I keep to compare this information to Water Supply Program

United States Department of the Interior

GEOLOGICAL SURVEY
P. O. Box 2857
Raleigh, NC 27602

August 8, 1978

Mr. John D. Wray, Deputy Chief
Water Resources Planning Section
Division of Environmental
Management, DNR&CD
P. O. Box 27687
Raleigh, NC 27611

Addendum to the following for "Allowable Draft" when not determined due to carryover storage analysis

Dear John:

I have computed the estimated allowable draft for those public water supplies that were not computed during the regular project because a carry-over storage analysis was required. Before the computations were made, I called and/or visited these cities to determine if the source and raw-water storage data were still accurate. The allowable drafts and a summary of new data are listed below.

Part 1 Northern Piedmont

1. Mebane, Alamance County:

   In 1975 Mebane and Graham entered a joint agreement to build a 6 mgd treatment plant on Graham's reservoir. Lake Michael, Mebane's reservoir, is used only when needed. Water released from Lake Michael flows into Graham's City lake. The estimated allowable draft of Lake Michael is 0.8 mgd with a storage of 217 million gallons.

2. Kernersville, Forsyth County:

   Kernersville's New Town Lake on Belews Creek was contaminated by a waste spill. The town has been given permission to use the lake but the City Council voted against returning the lake to service. Currently, the town is using the small standby lake for approximately one half of their needs and purchasing the remainder from Winston-Salem. They plan to eventually purchase all their water from Winston-Salem (May 1978). The estimated allowable draft of New Town Lake is 1.5 mgd with an adjusted storage of 120 million gallons.

3. Roxboro, Person County:

The treatment plant capacity was increased to 8 mgd. A new raw water reservoir is under construction on South Hyco Creek. The new reservoir is located about 1/2 mile upstream from SR 1102, Person County, near the Person-Caswell County line at lat 36°20'53", long 79°09'00". The drainage area at the dam is 27.1 square miles, approximately. Water is released from the dam and flows to a low dam and pumping station at lat 36°23'17", long 79°06'19". The pumping station is about 600' downstream from US 158. The raw water storage capacity of the new reservoir is 2,850 million gallons. The estimated allowable draft of the new reservoir is 11.3 mgd, with a storage of 2,850 million gallons.

The estimated allowable draft of the old lake is 3.3 mgd, with an adjusted storage of 790 million gallons.

4. Asheboro, Randolph County:

No change in source or storage since 1970. Currently planning a new lake on Uwharrie River with a storage capacity of 7420 acre-feet and an expected yield of 15.4 mgd. Estimated allowable draft of Lake Ross, Lake McCrary, and Lake Bunch combined is 1.0 mgd with a storage of 160 million gallons. Estimated allowable draft of Lake Lucas is 6.7 mgd with a storage of 1,250 million gallons.

Part 2 Southern Piedmont

1. Concord, Cabarrus County:

No changes. Estimated allowable draft of Lake Fisher is 7.5 mgd with an adjusted storage of 1,000 million gallons. Estimated allowable draft of Lake Concord is 1.8 mgd with an adjusted storage of 330 million gallons. Estimated allowable draft of Coddle Creek is 2.2 mgd with no storage.

2. Kannapolis, Rowan County:

No changes. Estimated allowable draft of Kannapolis Lake is 4.9 mgd with an adjusted storage of 980 million gallons.

3. Southern Pines, Moore County:

One well, with a reported yield of 110 gpm (0.16 mgd), was drilled and two more are planned in immediate future. A pipe line with a capacity of 0.5 mgd was installed from the Carthage pumping station on Nicks Creek to Southern Pines Lake. Estimated allowable draft of Southern Pines Lake is 1.8 mgd (including the water from Nicks Creek) with an adjusted storage of 200 million gallons.

4. Rockingham, Richmond County:
   Raw water storage data are very questionable and I have been unable to obtain any better values. The storage data are probably low and on the safe side. Estimated allowable draft of City Lake is 1.0 mgd with a storage of 5 million gallons. Estimated allowable draft of Roberdell Lake is 8.2 mgd with a storage of 25 million gallons.

5. Hamlet, Richmond County:
   The dam at the larger city lake has been raised and an additional 15 million gallons storage obtained. In addition, City Lake, which was contaminated in 1972 and not usable, has been cleaned and is available as an emergency supply. The drainage area at the intake was reported as 2.1 square miles in Part 2 and is actually 3.1 square miles. City Lake is also on Marks Creek, downstream of the other two lakes, and has a drainage area of 7.35 square miles. Raw water storage data for City Lake is not available. I estimate the storage as 90-100 million gallons. The estimated allowable draft of the combined system is 2.9 mgd with a storage of 275 million gallons.

Part 3 Mountains and Western Piedmont

1. Kings Mountain, Cleveland County:
   The estimated allowable draft of City Lake is 0.4 mgd with a storage of 96 million gallons. The estimated allowable draft of Davidson Lake is 0.7 mgd with a storage of 180 million gallons. The estimated allowable draft of John Henry Moss Reservoir is 46 mgd with a storage of 12,700 million gallons.

This completes our work on the Public Water Supply project. If you have any questions give me a call.

For the District Chief, Ralph C. Heath.

Sincerely yours,

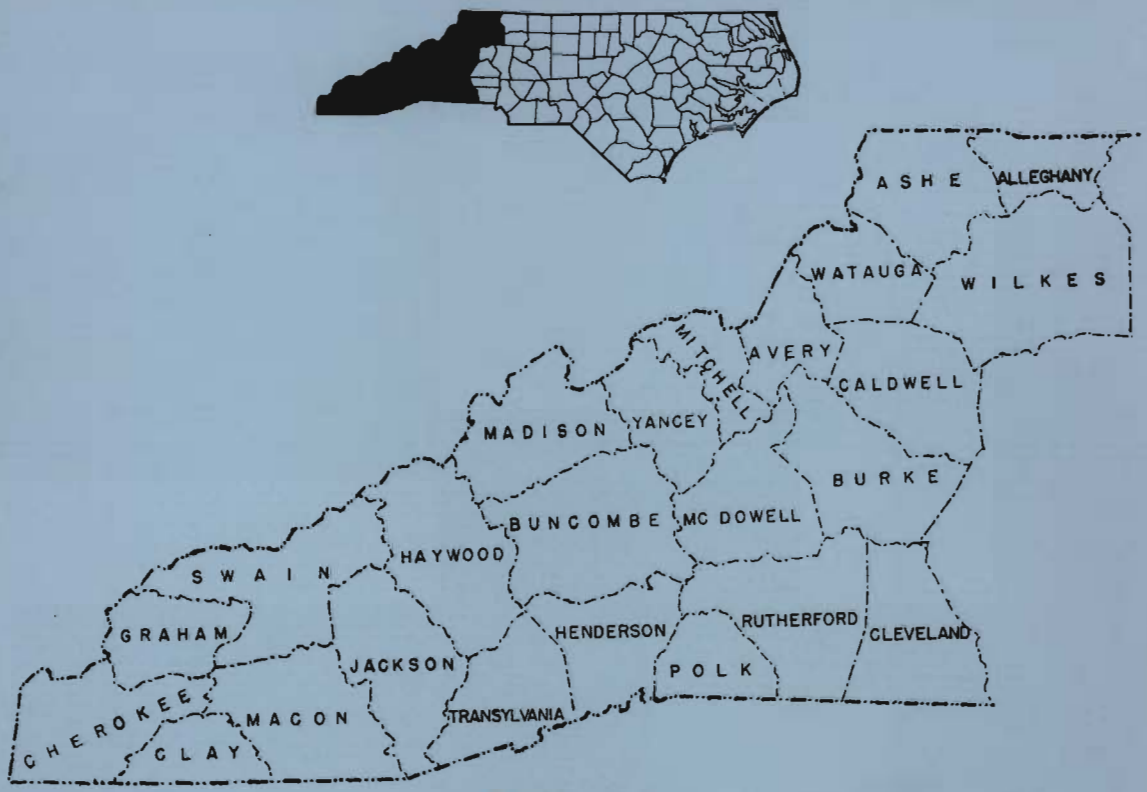
N. M. Jackson, Jr.

N. M. Jackson, Jr.
Hydrologist

NMJ:ceh

STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES

PUBLIC WATER SUPPLIES OF NORTH CAROLINA



Part 3
MOUNTAINS AND WESTERN PIEDMONT

By

N. M. Jackson, Jr.

Prepared by
United States Department of the Interior
Geological Survey
In Cooperation with the
North Carolina Department of Natural and Economic Resources

Raleigh, N.C.
JULY 1974

PREFACE

Interest in data on public water supplies of North Carolina has existed for many years. In 1947 the U.S. Geological Survey prepared Progress Report 1 on public supplies derived from surface-water sources and in 1949 Progress Report No. 2 on the public supplies derived from ground-water sources; both reports resulted from cooperative studies with the N.C. Board of Health. In 1961, Bulletin 2 of the North Carolina Department of Water Resources titled, "Chemical and Physical Character of Municipal Water Supplies in North Carolina" was published. This Bulletin reported the results of chemical analyses and rather brief information on source and pumpage or consumption of the water supplies of 324 cities and towns in North Carolina. The work was done by the U.S. Geological Survey in cooperation with the North Carolina Department of Water Resources. From 1961 to 1965 three supplements to Bulletin 2 were prepared under the continuing cooperative agreement to include new chemical analyses and changes in public water supplies. In 1969 all the data collected between 1960 and 1965 were published in Bulletin 3.

The rather brief information collected under this program was determined to be inadequate to meet long-range planning needs. Accordingly, the program has been enlarged to include a complete inventory and general comments on present and potential development of all public water supplies in North Carolina with 500 or more customers.

The enlarged scope of the program and fund limitations preclude collection and timely release of data on all water supplies in one volume. Therefore, the State has been divided into five areas, with approximately 60 public water systems in each. The division was made along county boundaries and is shown on the map in figure 1.

Inventory data on the public water supplies in each area are to be collected and published, in one volume on each area, at the rate of one volume annually.

This volume contains data on the Mountains and Western Piedmont, the third area to be studied.

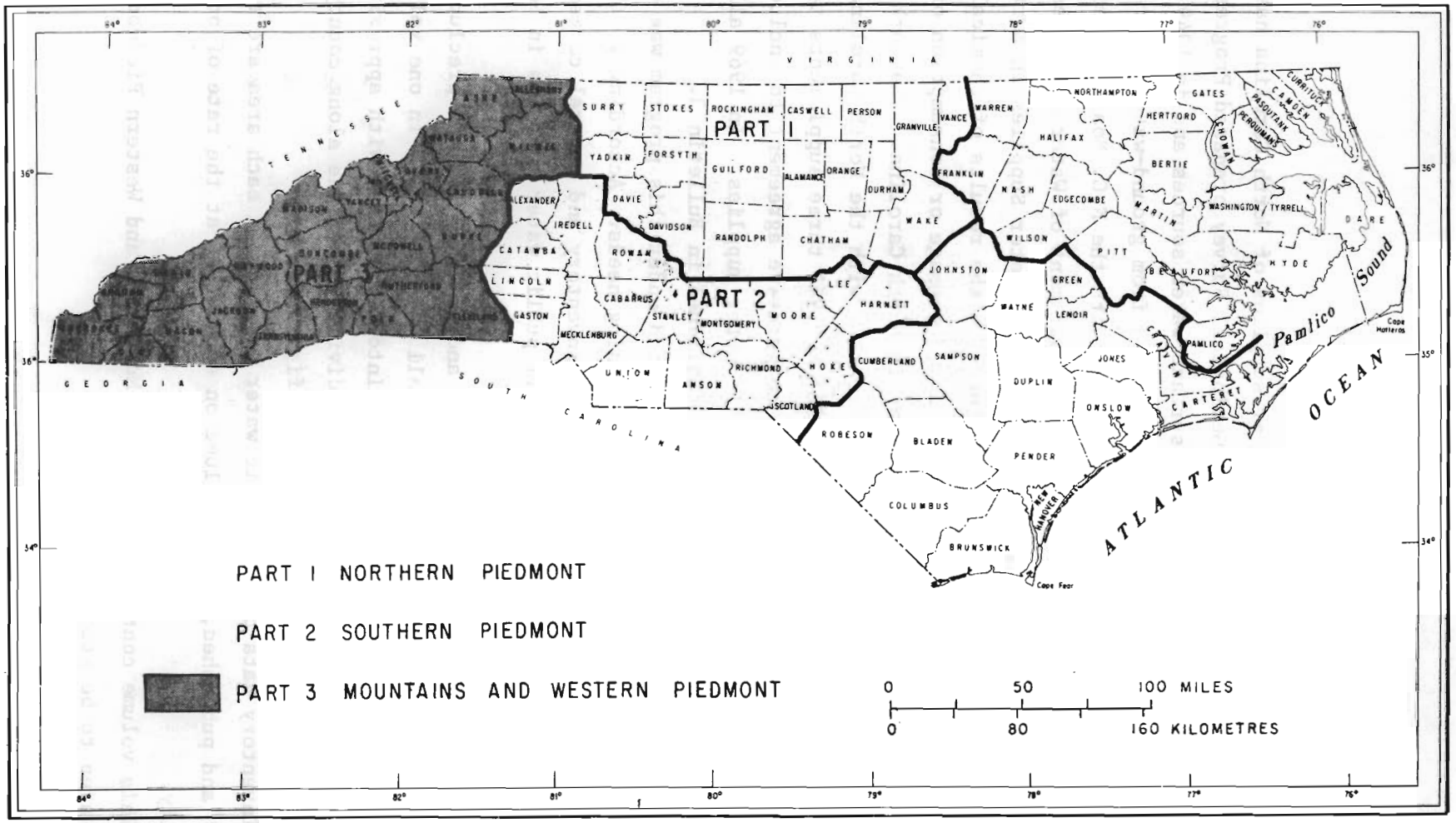


Figure 1.--Map of North Carolina showing subdivision of the State for purpose of the public water-supply inventory.

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Part 3
MOUNTAINS AND WESTERN PIEDMONT

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Raleigh, N.C.
JULY 1974

STATE OF NORTH CAROLINA
DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES
Box 27687 Raleigh 27611

JAMES E. HARRINGTON
SECRETARY
TELEPHONE
AREA CODE 919-829-4984

JAMES E. HOLSHOUSER, JR.
GOVERNOR

January 15, 1975

Honorable James E. Holshouser, Jr.
Governor
Raleigh, North Carolina 27611

Dear Governor Holshouser:

I am pleased to submit the latest report resulting from the State of North Carolina cooperative program with the U. S. Geological Survey. This report, "Public Water Supplies of North Carolina, Part 3 - Mountains and Western Piedmont," contains information on the water resources and inventories of the public water supplies in twenty-two counties in western North Carolina.

The data collected and assembled in this report are especially useful to local and regional planners concerned with water-supply availability, water-resources development, and water quality. It will also serve as a handy reference on the availability and quality of municipal water supplies for use by local and area development groups and for industrial and commercial organizations.

Inventories of existing water supplies and assembly of pertinent water resources data are a continuing activity to assure that data needed for planning the utilization of our water resources are available.

Sincerely,

James E. Harrington

Attachment

CONVERSION FACTORS TO INTERNATIONAL SYSTEM UNITS

For use of those readers who may prefer metric units rather than English units, the conversion factors for the terms used in this report are listed below:

Multiply English unit	by	to obtain metric unit
inches (in)	25.4	millimetres (mm)
feet (ft)	0.3048	metres (m)
miles (mi)	1.609	kilometres (km)
square miles (mi^2)	2.590	square kilometres (km^2)
gallons (gal)	3.785	litres (l)
gallons per minute (gpm)	6.309×10^{-2}	litres per second (l/s)
million gallons per day (mgd)	4.381×10^{-2}	cubic metres per second (m^3/s)
million gallons per day per square mile (mgd/mi^2)	1.692×10^{-2}	cubic metres per second per square kilometre [$(m^3/s)/km^2$]
acre-feet per square mile ($acft/mi^2$)	476	cubic metres per square kilometre (m^3/km^2)
cubic feet per second per square mile (cfs/mi^2)	10.93	litres per second per square kilometre [$(l/s)/km^2$]

PUBLIC WATER SUPPLIES OF NORTH CAROLINA

PART 3

MOUNTAINS AND WESTERN PIEDMONT

By N. M. Jackson, Jr.
U. S. Geological Survey

ABSTRACT

This report contains information on the water resources and inventories of the public water supplies in 24 counties in the mountains and western Piedmont section of North Carolina useful to planners and water managers concerned with water-supply availability, water-resources development, and water quality.

The report is divided into two sections. The first describes the method of investigation, an explanation of the information reported for each water supply and its significance to planning, a discussion of the chemical analyses included in the report, and a discussion of some of the problems noted during the investigation. The second includes a water-resources appraisal and a map of each county showing the general area served by public water supplies and an inventory of each public supply in the county with 500 or more customers that gives: (a) the population served, (b) the adjacent communities served, (c) the number of metered customers, (d) the source of water, (e) estimated allowable draft, (f) total and industrial water use, (g) raw and finished water storage, (h) raw and finished water-pumping capacity, (i) future plans, (j) a water-resources appraisal in the immediate vicinity of the supply and, (k) the results of chemical analyses of raw and finished water.

INTRODUCTION

An inventory of the municipal water supplies in North Carolina with 500 or more customers was undertaken in 1970 as a part of the cooperative program between the North Carolina Office of Water and Air Resources and the U.S. Geological Survey. The program provides information needed in the planning, development, and utilization of the municipal water supplies in the State. This report is one of a continuing series, each of which will contain information on approximately one-fifth of the municipal water supplies in the State. The information is reported on a county basis, with the number of counties included in each report being controlled by the number of municipal water systems.

The information for each county includes: a general appraisal of the surface-water and ground-water resources, a map showing the approximate area served by municipal systems, an inventory of each municipal system with 500 or more customers, and results of chemical analyses of samples of the raw and finished water from each water system.

The surface-water appraisals contain information on streams draining the county, including estimates of average and minimum flows. The ground-water appraisals include a summary of the ground-water conditions, data on reported well depths and yields, and a general statement on the chemical quality of ground water.

The inventory of the municipal systems in each county includes information on the population served, source of supply, raw and finished water storage, estimated allowable draft, total use, industrial use, pumping capacity, treatment and treatment capacity, and an appraisal of the surface-water and ground-water resources in the immediate vicinity of the municipality. The municipal systems in Part 3 were inventoried May 1973 to March 1974.

The results of chemical analyses include the results of an analysis of the chemical constituents most commonly found in water, a "standard complete analysis," and an analysis for a selected group of minor elements.

This report also includes a discussion of the method of investigation, brief descriptions of water-treatment processes, the significance of the data as related to planning, and general comments concerning problems noted.

COOPERATION AND ACKNOWLEDGMENTS

The study of the public water supplies in North Carolina is being made by the U.S. Geological Survey, in cooperation with the Division of Resource Planning and Evaluation, North Carolina Department of Natural and Economic Resources. The assistance and guidance of Col. Thomas G. Harton, Acting Chief, and Mr. John D. Wray, Deputy Chief, of the Water Resources Section, is gratefully acknowledged. The investigation was made under the supervision of Ralph C. Heath, District Chief.

Needless to say, most of the data contained in this report could not have been collected without the generous cooperation of municipal officials and engineering consultants, who supplied information on the water-supply installations and who collected many of the water samples.

This report is published by the North Carolina Department of Natural and Economic Resources, in the interest of making the information available to all concerned with the development and utilization of municipal water supplies in the State.

METHOD OF INVESTIGATION

Each municipality and rural water system in the Mountains and Western Piedmont subdivision of North Carolina with 500 customers or more was visited by hydrologists of the U.S. Geological Survey. The purpose of these visits was to obtain data on the major components of the water system and to collect water samples for analysis. Where possible, consulting engineers of the individual systems were visited to obtain additional information. Water system appraisal reports by consultants were reviewed, if available. The general appraisal of the surface-water and ground-water resources in each county and in the vicinity of each municipality was made largely on the basis of information in published reports or in the files of the Geological Survey.

The collection of streamflow data and the study of streamflow characteristics is a continuing activity of the Geological Survey. Streamflow data in this report were developed from streamflow records collected at more than 2,500 sites in the State. Extensive use was made of a report prepared by Goddard (1963). Goddard presented data on average discharge, flow-duration, low flow frequency, and draft-storage frequency based on streamflow records

collected through 1956. The results of similar studies based on additional records collected since the publication of Goddard's report were also used in making the surface-water appraisals.

The appraisals of ground water depend largely on a knowledge of the dominant geologic conditions of the locality. Previous investigators have divided the State into five broad hydrologic areas based on the dominant geologic conditions that affect the occurrence of ground water. These areas and the geologic conditions used as a basis for their differentation are:

1. Sand Hills Hydrologic Area.--Productive water-bearing sand at the land surface and overlying, for the most part, nonproductive material.

2. Outer Banks Hydrologic Area.--Productive water-bearing sand at the land surface containing fresh water in contact with sea water.

3. Castle Hayne Limestone Hydrologic Area.--Water-bearing limestone overlain by substantially less productive material.

4. Central Coastal Plain Hydrologic Area.--Numerous thin layers of productive sand complexly interbedded with nonproductive material.

5. Piedmont and Mountain Hydrologic Areas.--Poorly productive surficial granular material overlying relatively more productive fractured rock.

The location of these hydrologic areas is shown in figure 2 with the counties covered by this volume shaded. The counties covered by this volume lie in the Mountain and Piedmont hydrologic area.

In the Mountain and Piedmont section, ground water is stored between the individual grains in the soil and weathered rock and in the fractures of the underlying bedrock. Simply speaking, the saturated spaces in the soil form a reservoir of stored water and the bedrock fractures serve as pipe lines tapping the reservoir. It follows then, that normally the best wells are those drilled where the thickness of overlying soil is greatest, and where the bedrock contains numerous fractures. Of course it's impossible to predetermine, without drilling a test hole, the locations of fractures or the exact thickness of the soil cover. However, an examination of the surface features and a knowledge of the type of bedrock underlying the area greatly improves the chance of drilling a successful well. For a more complete discussion see "Ground Water of the Piedmont and Blue Ridge Province in the Southeastern States" by LeGrand (1967).

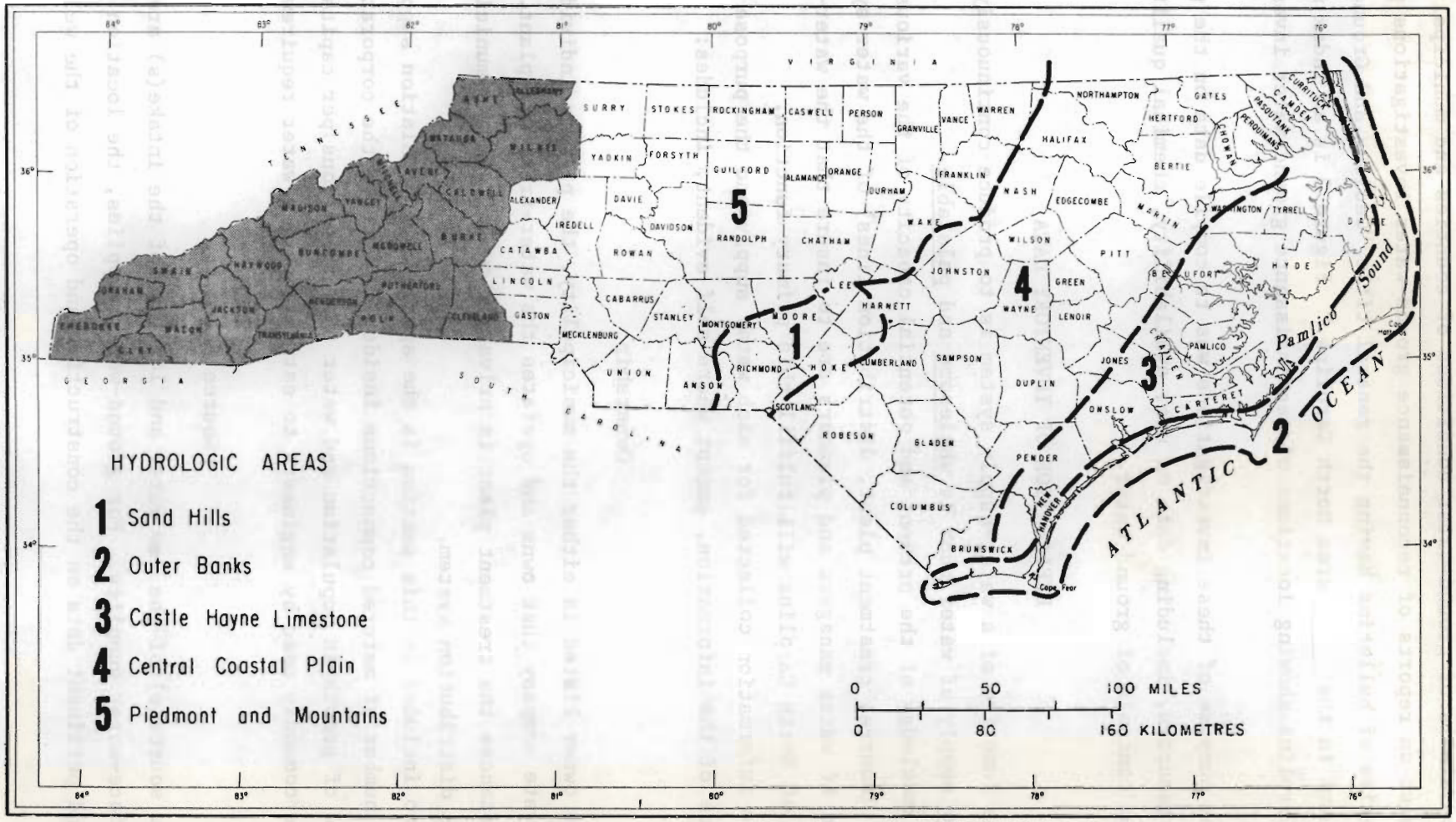


Figure 2.--Map of North Carolina showing the approximate boundaries of the hydrologic areas pertinent to the description of ground-water conditions. Shaded area is part 3.

Appraisals of ground-water conditions of counties and municipalities were based on reports of reconnaissance ground-water investigations published in a series of bulletins having the general title "Geology and Ground Water Conditions in the _____ area North Carolina." Figure 3 is an index map of North Carolina showing locations of reconnaissance ground-water investigations.

The purpose of these investigations was to compile data on the ground-water resources, including data on use, availability, chemical quality, and geologic controls of ground water.

EXPLANATION OF INVENTORY DATA

The function of a water-supply system is to produce continuously an adequate supply of water that is wholesome and palatable.

A knowledge of the present and potential capacity of the various components (source, treatment plant, distribution lines) of the water system is required if water managers and planners are to insure that the water-supply systems of North Carolina will fulfill this primary function.

The information collected for each water supply and the purpose or significance of the information, except where self evident, includes:

Ownership

The owner listed is either the municipality, the private individual, or the private company that owns and operates the water-treatment plant. In some instances the treatment plant is privately owned, and the municipality owns the distribution system.

Also included in this section is the approximate population supplied and the number of metered connections inside and outside the corporate limits. The rate of growth in population and water use, in gallons per capita per day, are commonly used by engineers to estimate future water requirements.

Source

The source(s) of the raw water and location of the intake(s) are given for surface-water supplies. For ground-water supplies, the location of the wells and pertinent data on the construction and operation of the wells are

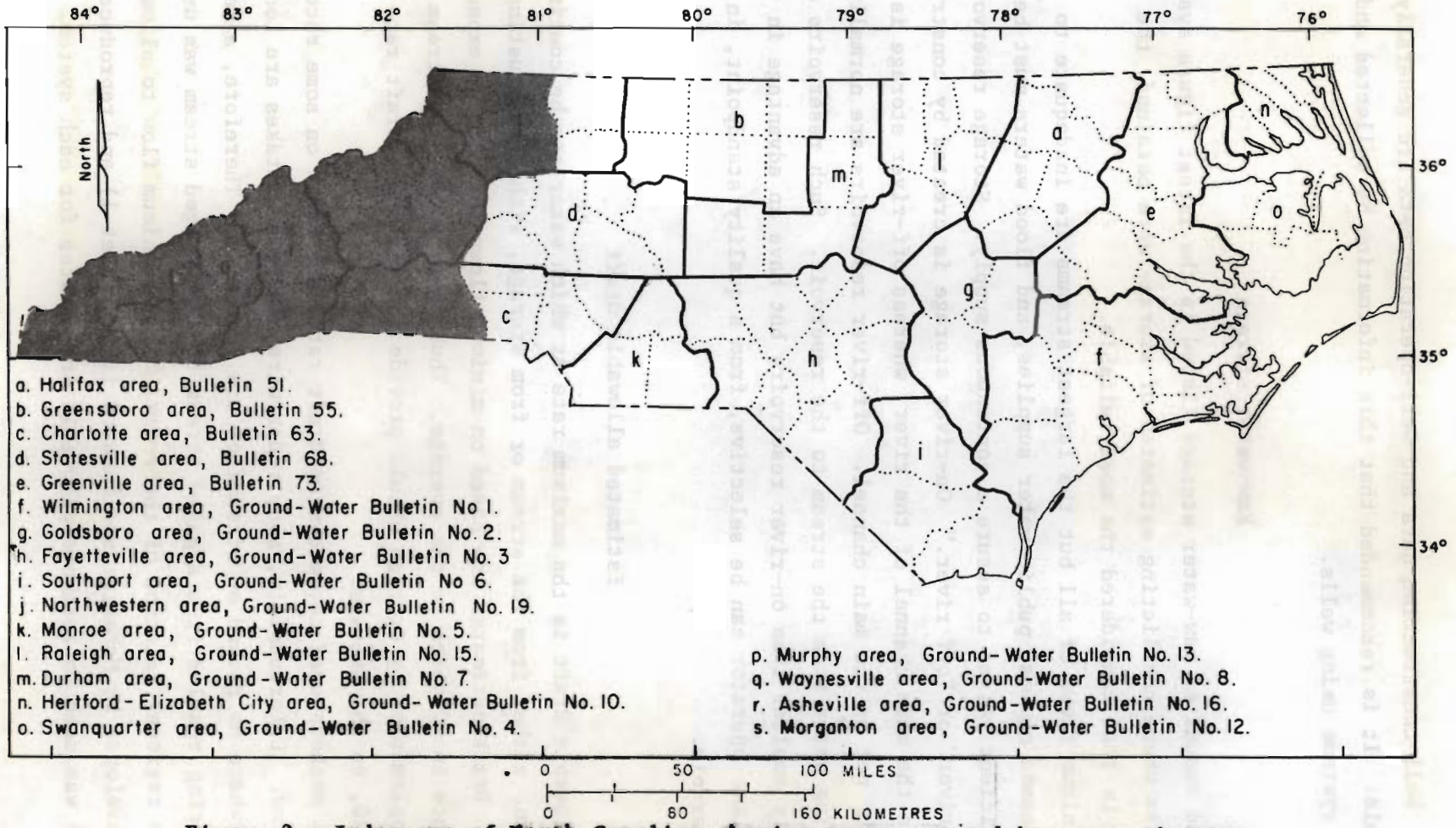


Figure 3.--Index map of North Carolina showing areas covered by reconnaissance ground-water investigations. Shaded area is part 3.

given. Well-construction data and well-operation data are generally not available. It is recommended that this information be collected and retained by all systems using wells.

Raw-water storage

The amount of raw-water storage listed is the latest figure available. In places where conflicting estimates of storage were obtained, the listed storage is that considered the most reliable.

Minimum flows of all but the largest streams are inadequate to meet the daily demand of most public water supplies, and flood waters must be stored in sufficient volume to assure a continuous supply. Storage reservoirs may be "on river" or "off river." On-river storage is created by construction of a dam on the main channel of the river, whereas off-river storage is a reservoir not on the main channel. Off-river reservoirs are normally filled by pumping water from the stream to the reservoir. Such reservoirs are generally smaller than on-river reservoirs but have an advantage in that the water-plant operator can be selective, from a quality standpoint, in filling the reservoir.

Estimated allowable draft

Allowable draft is the maximum rate at which water can be continuously withdrawn, either from the stream or from storage, without exhausting the supply. Draft estimates are based on minimum flows that can be expected to occur once in 20 years on the average. Thus, the flow of the stream or the flow supplemented by storage should provide the estimated draft rate 19 years out of 20, on the average.

All methods used to determine draft rates are based on some record of streamflow. Unfortunately, many reservoirs and water intakes are located on streams where no record of streamflow are available. Therefore, a method for transferring results from a gaged stream to the ungaged stream was used.

The regional relation of the 7-day, 2-year minimum flow to allowable draft developed by McMaster and Hubbard (1970, sheet 1) and reproduced in figure 4 was used to estimate allowable draft rates for each system.

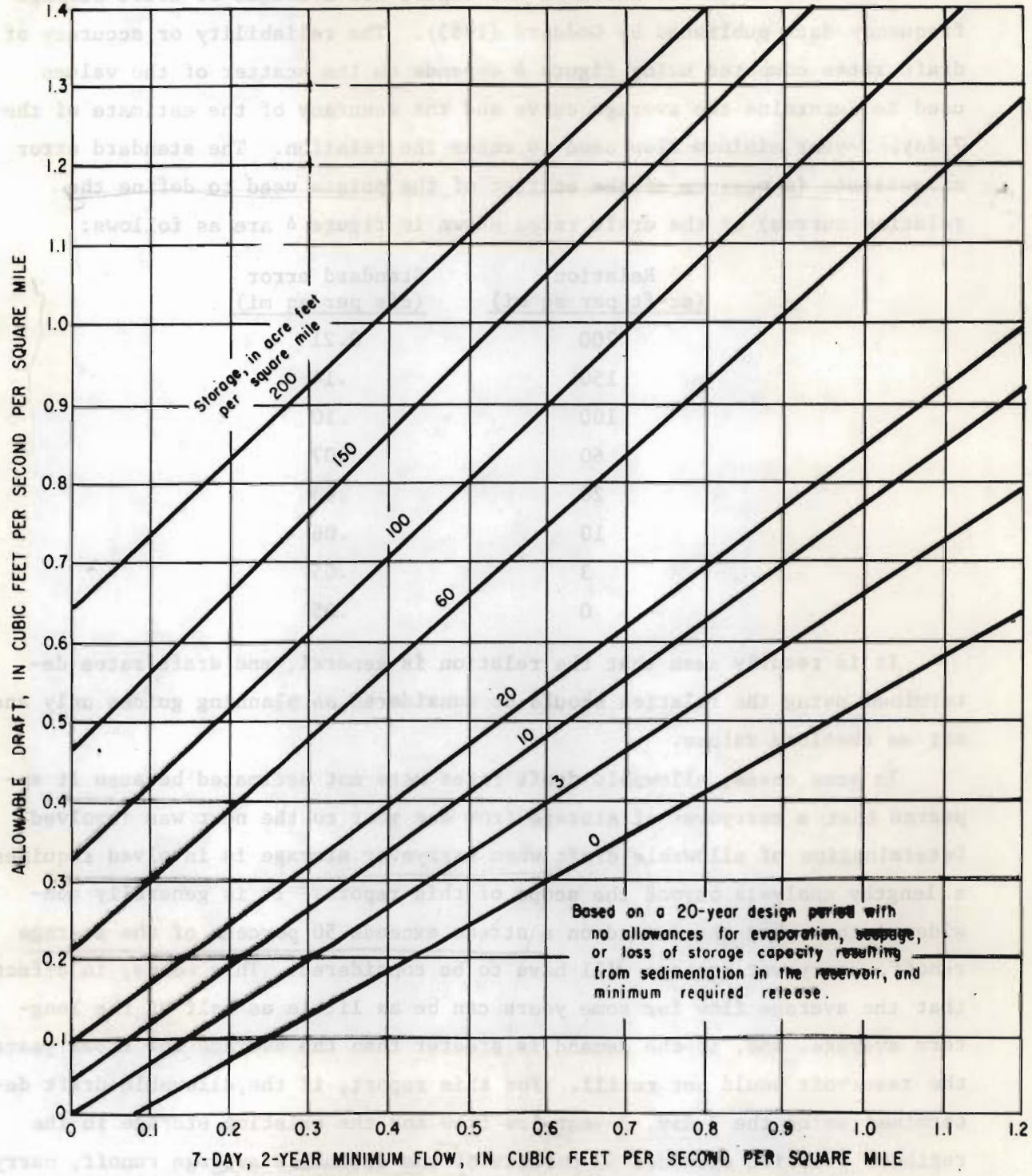


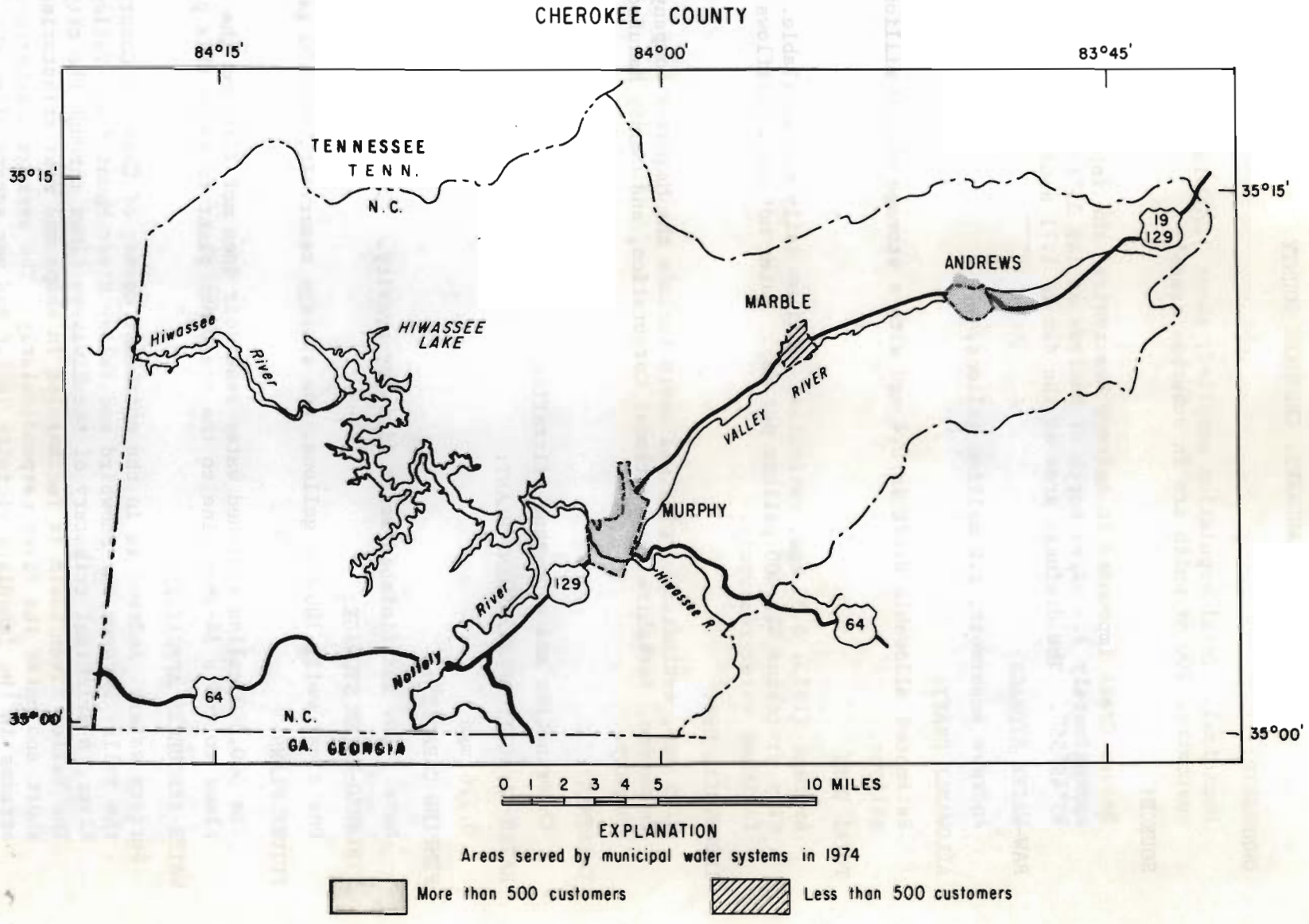
Figure 4.--Relation for estimating the allowable draft of a stream-reservoir using the 7-day, 2-year minimum flow of the stream as an index for entering the graph.

