, the dam which formed Mountain Island Lake was completed. The Catawba River was unchanged for over 30 years when Duke Power Company built its last and largest dam on the Catawba River, Cowans Ford Dam. This created Lake Norman, the largest lake in North Carolina. Lake Norman was named for Norman Atwater Cocke, president of Duke Power Company from 1953 to 1958. After Lake Norman was filled to full pond in 1963, the shoreline of the reservoirs bordering Mecklenburg County became what they are today.

While formed primarily for electric power generation and flood control, they also serve as the source of our drinking water and are used extensively for recreation, boating and fishing.

Lakes as Dynamic, Living Systems

Water levels or quantity in our three reservoirs, as in all the eleven reservoirs along the Catawba River, are carefully managed by Duke Power Company. But what about water quality? How does one go about measuring water quality in a reservoir? There is not a simple answer to this question. So, let us start with a few words on lakes and reservoirs in general.

Boaters and water skiers skimming along the surface of the lake on a hot, summer day may not be aware of all the things that happen beneath the surface of the water. A whole ecosystem is at work within lakes from bacteria and planktonic algae which form the bottom of the food chain through tiny animals called zooplankton to small fish and finally the large predator fish at the top of the food chain. Physical and chemical processes interact with these biological communities and all of these can vary tremendously in different parts of the same lake. In particular, the water quality in coves or near the shore may be different than that out in the main part of the lake. This is especially true where a tributary may enter a cove delivering various pollutants to the lake.

Water quality at the same location in a lake can vary dramatically over time. Lakes are dynamic entities that respond to seasonal changes in temperature and sunlight, warming up in the summer and cooling off in the winter. This change in temperature alone can have profound effects on the lake, influencing its mixing regime, chemistry and aquatic life. Most lakes stratify in the summer which means that as the surface water warms and become less dense, it tends to lie as a separate layer on top of the cooler bottom waters. Swimmers notice this when they dive down from the warm water on the surface to feel the cooler water at deeper depths. As the temperature cools in the fall, the lake will "turn over", meaning the water layers mix, and the water temperature will again become relatively uniform from top to bottom. Sometimes when this happens, material which had been on the bottom during the summer months gets resuspended and comes to the surface. This can sometimes be mistaken for pollution of some type.

Plume of sediment from Dutchmans Creek entering upper Lake Wylie after a storm event shows the influence of tributaries on the water quality of the main stem of the Catawba.

Water Quality Issues

So, how healthy are our lakes? What do we see when we do a lake sampling run or "check up" on the health of these water bodies? Usually, the major concerns about lake water quality relate either to public health issues or the ecological health of the lake (i.e., can fish and other aquatic organisms live in the water?).

Public Health Concerns

One major public health question asked by lake users is whether or not it is safe to swim. In order to answer this question, the Mecklenburg County Department of Environmental Protection (MCDEP) and other agencies routinely sample for fecal coliform bacteria. Fecal coliforms are found in the digestive track of warm blooded animals, including humans. They are an indicator of possible contamination from sewage and the possible presence of pathogenic bacteria. In the summer when swimming and recreational use increases on the lakes, additional fecal coliform samples are taken by MCDEP at selected sites. Lakes are generally quite clean in terms of fecal bacteria contamination although problems are sometimes found in coves or near the shoreline. Potential sources of fecal contamination around our lakes are leaking septic systems, sewer overflows, poorly performing wastewater treatment plants and storm event runoff from yards and various land uses. Wastewater treatment plants are generally not a source of fecal contamination when operating properly.

One question of concern to fisherman is whether the fish they catch in these reservoirs are safe to eat. There are currently no advisories on game fish consumption for the Catawba River Basin. Sores occasionally observed on fish may not necessarily be due to water pollution, but may be a sign of natural disease or stress.

MCDEP's lake sampling program involves taking field measurements and water samples for laboratory analysis monthly during summer and every other month during winter at all three reservoirs. Field measurements of temperature, dissolved oxygen, pH and conductivity are taken by lowering sensors into the water column. Water samples

David Rimer measures water clarity in Lake Wylie using a Secchi disk during a regular lake run in November.

are also routinely collected for various parameters including chlorophyll, nutrients, alkalinity, suspended solids and turbidity. In addition to routine sample analysis, other parameters such as metals, pesticides and volatile organic compound are periodically measured.

Environmental Health Concerns

Dissolved oxygen is always of particular interest for determining the ecological health of a lake, as fish and other aquatic life rely on it to "breathe." This factor alone can determine the amount of fish habitat in a reservoir.

Sediment, a widespread pollutant affecting surface waters, also impacts the ecological health of lakes. The same sediment coming from pollution sources in the watershed eventually makes its way into the reservoirs or "receiving waters" for the streams. There, the sediment can be a problem by carrying other pollutants such as metals from the watershed into the lakes, interfering with biological communities, and gradually filling in the reservoir thus decreasing its storage capacity. Sources of sediment include poor erosion control practices around construction sites, agriculture and shoreline erosion from wave action. Sediment in reservoirs is measured in several different ways. One way, perhaps the simplest type of field measurement taken during lake sampling, is the Secchi depth. This involves lowering a black and white disk into the water and recording the depth where it disappears. It is a quick and easy measure of water clarity and is used frequently by volunteer water quality monitoring groups. Turbidity and suspended solids are more exact measurements of the amount of suspended material in the water.

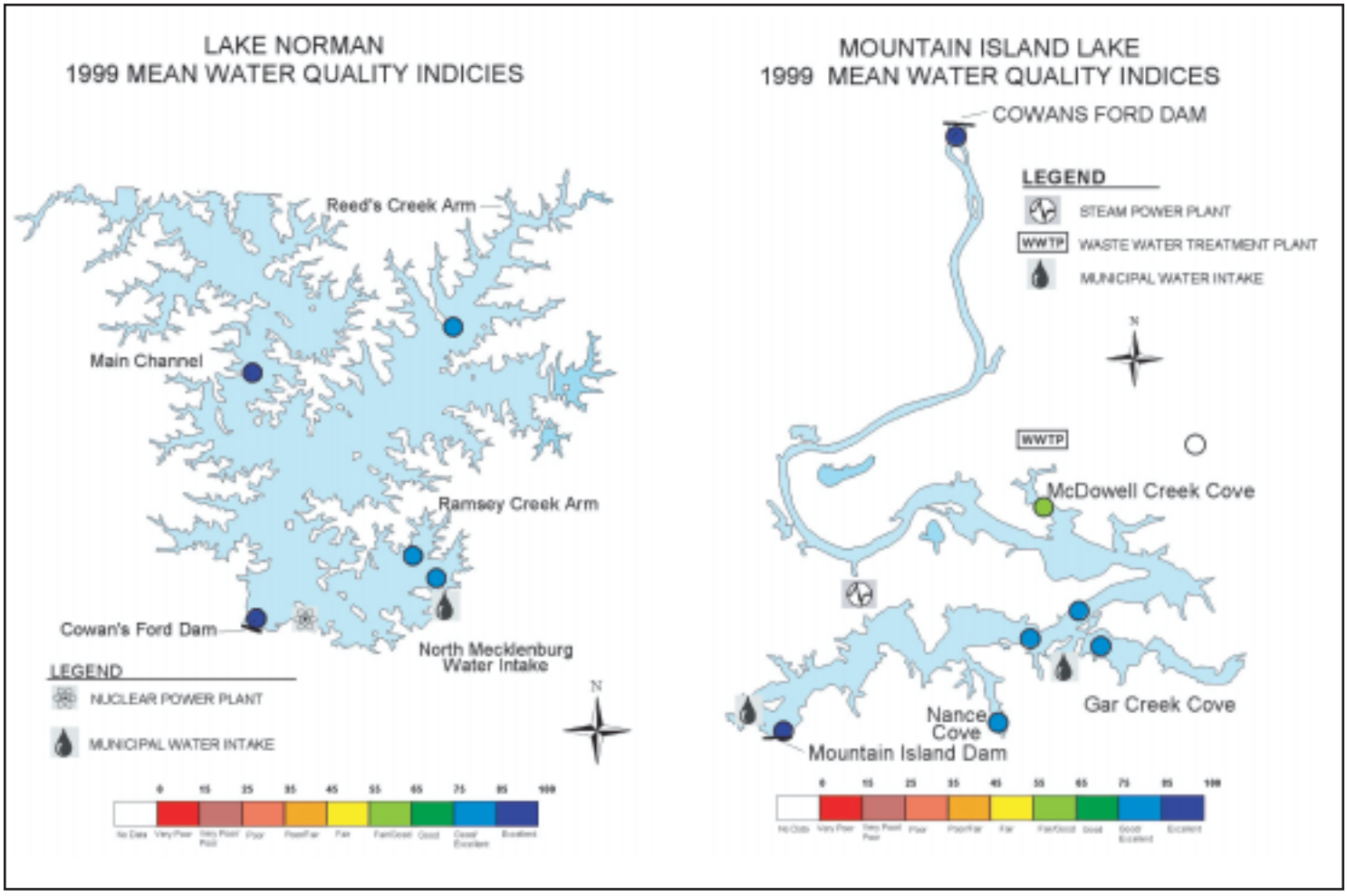
Plant nutrients, especially nitrogen and phosphorus, are carefully watched in lakes and reservoirs as too much of them can lead to algae blooms and other water quality problems. Just as adding fertilizer to your lawn can make your grass grow, excess nutrients in lakes makes the "grass" of reservoirs, tiny microscopic algae called phytoplankton, grow. While some algae growth is good for fish production in lakes, too much can result in fish kills from oxygen depletion. Algae can also form nuisance surface scums and create taste and odor problems for water treatment systems. Chlorophyll, the green photosynthetic pigment in plants, is monitored in order to measure the level of algae in the lake.

Lake Water Quality Index

As you can see, monitoring programs end up with a bewildering array of data on the lakes. In order to simplify this data into a more understandable form, MCDEP uses a lake index. This index, developed by Fusilier in 1982 takes nine of the most critical parameters (temperature, dissolved oxygen, pH, conductivity, total phosphorus, nitrates, alkalinity, chlorophyll and Secchi disk depth), rates them for water quality (from very poor to excellent) and combines them into a single number from 1 to 100. The ratings are then color coded and placed on a map. Like any other index it has its limitations. For example, not all parameters are included and it is a "snapshot" of water quality conditions at the time of sampling. However, in the absence of a nationally accepted water quality index, Fusilier's Water Quality Index is a useful indicator of overall water quality conditions. MCDEP has been using this index for over 10 years to communicate general water quality information about our reservoirs to the public. So what are the current water quality conditions of the lakes on our western border? Water quality ratings for sampling locations in the Catawba lakes bordering Mecklenburg County for 1999 are shown on the diagrams.

Lake Norman

Let us begin with Lake Norman, the "inland sea", with a surface area of 32,150 acres and a maximum depth of 120 feet. About 90 miles of Lake Norman's shoreline is within Mecklenburg County. Water stays in Lake Norman longer than any other Catawba reservoir, 239 days. This fact, also referred to as the retention time, is good for water quality. The long retention time allows for sediment coming into the upper end of the reservoir to settle out, and incoming nutrients to be

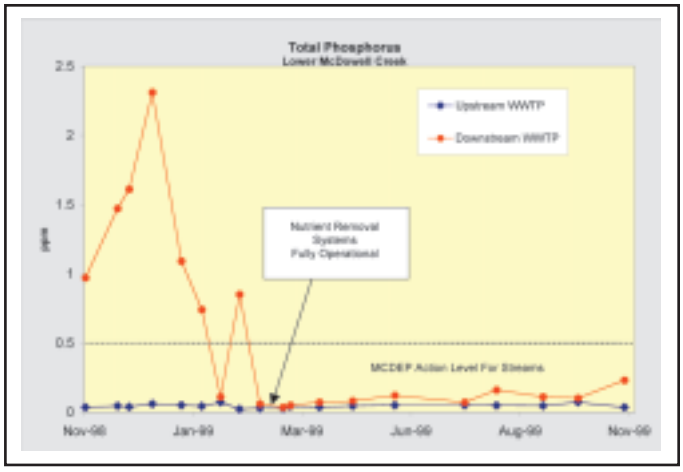


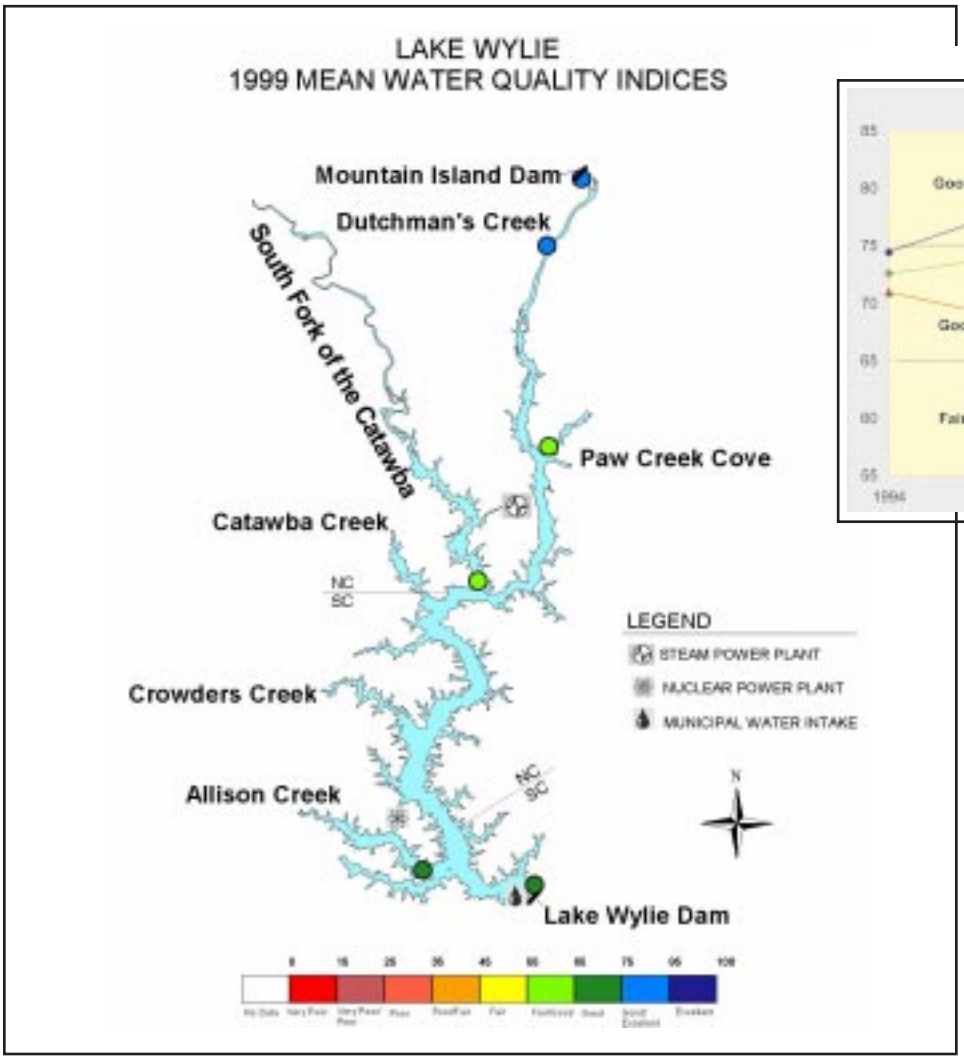
used up by algae populations in the upper lake. As a result, the water in lower Lake Norman, the part near Mecklenburg County, is typically of good quality: fairly clear with low nutrient levels. Water quality index values for 1999 were consistently in the good to excellent range. No exceedances of water quality standards were seen at any location sampled in Lake Norman during 1999.

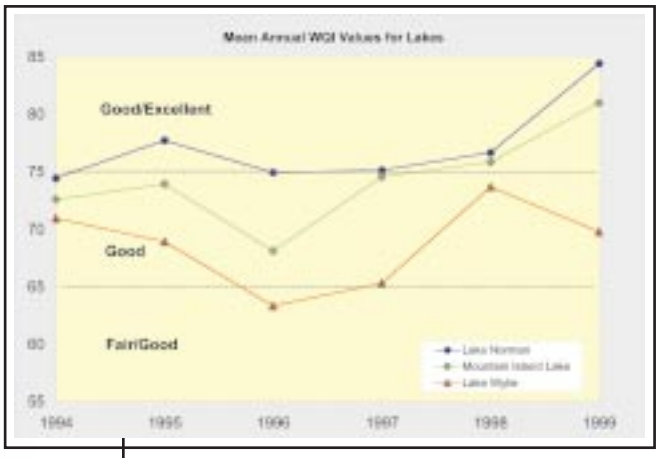
Mountain Island Lake

Next in line is Mountain Island Lake. Unseen from the lake surface in Lake Norman, about 100 yards upstream of Cowans Ford Dam, is an underwater dam or wier. This weir functions to trap the cool bottom waters of Lake Norman for cooling at the power plants. The weir also serves the function of allowing only the oxygenated surface waters of Lake Norman to enter Mountain Island Lake below. The relatively clean oxygenated surface water from lower Lake Norman funnels through this small, narrow reservoir connecting Lake Norman and Lake Wylie. The surface area of Mountain Island Lake (3235 acres) is about one tenth that of Lake Norman and its maximum depth is 30 feet. Because of its smaller size, residence time is very short, only about 12 days. The Mecklenburg County side of the lake has about 37 miles of shoreline. There are three creeks within Mecklenburg County which drain into Mountain Island Lake: McDowell, Torrence and Gar Creeks. This lake serves as the primary drinking water supply for the City of Charlotte and is classified by the state of North Carolina as WS-IV. This classsification places tighter development restrictions on the lake and its watershed in order to protect water quality.

Water quality indices from Mountain Island Lake in 1999 ranged from fair to excellent. Poorer ratings







were seen in McDowell Creek Cove due primarily to higher nutrient levels and algae growth in the cove. Water quality in McDowell Creek Cove has frequently been rated of poorer quality than the rest of Mountain Island Lake, due to point source inputs of nutrients from the McDowell Creek Wastewater Treatment Plant (WWTP) located on the lower end of McDowell Creek. These nutrient inputs have recently been reduced, however. During the WWTP's recent expansion, the state of North Carolina placed limits on the amount of phosphorus and nitrogen that can be discharged by the plant. Construction on the expansion at the WWTP was begun in 1996 and the nutrient removal systems were in place and fully operational by March 1999. Since then total phosphorus levels in McDowell Creek downstream of the WWTP discharge have decreased dramatically. While the water quality rating at the sampling location in McDowell Creek Cove improved slightly this year, it still ranks below other locations on the lake. It may be several years before the full effect of this reduction is seen due to stored nutrients in the sediments of the cove and nonpoint inputs from the McDowell Creek Watershed. One exceedance of the turbidity standard for lakes, indicating high sediment concentration, and one exceedance of fecal coliform levels were observed in Mountain Island Lake in 1999, both in McDowell Creek Cove. Both of these findings were most likely due to nonpoint pollution from the watershed.

Lake Wylie

After Mountain Island Lake, water from the Catawba River enters Lake Wylie, the third largest lake on the Catawba River. Lake Wylie, with a surface area of 12,450 acres, is about one third the size of Lake Norman and has the largest individual watershed of all the Catawba reservoirs. About 67 miles of shoreline are within Mecklenburg County. The water residence time for Lake Wylie is about 39 days. In contrast to Lake Norman, many large tributaries enter Lake Wylie which influence its water quality, most of which are not in Mecklenburg County. Foremost among these is the South Fork of the Catawba River which contributes 30% of the water volume to Lake Wylie. Water quality in the South Fork of the Catawba River has historically been poorer in quality than the main stem. The South Fork and other tributaries of Wylie, such as Crowders Creek, deliver nutrients from their respective watershed into Lake Wylie, resulting in increased algae growth. This is reflected in the lower water quality index values for 1999 which ranged from poor/fair in mid-lake locations to excellent in the upper reaches of the reservoir below Mountain Island Lake. Two exceedances of the NC water quality standard for chlorophyll (40 ug/l) were observed in 1999, both in May at mid-lake locations (52 and 73 ug/l). Six exceedances of fecal coliform action levels were observed in Lake Wylie during 1999.

Water Quality Trends

In what direction has the overall water quality in our three reservoirs been headed? The results look mixed but encouraging. Lake Water Quality Indices for the warmer months (May

through September) were averaged by year for the last five years. The warmer months were chosen since that is when we typically see more water quality problems such as algae blooms and when more people are using the lakes. The annual average water quality indices for both Lake Norman and Mountain Island Lake in 1999 were up compared with 1998 and appeared to show a slight improving trend for the past five years. The annual average water quality index for Lake Wylie declined in 1999 over 1998 and did not appear to show any distinct trend over the past five years.

The three reservoirs bordering Mecklenburg County have been developed and utilized in a way perhaps unimagined by those with the early vision to electrify the Catawba River. They have become a regional resource and treasure shared by our surrounding counties.

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David H. Buetow - Mecklenburg County Department of Environmental Protection

buetodh@co.mecklenburg.nc.us

Mecklenburg County Department of Environmental Protection collecting field measurements and water samples in Paw Creek on Lake Wylie.

Governing the Lakes

As the sun sets over Lake Norman, water skiers take advantage of the calmer waters that earlier were choppy and busy with boaters, jet skiers, and fishermen. On Mountain Island Lake, bird watchers quietly observe as a great blue heron searches for a meal. Lake Norman, Lake Wylie, and Mountain Island Lake provide an abundance of recreational opportunities for Mecklenburg County citizens. Whether you're a fisherman, a water skier, or a bird watcher, these lakes have something for everyone.

Of course, these lakes know no political boundaries and are shared by several counties and towns. In fact, Lake Wylie is the only Catawba River Lake that is shared by two states, North Carolina and South Carolina. As you may imagine, with individual interests involving a shared resource, conflicts may arise. These conflicts come in the form of safety, environmental, and lake use issues. The marine commissions of Lake Norman, Lake Wylie, and Mountain Island Lake were formed in order to facilitate various issues regarding the lakes. The marine commissions are units of local government, and were created through legislative acts by the General Assembly and joint resolutions from the various counties that border each lake. Each county, through the various boards of county commissioners, appoints each marine commissioner, which provides equal representation across the lakes. The three marine commissions hold public meetings once every month. The commission meetings provide a public forum in which lake users can share their concerns and interests with the board. The marine commissions partner with various law enforcement, regulatory, and volunteer groups to address lake issues.

During 1999, the marine commissions were involved in several environmental issues, which helped to strengthen environmental protection along our lakes. Some of these issues include:

- The restoration of 2 _ acres of wetlands in Lake Wylie that were destroyed by development activities;
- The implementation of sewage pump out station regulations at marinas;
- Providing comments to various regulatory agencies regarding shoreline management guidelines, new developments plans, and water quality plans; and
- Providing citizens and neighborhood groups with information on environmental protection, regulations, and appropriate contacts.