The relation curves shown in the figure are averages of draft-storage frequency data published by Goddard (1963). The reliability or accuracy of draft rates computed using figure 4 depends on the scatter of the values used to determine the average curve and the accuracy of the estimate of the 7-day, 2-year minimum flow used to enter the relation. The standard error of estimate (a measure of the scatter of the points used to define the relation curves) of the draft rates shown in figure 4 are as follows:

Relation (ac-ft per sq mi)	Standard error (cfs per sq mi)
200	0.21
150	.14
100	.10
60	.07
20	.08
10	.06
3	.05
0	.05

It is readily seen that the relation is general, and draft rates determined using the relation should be considered as planning guides only and not as absolute values.

In some cases, allowable draft rates were not estimated because it appeared that a carryover of storage from one year to the next was involved. Determination of allowable draft when carryover storage is involved requires a lengthy analysis beyond the scope of this report. It is generally considered that when the demand on a stream exceeds 50 percent of the average runoff, carryover storage will have to be considered. This means, in effect, that the average flow for some years can be as little as half of the long-term average, and, if the demand is greater than the average for those years, the reservoir would not refill. For this report, if the allowable draft determined using the 7-day, 2-year low flow and the existing storage in the regional relation exceeded 50 percent of the estimated average runoff, carryover storage was considered to be involved, and no estimate of allowable draft was made.


CHEROKEE COUNTY
84°15'
84°00'
83°45'
35°15'
35°00'
TENNESSEE
TENN.
N.C.
GA.
GEORGIA
Hiwassee River
HIWASSEE LAKE
MARBLE
ANDREWS
VALLEY RIVER
MURPHY
Hiwassee R.
Nottely River
19
129
64
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

ANDREWS, CHEROKEE COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,900 in 1973 (675 metered customers, 200 of which are in suburban areas).

SOURCE:

Beaver Creek impounded in Andrews Reservoir: the intakes are at the dam approximately 1.9 miles north of Andrews at lat 35°13'40", long 83°49'55". The drainage area at the dam is 1.71 square miles.

RAW-WATER STORAGE:

Andrews Reservoir, 1.0 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 0.4 mgd with a storage of 1.0 million gallons.

TOTAL USE:

Average (1973) 0.35 mgd, estimated. Maximum daily not available. The city processes 422,000 gallons per day. Water not used overflows the finished water reservoir.

INDUSTRIAL USE:

0.05 mgd, estimated. Principal users include the Magnavox Company of Tennessee, Berkshire International Corporation, and Owenby Manufacturing Company.

TREATMENT:

Chlorination and slow-sand filtration.

RATED CAPACITY OF TREATMENT PLANT:

0.576 mgd.

PUMPING CAPACITY:

None. Raw and finished water flows by gravity.

FINISHED-WATER STORAGE:

One clear well, 100,000 gallons, one storage reservoir, 500,000 gallons.

FUTURE PLANS:

The 500,000 gallon finished water reservoir does not fill and the city plans to run a 14-inch line to the treatment plant to solve this problem.

WATER-RESOURCES APPRAISAL:

Surface water: Andrews is in the northeast corner of Cherokee County in the valley between the Snowbird and Valley River Mountains. Valley River, a principal tributary of the Hiwassee flows through the city. The Valley River basin is rectangular in shape and most tributaries are short and enter the river perpendicularly. The average discharge of streams in the immediate vicinity is 1.6 mgd per square mile, the 7-day,

Allowable draft rates should include allowances or adjustments for evaporation, seepage, and loss of storage capacity resulting from sedimentation in the reservoir. Seepage losses or gains depend on a detailed knowledge of the type and construction of the dam and analysis of the geologic features of the reservoir, both of which are beyond the scope of this report. However, siltation rates and evaporation losses can be estimated with some certainty, and these adjustments were made, as described in the following paragraphs.

Sedimentation losses were estimated using data on annual loss rates for North Carolina reservoirs reported by Dendy and Champion (1969, p. 5, 6). The total sedimentation loss was computed using a loss rate experienced in similar types of basin and the time span from the time of the last reservoir volume determination to 1984. The volume loss thus estimated was subtracted from the reported storage before entering the relation in figure 4.

Minimum flows and maximum water demands generally occur during the summer and early fall in North Carolina. To coincide with this period, estimates of evaporation losses were based on the average daily land-pan evaporation during the months of August, September, and October, adjusted by a coefficient of 0.75. Evaporation data from the pan nearest each reservoir was used. A small amount of lake-evaporation data is available and was used in some evaporation estimates. Evaporation losses constitute a demand or additional draft on the source and were subtracted from the allowable draft obtained from the regional relation.

Total use

Average daily use and maximum daily use are given. Water usage varies from hour to hour, day to day, and season to season. In general, the smaller the community, the greater the variation in its demand for water. Water systems, of course, have to be of sufficient capacity to meet the peaks in demand. The ratio of the maximum daily use versus the average daily use is one design criteria used in sizing the various components of a water system. The rate of increase in usage over a period of years is used to predict future water requirements and to design and schedule construction of the necessary facilities.

Industrial use

The amount of water used by industry, in million gallons per day, is estimated. These estimates are based on actual metering of the larger users plus an estimated value for smaller industrial users. Where two or more industries use a significant amount of water, these corporations are listed.

Industrial water use often accounts for more than 50 percent of the total demand on a water supply. It is obvious then that a new "wet" industry, an expansion of an existing industry, a change in the manufacturing process that requires more or less water, or the closing of an industry, can greatly affect the water needs of a community. It is also obvious that good planning must include an analysis of present and future industrial water requirements.

Treatment

The treatment given to each water supply is listed in this section. Some raw waters are satisfactory in quality for all municipal uses. Most, however, require disinfection and purification before they can be used. The treatment given varies according to the quality of the raw water being treated. Briefly, some of the processes and their purposes that are used in water-treatment plants are as follows:

Aeration.--is a process in which water is brought in intimate contact with air for the purpose of changing the concentrations of volatile substances contained in the water. It reduces the amount of free carbon dioxide and hydrogen sulfide and supplies oxygen to those waters that are deficient. Aeration is generally associated with iron and manganese removal and taste and odor control.

Prechlorination.--is the application of chlorine at any stage in the treatment prior to filtration. The primary purpose of the application of chlorine to water is to kill disease-producing bacteria. However, prechlorination not only disinfects but also improves coagulation in those waters that contain objectionable amounts of color and iron, retards decomposition of organic matter in the coagulation basin, removes certain tastes and odors by oxidizing organic matter, and controls the growth of plants and microscopic organisms that could produce undesirable tastes and odors and reduce filter-bed efficiency.

Coagulation.--is a process that involves the formation of chemical flocs that adsorb, entrap, or otherwise bring together collodial and other finely-divided matter suspended in the water. These flocs, which resemble cotton candy, slowly settle and drag down the suspended matter.

Sedimentation.--Particles suspended in water tend to move downward under the influence of gravity regardless of size, shape, or weight. Flowing water tends to hold particles in suspension. Sedimentation is a process whereby the sediment-carrying power of flowing water is reduced by slowing the linear velocity of water until suspended matter will settle out. Coarse sediments may settle in hours, whereas fine sediments may require weeks to settle completely. Coagulation, as outlined above, speeds the rate at which fine sediments settle.

Taste and odor control with carbon.--The two major sources of undesirable tastes and odors are: (1) decaying vegetation, live and dead algae, and bacterial slimes and (2) sewage and industrial wastes. Practically all steps in the treatment process combat undesirable tastes and odors. Activated carbon is a chemical added primarily to adsorb taste, odor, and color from water supplies. After adsorbing undesirable tastes, odors, and colors, the carbon is either settled or filtered out.

Filtration.-- is the act of passing the water through a porous material in such a manner as to effectively remove suspended matter. A filter is, in essense, a strainer that physically traps the suspended material. The porous material (filter media) consists of layers of gravel, sand, and anthracite. The standard filtration rate per square foot of filter area is 2 gallons per minute.

Corrosion control.--The objectives of corrosion control are: (1) to increase the life of the distribution system, (2) to decrease pumping costs, and (3) to protect the potability of the water. The most popular method of control is the addition of sodium hexametaphosphate in the treatment process. It is not entirely clear how polyphosphate conditioners operate, but the current theory is that a film of molecular thickness is deposited over the pipe surface and acts as a protective coating. Polyphosphates also will hold iron and calcium in solution.

Probably the most effective method of controlling corrosion is by physically coating iron pipes with a protective coating, such as cement, or by using nonmetallic pipes, provided other factors such as workability, cost, and strength reduction are not involved.

Adjustment of pH.--pH is a number used to express the free hydrogen ion concentration of a solution. The free hydrogen ion concentration determines whether a solution is acid, neutral, or basic and is one of the most important chemical properties of water. The degree of acidity or basicity of a water frequently determines its suitability for a particular purpose, whether it will be corrosive and whether it will respond to a certain type of treatment. For these reasons, the pH of the water is adjusted in the treatment process.

Postchlorination.--The addition of chlorine at any time after filtration is called postchlorination. Sufficient chlorine is added to the water to ensure that bacterial growth is suppressed from the time the water leaves the treatment plant until it flows from the tap in the home.

Fluoridation.--is the adjustment of the fluoride content of water. Fluoride in water has been shown to reduce dental decay among children significantly. The North Carolina State Board of Health policy states that "Fluoridation of water is approved and recommended for public and institutional supplies serving communities where there is a strong public demand, and where the decision to fluoridate the water supply is concurred in by the local dental society, the local medical society, and the local or district health officer, provided that the required procedures for fluoridation for public and institutional supplies are adhered to."

Rated capacity of treatment plant

The rated capacity of each treatment plant, expressed in million gallons per day, is given in this report. Water treatment may consist of any one of several processes, singly or in various combinations, such as coagulation, sedimentation, filtration, disinfection, etc. Treatment facilities, ideally, are of sufficient size to provide, without interruption, treated water to meet the demands of the system. The component of the system having the least capacity fixes the capacity of the overall system.

Many cities, particularly those using ground water or surface water from protected watersheds, provide limited treatment without having what is normally recognized as a treatment plant. In these cases, chemicals are added usually in the line near the source or at the pumping station, and treatment plant capacity is shown as "None."

Pumping capacity

The raw water and finished water pumping capacities are listed. In relatively new systems or in systems that have recently pumped water at capacity, the pumping capacities listed are accurate. In older systems, where additions or alterations to the system have been made, the pumping capacities listed often are simply the sum of the rated capacities of the pumps. The latter method is not entirely correct because many factors, such as the condition of the pumps and the head on the pumps, control the pumping capacity. In addition, all water systems have standby pumps, which are normally used in case of a pump failure or when performing maintenance on the regular pumps but can be used in conjunction with the regular pump if needed, provided the distribution system can withstand the increased pressure.

Finished water storage

Finished water is stored in distribution reservoirs for the purpose of leveling off peaks in demand. Water usage during some hours of the day greatly exceed the capacity of the treatment plant, and these demands are met with water stored during periods of low demand. Distribution reservoirs are generally classed as elevated storage or ground storage. The amount of storage in each type of reservoir is given.

Future plans

Included in this section are plans for alterations or additions to the major components of the water-supply system. Minor changes in the distribution system are not included.

Water-resources appraisals

The quantity of water available in a particular locality is an important factor in the economic growth of the locality. The selection of a source for water supply, whether surface water or ground water, depends on the quantity available and the economic factors involved in developing the source. The water-resources appraisals are a summary of water-supply characteristics of streams and a summary of available information on ground-water conditions in the immediate vicinity of each municipality, including:

Surface water.--The magnitude and frequency of low flows and the average discharge are indicative of the amount of water available for development. In the water-resources appraisals, values for the average discharge and the average 7-day, 2-year minimum flows are listed. In addition, references are made in the discussions to "minimum flow" or to the "low-flow yield" of streams. These references to low flows generally refer to the average 7-day, 20-year minimum flows. Each appraisal also mentions possible streams for future development or a comment on the possibilities of further development of the present source.

Ground water.--Ground-water appraisals include a general summary of occurrence of ground water, including the types of rocks in which the water occurs, reported well depths and yields, and a general statement of the quality of ground water in the area. The appraisals also include the estimated potential yield of wells drilled in the immediate vicinity.

CHEMICAL ANALYSES

Water is referred to as the universal solvent because it has the capacity to dissolve at least minute amounts of nearly every substance it touches. Some of the substances dissolved in water, if present in sufficient concentrations, affect the use of the water for public supplies and for some industrial processes. Thus, an important segment of a public water supply inventory is the determination of the kinds and amounts of substances dissolved in the water. In the earlier public water supply inventories only a "standard complete" analysis of water samples was made. The "standard complete" analysis included determination of the following constituents and properties of both the raw and finished water:

Silica (SiO_2)	Bicarbonate (HCO_3)	Hardness as $CaCO_3$:
Aluminum (Al)	Carbonate (CO_3	Total
Iron (Fe)	Sulfate (SO_4)	Noncarbonate
Manganese (Mn)	Chloride (Cl)	Alkalinity as $CaCO_3$
Calcium (Ca)	Fluoride (F)	Specific conductance
Magnesium (Mg)	Nitrate (NO_3)	pH
Sodium (Na)	Dissolved solids	Color
Potassium (K)		Temperature

Currently, a great deal of research and general interest centers on minor elements and their possible detrimental or beneficial effect on man's health. No one knows when another element will be found to be beneficial, as for example fluoride in reducing dental decay, or when another element will produce the controversy recently raised by the finding of excessive mercury concentrations in water.

At present, there is a small amount of data on minor-element concentrations in the public water supplies of North Carolina. Some State and Federal agencies have recently started making these determinations, and a base of information is resulting. The complexity in making the determinations and the sophisticated equipment required almost rules out these determinations in all but the larger municipal water-treatment laboratories. For these reasons, it is apparent that an analysis of selected minor elements would be more valuable at this time than another "standard complete," the only problem being which constituents to look for.

Rather complete minor element analyses on a sample from a surface-water supply, Raleigh, and from a ground-water supply, New Bern, were made to obtain a representative sample of minor elements that might be found in North Carolina waters. With the results of these analyses and a study of reports in various professional journals, the following list was selected:

Surface-water Source		Ground-water Source	
Barium	Iron	Barium	Cyanide
Boron	Lead	Boron	Iron
Cadmium	Lithium	Cadmium	Lithium
Chloride	Manganese	Chloride	Manganese
Chromium	Mercury	Chromium	Strontium
Cobalt	Strontium	Cobalt	Zinc
Copper	Zinc	Copper	
Cyanide			

The list was reviewed after completion of parts 1 and 2, and one substitution was made, arsenic for cyanide. Cyanide was not detected in any of the samples collected. Arsenic, however, has been detected in samples collected for other studies ranging in concentrations from 0.001 to 1.1 mg/l (milligrams per litre). The sample containing 1.1 mg/l arsenic was from streams carrying a large waste load and was an extreme case.

Although we have added minor elements to the analyses contained in this report, this is not to say that the information contained in the former analyses is not still valuable to water-works operators and planners. It most definitely is, and, therefore, the latest standard complete analysis made by the Geological Survey and contained in earlier reports, or a new standard complete if the source of water has changed, is included for each water-supply system.

The collection of water samples varies with the municipalities according to the source of supply. For surface supplies, raw-water samples were collected at the impoundment, from the stream, or from the raw-water tap in the plant. Samples of finished water were collected from taps at the plant or in the distribution system. Ground-water samples were collected directly from the well, or, when no outlets were available, from the tap nearest the well. Finished ground-water samples were collected from taps in the plant or in the distribution system. Water samples for minor element analyses were, in most cases, collected only from the principal surface source or a single well.

The analytical data presented are from one sample at one point in time. In the course of a year, many samples are analyzed by water-works personnel and by the State Board of Health to insure that the water is of acceptable

chemical and bacteriological quality. Those interested can obtain more complete data from either of these sources.

SUMMARY AND DISCUSSION

North Carolina is a water-rich State. The municipal water systems of the State have done an excellent job of supplying their customers with an adequate supply of safe water. Occasionally, water use has been curtailed during very dry years, but these instances have been relatively rare. To maintain this fine record, local managers must continuously evaluate their water systems, must anticipate future requirements, and must plan and pursue any required expansion. Even though the State is water-rich, the supply is not limitless. Regional planners must insure that the available water resources are properly developed and wisely used.

The inventory of existing water supplies and the summary of pertinent water-resources data contained in this report is an attempt to assemble data that will assist water managers and planners in meeting future needs. Included is information on population served; the major components of the system, source of supply, treatment, pumping capacity, distribution and use; the chemical quality of raw and finished water; and general comments on the present and potential development of each system.

Planning to meet future water requirements is a continuous job and oftentimes a frustrating one. The population growth, industrialization, and water requirements have to be projected into the future. The yield of the source(s) of water must be estimated. From these projections and estimates must come the plans to insure a safe, dependable water supply. Implementation of plans can be frustrated by a lack of financing. Only when water managers do a poor job are they recognized, because no one thinks about water until there is a shortage.

Collecting and summarizing information on anything will undoubtedly uncover weaknesses, and some were noted during the inventory of municipal water supplies. One problem noted, especially in the small plants, is a lack of records. The value of accurate records in a water plant cannot be over emphasized. Accurate and complete records are essential to the efficient operation of the water plant and in making projections for future expansion.

The most common problem is the lack of data concerning the dependability of the source of supply, whether surface water or ground water. For small systems on large rivers, there is little worry that the supply is adequate, but for systems that impound or store water for use during periods of low streamflow, the adequacy of the supply ideally is continuously evaluated. Storage reservoirs continuously lose some of their capacity due to siltation, yet most municipalities list the capacity of their reservoirs as being the same as when they were constructed. Means of estimating the reduction in the storage capacity of reservoirs and for determining the minimum flow of the streams that feed the reservoirs are essential for maintaining an adequate supply. Only with this information, can a reliable estimate of the yield of the source be made.

Few towns have the experienced persons with diversified knowledge of wells and ground-water conditions to provide management comparable in quality to that available to most municipalities with surface-water systems (LeGrand, 1967, p. 10). The absence of well-construction and well-operation data in some municipalities may be evidence of this lack of experience. Efficient operation of a ground-water system is not possible without well data.

Collection and maintenance of complete records of well construction and operation are standard procedures for properly-run municipal systems using ground water. Analysis of these records can point out potential problems before a failure occurs and may indicate the need for additional wells.

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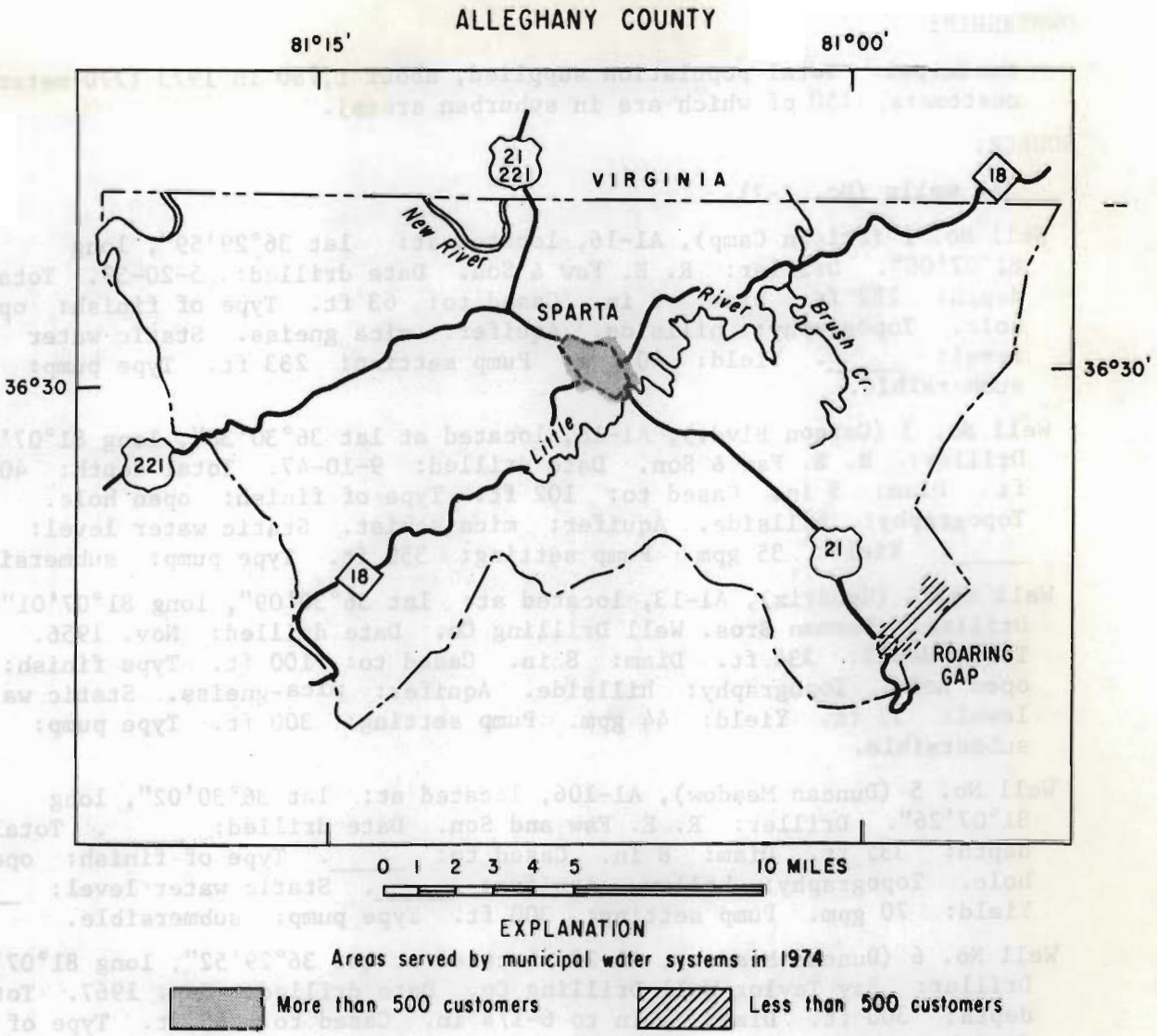
ALLEGHANY COUNTY

WATER-RESOURCES APPRAISAL

Alleghany County is in the Blue Ridge Province in northwestern North Carolina with the North Carolina-Virginia State line the northern boundary. The area is mountainous, stream slopes are relatively steep, and drainage is good. The county is drained by tributaries of New River of the Kanawha River basin except for a small area along the southeastern border which is drained by tributaries of the Yadkin River. The average discharge of streams ranges from 0.9 to 1.6 mgd per square mile. Minimum flows generally exceed 0.15 mgd per square mile and average 0.3 mgd per square mile. The 7-day, 2-year low flow ranges from 0.3 to 0.7 mgd per square mile. There are no municipalities using surface water for their water supply in the county. Sparta and other smaller communities use ground water for their source of supply. The county's population in 1970 was 8,134.

A large variety of rocks underlie the county, but they may be grouped into five major units that form northeast-southwest trending belts. Alternating belts of mica-gneiss, hornblende gneiss and mica schist underlie the northwestern half of the county except the extreme northwest corner which is underlain by granite gneiss. The southeastern half of the county is underlain principally by granite gneiss and granite schist with lesser belts of mica-gneiss and hornblende gneiss. These rocks weather rather deeply and the thickness of overlying weathered material is as much as 150 feet thick in places. There are not enough well records available to appraise the water-bearing potential of the various rock units. Available records show the general variation of yield with topography. The higher yielding wells are located in valleys and draws and generally yield about twice as much as those on slopes and four times as much as those on hills or ridges. Wells drilled in valleys or draws where there is a thick covering of weathered material might reasonably be expected to yield 50 gpm or more.

The chemical quality of ground water in the county is generally suitable for most uses with little or no treatment. The water is usually slightly acidic, soft, and locally may contain iron concentrations in excess of 0.3 mg/l.


ALLEGHANY COUNTY
81°15'
81°00'
36°30'
36°30'
VIRGINIA
21
221
18
New River
SPARTA
River
Brush Cr.
Little
221
18
21
ROARING GAP
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

SPARTA, ALLEGHANY COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 1,750 in 1973 (770 metered customers, 150 of which are in suburban areas).

SOURCE:

Six wells (No. 2-7).

Well No. 2 (Prison Camp), Al-16, located at: lat 36°29'59", long 81°07'08". Driller: R. E. Faw & Son. Date drilled: 5-20-39. Total depth: 282 ft. Diam: 8 in. Cased to: 63 ft. Type of finish: open hole. Topography: hillside. Aquifer: mica gneiss. Static water level: _____. Yield: 40 gpm. Pump setting: 233 ft. Type pump: submersible.

Well No. 3 (Carson Blvd.), Al-18, located at lat 36°30'38", long 81°07'52". Driller: R. E. Faw & Son. Date drilled: 9-10-47. Total depth: 408 ft. Diam: 8 in. Cased to: 102 ft. Type of finish: open hole. Topography: hillside. Aquifer: mica schist. Static water level: _____. Yield: 35 gpm. Pump setting: 350 ft. Type pump: submersible.

Well No. 4 (Hendrix), Al-13, located at: lat 36°30'09", long 81°07'01". Driller: Newman Bros. Well Drilling Co. Date drilled: Nov. 1956. Total depth: 334 ft. Diam: 8 in. Cased to: 100 ft. Type finish: open hole. Topography: hillside. Aquifer: mica-gneiss. Static water level: 55 ft. Yield: 44 gpm. Pump setting: 300 ft. Type pump: submersible.

Well No. 5 (Duncan Meadow), Al-106, located at: lat 36°30'02", long 81°07'26". Driller: R. E. Faw and Son. Date drilled: _____. Total depth: 335 ft. Diam: 8 in. Cased to: _____. Type of finish: open hole. Topography: hollow. Aquifer: _____. Static water level: _____. Yield: 70 gpm. Pump setting: 300 ft. Type pump: submersible.

Well No. 6 (Duncan Meadow), Al-20, located at lat 36°29'52", long 81°07'12". Driller: Ray Taylor Well Drilling Co. Date drilled: Jan. 1967. Total depth: 300 ft. Diam: 8 in to 6-1/4 in. Cased to: 65 ft. Type of finish: open hole. Topography: valley. Aquifer: mica-gneiss. Static water level: _____. Yield: 60 gpm. Pump setting: 290 ft. Type pump: submersible.

Well No. 7 (Homer Edwards), Al-107, located at: lat 36°30'19", long: 81°06'36". Driller: Ray Taylor Well Drilling Co. Date drilled: 8-1-70. Total depth: 398 ft. Diam: 6-1/4 in. Cased to: 32 ft. Type of finish: open hole. Topography: valley. Aquifer: _____. Static water level: 4 ft. Yield: 46 gpm. Pump setting: 375 ft. Type pump: submersible.

TOTAL USE:

Average (1972) 0.16 mgd, estimated; maximum daily not available.

INDUSTRIAL USE:

0.02 mgd, estimated. Principal users include Sparta Pipes, Inc., Hanes Corporation, Troutman Shirt Corporation, and Blue Ridge Shoe Company.

SPARTA, ALLEGHANY COUNTY

TREATMENT:

None.

PUMPING CAPACITY:

Raw water, not determined.

RAW-WATER STORAGE:

None.

FINISHED-WATER STORAGE:

One elevated tank, 100,000 gallons; one ground storage tank, 200,000 gallons.

FUTURE PLANS:

Plan to construct a 400,000 gallon ground storage tank by 1974.

WATER-RESOURCES APPRAISAL:

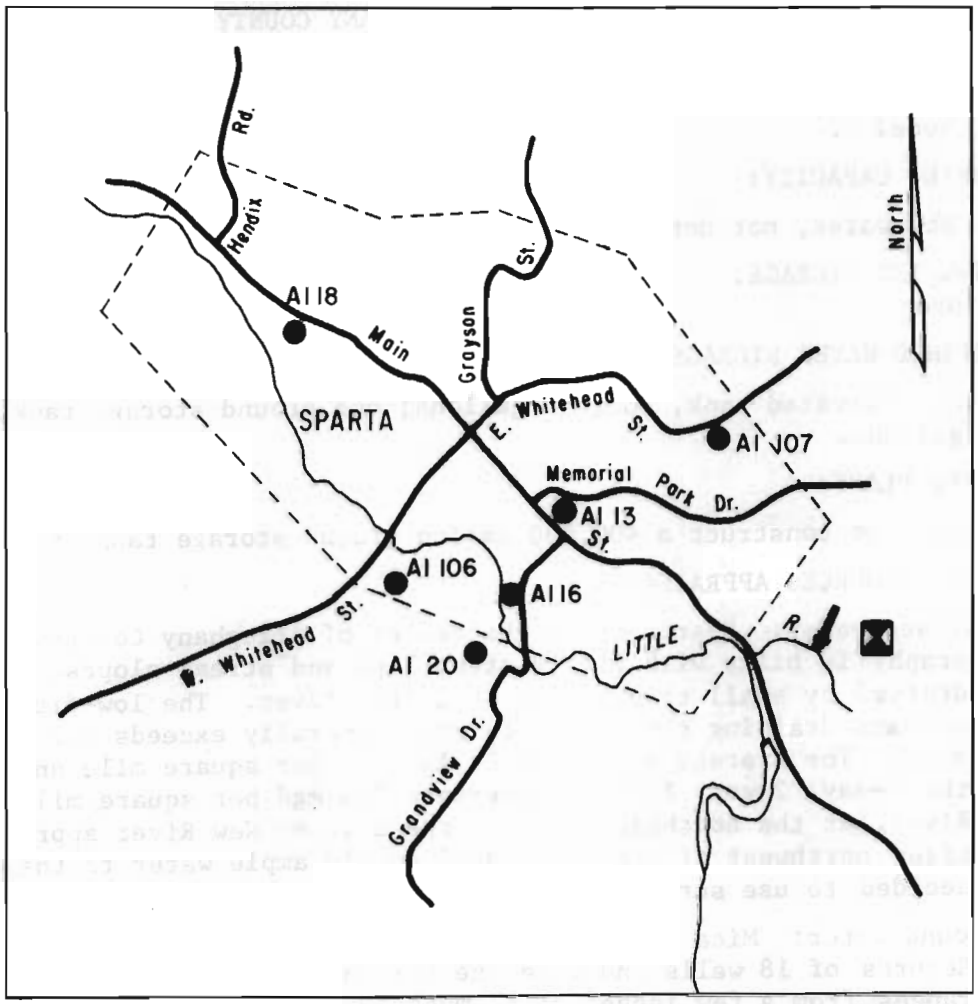
Surface water: Sparta is in the center of Alleghany County. The topography is hilly with fairly steep land and stream slopes. The city is drained by small tributaries of Little River. The low-flow yield of streams draining the immediate area generally exceeds 0.2 mgd per square mile. The average discharge is 1.5 mgd per square mile and the 7-day, 2-year low flow averages 0.4 mgd per square mile. Little River, at the southeast edge of the city or New River approximately 3 1/2 miles northwest of the city would supply ample water to the city if they decided to use surface water.

Ground water: Mica gneiss is the predominant rock type underlying Sparta. Records of 18 wells indicate the thickness of overlying weathered rock ranges from a few inches to as much as 100 feet. The average well casing length of these wells is 51 feet, the well depths range from 61 to 408 feet and average 192 feet, and the yields range from 2.5 to 70 gpm and average 19 gpm.

Wells drilled in favorable sites such as draws and valleys and spaced to prevent pumping interference can reasonably be expected to yield 40 to 60 gpm as evidenced by the 49 gpm average yield of the city wells.

The chemical quality of ground water is generally good and suitable for most uses with little or no treatment. The water is generally soft, slightly acidic, but locally may contain iron concentrations in excess of 0.3 mg/l.

CITY OF SPARTA



SPARTA, ALLEGHANY COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 2	Well No. 3	Well No. 4	Well No. 5
Date of collection.....	9-7-66	9-7-66	9-7-66	9-7-66
Copper (Cu).....	-------	-------	-------	-------
Cobalt (Co).....	-------	-------	-------	-------
Zinc (Zn).....	-------	-------	-------	-------
Chromium (Cr).....	-------	-------	-------	-------
Boron (B).....	-------	-------	-------	-------
Strontium (Sr).....	-------	-------	-------	-------
Barium (Ba).....	-------	-------	-------	-------
Mercury (Hg).....	-------	-------	-------	-------
Lead (Pb).....	-------	-------	-------	-------
Lithium (Li).....	-------	-------	-------	-------
Cadmium (Cd).....	-------	-------	-------	-------
Cyanide (CN).....	-------	-------	-------	-------
Chloride (Cl).....	0.8	1.0	0.6	11
Manganese (Mn).....	.01	.08	.02	.08
Iron (Fe).....	.01	.15	.13	.16
Calcium (Ca).....	4.9	23	12	18
Magnesium (Mg).....	.8	1.3	3.1	2.0
Sodium (Na).....	1.9	5.7	4.4	5.5
Potassium (K).....	1.0	1.1	2.5	2.8
Fluoride (F).....	.1	.1	.0	.1
Silica (SiO_2).....	12	19	21	19
Bicarbonate (HCO_3).....	21	76	40	34
Carbonate (CO_3).....	0	0	0	0
Sulfate (SO_4).....	2.6	11	22	26
Nitrate (NO_3).....	.4	.6	.2	.1
Dissolved Solids.....	39	106	89	109
Hardness as $CaCO_3$:				
Total.....	16	64	44	54
Noncarbonate.....	0	2	12	26
Alkalinity as $CaCO_3$.....	17	62	33	28
Specific conductance (micromhos at 25° C)....	43	152	118	150
pH.....	6.4	7.2	7.2	7.2
Temperature (°C).....	13	13	13	13

Note.--Additional analysis on next page.

SPARTA, ALLEGHANY COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 6			
Date of collection.....	10-26-73			
Copper (Cu).....	0.007			
Cobalt (Co).....	.001			
Zinc (Zn).....	.010			
Chromium (Cr).....	.000			
Boron (B).....	.340			
Strontium (Sr).....	.070			
Barium (Ba).....	.100			
Mercury (Hg).....	-------			
Lead (Pb).....	.003			
Lithium (Li).....	.000			
Cadmium (Cd).....	.001			
Arsenic (As).....	.004			
Chloride (Cl).....	6.5			
Manganese (Mn).....	.010			
Iron (Fe).....	.060			
Calcium (Ca).....	5.0			
Magnesium (Mg).....	1.3			
Sodium (Na).....	4.0			
Potassium (K).....	1.2			
Fluoride (F).....	0.0			
Silica (SiO2).....	14			
Bicarbonate (HCO3).....	21			
Carbonate (CO3).....	0			
Sulfate (SO4).....	2.2			
Nitrate (NO2 + NO3 as N).	1.3			
Dissolved Solids.....	50			
Hardness as CaCO3:				
Total.....	18			
Noncarbonate.....	1			
Alkalinity as CaCO3.....	17			
Specific conductance (micromhos at 25° C)....	64			
pH.....	6.2			
Temperature (°C).....	-			

ASHE COUNTY

WATER-RESOURCES APPRAISAL

Ashe County is in the Blue Ridge province in northwestern North Carolina and is bounded on the north by Virginia and on the west by Tennessee. The southeastern boundary of the county closely approximates the eastern continental divide. Except for scattered areas east of this boundary, which are drained by tributaries of the Yadkin River, the county is drained by tributaries of the Kanawha River basin. The North Fork New River and South Fork New River are the principal rivers. Minimum flows are relatively high, averaging 0.25 mgd per square mile. The average discharge of all streams is 1.4 mgd per square mile and the 7-day, 2-year low flow averages 0.45 mgd per square mile.

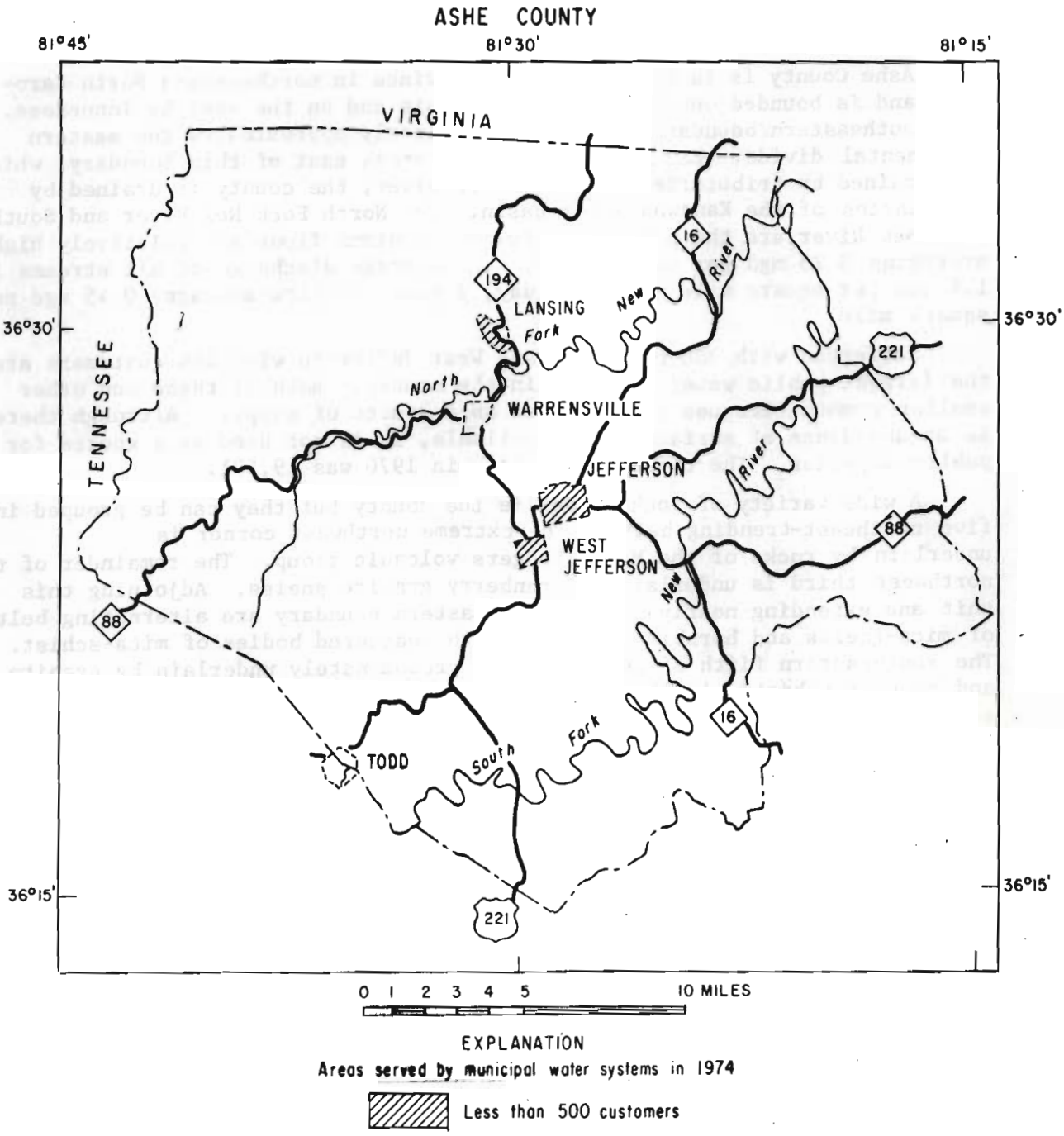
Jefferson with 300 customers and West Jefferson with 464 customers are the largest public water supplies in the county. Both of these and other smaller communities use ground water as a source of supply. Although there is an abundance of surface water available, it is not used as a source for public supplies. The county population in 1970 was 19,571.

A wide variety of rocks underlie the county but they can be grouped in five northeast-trending belts. The extreme northwest corner is underlain by rocks of the Mount Rodgers volcanic group. The remainder of the northwest third is underlain by cranberry granite gneiss. Adjoining this unit and extending nearly to the southeastern boundary are alternating belts of mica-gneiss and hornblende-gneiss with scattered bodies of mica-schist. The southeastern fifth of the county is predominately underlain by granite and granite schist. Available well records do not allow a complete comparison of the water-bearing characteristics of the various rock units. However, records from 132 wells are sufficiently complete to allow compilation of the following table. The table shows typical yields and average depth of drilled wells in some of the predominant rocks.

Rock unit	Yield (gpm)		Average depth (feet)
	Maximum	Average	
Cranberry Gneiss	60	15	111
Mica-gneiss	50	15	126
Hornblende-gneiss	150	27	118
Granite-schist	40	28	146

As in most areas in the mountains, topographic location is more significant to yield than rock type. Wells on hills or ridges have the smallest yield, yielding about a third as much as wells in draws. Generally the best wells are those drilled in topographically low areas where the overlying weathered material is thickest. Wells drilled in favorable locations, and spaced to prevent interference between each other, will yield on the order of 0.04 to 0.05 mgd per well.

The chemical quality of ground water is generally good. The water is usually slightly acidic and soft, but locally iron concentrations may exceed 0.3 mg/1.


ASHE COUNTY
81°45'
81°30'
81°15'
36°30'
36°15'
VIRGINIA
TENNESSEE
194
16
221
88
LANSING
WARRENSVILLE
JEFFERSON
WEST JEFFERSON
TODD
New River
North Fork
South Fork
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
Less than 500 customers

AVERY COUNTY

WATER-RESOURCES APPRAISAL

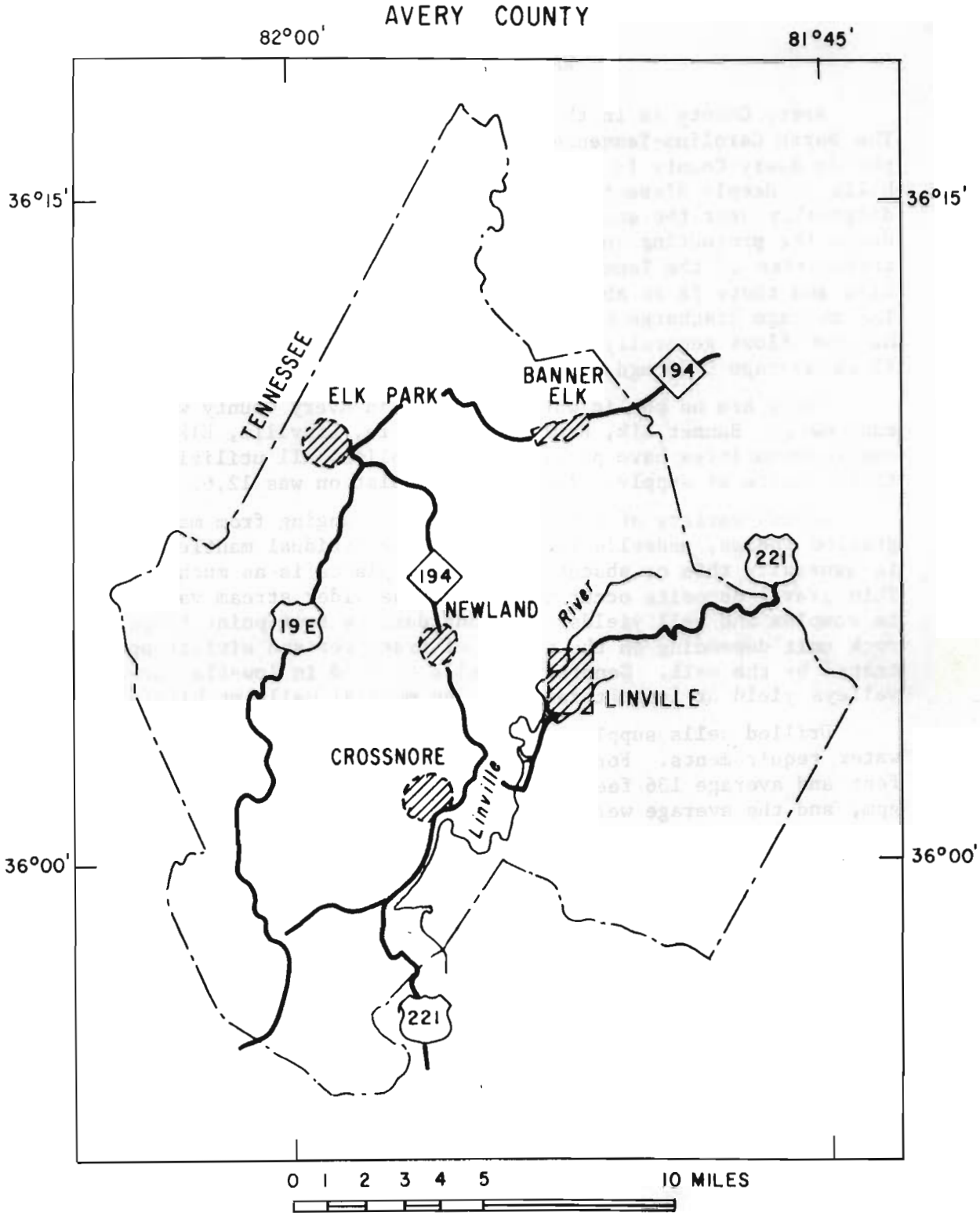
Avery County is in the Blue Ridge province in western North Carolina. The North Carolina-Tennessee State line is the northwest boundary. Topography in Avery County is varied, ranging from moderately wide valleys and low hills to deeply dissected slopes. The eastern continental divide runs diagonally near the southeastern boundary. Tributaries of the Catawba River drain the projecting southeastern corner and the remainder is drained by tributaries of the Tennessee River. The yields of streams are relatively high and there is an abundance of surface water available for water supplies. The average discharge of streams ranges from 1.2 to 1.7 mgd per square mile. Minimum flows generally exceed 0.1 mgd per square mile, and 7-day, 2-year low flows average 0.35 mgd per square mile.

There are no public water supplies in Avery County with 500 or more customers. Banner Elk, Newland, Crossnore, Linville, Elk Park and other small communities have public water supplies, all utilizing ground water as their source of supply. The county population was 12,655 in 1970.

A wide variety of metamorphic rocks, ranging from mafic volcanics to granite gneiss, underlie the county. The residual mantle of weathered rock is generally thin or absent but in some places is as much as 90 feet thick. Thin gravel deposits occur in some of the wider stream valleys. The geology is complex and well yields vary considerably from point to point in the same rock unit depending on the number of fractures and similar openings penetrated by the well. Generally, wells drilled in low-flat areas, draws, and valleys yield at least three times as much as wells on hilltops or ridges.

Drilled wells supply most of the domestic, municipal, and industrial water requirements. For 73 drilled wells, the depths range from 36 to 475 feet and average 136 feet, yields range from 1.0 to 165 gpm and average 26 gpm, and the average well casing length is 42 feet.

The chemical quality of ground water is good and suitable for most uses with little or no treatment. The water is usually soft, slightly acidic, but locally may contain higher than desirable iron concentrations.


AVERY COUNTY
82°00'
81°45'
36°15'
36°15'
36°00'
36°00'
TENNESSEE
ELK PARK
BANNER ELK
194
194
NEWLAND
19E
221
221
River
LINVILLE
CROSSNORE
Linville
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
Less than 500 customers

BUNCOMBE COUNTY

WATER-RESOURCES APPRAISAL

Buncombe County is in the Blue Ridge province in western North Carolina. the area is characterized as a dissected central peneplain, known as the Asheville Peneplain, with mountains on the east and west sides. The county is drained by the French Broad River and its tributaries except for the southeast corner which is drained by tributaries of the Broad River. Compared to other areas in the mountain region, streamflow in the county is relatively small. The average discharge of streams ranges from 0.6 to 1.6 mgd per square mile and averages 0.9 mgd per square mile. Minimum flows generally exceed 0.05 mgd per square mile, and the 7-day, 2-year low flow averages 0.25 mgd per square mile. Public water supplies serve most of the populated areas in the county. Asheville, Black Mountain, Weaverville, Woodfin, Montreat and other smaller communities use surface water as their source of supply. All surface water supplies are taken from protected watersheds, consequently only minimum treatment is required. As the population of the county and water demands increase, the protected-watershed concept may have to be abandoned and treatment plants constructed as supplies are drawn from larger watersheds. The availability and land costs for protected watersheds may be prohibitive. The county population in 1970 was 145,056.

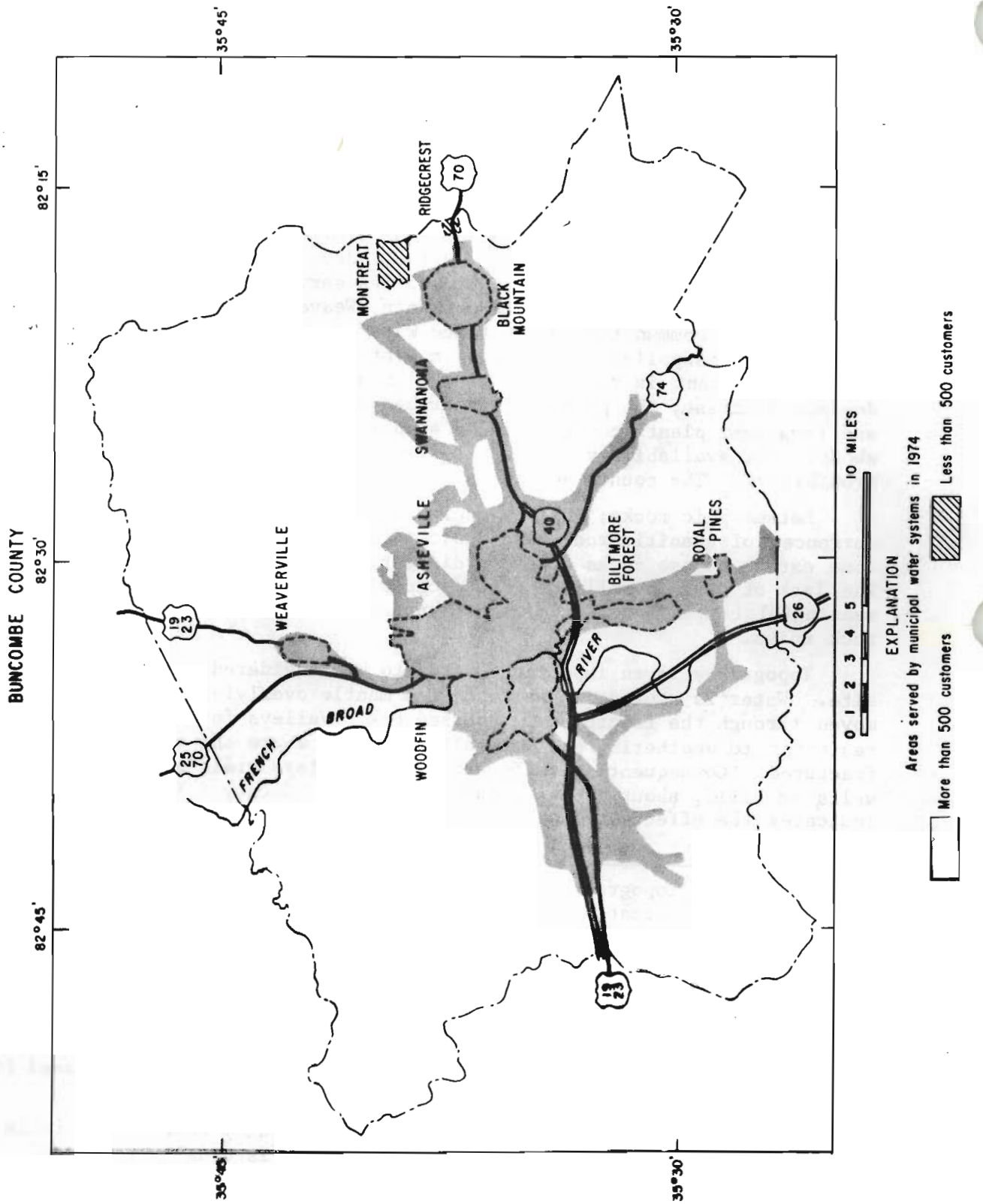
Metamorphic rocks, chiefly gneiss and schist, with subordinate occurrences of granitic rocks and basic intrusives underlie the county. To some extent, these rocks occur in discontinuous northeast trending belts. The lack of data on wells of tested capacity makes it impossible to make a meaningful comparison of the water-bearing characteristics of the various rock units.

Topography is an important factor to be considered in selecting a well site. Water is stored in the weathered mantle overlying the bedrock and moves through the fractures in the bedrock. Valleys form in areas least resistant to weathering and generally in areas where the rock is more fractured. Consequently, wells drilled in valleys yield more water than wells on hills, about twice as much in Buncombe County. The following table indicates the effect of topography on well yields.

Topographic Location	Average depth (feet)	Yield (gpm)	
		Maximum	Average
Hill or Ridge	148	35	10.9
Slope	131	80	14.3
Valley	96	55	19.6

The yields in the table are those reported for drilled wells used for domestic purposes and are probably low.

The chemical quality of ground water is generally good and suitable for most uses with little or no treatment. The water is usually soft and slightly acidic.


BUNCOMBE COUNTY
82°45'
82°30'
82°15'
35°45'
35°30'
RIDGECREST
MONTREAT
BLACK MOUNTAIN
SWANNANOA
ASHEVILLE
WEAVERVILLE
BILTMORE FOREST
ROYAL PINES
WOODFIN
FRENCH BROAD RIVER
70
74
40
26
19
23
25
70
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

ASHEVILLE, BUNCOMBE COUNTY

OWNERSHIP:

Municipal. Also serves Biltmore, Royal Pines, Skyland, Enka, and Swannanoa. Total population supplied, about 105,000 in 1973 (33,000 metered customers, 11,060 of which are in suburban areas).

SOURCE:

North Fork Swannanoa River impounded in Burnett Lake: The intakes are approximately 500 feet upstream from the dam about 12 miles east of Asheville at lat 35°39'44", long 82°20'43". The drainage area at the dam is 21.9 square miles.

Prior to June 1963, the city also obtained water from Beetree Reservoir, a 500-million gallon impoundment on Beetree Creek. The reservoir area is now used as a recreation park but the reservoir could be put back in service if needed.

RAW-WATER STORAGE:

Burnett Lake, 5.5 billion gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 24 mgd with an adjusted storage of 5.45 billion gallons.

TOTAL USE:

Average (1972-73) 20.9 mgd, metered; maximum daily (1-17-73) 24.2 million gallons.

INDUSTRIAL USE:

4.7 mgd, estimated. Principal users include Beacon Manufacturing Co., Gerbers Products Co., Ball Brothers, Philips Industries, and American Enka Co.

TREATMENT:

Chlorination, adjustment of pH with caustic soda, addition of phosphate compounds for corrosion control, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

None, chemicals fed directly into water lines.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity supplemented by booster pumps in the distribution system.

FINISHED-WATER STORAGE:

Fourteen reservoirs, 11,000,000, 5,000,000, 2 of 1,000,000 each, 5 of 500,000 each, 250,000, 200,000, 108,500, and 2 of 50,000 gallons.

FUTURE PLANS:

In January 1974, a consulting firm was attempting to locate leaks in the distribution system. Leakage losses have been estimated as high as

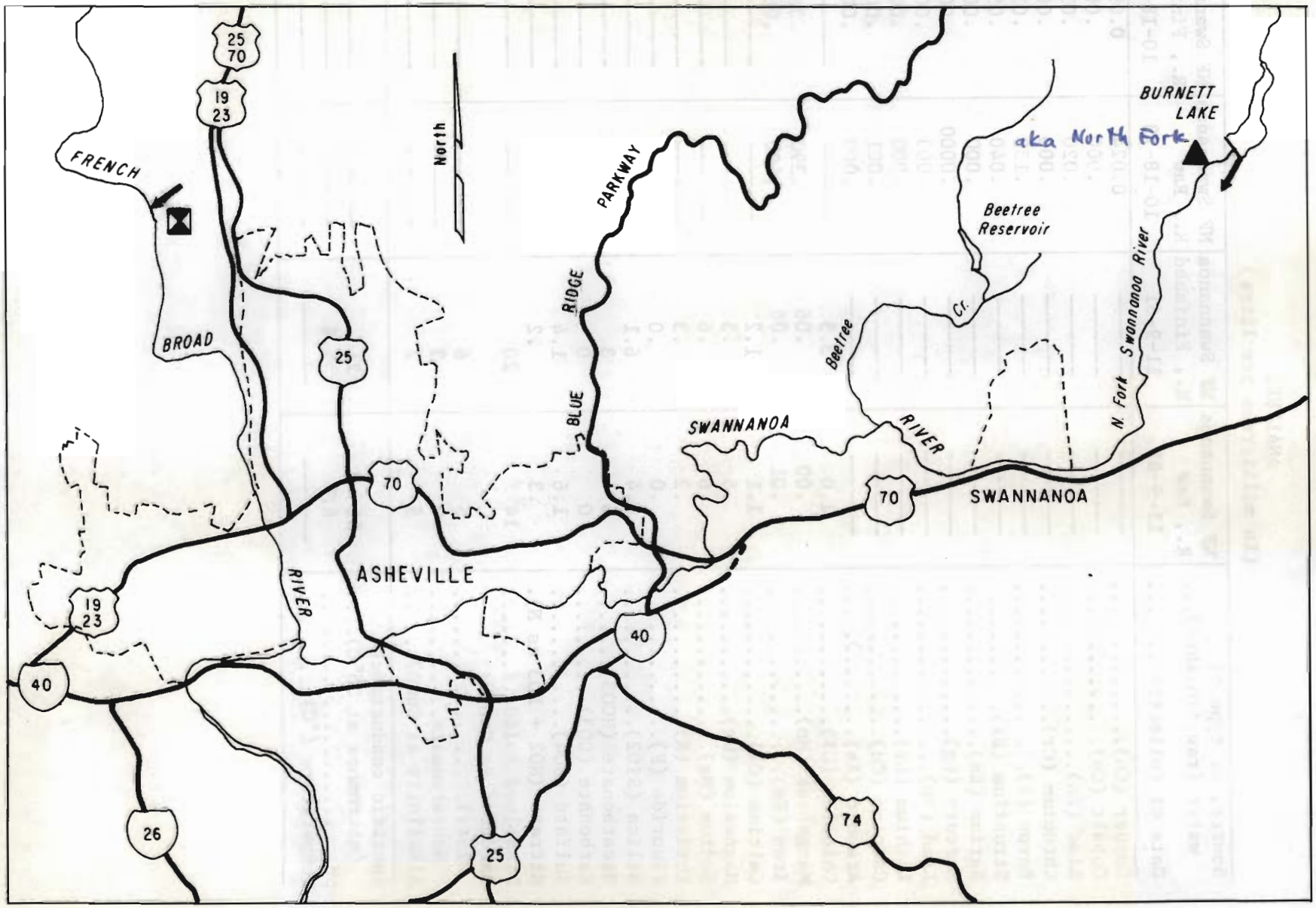
50 percent. Bonds for construction of a treatment plant on North Fork Swannanoa River have been approved.

WATER-RESOURCES APPRAISAL:

Surface water: Asheville is situated on a dissected central peneplain, known as the Asheville Peneplain, in central Buncombe County. The topography ranges from hilly to mountainous. Stream slopes are steep and drainage is good. The city is drained by the Swannanoa and French Broad Rivers and their tributaries. The average discharge of streams draining the immediate area ranges from 0.8 to 1.5 mgd per square mile. Their 7-day, 2-year low flow averages 0.25 mgd per square mile, and minimum flows generally exceed 0.10 mgd per square mile. Maximum demand is approaching the estimated allowable draft of Burnett Lake indicating that Beetree Reservoir may be needed in a dry year. Demand may be reduced considerably if the leakage problem is solved.

Ground water: The predominant rocks underlying Asheville are gneiss and schist. With the abundance of surface water available and the large area covered by the Asheville municipal system little use has been made of ground water in the Asheville area. However, it may be possible to use ground water for air-conditioning, supplemental, and small industrial supplies. One well used for air-conditioning and filling a swimming pool was reported to yield 55 gpm.

CITY OF ASHEVILLE



ASHEVILLE, BUNCOMBE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	NF Swannanoa R., Raw	NF Swannanoa R., Finished	NF Swannanoa R., Raw	NF Swannanoa R., Finished
Date of collection.....	11-9-61	11-9-61	10-18-73	10-18-73
Copper (Cu).....	-------	-------	0.024	0.090
Cobalt (Co).....	-------	-------	.000	.000
Zinc (Zn).....	-------	-------	.020	.010
Chromium (Cr).....	-------	-------	.000	.000
Boron (B).....	-------	-------	.130	.010
Strontium (Sr).....	-------	-------	.040	.050
Barium (Ba).....	-------	-------	.000	.000
Mercury (Hg).....	-------	-------	.0000	.0000
Lead (Pb).....	-------	-------	.003	.002
Lithium (Li).....	-------	-------	.000	.000
Cadmium (Cd).....	-------	-------	.001	.000
Arsenic (As).....	-------	-------	.000	.000
Chloride (Cl).....	1.0	3.5	-------	-------
Manganese (Mn).....	.00	.06	.390	.360
Iron (Fe).....	.01	.06	.090	.080
Calcium (Ca).....	1.1	1.2	-------	-------
Magnesium (Mg).....	.5	.5	-------	-------
Sodium (Na).....	.6	.6	-------	-------
Potassium (K).....	.2	.3	-------	-------
Fluoride (F).....	.0	.0	-------	-------
Silica (SiO2).....	6.4	6.1	-------	-------
Bicarbonate (HCO3).....	6	3	-------	-------
Carbonate (CO3).....	0	0	-------	-------
Sulfate (SO4).....	1.6	1.4	-------	-------
Nitrate (NO2 + NO3 as N).	.3	.2	-------	-------
Dissolved Solids.....	14	20	-------	-------
Hardness as CaCO3:				
Total.....	5	6	-------	-------
Noncarbonate.....	0	3	-------	-------
Alkalinity as CaCO3.....	5	2	-------	-------
Specific conductance (micromhos at 25° C)....	16	21	-------	-------
pH.....	6.5	5.6	-------	-------
Temperature (°C).....	-------	-------	-------	-------

BLACK MOUNTAIN, BUNCOMBE COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 5,000 in 1973 (1,650 metered customers, 400 of which are in suburban areas).

SOURCE:

Springs in Dunsmore Cove impounded in two reservoirs: The intakes are at the dam of the upper reservoir approximately 2 miles east of Black Mountain at lat 35°36'39", long 82°17'14". Water is pumped from the lower reservoir to the upper reservoir when needed. The drainage area at the lower reservoir dam is 0.6 square miles, approximately.

RAW-WATER STORAGE:

Two reservoirs, approximately 25 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 0.3 mgd with a storage of 25 million gallons.

TOTAL USE:

Average (1973) 0.42 mgd, metered; maximum daily (8-8-73) 0.48 million gallons.

INDUSTRIAL USE:

Negligible.

TREATMENT:

Chlorination.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity with booster pumps in the distribution system.

FINISHED-WATER STORAGE:

Five reservoirs, 200,000, 17,300, 3,800, 3,600, and 3,600 gallons.

FUTURE PLANS:

Plan to increase capacity of water lines from the raw-water reservoirs to town.

WATER-RESOURCES APPRAISAL:

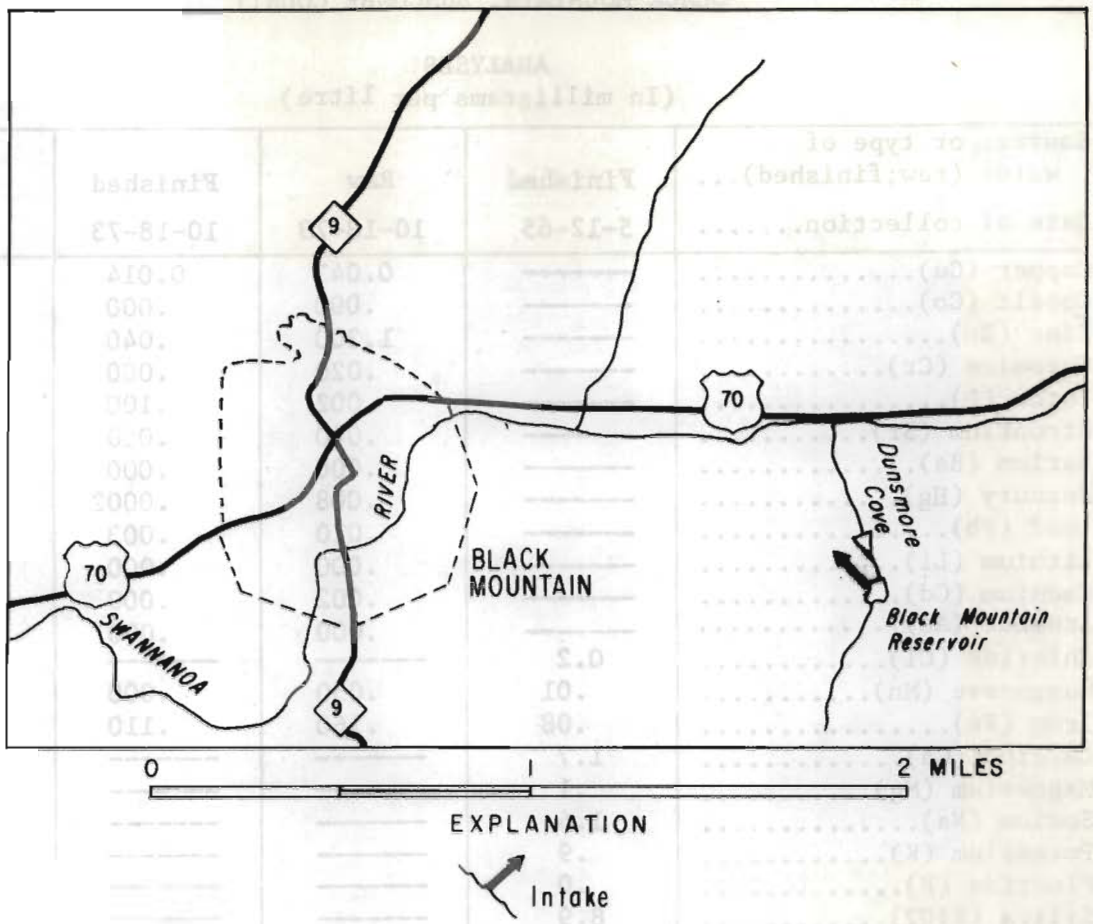
Surface water: Black Mountain is in eastern Buncombe County in the Swannanoa River valley. The valley is oriented east-west with mountain ridges to the north and south. Tributaries of the Swannanoa River drain the city. The average discharge of streams in the immediate vicinity of Black Mountain is 1.5 mgd per square mile, the 7-day, 2-year low flow averages 0.35 mgd per square mile, and minimum flows generally exceed 0.1 mgd per square mile. The estimated allowable draft of the present supply is less than current use indicating that the supply might be deficient in

a dry year. There are two connections with the Asheville water system so supplemental water can be obtained from or furnished to Asheville.

Ground water: The predominate rock underlying Black Mountain is schist. Records of well casing lengths in the vicinity of Black Mountain indicate the overlying thickness of weathered material exceeds 100 feet in places. The only available records of well yields are for domestic wells which are normally located near the point of use rather than at the most favorable sites and reported well yields are low (less than 10 gpm). However, if wells are located in favorable areas, yields of 30 gpm or more, might reasonably be expected.

Ground water is generally of good chemical quality. It is usually soft and slightly acidic.

CITY OF BLACK MOUNTAIN



BLACK MOUNTAIN, BUNCOMBE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Finished	Raw	Finished	
Date of collection.....	5-12-65	10-18-73	10-18-73	
Copper (Cu).....	-------	0.043	0.014	
Cobalt (Co).....	-------	.000	.000	
Zinc (Zn).....	-------	1.300	.040	
Chromium (Cr).....	-------	.020	.000	
Boron (B).....	-------	.002	.100	
Strontium (Sr).....	-------	.040	.050	
Barium (Ba).....	-------	.000	.000	
Mercury (Hg).....	-------	.008	.0002	
Lead (Pb).....	-------	.010	.003	
Lithium (Li).....	-------	.000	.000	
Cadmium (Cd).....	-------	.002	.000	
Arsenic (As).....	-------	.000	.000	
Chloride (Cl).....	0.2	-------	-------	
Manganese (Mn).....	.01	.050	.000	
Iron (Fe).....	.08	.160	.110	
Calcium (Ca).....	1.7	-------	-------	
Magnesium (Mg).....	.1	-------	-------	
Sodium (Na).....	1.4	-------	-------	
Potassium (K).....	.9	-------	-------	
Fluoride (F).....	.0	-------	-------	
Silica (SiO2).....	8.9	-------	-------	
Bicarbonate (HCO3).....	7	-------	-------	
Carbonate (CO3).....	0	-------	-------	
Sulfate (SO4).....	1.8	-------	-------	
Nitrate (NO3).....	.1	-------	-------	
Dissolved Solids.....	27	-------	-------	
Hardness as CaCO3:				
Total.....	5	-------	-------	
Noncarbonate.....	0	-------	-------	
Alkalinity as CaCO3.....	6	-------	-------	
Specific conductance (micromhos at 25° C)....	19	-------	-------	
pH.....	6.8	-------	-------	
Temperature (°C).....	-------	-------	-------	

WEAVERVILLE, BUNCOMBE COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,500 in 1973 (1,015 metered customers, 500 of which are in suburban areas).

SOURCES:

Eller Cove Creek impounded: The intakes are at the dam approximately 3.1 miles southeast of Weaverville at lat 35°40'17", long 82°30'51". The drainage area at the dam is 0.5 square mile, approximately. Ox Creek: The intakes are in a catch basin approximately 6.1 miles southeast of Weaverville at lat 35°40'33", long 82°27'31". The drainage area at the intakes is 0.4 square mile, approximately.

RAW-WATER STORAGE:

Eller Cove Reservoir, approximately 6 million gallons.

Ox Creek settling reservoir, 0.5 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Eller Cove Creek is 0.2 mgd with a storage of 6 million gallons.

Estimated allowable draft of Ox Creek is 0.1 mgd with negligible storage.

TOTAL USE:

Average (1973) 0.35 mgd, metered; maximum daily not available.

INDUSTRIAL USE:

0.03 mgd, estimated. Principal users include Quorum Fabrics, Woodcrafters, Inc. Cheney Bigelow Fabric Plant, New Found Industries, Inc. and Bernard Conrad Embrodiery Co.

TREATMENT:

Chlorination, addition of phosphate compounds for corrosion control, and adjustment of pH with soda ash.

RATED CAPACITY OF TREATMENT PLANT:

None. Chemicals fed directly into lines.

PUMPING CAPACITY:

Raw and finished water flows by gravity.

FINISHED-WATER STORAGE:

Two storage tanks, 1,000,000 and 100,000 gallons.

FUTURE PLANS:

None.