In addition to environmental issues, the marine commissions also addressed several safety issues such as: age restrictions and safety class requirements for jet ski operators; no wake zones; and maintenance of shallow water and channel markers. In response to citizen complaints, the marine commissions have also encouraged increased law enforcement coverage on the lakes.

With the rapidly increasing population and use of our lakes, environmental and safety issues will be on the rise. The marine commissions provide a governing body, representing all jurisdictions to ensure safe and healthy lakes for the region. Additional information may be obtained about the Lake Wylie and Mountain Island Lake Marine Commissions from Michael McLaurin at (704) 372-2416. Information about the Lake Norman Marine Commission may be obtained from Ron Smith at 1-800-464-7512.

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fmclauri@charweb.org

PROTECTING OUR PRECIOUS WATER SUPPLY

Did you ever take a moment to wonder where your drinking water comes from? The tap....pipes....The City....?

Drinking water is a resource which is often taken for granted by the general public. A lot of folks really don't know where their drinking water originates, only that it flows from the tap when the faucet is open. In the Mecklenburg County area, water can easily be taken for granted because it is so plentiful and relatively inexpensive. It is often the things that are most common in our lives which go unnoticed and unappreciated.

The truth of the matter is that our water supply is the lifeline of the community. Mecklenburg County is blessed with abundant water resources which led to the settlement of this area by Europeans in the 1700's. Prior to this, Native Americans prospered from the wealth of the waters of this region. In more recent history, these water resources have supported the incredible population and economic growth Mecklenburg County has experienced and it is apparent that we are ever more dependent on our precious water supply. Evidence of this growth trend can be illustrated as easily by water usage trends as by population figures. For example, Charlotte-Mecklenburg Utilities (CMU) reports that average daily water usage over the past decade has increased from 61 million gallons per day in 1989 to 100 million gallons per day in 1999.

Unfortunately, the rapid growth, extensive development, and changing land uses seen throughout this region often come at the expense of environmental degradation. Mecklenburg County's water supply reservoirs are particularly susceptible to the detrimental impacts of an expanding community in that we desire to live and recreate on or near these water bodies. As we move into the future, great emphasis must be placed on protecting our water supply so that we may maintain the resources which have made our community a leader and trend setter, both regionally and abroad.

The Catawba River - A Journey From the Blue Ridge Mountains to the Tap

High on the eastern slopes of the Blue Ridge Mountains in Avery, Burke, Caldwell, and McDowell counties, thousands of tiny springs and seemingly insignificant tributaries act as conduits for rainwater and groundwater. These small conduits converge as they flow down the mountain slopes and create larger streams which in turn converge into rushing rivers such as the Catawba River and the scenic Linville River. These rivers enter Lake James, which is the first of eleven manmade impoundments along the Catawba which were created to harness her impressive power.

As the Catawba River emerges on the other side of the dam at Lake James it continues it's southeastern trek flowing through three more manmade impoundments including Lake Rhodhiss, Lake Hickory, and Lookout Shoals. The free flowing segments of the Catawba meander through undisturbed forests, cow pastures, corn fields, residential, and industrial areas through both urban and rural communities. All along the way, water is being added to the system through natural hydrologic processes such as stream flow, rainfall, overland runoff and through human activities such as treated wastewater discharges. Conversely, water is also being extracted from the river and it's impoundments for agricultural uses, treatment for human consumption, industrial processes, and through evaporation.

Some of the headwaters of the Catawba River flows over Catawba Falls near Old Fort, N.C.

Like any other traveler, the Catawba River acquires mementos along the way which represent the places it has been. For example, the river may pick up sediment from stormwater runoff over disturbed land, nutrients from agricultural activities and wastewater discharges, oil and grease, hydrocarbons, and other chemicals from parking lot runoff, and bacteria from human activity and wildlife.

The Catawba River enters Mecklenburg County under the name of Lake Norman which is the largest man-

made lake in North Carolina. Here, the water is detained for more than 200 days until it flows through the dam and enters the much smaller Mountain Island Lake. The sheer size and volume of Lake Norman along with the detention time in some ways acts as a natural water treatment process for a portion of the contaminants which were picked up along the rivers journey. As the water velocity is slowed, sediment and suspended solids settle to the lake bottom and nutrients and other organic substances are utilized by aquatic organisms.

Lake Norman and Mountain Island Lake serve as the drinking water supply reservoirs for Mecklenburg County. Though Lake Norman is approximately 95 percent larger than Mountain Island from a volume standpoint, Mountain Island serves as Mecklenburg County's primary water supply reservoir. Two water intakes pump raw water from these lakes and distribute it to three water treatment facilities operated by Charlotte-Mecklenburg Utilities. CMU is capable of treating 183 million gallons of water each day and provides drinking water to approximately 70 percent of Mecklenburg County's estimated 661,091 people. On the average, each person uses nearly 147 gallons of water per day at a cost of approximately $.0014 per gallon including treatment and distribution. The treated water is distributed to customers through a network of 2,965 miles of water main and 174,800 service connections. Industries within the County are dependent on this source of water to maintain industrial processes. In addition, 8,846 fire hydrants offer fire protection to individuals and industries within the service area.

Managing the Threats to Our Water Supply

Considering that our water supply reservoirs are such an important aspect of the foundation of our community, the obvious question arises, "What is being done to protect these essential resources?"

The answer to this question is somewhat complex in that it often conflicts with the community development agenda, crosses political lines, and often requires personal sacrifice. You may have heard the phrase, "We all live downstream". This concept holds the key to drinking water reservoir protection. The successful protection of these resources must actually be implemented on the regional as well as the local watershed scale. A watershed would include all land area which drains to our water supply reservoirs. In other words, the protection of our water supply begins at it's point of origin in the Blue Ridge Mountains, along the meandering 112 mile journey to Mecklenburg County, and yes, even in our own backyards. The total watershed area from the headwaters of the Catawba River to the Mountain Island Lake Dam encompasses approximately 1,859 square miles.

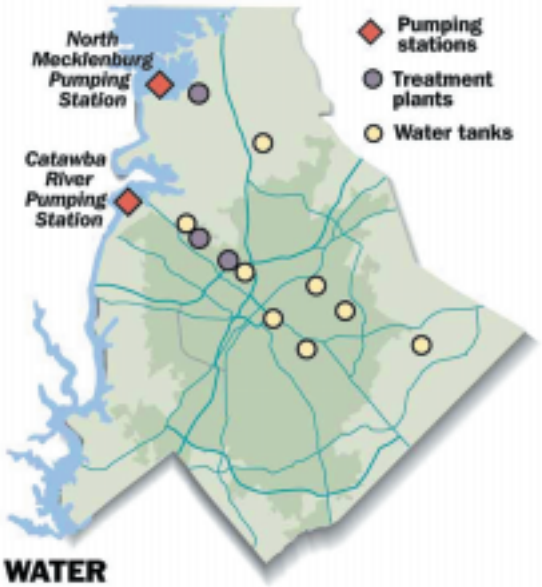
Considering that our water supply reservoirs are such an important aspect of the foundation of our community, the obvious question arises, "What is being done to protect these essential resources?"

Pollution which threatens our water supply reservoirs and streams can be divided into the two general categories of point source and non-point source pollution. Point sources of pollution can be defined as discharges from pipes such as treated industrial and domestic wastewaters. These dis-

Have you ever wondered where Charlotte-Mecklenburg's water supply comes from and what happens to it on its way to our homes? Here's a look at the process that brings water to our taps.

How we get our water

Mountain Island Lake



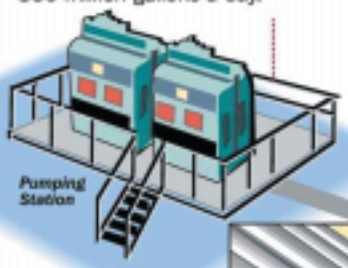
GETTING THE WATER

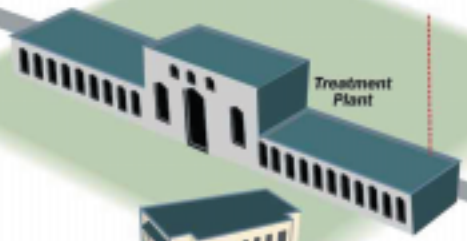
1 Most of the system's water comes through the Catawba River Pumping Station on Mountain Island Lake. The station has a pumping capacity of about 142 million gallons of water a day. When the current expansion is complete, its capacity will increase to 350 million gallons a day.

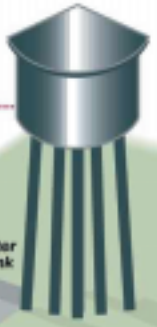
2 Four pipes measuring 30, 36, 54 and 60 inches, connect the station to the Franklin Water Treatment Plant on Brookshire Boulevard. A 120-inch pipe is under construction in the Oakdale community in northwest Mecklenburg County.

TREATING THE WATER

3 Most of Charlotte's water is held at the Franklin Treatment Plant in three reservoirs, with a total capacity of 350 million gallons. It has a treatment capacity of 141 million gallons per day. Some untreated water is sent to the West Treatment Plant on on Beatties Ford Road. The North Mecklenburg Treatment Plant gets most of its untreated water from a pumping station on Lake Norman. Sediment is removed and chlorine added to kill bacteria. Once the water is treated, it is stored in large tanks called clearwells before being pumped into the system.







6 Each month, the water that comes into our homes is recorded by 34 water system employees who must read 174,800 water meters.

CONSUMING THE WATER

5 Although the Charlotte-Mecklenburg system serves mostly residential customers, the 10 largest users (including UNC Charlotte and Frito-Lay, Inc.) account for about 5 percent of usage. During the peak-use months, April through September, watering lawns, washing cars and filling swimming pools increases consumption.

DISTRIBUTING THE WATER

4 The distribution system is a network of nearly 3,000 miles of underground pipes throughout the county. Eight elevated storage tanks help maintain pressure. Pumps fill the tanks during the night and gravity moves the water into the system during the day. It normally moves 3 to 6 feet per second, through pipes of different sizes, the largest of which is a 54-inch main along Providence Road. Hydrants have a minimum pipe size of 6 inches and typical lines that carry water into homes are $^{3}/_{4}$-inch.

GEORGE BREISACHER/Staff
Charlotte Observer

charges are regulated and monitored by the National Pollution Discharge Elimination System (NPDES) permitting program. NPDES permits specify the maximum pollutant load of individual characteristics a facility is allowed to discharge to surface waters.

Non-point sources on the other hand, would include those discharges associated with rainfall runoff and snowmelt. The quality and rate of runoff of non-point source pollution is dependent on the type of land cover and land use from which the rainfall runoff flows. For example, rainfall runoff from undisturbed forested land will generally contain much less pollution and run off more slowly than runoff from urban and industrial land uses with large amounts of impervious cover, such as paved parking lots, roof tops, and roadways.

Non-point source pollution is widely considered to have the greatest negative impact on water quality in the Catawba River because it is widespread, difficult to study and quantify, and because it is even more difficult to control. Due to changing land uses in the watershed, sediment is one of the main pollutants contributed by non-point sources. While some sediment is expected to enter our waters through natural streambank erosion, excessive sediment is contributed by rainfall runoff over disturbed or graded land. Sediment is known to disrupt aquatic ecosystems and many other contaminants such as bacteria, nutrients, and both mineral and toxic metals "cling" to sediment and enter our waterways.

Erosion controls at construction sites, undisturbed riparian (streamside) buffers and structural stormwater best management practices (BMPs) are proven to be effective means of controlling non-point source pollution. Proper erosion controls such as silt fences and sediment basins capture silt and sediment and prevent them from leaving the construction site and entering streams and lakes. Riparian buffers allow runoff to sheet flow across natural wooded or vegetated areas prior to entering surface water bodies. A wide variety of structural stormwater BMPs such as retention basins and constructed wetlands also decrease non-point source pollution. Buffers and BMPs function similarly by decreasing the velocity of stormwater runoff, thereby allowing solids to settle out and by allowing nutrients and other contaminants to filter into the ground. Further, all of these methods are effective means of flood control in that they slow runoff velocities and reduce the runoff volume.

Who is Protecting Our Water Supply?

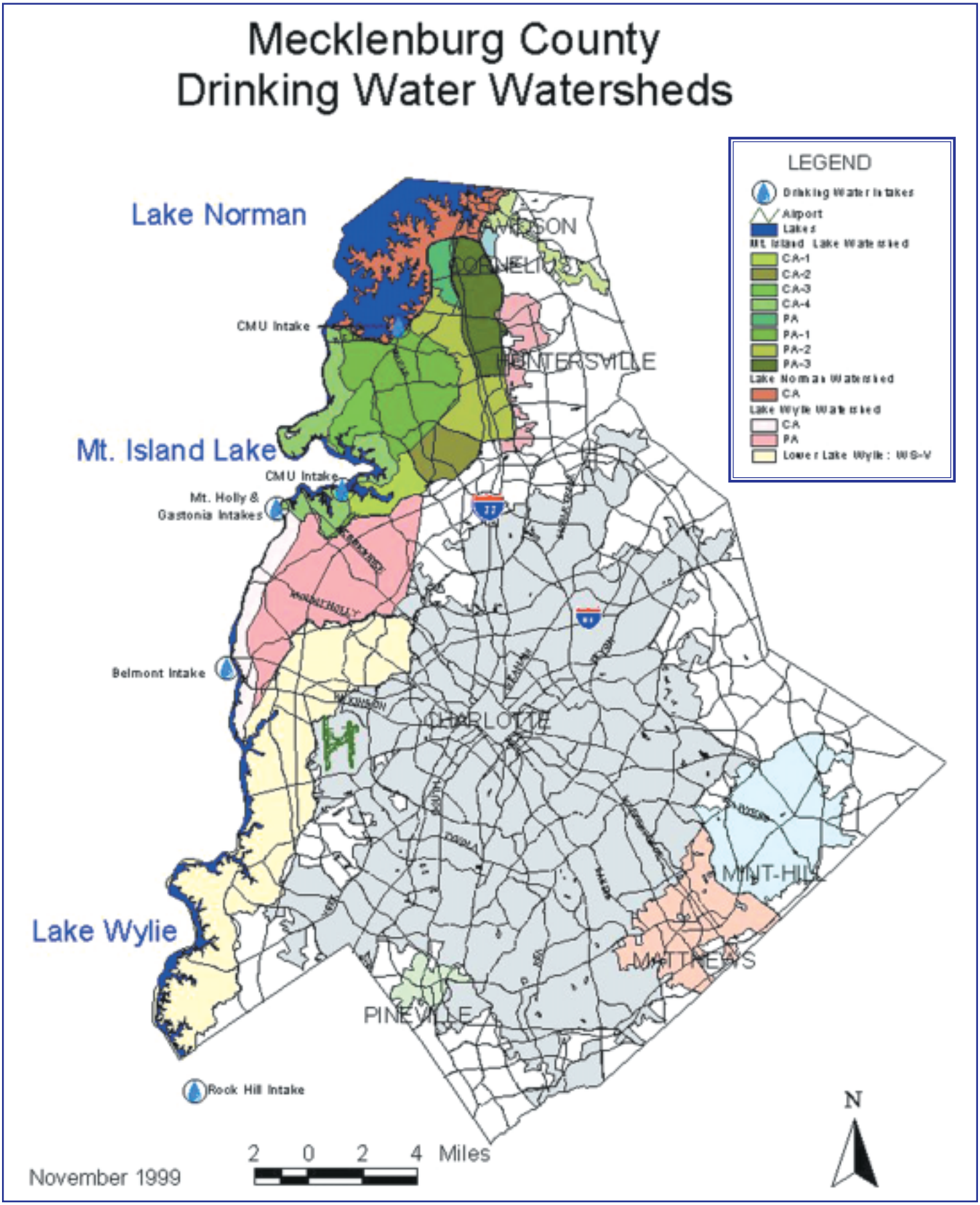
Federal regulations require that state governments have measures in place to protect water supply sources. In North Carolina, this is accomplished by designating the use of all or parts of certain streams, rivers and lakes as water supply sources (WS) or technically WS-I, WS-II, WS-III, WS-IV or WS-V waters. These water supply classifications require varying degrees of protection to ensure that the waters meet their designated use. The degree of protection and restriction is also based upon the environmental sensitivity of the surface water. To ensure that the desired use of these waters is maintained, the State regulates minimum ambient water quality standards and wastewater discharge limitations within a water supply watershed.

In June of 1989, the N.C. Water Supply Watershed Protection Act (NCGS 143-214.5) was passed. This Act instituted a cooperative program of watershed management and protection to be administered by local governments. Through this Act, local governments had the option of developing, implementing, and enforcing their own watershed management policies as long as they met minimum state requirements. If local governments chose not to develop a watershed management plan, the State would administer and enforce minimum statewide requirements. This Act had a large impact on Mecklenburg County since its entire western boundary is defined by the Catawba River which is designated as a WS-IV water supply, with the exception of lower Lake Wylie which is a WS-V water supply. Mecklenburg County has three major watershed protection areas which are regulated under this Act: Lake Norman, Mountain Island Lake, and upper Lake Wylie. Although Lake Wylie is currently not a drinking water reservoir for Mecklenburg County, the Town of Belmont in Gaston County, and the Towns of Rock Hill and Fort Mill, South Carolina are dependent on this source. These three protected areas encompass roughly one fourth of the land area of Mecklenburg County.

> "The Mountain Island Lake vicinity is providing important community objectives...recreation, wildlife conservation and drinking water supply. These objective have been met through a deliberate and concerted effort."
>
> ***Roy Alexander***
> ***Mecklenburg County***
> ***Parks and Recreation***

Governments in Mecklenburg County which have jurisdiction within the protected areas have adopted watershed protection regulations as required by NCGS 143-214.5. These regulations provide limits, requirements and restrictions for development within the protected areas. Included as part of these regulations are undisturbed vegetated buffers along perennial streams and lakes. The required buffer widths vary from 30 feet to 100 feet depending on the location of the development and proximity to the drinking water intakes. All local watershed regulations must meet the minimum State standards. Mecklenburg County has excerised a proactive approach to protecting our drinking water supplies by creating regulations which exceed State minimum standards. These local watershed regulations are administered under County, City, and Town zoning and subdivision ordinances.

While regulations serve as an essential tool for watershed protection, another extremely important aspect of the preservation of our water supply


Mecklenburg County
Drinking Water Watersheds
LEGEND
Drinking Water Intakes
Airport
Lakes
Mt. Island Lake Watershed
CA-1
CA-2
CA-3
CA-4
PA
PA-1
PA-2
PA-3
Lake Norman Watershed
CA
Lake Wylie Watershed
CA
PA
Lower Lake Wylie : WS-V
Lake Norman
CMU Intake
Mt. Island Lake
CMU Intake
Mt. Holly &
Gastonia Intakes
Belmont Intake
Lake Wylie
Rock Hill Intake
DAVIDSON
CORNELIUS
HUNTERSVILLE
CHARLOTTE
MINT-HILL
MATTHEWS
PINEVILLE
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and natural resources has come in the form of private organizations which are not only active in Mecklenburg County but all along the Catawba River. Groups such as the Catawba Lands Conservancy, Catawba River Foundation, Trust for Public Lands, the RiverKeeper/CoveKeeper Program, and Adopt-A-Stream groups are instrumental to the protection of our water resources. Some of the major accomplishments of these organizations include the preservation of several hundred acres of land on Mountain Island Lake, development of water quality monitoring programs, patrolling hundreds of miles of Catawba shoreline to identify illegal discharges and buffer violations, adoption of several stream and shoreline miles resulting in the removal of hundreds of pounds of trash from our surface waters, and providing funding for land acquisition projects in Mecklenburg and surrounding counties to name a few.

Mecklenburg County and Charlotte-Mecklenburg Utilities have also made great strides in preserving the water supply watersheds, particularly around Mountain Island Lake. In 1970, the County passed a $20-million bond package to create parks and greenways, primarily on the east side of Mountain Island. In that same decade, CMU also launched a land acquisition program in the watershed. Each year $50,000 from the utility's capital improvement budget goes to protection of land in the watershed, particularly on the eastern lakeshore where the CMU intake is located. This land, managed by Mecklenburg County Parks and Recreation, now totals 2,700 acres. Regulations permit only low-impact recreation, such as canoeing, fishing, and hiking in these areas.

Looking Ahead

The future of Mecklenburg County's water supply will find itself threatened by population growth and extensive development as urbanization continues both locally and upstream in the more rural counties. As development forces land values to rise, major landowners will feel increasing pressure to sell watershed land for housing, shopping centers, and industrial development. To ensure high quality water supplies and natural resources for future generations, water supply watershed protection must continue through a balance of watershed regulation enforcement, intensified efforts to preserve land and riparian buffers along our streams, lakes and rivers, and through community involvement and education.

State Senator Fountain Odom, whose district encompasses the eastern side of Mountain Island Lake and who has been working to protect it for 30 years, once said in describing Mountain Island Lake, "There's tremendous diversity of wildlife—white-tailed deer, red-tailed hawks, as well as rare and endangered flowers. The lake is the crown jewel of the area. It is to us as Central Park is to Manhattan, only more so—it's not only our recreational oasis, but also the source of our drinking water." SOER

www.

John McCulloch - Mecklenburg County Department of Environmental Protection

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The Initiative for Mountain Island Lake

For more than seventy-five years, Mountain Island Lake has remained a quiet, peaceful reservoir with abundant wildlife and natural scenery. This pristine lake remains untouched and unheard-of by most Mecklenburg County residents. Being primarily undeveloped and located downstream of the state's largest manmade impoundment (Lake Norman), Mountain Island Lake is an ideal spot for a raw drinking water intake. Since Lake Norman is so large, pollutants and sediment have ample time to settle out of the water before it enters Mountain Island Lake. In fact, Charlotte's intake has been located on Mountain Island Lake since the early 1900's. The Cities of Gastonia and Mt. Holly also have intakes on the lake. It is estimated that Gastonia has saved over $250,000 annually in drinking water treatment costs since they moved their intake to Mountain Island.

Within the past decade, sprawling development from Charlotte has encroached upon Mountain Island Lake, bringing several subdivisions, two schools, and many new residents to the watershed. The new growth and development in the area has sparked an enormous interest in protecting the lake from degradation. Although land conservation efforts were started in the 1970's, the majority of land in the watershed remains unprotected. In 1997, a partnership between the Catawba Lands Conservancy, the Community Foundation of Gaston County, the Foundation for the Carolinas, and the Trust for Public Land formed the Initiative for Mountain Island Lake. In 1998 this collaboration worked with Gaston and Lincoln counties on a $6.15 million grant from the NC Clean Water Management Trust Fund for the acquisition of a 1,231 acre tract with six miles of shoreline on the western shore of the lake. In March 1999, the first ever governmental summit was held in Mecklenburg County concerning water quality. At the initial meeting, the Carolinas Lands Conservation Network presented a Geographic Information System (GIS) based model of the Mountain Island Lake Watershed, prioritizing nearly 125 miles of tributaries needing protection. The results of a three-county poll were also unveiled showing that residents of the region ranked water quality protection among the top of their concerns, and were willing to pay to keep their drinking water safe and clean. During this meeting, staff and elected officials agreed to protect at least 80% of the undeveloped shoreline and high priority stream segments in the next two years.

Since that summit, the City of Gastonia is purchasing a 425 acre tract located near their drinking water intake, and Mecklenburg County voters passed a $220 million land purchase bond providing $15 million for the land acquisition within the Mountain Island Lake Watershed. Currently, approximately 56% of the shoreline is protected and conservation efforts are at an all- time high. Both the Catawba Lands Conservancy and Mecklenburg County Parks and Recreation are active partners in the identification and purchase of land and conservation easements.

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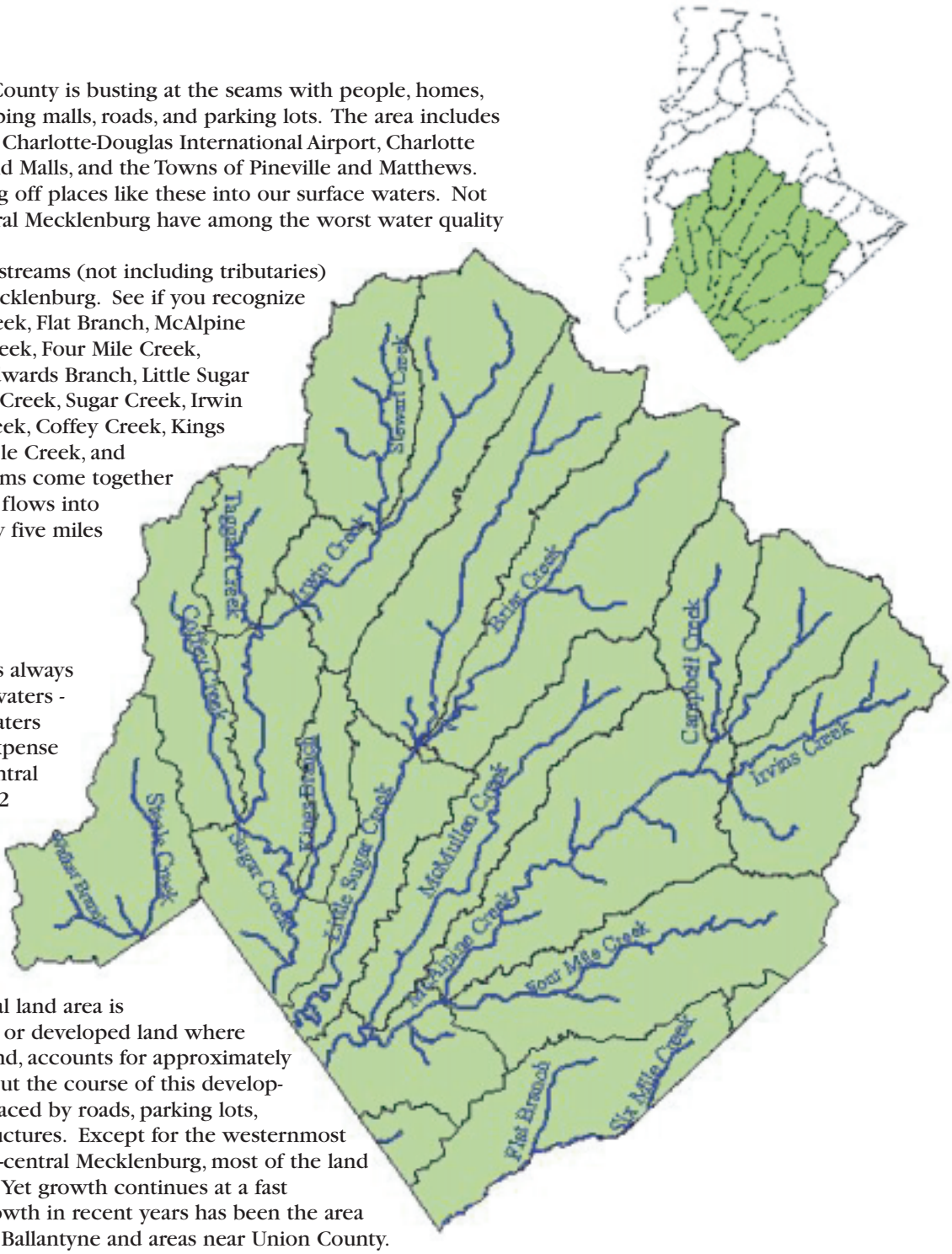
The cleaner the water entering the treatment plant, the less it will cost to treat it. Therefore, preserving land within the Mountain Island Lake Watershed will be the most cost effective and lasting method of keeping our drinking water safe and of high quality. SOER

South-Central Streams Suffer Impacts of Urbanism

South-central Mecklenburg County is busting at the seams with people, homes, office buildings, industries, shopping malls, roads, and parking lots. The area includes places like downtown Charlotte, Charlotte-Douglas International Airport, Charlotte Coliseum, South Park and Eastland Malls, and the Towns of Pineville and Matthews. Think of all the pollution running off places like these into our surface waters. Not surprising, streams in south-central Mecklenburg have among the worst water quality in the county.

Approximately 163 miles of streams (not including tributaries) run throughout south-central Mecklenburg. See if you recognize any of the following: Six Mile Creek, Flat Branch, McAlpine Creek, Campbell Creek, Irvins Creek, Four Mile Creek, McMullen Creek, Briar Creek, Edwards Branch, Little Sugar Creek, Dairy Branch, Little Hope Creek, Sugar Creek, Irwin Creek, Stewart Creek, Taggart Creek, Coffey Creek, Kings Branch, McCullough Branch, Steele Creek, and Walker Branch. All of these streams come together as Sugar Creek which eventually flows into the Catawba River approximately five miles southeast of Fort Mill, SC.



Surface Water Quality Reflects Land Use

The way we use the land has always impacted the quality of surface waters - and not for the better. Surface waters have generally perished at the expense of growth, especially in south-central Mecklenburg. Areas with 1/4 to 2 acre residential lots account for 40% of the area while commercial/industrial land use accounts for another 14%. Another 16% is greater than 2 acre residential and open space (includes farms, open fields, parks, etc.). Only 28% of the total land area is woods/brush. Impervious cover, or developed land where water cannot soak into the ground, accounts for approximately 10% of total land area. Throughout the course of this development, many trees have been replaced by roads, parking lots, homes, strip malls, and other structures. Except for the westernmost and southernmost areas of south-central Mecklenburg, most of the land is almost completely developed. Yet growth continues at a fast pace. Experiencing the most growth in recent years has been the area south of I-485, especially around Ballantyne and areas near Union County.

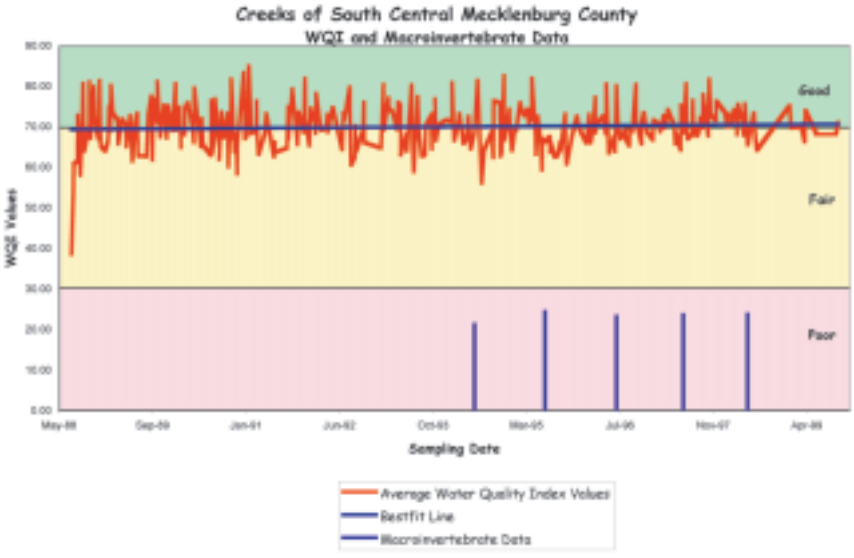
South-Central Streams Suffer Impacts of Urbanism

This area of the Little Sugar Creek watershed (N.Tryon and Sugar Creek Rd.) Has among the highest percentage of impervious cover in the county.

The result has been consistent fair to poor-fair water quality ratings in Four Mile and Six Mile Creeks over the past five years.

Two major forces expected to drive future development will be I-485 and the proposed transit corridors. New roads create new places to build. You can see it already at existing interchanges along I-485. Except for a stretch through the Steele Creek basin and an interchange at Weddington Rd., I-485 through south-central Mecklenburg is complete. Proposed land use at the interchanges will be a mixture of commercial, office, industrial, and residential zoning. A shining star in terms of its implications for managed growth and environmental protection is the development of transit corridors through south-central Mecklenburg. Light rail is recommended to run on the existing line that parallels South Boulevard. A busway, already partially constructed, is recommended for the Independence corridor. Land use plans recommend that density be established along these corridors to increase ridership opportunities near home and work and to minimize growth in other areas of the county. Such planning is part of the Smart Growth initiative which received attention in 1999. Smart Growth is a way of balancing growth with environmental responsibility. It involves measures such as controlling sprawl, rural and open space protection, and transportation alternatives.

Water Quality Index (WQI) values, based on a scale of 0 to 100, express the overall water quality at a given stream site and are based on chemical, physical, and biological data. Graphed WQI data was obtained from 28 monitoring sites in south-central Mecklenburg. Average WQI values have remained in the fair-good range for south-central Mecklenburg streams since 1988. The graph also shows that, since 1996, extreme "dips" into the fair range have not occurred, but despite what the graph shows, many of these streams are still unsuitable for prolonged human contact and fishing due to specific elevated pollutants and fluctuating conditions. This is not the whole story. Macroinvertebrates, small critters that attach to objects in streams and lakes, also help indicate water quality conditions. In fact, they are considered better indicators because they live in the water and, therefore, are exposed to pollutants daily. Typical pollutant sampling is only performed on a monthly or quarterly basis and, henceforth, provides only a "snapshot" of water quality conditions. Data results based on macroinvertebrate species composition surveys have consistently averaged in the poor range. Combining the WQI and macroinvertebrate data, average water quality for south-central Mecklenburg streams has consistently been in the lower to mid-fair range.



The high concentration of people and impervious cover coupled with a low concentration of forested and open space contribute to the degraded conditions. Little Sugar Creek, Mecklenburg County's "poster-child" for degraded urban streams, has consistently had the poorest water quality. Not surprising, its basin contains many

old sewer lines, a large amount of impervious cover, many industrial sites, and large residential developments. Improvement projects have been conducted and are currently underway to improve conditions within Little Sugar Creek. Trends indicate that this work has helped to improve conditions slightly over the past few years. More exciting restoration projects are planned for the future in Little Sugar and other streams.

The Arch-Enemies: Bacteria, Nutrients, and Sediment

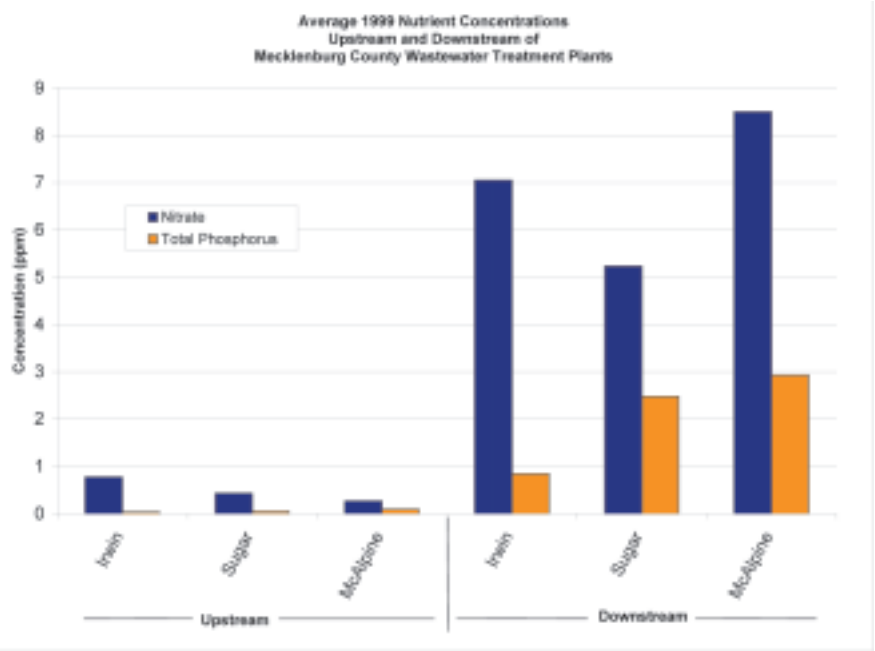
While dense development and population are two of the over-arching causes of degraded water quality conditions in this area, there are also pollutant-specific causes for the degradation. The most widespread culprit in south-central Mecklenburg streams is fecal coliform bacteria. Fecal coliforms are a family of bacteria present in the intestines of humans and other warm-blooded animals. They are not harmful themselves, but indicate the potential presence of other bacteria and viruses that cause disease. Because of the risk to human health, fecal coliform affect the useability of our streams more than any other pollution parameter.

Significant sources of fecal coliform bacteria in the south-central area of Mecklenburg County are leaking and overflowing sanitary sewer lines, pet and wildlife waste, illegal dumping, and illicit connections of sanitary wastewater. 274 discharges from municipal sanitary sewer lines were reported in south-central basins in 1999. Sewage overflows are common in many municipalities with old sewer systems. The problem is exacerbated in Mecklenburg County due to the increasing number of people and businesses connecting to the system. Also, many people create blockages by putting items into the system such as grease and paper towels. To address the severity and widespread nature of the problem, a new state law was passed in 1999. Charlotte-Mecklenburg Utilities (CMU) has taken the reigns on complying with the new rules, including notifying the public of sewage overflows and increasing response time to reported overflows. They have also implemented an aggressive sewer line cleaning, repair, and rehabilitation program and an educational campaign about proper grease disposal.

The NC state baseflow fecal coliform standard for the class of streams located in south-central Mecklenburg is a geometric mean of 400 colonies/100 ml of sample water. Average fecal coliform levels exceeded the standard in many streams in 1999, including Briar, Little Sugar, Stewart, Taggart, Irwin, Steele, McAlpine, McMullen, Irvins, Six Mile, and Kings Branch. Briar Creek had the highest average at 3391 colonies/100 ml, followed by Taggart with 2275, Stewart with 2318, and Little Sugar with 992. Incidentally, these basins had among the highest reported numbers of sewer overflows per land area in 1999. Briar, Little Sugar, and McAlpine Creeks are on North Carolina's list of impaired waters for chronic exceedances of the fecal coliform standard. All states are required by the EPA to develop a list of waters, called the 303(d) list, not meeting water quality standards or not supporting designated uses. States are then required, on a priority basis, to develop Total Maximum Daily Loads (TMDLs) or management strategies for 303(d) listed waters to address impairment. A TMDL is the total daily amount of a pollutant that a water body can assimilate without jeopardizing water quality standards or designated uses. Pollutant sources are allocated a certain portion of this load and are only allowed to discharge up to their allotted pollutant load.

The Mecklenburg County Department of Environmental Protection (MCDEP) is currently working with the North Carolina Division of Water Quality and a local stakeholder team on the development of the fecal coliform TMDLs. MCDEP staff has also increased sampling and source tracking efforts in these streams. This has and will continue to help reduce fecal coliform levels and provide much needed data for developing the TMDLs.

Nutrients are another significant form of pollution in south-central Mecklenburg streams. Nutrients are elemental forms of phosphorus, nitrogen, and carbon that are essential for growth and ecosystem health. In excessive amounts (especially phosphorus), nutrients can impair surface waters by causing excessive algae growth, reduced transparency, and undesirable shifts in fish populations. Excessive algae growth sometimes causes dissolved oxygen to drop below levels necessary to sustain fish and other aquatic life. Excess nutrients are not nearly as detrimental to stream systems as they are to lakes. For this reason, North Carolina does not impose



nutrient limits on direct dischargers to streams except for a small percentage of cases. Nutrients may enter water resources dissolved in surface or groundwater or attached to sediment. The main sources of nutrients in south-central Mecklenburg are wastewater treatment plant (WWTP) discharges, chemical fertilizers, leaking and overflowing sewer lines, pet and wildlife waste, sediment runoff, decaying organic material, and atmospheric deposition.

Data in 1999 and in previous years show that, during ambient stream conditions (no rain in past 72 hours), wastewater treatment plants are a large source of nutrient loading to streams. 1999 averages for total phosphorus and nitrate-nitrogen levels upstream and downstream of the three major wastewater treatment plants in south-central Mecklenburg show that wastewater effluent contributes heavily to instream nutrient concentrations. CMU operates the three major treatment facilities, Sugar Creek WWTP (discharges to Little Sugar), Irwin Creek WWTP, and McAlpine WWTP. The combined average discharge for the three plants in 1999 was 63.41 million gallons per day. Due to possible impacts on South Carolina lakes, some local and regional stakeholders argue that regulations should be imposed which mandate that CMU install nutrient reduction systems at their facilities. However, such measures would be extremely costly to them and, ultimately, taxpayers. In 1999, CMU began working with local stakeholders on voluntary measures to reduce nutrient discharges, including working with industries to reduce their nutrient inputs to the system and efforts toward creating opportunities for the reuse of treated wastewater (called graywater).

Another pollutant having a large impact on streams in south-central Mecklenburg is sediment. Sedimentation, or the movement of sediment from its source into surface waters, is extremely detrimental to surface waters. It buries aquatic life habitat and fish eggs, clogs fish gills, reduces water clarity, increases flooding potential, and carries attached pollutants, not to mention has a variety of economic consequences.

This straight section of Little Sugar Creek near E. 36th Street is typical of past engineering designs to control streambank erosion and flooding.

Development is almost exclusively the root cause of sedimentation in south-central Mecklenburg. First, higher stormwater flows resulting from increased impervious cover coupled with tree removal near streams causes severe erosion of streambanks during storm conditions. Second, rain washes sediment from construction sites where sediment control structures are not properly applied or maintained. Turbidity, a measurement of water clarity, is a surrogate measure of sedimentation in surface waters. The higher the amount of sedimentation, the higher the turbidity. 1999 quarterly stream sampling produced one turbidity standard exceedance at four sites: Four Mile Creek, Six Mile Creek, McAlpine Creek below McAlpine WWTP, and Campbell Creek. As mentioned, rapid development is occurring in the Four Mile and Six Mile Creek basins which likely accounts for the exceedances in those two creeks.

MCDEP took major steps toward reducing sedimentation in Mecklenburg County in 1999. Staff began a single-family residence erosion control program. Between July 1, 1999 and January 10, 2000, over 2900 single-lot site visits were conducted in south-central Mecklenburg County. Many of these resulted in Notices of Violation (NOVs) being issued to builders, some of whom were later assessed fines for not complying by dates stated in the NOVs. The other major stride toward reducing sedimentation was the passing of streamside buffer regulations in the City of Charlotte and Mecklenburg County. Buffers are naturally vegetated areas along streams that help to filter pollutants, store flood waters, reduce bank erosion, shade streams, and protect the natural meandering of steams. Buffer ordinances are currently being drafted by Matthews and Pineville and should be in place by summer 2000.

Life Beneath the Water's Surface

Perhaps as a kid you used to splash around in streams, look for critters, or even catch fish. Maybe you still get a kick out of it with your kids or by yourself. People mostly care about

streams because of what lives in them. Let's face it, without the dash of a bluegill or dart of a crayfish, streams would not be nearly as fun or interesting. As mentioned, MCDEP monitors the waters of south-central Mecklenburg for macroinvertebrates, and for fish species. Fish surveys since 1995 varied from a low of two species found on upper Little Sugar Creek to a high of 18 species on Rocky Branch. As a general rule, the higher the species diversity, the better the water quality and habitat conditions. On a good note, compared to a fish survey conducted in 1976, significant increases in the number of fish species occurred in both the Little Sugar (from 10 to 20) and Irwin/Sugar basins (from 13 to 24). Improvements are mostly attributable to major reductions in point source discharges and local efforts by government, civic groups, and citizens.

Our Streams' Fate

South-central Mecklenburg streams have suffered at the expense of our modern, industrial existence. The more urban streams, such as Little Sugar and Irwin, are undoubtedly better off than they were in the 1960s. However, years of abuse and current discharges of nonpoint source pollution render them far less than pristine. The dilemma remains, how much time and effort should we as a community spend to improve these streams in the face of a myriad of other social, economic, and environmental problems? Many factors will have to be weighed, including what direct and indirect benefits we'll receive by improving them, and what direct and indirect losses we'll suffer by not doing anything or, worse yet, degrading them further. One thing is for certain. A lot of mistakes have been made where these streams are concerned, but hopefully we've learned from our mistakes. With the interest and energy circulating among our citizens in addition to the exciting restoration projects currently underway, the future certainly looks brighter for the streams of south-central Mecklenburg County.

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Restoring Edwards Branch

As part of Mecklenburg County's Surface Water Improvement and Management (SWIM) Initiative, MCDEP is undertaking a comprehensive restoration project in the Edwards Branch watershed. The goal is to restore waters in Edwards Branch, and ultimately the entire County, to a "fishable and swimmable" condition. The majority of the funding for the project has been provided by a grant from the Clean Water Management Trust Fund. This water quality project is coordinated closely with an ongoing City of Charlotte Storm Water services (CSWS) flood control project, demonstrating that flood control and water quality improvement can be achieved simultaneously.

The Edwards Branch Watershed is one square mile in size and is an area encompassed by Independence Boulevard, Albemarle Rd., Sharon Amity Rd., Central Avenue and Norland Rd. The watershed is a "built out" highly urbanized watershed including single and multi family residential, commercial and industrial land uses along with a public park, a cemetery, schools and churches. The watershed contains one major waterway, Edwards Branch, with its three tributaries as well as two ponds. Its waters have been impaired by non-point source runoff from adjacent land uses. Non-point source pollution refers to the pollutants such as fecal coliform bacteria, sediment, nutrients and metals that are washed off the land surface during rain events.