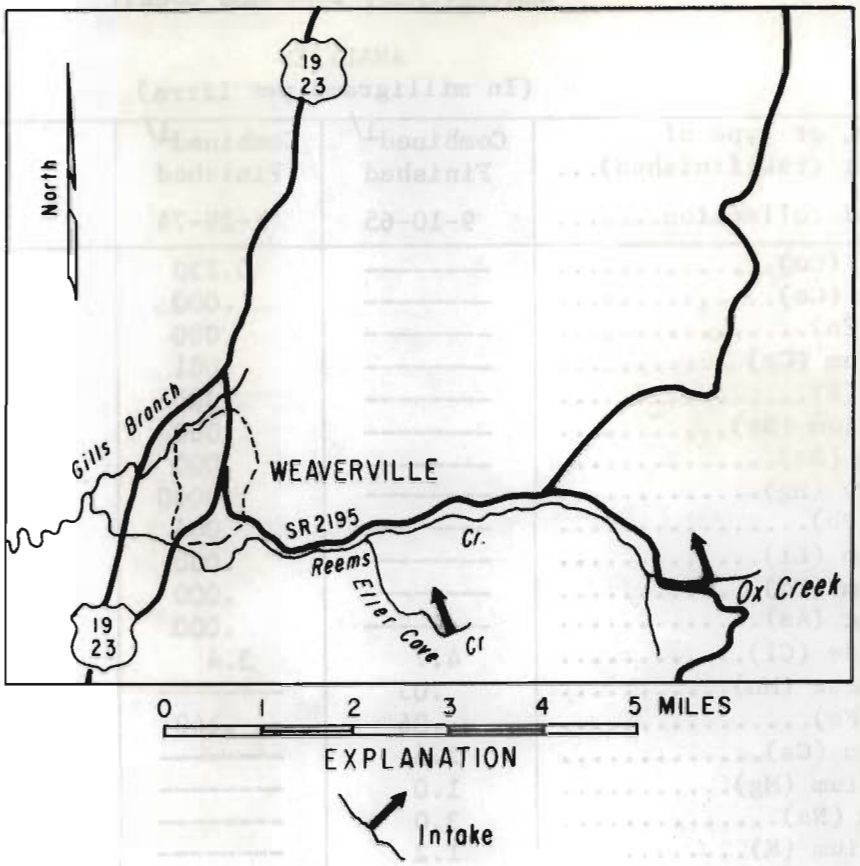
WATER-RESOURCES APPRAISAL:

Surface water: Weaverville is in north-central Buncombe County in an area of moderate topographic relief. The city is drained by Reems Creek, Gills Branch, and their tributaries. The low-flow yield of streams

draining the immediate area is relatively low, averaging about 0.05 mgd per square mile. The average discharge of streams is 0.8 mgd per square mile, and the 7-day, 2-year low flow averages 0.15 mgd per square mile. The estimated allowable draft of the present sources is less than the current use indicating that the supply would be deficient in a dry year. However, the system is connected to the Asheville and Woodfin systems for emergency supplies.

Ground water: Gneiss, schist, and granitic rocks underlie Weaverville. No data for wells in the immediate vicinity are available. However, based on available records of wells in the surrounding area, it is reasonable to expect yields of 25 gpm or more from wells drilled in favorable locations. The higher yielding wells are those drilled where the mantle of weathered rock is thickest, generally in draws, sags, and valleys.

CITY OF WEAVERVILLE



WEAVERVILLE, BUNCOMBE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Combined[1/] Finished	Combined[1/] Finished		
Date of collection.....	9-10-65	1-29-74		
Copper (Cu).....	--------	0.230		
Cobalt (Co).....	--------	.000		
Zinc (Zn).....	--------	.080		
Chromium (Cr).....	--------	.001		
Boron (B).....	--------	.000		
Strontium (Sr).....	--------	.000		
Barium (Ba).....	--------	.000		
Mercury (Hg).....	--------	.0000		
Lead (Pb).....	--------	.004		
Lithium (Li).....	--------	.000		
Cadmium (Cd).....	--------	.000		
Arsenic (As).....	--------	.000		
Chloride (Cl).....	4.7	3.4		
Manganese (Mn).....	.03	--------		
Iron (Fe).....	.06	.140		
Calcium (Ca).....	2.6	--------		
Magnesium (Mg).....	1.0	--------		
Sodium (Na).....	3.0	--------		
Potassium (K).....	1.2	--------		
Fluoride (F).....	.0	--------		
Silica (SiO2).....	18	--------		
Bicarbonate (HCO3).....	14	--------		
Carbonate (CO3).....	0	--------		
Sulfate (SO4).....	3.0	--------		
Nitrate (NO3).....	.2	--------		
Dissolved Solids.....	44	--------		
Hardness as CaCO3:				
Total.....	11	--------		
Noncarbonate.....	0	--------		
Alkalinity as CaCO3.....	11	--------		
Specific conductance (micromhos at 25° C)....	39	--------		
pH.....	6.5	--------		
Temperature (°C).....	--------	--------		

[1/] Combined sample of Ox Creek and Eller Creek.

WOODFIN, BUNCOMBE COUNTY

OWNERSHIP:

. Woodfin Sanitary Water and Sewer District. Total population supplied, about 6,050 in 1973 (2,150 metered customers).

SOURCES:

Sugar Camp Fork impounded: The intakes are at the dam approximately 8.5 miles northeast of Woodfin at lat 35°41'58", long 82°26'09". The drainage area at the intakes is 1.7 square miles, approximately.

Laurel Fork (supplementary supply): the intakes are approximately 8 miles northeast of Woodfin at lat 35°42'02", long 82°26'57". The drainage area at the intakes is 1.2 square miles, approximately.

RAW-WATER STORAGE:

Sugar Camp Fork reservoir, 30 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Sugar Camp Fork is 0.4 mgd with an adjusted storage of 29 million gallons.

Estimated allowable draft of Laurel Fork is 0.05 mgd with no storage.

TOTAL USE:

Average (1973) 0.70 mgd, metered; maximum daily (date not available) 0.96 million gallons.

INDUSTRIAL USE:

0.25 mgd, estimated. Principal users include Burlington Industries, Drexel Furniture Co., Northrup Carolina Corporation, and Mills Manufacturing Co.

TREATMENT:

Chlorination and adjustment of pH with soda ash.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity with a pressure booster pump in north section of community.

FINISHED-WATER STORAGE:

One ground concrete tank, 1.0 million gallons.

FUTURE PLANS:

None.

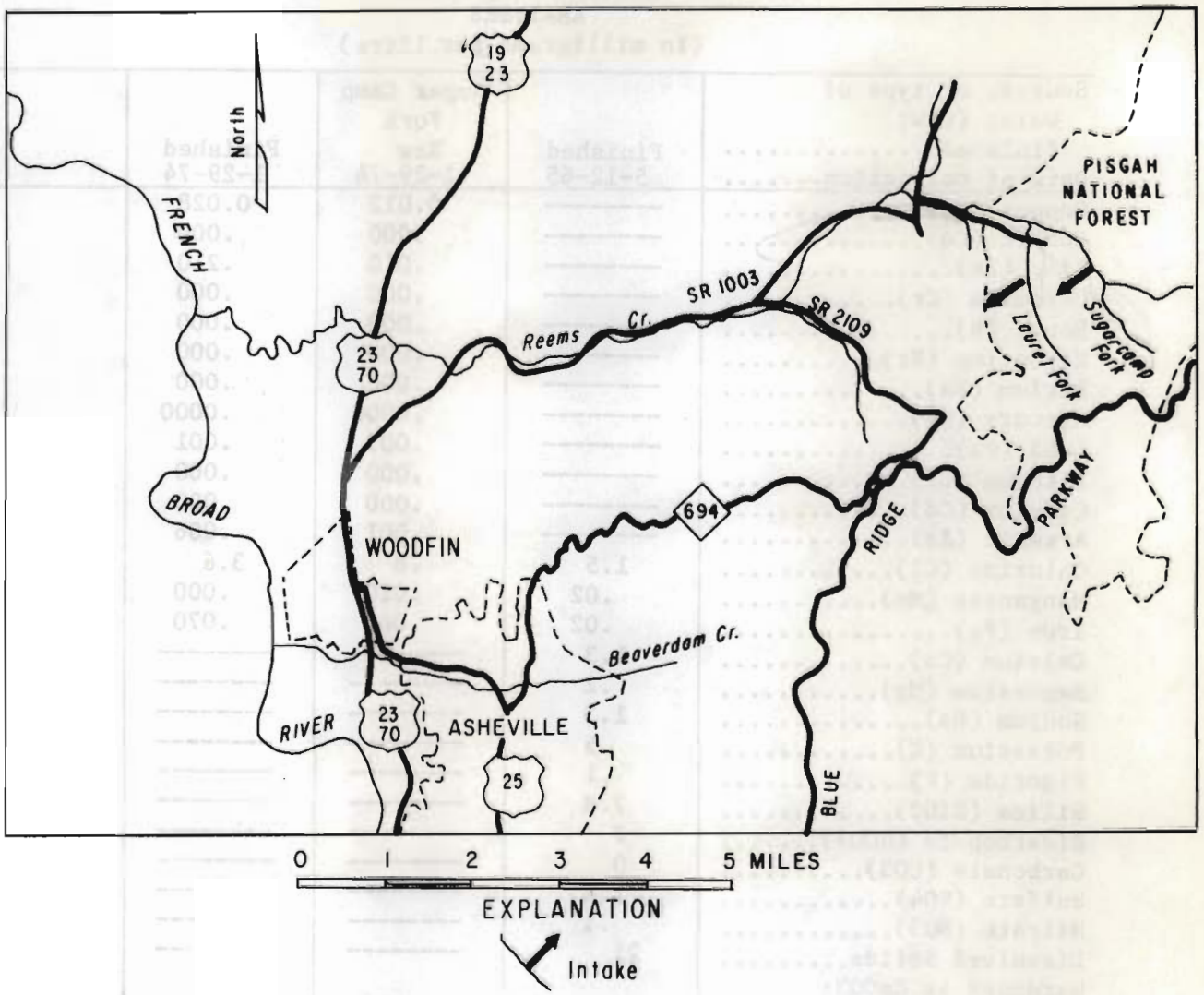
WATER-RESOURCES APPRAISAL:

Surface water: Woodfin is an unincorporated community adjoining the northern boundary of Asheville in north-central Buncombe County. The area is hilly with moderate to steep land and stream slopes. Small

tributaries of Beaverdam Creek and the French Broad River drain the area. The low-flow yield of streams in the immediate vicinity averages about 0.1 mgd per square mile. The average discharge is 1.2 mgd per square mile and the 7-day, 2-year low flow is 0.25 mgd per square mile. The Woodfin area is growing and water demands will continue to increase. Current use exceeds the estimated allowable draft and during dry years water shortages may occur. However, the system is connected to the Asheville and Weaverville systems for emergency supply.

Ground water: Gneiss, schist, and granitic rocks are the predominant rocks underlying Woodfin. No data for wells in the immediate vicinity are available. However, based on available records of wells in the surrounding area, it is reasonable to expect yields of 25 gpm or more from wells drilled in favorable locations. The higher yielding wells are those drilled where the mantle of weathered rock is thickest, generally in draws, sags, and valleys.

WOODFIN SANITARY WATER AND SEWER DISTRICT, BUNCOMBE COUNTY



WOODFIN, BUNCOMBE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw; finished)		Sugar Camp Fork		
Date of collection	Finished 5-12-65	Raw 1-29-74	Finished 1-29-74	
Copper (Cu)	--------	0.012	0.028	
Cobalt (Co)	--------	.000	.000	
Zinc (Zn)	--------	.010	.210	
Chromium (Cr)	--------	.000	.000	
Boron (B)	--------	.000	.000	
Strontium (Sr)	--------	.000	.000	
Barium (Ba)	--------	.000	.000	
Mercury (Hg)	--------	.0000	.0000	
Lead (Pb)	--------	.003	.001	
Lithium (Li)	--------	.000	.000	
Cadmium (Cd)	--------	.000	.000	
Arsenic (As)	--------	.001	.006	
Chloride (Cl)	1.5	.8	3.6	
Manganese (Mn)	.02	.010	.000	
Iron (Fe)	.02	.060	.070	
Calcium (Ca)	1.3	--------	--------	
Magnesium (Mg)	.2	--------	--------	
Sodium (Na)	1.3	--------	--------	
Potassium (K)	.5	--------	--------	
Fluoride (F)	.1	--------	--------	
Silica (SiO_2)	7.8	--------	--------	
Bicarbonate (HCO_3)	7	--------	--------	
Carbonate (CO_3)	0	--------	--------	
Sulfate (SO_4)	1.4	--------	--------	
Nitrate (NO_3)	.1	--------	--------	
Dissolved Solids	21	--------	--------	
Hardness as $CaCO_3$:				
Total	4	--------	--------	
Noncarbonate	0	--------	--------	
Alkalinity as $CaCO_3$	6	--------	--------	
Specific conductance (micromhos at 25° C)	15	--------	--------	
pH	6.2	--------	--------	
Temperature (°C)	--------	--------	--------	

BURKE COUNTY

WATER-RESOURCES APPRAISAL

Burke County is in the central part of the western half of North Carolina. Approximately three-fifths of the county, the central and eastern parts, are in the Piedmont Province. The Blue Ridge mountains are in the northwest and the South Mountains are in the southern part. The topography in the mountain region is rugged, and in the Piedmont is rolling to hilly. Land and stream slopes are steep and drainage is good. The Catawba River and its tributaries drain the county. Parts of Rhodhiss Lake and Lake James, hydroelectric impoundments on the Catawba River, are in the county. The average discharge of streams whose headwaters are in the mountains is considerably higher than those in the remainder of the county. For streams draining the mountain, the average discharge is 1.5 mgd per square mile. In the remainder of the county, average discharge ranges generally west to east from 1.0 to 0.8 mgd per square mile. Minimum flows generally exceed 0.15 mgd per square mile, and 7-day, 2-year low flows average 0.30 mgd per square mile.

Morganton, Valdese, and Drexel obtain their water from surface sources. Oak Hill Water Corporation, Triple Communities Water System, and Glen Alpine use ground water. The county population in 1970 was 60,364.

Metamorphic rocks underlying Burke County are heterogeneous, with mica-schist, mica-gneiss, granitic gneiss, and schistose quartzite predominating. In the Piedmont parts, the overlying mantle of weathered rock is as much as 100 feet thick in places and probably averages 40 to 50 feet. In the more rugged mountainous areas, the mantle is thin or absent.

Most drilled wells in the county are less than 200 feet deep. For 62 drilled wells, the average depth is 137 feet and the average yield is 14 gpm. Several wells are reported to yield 100 gpm or more and yields in excess of 25 gpm are not unusual.

Drilled wells obtain water from fractures and other small openings in the bedrock. Water stored in the overlying weathered rock moves into the fractures under the influence of pumping.

The topography of a well site is a good indicator of the potential yield of a well. Generally the best wells are those in low-flat areas, narrow linear valleys, or draws where the mantle of weathered rock is thickest. The following table shows the relation of topography to reported yield for 62 wells in the county.

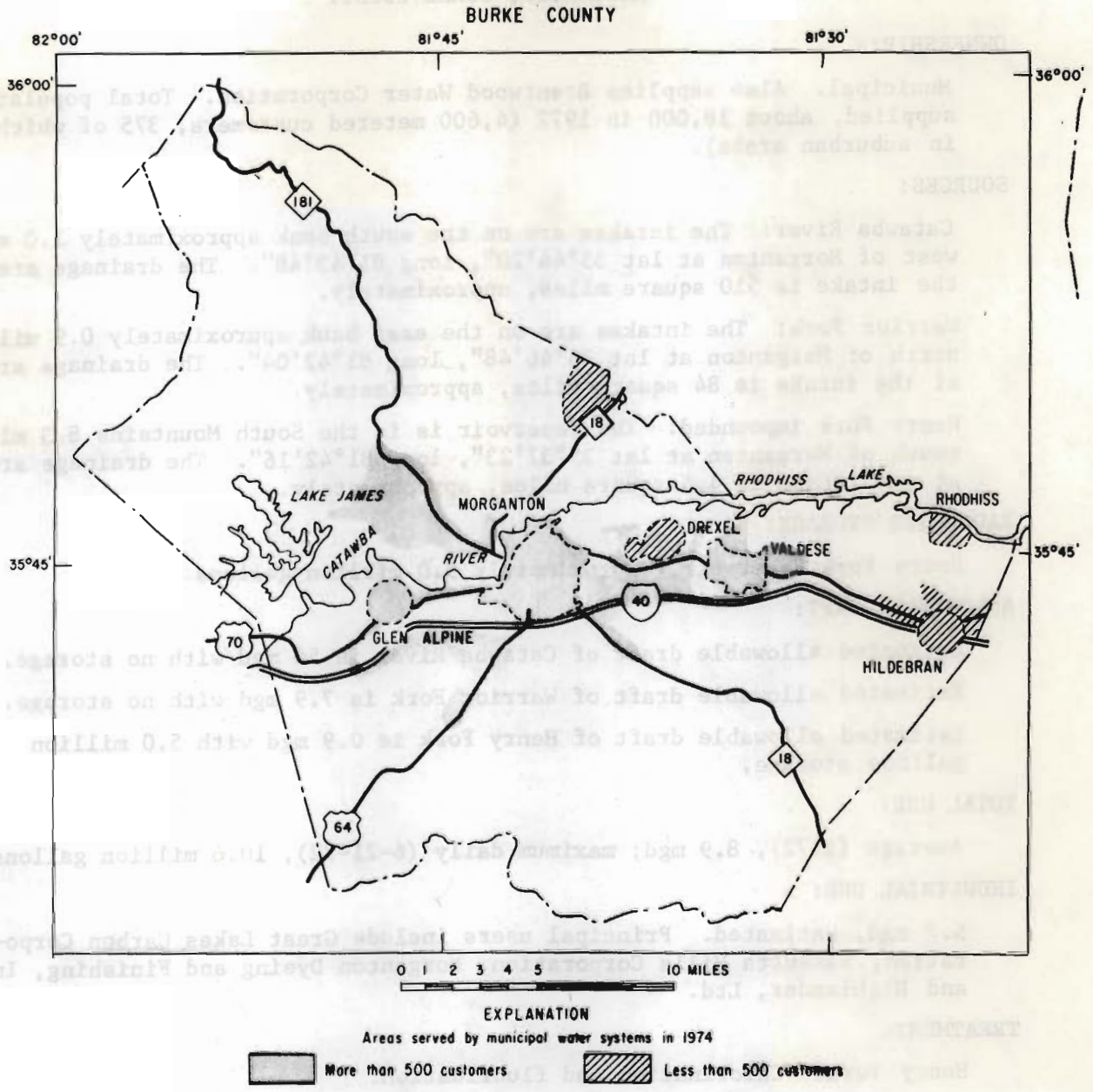
Topography	Average depth (feet)	Average Yield (gpm)
Hilltop	298	5.0
Slope	160	7.0
Flat	175	18
Draw	179	56

BURKE COUNTY

WATER-RESOURCES APPRAISAL

The chemical quality of ground water is good and is acceptable for most domestic and industrial uses with little or no treatment. Usually the water is soft to moderately hard. Locally, iron concentrations exceed 0.3 mg/1.

Ground water will continue to be an important source of supply for small municipalities, water associations, and for industrial and domestic use in areas remote from municipal systems. It is estimated that the amount of ground water available for development is 0.5 mgd per square mile.


BURKE COUNTY
82°00'
81°45'
81°30'
36°00'
35°45'
181
18
LAKE JAMES
CATAWBA
RIVER
MORGANTON
RHODHISS LAKE
RHODHISS
DREXEL
VALDESE
40
70
GLEN ALPINE
HILDEBRAN
64
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

MORGANTON, BURKE COUNTY

OWNERSHIP:

Municipal. Also supplies Brentwood Water Corporation. Total population supplied, about 18,000 in 1972 (4,600 metered customers, 375 of which are in suburban areas).

SOURCES:

Catawba River: The intakes are on the south bank approximately 1.0 mile west of Morganton at lat 35°44'20", long 81°43'48". The drainage area at the intake is 510 square miles, approximately.

Warrior Fork: The intakes are on the east bank approximately 0.9 mile north of Morganton at lat 35°46'48", long 81°42'04". The drainage area at the intake is 84 square miles, approximately.

Henry Fork impounded: The reservoir is in the South Mountains 8.3 miles south of Morganton at lat 35°37'23", long 81°42'16". The drainage area at the intake is 4.5 square miles, approximately.

RAW-WATER STORAGE:

Henry Fork Reservoir, approximately 5.0 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Catawba River is 56 mgd with no storage.

Estimated allowable draft of Warrior Fork is 7.9 mgd with no storage.

Estimated allowable draft of Henry Fork is 0.9 mgd with 5.0 million gallons storage.

TOTAL USE:

Average (1972), 8.9 mgd; maximum daily (6-21-72), 10.6 million gallons.

INDUSTRIAL USE:

6.7 mgd, estimated. Principal users include Great Lakes Carbon Corporation, Wamsutta Mills Corporation, Morganton Dyeing and Finishing, Inc., and Highlander, Ltd.

TREATMENT:

Henry Fork: Chlorination and fluoridation.

Catawba River and Warrior Fork: Prechlorination, coagulation with alum and soda ash, sedimentation, rapid sand and anthracite filtration, adjustment of pH with soda ash, post chlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANTS:

Plant No. 1 (Warrior Fork), 2 mgd.

Plant No. 2 (Catawba River), 6 mgd.

Henry Fork (capacity of gravity line), 1.3 mgd.

PUMPING CAPACITY:

Plant No. 1: Raw water, 4.2 mgd; finished water, 3.8 mgd.

MORGANTON, BURKE COUNTY

Plant No. 2: Raw water, 6.5 mgd; finished water, 13.6 mgd.

Gravity line from Henry Fork, 1.3 mgd.

FINISHED-WATER STORAGE:

Five clear wells, one with 1,000,000 gallons, and 4 with 500,000 gallons each; one elevated tank, 750,000 gallons; two stand pipes, 75,000 gallons each.

FUTURE PLANS:

The capacity of plant No. 2 is being increased to 12 mgd (scheduled completion date January 1974), and a new pump station and a new 24-inch raw water line from the Catawba River are under construction.

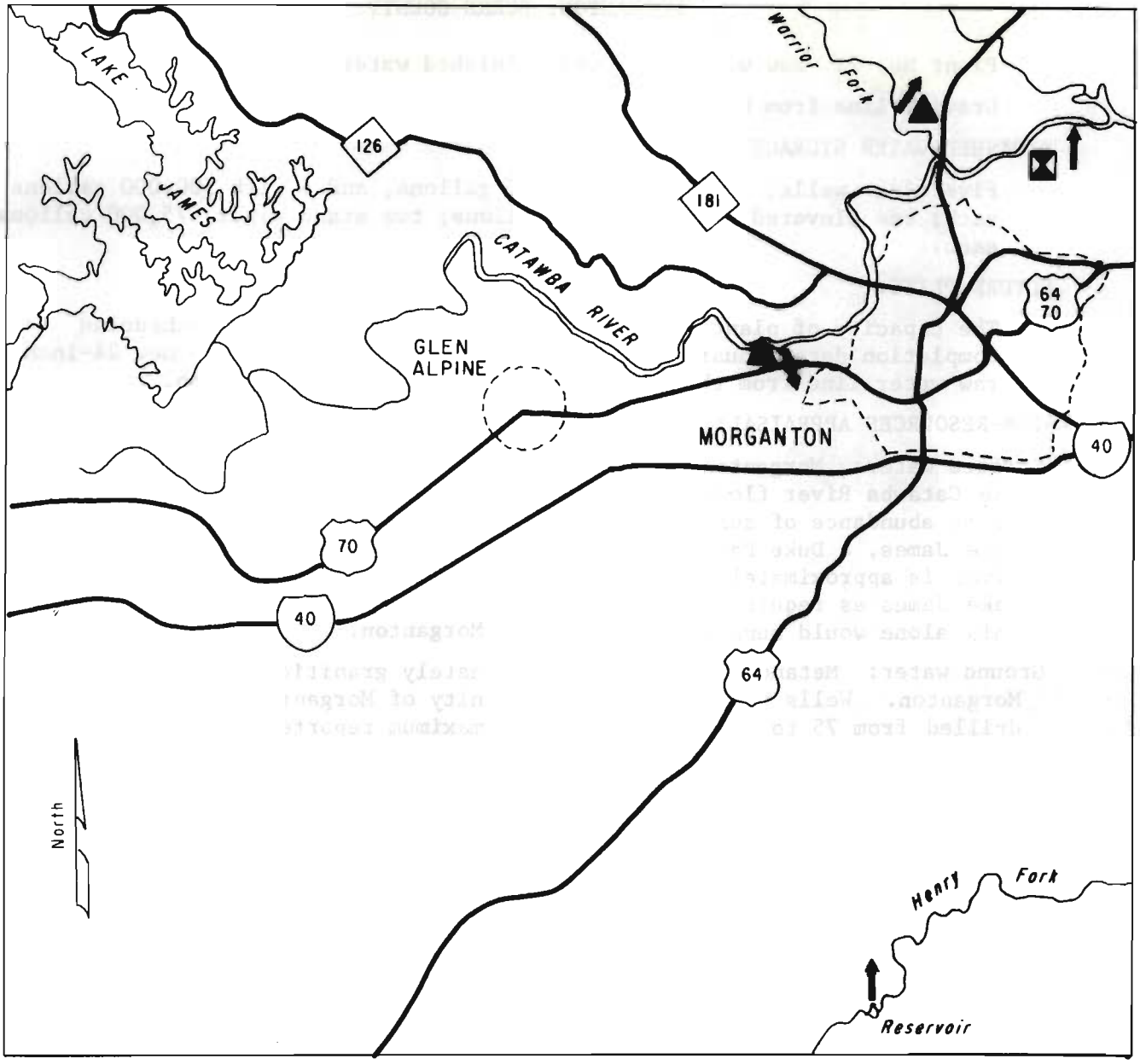
WATER-RESOURCES APPRAISAL:

Surface water: Morganton is in an upland area in central Burke County. The Catawba River flows very near the west and north city limits. There is an abundance of surface water available for the municipal supply. Lake James, a Duke Power Company hydroelectric impoundment on the Catawba River is approximately 8 miles upstream. The minimum daily release from Lake James as required by the Federal Power Commission is 42.6 mgd and this alone would supply ample water to Morganton.

Ground water: Metamorphic rocks, predominately granitic gneiss, underlie Morganton. Wells in the immediate vicinity of Morganton generally are drilled from 75 to 175 feet deep. The maximum reported yield in available records is 20 gpm. If wells are drilled in carefully selected sites, it is probable that considerably higher yields could be obtained. It is estimated that such wells could reasonably be expected to yield 35 gpm or more.

With the abundance of surface water available it is not likely that ground water will be used for the municipal supply. However, the potential exists for development of supplies adequate for small industrial, air conditioning, or supplemental supplies.

CITY OF MORGANTON



MORGANTON, BURKE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Catawba R. Raw	Catawba R. Finished	Warrior Fk. Raw	Warrior Fk. Finished
Date of collection.....	7-27-66	7-27-66	7-27-66	7-27-66
Copper (Cu).....	--------	--------	--------	--------
Cobalt (Co).....	--------	--------	--------	--------
Zinc (Zn).....	--------	--------	--------	--------
Chromium (Cr).....	--------	--------	--------	--------
Boron (B).....	--------	--------	--------	--------
Strontium (Sr).....	--------	--------	--------	--------
Barium (Ba).....	--------	--------	--------	--------
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	--------	--------
Lithium (Li).....	--------	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------	--------
Cyanide (CN).....	--------	--------	--------	--------
Chloride (Cl).....	3.5	7.5	0.5	4.3
Manganese (Mn).....	.02	.01	.02	.01
Iron (Fe).....	.01	.02	.03	.04
Calcium (Ca).....	3.5	3.0	2.6	2.6
Magnesium (Mg).....	1.5	.9	.6	.4
Sodium (Na).....	5.5	17	2.3	15
Potassium (K).....	1.1	1.0	.9	.9
Fluoride (F).....	.0	.1	.2	.2
Silica (SiO_2).....	7.5	7.5	11	11
Bicarbonate (HCO_3).....	21	37	16	34
Carbonate (CO_3).....	0	0	0	0
Sulfate (SO_4).....	3.4	6.8	1.0	8.0
Nitrate (NO_3).....	.6	.3	.3	.2
Dissolved Solids.....	37	108	27	60
Hardness as $CaCO_3$:				
Total.....	15	11	9	8
Noncarbonate.....	0	0	0	0
Alkalinity as $CaCO_3$.....	17	30	13	28
Specific conductance (micromhos at 25° C)....	58	100	29	89
pH.....	6.9	7.3	6.8	7.3
Temperature (°C).....	26	18	27	26

Note: See next page for additional analyses.

MORGANTON, BURKE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Henry Fork Raw	Catawba R. Raw	Catawba R. Finished
Date of collection.....	8- 5-66	5-30-73	5-30-73
Copper (Cu).....	--------	0.030	0.010
Cobalt (Co).....	--------	.000	.000
Zinc (Zn).....	--------	.000	.040
Chromium (Cr).....	--------	.010	.010
Boron (B).....	--------	.010	.020
Strontium (Sr).....	--------	.060	.070
Barium (Ba).....	--------	.000	.050
Mercury (Hg).....	--------	.0001	.0001
Lead (Pb).....	--------	.000	.000
Lithium (Li).....	--------	.000	.000
Cadmium (Cd).....	--------	.000	.000
Arsenic (As).....	--------	.004	.003
Chloride (Cl).....	0.5	--------	--------
Manganese (Mn).....	.02	.000	.000
Iron (Fe).....	.00	.110	.050
Calcium (Ca).....	1.4	--------	--------
Magnesium (Mg).....	.5	--------	--------
Sodium (Na).....	1.4	--------	--------
Potassium (K).....	.8	--------	--------
Fluoride (F).....	.0	--------	--------
Silica (SiO2).....	8.6	--------	--------
Bicarbonate (HCO3).....	9	--------	--------
Carbonate (CO3).....	0	--------	--------
Sulfate (SO4).....	.4	--------	--------
Nitrate (NO3).....	.3	--------	--------
Dissolved Solids.....	21	--------	--------
Hardness as CaCO3:			
Total.....	6	--------	--------
Noncarbonate.....	0	--------	--------
Alkalinity as CaCO3.....	7	--------	--------
Specific conductance (micromhos at 25° C)....	23	--------	--------
pH.....	6.4	--------	--------
Temperature (°C).....	17	--------	--------

OAK HILL WATER CORPORATION, BURKE COUNTY

OWNERSHIP:

Oak Hill Water Corporation. Total population supplied, about 2,400 in 1973 (815 metered customers).

SOURCE:

Six wells (Nos. 1-6).

Well No. 1, Bk 117, located at lat 35°48'18", long 81°45'52". Driller: Southeastern Well Drillers. Date drilled: 1965. Total depth: 225 ft? Diam: 6 in. Cased to: _____. Type finished: open hole. Topography: slope. Aquifer: _____. Static water level: _____. Yield: 68 gpm? Pump setting: _____. Type pump: submersible.

Well No. 2, Bk 118, located at lat 35°48'18", long 81°45'56". Driller: Southeastern Well Drillers. Date drilled: 1965. Total depth: 245 ft? Diam: 6 in. Cased to: _____. Type finish: open hole. Topography: slope. Aquifer: _____. Static water level: _____. Yield: 44 gpm? Pump setting: _____. Type pump: submersible.

Well No. 3, Bk 119, located at lat 35°48'16", long 81°45'54". Driller: Southeastern Well Drillers. Date drilled: 1965. Total depth: 229 ft? Diam: 6 in. Cased to: _____. Type finish: open hole. Topography: slope. Aquifer: _____. Static water level: -----. Yield: 35 gpm? Pump setting: _____. Type pump: submersible.

Well No. 4, Bk 120, located at lat 35°46'57", long 81°45'24". Driller: Southeastern Well Drillers. Date drilled: 1965. Total depth: 524 ft? Diam: 6 in. Cased to: _____. Type finish: open hole. Topography: slope. Aquifer: _____. Static water level: _____. Yield: 37 gpm? Pump setting: _____. Type pump: submersible.

Well No. 5, Bk 121, located at lat 35°47'01", long 81°45'21". Driller: Southeastern Well Drillers. Date drilled: 1965. Total depth: _____. Diameter: 6 in. Cased to: _____. Type finish: open hole. Topography: slope. Aquifer: _____. Static water level: _____. Yield: 29 gpm? Pump setting: _____. Type pump: submersible.

Well No. 6, Bk 122, located at lat 35°46'18", long 81°44'22". Driller: Southeastern Well Drillers. Date drilled: 1965. Total depth: 525 ft. Diam: 6 in. Cased to: 84 ft. Type finish: open hole. Topography: slope. Aquifer: _____. Static water level: _____. Yield: 31 gpm? Pump setting: _____. Type pump: submersible.

TOTAL USE:

Average (1973), 0.12 mgd, estimated; maximum daily not available.

INDUSTRIAL USE:

None.

TREATMENT:

Chlorination at each well.

OAK HILL WATER CORPORATION, BURKE COUNTY

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

0.34 mgd.

RAW-WATER STORAGE:

None.

FINISHED-WATER STORAGE:

One elevated tank, 200,000 gallons; one ground storage tank at the booster pump station, 20,000 gallons.

FUTURE PLANS:

Engineering consultants have recommended the purchase of water from Morganton to meet future demands, or as a second alternative, construction of a treatment facility using Lake James as a source.

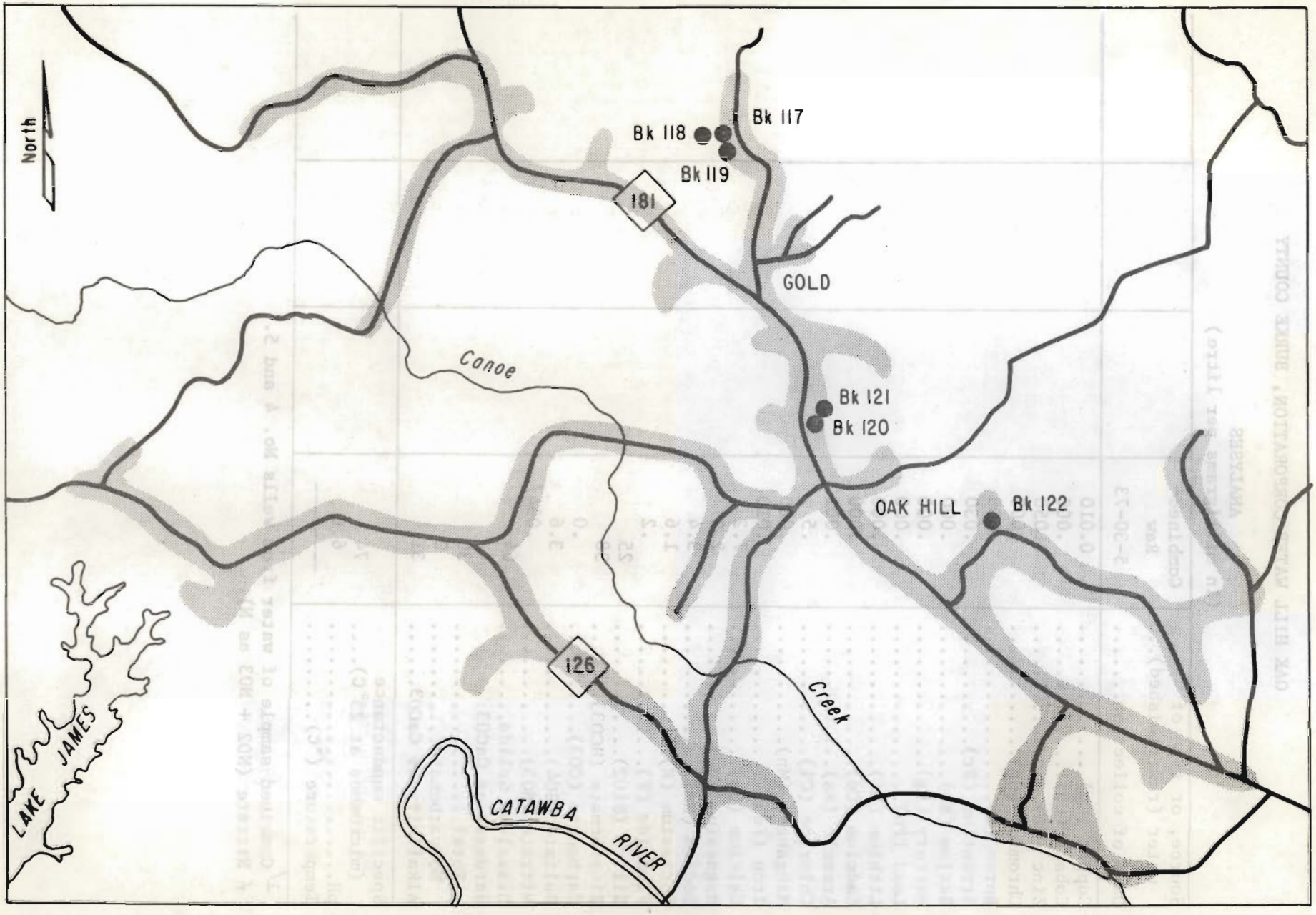
WATER-RESOURCES APPRAISAL:

Surface water: The area served by the Oak Hill Water Corporation is a rural area in central Burke County generally northwest of Morganton. The area is drained by Canoe Creek and other smaller tributaries of the Catawba River. Lake James, a hydroelectric impoundment on the Catawba River, is less than a mile from the west edge of the distribution system. For streams draining the area, the average discharge is 1.0 mgd per square mile, the 7-day, 2-year low flow is 0.32 mgd per square mile, and minimum flows generally exceed 0.15 mgd per square mile. There is ample surface water available if the corporation decided to change sources.

Ground water: Granite and mica-gneiss predominate in the service area of the corporation. Originally 13 wells were drilled and six yielded sufficient water to warrant their use. The yield of the existing wells is adequate to meet the demands of the immediate future. There are numerous sites in the area where conditions are favorable for relatively high yielding wells. Generally, the higher yielding wells are those drilled in draws, sags, and topographically low areas, where the mantle of overlying soil and weathered rock is thickest. It is estimated that the potential supply of ground water available for development is 0.5 mgd per square mile.

The chemical quality of ground water is good and suitable for most uses with little or no treatment. Locally, iron concentrations may be higher than desirable.

OAK HILL WATER CORPORATION



OAK HILL WATER CORPORATION, BURKE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Combined[1] Raw			
Date of collection.....	5-30-73			
Copper (Cu).....	0.010			
Cobalt (Co).....	.000			
Zinc (Zn).....	.050			
Chromium (Cr).....	.000			
Boron (B).....	.008			
Strontium (Sr).....	.030			
Barium (Ba).....	.000			
Mercury (Hg).....	.000			
Lead (Pb).....	.000			
Lithium (Li).....	.000			
Cadmium (Cd).....	.000			
Arsenic (As).....	.001			
Chloride (Cl).....	.5			
Manganese (Mn).....	.000			
Iron (Fe).....	.010			
Calcium (Ca).....	7.2			
Magnesium (Mg).....	2.9			
Sodium (Na).....	3.4			
Potassium (K).....	1.6			
Fluoride (F).....	.2			
Silica (SiO2).....	25			
Bicarbonate (HCO3).....	38			
Carbonate (CO3).....	.0			
Sulfate (SO4).....	3.6			
Nitrate (NO3).....	.094/			
Dissolved Solids.....	64			
Hardness as CaCO3:				
Total.....	30			
Noncarbonate.....	0			
Alkalinity as CaCO3.....	31			
Specific conductance (micromhos at 25° C)....	74			
pH.....	6.6			
Temperature (°C).....	--------			

[1] Combined sample of water from wells No. 4 and 5.
/ Nitrate (NO2 + NO3 as N).

TRIPLE COMMUNITIES WATER CORPORATION, BURKE COUNTY

OWNERSHIP:

Triple Communities Water Corporation. Total population supplied, about 3,000 in 1973 (908 metered customers).

SOURCE:

Three wells (Nos. 1-3).

Well No. 1, Bk 114, located at lat 35°43'53", long 81°36'55". Driller: Southeastern Well Drillers. Date drilled: March 1965. Total depth: 290 ft. Diam: 6 in. Cased to: 60 ft. Type finish: open hole. Topography: hillside. Aquifer: mica-schist? Static water level: 10 ft. Yield: 174 gpm. Pump setting: 250 ft? Type pump: submersible.

Well No. 2, Bk 115, located at lat 35°43'48", long 81°36'58". Driller: Southeastern Well Drillers. Date drilled: March 1965. Total depth: 450 ft. Diam: 6 in. Cased to: 54 ft. Type finish: open hole. Topography: slope. Aquifer: mica-schist? Static water level: flowing when drilled. Yield: 227 gpm. Pump setting: 268 ft. Type pump: submersible.

Well No. 3, Bk 116, located at lat 35°43'46", long 81°36'59". Driller: Southeastern Well Drillers. Date drilled: March 1965. Total depth: 350 ft. Diam: 6 in. Cased to: 61 ft. Type finish: open hole. Topography: slope. Aquifer: mica-schist? Static water level: 27 ft. Yield: 91 gpm. Pump setting: 100 ft. Type pump: submersible.

TOTAL USE:

Average (1973) 0.2 mgd, estimated; maximum daily (5-20-73) 0.234 million gallons.

INDUSTRIAL USE:

Negligible.

TREATMENT:

Filtration, adjustment of pH with caustic soda, addition of potassium permanganate for iron and manganese removal, post chlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

0.32 mgd.

PUMPING CAPACITY:

0.32 mgd.

RAW-WATER STORAGE:

None.

FINISHED-WATER STORAGE:

One clear well, 250,000 gallons; one elevated tank, 50,000 gallons.

TRIPLE COMMUNITIES WATER CORPORATION, BURKE COUNTY

FUTURE PLANS:

Plan to expand distribution system as necessary. Engineering consultant is analyzing the system. Obtaining water from a nearby municipality is under consideration.

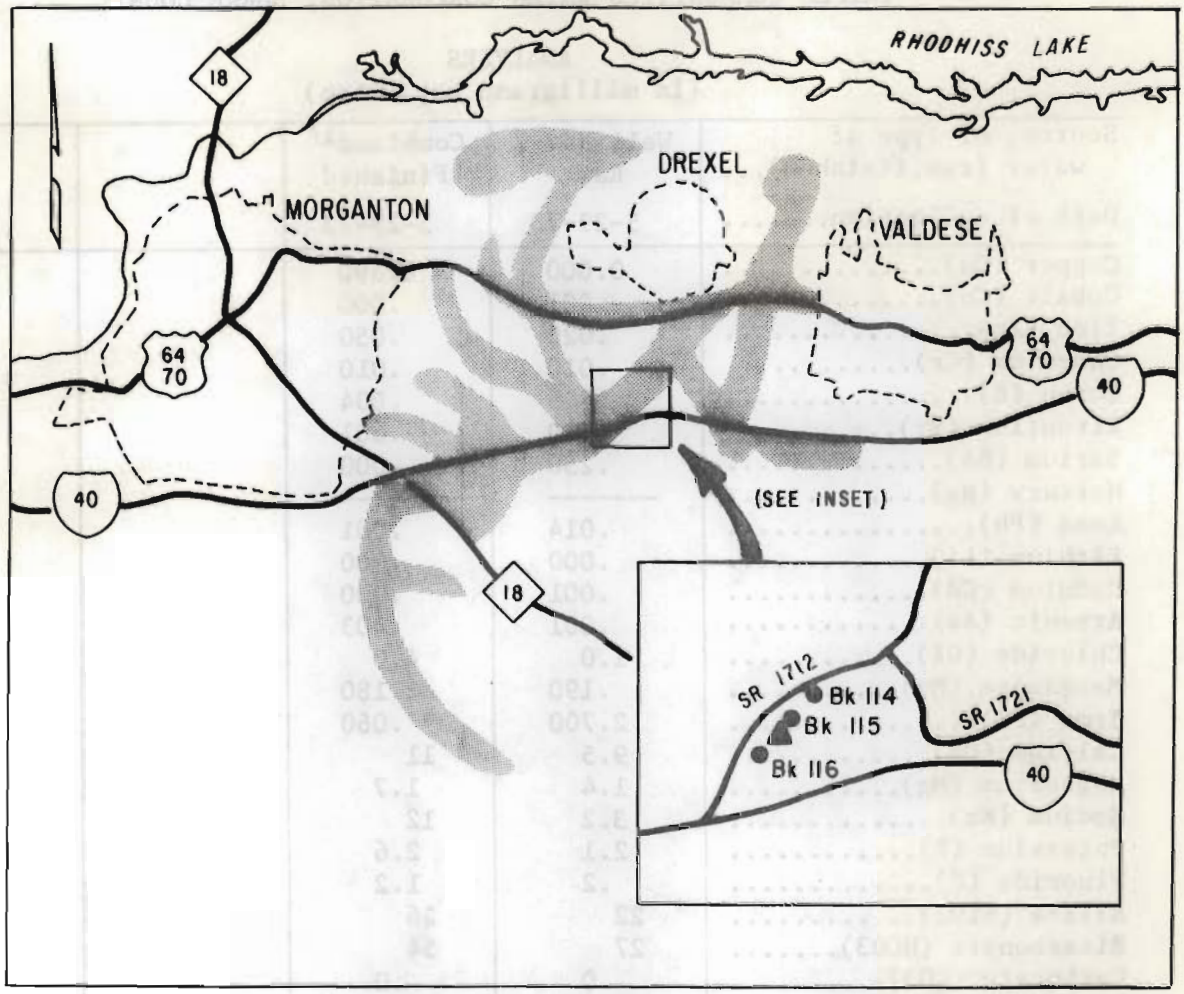
WATER-RESOURCES APPRAISAL:

Surface water: The area served by the corporation is in central Burke County and is generally the rural areas between the cities of Morganton, Valdese, and Drexel. The area is drained by small tributaries of the Catawba River. For all streams draining the area, the average discharge is 1.0 mgd per square mile, the 7-day, 2-year low flow averages 0.30 mgd per square mile, and minimum flows generally exceed 0.14 mgd per square mile. The Catawba River, impounded in Rhodhiss Lake is within 1 mile of the distribution system and would be the most reliable source if the corporation should decide to use surface water.

Ground water: The present source of supply is three wells ranging in depth from 290 to 450 ft, and in yield from 91 to 227 gpm. The yield of the wells is adequate to supply the demand but excessive iron concentrations are causing problems. Iron-concentrations as much as 7.5 mg/l have been observed in water from one well.

Obtaining water from one of the nearby municipalities is under consideration.

TRIPLE COMMUNITIES WATER CORPORATION



TRIPLE COMMUNITIES WATER CORPORATION, BURKE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 2 Raw	Combined[1] Finished		
Date of collection.....	5-29-73	5-29-73		
Copper (Cu).....	0.000	0.590		
Cobalt (Co).....	.001	.000		
Zinc (Zn).....	.020	.050		
Chromium (Cr).....	.010	.010		
Boron (B).....	.005	.004		
Strontium (Sr).....	.080	.001		
Barium (Ba).....	.250	.000		
Mercury (Hg).....	-------	-------		
Lead (Pb).....	.014	.001		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.001	.000		
Arsenic (As).....	.001	.003		
Chloride (Cl).....	1.0	4.0		
Manganese (Mn).....	.190	.180		
Iron (Fe).....	2.700	.060		
Calcium (Ca).....	9.5	11		
Magnesium (Mg).....	1.4	1.7		
Sodium (Na).....	3.2	12		
Potassium (K).....	2.1	2.6		
Fluoride (F).....	.2	1.2		
Silica (SiO2).....	22	26		
Bicarbonate (HCO3).....	27	54		
Carbonate (CO3).....	.0	.0		
Sulfate (SO4).....	12	11		
Nitrate (NO3).....	.0	.0		
Dissolved Solids.....	78	96		
Hardness as CaCO3:				
Total.....	30	34		
Noncarbonate.....	8	0		
Alkalinity as CaCO3.....	22	44		
Specific conductance (micromhos at 25° C)....	80	130		
pH.....	6.2	6.9		
Temperature (°C).....	-------	-------		

[1] Combined sample of water from wells 1, 2 and 3.

VALDESE, BURKE COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 4,700 in 1972 (1,500 metered customers, 95 of which are located in suburban areas). Also supplies Rutherford College Water Corporation which has 250 metered customers.

SOURCE:

Catawba River impounded in Rhodhiss Lake: The intakes are about 2-1/2 miles north of Valdese at lat 35°46'27", long 81°33'34". Rhodhiss Lake is used for hydroelectric power development by Duke Power Company. The drainage area at the dam is 1,090 square miles, approximately.

RAW-WATER STORAGE:

Rhodhiss Lake, 23.8 billion gallons.

ALLOWABLE DRAFT:

Not determined. There are no contractual restrictions as to the amount of water that can be withdrawn from Rhodhiss Lake.

TOTAL USE:

Average (1972), 3.0 mgd, metered; maximum daily (6-23-72), 6.25 million gallons.

INDUSTRIAL USE:

2.6 mgd, estimated. Principal users include Valdese Manufacturing Company, Inc., Burke Yarns, Inc., and Francis Louise, Inc.

TREATMENT:

Prechlorination, coagulation with alum and caustic soda, sedimentation, addition of potasium permanganate for control of taste and odor, rapid sand and anthra-filt filtration, adjustment of pH with caustic soda, post chlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

8.0 mgd.

FINISHED-WATER STORAGE:

Three clear wells, 500,000, 250,000, and 250,000 gallons; two ground storage tanks, 1,000,000 and 500,000 gallons.

FUTURE PLANS:

Within next 5 years plan to: (1) install new raw and finished water pumps; (2) install a new raw water line, (3) construct additional settling basins, and (4) possibly construct additional filters to increase the treatment plant capacity to 15 mgd.

WATER-RESOURCES APPRAISAL:

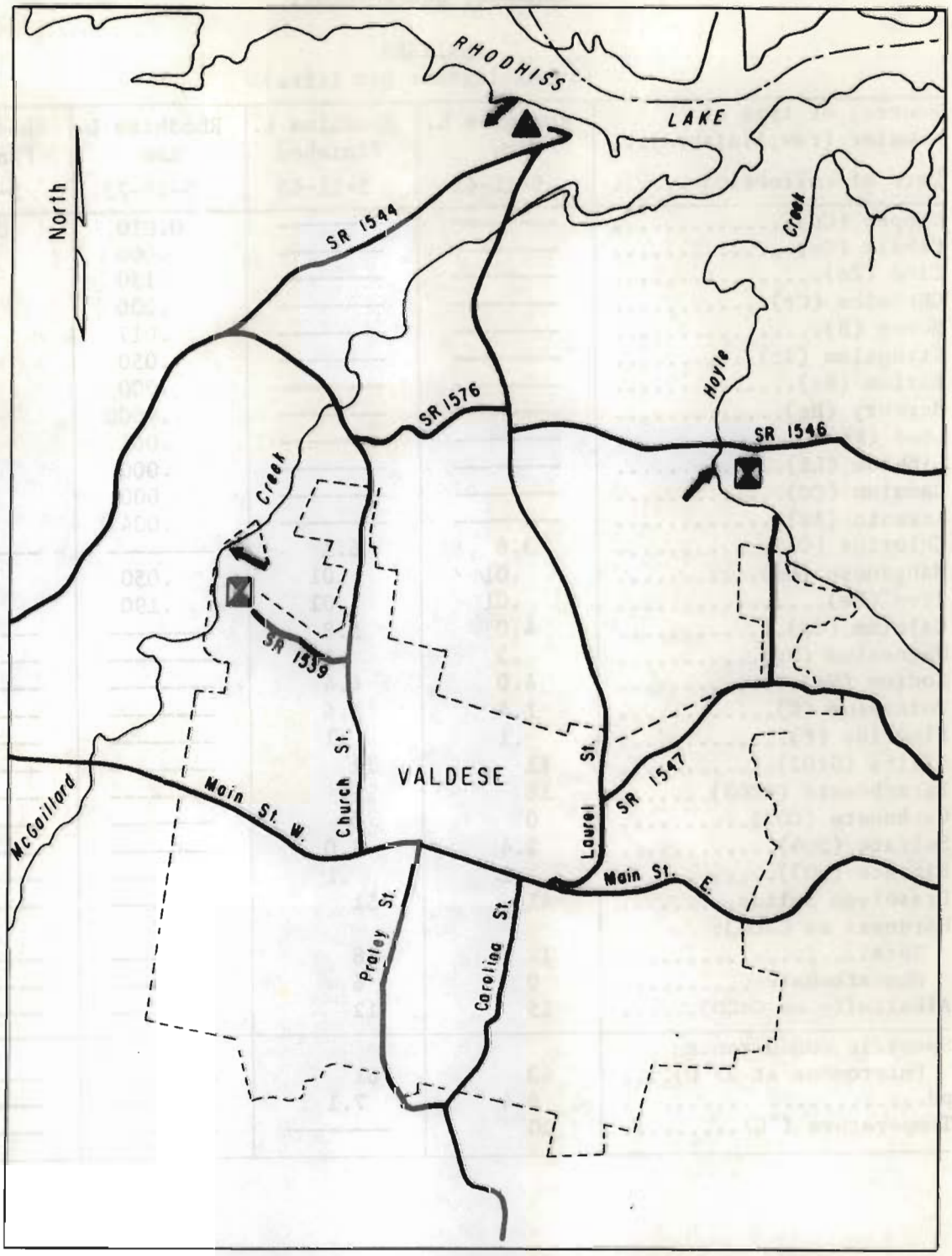
Surface water: There is an abundance of surface water available for the municipal supply. The minimum flow of the Catawba River is adequate to supply the demand for the foreseeable future.

VALDESE, BURKE COUNTY

Ground water: Mica schist is the predominant rock type underlying Valdese. Wells in the immediate vicinity of the city are usually less than 200 feet deep. No well yield data is available. However, if wells are drilled in carefully selected sites, and spaced to prevent pumping interference, yields of 35 gpm or more can reasonably be expected.

With the abundance of surface water available it is not likely that ground water will be used for municipal supply.

CITY OF VALDESE



VALDESE, BURKE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Rhodhiss L. Raw	Rhodhiss L. Finished	Rhodhiss L. Raw	Rhodhiss L. Finished
Date of collection.....	5-11-65	5-11-65	5-29-73	5-29-73
Copper (Cu).....	--------	--------	0.010	0.010
Cobalt (Co).....	--------	--------	.000	.000
Zinc (Zn).....	--------	--------	.150	.040
Chromium (Cr).....	--------	--------	.000	.010
Boron (B).....	--------	--------	.017	.010
Strontium (Sr).....	--------	--------	.050	.080
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	.0000	.0000
Lead (Pb).....	--------	--------	.001	.001
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.004	.003
Chloride (Cl).....	3.6	6.1	--------	--------
Manganese (Mn).....	.01	.01	.050	.080
Iron (Fe).....	.01	.01	.190	.010
Calcium (Ca).....	4.0	5.8	--------	--------
Magnesium (Mg).....	.3	.7	--------	--------
Sodium (Na).....	4.0	4.4	--------	--------
Potassium (K).....	1.4	1.6	--------	--------
Fluoride (F).....	.1	.1	--------	--------
Silica (SiO2).....	11	11	--------	--------
Bicarbonate (HCO3).....	18	15	--------	--------
Carbonate (CO3).....	0	0	--------	--------
Sulfate (SO4).....	2.4	8.0	--------	--------
Nitrate (NO3).....	.1	.1	--------	--------
Dissolved Solids.....	41	51	--------	--------
Hardness as CaCO3:				
Total.....	12	18	--------	--------
Noncarbonate.....	0	6	--------	--------
Alkalinity as CaCO3.....	15	12	--------	--------
Specific conductance (micromhos at 25° C)....	43	61	--------	--------
pH.....	6.4	7.1	--------	--------
Temperature (°C).....	20	--------	--------	--------

CALDWELL COUNTY

WATER-RESOURCES APPRAISAL

Caldwell County is in northwestern North Carolina. The northern two-thirds of the county is mountainous, while the southern third consists of undulating to rolling country typical of the Piedmont province. Land and stream slopes are relatively steep and drainage is good. The northeast quarter is drained by the Yadkin River and its tributaries, and the remainder is drained by the Catawba River and its tributaries. Flow of the Catawba River is highly regulated by hydroelectric impoundments, two of which, Rhodhiss Lake and Lake Hickory, form the southern boundary. The average discharge of streams ranges from 1.3 mgd per square mile for those whose headwaters are in the mountains in the west to 0.8 mgd per square mile for those in the east. For all streams, minimum flows generally exceed 0.15 mgd per square mile, and 7-day, 2-year low flows average 0.30 mgd per square mile.

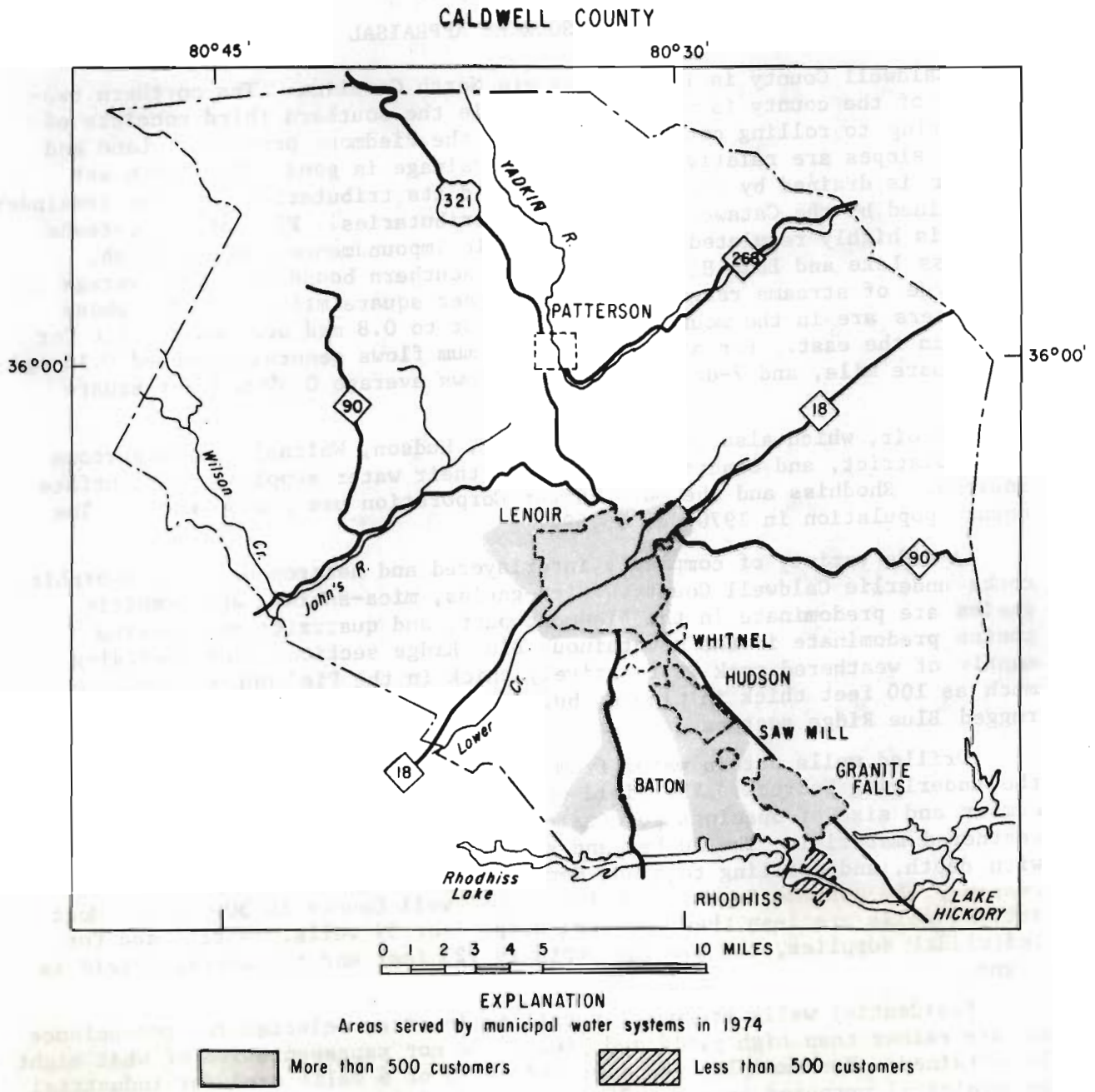
Lenoir, which also supplies Saw Mill, Hudson, Whitnel and Harpertown Water District, and Granite Falls obtain their water supplies from surface sources. Rhodhiss and the Baton Water Corporation use ground water. The county population in 1970 was 56,699.

A wide variety of complexly interlayered and heterogeneous metamorphic rocks underlie Caldwell County. Mica-gneiss, mica-schist, and granitic gneiss are predominate in the Piedmont part, and quartzite and layered gneiss predominate in the mountainous Blue Ridge section. The overlying mantle of weathered rock is relatively thick in the Piedmont section, as much as 100 feet thick in places, but is relatively thin or absent in the rugged Blue Ridge section.

Drilled wells obtain water from fractures and other small openings in the underlying bedrock. The yield of wells is largely dependent on the number and size of openings penetrated and to the thickness of overlying weathered material. The number and size of openings in the bedrock decreases with depth, and drilling to great depths is usually not warranted. On the average, the optimum depth for wells in Caldwell County is 300 feet. Most drilled wells are less than 200 feet deep. For 59 wells, mostly used for individual supplies, the average depth is 123 feet and the average yield is 9 gpm.

Residential wells are usually drilled in sites selected for convenience of use rather than high yield and yields are not representative of what might be obtained. For example, the reported yield of 6 wells used for industrial or municipal purposes averages 74 gpm. Wells drilled in favorable sites, such as draws, sags, and narrow linear valleys, where the overlying mantle of weathered rock is thickest, can reasonably be expected to yield 35 gpm or more.

The chemical quality of ground water is generally excellent. Locally, iron concentrations may be higher than desirable.


CALDWELL COUNTY
80°45'
80°30'
36°00'
36°00'
321
YADKIN R.
268
PATTERSON
90
18
WILSON CR.
JOHN'S R.
LENOIR
90
WHITNEL
HUDSON
SAW MILL
GRANITE FALLS
BATON
LOWER CR.
18
RHODHISS LAKE
RHODHISS
LAKE HICKORY
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

BATON WATER CORPORATION, CALDWELL COUNTY

OWNERSHIP:

Baton Water Corporation. Also supplies North Catawba Community. Total population supplied, about 1,800 in 1973 (566 metered customers).

SOURCE:

Three wells (Nos. 1-3).

Well No. 1, Cd 101, located at lat 35°48'18", long 81°31'45". Driller: Smith Well and Pump Co. Date drilled: 1968. Total depth: 253 ft. Diam: 6 in. Cased to: 120 ft? Type finish: open hole. Topography: draw. Aquifer: _____. Static water level: 28 ft. Yield: 75 gpm. Pump setting: 200 ft? Type pump: turbine.

Well No. 2, Cd 102, located at lat 35°48'16", long 81°32'01". Driller: Smith Well and Pump Co. Date drilled: 1968. Total depth: 203 ft. Diam: 6 in. Cased to: 90 ft? Type finish: open hole. Topography: draw. Aquifer: _____. Static water level: 30 ft. Yield: 100 gpm. Pump setting; 150 ft? Type pump: turbine.

Well No. 3, Cd 103, located at lat 35°48'50", long 81°33'00". Driller: Smith Well and Pump Co. Date drilled: Nov. 1971. Total depth 320 ft. Diam: 8 in. Cased to: 30 ft. Type finish: open hole. Topography: valley slope. Aquifer: _____. Static water level: 35 ft. Yield: 79 gpm. Pump setting: 300 ft? Type pump: submersible.

TOTAL USE:

Average (1973) 0.15 mgd, estimated; maximum daily not available.

INDUSTRIAL USE:

None.

TREATMENT:

Chlorination.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Approximately 0.29 mgd.

RAW-WATER STORAGE:

None.

FINISHED-WATER STORAGE:

One ground storage tank, 150,000 gallons.

FUTURE PLANS:

Plan to drill another well in 1974 and to extend distribution system as necessary.

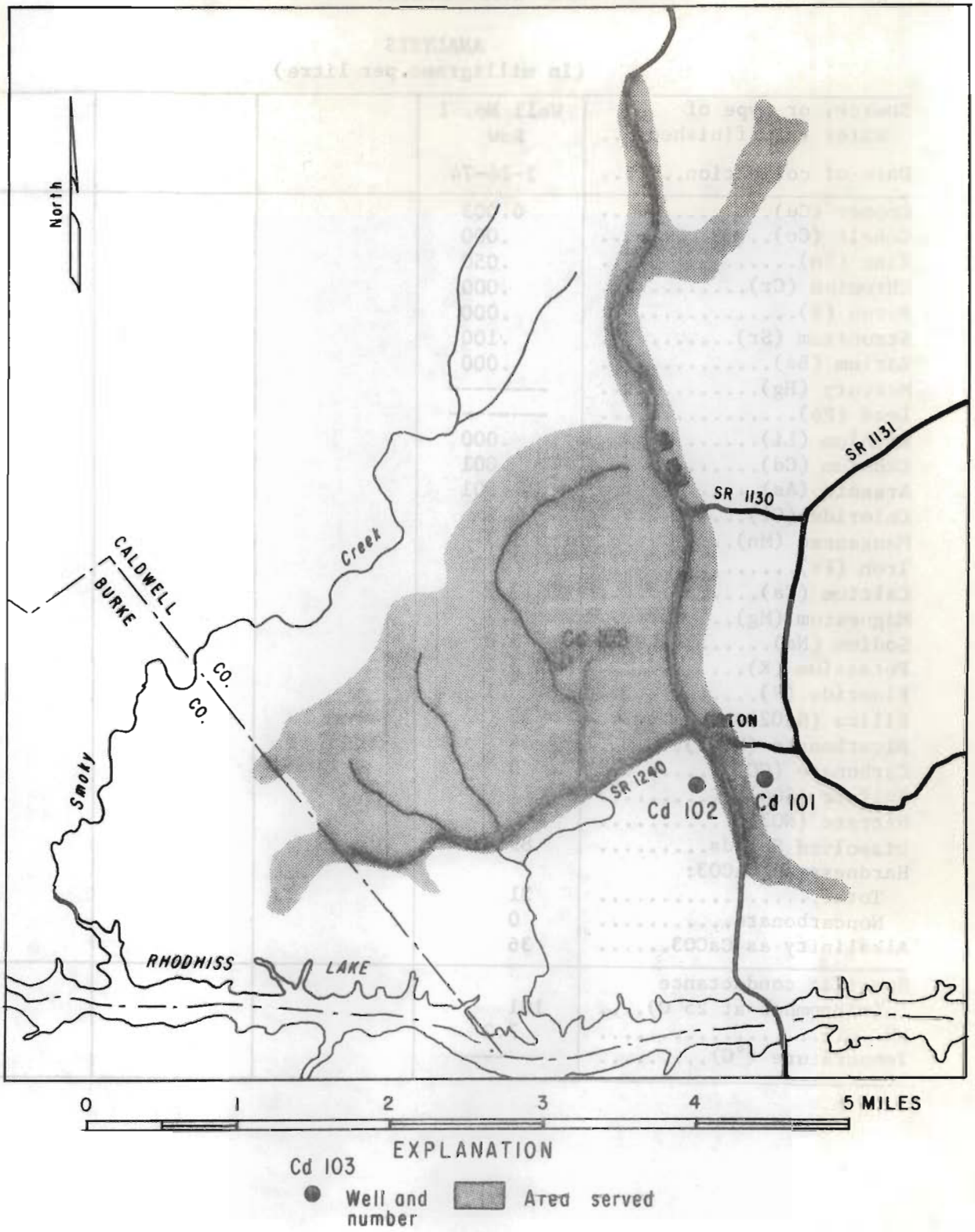
BATON WATER CORPORATION, CALDWELL COUNTY

WATER-RESOURCES APPRAISAL:

Surface water: The area served by the Baton Water Corporation is in south Caldwell County. The area is drained by tributaries of the Catawba River. The distribution system is within one half mile of Rhodhiss Lake, a Duke Power Co. hydroelectric impoundment on the Catawba River. If the corporation decided to use surface water in the future, Rhodhiss Lake would be the most abundant source.

Ground water: Mica-schist is the predominant rock underlying the area served by the Baton Water Corporation. The average depth of wells used by the corporation is 258 feet and the average reported yield is 84.6 gpm. The relative high yields reported can be attributed to careful selection of well sites. There are numerous sites in the service area where wells with yields equally as good can reasonably be expected. It is estimated that the amount of ground water available for development is 0.55 mgd per square mile.

BATON WATER CORPORATION



BATON WATER CORPORATION, CALDWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 1 Raw			
Date of collection.....	2-26-74			
Copper (Cu).....	0.003			
Cobalt (Co).....	.000			
Zinc (Zn).....	.050			
Chromium (Cr).....	.000			
Boron (B).....	.000			
Strontium (Sr).....	.100			
Barium (Ba).....	.000			
Mercury (Hg).....	--------			
Lead (Pb).....	--------			
Lithium (Li).....	.000			
Cadmium (Cd).....	.001			
Arsenic (As).....	.001			
Chloride (Cl).....	.9			
Manganese (Mn).....	1.7			
Iron (Fe).....	.33			
Calcium (Ca).....	9.6			
Magnesium (Mg).....	1.7			
Sodium (Na).....	5.8			
Potassium (K).....	3.2			
Fluoride (F).....	.1			
Silica (SiO2).....	33			
Bicarbonate (HCO3).....	44			
Carbonate (CO3).....	0			
Sulfate (SO4).....	11			
Nitrate (NO3).....	0			
Dissolved Solids.....	89			
Hardness as CaCO3:				
Total.....	31			
Noncarbonate.....	0			
Alkalinity as CaCO3.....	36			
Specific conductance (micromhos at 25° C)....	101			
pH.....	7.2			
Temperature (°C).....	-------			

GRANITE FALLS, CALDWELL COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 2,800 in 1973 (900 metered customers, 4 of which are in suburban areas).

SOURCE:

Catawba River impounded in Rhodhiss Lake: The intakes are about 0.5 mile southwest of Granite Falls at lat 35°47'12", long 81°26'29". Rhodhiss Lake is used for hydroelectric power generation by Duke Power Company. The drainage area at the dam is 1,090 square miles, approximately.

RAW-WATER STORAGE:

Rhodhiss Lake, 23.8 billion gallons.

ALLOWABLE DRAFT:

Not determined. There are no contractual limitations on the amount of water that can be withdrawn from Rhodhiss Lake.

TOTAL USE:

Average (1972), 0.32 mgd, metered; maximum daily (10-30-72), 0.53 million gallons.

INDUSTRIAL USE:

0.03 mgd, estimated. Principal users include Granite Bottling Works and Hammary Furniture Division of U. S. Industries.

TREATMENT:

Prechlorination, coagulation with alum, sedimentation, rapid sand and anthrafilt filtration, addition of phosphate compounds for corrosion control, adjustment of pH with lime, and post-chlorination when necessary.

RATED CAPACITY OF TREATMENT PLANT:

0.6 mgd.

PUMPING CAPACITY:

Raw water, 0.6 mgd; finished water, 0.6 mgd.

FINISHED-WATER STORAGE:

Two clear wells, 200,000 and 125,000 gallons. Two elevated tanks, 200,000 and 115,000 gallons.

FUTURE PLANS:

None.

WATER-RESOURCES APPRAISAL:

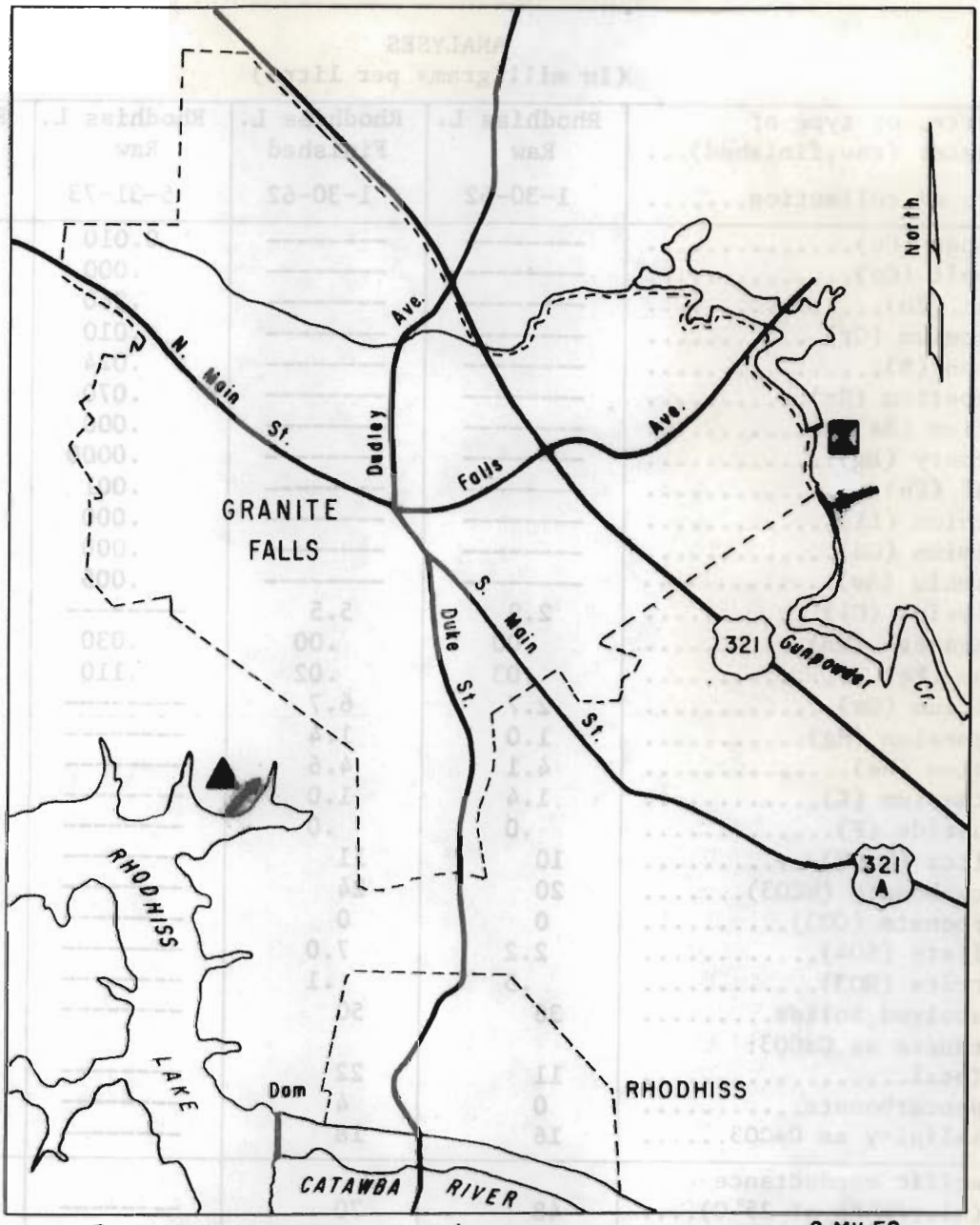
Surface water: Water is obtained from Rhodhiss Lake, a Duke Power Company hydroelectric impoundment on the Catawba River. The minimum flow of the Catawba River is ample to meet the needs of Granite Falls for the foreseeable future.