The Edwards Branch demonstration project will evaluate the feasibility and cost effectiveness of restoring degraded waters in an urban setting using established Best Management Practices (BMPs). BMPs are structural and non-structural methods that are used to control storm water quality and quantity. Most structural BMPs work by providing a temporary storage of storm water runoff, allowing pollutants to settle out or be consumed by physical and biological processes. An example of a non-structural BMP would include public initiatives such as storm drain stenciling and fertilizer/pesticide education application programs. The proposed basin-wide BMP plan includes the design and implementation of wet ponds, multiple pond/marsh systems, bioretention areas, riparian buffers, level spreaders, stream bank stabilization, stream channel restoration, constructed wetlands and targeted public education programs. In addition to water quality improvement goals, the project also hopes to improve aquatic habitat through the construction of riffles and pools along the tributaries of Edwards Branch.

A storm water quality monitoring station has been installed at the outlet of the watershed which will be used to conduct baseline, construction and post construction monitoring. In addition, stream habitat assessment, fish and macroinvertebrate studies and channel cross section monitoring have been and will continue to be used to collect data to justify implementation of successful BMPs throughout the County. It is anticipated that the Edwards Branch restoration project will pave the way for future similar projects in an effort to restore and protect the waters of Mecklenburg County.

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Streams of Western Mecklenburg County...

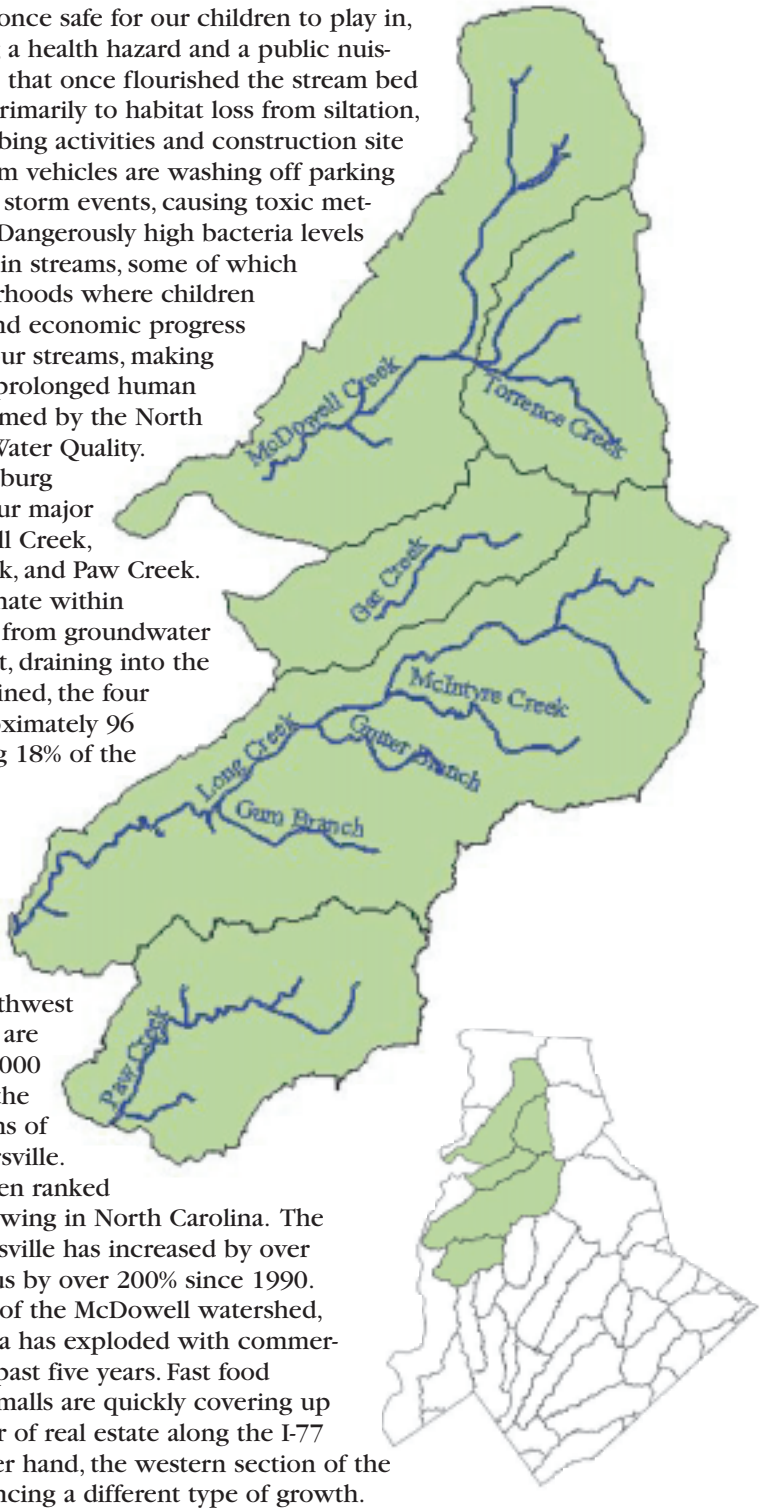
A THREATENED RESOURCE

The year was 1910 and Charlotte had grown to nearly 18,000 people. Children swing from ropes, tied high in river birch trees, landing in the cool waters of Long Creek in western Mecklenburg County. Although streams in the inner city were polluted by poorly operating sewage treatment plants, the western Mecklenburg County streams remained primarily untouched and untarnished. These streams were often used for fishing and swimming. In fact, a private park called Camp Latta was located along NC Hwy. 27, which boasted a deep pool swimming area which was created by damming up a section of Long Creek. Rural western Mecklenburg had seen little to no growth and residents often enjoyed the private, natural settings that the Long and McDowell Creek bottoms provided. On hot days, these streams provided a cool, wet place to relax and play. Children were drawn to these creeks primarily by curiosity, often fishing, swimming, wading, catching crawdads, and exploring.

Today the year is 2000 and children are still drawn to the same streams, for much the same reasons. The only problem is that these streams, which were once safe for our children to play in, are quickly becoming a health hazard and a public nuisance. The aquatic life that once flourished the stream bed is disappearing due primarily to habitat loss from siltation, caused by land disturbing activities and construction site runoff. Pollutants from vehicles are washing off parking lots and roads during storm events, causing toxic metals to enter streams. Dangerously high bacteria levels are sometimes found in streams, some of which run through neighborhoods where children play. Development and economic progress has taken its toll on our streams, making them "unsuitable for prolonged human body contact", as deemed by the North Carolina Division of Water Quality.

> "Creeks should be somewhere that people can go to enjoy nature, rather than polluted drainage ditches."
>
> **Kevin McMahon**
> Independence High School

Western Mecklenburg County is home to four major watersheds, McDowell Creek, Gar Creek, Long Creek, and Paw Creek. All four streams originate within Mecklenburg County from groundwater springs and flow west, draining into the Catawba River. Combined, the four watersheds are approximately 96 square miles, covering 18% of the County.



McDowell and Gar Creek Watersheds

The McDowell and Gar watersheds, located in the far northwest corner of the County are inhabited by over 30,000 people and includes the quickly growing towns of Cornelius and Huntersville. These towns have been ranked among the fastest growing in North Carolina. The population of Huntersville has increased by over 400%, and in Cornelius by over 200% since 1990. Near the headwaters of the McDowell watershed, the interstate I-77 area has exploded with commercial growth over the past five years. Fast food restaurants and strip malls are quickly covering up every available corner of real estate along the I-77 corridor. On the other hand, the western section of the watershed is experiencing a different type of growth.

Acres of woods and pastures that were once only useful to cattle farmers and hunters are being replaced by large sprawling residential subdivisions with community pools and tenniscourts. Increasing property values have persuaded many land owners to sell large plots of family land to developers. Although the pressure of development is evident, the watershed still remains primarily undeveloped on the western side.

McDowell Creek originates in the Town of Cornelius and flows south, joined by Caldwell Station Creek, then by Torrence Creek from the east. McDowell then turns towards the west, eventually discharging into Mountain Island Lake which serves as the primary drinking water reservoir for Mecklenburg County. As McDowell Creek gets closer to the lake, it's not unusual to see the stream standing still, or sometimes actually flowing backwards due to its confluence with Mountain Island Lake.

Protecting Our Drinking Water Supply

Gar Creek, located south of McDowell originates near Mt. Holly Huntersville Road and Alexanderana Road, and discharges into Mountain Island just upstream of the Charlotte Mecklenburg drinking water intake. The Gar watershed measures only eight square miles, compared to the 30 square miles of the McDowell watershed. The McDowell and Gar watersheds have the most restrictive development standards in the County, due to their proximity to the County's raw drinking water supply. These regulations limit the amount of impervious surfaces within a development and require undisturbed buffers along streams. Numerous studies have shown that storm water runoff from impervious cover, such as pavement and roof tops results in negative water quality impacts to nearby streams. Watershed protection regulations help to reduce impervious cover, which allows for more open space where rainfall can soak into the ground and recharge streams.

A muddy McDowell Creek flows past Beatties Ford Rd., heading into Mountain Island Lake.

Sediment and Bacteria Among the Primary Pollutants in McDowell

The Mecklenburg County Department of Environmental Protection has four monitoring sites in the McDowell watershed and one site in the Gar watershed. Samples have been routinely collected and tested for various chemical parameters since the late 1970's. A water quality index is used to consolidate various data for a given water body. These data are useful for determining the chemical components of the stream, such as nutrient, oxygen, sediment, and bacteria levels. Biological data such as macroinvertibrate and fish diversity have also been collected over the years. These data are helpful in determining stream health by defining the aquatic life diversity, since certain species are very pollution tolerant, while others are not.

Chemical water quality data for the McDowell watershed have shown little fluctuation over the past ten years. Water quality index values have generally remained in the average to good ranges. The primary pollutants in the watershed are fecal coliform bacteria and sediment. Although these pollutant levels are low when compared to streams such as Little Sugar in more urbanized areas, it is likely the levels will become higher as more development, impervious areas and other pollution sources increase. Fecal coliform levels have sometimes been traced back to overflowing and leaking sewer lines. Dairy and cattle farms are also a source of bacteria in some streams in the McDowell watershed. This will likely not be a source in years to come, due to the rapidly decreasing number and size of farms in the watershed. Chemical water quality data collected during storm events in McDowell Creek have consistently shown high levels of mineral and toxic metals. This data is not unusual when compared to storm water data collected in other watersheds across the County.

Sediment comes from the erosion of bare soils and the eroding stream banks, while bacteria can be traced to many natural animal sources as well as some human sources. Some metals, such as iron are found naturally in the soils, while zinc and copper are likely wearing off automobile tires and brakes, then washing off impervious areas into nearby streams. The data show a correlation between the amount of impervious cover, sediment and metals, with watersheds with more impervious cover appearing to have higher amounts of sediment and met-

als. This would indicate that the increasing development within the McDowell and Gar watersheds will cause increased levels of sediment and metals believed to be related to non-point sources, meaning they are washing off various land uses during rain events, as opposed to being discharged by a particular source.

There are very few point source pollution contributors in the McDowell and Gar watersheds. The McDowell Creek Wastewater Treatment plant, one of five Charlotte-Mecklenburg municipal wastewater treatment plants, is the largest point source contributor. The plant serves the entire northern Mecklenburg area and has a permitted average annual discharge of 6.0 million gallons of treated wastewater per day (MGD), although the current discharge from the plant is around 4.0 MGD. As you may imagine, this discharge has historically elevated the level of nutrients in McDowell Creek and has been one of the contributing factors in the algal abundance in McDowell Creek cove on Mtn. Island Lake. Recently the plant added a nutrient removal system, which caused a dramatic improvement in the water quality of McDowell Creek below the plant's discharge.

Macroinvertibrate data tend to show a slight decrease in species richness in lower and mid McDowell Creek, likely due to habitat alterations caused by siltation. The State of North Carolina Division of Water Quality has recently added McDowell Creek to a list of impaired streams within North Carolina, not because of a particular pollutant, but because of its poor biological diversity.

The water quality in Gar Creek remains among the best in the County. This little watershed continues to dodge development and remains primarily undisturbed. Gar Creek is home to a wide diversity of biological life and often serves as a model for other streams in the County.

In 1998, the Carolinas Land Conservation Network and the Centralia Council of Governments guided a scientific steering committee to identify priority lands for protection of Mountain Island Lake. Several stream segments in the McDowell and Gar watersheds were identified as high priority streams. The Mecklenburg County Department of Environmental Protection has also initiated an effort in the McDowell watershed called Water Improvement Now (WIN). This initiative is geared towards involving the public in protecting the natural resources within their own watershed. The McDowell watershed was targeted for this pilot project due to its importance in protecting Mecklenburg's drinking water supply, and the increasing threats that development is having on water quality in the area.

The Paw Creek watershed is home to eight major petroleum distribution companies.

Long and Paw Creek Watersheds

The Long and Paw Creek watersheds are located just south of the McDowell watershed. Like most areas in Mecklenburg County, they have not been overlooked by development, but have a relatively low population density when compared with other areas of the County. The predominant land use is residential.

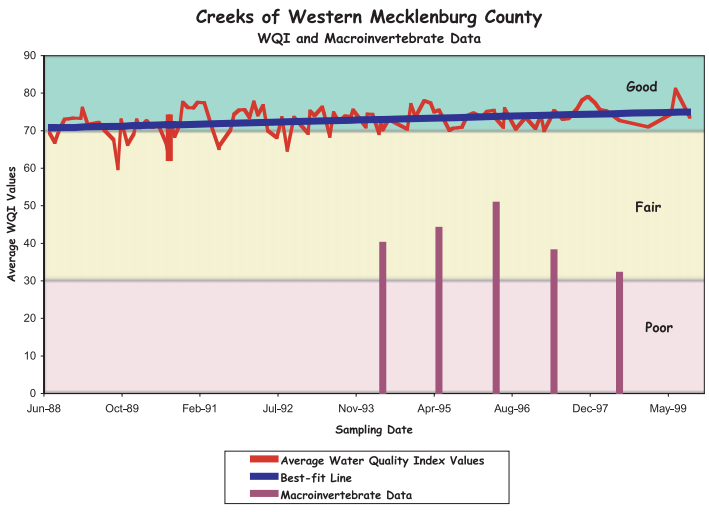
Like the McDowell watershed, Long Creek is experiencing significant growth in the form of single family residential subdivisions. Long Creek originates just east of I-77 near W.T. Harris Blvd. and flows west, eventually discharging into the upper portion of Lake Wylie. It is the largest among the western watersheds, stretching across 36 square miles, with major tributaries being Long Creek, McIntyre Creek and Gum Branch. The lower portion of Long Creek falls within the Lake Wylie drinking water supply watershed regulations, which provide additional protection to the Town of Belmont's drinking water intake located along the shoreline of Lake Wylie.

The Paw Creek watershed is located just south of Long Creek and originates north of Freedom Drive, just west of I-85. Paw Creek meanders towards the west, draining into Lake Wylie just below the Town of Belmont. The watershed encompasses about 20 square miles and is partly residential, but with a significant amount of industrial and commercial land uses. The upper portion of the Paw Creek watershed, known by many Mecklenburg residents as "Tank Town," is a major petroleum distribution hub for eight petroleum distribution companies.

A child explores the banks along McDowell Creek.

Long Creek Threatened by New Highway Development

Three monitoring sites are located in the Long Creek watershed and one site in the Paw Creek watershed. Water quality index values for the Long and Paw Creek watersheds have remained fairly consistent over the past ten years, generally staying in the average to good ranges. The primary pollutants are sediment and fecal coliform bacteria. Samples collected in Long and Paw Creeks during storm events are high in sediment, bacteria, and metals. Although there are several point source dischargers in the watersheds, the pollutants are believed to be non-point source related. Long Creek has also been added to North Carolina's list of impaired waters due to sediment problems. The expansion of interstate I-485 will cut through the upper portion of the watershed, crossing portions of Long Creek and it's tributaries six times, and run parallel to the main branch of Long Creek for approximately eight miles. This close proximity to the stream will result in increased velocities and water temperatures during rain events. Higher velocities could result in more bank erosion and sediment, while higher temperatures could promote algae growth, leading to oxygen depletion. Biological diversity in Long and Paw Creeks are currently in the fair to good range and have shown little fluctuation over the years.



What Does the Future Hold?

Although Camp Latta no longer exists, children still play in western Mecklenburg streams, just as they did in 1910. They look for frogs and crawdads, and explore some of the same areas. The only difference is that urban growth and development has surrounded many of the streams, making them vulnerable to many pollution sources. While some Mecklenburg citizens describe this growth as "progress," others describe it as "destruction." When all western Mecklenburg stream data is combined and illustrated over a 12 year period, the chemical water quality parameters appear to show a very slight improvement, but the declining macroinvertibrate data clearly illustrates the results of cumulative pollution and aquatic habitat alteration over the years. In a county such as Mecklenburg, is it possible to balance economic growth with the protection of our environment? Some say yes, and cite environmental protection initiatives, such as new County wide stream buffer regulations designed to preserve floodplains as open space and parks, while providing areas for children to play and explore natural resources. There are also aggressive, innovative initiatives underway such as educating citizens about protecting streams in their own backyard. The threat to the water quality in our western streams is real, but these resources can be protected through wise planning and the support of citizens and property owners.

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"WIN" Water Improvements Now Initiative for the McDowell Creek Watershed

Located in northwestern Mecklenburg County, McDowell Creek winds behind neighborhoods and businesses, under roads and through agricultural fields of Huntersville and Cornelius. A canopy of oaks, hickories and poplars shade the waters of McDowell Creek, form a forested buffer, and stabilize it's stream banks. However, McDowell Creek, for the most part, goes unnoticed. Perhaps only the occasional fisherman or resident has noticed the muddy red waters of the creek during a rain storm or how the stream banks quickly erode when the forested creek buffer is cleared.

The McDowell Creek Watershed is defined as McDowell, Caldwell Station, and Torrence Creeks and all the lands these creeks drain. At the southern end of the watershed, McDowell Creek flows into McDowell Creek Cove and eventually into Mountain Island Lake. Portions of the watershed's stream banks remain forested, but sediment and silt have already covered most of the watershed's stream beds, destroying aquatic life and habitat.

In May of 1999, Mecklenburg County Department of Environmental Protection's (MCDEP) Water Quality Section targeted the McDowell Creek Watershed for a pilot project, the Water Improvements Now Initiative (WIN). This particular watershed was chosen for three reasons. McDowell Creek has recently been added to North Carolina's list of "impaired" waters. It is located in one of the fastest growing areas of Mecklenburg County, and McDowell Creek drains into Mountain Island Lake just north of Charlotte's drinking water intake. In addition to the reasons mentioned above, biological data collected over the last five (5) years has illustrated a steady decline in the populations and diversity of aquatic life found in McDowell Creek. Sediment, the primary pollutant in this watershed is not only detrimental to aquatic life, it also fills up the stream beds which decreases the storm water storage capacity of the stream and increases the risk of flooding.

The WIN Initiative has been designed to organize a group of enthusiastic watershed residents (WINners) to focus on environmental issues impacting their community including creek buffers, storm water, development, and open space preservation. MCDEP staff are excited about this pilot project and are committed to providing support and resources to this special group of environmental advocates. It is hoped that the WINners group will encourage local government to support "smart growth" and initiate exciting "hands-on" projects such as a volunteer stream monitoring program, stream bank restoration and stream buffer enhancement projects.

During the Fall of 1999, staff used a combination of tools to reach potential WINners: public presentations, news releases, feature articles, and a promotional poster and brochure. The WINners group will consist of residents, students, businesses and community leaders who live and/or work in the McDowell Creek Watershed. Together these individuals will be able to combine resources and work towards sustainable solutions for protecting water resources, the overall environment, and the quality of life in their community. A kickoff celebration is planned for Spring 2000. Ultimately, the McDowell Creek Watershed WINners group will establish a firm foundation upon which future WIN groups in other critical watersheds can build. Clean water is not only a critical local issue, it is one of the top regional, national and global issues of the future! SOER

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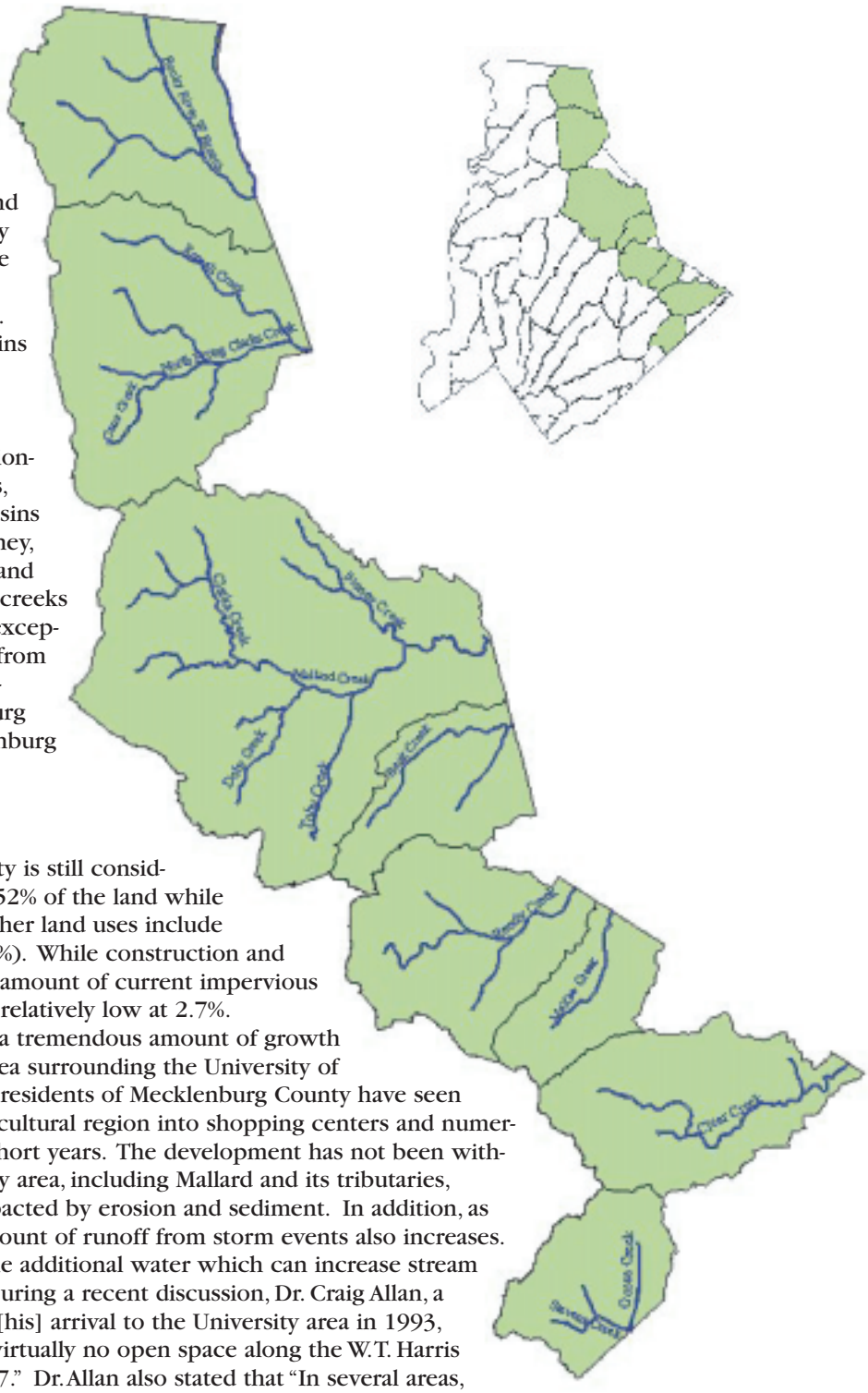
> Never doubt that a small group of thoughtful, committed people can change the world, indeed it is the only thing that ever has.
> **-Margaret Mead**

The Other Basin - The Yadkin River Basin

When most people think of a river basin in Mecklenburg County, the Catwba is the first thing that enters their mind, but there is one other important drainage basin located in the County. Along the central and northern borders of eastern Mecklenburg County flow the streams that drain to the Yadkin-Pee Dee River Basin. This network of streams comprises approximately one third of the County's streams. The Yadkin-Pee Dee Basin contains eight sub-basins that, collectively, have a drainage area of 1328 square miles. The primary function of these streams is to provide habitat for fish and other wildlife and, secondly, to provide various recreational uses for citizens. There are 14 primary creeks, stretching some 88 miles, that drain these sub-basins including Clear, McKee, Reedy, Back, Mallard, Stoney, Clarke, Doby, Toby, Cane, Ramah, Goose, Stevens and the West Branch of the Rocky River. All of these creeks originate within Mecklenburg County, with the exception of the Rocky River which flows southward from Iredell County and then along the Mecklenburg - Cabarrus County line before entering Mecklenburg County. The creeks flow southeast from Mecklenburg County before entering the Yadkin River.