GRANITE FALLS, CALDWELL COUNTY

Ground water: Granite Falls is predominately underlain by mica-gneiss. Wells in the immediate vicinity of the city are normally drilled 50 to 175 feet deep and yields as much as 100 gpm have been reported.

With the abundance of surface water available, it is not likely that ground water will be used for municipal water supply. However, the potential exists to develop supplies of 0.04 to 0.05 mgd per well.

CITY OF GRANITE FALLS



GRANITE FALLS, CALDWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Rhodhiss L. Raw	Rhodhiss L. Finished	Rhodhiss L. Raw	Rhodhiss L. Finished
Date of collection.....	1-30-62	1-30-62	5-31-73	5-31-73
Copper (Cu).....	--------	--------	0.010	0.000
Cobalt (Co).....	--------	--------	.000	.000
Zinc (Zn).....	--------	--------	.260	.030
Chromium (Cr).....	--------	--------	.010	.010
Boron (B).....	--------	--------	.024	.018
Strontium (Sr).....	--------	--------	.070	.070
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	.0000	.0000
Lead (Pb).....	--------	--------	.001	.002
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.005	.003
Chloride (Cl).....	2.9	5.5	--------	--------
Manganese (Mn).....	.00	.00	.030	.030
Iron (Fe).....	.03	.02	.110	.010
Calcium (Ca).....	2.7	6.7	--------	--------
Magnesium (Mg).....	1.0	1.4	--------	--------
Sodium (Na).....	4.1	4.6	--------	--------
Potassium (K).....	1.4	1.0	--------	--------
Fluoride (F).....	.0	.0	--------	--------
Silica (SiO2).....	10	11	--------	--------
Bicarbonate (HCO3).....	20	24	--------	--------
Carbonate (CO3).....	0	0	--------	--------
Sulfate (SO4).....	2.2	7.0	--------	--------
Nitrate (NO3).....	.5	.1	--------	--------
Dissolved Solids.....	36	50	--------	--------
Hardness as CaCO3:				
Total.....	11	22	--------	--------
Noncarbonate.....	0	4	--------	--------
Alkalinity as CaCO3.....	16	18	--------	--------
Specific conductance (micromhos at 25° C)....	48	70	--------	--------
pH.....	6.6	7.3	--------	--------
Temperature (°C).....	--------	--------	--------	--------

LENOIR, CALDWELL COUNTY

OWNERSHIP:

Municipal. Also supplies Saw Mill, Hudson, Whitnel, and Harpertown Water District. Total population supplied, about 22,000 in 1973 (4,300 metered customers including those in Whitnel).

SOURCES:

Catawba River impounded in Rhodhiss Lake: the intakes are on the north side of the lake approximately 3 miles upstream from the dam at lat 35°47'00", long 81°28'58". Rhodhiss Lake is primarily used for hydroelectric power generation by Duke Power Company. The drainage area at the intakes is 1,090 square miles, approximately.

Zacks Fork Creek impounded by a low dam (pumping pool only): The intakes are approximately 1/4 mile northwest of Lenoir at lat 35°56'05", long 81°31'32". The drainage area at the intakes is 8.7 square miles, approximately.

RAW-WATER STORAGE:

Rhodhiss Lake, 23.8 billion gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Zacks Fork Creek is 1.0 mgd with no storage. Estimated allowable draft of Rhodhiss Lake not determined. There are no contractual limitations on the amount of water that can be withdrawn.

TOTAL USE:

Average (1972-73) 3.21 mgd, metered; maximum daily (date not available) 4.7 million gallons.

INDUSTRIAL USE:

1.2 mgd, estimated. Principal users include Lenoir Furniture Corporation, Consolidated Furniture Corporation, Harper Furniture Corporation, American Effird Corporation, and Rospatch Industries.

TREATMENT:

Prechlorination, coagulation with alum and caustic soda, addition of carbon for control of taste and odor, rapid anthracite filtration, addition of phosphate compounds for corrosion control, adjustment of pH with caustic soda, post chlorination when necessary, and fluoridation. At the Rhodhiss Plant, postassium permanganate is added for control of taste and odor.

RATED CAPACITY OF TREATMENT PLANTS:

Rhodhiss plant, 3.0 mgd.

Zacks Fork plant, 1.5 mgd.

PUMPING CAPACITY:

Rhodhiss Plant: Raw water 4.5 mgd; finished water, 3.0 mgd.

Zacks Fork Plant: Raw water, 1.8 mgd; finished water, 3.1 mgd.

LENOIR, CALDWELL COUNTY

FINISHED-WATER STORAGE:

Two clear wells, 500,000 and 150,000 gallons; three elevated tanks, 1,000,000, 1,000,000 and 500,000 gallons.

FUTURE PLANS:

Plans include: An additional 3.0 million finished water storage; expanding capacity of the Rhodhiss plant to 12.0 mgd; a 24 inch water line from the Rhodhiss plant to town; and a 500,000 gallons storage tank at Whitnell. Implementation of plans is scheduled for May 1974.

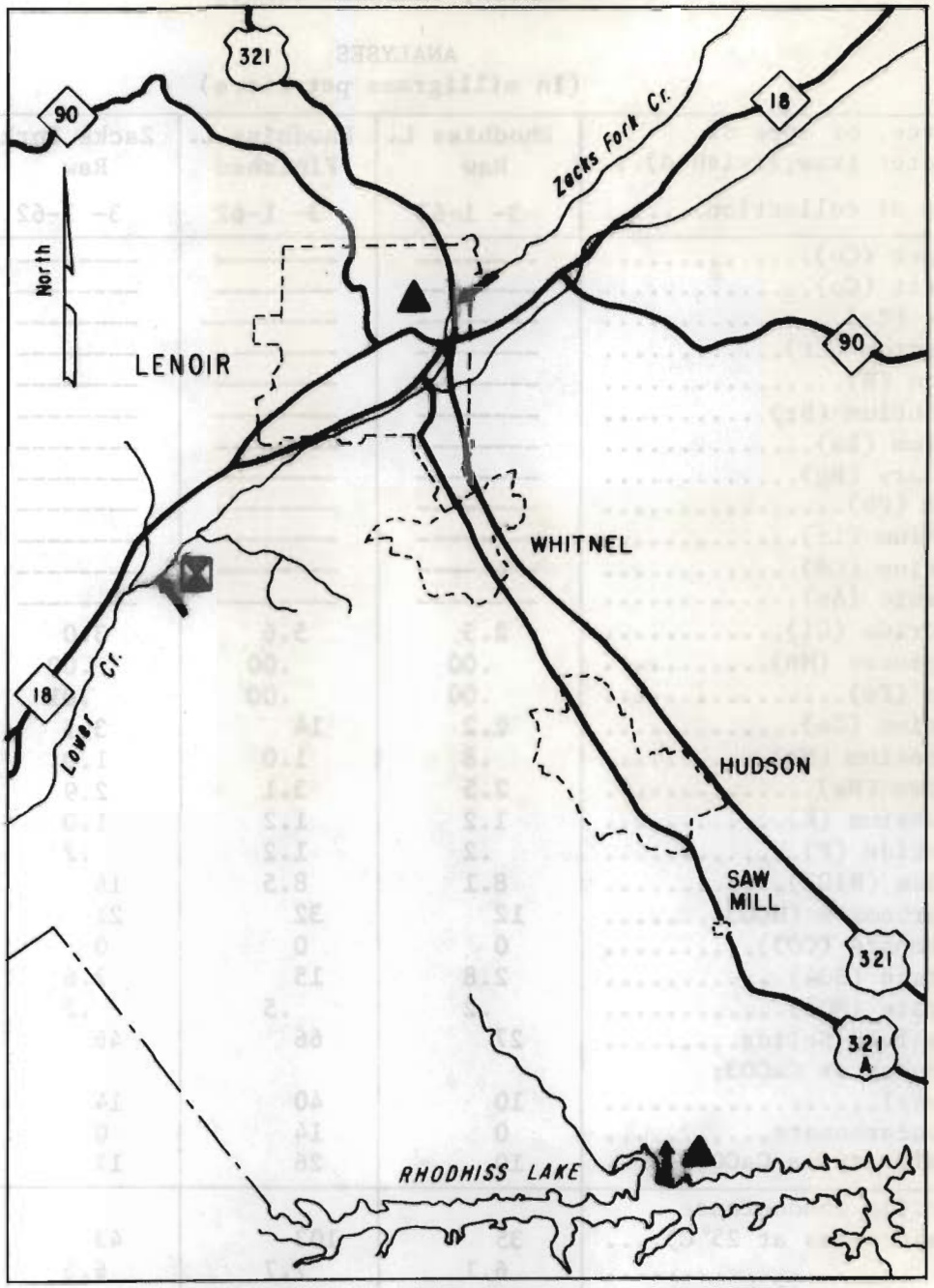
WATER-RESOURCES APPRAISAL:

Surface water: Lenoir obtains water from Zacks Fork Creek and Rhodhiss Lake, a Duke Power Company hydroelectric impoundment. When the expansion of the treatment plant on Rhodhiss Lake is complete, the Zacks Fork plant will be abandoned. The minimum flow of the Catawba River is ample to meet the needs of Lenoir for the foreseeable future.

Ground-water: Granitic-gneiss is the predominate rock underlying Lenoir. Based on records of well casing length, the overlying mantle of weathered rock exceeds 75 feet in places. Wells are normally drilled between 75 and 200 feet deep. Reported well yields are low, averaging 10 gpm, because most serve individual homes.

With the abundance of surface water available, it is not likely that ground water will be used for municipal supply. However, the potential exists for development of moderate supplies of 0.04 to 0.05 mgd per well. This amount of water is adequate for many purposes.

CITY OF LENOIR



LENOIR, CALDWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Rhodhiss L. Raw	Rhodhiss L. Finished	Zacks Fork Raw	Zacks Fork Finished
Date of collection.....	3- 1-62	3- 1-62	3- 1-62	3- 1-62
Copper (Cu).....	--------	--------	--------	--------
Cobalt (Co).....	--------	--------	--------	--------
Zinc (Zn).....	--------	--------	--------	--------
Chromium (Cr).....	--------	--------	--------	--------
Boron (B).....	--------	--------	--------	--------
Strontium (Sr).....	--------	--------	--------	--------
Barium (Ba).....	--------	--------	--------	--------
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	--------	--------
Lithium (Li).....	--------	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------	--------
Arsenic (As).....	--------	--------	--------	--------
Chloride (Cl).....	2.5	5.6	3.0	4.5
Manganese (Mn).....	.00	.00	.00	.00
Iron (Fe).....	.00	.00	.01	.00
Calcium (Ca).....	2.2	14	3.5	10
Magnesium (Mg).....	.8	1.0	1.0	1.4
Sodium (Na).....	2.5	3.1	2.9	3.4
Potassium (K).....	1.2	1.2	1.0	1.1
Fluoride (F).....	.2	1.2	.2	1.1
Silica (SiO2).....	8.1	8.5	16	16
Bicarbonate (HCO3).....	12	32	21	30
Carbonate (CO3).....	0	0	0	0
Sulfate (SO4).....	2.8	15	2.6	8.0
Nitrate (NO3).....	.2	.5	.2	.6
Dissolved Solids.....	27	66	46	66
Hardness as CaCO3:				
Total.....	10	40	14	32
Noncarbonate.....	0	14	0	7
Alkalinity as CaCO3.....	10	26	17	25
Specific conductance (micromhos at 25° C)....	35	103	43	82
pH.....	6.1	7.7	6.5	7.5
Temperature (°C).....	--------	--------	--------	--------

LENOIR, CALDWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Rhodhiss L. Raw	Rhodhiss L. Finished		
Date of collection.....	10-17-73	10-17-73		
Copper (Cu).....	0.002	0.007		
Cobalt (Co).....	.000	.000		
Zinc (Zn).....	.030	.100		
Chromium (Cr).....	.000	.000		
Boron (B).....	.040	.200		
Strontium (Sr).....	.060	.050		
Barium (Ba).....	.000	.000		
Mercury (Hg).....	.0000	.0001		
Lead (Pb).....	.003	.003		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.000	.000		
Arsenic (As).....	.002	.000		
Chloride (Cl).....	--------	--------		
Manganese (Mn).....	.000	.000		
Iron (Fe).....	.120	.020		
Calcium (Ca).....	--------	--------		
Magnesium (Mg).....	--------	--------		
Sodium (Na).....	--------	--------		
Potassium (K).....	--------	--------		
Fluoride (F).....	--------	--------		
Silica (SiO_2).....	--------	--------		
Bicarbonate (HCO_3).....	--------	--------		
Carbonate (CO_3).....	--------	--------		
Sulfate (SO_4).....	--------	--------		
Nitrate (NO_3).....	--------	--------		
Dissolved Solids.....	--------	--------		
Hardness as $CaCO_3$:				
Total.....	--------	--------		
Noncarbonate.....	--------	--------		
Alkalinity as $CaCO_3$.....	--------	--------		
Specific conductance (micromhos at 25° C)....	--------	--------		
pH.....	--------	--------		
Temperature (°C).....	--------	--------		

CHEROKEE COUNTY

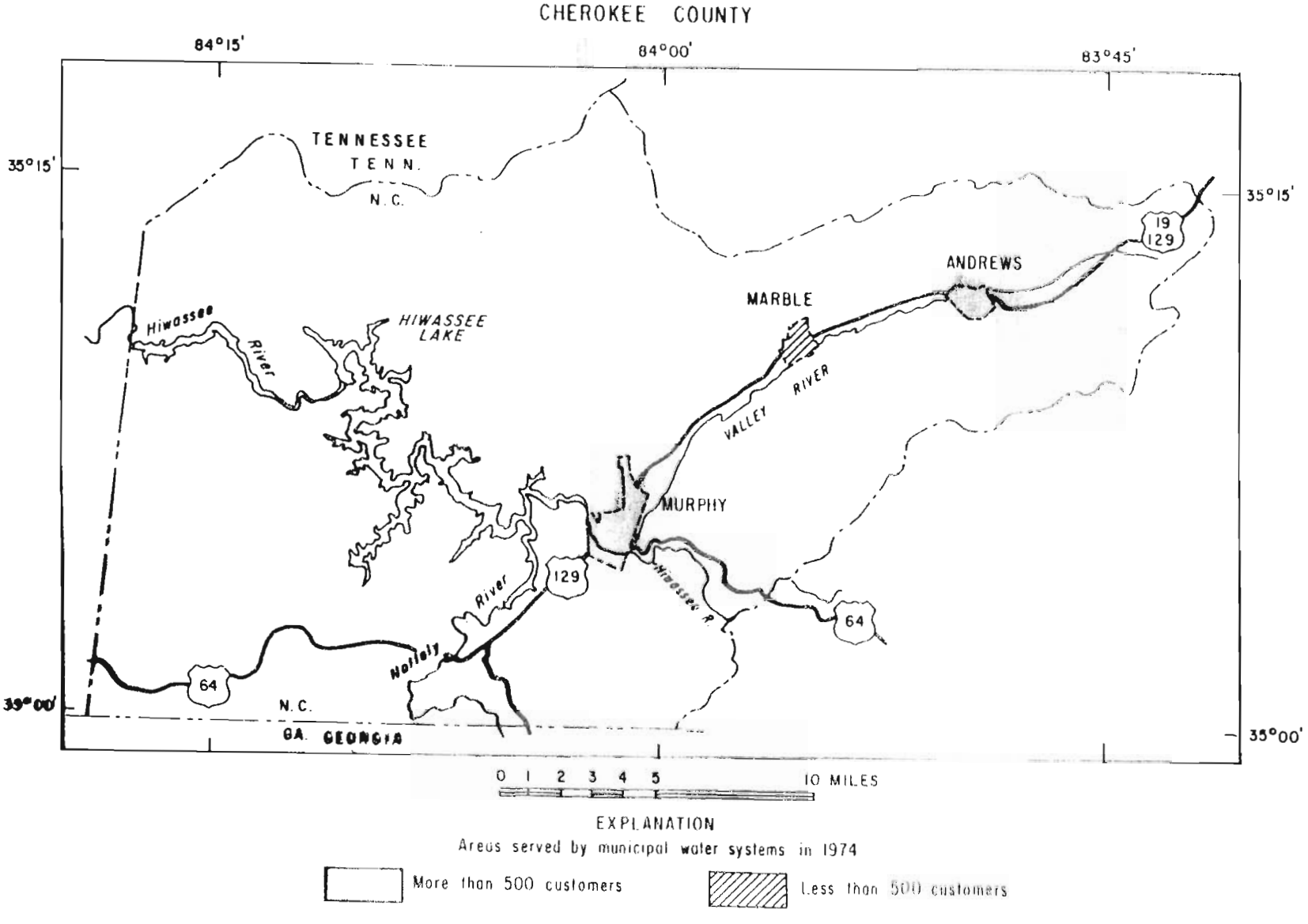
WATER-RESOURCES APPRAISAL

Cherokee County, the westernmost county in North Carolina, is in the Blue Ridge physiographic province. The county is mountainous and local relief is great. The area between Andrews and Murphy is an unusually wide valley as much as 4,000 feet wide in places. Stream slopes are steep and drainage is excellent. The Hiwassee River and its two principal tributaries, the Valley and Nottely Rivers, drain the county. The Hiwassee and Nottely Rivers are highly regulated by Tennessee Valley Authority miltipurpose reservoirs. The average discharge of unregulated streams ranges from 1.2 to 1.6 mgd per square mile. Minimum flows generally exceed 0.1 mgd per square mile and 7-day, 2-year low-flows average 0.35 mgd per square mile. Murphy and Andrews obtain their water from surface sources. Marble and other smaller communities use ground water. The county's population in 1970 was 16,330.

Metamorphic rocks (predominantly quartzite, metaconglomerate, and metagrawacke in the western half and schist, gneiss and marble in the eastern half) underlie the county. The geologic structure along the valleys is complex and contacts between rock units is gradational. The chief aquifers are the fracture zones in the bedrock. There are insufficient records of wells of tested capacity available for assessing the water-bearing characteristics of the various rock units. Generally the higher yielding wells are those that intersect crushed quartz veins or solution cavities in the marble. One well in the marble was reported to yield 60 gpm with negligible drawdown. The marble occurs in the principal valleys thus is favorably located for development of small municipal or industrial supplies.

Use of springs and dug wells are common in the rural areas. However, these may go dry in drought years.

The chemical quality of ground water is generally excellent. Based on analyses of water from 17 wells, the water is usually soft, slightly acidic and low in dissolved-solids concentrations. Iron concentrations in the 17 wells were all less than 0.3 mg/1.


CHEROKEE COUNTY
84°15'
84°00'
83°45'
35°15'
35°00'
TENNESSEE
TENN.
N.C.
GA. GEORGIA
ANDREWS
MARBLE
MURPHY
HIWASSEE LAKE
Hiwassee River
VALLEY RIVER
Hiwassee R.
Notley River
19
129
64
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

ANDREWS, CHEROKEE COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,900 in 1973 (675 metered customers, 200 of which are in suburban areas).

SOURCE:

Beaver Creek impounded in Andrews Reservoir: the intakes are at the dam approximately 1.9 miles north of Andrews at lat 35°13'40", long 83°49'55". The drainage area at the dam is 1.71 square miles.

RAW-WATER STORAGE:

Andrews Reservoir, 1.0 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 0.4 mgd with a storage of 1.0 million gallons.

TOTAL USE:

Average (1973) 0.35 mgd, estimated. Maximum daily not available. The city processes 422,000 gallons per day. Water not used overflows the finished water reservoir.

INDUSTRIAL USE:

0.05 mgd, estimated. Principal users include the Magnavox Company of Tennessee, Berkshire International Corporation, and Owenby Manufacturing Company.

TREATMENT:

Chlorination and slow-sand filtration.

RATED CAPACITY OF TREATMENT PLANT:

0.576 mgd.

PUMPING CAPACITY:

None. Raw and finished water flows by gravity.

FINISHED-WATER STORAGE:

One clear well, 100,000 gallons, one storage reservoir, 500,000 gallons.

FUTURE PLANS:

The 500,000 gallon finished water reservoir does not fill and the city plans to run a 14-inch line to the treatment plant to solve this problem.

WATER-RESOURCES APPRAISAL:

Surface water: Andrews is in the northeast corner of Cherokee County in the valley between the Snowbird and Valley River Mountains. Valley River, a principal tributary of the Hiwassee flows through the city. The Valley River basin is rectangular in shape and most tributaries are short and enter the river perpendicularly. The average discharge of streams in the immediate vicinity is 1.6 mgd per square mile, the 7-day,

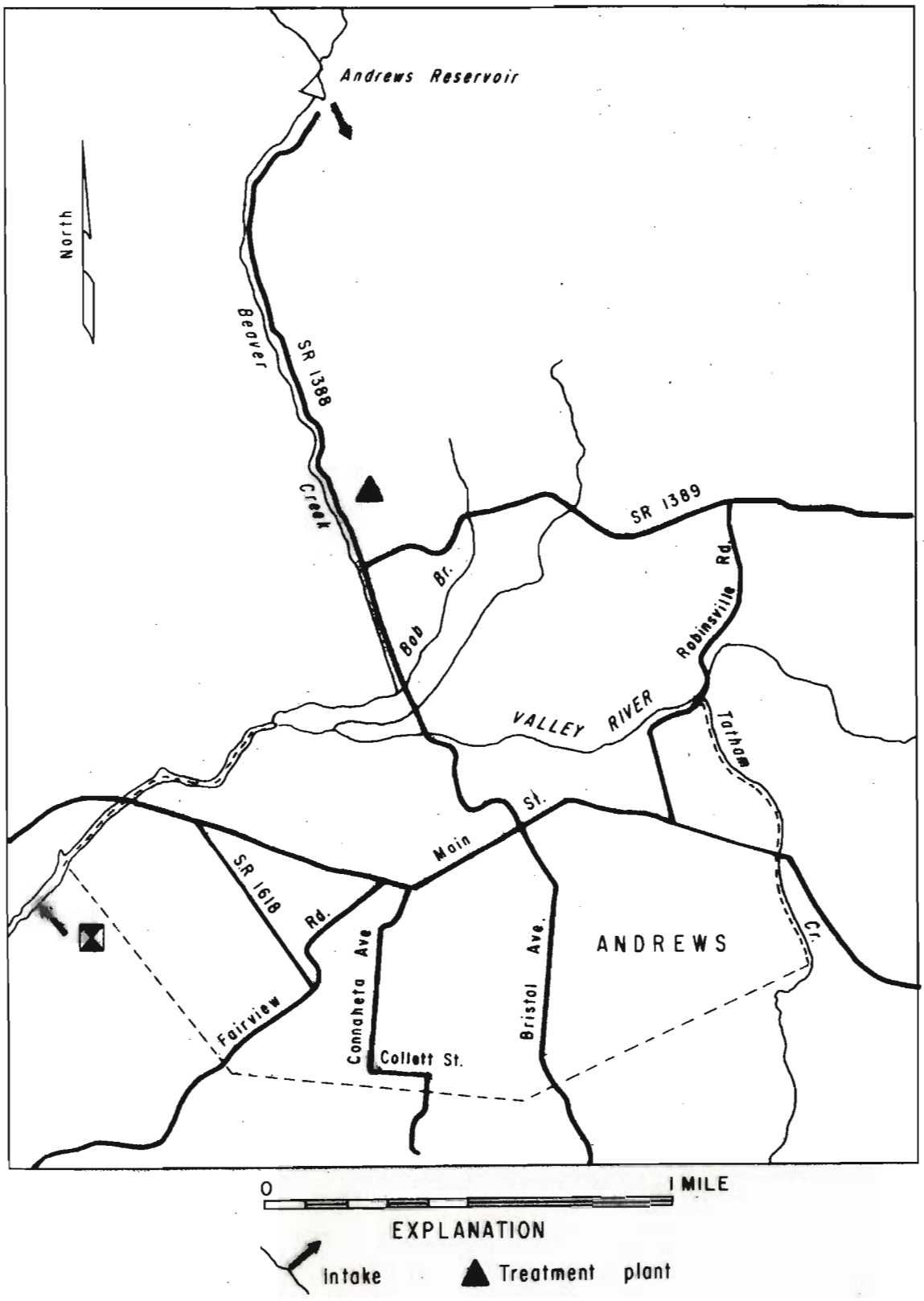
ANDREWS, CHEROKEE COUNTY

2-year low flow averages 0.35 mgd per square mile, and minimum flows generally exceed 0.15 mgd per square mile. The current use of water is approaching the estimated allowable draft of the present source, and if demand increases additional raw water storage or a new source will be necessary. There is ample surface-water available for development.

Ground water: Records of wells in the immediate vicinity of Andrews are not available for assessing ground water conditions. However, some general statements can be made. Marble, quartz-mica gneiss, and mica-schist are the predominant rock types underlying Andrews. The thickness of overlying weathered material and alluvial deposits is probably as much as 100 feet thick in places. The fracture characteristics and possible solution cavities in the marble combined with the thick soil cover are favorable for higher yielding wells.

Based on chemical analyses of ground water from similar rock units, the water is probably soft, and slightly acidic.

CITY OF ANDREWS



ANDREWS, CHEROKEE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Beaver Cr. Finished	Beaver Cr. Raw	Beaver Cr. Finished	
Date of collection.....	9-7-65	1-8-74	1-8-74	
Copper (Cu).....	-------	0.033	0.006	
Cobalt (Co).....	-------	.000	.000	
Zinc (Zn).....	-------	.010	.000	
Chromium (Cr).....	-------	.001	.000	
Boron (B).....	-------	.000	.000	
Strontium (Sr).....	-------	.000	.000	
Barium (Ba).....	-------	.000	.000	
Mercury (Hg).....	-------	.0033	.0000	
Lead (Pb).....	-------	.033	.017	
Lithium (Li).....	-------	.000	.000	
Cadmium (Cd).....	-------	.001	.000	
Arsenic (As).....	-------	.001	.000	
Chloride (Cl).....	0.2	1.0	1.6	
Manganese (Mn).....	.00	.000	.000	
Iron (Fe).....	.04	.000	.050	
Calcium (Ca).....	1.2	-------	-------	
Magnesium (Mg).....	.2	-------	-------	
Sodium (Na).....	1.3	-------	-------	
Potassium (K).....	.2	-------	-------	
Fluoride (F).....	.1	-------	-------	
Silica (SiO_2).....	7.6	-------	-------	
Bicarbonate (HCO_3).....	8	-------	-------	
Carbonate (CO_3).....	0	-------	-------	
Sulfate (SO_4).....	1.2	-------	-------	
Nitrate (NO_3).....	.1	-------	-------	
Dissolved Solids.....	15	-------	-------	
Hardness as $CaCO_3$:				
Total.....	4	-------	-------	
Noncarbonate.....	0	-------	-------	
Alkalinity as $CaCO_3$.....	7	-------	-------	
Specific conductance (micromhos at 25° C)....	17	10	14	
pH.....	6.8	-------	-------	
Temperature (°C).....	-------	-------	-------	

MURPHY, CHEROKEE COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 2,500 in 1973 (903 metered customers, 71 of which are in suburban areas).

SOURCES:

Hiwassee River: The intakes are about 200 feet southwest of the treatment plant near the southeast city limits at lat 35°04'41", long 84°01'33". The drainage area at the intakes is 420 square miles, approximately.

Marble Creek: The intakes are approximately 3.5 miles northeast of Murphy at lat 35°08'09", long 84°00'50". The drainage area at the intakes is 0.9 square miles, approximately.

Marble Creek tributary: The intakes are about 300 ft upstream from Marble Creek, 3.4 miles northeast of Murphy at lat 35°08'04", long 84°00'52". The drainage area at the intakes is 0.4 square miles, approximately.

RAW-WATER STORAGE:

Fain Mountain reservoir, 1.8 million gallons. Water from Marble Creek and Marble Creek tributary is stored in this reservoir.

ALLOWABLE DRAFT:

Estimated allowable draft of Hiwassee River is 80 mgd with no storage.

Combined estimated allowable draft of Marble Creek tributary and Marble Creek is 0.25 mgd with a storage of 1.8 million gallons.

TOTAL USE:

Average (1973) 0.448 mgd, metered; maximum daily (8-25-73) 0.726 million gallons.

INDUSTRIAL USE:

0.15 mgd, estimated. Principal users include Native Textiles, Levi Strause Co., and Nehi Bottling Co.

TREATMENT:

Hiwassee River: Prechlorination, coagulation with alum and lime, sedimentation, rapid sand filtration, adjustment of pH with lime, and post chlorination.

Marble Creek and Marble Creek tributary: Prechlorination, pressure filtration, and post chlorination.

RATED CAPACITY OF TREATMENT PLANT:

Hiwassee River Plant, 1.0 mgd.

Marble Creek, 0.43 mgd.

PUMPING CAPACITY:

Marble Creek plant: gravity.

MURPHY, CHEROKEE COUNTY

Hiwassee River Plant: raw water, 1.0 mgd; finished water, 1.0 mgd.

FINISHED-WATER STORAGE:

One clear well, 150,000 gallons; two storage tanks, 500,000 and 250,000 gallons.

FUTURE PLANS:

None except routine updating of system. May double treatment plant capacity in next 5-10 years.

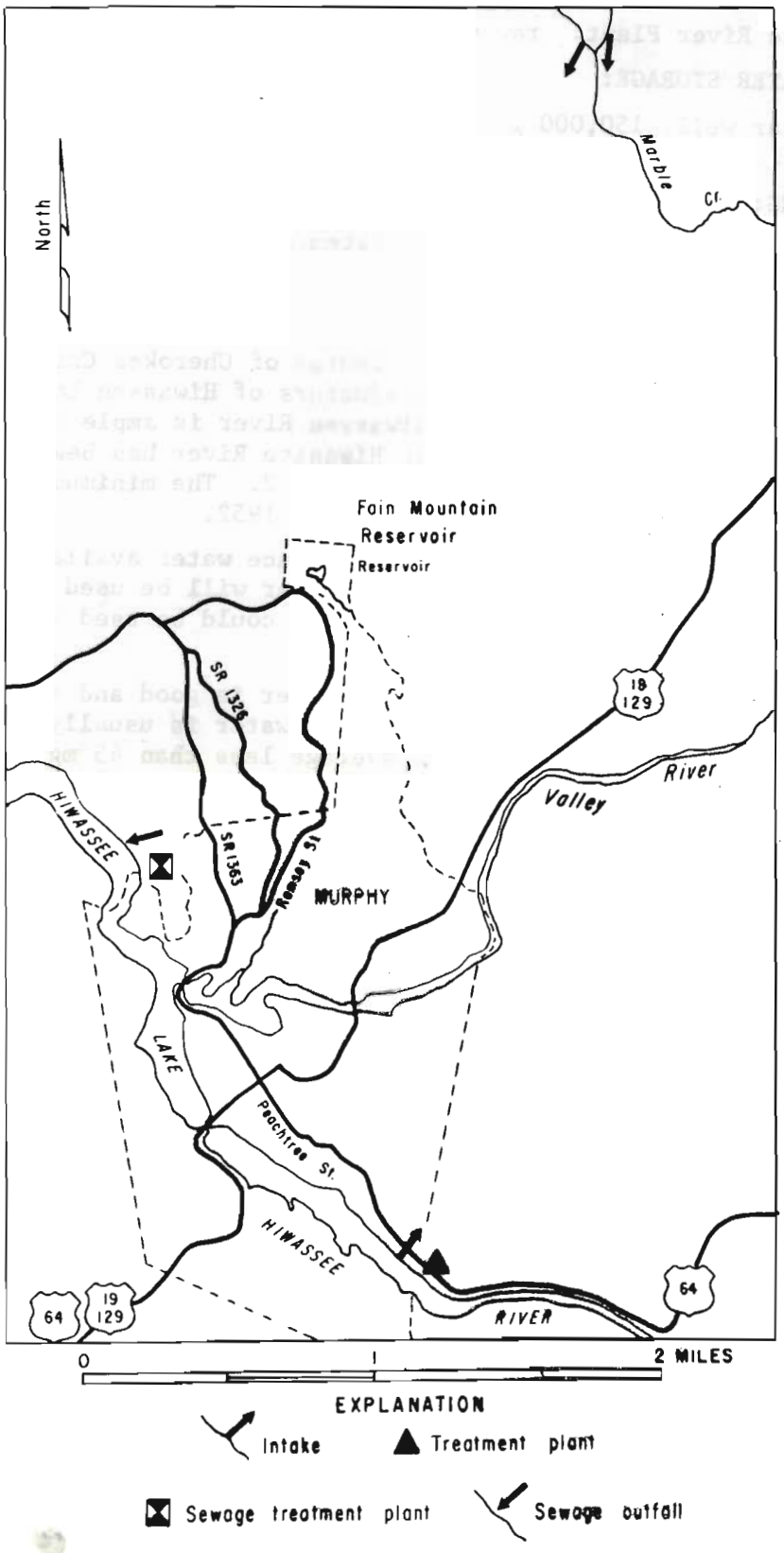
WATER-RESOURCES APPRAISAL:

Surface water: Murphy is near the center of Cherokee County. Valley River, Hiwassee River and the headwaters of Hiwassee Lake are inside the city limits. The flow of the Hiwassee River is ample to supply Murphy for the foreseeable future. The Hiwassee River has been regulated by Chatuge Dam, 22 miles upstream since 1942. The minimum daily flow since regulation began was 40 mgd October 19, 1952.

Ground water: With the abundance of surface water available for municipal supply it is not likely that ground water will be used to supplement the municipal supply; however, ground water could be used for small industrial supplies.

The chemical quality of ground water is good and suitable for most uses with little or no treatment. The water is usually soft and dissolved-solids concentrations average less than 45 mg/1.

CITY OF MURPHY



MURPHY, CHEROKEE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Hiwassee R. Raw	Hiwassee R. Finished	Marble Cr. Finished	Mixed Finished
Date of collection.....	9- 7-65	9- 7-65	9- 8-65	9- 7-65
Copper (Cu).....	--------	--------	--------	--------
Cobalt (Co).....	--------	--------	--------	--------
Zinc (Zn).....	--------	--------	--------	--------
Chromium (Cr).....	--------	--------	--------	--------
Boron (B).....	--------	--------	--------	--------
Strontium (Sr).....	--------	--------	--------	--------
Barium (Ba).....	--------	--------	--------	--------
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	--------	--------
Lithium (Li).....	--------	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------	--------
Arsenic (As).....	--------	--------	--------	--------
Chloride (Cl).....	0.6	5.3	3.3	5.0
Manganese (Mn).....	.00	.00	.01	.02
Iron (Fe).....	.01	.01	.05	.02
Calcium (Ca).....	2.2	4.9	1.0	5.9
Magnesium (Mg).....	.6	.9	.5	.7
Sodium (Na).....	1.6	1.8	1.2	1.6
Potassium (K).....	.7	.9	.4	.7
Fluoride (F).....	.1	.1	.1	.0
Silica (SiO_2).....	7.7	7.7	7.5	7.7
Bicarbonate (HCO_3).....	13	12	4	13
Carbonate (CO_3).....	0	0	0	0
Sulfate (SO_4).....	1.2	5.0	1.0	5.2
Nitrate (NO_3).....	.1	.3	.1	.3
Dissolved Solids.....	21	33	20	32
Hardness as $CaCO_3$:				
Total.....	8	16	4	18
Noncarbonate.....	0	6	1	8
Alkalinity as $CaCO_3$.....	11	10	2	11
Specific conductance (micromhos at 25° C)....	26	45	17	47
pH.....	6.2	7.0	6.5	7.0
Temperature (°C).....	--------	--------	--------	--------

Note: See next page for additional analyses.

MURPHY, CHEROKEE COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Hiwassee R. Raw	Hiwassee R. Finished		
Date of collection.....	1- 9-74	1- 9-74		
Copper (Cu).....	0.000	0.003		
Cobalt (Co).....	.003	.003		
Zinc (Zn).....	.006	.010		
Chromium (Cr).....	.000	.000		
Boron (B).....	.000	.000		
Strontium (Sr).....	.000	.000		
Barium (Ba).....	.000	.000		
Mercury (Hg).....	.0000	.0000		
Lead (Pb).....	.013	.020		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.000	.000		
Arsenic (As).....	.007	.017		
Chloride (Cl).....	.6	4.9		
Manganese (Mn).....	.033	.017		
Iron (Fe).....	.000	.000		
Calcium (Ca).....	--------	--------		
Magnesium (Mg).....	--------	--------		
Sodium (Na).....	--------	--------		
Potassium (K).....	--------	--------		
Fluoride (F).....	--------	--------		
Silica (SiO_2).....	--------	--------		
Bicarbonate (HCO_3).....	--------	--------		
Carbonate (CO_3).....	--------	--------		
Sulfate (SO_4).....	--------	--------		
Nitrate (NO_3).....	--------	--------		
Dissolved Solids.....	--------	--------		
Hardness as $CaCO_3$:				
Total.....	--------	--------		
Noncarbonate.....	--------	--------		
Alkalinity as $CaCO_3$.....	--------	--------		
Specific conductance (micromhos at 25° C)....	--------	--------		
pH.....	--------	--------		
Temperature (°C).....	--------	--------		

CLAY COUNTY

WATER-RESOURCES APPRAISAL

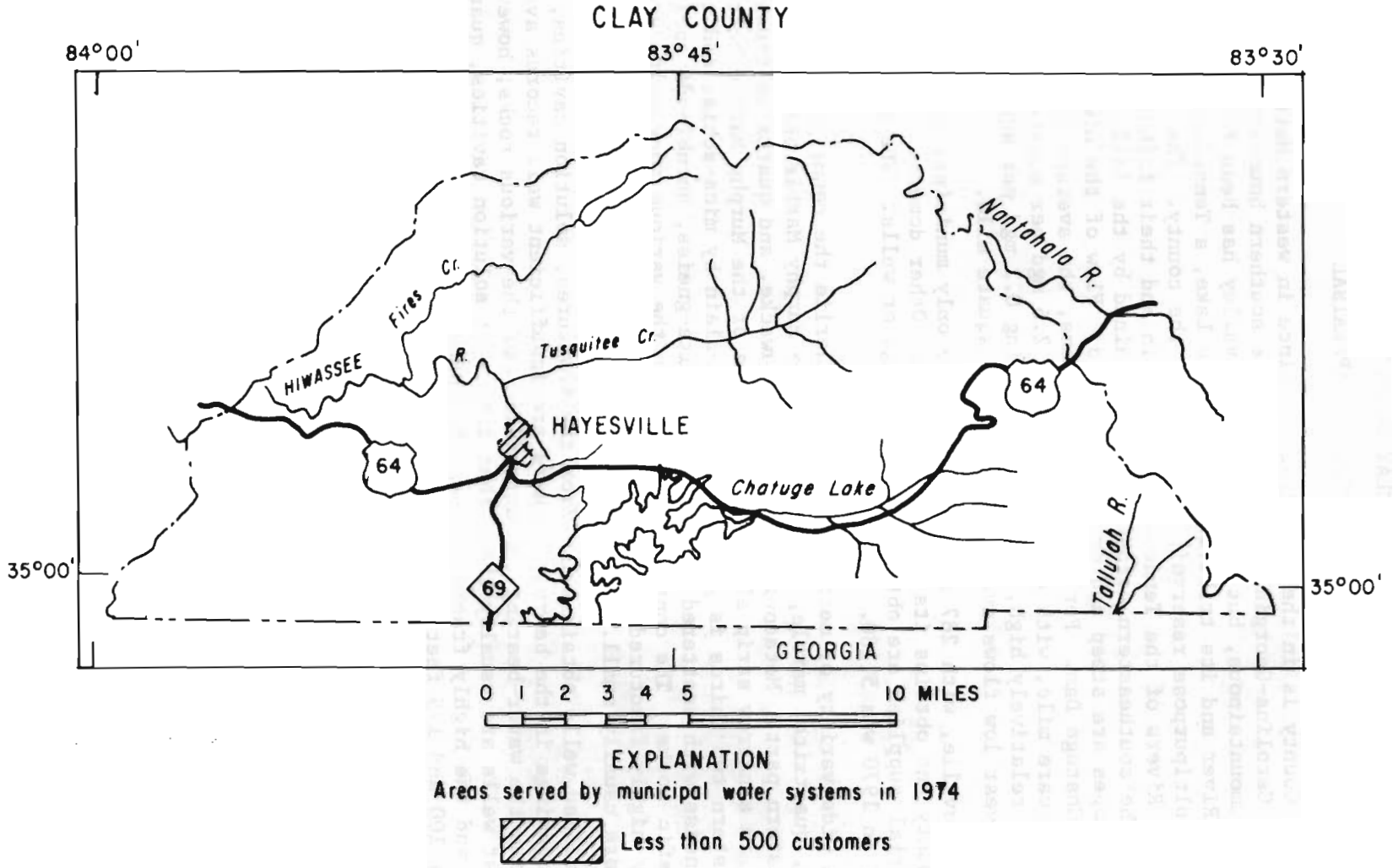
Clay County is in the Blue Ridge Province in western North Carolina. The North Carolina-Georgia State line is the southern boundary. The county is mostly mountainous, but a broad rolling valley has been formed by the Hiwassee River and its tributaries. Chatuge Lake, a Tennessee Valley Authority multipurpose reservoir is mostly in the county. The Hiwassee and Nantahala Rivers of the Tennessee River basin and their tributaries drain all but the southeastern corner which is drained by the Tallulah River. Stream slopes are steep and drainage is good. Flow of the Hiwassee is regulated by Chatuge Dam. For unregulated streams, the average discharge is 1.8 mgd per square mile, with a range of 1.3 to 2.6 mgd per square mile. Minimum flows are relatively high, generally exceeding 0.2 mgd per square mile, and 7-day, 2-year low flows average 0.4 mgd per square mile.

Hayesville, with 287 customers, has the only municipal water system in the county and obtains its water from wells. Other domestic and small industrial supplies are obtained from springs or wells. The county population in 1970 was 5,180.

A wide variety of metamorphic rocks underlie the county. Phyllite, schist, quartzite, marble, and gneiss of the Murphy Marble belt crop out in the western part. Metaconglomerate, metagrawacke, and quartzite cross the county in a narrow strip along the east edge of the Murphy Marble belt. The eastern two thirds is predominately underlain by mica-schist and quartz-mica gneiss with scattered outcrops of granite-gneiss, hornblende gneiss and ultramafic rocks. The contact zones between the various rock units are usually highly fractured. There are solution cavities in the marble, but these are usually small.

Drilled wells obtain water from the fractures, solution cavities, and other openings in the bedrock. There are insufficient well records available to assess the water-bearing characteristics of the various rocks; however, the best wells are usually those that intersect solution cavities, quartz veins, and the highly fractured contact zones. Wells are normally drilled between 100 and 175 feet. For 19 drilled wells, the average depth is 157 feet and the maximum reported yield is 42 gpm. It is estimated that wells drilled in favorable sites, such as draws, valleys, or topographically low areas would yield as much as 50 gpm or more.

The chemical quality of ground water is generally good. The water is usually soft, slightly acidic, but locally may contain iron concentrations in excess of 0.3 mg/l.


CLAY COUNTY
84°00'
83°45'
83°30'
35°00'
35°00'
HIWASSEE R.
Fires Cr.
Tusquitee Cr.
Nantahala R.
HAYESVILLE
64
64
69
Chatuge Lake
Tallulah R.
GEORGIA
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
Less than 500 customers

CLEVELAND COUNTY

WATER-RESOURCES APPRAISAL

Cleveland County is in the Piedmont province in southwestern North Carolina. The North Carolina-South Carolina State line is the southern boundary. The southern two-thirds of the county is characterized by a flat to gently rolling plateau, with the northern third being hilly to semi-mountainous. The Broad River and its tributaries, principally the First Broad River, drain the county. The average discharge of streams ranges from 0.95 mgd per square mile in the west to 0.80 mgd per square mile in the east. The low-flow yield of streams generally exceeds 0.15 mgd per square mile, and the 7-day, 2-year low flow averages 0.35 mgd per square mile.

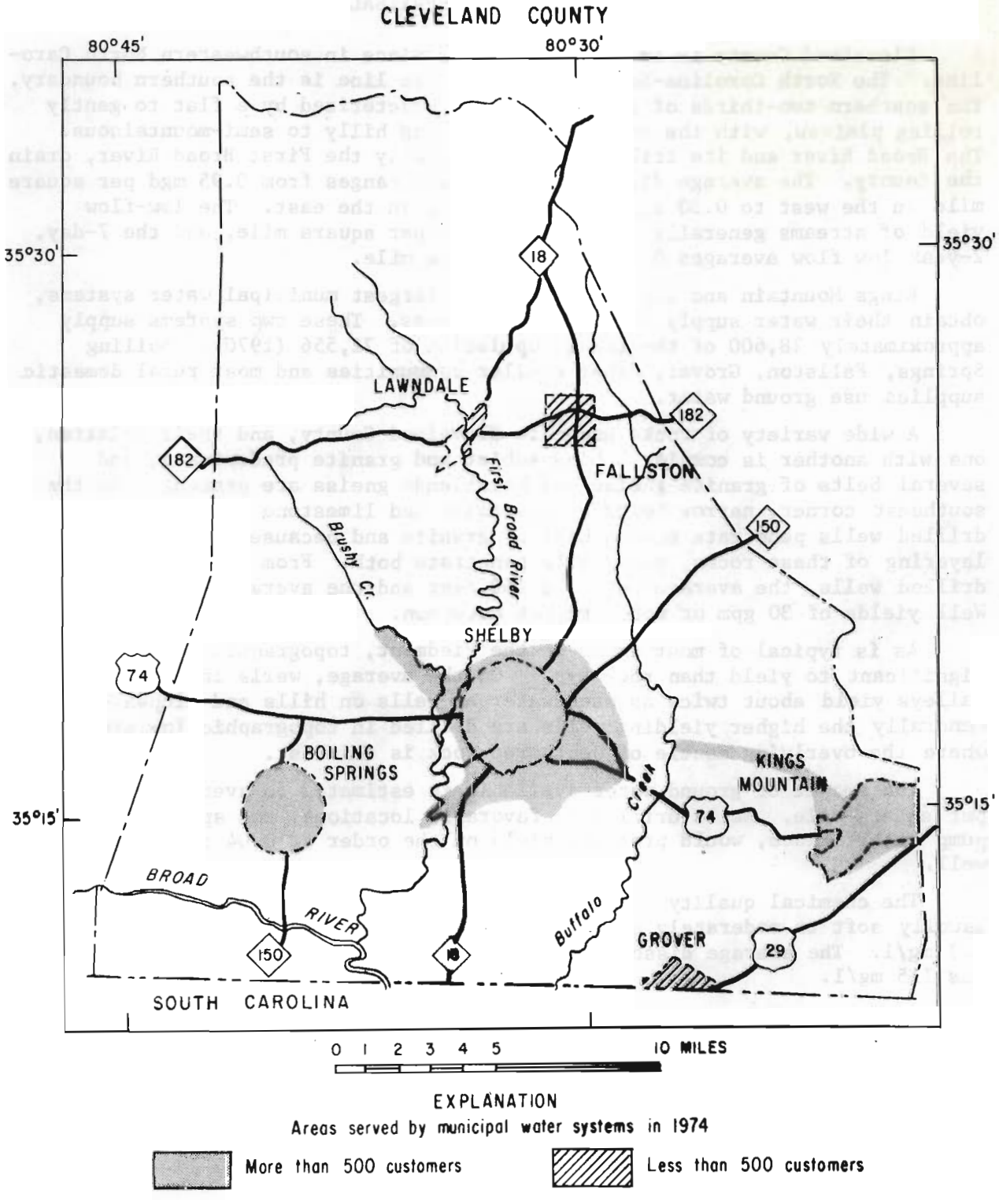
Kings Mountain and Shelby, two of the largest municipal water systems, obtain their water supply from surface sources. These two systems supply approximately 28,600 of the total population of 72,556 (1970). Boiling Springs, Fallston, Grover, other smaller communities and most rural domestic supplies use ground water.

A wide variety of rocks underlie Cleveland County, and their relation, one with another is complex. Mica schist and granite predominate, and several belts of granite gneiss and hornblende gneiss are present. In the southeast corner, narrow belts of quartzite and limestone crop out. Most drilled wells penetrate mica schist or granite and because of the close interlayering of these rocks, many wells penetrate both. From records of 40 drilled wells, the average depth is 160 feet and the average yield is 24 gpm. Well yields of 30 gpm or more are not uncommon.

As is typical of most areas in the Piedmont, topographic setting is more significant to yield than rock type. On the average, wells in draws and valleys yield about twice as much water as wells on hills and slopes. Generally the higher yielding wells are drilled in topographic low areas where the overlying mantle of weathered rock is thickest.

The amount of ground water available is estimated to average 0.45 mgd per square mile. Wells drilled in favorable locations, and spaced to prevent pump interference, would probably yield on the order of 0.04 to 0.05 mgd per well.

The chemical quality of ground water is generally good. The water is usually soft to moderately hard and locally iron concentrations may exceed 0.3 mg/1. The average dissolved solids concentration in water from 13 wells was 115 mg/1.


CLEVELAND COUNTY
80°45'
80°30'
35°30'
35°30'
35°15'
35°15'
18
182
182
150
74
74
150
18
29
LAWNDALE
FALLSTON
First Broad River
Brushy Cr.
SHELBY
BOILING SPRINGS
KINGS MOUNTAIN
Crook
BROAD RIVER
Buffalo
GROVER
SOUTH CAROLINA
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

BOILING SPRINGS, CLEVELAND COUNTY

OWNERSHIP:

Municipal. Also supplies Gardner-Webb College. Total population supplied about 2,500 in 1973 (610 metered customers, 58 of which are in suburban areas).

SOURCE:

Four wells (Nos. 1, 3, 4, 5). (Well No. 1 not in use; Well No. 3 used as standby)

Well No. 3, Cv 134, located at lat 35°15'05", long 81°40'06". Driller: Max Swain Well Drilling Co. Date drilled: 1958? Total depth: 352 ft. Diam: 8 in. Cased to: 90 ft? Type finish: open hole. Topography: slope. Aquifer: blue granite. Static water level: 30 ft? Yield: 75 gpm. Pump setting: 220 ft. Type pump: submersible.

Well No. 4, Cv 135, located at lat 35°15'05", long 81°39'46", Driller: Southeastern Well Drilling Co. Date drilled: 1966? Total depth: 300 ft. Diam: 6 in. Cased to: 90 ft? Type finish: open hole. Topography: slope. Aquifer: blue granite. Static water level: 20 ft. Yield: 150 gpm. Pump setting: 220 ft. Type pump: submersible.

Well No. 5, Cv 136, located at lat 35°15'06", long 81°39'44". Driller: Southeastern Well Drilling Co. Date drilled: 1970. Total depth: 220 ft. Diam: 6 in. Cased to: 90 ft. Type finish: open hole. Topography: slope. Aquifer: blue granite. Static water level: 20 ft. Yield 180 gpm. Pump setting: 190 ft. Type pump: submersible.

TOTAL USE:

Average (1973) 0.15 mgd, estimated; maximum daily not available.

INDUSTRIAL USE:

None.

TREATMENT:

Chlorination and addition of phosphate compounds for corrosion control.

RATED CAPACITY OF TREATMENT PLANT:

None. Water is treated in the ground storage tank.

PUMPING CAPACITY:

Raw water, approximately 0.6 mgd; finished water, 2.1 mgd.

FINISHED-WATER STORAGE:

One ground storage tank, 400,000 gallons; one elevated tank, 75,000 gallons.

FUTURE PLANS:

None.

BOILING SPRINGS, CLEVELAND COUNTY

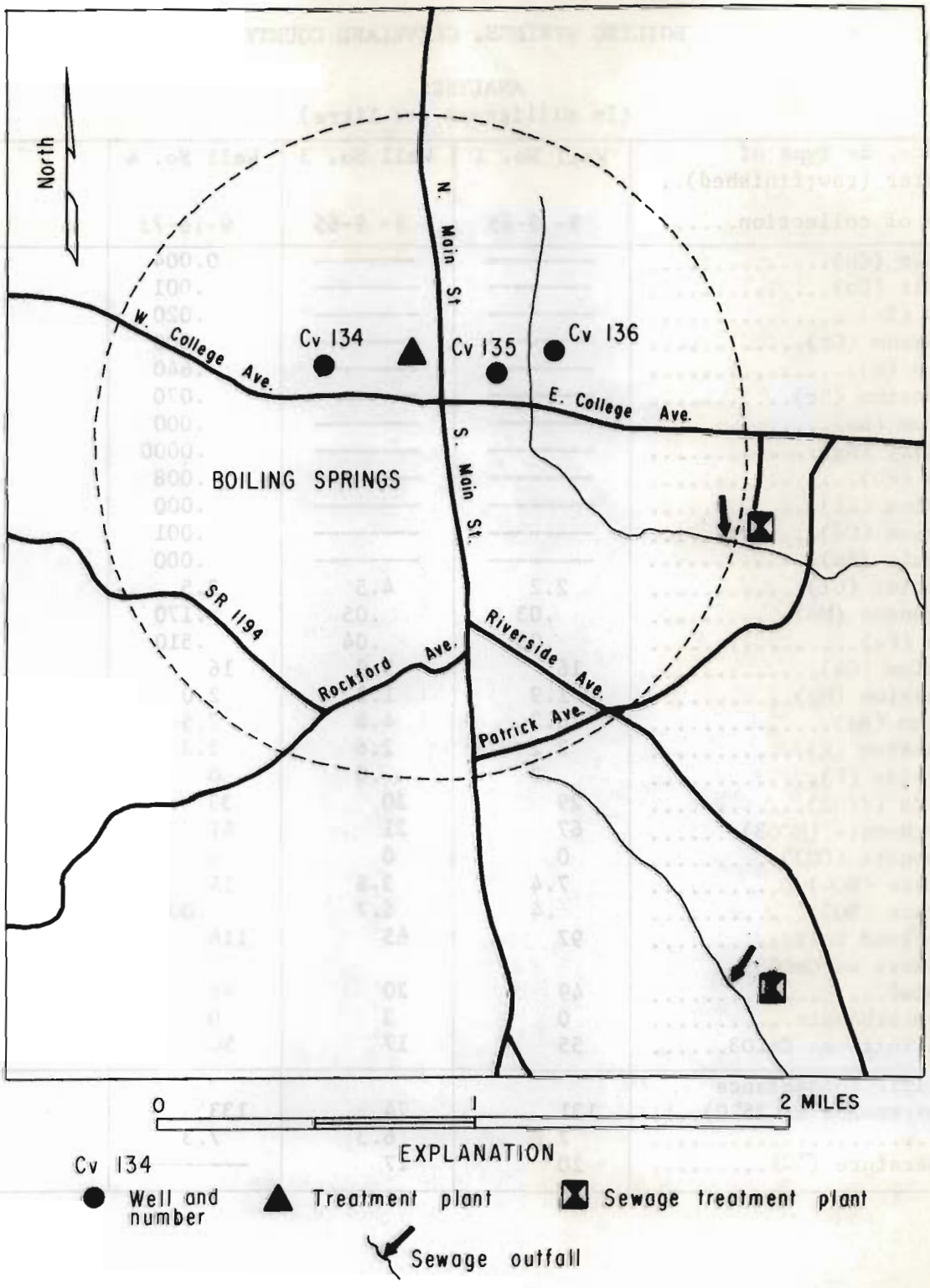
WATER-RESOURCES APPRAISAL:

Surface water: Boiling Springs is drained by small tributaries of the Broad River. The low flow yield of streams draining the immediate vicinity of the city generally exceeds 0.15 mgd per square mile. The average discharge of streams is 0.9 mgd per square mile, and the 7-day, 2-year low flow averages 0.3 mgd per square mile. Two large rivers are nearby, the First Broad River is 4.8 miles east and the Broad River is 2.5 miles south. If the city decided to use surface water in the future, either of these rivers would furnish a dependable supply.

Ground water: Mica schist and granite, with granite predominate, underlie Boiling Springs. The overlying mantle of weathered rock, based on reported well casing lengths, is as much as 110 feet in places. This relatively thick layer of weathered rock that acts as a reservoir to store water in the ground, is conducive to high yielding wells. Wells No. 4 and 5 with yields of 150 and 180 gpm were supplying the city in 1973. Well No. 3 with a yield of 75 gpm was on standby. If demand increases beyond the capacity of the present wells, additional wells drilled in favorable sites, and spaced to prevent pumping interference with existing wells, could supply the need.

The ground water is of good chemical quality except the iron concentration exceeds the recommended limit of 0.3 mg/1.

CITY OF BOILING SPRINGS



BOILING SPRINGS, CLEVELAND COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 1	Well No. 3	Well No. 4	
Date of collection.....	9- 9-65	9- 9-65	9-18-73	
Copper (Cu).....	--------	--------	0.004	
Cobalt (Co).....	--------	--------	.001	
Zinc (Zn).....	--------	--------	.020	
Chromium (Cr).....	--------	--------	.000	
Boron (B).....	--------	--------	.640	
Strontium (Sr).....	--------	--------	.070	
Barium (Ba).....	--------	--------	.000	
Mercury (Hg).....	--------	--------	.0000	
Lead (Pb).....	--------	--------	.008	
Lithium (Li).....	--------	--------	.000	
Cadmium (Cd).....	--------	--------	.001	
Arsenic (As).....	--------	--------	.000	
Chloride (Cl).....	2.2	4.5	3.5	
Manganese (Mn).....	.03	.05	.170	
Iron (Fe).....	.05	.04	.510	
Calcium (Ca).....	16	5.9	16	
Magnesium (Mg).....	1.9	1.2	2.0	
Sodium (Na).....	6.2	4.8	7.5	
Potassium (K).....	2.2	2.6	2.3	
Fluoride (F).....	.2	.0	0	
Silica (SiO_2).....	29	20	33	
Bicarbonate (HCO_3).....	67	21	61	
Carbonate (CO_3).....	0	0	0	
Sulfate (SO_4).....	7.4	3.8	14	
Nitrate (NO_3).....	.4	6.7	.00	
Dissolved Solids.....	97	65	116	
Hardness as $CaCO_3$:				
Total.....	49	20	48	
Noncarbonate.....	0	3	0	
Alkalinity as $CaCO_3$.....	55	17	50	
Specific conductance (micromhos at 25° C)....	131	74	133	
pH.....	7.0	6.3	7.3	
Temperature (°C).....	20	17	--------	

KINGS MOUNTAIN, CLEVELAND COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 8,600 in 1973 (3,000 metered customer, 110 of which are in suburban areas). Also supplements Bessemer City.

SOURCE:

Buffalo Creek (new plant) impounded in John Henry Moss Reservoir: The intakes are 6 miles west of Kings Mountain at lat 35°16'38", long 81°27'10". The drainage area at the dam is 68 square miles, approximately.

Davidson Creek (old plant) impounded in Davidson Lake: the intakes are at the dam about 2.5 miles south of Kings Mountain at lat 35°12'04", long 81°21'10". The drainage area at the dam is 0.7 square miles, approximately.

Kings Creek tributary (old plant) impounded in city lake: the intakes are at the dam about 2.0 miles south of Kings Mountain at lat 35°11'36", long 81°21'17". The drainage area at the dam is 1.0 square miles, approximately.

RAW-WATER STORAGE:

John Henry Moss Reservoir, 12,700 million gallons.

City Lake, 96 million gallons.

Davidson Lake, 180 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft not determined, carryover storage analysis required. The allowable draft is probably in excess of 30 mgd.

TOTAL USE:

Average (1972), 2.68 mgd, maximum daily (7-31-73) 5.64 million gallons.

INDUSTRIAL USE:

1.5 mgd, estimated. Principal users include Spectrum Textured Fibers, Craftspun Yarns, K-Mills, Neisco, and Duplex International.

TREATMENT:

Ellison Plant (new): Prechlorination, coagulation with alum and liquid caustic soda, sedimentation, addition of potassium permanganate for control of taste and odor (equipment for addition of carbon for control of taste and odor is also available if needed), rapid mixed-media filtration, adjustment of pH with liquid caustic soda, postchlorination if necessary, and fluoridation.

Deale Street Plant (old): Prechlorination, coagulation with alum and lime, sedimentation, addition of potassium permanganate for control of taste and odor, Anthra-filt filtration, adjustment of pH with soda ash, post-chlorination, and fluoridation.

KINGS MOUNTAIN, CLEVELAND COUNTY

RATED CAPACITY OF TREATMENT PLANTS:

Ellison Plant, 4.0 mgd.

Deale Street Plant, 2.0 mgd.

PUMPING CAPACITY:

Ellison Plant: Raw water, 4.0 mgd; finished water 4.0 mgd.

Deale Street Plant: Raw water, 2.5 mgd; finished water, 2.4 mgd.

FINISHED-WATER STORAGE:

One clear well, 300,000 gallons; three ground storage tanks, 2,000,000, 1,000,000, and 500,000 gallons.

FUTURE PLANS:

Plan to add additional finished water storage.

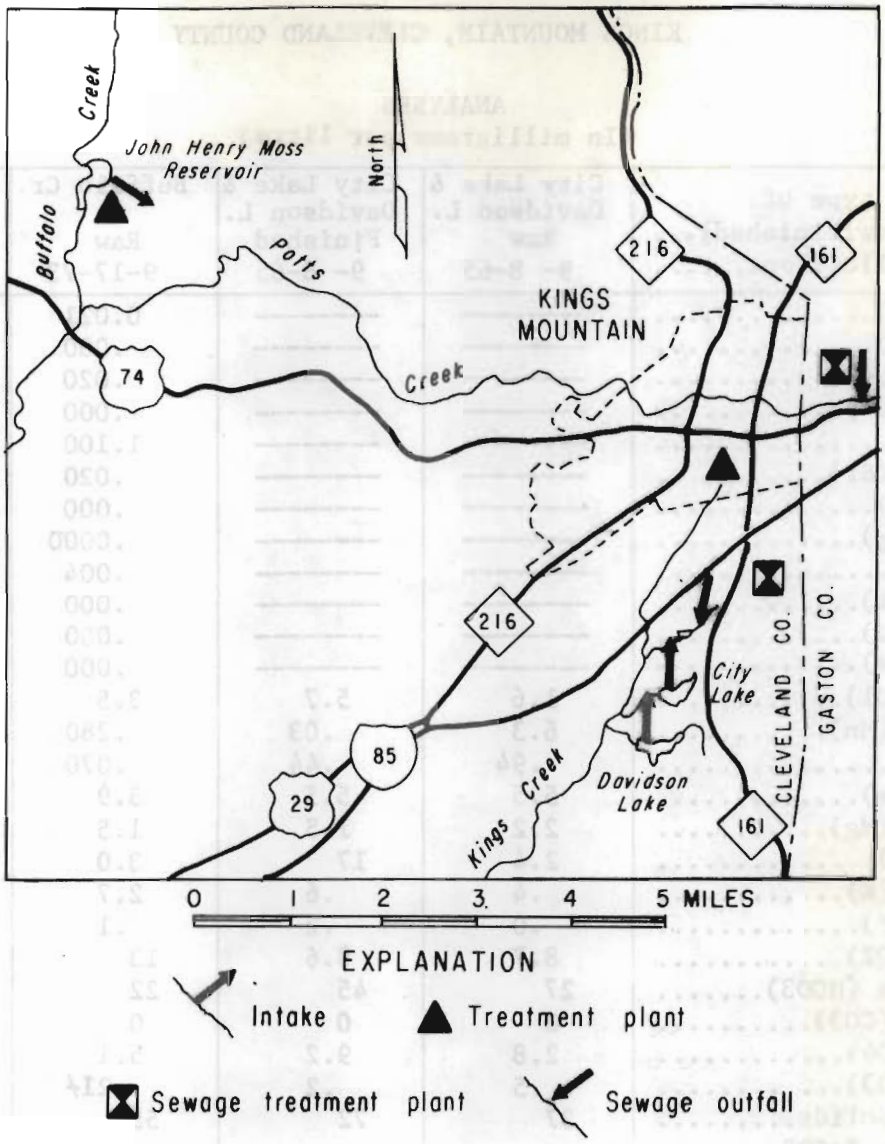
WATER-RESOURCES APPRAISAL:

Surface water: Kings Mountain is on the drainage divide of the Broad and Catawba River basins in southeastern Cleveland County. A small part of the eastern side of town extends into Gaston County. The city is drained by many small streams radiating in all directions. The average discharge of streams draining the immediate vicinity of Kings Mountain is 0.85 mgd per square mile. Minimum flows generally exceed 0.08 mgd per square mile and the 7-day 2-year low flow averages 0.25 mgd per square mile. With the construction of the new reservoir on Buffalo Creek, the city has developed a water supply adequate for the foreseeable future.

Ground water: Granite, schist, and hornblende gneiss are the predominate rocks underlying the city. Wells drilled in the immediate vicinity of Kings Mountain are normally 75 to 200 feet deep. Well yields as high as 80 gpm have been reported and yields greater than 30 gpm are not uncommon.

The chemical quality of ground water is generally good. Locally, iron and chloride concentrations may be higher than desirable.

CITY OF KINGS MOUNTAIN



KINGS MOUNTAIN, CLEVELAND COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)... Date of collection.....	City Lake & Davidson L. Raw 9- 8-65	City Lake & Davidson L. Finished 9- 8-65	Buffalo Cr. Raw 9-17-73	Buffalo Cr. Finished 9-17-73
Copper (Cu).....	--------	--------	0.021	0.007
Cobalt (Co).....	--------	--------	.000	.000
Zinc (Zn).....	--------	--------	.020	.020
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	1.100	.590
Strontium (Sr).....	--------	--------	.020	.030
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	.0000	.0000
Lead (Pb).....	--------	--------	.004	.005
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.000	.002
Chloride (Cl).....	1.6	5.7	3.5	7.6
Manganese (Mn).....	6.3	.03	.280	.000
Iron (Fe).....	.94	.44	.070	.040
Calcium (Ca).....	5.5	5.5	3.9	4.5
Magnesium (Mg).....	2.2	1.5	1.5	1.4
Sodium (Na).....	2.4	17	3.0	27
Potassium (K).....	.4	.6	2.7	3.3
Fluoride (F).....	.0	.2	.1	0.7
Silica (SiO2).....	8.7	8.6	13	11
Bicarbonate (HCO3).....	27	45	22	31
Carbonate (CO3).....	0	0	0	0
Sulfate (SO4).....	2.8	9.2	5.1	45
Nitrate (NO3).....	.5	.2	.21/	.26/
Dissolved Solids.....	37	72	55	124
Hardness as CaCO3:				
Total.....	23	20	16	17
Noncarbonate.....	1	0	0	0
Alkalinity as CaCO3.....	11	44	18	25
Specific conductance (micromhos at 25° C)....	56	123	59	191
pH.....	6.6	7.7	7.0	7.4
Temperature (°C).....	24	--------	--------	--------

/Nitrate (NO2 + NO3 as N).

SHELBY, CLEVELAND COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 20,000 in 1973 (8,171 metered customers, 1,282 of which are in suburban areas).

SOURCE:

First Broad River impounded by a low dam (basically a pumping pool). There are two intakes approximately 1,000 feet apart at the northwest edge of the city. The upstream intake is at lat 35°18'20", long 81°33'45", and the downstream intake is at the dam at lat 35°18'22", long 81°33'36". The drainage area at the intake is 230 square miles, approximately.

RAW-WATER STORAGE:

Three off-river reservoirs, total capacity approximately 25 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 30 mgd with a storage of 25 million gallons.

TOTAL USE:

Average (1972), 4.27 mgd, metered; maximum daily (7-7-72), 6.3 million gallons.

INDUSTRIAL USE:

3.0 mgd, estimated. Principal users include Pittsburg Plate Glass Co., Dicey Fabrics, Inc., Dover Textile Group, Esther Mill Corporation, and J. P. Stevens and Company.

TREATMENT:

Prechlorination, coagulation with alum, sedimentation, addition of carbon for control of taste and odor, rapid sand filtration, adjustment of pH with lime, postchlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

10.0 mgd.

PUMPING CAPACITY:

Raw water, 14.1 mgd; finished water, 10.5 mgd.

FINISHED-WATER STORAGE:

One clear well, 9,900,000 gallons; two elevated tanks, 500,000 gallons each.

FUTURE PLANS:

Plan to erect a 1.0 million gallon elevated tank in near future.

WATER-RESOURCES APPRAISAL:

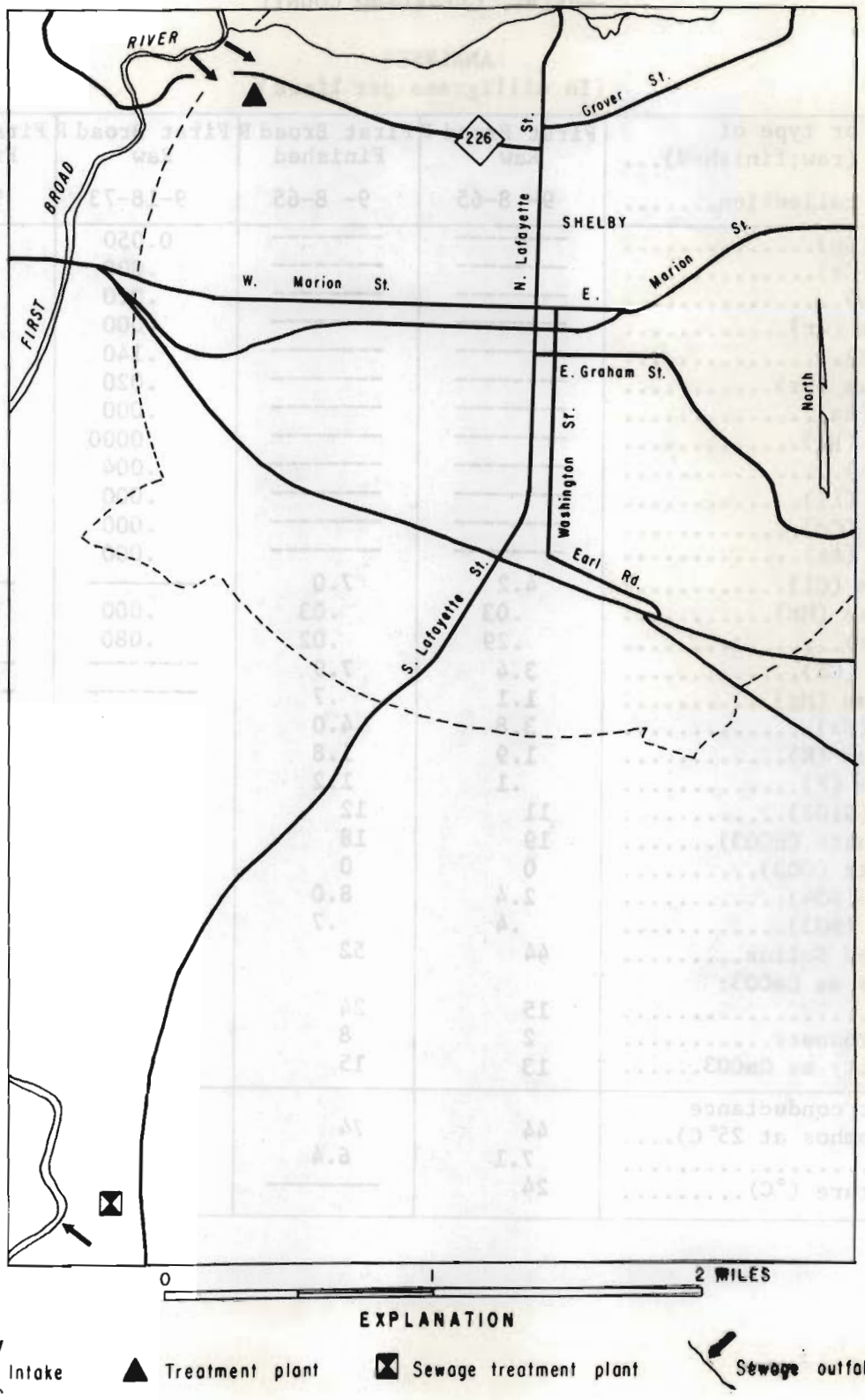
Surface water: Shelby is in south-central Cleveland County where the topography is rolling to hilly. The city is drained by tributaries of

the First Broad River which flows southward near the west city limits. The estimated allowable draft of the present source of water, the First Broad River, is more than six times current use and should be adequate for the foreseeable future.

Ground water: Shelby is underlain by granite and mica-schist. Drilled wells in the immediate vicinity of the city average about 160 feet deep, and reported yields range up to 50 gpm.

With the abundance of surface water available, it is not likely that ground water will be used for municipal supply. However, the potential exists to develop moderate supplies of 0.04 to 0.05 mgd per well. Supplies of this magnitude are adequate for many purposes.

CITY OF SHELBY



SHELBY, CLEVELAND COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	First Broad R Raw	First Broad R Finished	First Broad R Raw	First Broad R. Finished
Date of collection.....	9- 8-65	9- 8-65	9-18-73	9-18-73
Copper (Cu).....	--------	--------	0.050	0.040
Cobalt (Co).....	--------	--------	.000	.000
Zinc (Zn).....	--------	--------	.010	.030
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.140	.220
Strontium (Sr).....	--------	--------	.020	.030
Barium (Ba).....	--------	--------	.000	.100
Mercury (Hg).....	--------	--------	.0000	.0002
Lead (Pb).....	--------	--------	.004	.004
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.000	.040
Chloride (Cl).....	4.2	7.0	--------	--------
Manganese (Mn).....	.03	.03	.000	.000
Iron (Fe).....	.29	.02	.080	.030
Calcium (Ca).....	3.4	7.9	--------	--------
Magnesium (Mg).....	1.1	.7	--------	--------
Sodium (Na).....	3.8	4.0	--------	--------
Potassium (K).....	1.9	1.8	--------	--------
Fluoride (F).....	.1	1.2	--------	--------
Silica (SiO2).....	11	12	--------	--------
Bicarbonate (HCO3).....	19	18	--------	--------
Carbonate (CO3).....	0	0	--------	--------
Sulfate (SO4).....	2.4	8.0	--------	--------
Nitrate (NO3).....	.4	.7	--------	--------
Dissolved Solids.....	44	52	--------	--------
Hardness as CaCO3:				
Total.....	15	24	--------	--------
Noncarbonate.....	2	8	--------	--------
Alkalinity as CaCO3.....	13	15	--------	--------
Specific conductance (micromhos at 25° C)....	44	74	--------	--------
pH.....	7.1	6.4	--------	--------
Temperature (°C).....	24	--------	--------	--------

GRAHAM COUNTY

WATER-RESOURCES APPRAISAL

Graham County is in the Blue Ridge Province in western North Carolina. The North Carolina-Tennessee State line is the western boundary. The county is nearly all mountainous with about four fifths of the land slopes exceeding 30 percent. Streams slopes are steep and drainage is good. The Little Tennessee River and Fontana Lake are the north boundary. Santeetlah Lake, a hydroelectric impoundment, is in the county. Tributaries of the Little Tennessee River, principally the Cheoah River, drain the county.