From Farmlands to Freeways

The eastern most side of Mecklenburg county is still considered somewhat rural. Open space accounts for 52% of the land while 42% of the land is utilized for residential use. Other land uses include commercial (1.3%) and also some industrial (1.6%). While construction and development within the basin is on the rise, the amount of current impervious cover such as roads, parking lots and rooftops is relatively low at 2.7%.

During the last several years there has been a tremendous amount of growth within the basin. This is especially true in the area surrounding the University of North Carolina at Charlotte (UNCC). Long term residents of Mecklenburg County have seen this area transform from a rural farming and agricultural region into shopping centers and numerous residential developments within just a few short years. The development has not been without a price as the creeks that drain the University area, including Mallard and its tributaries, Stoney, Toby and Doby, have been negatively impacted by erosion and sediment. In addition, as the amount of impervious areas increase, the amount of runoff from storm events also increases. The result is that the streams are forced to handle additional water which can increase stream bank erosion and can raise flooding potential. During a recent discussion, Dr. Craig Allan, a hydrology professor at UNCC, stated that "Since [his] arrival to the University area in 1993, the amount of development in the area has left virtually no open space along the W.T. Harris Boulevard corridor between Highway 49 and I-77." Dr. Allan also stated that "In several areas, Doby Creek has developed unstable stream banks that are slumping and the channel depth has deepened due to scour from increased flows during storm events."

Other areas within the basin are also under pressure from construction. The construction of the new I-485 beltway will impact many of the sub-basins in the area. I-485 will travel along the entire eastern border of Mecklenburg County and, by the time construction is finished, will go through every sub-basin that drains to the Yadkin River. The forests and open land within the basin will continue to give way to growth and development. Therefore, the quality of the natural resources of the area, including our creeks and streams, may progressively decline. Not only will the creeks be impacted by the construction of the road itself, but they will also be affected by the future growth that will be a result of the 12 planned interchange locations that will be constructed within the basin.

While the land around some of the proposed I-485 interchanges has already been developed, there are many areas that have yet to be fully developed. The proposed land use at seven of the I-485 interchanges is for residential (single family and/or multi-family). These seven interchanges will be located at Highway 49, Rocky River Rd., Harrisburg Rd., Blair Rd., Fairview Rd., Lawyers Rd., and Idlewild Rd. Office and industrial land uses have been recommended for areas around three of the interchanges in northeastern Mecklenburg County at Mallard Creek Rd., I-85 North and North Tryon St. The recommended land use for the area surrounding the Albemarle Rd. interchange is office and/or industrial. The proposed land use at the remaining interchange at Prosperity Church Rd. is for a village/town center. The face of these rural, countryside communities, as we now know them, will be forever changed by the construction of these interchanges.

Development of I-485 will transform many rural areas into urban corridors.

"Muddy trashy creeks makes me feel terrible. I want to clean it up...start a club, a campaign!"

Alberta Watkins
Independence High School

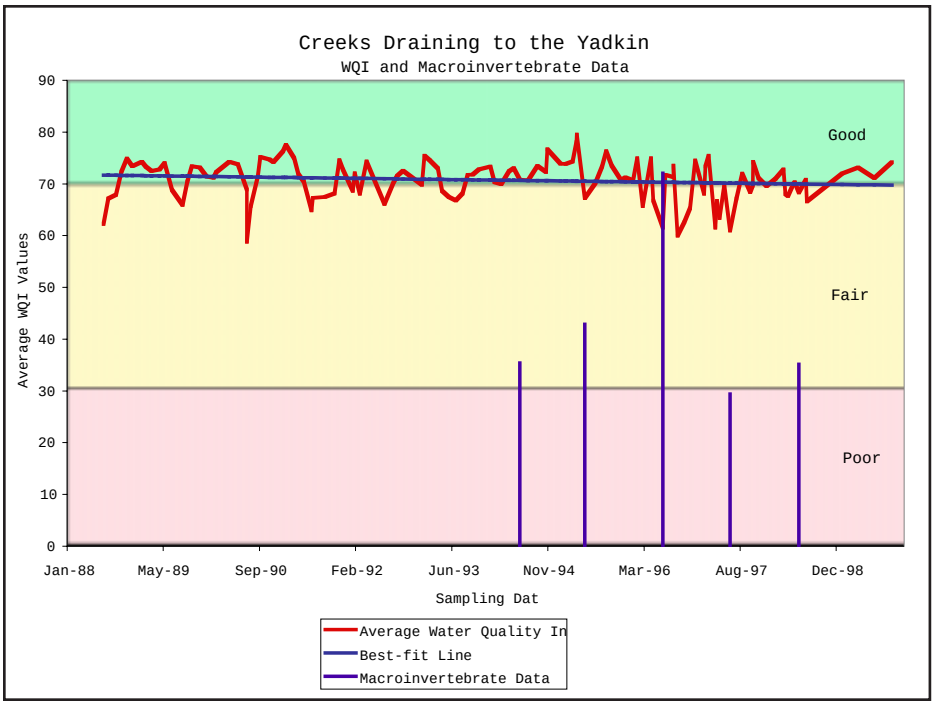
More Pavement Means More Pollution

In an effort to document changing water quality conditions within the basin, monitoring has been conducted by the Mecklenburg County Department of Environmental Protection (MCDEP) at numerous sites within the basin since the late 1970s. Water samples are tested for fecal coliform bacteria, physical and chemical parameters, as well as metals. The data indicates that, historically, the primary pollutants within the basins have been turbidity from suspended sediments and fecal coliform bacteria. Turbidity is a measure of the amount of suspended solids in a water sample. Most of the turbidity in streams is caused by sediment loss from construction sites and from eroding streambanks. Fecal coliform bacteria is found in the intestine of warm blooded animals, including humans. Fecal coliform bacteria can indicate the presence of sewage as well as harmful pathogenic bacteria.

Currently there are ten water quality monitoring sites located within the eight sub-basins that are monitored quarterly. The creeks that are monitored include Clarke, Mallard (two sites), Back, Stevens, Goose, Clear, McKee, Reedy and Rocky River. Monitoring conducted during 1999 indicates that the primary pollutants throughout the basin continue to be turbidity from suspended sediments and fecal coliform.

Sediment is harmful to overall water quality as it can cover stream beds thus destroying aquatic habitat and covering fish eggs. If enough sediment accumulates in the stream bed, the water conveyance capacity of the stream can be reduced resulting in increased flooding potential. When streams have excessive amounts of suspended sediment the aesthetic value of the stream is also diminished. In addition, suspended sediments can increase the amount of fecal coliform in streams as fecal coliform bacteria attaches to suspended sediment thereby increasing harmful bacteria counts. High fecal coliform counts in creeks can also increase health risks to humans during contact. This can be especially true when children come in contact with waters that have high fecal coliform bacteria concentrations and inadvertently ingest some of the water while playing.

In addition to physical and chemical water quality monitoring, MCDEP also conducts biological monitoring at all of the aforementioned sampling locations as well as two additional locations on Toby Creek. Biological monitoring determines the number of different species, or taxa richness, of aquatic macroinvertebrates such as stoneflies, mayflies and caddisflies that are present in the stream. The presence or absence of these pollution sensitive aquatic insects help to determine the overall health of the stream. Aquatic



macroinvertebrates are ideal water quality indicators because they are sensitive to changes in water quality and are found in all types of aquatic habitats. They are also less mobile than other aquatic dwellers, such as fish, and are unable to relocate if water quality conditions worsen.

MCDEP uses the physical and chemical water quality data to compute a water quality index (WQI) value for each specific sub-basin. The WQI values are expressed numerically from 0 to 100. The WQI numbers correlate to a ranking ranging from Very Poor (0-15) to Excellent (85-100). While the surface water quality in the Yadkin basin is better than average compared to other streams in the County, the WQI "best fit line" for the creeks in the basin shows a downward trend in water quality.

The WQI value for waters in the Rocky River sub-basin have decreased from "Good" in 1995 to "Fair/Good" in 1999. Waters in the Clarke Creek sub-basin have dropped from a "Fair/Good" WQI rating in 1995 compared to a "Fair" rating in 1999, while the Back Creek sub-basin has seen its WQI rating drop from "Good" to "Fair" over the same period. The Reedy Creek and McKee sub-basin WQI ratings have remained constant at "Fair/Good" over the last five years, Clear and Goose Creeks have seen their ratings drop from "Good" in 1995 to "Fair/Good" in 1999. The North Carolina State Division of Water Quality (DWQ) has recently added McKee, Clear and Goose Creeks to a list of impaired streams within the State due to high sediment and fecal coliform concentrations. Sections of Goose Creek in Mecklenburg County were once the home of an endangered species of mussel, the Carolina Heel Splitter. It is not difficult to see that recent development has taken its toll on the waters of the Yadkin basin.

Mallard Creek has some of the poorest water quality in the entire basin with WQI values in the "Fair" range. The primary pollutants found on the lower reaches of Mallard Creek are nutrients such as nitrogen and phosphorus. These pollutants are especially prevalent at the monitoring site located downstream of the Mallard Creek Wastewater Treatment Plant (WWTP). Excessive nutrients in surface waters can lead to algae blooms which can deplete the water of precious oxygen that aquatic organisms need. The primary source for these nutrients is the Mallard Creek WWTP which can process 8 million gallons of sewage per day (MGD). Due to increased recent development in the area, there are plans to expand the facility's capacity to 12 MGD. Secondary sources of nutrients include yard fertilizers and waste from wild and domestic animals.

The headwaters of Mallard Creek flow adjacent to a new development.

The Fate of the Yadkin Basin is in Our Hands

Is it too late to save the waters of the Yadkin River basin? With new development and construction continuing at a record pace, it will be a difficult challenge to preserve these precious natural resources. Mecklenburg County has initiated programs that will help to preserve and protect surface waters. One such program is increased erosion control inspections, especially on single family lots, which will help to ensure that sediment loss from these sites is kept to a minimum by installing and maintaining effective erosion control devices. An intensive monitoring program has been initiated in the Yadkin Basin that will identify stream sections with high fecal coliform concentrations and then locate and eliminate sources such as sewer overflows and illicit sewage connections. Additionally, implementation of the Stream Buffer Ordinance, which will require buffers along all undeveloped streams in the County, will help to ensure protection of our surface waters. Together, with the help of concerned citizens, these measures and other innovative strategies will protect and preserve the water quality resources of the Yadkin basin and all of Mecklenburg County.

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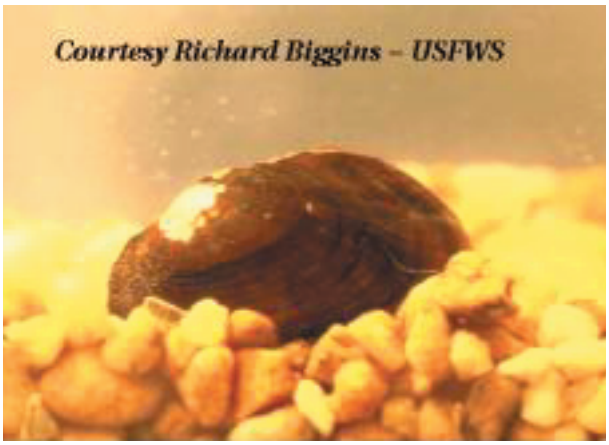
PROTECTING THE ENDANGERED CAROLINA HEELSPLITTER IN GOOSE CREEK



Goose Creek is home to the endangered Carolina Heelsplitter (Lasmiogona decorata).

The Carolina heelsplitter (Lasmigona decorata), a small yellowish brown mollusk related to clams, oysters and scallops, is native only to the Carolinas. The mussel is historically known to exist within the Catawba River and Pee-Dee River systems in North Carolina and the Saluda and Pee-Dee River systems in South Carolina. It is presently thought that only three populations are still surviving—Waxhaw Creek and Goose Creek in Union County, N.C., and a short reach of the Lynches River and Flat Creek, a tributary to the Lynches River, in S.C. During the late 1980s, the U.S. Fish & Wildlife Service conducted status surveys of the remaining populations of the mussel. The survey determined that the heelsplitter has been eliminated from most of these original sites. Because of its decline, the Carolina heelsplitter was added to the federal endangered species list in June 1993.

Years of habitat alteration and water quality degradation are believed to be the main reasons for the species extirpation from its historic range. Increased suburban residential development and incorrect agricultural operations near the headwaters of Goose and Stevens Creeks in southeast Mecklenburg County provides sources of pollutants found in stormwater runoff. Stormwater pollution, also know as nonpoint source pollution, originates from diffuse sources of everyday activities. The pollutants are carried down stream in Goose Creek into Union County, severely degrading the aquatic environment. "The mussels are like living rocks," explains Kate Pipkin, a conservation biologist with the N.C. Wildlife Resources Commission. "Because they filter water and are relatively stable in their stream bed, the mussels cannot escape pollutants from upstream. Their numbers decline when the water is not right." Consequently, the mussels are good indicators of water quality. "They require streams with well oxygenated clean water with stable streambanks of large trees providing shading and woody debris," says Pipkin.

The N.C. Wildlife Resources Commission, a division of the State's Department of Environment & Natural Resources, and the Mecklenburg County Department of Environmental Protection recently began conservation efforts to drastically improve water quality in the Stevens and Goose Creeks watershed. Planned construction of miniature stormwater wetlands in an urban neighborhood in Mint Hill and the recent promulgation of county stream buffers, part of Mecklenburg County's Surface Water Improvement & Management initiative, will help provide water quality protection by filtering pollutants and providing storage of flood waters flowing downstream into heelsplitter habitats. Also, community education and involvement in the protection of the watershed headwaters will be encouraged to help reduce pollutants from the misuse of household and lawn chemicals. Four water quality related educational presentations are planned to be held in Mint Hill in 2000 and will hopefully generate interest and long term stewardship in the sustained recovery of the heelsplitter. Mecklenburg County currently monitors many chemical, physical and biological parameters and will continue to do so in order to assess the improvements in water quality flowing down stream from the watershed.

"The overall success of the heelsplitter recovery depends upon the conservation efforts of the people that are connected to the species by their work, their land, and their actions" —NC Wildlife Resources Commission.

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Staying Above Water: Floodplain Initiatives in 1999

Flood waters threaten a house along Little Sugar Creek.

According to the Federal Emergency Management Agency (FEMA), 1999's Hurricane Floyd alone was responsible for 13 hurricane-related disaster declarations, the most authorized for any single disaster. The 1993 Mid-west floods held the previous record with nine declarations. Nearly $514 million has been poured into Hurricane Floyd recoveries, including more than $277 million for North Carolina, the hardest hit of the Floyd-damaged states. Although Mecklenburg County was spared Hurricane Floyd's wrath, Charlotte-Mecklenburg has a history with flooding:

- Over $50 million in insured and uninsured losses resulted from local storms in 1995 and 1997;
- $13 millin in insured losses have been paid since the mid-70's;
- 1530 flood insurance policies in force;
- 2000+ structures in the floodplain (approximately 1400 residential and 600 commercial properties). Floods are natural processes. They are part of dynamic and complex systems that provide many environmental benefits. Throughout time, floods have shaped the landscape, carved out habitat for wildlife and sowed the lands with rich, fertile soils.

Unfortunately, the most lasting impression left by floods has been one of destruction. Floods have become our nation's greatest natural disaster, disrupting lives and often causing significant economic impact. Flood events also impact the environment by carrying pollutants from impervious areas into streams and by scouring away streambanks.

In 1999, Mecklenburg County completed several aggressive initiatives

As Mecklenburg County has grown, the new buildings, roads and parking lots we have constructed have changed the natural system. When the land draining to the creek (termed "watershed") was more natural, the rainwater soaked into the ground, flowed slowly across the land and had its pollutants filtered by soils and plants. In these undeveloped lands, floodwaters only swelled so high and basically nothing stood in the path of the flood. However, with development, not only is there more rainwater skidding across roads and parking lots, but it is making a speedier plunge. Therefore, the rainwater does not soak into the ground as much and travels over the land faster, which reduces the quality of water in streams and lakes. Also, the levels of the floodwaters get higher and people find themselves and their structures in the path of a flood.

In 1999, Mecklenburg County completed several aggressive initiatives centered on the following objectives:

- to prevent or reduce the loss of life, disruption of vital services, and damage caused by floods
- to preserve and restore the natural and beneficial functions of the floodplains.

These objectives are the backbone of the Mecklenburg County Floodplain Guidance Document, which clearly outlines how meeting the above objectives also takes into consideration other goals. It recognizes that protecting water quality in creeks and keeping structures and people out of harm's way also can have a positive impact on the physical and economic health of a community. The creeks and surrounding lands can be used to support community values, such as improved water quality, open space, greenways, ball fields and wetland areas. The following four initiatives supporting multiple goals were completed in 1999:

- adopted Hazard Mitigation Plans
- secured $12.2 million in Hazard Mitigation Grant Funds (Hurricane Fran) to purchase 116 structures in the floodplains of Little Sugar and Irwin Creeks
- secured $940,000 in North Carolina Clean Water Management Trust Fund (CWMTF) to construct wetlands in the floodplain
- adopted new floodplain regulations that set aside more land for the passage of floodwaters.

Hazard Mitigation Plans

In April 1999, the Mecklenburg County Board of Commissioners adopted Hazard Mitigation Plans (Plans) for the four watersheds with the highest number of structures at risk of flooding and the poorest water quality. These include upper Little Sugar, Briar, McMullen, and Irwin Creeks.

The Plans' recommended alternatives include removing buildings from the floodplain, elevating buildings in place, floodproofing buildings, constructing levees or floodwalls, and constructing storm drainage improvements. The Plans are a result of detailed analyses of flooding problems along major creeks in each watershed. Development of the Plans also took into account the potential location of future greenways and possible water quality improvements.

Public meetings for each watershed were held in July and August of 1998 to gather input on the flood problems and potential solutions. Information from these meetings was incorporated into the Plans and public comment summaries are included as an appendix in each Plan. The draft Plans, including color maps, were posted on Storm Water Services web page to solicit additional comment. The adopted Plans may be viewed by accessing http://www.co.mecklenburg.nc.us/coeng/Storm.

In 2000, after the completion of new floodplain maps, hazard mitigation plans will be developed for the surrounding watersheds. The focus of these plans will be to identify not only the structures that currently flood, but also those prone to flooding in the future as the watershed is fully developed.

While carrying out the recommendations outlined in the Plans hinges on funding, the Plans enable the County to respond to potential Federal and State funding opportunities more quickly and in a more reliable manner, as was the case with Hazard Mitigation Grant Program (HMGP) Hurricane Fran Disaster funds.

$12.2 million Hazard Mitigation Grant Funds (Hurricane Fran)

Although Mecklenburg County did not receive any damages as a result of Hurricane Fran, the County was able to secure $12.2 million in state, federal and local funding for the acquisition of 116 residential structures built in the floodplain in the 50's and 60's - prior to the current Floodplain Regulations. These funds were made available through the HMGP administered by Federal Emergency Management Agency (FEMA). Through the planning process mentioned above, as well as the automation of benefit-cost programming using Geographic Information Systems (GIS), Mecklenburg County was capable of quickly developing grant applications to secure remaining Hurricane Fran funds just prior to the project close-out.

The eligible properties were in six neighborhoods, three of which are in the Little Sugar Creek watershed, which has a history of poor water quality. The other three neighborhoods are in the Irwin Creek watershed, which has fair water quality.

Acquisition of these structures is anticipated to begin in March of 2000 and should take approximately two years to complete. This is a voluntary program and the participation by flood-prone property owners will ultimately dictate the timing of the project and use of the acquired land.

The properties acquired through the HMGP mentioned above will be deeded to Mecklenburg County after acquisition. With these 116 structures removed from the floodplain, there is the potential for over 56 acres of floodplain property to be restored, allowing it to provide its "natural and beneficial functions" to the community – including open space, greenways, stream buffers, wetlands, or a combination thereof.

$940,000 from CWMTF

Mecklenburg County, in coordination with the City of Charlotte, submitted a grant application to the Clean Water Management Trust Fund (CWMTF) for the creation of wetlands in each of the six neighborhoods identified in the HMGP buy-out project areas. The grant was awarded in the amount of $940,000. The highest priority wetland site is along Wellingford Road. This is an area in the Hidden Valley neighborhood located in the upper portions of Little Sugar Creek.

The objectives of the wetlands project is to reduce pollutant loading in Little Sugar Creek by 70% for phosphorous, 80% for suspended solids, and 60% for fecal coliform counts. Acquisition of the structures is anticipated in March of 2000 and construction of the wetland areas is projected for December of 2000.

The above three initiatives address the planning and restoration of the environment where development has already occurred. The fourth initiative, completed in 1999, focuses on preventing flooding as well as enhancing the beneficial uses of the floodplain in areas where properties have yet to be developed.

Little Sugar Creek spills over its banks into a south Charlotte neighborhood.

New Floodplain Regulations

Numerous communities across the United States have to deal with outdated FEMA floodplain maps. Floodplain maps are used to determine flood insurance rates and to educate the public on potential flood risks. The existing floodplain maps are more than 10 years old for over 50% of the communities that participate in the National Flood Insurance Program (NFIP). Mecklenburg County is experiencing significant development and the accuracy of the FEMA floodplain maps have been a concern for some time. With the continued increase in building activity and flooding in certain areas not depicted on the FEMA maps, the County has recognized the critical need for accurate floodplain maps. In addition, there has been a realization that new development in and around floodplains must be protected from "future" flooding and degradation of water quality that is expected from increased development upstream.

Based on a pilot study of Mallard and McAlpine Creek watersheds, flood elevations on the old FEMA maps are too low and greatly underestimate the actual risk of flooding. In fact, the 100-year flood elevations may be as much as three to four feet too low. Therefore, Mecklenburg County, the City of Charlotte, and the surrounding Towns adopted an interim policy that requires buildings to be 5.7 feet higher than the FEMA 100-year flood elevations. Previously, the requirement was to build only a foot above the FEMA flood elevations. The interim policy will be in effect until the new maps are adopted in the summer of 2000. The BOCC also adopted an amendment to the Floodplain Regulations which stipulates that new floodplain maps will be developed based on ultimate development capacity in the watershed.

During 1999, Mecklenburg County not only wrestled with how high structures in the floodplain should be elevated, but actually where they can be built. This area in the floodplain reserved for building is termed the "fringe." Old FEMA maps were drawn to maximize the amount of land available for development. This resulted in a minimum amount of area set aside for floodwaters – termed "floodway" area (no-build zone). The old FEMA maps allocated 50% of the floodplain to fringe areas and 50% to floodway areas. The new maps will be drawn such that essentially only 25% of the floodplain will be available for development (fringe areas) and 75% of the floodplain reserved for floodwaters (floodway). This change was brought about by an increasing interest to protect against future flood losses, coupled with a greater effort to protect our environmental resources.

These more restrictive regulations were developed in conjunction with the SWIM Stream Buffers initiative. To offset restrictions that these regulations place on development, incentives and mitigation allowances were included in the Zoning Ordinance. With the Floodplain Regulations and the SWIM Buffer Regulations working together, there will be larger areas set aside than before for the floodplain to perform its natural and beneficial functions, which include conveyance of flood water, filtering of pollutants, allowing channels to meander naturally, and preservation of wildlife habitat.

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STREAM FISH HABITATS ARE BEING RESTORED

The fish in Mecklenburg County streams are making a come back. In 1999, the Mecklenburg County Department of Environmental Protection (MCDEP) fisheries biologist was amazed at the number and variety of fish found in a sample taken from Little Sugar Creek. Fourteen different species of fish were found in the stream. This was a vast improvement over the fish sampling results reported in a September 1969

Charlotte News article in which Dr. Edward Menhinick, a University of North Carolina at Charlotte fisheries biologist, reported finding no fish in Little Sugar Creek after several hours of searching.

n the late 1960s and early 1970s, Mecklenburg County's streams were severely polluted. The primary pollutants in the streams at that time included the discharge of partially treated wastewater from small, poorly operated wastewater treatment plants, failing septic systems, illegal connections to the storm drain system, pollutants in stormwater runoff, sedimentation from construction sites and streambank erosion. The majority of these problems now have been addressed by Charlotte-Mecklenburg Utilities, the Mecklenburg County Health Department, Mecklenburg County Storm Water Services (MCSWS) and MCDEP. The combined action of these agencies has resulted in substantial improvements in the water quality of the County's streams. The better water quality has enabled many of the more pollution tolerant fish species, such as the redbreast sunfish, to return to the streams.

Sediment Covering up Aquatic Habitat

Unfortunately, all is not well. Some of the pollution sensitive fish, like the darters, the eastern silvery minnow and the greenhead shiner, which historically had been present in urban streams like Little Sugar Creek, have not returned. These fish require fairly cool, clear water streams with rocky bottoms for reproduction. The stream bottoms of most of the County's urban streams have become covered with silt, sand and sediment from construction sites and streambank erosion, clogging the small spaces among the rocks and gravel where aquatic insects (fish food organisms) and small fish live. Fish spawning areas have become covered with sand and sediment preventing the successful reproduction of a number of different types of fish. Also, the majority of the urban streams have long stretches exposed to full sunlight resulting in warm streams choked with algae. Summer stream temperatures often exceed 80oF which may be lethal to some species of fish. Overall the lack of suitable fish habitats is preventing these fish from returning to the urban streams.

Every time it rains, the water level in Mecklenburg County's streams rises rapidly. This is most noticeable in the highly developed watersheds within the City of Charlotte. The owners of land adjacent to a stream can testify to the damage that rapidly rising stormwater has on streambanks. Each year some streambanks may lose as much as a foot or more of soil, especially in the erosion sensitive stream bends and turns. Such extreme erosion is threatening backyards, trees, fences, parking lots, outdoor storage buildings and even some homes.

Traditionally, hard engineering practices, such as the lining of streambanks with rip-rap rocks, have been used to stabilize eroding streambanks. These techniques were often accompanied by stream channelization, or the straightening of the stream, which required the removal of the protective streambank vegetation. One of the primary objectives of the traditional streambank stabilization approach, other than

Mecklenburg County Storm Water Services Little Sugar Creek streambank stabilization project combined hard engineering techniques (rip-rap) and soil bioengineering to stabilize the streambank.

stopping the streambank erosion, was to move stormwater downstream as quickly as possible, and little or no attention was given to the fish and other aquatic organisms that lived in the streams. The resulting stream channels often lacked habitat diversity as the natural stream characteristics (meanderings, pools, riffles and shading tree canopy) were removed resulting in a difficult environment for fishes and aquatic insects to survive in.

New Techniques for Fish Habitat Restoration

MCSWS is currently testing new techniques to stabilize eroding streambanks. New techniques include more environmentally friendly approaches to streambank stabilization such as soil bioengineering and aquatic habitat restoration.

Soil bioengineering is the specialized use of plants and plant material to stabilize the streambank by combining engineering principals with plant science. The use of plants on streambanks can be very beneficial to the environment because they provide habitat for wildlife, can filter pollutants from the water, provide shade to the stream, and their roots simply hold the soil in place.

Aquatic habitat restoration techniques used by MCSWS are designed to increase the diversity of stream velocities, simulate natural stream meanderings, and provide cover for fish and macroinvertebrates. Some of the structures that are being installed to restore aquatic habitats include current deflectors, boulder clusters, fish lunkers (which simulate undercut banks), plunge pool/drop structures and artificial riffles. The restoration of the natural diversity of habitats and canopy covering impacted by streambank stabilization activities will result in greater abundance and diversity of fish and aquatic macroinvertebrates.

Structures such as current deflectors, arranged in an alternating pattern, will simulate natural stream meandering. Deeper pools will develop at the ends of the deflectors and slow moving areas behind the deflectors will serve as refuge and shelter for young fish. Artificial riffles, constructed of boulders and rocks placed in a band across the width of the stream, will stimulate the production of aquatic insects and

2 years after construction, the vegetation has stabilized Little Sugar Creek's streambank in Huntingtowne Farms Park.

create shelter for young fish. Stream temperature problems will be reduced with the replacement of the stream's protective canopy cover through selective plantings.

One of the first soil bio-engineering streambank stabilization projects by MCSWS is located on Little Sugar Creek in the Huntingtowne Farms Park and was completed in 1997. The section of the stream at Huntingtowne Farms Park was eroding rapidly. Within just a one year time period prior to construction, storms caused up to 20 feet of the bank to erode. The project combined soil bioengineering and rip-rap to stabilize the channel. In two years, the plantings along the bank have grown considerably and are beginning to provide shade to the stream. Fish enhancement structures introduced into the stream channel included current deflectors and boulder clusters and fish lunkers (stabilized undercut bank structures). The current deflectors are beginning to create a meandering flow pattern in the stream channel. Fish sampling has shown that an abundance of fish and a good variety of different fish are residing in this segment of Little Sugar Creek.

A number of plunge pool/drop structures are also being installed in the County's streams. The first structures have been installed in Briar, Little Sugar, Long and McAlpine Creeks. These structures are constructed by placing rocks along the entire width of the stream. Some structures have been built to narrow the stream and increase the stream's velocity. The purpose of these structures is to provide cover for the fish and aquatic insects and to create deep pools in the stream where larger fish can find refuge. A preliminary sampling of the fish in the vicinity of these structures has shown a large number of fish are attracted to the structures. Also, down stream of these structures, deep pools are beginning to form.

Fish lunkers, or constructed bank overhangs, installed in Briar Creek provide cover and refuge for fish.

Hope for the Future

Long ago, fishing the streams of Mecklenburg County was an important recreational pastime for it's citizens. Thirty years ago, the streams were not a sanitary place to go. Very few people were fishing the streams for recreation. If changes in the approach to stabilizing eroding streambanks are successful, fishing will again become a popular pastime. The restoration of the vegetation along the streambank will support wildlife, such as birds, making a visit to the stream a pleasant experience. The increased diversity of habitats in the County's streams will, one day, encourage the return of the darter, the eastern silvery minnow, and the greenhead shiner to the urban streams, as well as stimulate a good bass and sunfish fishery. SOER

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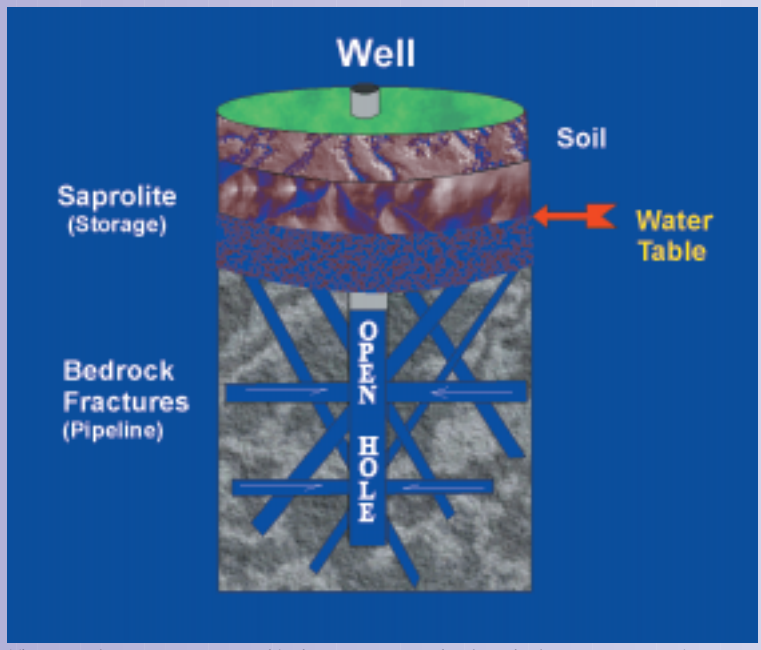
If you are a resident of Mecklenburg County and your home is not connected to the Charlotte Mecklenburg Utility system, the water you drink is most likely groundwater. The protection of your water supply is one of the most important things you can do for your health and well being. Twenty-nine percent of the Mecklenburg county residents are dependent on groundwater for their drinking water as compared to fifty-three percent of the population statewide. Groundwater is generally a safe source of drinking water, however, it is susceptible to pollution. If groundwater is not being used as drinking water is its protection an issue?

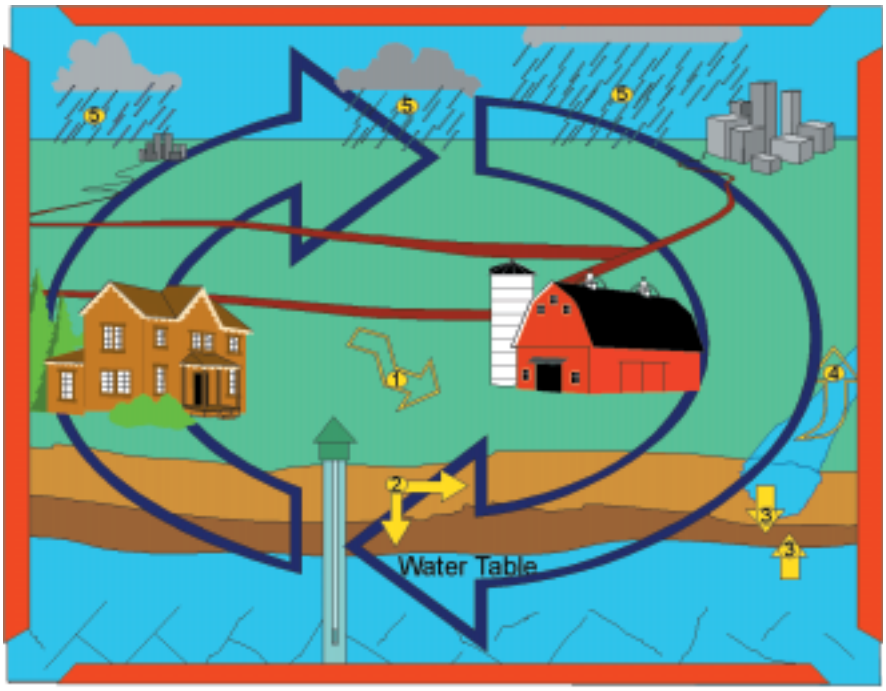
Mecklenburg County is located in the Piedmont of North Carolina. Bedrock in Mecklenburg County is a complex series of metamorphic (sedimentary and volcanic rocks that have been altered by heat and pressure) and igneous rocks (rocks that crystalize from magma). Soils in the area are residual, the result of weathering and decomposition of the bedrock. Residual soils which have the texture of soil but retain the appearance and structure of the bedrock are termed "saprolite." The saprolite contains water within the pore spaces of unconsolidated material and acts as a "reservoir" or storage area for the groundwater. Think of groundwater as water that fills the spaces between rocks and soil particles underground, in much the same way as water fills a sponge. This underground water system is called an aquifer. There are no geologic barriers in Mecklenburg County that protect the aquifer from spills and leaks that occur at the ground surface. The bedrock does not contain any significant pore space. It contains fractures within the bedrock which function like a "pipeline", transmitting water from one area to another. The flow through the pipeline is dependent on the ability of the water to move through the system (hydraulic conductivity) and the thickness of the aquifer.



The groundwater system in Mecklenburg County can be described as a storage pipeline system.

The "pipeline" is replenished from the "reservoir." Mecklenburg County's water table is found at various depths in the county, typically ranging from fifteen to fifty feet, and is generally located within the saprolite or "reservoir." Most of the drinking water wells in Mecklenburg County are located in the bedrock or "pipeline" portion of the aquifer.

Pollutants that contaminate groundwater may be some of the same pollutants that contaminate surface water. Surface water and groundwater are commonly connected hydraulically, but the interactions are difficult to observe and measure. Historically, in the Piedmont the interaction between the two systems has been ignored. Streams interact with groundwater in three basic ways; streams gain water through the stream bed from groundwater (gaining stream), streams lose water to groundwater by out flow through the stream bed (losing stream) or the stream can lose in some reaches of the stream and gain in other reaches. Because of this interaction, compounds found in surface water can move through the soil and end up in the groundwater. And compounds found in the groundwater may feed into streams,



The hydrologic cycle: (1) Surface water runoff; (2) water absorbed into the ground; (3) gaining and losing streams; (4) evaporation; (5) precipitation.

lakes and springs. For example, in at least two locations, Briar Creek has been contaminated with heating oil from leaking underground storage tanks. In both cases the releases were first identified when a petroleum sheen was observed seeping into the creek. Another example occurred along Little Sugar Creek where the four main components of gasoline (benzene, toluene, ethylbenzene and zylene) and an additive of gasoline (MTBE) were found in a storm water outfall. In this example it is believed that contaminated groundwater seeped into the storm drain which eventually discharged into the Creek.

The primary reason for protecting the groundwater in Mecklenburg County is to insure that residents of Mecklenburg County are not at a risk of drinking contaminated groundwater. This should always be the primary reason for protecting the groundwater, however the groundwater system is not an isolated system. Because surface water and groundwater are integrated portions of the hydrologic cycle it is pointless to clean up one resource and ignore the other. SOER

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Potential Sources of Groundwater Pollution

At this time there are a total of 1157 confirmed incidents of UST leakage within Mecklenburg County. Of the confirmed incidents of leakage, 331 of the sites have been cleaned-up and closed. An additional 134 have been determined to not have caused contamination and are closed. There are 581 sites which are open and currently being evaluated for cleanup and another 111 sites which are open and have been determined contaminated the soil, but not the groundwater in the area. These 111 sites are still being monitored.

Surface spills that are not promptly cleaned up may contaminate the groundwater.

In the last decade, the problem of contaminated groundwater has become more widely recognized with the passage of the Clean Water Act in 1987 and the Safe Drinking Water Act of 1991. These laws, combined with the overall increase in environmental awareness by the population at large and an increased demand on the available groundwater have helped to give importance to the issue of contaminated groundwater. In Mecklenburg County, the primary sources of groundwater pollution include accidental spills, underground storage tanks, above ground storage tanks, septic tanks and landfills. The primary pollutants associated with these sources are petroleum products (e.g., gasoline and heating oil) and chlorinated solvents (e.g., solvents and de-greasers). These types of pollutants act differently once they reach groundwater. For example, chlorinated solvents move more quickly and deeply than petroleum products.

Accidental Spills

Accidental spills occur when any potential contaminant is spilled onto the surface of the ground. If the contaminant is not promptly and effectively recovered it will often saturate the surface soil. Once the soil is saturated, the contaminant moves downward through the soil and partially weathered rock below the surface, until it reaches the water table, which causes contamination of groundwater.

How and where do these accidental spills occur? There are several ways in which pollutants are accidentally spilled. The most readily recognized spills are those that occur during an accident involving motorized vehicles where chemicals are spilled onto the roadway. Other accidents involving household items such as gasoline, heating oil, cleaners, motor oils and detergents, contribute to the amount of pollution in this category. Accidents like these occur when chemicals are spilled onto a lawn, a driveway, at an industrial facility, at a neighborhood business or when sewage systems back up causing them to overflow. In 1999, there were 79 accidental spills requiring emergency response and 331 incidents of sewage overflows requiring responses.

Underground Storage Tanks

Underground storage tanks (USTs) are a major source of groundwater pollution. In Mecklenburg County there are 6133 registered USTs of 1100 gallons in size or larger. Of these USTs, only 1923 are currently in use. Of the remaining, 3957 are closed or have been removed, and 253 are temporarily closed while under going cleanup work or while they are being upgraded. USTs can cause contamination to groundwater when they leak. The number of USTs of less than100 gallon capacity used in either residential or farm applications are unknown. Originally, USTs were constructed of steel. After years underground, these tanks would rust and holes would form. The holes would form in the tank itself, or in the pipes which carried the liquid from the tanks to dispenser. Most often, USTs were used for gasoline storage or for the storage of chemicals used in manufacturing.

In the early 1980's the subject of UST contamination and design was was addressed by the United States Environmental Protection Agency (USEPA), and the United States Congress. The result was a law that had requirements for all existing tanks to be upgraded with leak detection, corrosion protection, spill and overflow prevention. These upgrades could only be avoided by replacement of old USTs with new tanks meeting the higher standards. The owners that upgraded or replaced their USTs had to show that no previous groundwater contamination had occurred; however, if they had caused contamination of the groundwater they were required to remediate the site. All tank owners were required to show that they had the financial resources to cleanup any future spills should

Steel underground storage tanks corrode with time.

they occur. These upgrade requirements were to be completed by 1998 and apply to only those tanks that hold petroleum products. These new tanks should help prevent future groundwater contamination from UST leakage.

Common chemicals found in sites which have been contaminated by petroleum products include gasoline and heating oil components. Petroleum pollutants are found at approximately 88% of all the contaminated sites. These sites have a variety of chemicals and additives present in the groundwater. Once these products are in the groundwater they tend to separate because each different chemical has a different rate of movement. Gasoline is the most common contaminant present, and is found at approximately 70% of all sites in Mecklenburg County. Methyl tertiary-butyl ether (MTBE) is a gasoline additive that improves combustion in engines resulting in lower emissions and lower amounts of air pollution. MTBE has recently shown up in polluted groundwater.

Above Ground Storage Tanks

Above ground storage tanks (ASTs) are not regulated by the county or state, therefore accurate information on the total number of ASTs present, or the total amount of contamination caused by ASTs is not available. These tanks frequently contain heating oil, propane, commercial solvents, gasoline and assorted other industrial chemicals. It is common to find ASTs in older residential neighborhoods, industrial areas and rural areas. When a leak occurs in an AST it is frequently easier to detect it. Easier detection typically allows for more effective leak stoppage, which lowers pollution potential. However, if an AST leak it is not halted promptly, the resulting pollution potential is similar to the accidental spills discussed above and groundwater contamination can occur.

Septic Tanks

Septic Tanks are a form of under ground storage tank (UST). Currently there are over thirty thousand recorded septic tanks in Mecklenburg County, although there are no firm numbers on how many of these tanks are currently active. These tanks are the type of UST that most people are familiar with and they have the potential to contaminate groundwater with fecal coliform bacteria if the are not properly maintained. Further problems may arise when household chemicals are introduced into these tanks when inadvertently flushed down the toilet or poured down sink drains. Once these chemicals get into the septic system they tend to migrate rapidly into the surrounding ground. This may cause increased problems if the septic tank is positioned near a well. There are currently no mechanisms in place to determine the extent of contamination caused by septic tanks, other than by extensive on-site evaluations.

Landfills

Landfills have followed humans where ever they have traveled. Throughout history humans have discarded one form of refuse or another. Typically they have thrown their refuse in a hole and buried it. Today we have more sophisticated ways of burying our refuse, but the final reult still the same. We bury our trash.

Current federal regulations require that we use a lined landfill to dispose of our municipal solid wastes (MSW). This type of landfill has a lower barrier that is impermeable to help prevent the leakage of landfill liquids, thus preventing them from reaching the groundwater below. Most MSW landfill's in the past were unlined and must be monitored to ensure they are not contaminating the groundwater in areas where they are located. Mecklenburg County has a total of six unlined MSW landfills which were formerly permitted to operate but are now closed.

In addition to MSW landfills, there are several other types of unlined landfills permitted to operate within Mecklenburg County, which are not allowed to accept MSW or hazardous wastes. They are inspected on a monthly basis as required by their permits for operation within Mecklenburg County. They include fourteen Land Clearing and Inert Debris landfills(LCID's) and one Construction and Demolition Debris Landfill (C&D). LCID Landills of less than one acre in size do not

A landfill operation in Mecklenburg County.

Open Landfills in Mecklenburg County
Permitted Landfills in Mecklenburg County;
Construction and Demolition 1
Land Clearing & Inert Debris 14
Sanitary MSW 2

recieve a permit, but must have their locations recorded on the land deeds for the property. Tonnages for these non-MSW type landfills (LCID's and C&D's) are not currently available.

Though many waste professionals claim that the newer landfills should not be a problem because of their liner, no one disputes the fact that unlined landfills are a significant threat to groundwater quality over time. According to the State of North Carolina Department of Environment and Natural Resources, approximately 90% of closed unlined MSW landfills have had an impact on groundwater quality. Closed landfills which were previously permitted are not of as great of a concern as closed illegal and unpermitted landfills, since their true contents are unknown. For this reason, illegal or unpermitted landfills may require monitoring after closure.

Landfills of newer design which operate under proper permits, are not considered to have as much potential for contaminating groundwater. Not only are they inspected more thoroughly and more often, they are also designed to be a more secure containment system. As with USTs requirements for safeguards and early detection devices exist as an operational requirement. These precautions are required to provide warning of any problem before it seriously impacts the environment. SOER

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Closed Landfills in Mecklenburg County
Permitted Landfills in Mecklenburg County;
Ash Monofill 1
Construction and Demolition 1
Land Clearing & Inert Debris 33
Sanitary MSW 6

Non-Permitted Landfills in Mecklenburg County:
Land Clearing & Inert Debris 12
Stump Holes 2071
Sanitary MSW 9
Open Dumps 17

Underground Home Heating Oil Tanks - a Citizens Guide

There are two basic types of home heating oil tanks, above ground storage tanks (AST) and underground storage tanks (UST). ASTs are visible and when a leak or spill occurs it is apparent. This is not always true with USTs. Typically, these tanks are constructed of steel and can range in size from 50 gallons to several thousand gallons. One of the greatest misconceptions is that residential heating oil UST's are regulated the same way gasoline station tanks are regulated. Actually, USTs that are home heating oil tanks are exempt from technical requirements. This means that UST home heating oil tanks do not have to install a leak detection device, corrosion protection or spill and overfill prevention. Owners of underground home heating oil tanks are not required to sample the soil when the system is closed out. In fact, unless there is a spill or release from the home heating oil UST there are no reporting requirements.

What should you do with a home heating oil tank that is no longer in use? Home heating oil tanks are exempt from the state regulatory closure requirements. Even though a home owner is not required to close a UST, a tank owner is advised to remove any product from the tank once it is no longer in use in order to limit the chances of a leak or spill. It is also recommended that the tank is removed from the ground or that it is abandoned in place. If you select to abandon the UST in place, filling the UST with inert material such as sand, cement or foam will bind any petroleum sludge in the bottom of the tank. This also will weight the tank system down so it will not float to the surface of the ground. You do not need to contact the Mooresville regional office unless you discover signs of a leak, spill or soil contamination. However, if there is a release or spill from the tank then you must report the spill to the North Carolina Department of Environment and Natural Resources (NCDENR) (704) 663-1699. Typical signs of a leak or spill include stains on the soil, strong petroleum odors, puddles of oil and dead vegetation.

Why should you bother with the cost and hassle of properly abandoning a home heating oil UST system after it is no longer needed? The answers to this question are numerous, but the bottom line is the cost of preventing soil and groundwater contamination are small compared to the cost of cleaning up a leak or spill from a UST. Also, lending institutions may not be willing to loan money with the property as collateral if the home heating oil UST system is not closed out properly. Lastly, real estate transactions become problematic when an old improperly abandoned UST is found on site.

Why do UST's leak? Typically it is a result of the steel tank or piping corroding with time. Once the steel has been corroded the break in the system allows product to exit. Another common problem occurs when the fill pipe has been broken off. Many times this happens after it has been run over by a lawn mower or other yard equipment; other times the cap to the fill pipe has been simply removed. When the fill pipe is broken or left open, rain water can enter the UST system causing the heating oil to float on the water and eventually flow out of the fill pipe to the surface of the ground. Remember that it is the homeowner's responsibility to report the spill to NCDENR.

If a leak occurs, who is responsible for cleaning up the contamination around the UST? If the UST has been used on or after November 8,1984 then the current property owner is the tank owner. If the UST was taken out of use before November 8,1984 then the last person to use the UST is considered the tank owner. There is financial assistance for the tank owner through the Noncommercial Leaking Petroleum UST Cleanup Fund that will pay up to one million dollars for reasonable and necessary costs directly related to the cleanup of a petroleum release from your UST, but the fund will not pay for attorney fees, tank removal costs or excessive or unnecessary work. It is important to work closely with the NCDENR regional office in Mooresville to ensure that the work is within the cleanup fund guidelines. Unfortunately leaks or spills from aboveground storage tanks are not covered by the Noncommercial leaking UST cleanup fund.

If you are responsible for cleaning up a leak or spill from a home heating oil UST, what should you do after you report the contamination? First, soil samples need to be taken to determine how much contamination is present. Typically, these samples need to be analyzed for total petroleum hydrocarbon concentration. Groundwater samples may also need to be taken if the water table is close to the contaminated soil. These samples must be analyzed by a certified laboratory to ensure that the sampling is completed according to NCDENR guidelines it is recommended that a professional consultant is retained. Depending on the concentration and on the extent of contamination, further assessment of the site may be necessary. The NCDENR Regional office in Mooresville will be helpful in determining what further steps are needed. If further action is required, you will likely have to hire a professional to assess the site and clean up the contamination.

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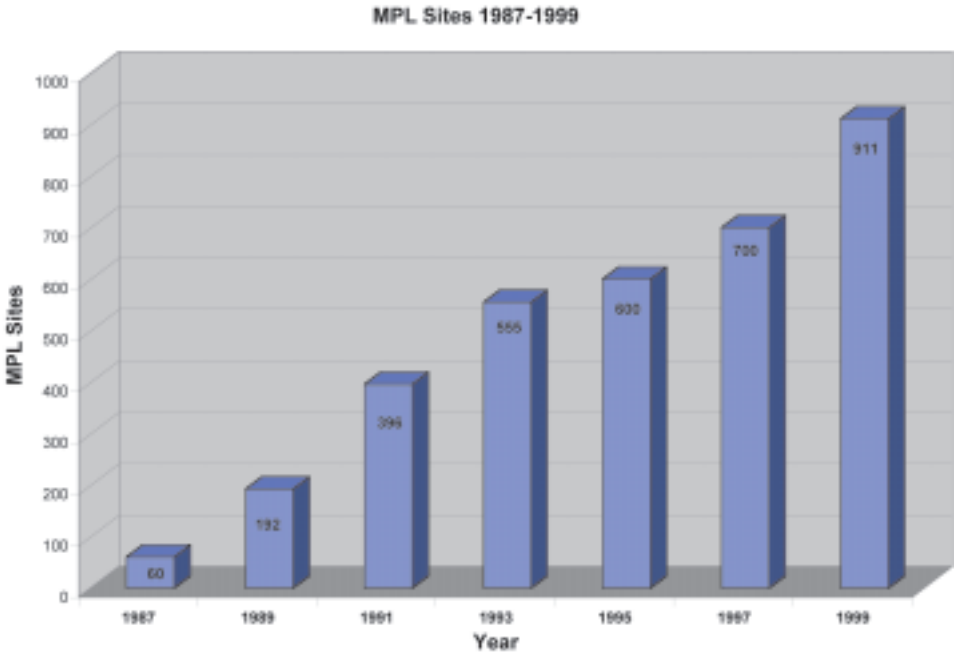
Groundwater Contamination in Mecklenburg County

There are currently 911 sites where pollution release incidents have occurred in Mecklenburg County. Some of the sites have minor soil contamination and other sites have contamination that has extended into the groundwater. So far, 479 pollution release incident sites have been evaluated resulting in the identification of 186 contaminated wells located near 42 of the release sites.

In 1989, the Mecklenburg Priority List (MPL) was established in response to the need for a more aggressive program to protect to citizens from drinking contaminated groundwater. The MPL program is the only program of its kind in the region that actively investigates contaminated sites to insure that residents are not drinking or at a risk of drinking contaminated groundwater. The program does not duplicate the State's efforts in addressing the clean up of contaminated sites.

A site is added to the MPL when information is provided that reports contamination of soil or groundwater. The MPL is a compilation of the federal National Priority List (NPL or Superfund), the State Priority List, the State Priority Pending List, the NCDENR Incident List and the Non-discharge Permits for Mecklenburg County. Sites may be added on a case-by-case basis if the land use activity and the potential to impact the groundwater is considered significant. In 1999 landfills were added as MPL sites. The MPL's are subdivided into active, inactive and unknown sites. Active sites have wells within 1500 feet of the site, inactive sites do not have wells within 1500 feet of the site and unknown sites have not been investigated. To date, 85% of the sites on the list are active or unknown sites.

In 1999, the Mecklenburg County Department of Environmental Protection investigated 90 MPL sites. Sixty-eight were active sites where a total of 956 wells were identified within 1500 feet. Currently, over 2850 peo-



MPL Sources of Information on Groundwater and Soil Contamination

North Carolina Department of Environment and Natural Resources (NCDENR) Mooresville Regional Office

North Carolina Department of Environment and Natural Resources (NCDENR) Superfund Section Mecklenburg County Department of Environmental Protection (MCDEP)

US Environmental Protection Agency (EPA) Federal Superfund List

Non-discharge permits for Mecklenburg County

ple are using groundwater as a drinking water source around these sites. In 1999, sampling was performed on 211 wells. Fortunately only two of the wells showed contamination above the EPA drinking water standards. In both cases, the contaminant was tetrachloroethylene.

The MPL program is unique because the focus is to aggressively search for contaminated drinking water wells. When contamination is identified in a drinking water well, there is direct contact with the resident or home owner to insure that they are aware of the contamination. It is the goal of the program to work with the residents and with local, state and federal agencies to ensure that all citizens have a safe permanent drinking water source. If the responsible party for the contamination can not be identified and the contamination is not at a level for state or federal involvement, the owner becomes responsible for obtaining an alternative source of drinking water. Filtering the groundwater may be the only option if Charlotte-Mecklenburg Utilities water or some other water supply is not available; however, filtering groundwater to remove contamination can be very costly and often cost prohibitive for a typical homeowner.

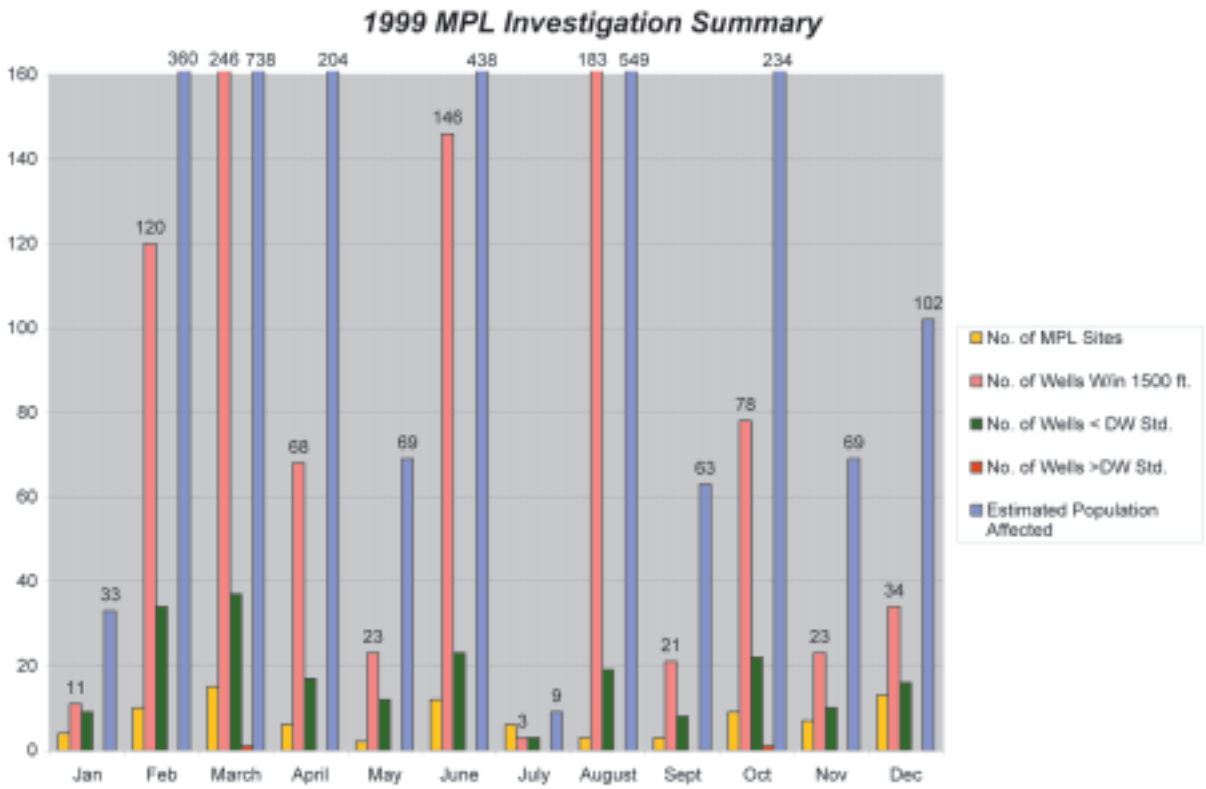
Zip codes 28208, 28205 and 28206, located in the central and western portions Mecklenburg County, have more than 70 MPL sites each. In 1997, only

Tetrachloroethylene (PCE)

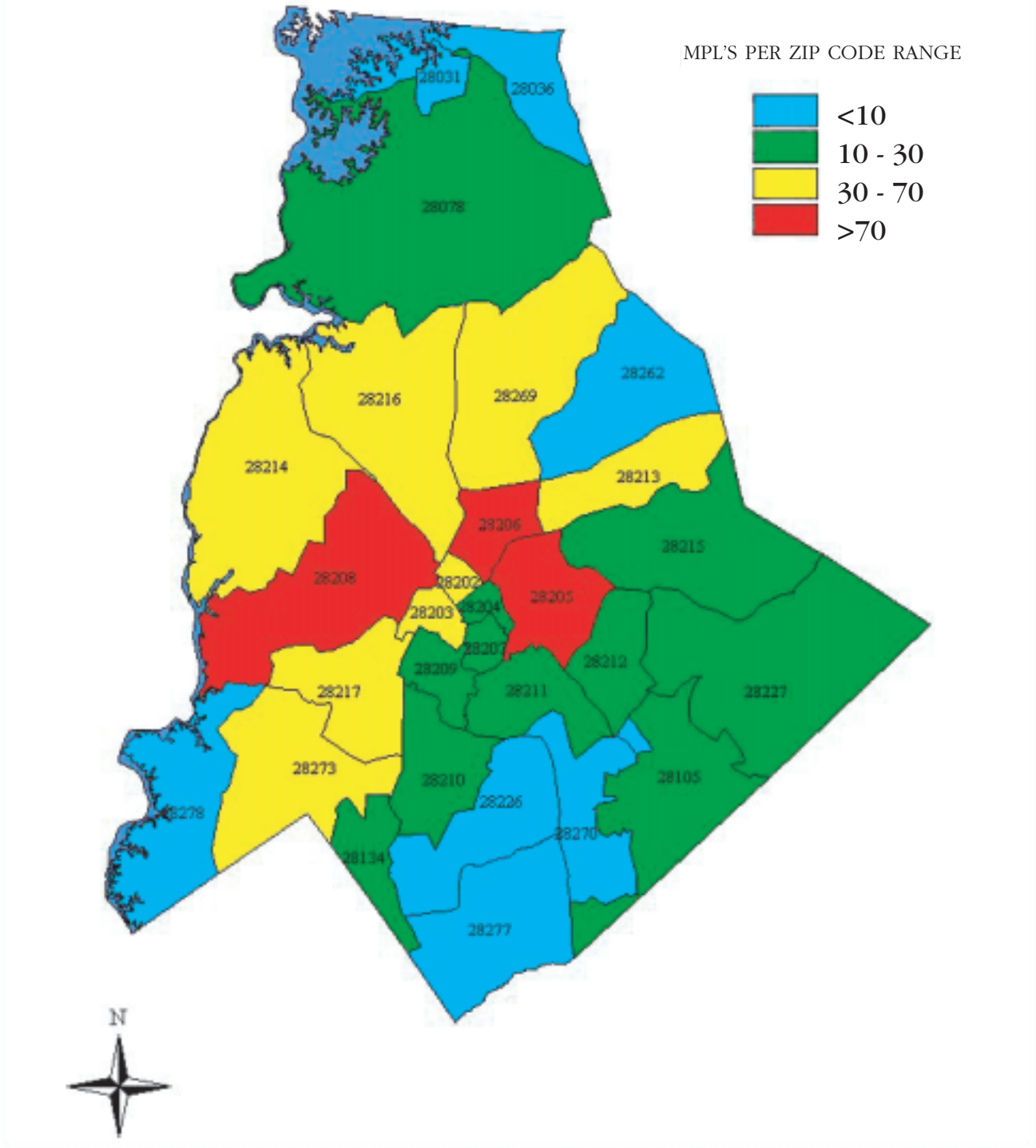
Tetrachloroethylene (PCE) is a colorless organic liquid with a mild chloroform-like odor. Its greatest use is in the textile industry, and as a component of aerosol dry-cleaning products. The maximum contaminant level (MCL) allowed in drinking water for tetrachloroethylene is 5 parts per billion (ppb). Some people who drink water containing tetrachloroethylene in excess of the MPL over many years could have problems with their livers and may have an increased risk of getting cancer.

In 1986, 405 million pounds of PCE were produced. Major releases of tetrachloroethylene to air and water are from dry cleaning and industrial metal cleaning or finishing. From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, tetrachloroethylene releases to land and water totaled over 1 million lbs. These releases were primarily from alkali and chlorine industries which use it to make other chemicals. The largest releases occurred in Louisiana and South Carolina.

PCE released to soil will readily evaporate or may leach slowly to the groundwater. The break down by soil microbes is slow. PCE released to water will primarily evaporate and has little potential for accumulating in aquatic life.



Mecklenburg County Priority List Sites (MPL's)



zip code 28208 had more than 70 sites. There were also increases in the number of MPL sites in zip codes 28216, 28269 and 28213 where each area had 30-70 MPL sites. The southern portion of the county and the northern portion of the county have the fewest MPL sites. All of these areas have people that rely on groundwater as a source of drinking water.

EPA Team investigating the extent of contamination at a drycleaning facility.

Case History

How does a site become an MPL site? What exactly happens from that point? To answer these question lets look at one local MPL site. On the eastern border of Mecklenburg county there was a dry cleaning facility that operated from 1977 through 1993 until the owners filed bankruptcy. Groundwater is the only source of drinking water in this area, and it is estimated that 120 people live within 1500 feet of this facility. The facility used various chlorinated solvents (Tetrachloroethlyene, Trichloroethylene and 1,2 Dichloroethene) and mineral spirits in the cleaning process. The chemicals were stored in 55 gallon drums as well as above ground storage tanks behind the building. Chemicals used in the cleaning process were put into a metal dumpster on site and were also stored in 55 gallon drums. These used chemicals were periodically removed by a regulated company for proper disposal. The building also has a septic tank and septic drain field which were used during this same time.

An inspection of the facility by MCDEP in April 1991 revealed 49 unsealed, unmarked drums of hazardous waste on a loading dock on the west side of the building and an illegal boiler blowoff discharge draining toward surface water. The site was reported to the North Carolina Department of Environment and Natural Resources Groundwater and Hazardous Waste Sections. The Hazardous Waste Section became the lead agency and issued a Notice of Violation in July of 1991 and an administrative penalty in 1992. Upon investigation, it was determined that the property was contaminated and the site became an MPL site. Drinking water wells and one spring (used as aother drinking water source) adjacent to the property were sampled. The analyses showed the well on the facility site, the spring and two additional private drinking water wells had contaminants above the drinking water standards. The residents and the owner of the facility were advised not to use the water for drinking or cooking and to limit their shower times.

The Charlotte-Mecklenburg Utilities water system was located three miles away, so the residents were dependent on groundwater as a drinking water source. Bottle water was provided by the company causing the contamination for a short period of time and then by the NCDENR. Through the MPL Program, six of the most affected wells were tested eight times between 1991 and 1994 for the purpose of monitoring the concentration of the contaminants in the wells. Additional wells in the area were tested with less frequency. The EPA was contacted when the levels in one of the wells exceeded the EPA Emergency Action Level. At that point, the EPA became the lead agency and through an emergency response fund, installed carbon filters on three private wells that exceeded the drinking water standard. MCDEP has continued to monitor off-site wells near this facility in addition to the wells equipped with carbon filters to verify the filters' contaminant removal efficiency through a cooperative agreement with EPA and NCDENR.

EPA is currently determining the extent of contamination at the facility and will determine what actions need to be taken to clean up the facility. Until the site is cleaned up adjacent wells that have not been contaminated or wells that have an EPA treatment system will be sampled periodically. SOER

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A REGIONAL PERSPECTIVE ON GROUNDWATER

The Mooresville Region is one of seven subdivisions for the North Carolina Department of Environment and Natural Resources (NCDENR), and includes Mecklenburg and the 10 surrounding counties. The department through its Groundwater Section is responsible for protection of the groundwater throughout the 11-county region. Approximately 55 percent of the people in the region use groundwater and wells for their water supply, although the percentage is lower for Mecklenburg County due to the extensive network of municipal water lines throughout the county. The same number of people in Mecklenburg and the surrounding counties who get their water from groundwater is roughly the same as the number of people who get their water from Mountain Island Lake. Many of the wells in the county and the region are private wells serving a single-family dwelling, while others are community wells serving 15 or more households. Regardless of the type of well, water quality and quantity are important issues for these 600,000 groundwater users.

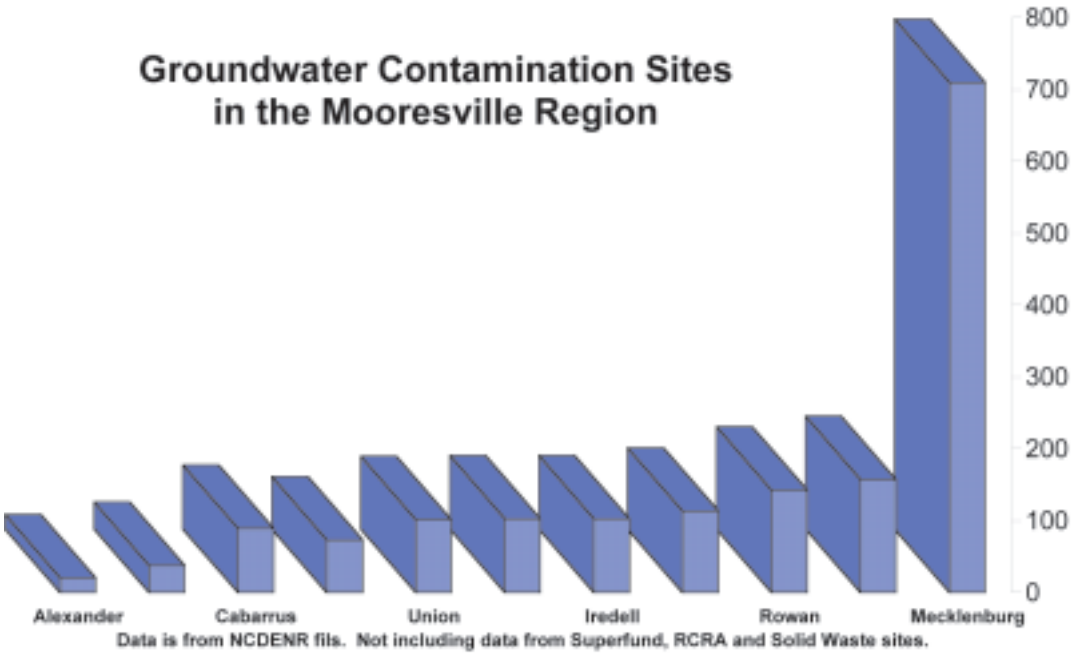
Groundwater Quality

In the 1970s and 1980s, the State Groundwater Section routinely checked the groundwater and found it to be of good quality. In general, the naturally occurring groundwater in the Mecklenburg area is not hard or saline and does not contain an unusually high metal content such as iron in the water. Mecklenburg County has continued with a program to check the quality of groundwater and has confirmed the earlier findings for groundwater throughout the county.

In the 11 counties that make up the Mooresville Region, nearly 4,000 contamination sites have been reported. At about half of these sites, only the soil is known or reported to be contaminated. At the other nearly 2,000 sites, soil and groundwater have been contaminated. The majority of the contamination has resulted from leaking underground petroleum storage tanks.

Type of Facility	County	Source	Contaminant	Impact
Manufacturing Plant	Mecklenburg	Illegal dumping behind plant	Solvents (industrial cleaners and degreasers)	On site and subdivision backup well across interstate contaminated
Textile Parts Manufacturer	Gaston	Chemicals piped to open field behind shop	Solvents from machine shop	On site well for workers and adjacent well highly contaminated
Above Ground Storage Tanks at Small Distributor	Rowan	Leaking tanks and lines	Petroleum	Vapors from gasoline collected in sewer line in street causing an explosion hazard
Fertilizer Packing Plant	Iredell	Damaged packages of fertilizer dumped in pond behind plant	Nitrates	Subdivision well on backside of plant contaminated; children with "blue baby" syndrome
Residential Subdivision	Union	Coating stripped off wire by dipping into drums; drums pushed over when chemicals spent	Solvents and metals	Nearly all wells in subdivision contaminated when old farm developed
Screen Printer for Clothing	Stanly	Waste chemicals piped to underground "septic" tank and allowed to overflow	Solvents	On site wells contaminated and works exposed

The Number of Groundwater Contamiantion Sites in the Mooresville Region



"Other sources" of contamination include a wide variety of facilities and activities. Although these "other sources" make up a smaller percentage of the total number of contamination sites in the region, they are often the sites of greater concern. The contaminants at some of these sites are industrial solvents and cleaners, which are heavier than petroleum, and tend to sink into the subsurface. As a result, the sites with solvents as the contaminant have groundwater contamination that spreads farther and travels deeper. Nearly 70 percent of the contaminated water supply wells in the region are contaminated by the "other sources" in comparison to petroleum leaks from the underground storage tanks. At half the sites where groundwater has been contaminated, water supply wells are not in use and are not threatened by the contamination. On the other hand, that can be restated that close to half the time water supply wells are threatened or impacted by the contamination. These sites are high priority sites for groundwater cleanups for the regional office staff.

A review of the NCDENR groundwater and underground storage tank pollution databases shows that counties with more industry and commercial enterprises, such as Gaston and Mecklenburg, have the highest number of pollution sites. Although Mecklenburg County has the highest number of pollution sites over all, Rowan and Gaston counties surpass it with the number of high priority sites where water supply wells have been contaminated. Mecklenburg has 24 sites with contaminated wells while Rowan has 29 and Gaston has 32.

Groundwater Quantity

The Mooresville Region contains one-fifth of North Carolina's population, and Mecklenburg County is one of the faster growing areas in the state. New subdivisions are sometimes located in areas, such as around Lake Norman, that are beyond the reach of the nearest municipal water lines. In an effort to supply water, developers look to the groundwater and the use of private or community water supply wells. Two problems seem to be arising more often in recent years. The first is that the wells do not produce enough water to supply the households in the subdivision. The second is that better producing wells go dry after a number years because of over pumping the supply in the aquifer. In either case, the result can be quite alarming for those dependent on a good supply.

As the issue of groundwater quantity becomes more critical with growth in the Mecklenburg area, the need for more information to determine beneficial well locations, appropriate lot sizes, choice of waste disposal systems and the amount of open area needed around the well will also grow. Studies similar to the one conducted recently in Guilford County by the U.S. Geological Survey will become a necessity. This study includes two examples of groundwater management planning, which is a new concept in water supply and demand in the Piedmont. The first example is a single-family dwelling with a private well and septic system and the second is a community well system for a cluster of houses in a subdivision setting, both typical of the type of developments in the Mecklenburg area. Without some data gathering of this sort on the amount of groundwater being recharged and stored, developers and groundwater users can expect to continue with the panic that comes from suddenly learning that the well is dry.

Another component of the Guilford County project was a study of the contribution of groundwater to stream flow. Depending on the location in the county, groundwater contributes anywhere from 30 to 60 percent of the water in streams. If the groundwater is over pumped and the wastewater disposal system does not allow much of the used water to be returned to the aquifer, the stream flow can be notice-

ably reduced. This is a groundwater quantity issue that does not receive enough attention in land use and development plans.

Well Construction

In addition to having good quality and a sufficient quantity of groundwater available, the well itself needs to be up to the task. Proper well construction plays an important role here. Only three counties in the Mooresville Region have inspection programs for private water supply wells—Gaston, Rowan and Catawba counties. The Mooresville office responds to complaints about muddy water, bacteria in the water or other problems resulting from well construction violations for the other eight counties. These state inspections are handled on a complaint-only basis and typically begin after the family has moved into their new home and are coping however they can with water problems. With less than one full-time position devoted to the eight counties, the correction of the violations can take months.

The well construction violations listed for Gaston, Catawba and Rowan counties represent those found prior to the start of the county well inspection program. Since county health and environmental health departments inspect the wells prior to and during completion, violations being reported to Mooresville in these counties have stopped. Gaston County reports that about 45 drillers operated in that county prior to the local inspection program. Now only about 12 drillers install wells in the county.

In the luckier situations, a well construction violation will result only in a nuisance problem. If muddy water is entering a well, clothing, ceramics and glassware show red-brown stains. In the more serious situations, coliform bacteria enter the well causing health problems for the well users. In one household in Union County, the mother developed gastro-intestinal problems after moving into the family's newly built home. After a series of medical tests, some of which were quite invasive, the family doctor thought to suggest that the well water be tested. The results showed fecal coliform bacteria from nearby septic tanks to be present in the well water. Once the well construction violations were corrected, the health problems disappeared.

Just about every facet of a home building project is required to be completed by a licensed or certified worker and a third party inspects that work. Well water and well construction for private wells have never received this type of scrutiny in North Carolina until recently. Beginning January 1, 2000, all wells in North Carolina must be constructed by a certified well driller. Some drillers were "grandfathered in" at the start of the program. Other drillers and all future drillers will be required to pass a competency exam to become certified. One safeguard that is still missing in well construction, however, is the inspection of the driller's work. This is where counties have played a helpful role in protection of public health for private well users. The Groundwater Section strongly encourages counties to be more involved in well construction inspections, especially if the county has a high number of violations. The challenge before us all is to balance the growth and the environmental impact such that when groundwater is needed as the water supply, the pump in the well will produce clean, plentiful water.

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Barbara Christian, Mooresville Regional Office, NC Department of Environment and Natural Resources.

Contributors: C. Daniel, D. Harned, R. Forsythe, M. Heller

PUBLIC WATER SUPPLY SYSTEMS:

WHAT THEY ARE AND WHERE THEY ARE

Drinking water is supplied to the majority of the population in Mecklenburg County by public water supply systems. These sources of water are withdrawn from both surface water (the Catawba River) and from groundwater wells. Naturally, depending on number of people served, these systems can vary in size and complexity.

First of all, a little background. A public water system is defined as a system for the provision of piped water for human consumption if the system serves 15 or more service connections or which regularly serves 25 or more individuals. And, to make it even more confusing, they are categorized into three classifications which include Community, Nontransient Noncommunity (NTNC) and Transient Noncommunity (TNC) public water systems. Each of these classifications can include both surface and well water supplies.

The largest and only community surface water supply system in Mecklenburg County is Charlotte-Mecklenburg Utilities (CMU). CMU provides water to the majority of people in Mecklenburg County through its vast interconnected system of distribution and treatment plants which include the Franklin Water Treatment Plant in northwest Charlotte and the Vest Water Treatment Plant in central Charlotte. Each of these receives water from Mountain Island Lake, whereas the North Mecklenburg Water Treatment Plant receives its water from Lake Norman. The entire system has a total treatment capacity of 183 million gallons per day.

The "Rules Governing Public Water Systems" in North Carolina requires CMU to monitor its water for approximately 150 different contaminants. Fortunately, there have been no exceedances of the maximum contaminant levels.

Mecklenburg County has approximately 40 community well supplies which get their water predominantly from fractured bedrock. Since the quality of water in different parts of the county varies with location, the community well system must also monitor for approximately 150 contaminants. In Mecklenburg County, the largest community well water systems are operated by private water utility companies such as Carolina Water Services, Heater Utilities, Rayco Utilities and Water Resources. These systems are usually found in rural areas not served by CMU.

Only 13 NTNC public water supply systems are operated in Mecklenburg County. Most of these systems obtain water from groundwater and most have wells constructed in fractured bedrock. Most of this classification consists of schools, day cares and a few businesses. NTNC systems also monitor the safety of the groundwater by analyzing for 150 contaminants. These systems are most often found in the more rural parts of the county where municipal water is not available.

Public Water Supply Systems continued

The final group are the TNC public water systems. There are approximately 75 TNC systems in Mecklenburg County which withdraw water from both fractured bedrock and watertable aquifer wells. These systems typically serve churches, restaurants, parks, quick stops, etc. in the more rural areas of the county where CMU water lines are not available. The monitoring requirements for TNC systems are limited. They include testing for bacteriological contaminants, nitrates and nitrites.

For more information about public water supplies, you can call the Mooresville Regional Office of the Division of Environmental Health, NC Department of Environment and Natural Resources.

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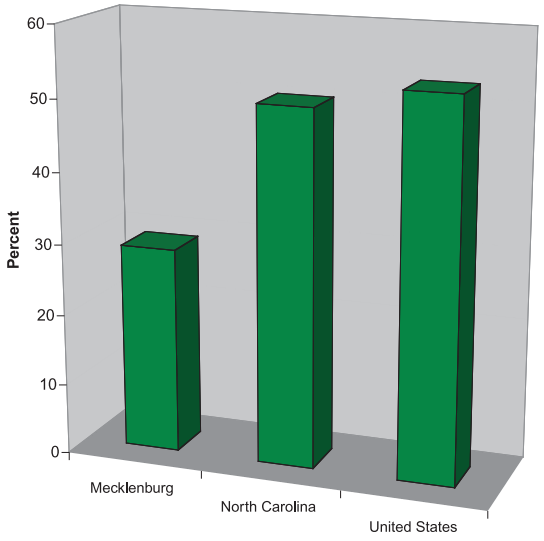
Britt L. Setzer, Mooresville Regional Office, NC Department of Environment and Natural Resources

Groundwater Guardian Protects a **Precious Resource**

Population Using Groundwater as a Drinking Water Source



A little over half of the United State's population (53%) and almost 30% of Mecklenburg County's citizens use groundwater as their primary drinking water source. With so many people depending on groundwater, protection of this vital resource is just as important here as throughout the country.

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. Groundwater Guardian educates businesses, the public, schoolteachers and students on important environmental issues that affect the quality of groundwater. Educational outreach is crucial to reducing pollution and creating more environmentally conscious citizens. Groundwater Guardian teams can also help reduce pollutants by educating polluters as to the effects of their careless actions and thus protecting Mecklenburg's groundwater.

Presently there are three Groundwater Guardian teams in Mecklenburg County one each in the Mint Hill, Lake Norman East and Steele Creek communities. A team can be formed by any interested citizen as long as there is at least one representative from each of the following sectors: civic group and/or citizen, government, educator, business and/or agriculture. Once the four representatives have been named, the team can then meet to learn and plan their goals for the coming year. Learn, plan, act, designate and maintain - these are the five steps for organizing and maintaining a Groundwater Guardian team. With registration and a plan of action, the team is ready to educate their community about groundwater. A national conference is held every

Mint Hill area students learn about protecting groundwater

fall to officially designate the team locales as Groundwater Guardian Communities and update members on the special achievements of the Groundwater Foundation and educate members on current events in groundwater research.

The Mecklenburg County teams have all been established within the last year. The Mint Hill Neighborhood has been a groundwater guardian community since January of 1999; while, Lake Norman East and Steele Creek were formed in late 1999. Mint Hill was recognized nationally at the 1999 Groundwater Foundation conference where the official designation as a Groundwater Guardian Community was received. The other two communities are hoping to receive their designation at the Foundation's year 2000 convention. Mint Hill's activities in 1999 included a "Water Festival" for students and parents and educational outreach in the Mint Hill schools. The Lake Norman East community, which encompasses parts of Mecklenburg and Iredell Counties, has already set up an educational display in the Statesville Mall and conducted seminars at the local middle schools. The Steele Creek Neighborhood Team is just forming.

In addition to the three groundwater teams in the county, there are still many other communities within Mecklenburg that would benefit from the Groundwater Guardian program. All it takes are four interested and concerned citizens to form a team. MCDEP is an official Groundwater Guardian Affiliate: a role that promotes the startup of teams in interested parts of the county. If you are interested in starting a Groundwater Guardian team in your neighborhood, please contact MCDEP at 704-336-5500.

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Mint Hill Groundwater Guardian Team and Independence High School – Educational Teamwork

International Baccalaureate Students from Independence High School designed "Problem in Bain Village," an activity where the students find the source of the groundwater contamination.

The Mint Hill Groundwater Guardian Team was formed in January 1999 in a collaborative effort to educate local citizens about ways to conserve and protect drinking water and to deal with the increased risks to the local groundwater due to the growth in the area and the expansion of I-485. With more than 50% of the Mint Hill population dependent upon private wells for drinking water, protection of this resource was a priority. Members of the team include students/teacher from the Biology III International Baccalaureate (IB) classes at Independence High School, staff from Bain Elementary in Mint Hill, a representative from the Mint Hill Business Association, a hydrogeologist from the Meckenburg County Department of Environmental Protection, and the Mint Hill Town Manager. The IB diploma program requires the students to complete 150 hours of community service, so the students were excited about combining their academic classes with community service. The first year goal of the team was to host an educational event for local elementary students and their parents. The IB students from Independence were responsible for planning designing, implementing, and evaluating the Water Festival itself. Other members of the team were there to assist with fund-raising, and to provide technical information. The high school students spent 10 hours in field research on a environmental problem in a local water source, and were very interested in educating other about problems with groundwater.

The First Annual Water Festival was held at Independence High School on Saturday May 24, 1999 with

fifty elementary students and their parents as participants. Participants were introduced to Willy the Wacky Water Molecule, who served as their host for the day. The participants took a pre-test to measure their basic water knowledge, and then were placed in small teams with a "Water Guide." These groups rotated through ten hands-on stations where they learned the parts of a well, conducted chemical tests to determine if substances will be soluble or insoluble in water, carried out procedures to purify "foul water", posed as government officials in a small town with "Trash Troubles" and manipulated models of aquifers. A favorite activity was making an "Edible Aquifer" to illustrate how common substances such as oil, paint, fertilizer seep into bedrock to contaminate well water. The average scores on the pre-tests were 45% correct, and on the post test the participants scored an average of 80%.

During the five month collaboration between schools, business, local government and the Mecklenburg County Department of Environmental Protection, the students and team members were actively involved in researching local environmental issues, fund-raising, planning, and implementing the water festival. Many of the high school seniors from this team are now in college, and are considering environmental careers because of this positive experience. This type of "grass roots" collaboration is fundamental to increasing community awareness of environmental issues, and to begin working towards solutions to our problems. The Mint Hill Groundwater Guardian Team was designated as a 1999 Groundwater Guardian Community and received a plaque from the Groundwater Foundation for their work on the Water Festival. The team plans to host the Water Festival again this spring and hope it will become an annual event for the students in the Mint Hill area.

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Cindy Moss, Independence High school Faculty

Water Environmental Indicators, 1999

Point Source Pollution Management	
Number of Point Source Discharges	425
Wastewater Treated (millions of gallons per day)	71
Wastewater Generated Per Capita (gallons per person per day)	121
Exceedance of Daily Permit Limits for Groups of Known Sources	347
Average Water Quality Index Values	
Lakes	80 (Good/Excellent)
Streams	71 (Good)
Countywide (lakes & stream combined)	75 (Good/Excellent)
Exceedance of Surface Water Quality Action Levels Creeks (Total)	110
Fecal Coliform Bacteria	27
Conductivity	2
Total Phosphorus	27
pH	2
Biochemical Oxygen Demand	2
Turbidity	5
Ammonia	4
Dissolved Oxygen	2
Total Kjeldahl Nitrogen	7
Nitrate Nitrogen	32
Exceedance of Surface Water Quality Action Levels Lakes (Total)	43
Fecal Coliform Bacteria	3
pH	3
Chlorophyll-a	2
Secchi Disk Depth	10
Total Phosphorus	21
Turbidity	2
Nitrate Nitrogen	2
Water Supply	
Drinking Water Supplied by CMU (Millions Gallons/Day)	101
Population Using CMU Drinking Water	476,166
Selected Sources of Potential Groundwater Contamination	
Septic Tank Systems Permitted	300
Septic Tank Systems Repaired	82
Estimated Number of Septic Tank Systems	30,000
Sanitary Landfill Sites	2
Land Clearing Inert Debris Landfills	13
Construction and Demolition	1
Groundwater Usage	
Existing Community Wells	40
Private Wells (Calculated)	63,695
Non-Community Wells	88
Citizens Dependent on Groundwater for Drinking Source (Calculated)	184,925
MPL Sites	
Number of sites Evaluated	479
Contaminated Drinking Water Wells	186

Strategies to Coordinate Environmental Policies

Pat McCrory, Mayor
Charlotte, NC

As the Mayor of Charlotte, North Carolina, and a person truly concerned about our current and future environment, I have come to realize that current U.S. Environmental Protection Agency (EPA) programs are fragmented, making it difficult to implement holistic solutions. I believe EPA policies do not support good land use or smart growth practices. Consider the following examples:

- Smaller wastewater treatment plants have less stringent requirements than larger ones, which of course encourages construction of more small plants, resulting in inefficiency and sprawl.
- Brownfield initiatives encourage redevelopment of old inner city industrial sites while air policies may punish cities for this same redevelopment.

In order to deal with environmental concerns in the Charlotte-Mecklenburg area for the next fifty years, I am recommending that we follow a plan of action that will help us to better coordinate environmental policies. We must first develop a strategy to protect our environment that will ensure our air, water and land policies complement each other. One example of an area in which this strategy could effectively be employed is air pollution. Current air pollution regulations encourage industry and residents to locate away from nonattainment areas. This, in turn, prevents the preservation of farmland and greenfields, and also encourages more highway construction. We should as an alternative expand and encourage infill development to reduce air pollution and to preserve much-needed farmland.

Other specific programs and policies that could be jointly enacted by Charlotte and Mecklenburg County to improve and preserve our environmental quality include:

- Increasing recycling from commercial sectors
- Recycling landscaping materials such as rocks, dirt, and trees
- Developing markets for recycled materials and for community acceptance of these materials (e.g. paper, wood, plastics)
- Promoting the use of white roofs on buildings for deflecting heat, thus saving cooling energy
- Working with developers to increase tree preservation, recycling, and setback requirements
- Providing incentives for targeted development such as infill, "smart growth," and transit- oriented development
- Building upon previous vision statements for our community such as those from as Voices and Choices, and the 2015 City/County vision

The second strategy we should pursue is government reorganization. The environmental efforts of government entities do not always complement each other's work because of existing organizational structures. For example, the Metropolitan Planning Organization is composed of representatives from Union and Mecklenburg counties. Our air quality ozone attainment area as designated under the 1990 Clean Air Act is made up of Mecklenburg and Gaston county residents only. State

Highway Division consists of a region that stretches from Mecklenburg County to Pinehurst. None of these organizational boundaries complement each other, and as a result, some of our most crucial customers are not involved in efforts to preserve air, land and water.

We need only look at neighboring sections of Cabarrus County to illustrate this problem. Here we find an area exhibiting rapid growth and yet the Concord Mills Mall road system is not part of a common regional highway plan. It is obvious that we need to organize our efforts so that all regulatory entities work together to address common issues of transportation, air and water quality, and land use in an effort to encourage "smart growth" development and transit hubs. On a more regional scale, the South Carolina jurisdictions of York, Chester and Lancaster Counties must also be included. Political buy-in from regional elected officials is critical to keep our region competitive and to attract economic growth.

Thirdly, since there are regulations, standards and permits outside of our local control that affect environmental quality, governmental units including the state and federal governments must work as a team to deal with the environment across political boundaries. A coordinated approach to growth, land use and zoning is necessary to protect our environment yet provide infrastructure elements such as schools for our growing population. If this is done properly, we can reduce the effects of growth that lead to air and water pollution and brownfields. Possible approaches to pursue include:

- Administration and governance using a "holistic" approach (this may necessitate State and/or Federal assistance)
- Transfer of applicable regulatory authority from State/Federal to local level
- Transfer more authority from EPA to local governments for brownfields redevelopment
- Integrated permitting for air, water, stormwater, brownfields, etc.
- Resolve conflicts in regulations among federal agencies (EPA, USDOT, FEMA, Corps of Engineers, Fish and Wildlife) which affect population growth, economic development and a sustainable environment
- Establish air quality regulations that complement land-use planning regulations
- Create a combined air, transportation, watershed management and land use planning region (multi-county, interstate)

In all of these actions community support is key. It is imperative that we do a better job of communicating our long-term environmental goals in an effort to demonstrate the connection between population growth, infrastructure, industrial development and redevelopment of brownfields. If we are successful in our efforts, the results can be cleaner air, creeks suitable for swimming and fishing, less solid waste, good jobs and schools as well as low crime rates.

It is also imperative that we understand what the environmental impacts will be fifty years from now as a result of the policies and decisions made today. Our goal should be to enact environmentally friendly land-use practices, which augment a total transportation system including HOV lanes wherever possible. It is this type of long-term thinking that must be utilized to create sound and comprehensive environmental policies for our region for the next fifty years.