The average discharge of streams is relatively high, averaging 2.2 mgd per square mile. Minimum flows generally exceed 0.15 mgd per square mile, and 7-day, 2-year low flows average 0.4 mgd per square mile. There is an abundance of surface water available for public supply.

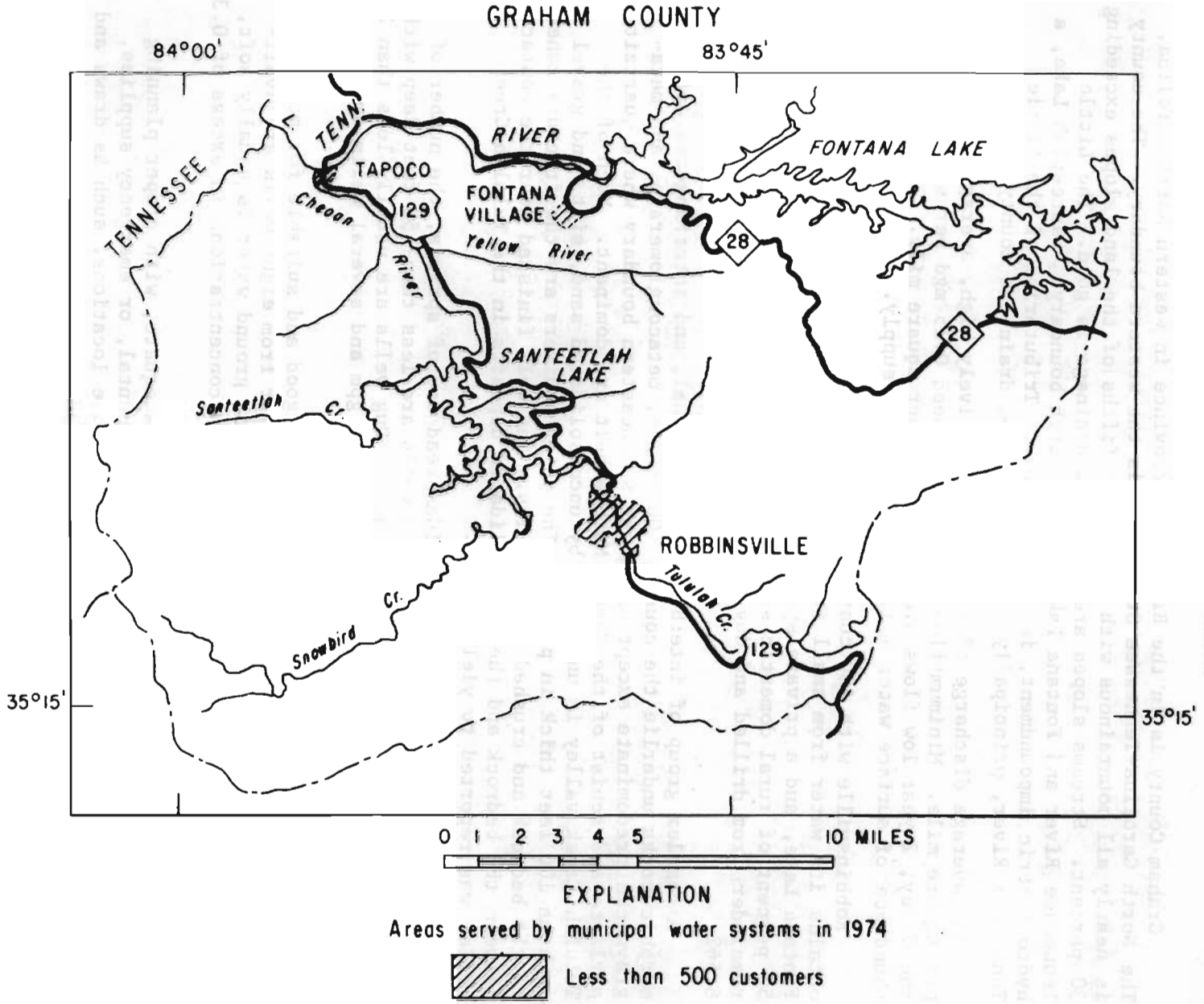
Robbinsville with 480 customers has the largest public water system and obtains its water from small streams. Fontana Village obtains water from Fontana Lake, and a private system in Tapoco uses the Cheoah River. Roughly 50 percent of rural domestic supplies are obtained from springs with the remainder from drilled and dug wells. The county population in 1970 was 6,562.

A complex group of interbedded, gradational, and interfingered metamorphic rocks underlie the county. Quartzite, metaconglomerate, and metagraywacke predominate except along the southeastern boundary where quartzite, phylitte and schist of the Murphy Marble belt are dominant. Much of the Tululah Creek valley is underlain by unconsolidated sand, silt, and gravel as much as 100 feet thick in places. The chief aquifers are the fracture zones in the bedrock and crushed quartz veins. One well finished near the contact between the bedrock and the unconsolidated deposits in the Tululah Creek valley was reported to yield 48 gpm.

Because of the abundance and widespread use of springs, the number of drilled wells is small. Most drilled wells are less than 150 feet deep with about half being less than 100 feet deep. Dug wells are usually less than 25 feet deep. The maximum reported yield is 48 gpm and several wells are reported to yield 30 gpm.

The chemical quality of ground water is good and suitable for most uses with little or no treatment. Analyses of water from eight wells are available. Results of these analyses indicate that ground water is usually soft, slightly acidic, and locally may contain iron concentrations in excess of 0.3 mg/1.

Potential supplies of ground water are adequate, with proper planning and management, for small industrial, supplemental, or emergency supplies. It is estimated that wells drilled in favorable locations, such as draws and small valleys, would yield as much as 0.07 mgd.


GRAHAM COUNTY
84°00'
83°45'
35°15'
35°15'
TENNESSEE
TENN. R.
RIVER
TAPOCO
Cheoah
129
FONTANA VILLAGE
FONTANA LAKE
Yellow River
28
28
River
SANTEETLAH LAKE
Santeetlah Cr.
ROBBINSVILLE
Tulula Cr.
Snowbird Cr.
129
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
Less than 500 customers

HAYWOOD COUNTY

WATER-RESOURCES APPRAISAL

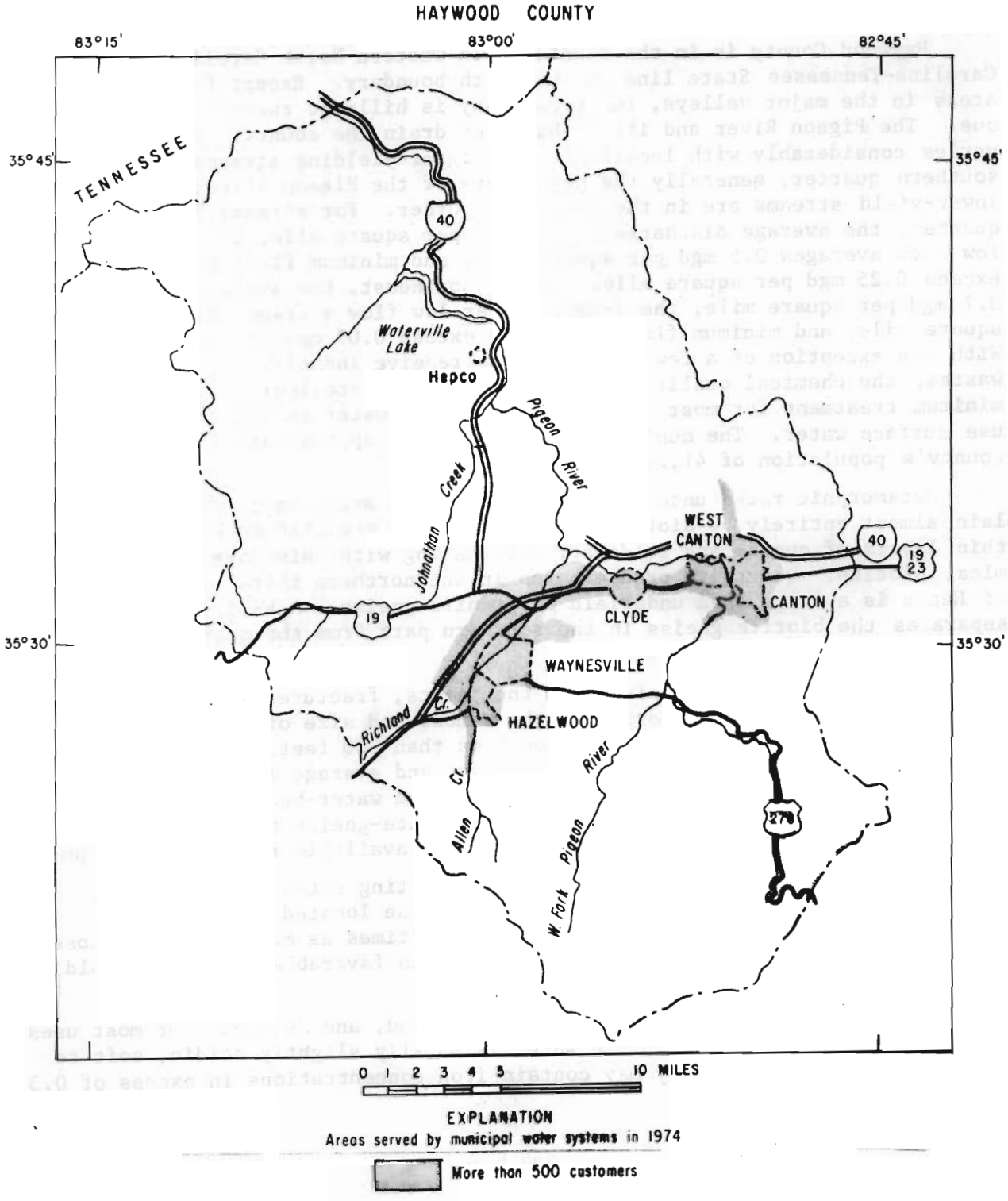
Haywood County is in the mountains in western North Carolina. The North Carolina-Tennessee State line is the north boundary. Except for a few flat areas in the major valleys, the topography is hilly to rugged and mountainous. The Pigeon River and its tributaries drain the county. Streamflow varies considerably with location. The higher-yielding streams are in the southern quarter, generally the headwaters of the Pigeon River, and the lower-yield streams are in the northeast corner. For streams in the southern quarter, the average discharge is 2.0 mgd per square mile, the 7-day, 2-year low flow averages 0.5 mgd per square mile, and minimum flows generally exceed 0.25 mgd per square mile. In the northeast, the average discharge is 0.7 mgd per square mile, the 7-day, 2-year low flow averages 0.15 mgd per square mile, and minimum flows generally exceed 0.07 mgd per square mile. With the exception of a few streams which receive industrial or municipal wastes, the chemical quality of surface water is excellent and requires only minimum treatment for most uses. All municipal water supplies in the county use surface water. The municipal systems supply approximately 29,000 of the county's population of 41,710 (1970).

Metamorphic rocks underlie the county. The southern two-thirds is underlain almost entirely by biotite gneiss, a banded granitic rock consisting of thin layers of quartz and feldspar, alternating with thin layers of black mica, biotite. Quartzite predominates in the northern third. North and east of Hepco is a large area underlain by granite gneiss. A belt of mica-schist separates the biotite gneiss in the southern part from the quartzite and granite gneiss in the north.

Drilled wells obtain water from the joints, fractures, and other small openings in the bedrock. Normally, the number and size of fractures decrease with depth. Wells are usually drilled less than 300 feet. For 36 drilled wells, the depths range from 36 to 425 feet, and average 154 feet. There is insufficient data on well yields to appraise the water-bearing characteristics of the various rocks; however, the granite-gneiss appears to be the better aquifer. The maximum reported yield in available records is 50 gpm.

Topography is an important factor in selecting sites for the higher yielding wells. The best wells are usually those located in draws and valleys, yielding, on the average, about 2 1/2 times as much water as those on hills. It is estimated that wells drilled in favorable locations could reasonably be expected to yield 35 gpm or more.

The chemical quality of ground water is good, and suitable for most uses with little or no treatment. The water is usually slightly acidic, soft to moderately hard, but locally may contain iron concentrations in excess of 0.3 mg/l.


HAYWOOD COUNTY
83°15'
83°00'
82°45'
35°45'
35°30'
TENNESSEE
40
Waterville Lake
Hepco
Pigeon River
Johnathon Creek
WEST CANTON
CANTON
40
19
23
19
CLYDE
WAYNESVILLE
HAZELWOOD
Richland Ck.
Allen Ck.
Pigeon River
W. Fork
276
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers

CANTON, HAYWOOD COUNTY

OWNERSHIP:

Municipal. Also supplies Clyde and six water associations. Total population supplied, about 9,000 in 1973 (2,500 metered customers, 850 of which are in suburban areas).

SOURCES:

Pigeon River: The intakes are at the southern city limits approximately 400 feet west of N. C. Highway 215 at lat 35°31'29", long 82°50'57". The drainage area at the intake is 133 square miles, approximately.

Rough Creek: The intakes are approximately 3.5 miles north of Canton at lat 35°35'17", long 82°50'38". The drainage area at the intakes is 1.3 square miles, approximately.

RAW-WATER STORAGE:

None.

ALLOWABLE DRAFT:

Estimated allowable draft of Rough Creek is 0.2 mgd with no storage.

Estimated allowable draft of Pigeon River is 25 mgd with no storage.

TOTAL USE:

Average (1973) 1.12 mgd, metered; maximum daily (7-24-73) 1.82 million gallons.

INDUSTRIAL USE:

0.15 mgd, estimated.

TREATMENT:

Pigeon River: Prechlorination, coagulation with alum and lime, sedimentation, rapid sand filtration, adjustment of pH with lime, post chlorination, and fluoridation.

Rough Creek: Pressure filtration, chlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

Pigeon River plant, 2.0 mgd.

Rough Creek plant, 0.6 mgd.

PUMPING CAPACITY:

Pigeon River: Raw water, 2.1 mgd; finished water, 2.0 mgd.

Rough Creek: gravity; capacity of the line is approximately 0.6 mgd.

FINISHED-WATER STORAGE:

One clear well, 100,000 gallons; two reservoirs, 750,000 and 550,000 gallons, and one tank in Clyde, 450,000 gallons.

FUTURE PLANS:

No definite plans in January 1973. A new treatment plant and dam at Rough Creek for construction in 4 to 5 years are under consideration.

CANTON, HAYWOOD COUNTY

WATER-RESOURCES APPRAISAL:

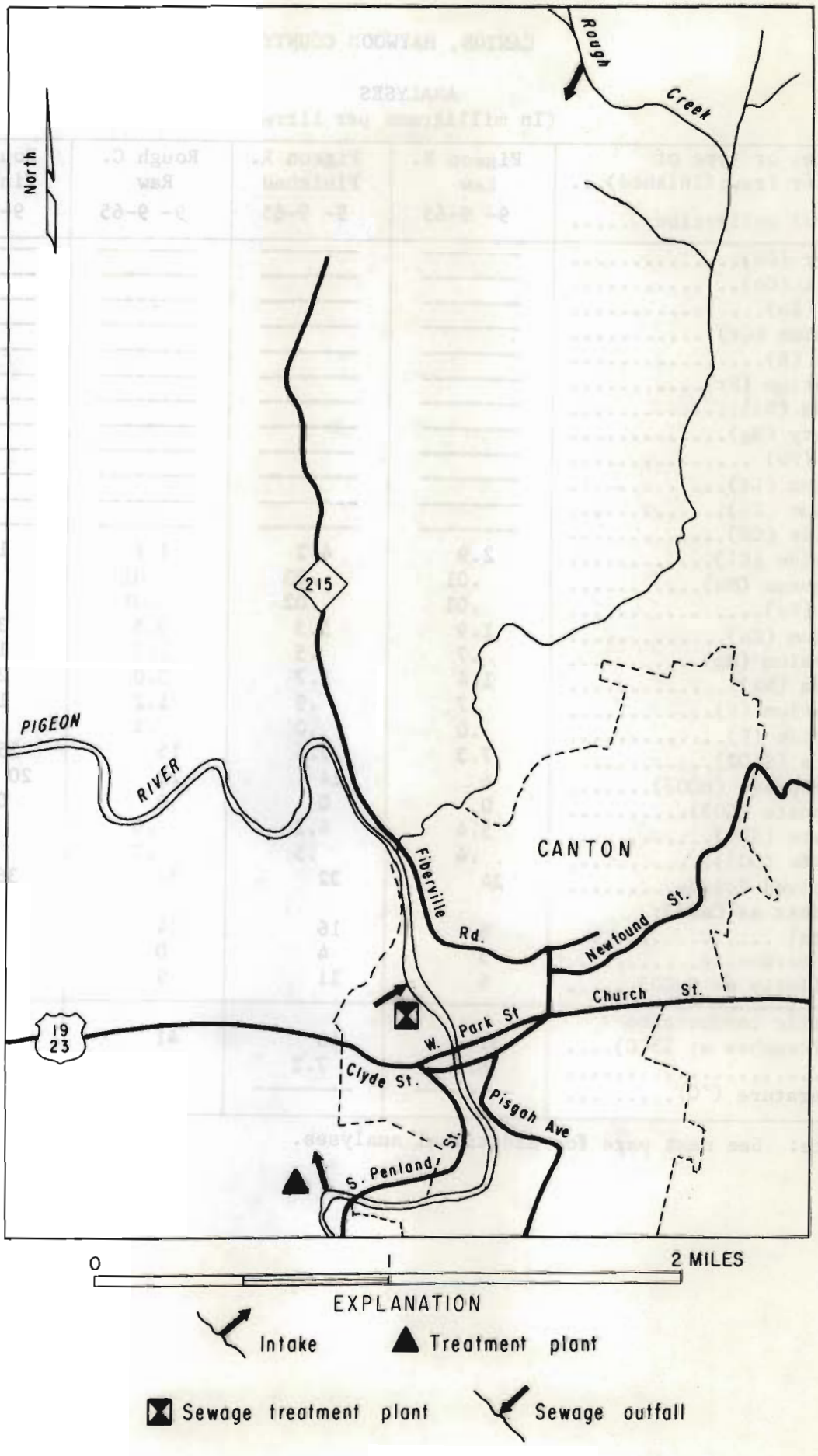
Surface water: Canton is in the Pigeon River Valley in east-central Haywood County. The Pigeon River and its tributaries drain all but the east side of the city which is drained by tributaries of the French Broad River. For streams draining the immediate area, the average discharge is 1.5 mgd per square mile, the 7-day, 2-year low flow is 0.5 mgd per square mile, and minimum flows generally exceed 0.1 mgd per square mile.

Canton normally withdraws as much water as it can from Rough Creek and obtains the remainder from Pigeon River. In 1973, 47 percent of the water requirements were obtained from Rough Creek. The water withdrawn from Rough Creek is limited to the capacity of the line or to the amount of water available, which is sometimes less than the capacity of the line. There is ample water in the Pigeon River to meet the needs of the city for the foreseeable future.

Ground-water: Biotite-gneiss is the predominant rock underlying Canton. Wells in this unit in the Canton vicinity are usually drilled from 50 to 150 feet deep. The maximum reported yield in available records is 25 gpm. With the abundance of surface water available it is not likely that ground water will be used for the municipal supply.

The chemical quality of ground water is good, however, locally iron concentrations may exceed 0.3 mg/1.

CITY OF CANTON



CANTON, HAYWOOD COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Pigeon R. Raw	Pigeon R. Finished	Rough C. Raw	Rough C. Finished
Date of collection.....	9- 9-65	9- 9-65	9- 9-65	9- 9-65
Copper (Cu).....	--------	--------	--------	--------
Cobalt (Co).....	--------	--------	--------	--------
Zinc (Zn).....	--------	--------	--------	--------
Chromium (Cr).....	--------	--------	--------	--------
Boron (B).....	--------	--------	--------	--------
Strontium (Sr).....	--------	--------	--------	--------
Barium (Ba).....	--------	--------	--------	--------
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	--------	--------
Lithium (Li).....	--------	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------	--------
Cyanide (CN).....	--------	--------	--------	--------
Chloride (Cl).....	2.9	4.2	1.1	1.5
Manganese (Mn).....	.01	.03	.01	.01
Iron (Fe).....	.01	.02	.01	.01
Calcium (Ca).....	1.9	5.3	3.5	3.4
Magnesium (Mg).....	.7	.5	1.1	1.1
Sodium (Na).....	1.4	1.7	3.0	2.8
Potassium (K).....	.7	.9	1.2	1.0
Fluoride (F).....	.0	.0	.1	.0
Silica (SiO2).....	7.3	7.6	15	15
Bicarbonate (HCO3).....	6	14	22	20
Carbonate (CO3).....	0	0	0	0
Sulfate (SO4).....	5.4	6.2	.6	.8
Nitrate (NO3).....	.4	.5	.7	.2
Dissolved Solids.....	24	32	37	36
Hardness as CaCO3:				
Total.....	8	16	14	13
Noncarbonate.....	3	4	0	0
Alkalinity as CaCO3.....	6	11	9	5
Specific conductance (micromhos at 25° C)....	31	43	41	39
pH.....	6.2	7.2	6.6	6.8
Temperature (°C).....	--------	--------	15	--------

Note: See next page for additional analyses.

CANTON, HAYWOOD COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Pigeon R. Raw	Pigeon R. Finished		
Date of collection.....	1-28-74	1-28-74		
Copper (Cu).....	0.010	0.002		
Cobalt (Co).....	.000	.000		
Zinc (Zn).....	.120	.050		
Chromium (Cr).....	.000	.000		
Boron (B).....	.000	.000		
Strontium (Sr).....	.040	.070		
Barium (Ba).....	.000	.000		
Mercury (Hg).....	.0000	.0001		
Lead (Pb).....	.000	.000		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.002	.002		
Arsenic (As).....	.016	.006		
Chloride (Cl).....	.7	2.2		
Manganese (Mn).....	.000	.000		
Iron (Fe).....	.100	.040		
Calcium (Ca).....	--------	--------		
Magnesium (Mg).....	--------	--------		
Sodium (Na).....	--------	-------		
Potassium (K).....	--------	-------		
Fluoride (F).....	--------	-------		
Silica (SiO_2).....	--------	-------		
Bicarbonate (HCO_3).....	--------	-------		
Carbonate (CO_3).....	--------	-------		
Sulfate (SO_4).....	--------	-------		
Nitrate (NO_3).....	--------	-------		
Dissolved Solids.....	--------	-------		
Hardness as $CaCO_3$:				
Total.....	--------	-------		
Noncarbonate.....	--------	-------		
Alkalinity as $CaCO_3$.....	--------	-------		
Specific conductance (micromhos at 25° C)....	21	49		
pH.....	--------	--------		
Temperature (°C).....	--------	--------		

WAYNESVILLE, HAYWOOD COUNTY

OWNERSHIP:

Municipal. Also supplies Junaluska Sanitary District, Lake Junaluska Assembly, and Hazelwood. Total population supplied, about 20,000 in 1973 (3,600 metered customers, and 800 to 1,000 unmetered customers).

SOURCES:

Rocky Branch impounded: The intakes are at the dam about 800 ft north of the treatment plant at lat 35°25'40", long 83°00'43". The drainage area at the intakes is 1.31 square miles.

Allen Creek impounded: The intakes are about 500 feet south of the treatment plant at lat 35°25'29", long 83°00'33". The drainage area at the intakes is 13 square miles, approximately.

RAW-WATER STORAGE:

Rocky Branch impoundment, about 300,000 gallons.

Allen Creek impoundment, about 500,000 gallons.

ALLOWABLE DRAFT:

Combined estimated allowable draft of Rocky Branch and Allen Creek is 3.0 mgd with negligible storage.

TOTAL USE:

Average (1973) 4.22 mgd, metered; maximum daily (9-28-73) 5.77 million gallons.

INDUSTRIAL USE:

2.3 mgd, estimated. Principal users include Champion Paper Co., Dayco Southern-Division of Dayco Corporation, A. C. Lawrence Leather Co., and Unagusta Manufacturing Corporation.

TREATMENT:

Prechlorination, coagulation with alum and caustic soda, sedimentation, high-rate, mixed-media filtration, addition of phosphate compounds for corrosion control, adjustment of pH with caustic soda, post chlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

8.0 mgd.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity and one 150 gpm booster pump in the distribution system.

FINISHED-WATER STORAGE:

One clear well, 150,000 gallons; two ground storage tanks, 1,000,000 and 100,000 gallons. Also have two tanks, 250,000 and 50,000 gallons not in use.

WAYNESVILLE, HAYWOOD COUNTY

FUTURE PLANS:

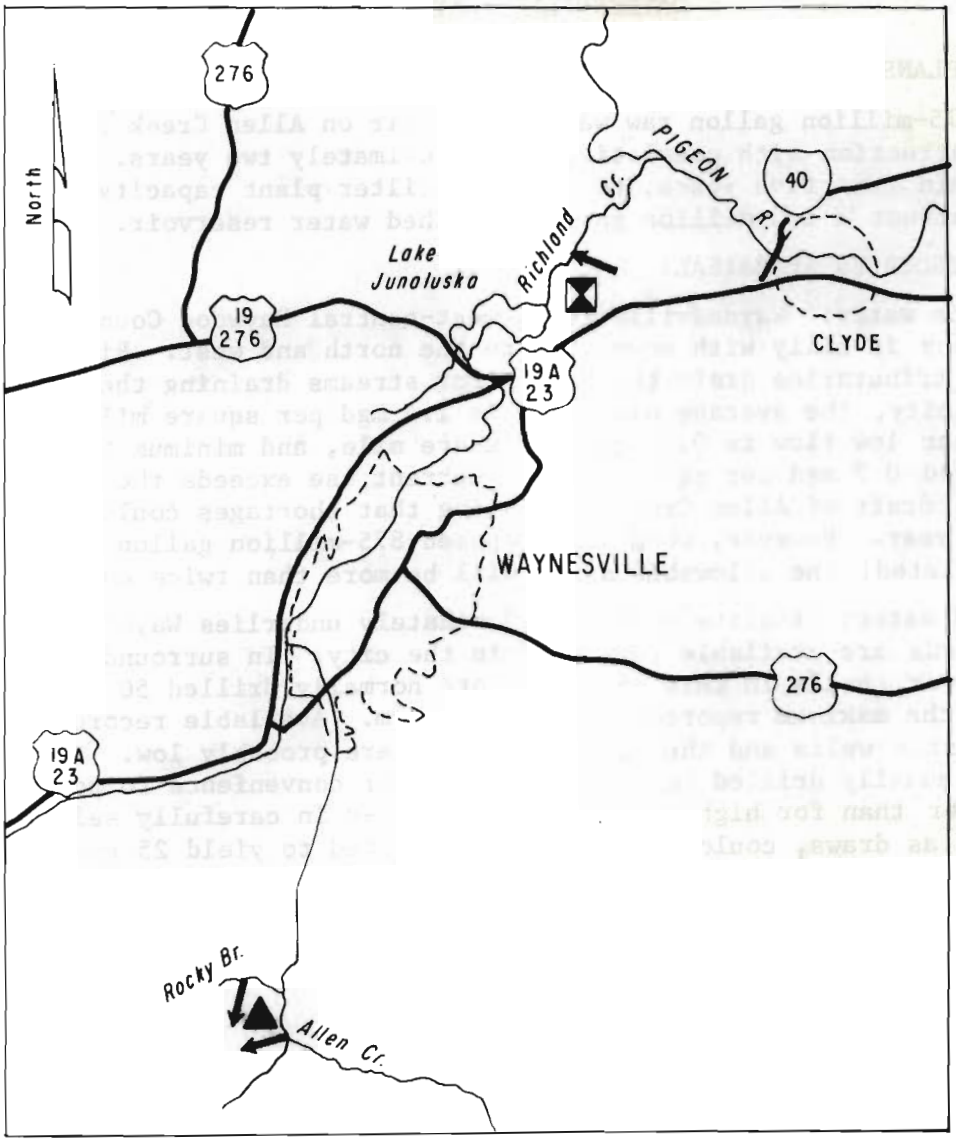
A 875-million gallon raw water reservoir on Allen Creek is scheduled for construction with completion in approximately two years. Also plan, within next five years, to increase filter plant capacity to 12 mgd and construct a 1.0-million gallon finished water reservoir.

WATER-RESOURCES APPRAISAL:

Surface water: Waynesville is in west-central Haywood County. The topography is hilly with mountains to the north and west. Richland Creek and its tributaries drain the city. For streams draining the immediate vicinity, the average discharge is 1.4 mgd per square mile, the 7-day, 2-year low flow is 0.4 mgd per square mile, and minimum flows generally exceed 0.2 mgd per square mile. Current use exceeds the estimated allowable draft of Allen Creek indicating that shortages could occur in a dry year. However, when the proposed 875-million gallon reservoir is completed, the allowable draft will be more than twice current use.

Ground water: Biotite gneiss predominately underlies Waynesville. No records are available for wells in the city. In surrounding area, however, wells in this rock unit are normally drilled 50 to 150 feet deep and the maximum reported yield is 14 gpm. Available records are for domestic wells and the reported yields are probably low. Domestic wells are usually drilled in sites selected for convenience to point of use rather than for high yield. Wells drilled in carefully selected sites, such as draws, could reasonably be expected to yield 25 gpm or more.

CITY OF WAYNESVILLE



WAYNESVILLE, HAYWOOD COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Allen Cr. Raw	Allen Cr. Finished	Allen Cr. Raw	Allen Cr. Finished
Date of collection.....	9- 8-65	9- 8-65	1-28-74	1-28-74
Copper (Cu).....	--------	--------	0.001	0.003
Cobalt (Co).....	--------	--------	.000	.000
Zinc (Zn).....	--------	--------	.060	.090
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.010	.000
Strontium (Sr).....	--------	--------	.000	.000
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	.0000	.0000
Lead (Pb).....	--------	--------	.003	.003
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.000	.003
Chloride (Cl).....	0.5	1.9	.6	2.1
Manganese (Mn).....	.05	.02	.010	.010
Iron (Fe).....	.06	.00	.050	.050
Calcium (Ca).....	2.4	3.2	--------	--------
Magnesium (Mg).....	.2	.6	--------	--------
Sodium (Na).....	1.3	1.2	--------	--------
Potassium (K).....	.6	.5	--------	--------
Fluoride (F).....	.0	.0	--------	--------
Silica (SiO2).....	9.3	9.5	--------	--------
Bicarbonate (HCO3).....	12	13	--------	--------
Carbonate (CO3).....	0	0	--------	--------
Sulfate (SO4).....	1.0	2.4	--------	--------
Nitrate (NO3).....	.0	.1	--------	--------
Dissolved Solids.....	25	22	--------	--------
Hardness as CaCO3:				
Total.....	8	11	--------	--------
Noncarbonate.....	0	1	--------	--------
Alkalinity as CaCO3.....	10	11	--------	--------
Specific conductance (micromhos at 25° C)....	20	29	16	69
pH.....	6.9	7.1	--------	--------
Temperature (°C).....	--------	--------	--------	--------

HENDERSON COUNTY

WATER-RESOURCES APPRAISAL

Henderson County is in the Blue Ridge Province in southwestern North Carolina. The North Carolina-South Carolina State line is the south boundary. The topography is characterized as a dissected central plateau bounded by the Pisgah Ridge on the northwest and the Blue Ridge front on the south and east. Roughly 75-80 square miles of the county is mildly rolling valley land. Tributaries of the Tennessee River Basin, principally Mills and French Broad Rivers and Mud, Clear, Cane and Hoopers Creeks, drain about three-fourths of the county. The remainder is drained by the Green and Broad Rivers of the Wateree River basin.

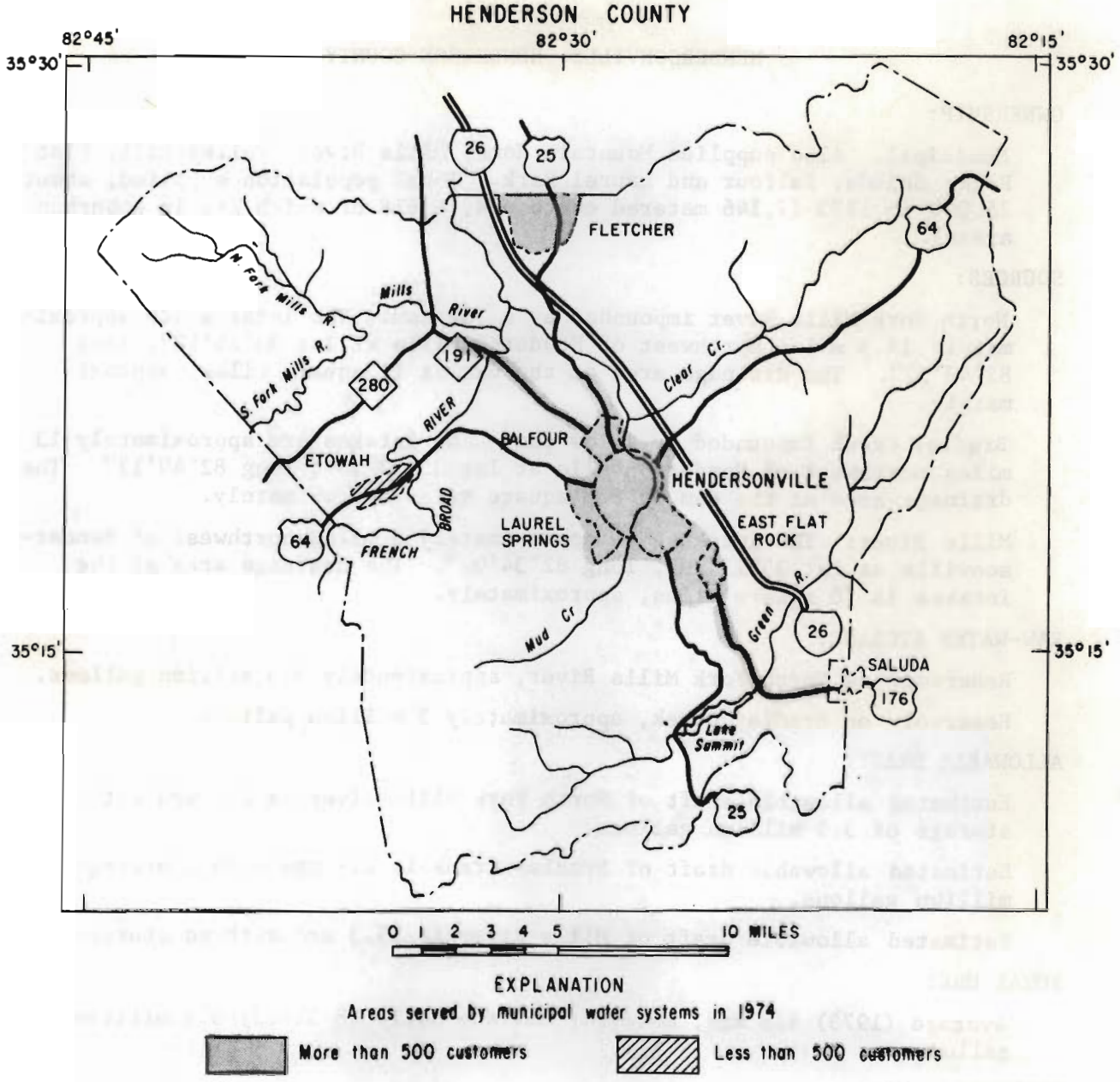
Streamflow varies considerably across the county, generally being greater in the western third and smaller in the north central part. For streams in the western third, the average discharge is 1.9 mgd per square mile, the 7-day, 2-year low flow is 0.6 mgd per square mile, and minimum flows generally exceed 0.3 mgd per square mile. In the north central part, the average discharge is 0.9 mgd per square mile, the 7-day, 2-year low flow is 0.25 mgd per square mile and minimum flows generally exceed 0.1 mgd per square mile. Hendersonville, who also supplies Mountain Home, Flat Rock, Saluda, Balfour, and Laurel Park, obtains its water from surface sources. Fletcher, on the Buncombe-Henderson county line obtains its water supply from Asheville. Most other smaller communities and rural domestic supplies use ground water. Hendersonville supplies more than one half of the county population of 42,804 (1970).

A wide variety of metamorphic rocks underlie Henderson County. The northwest corner is underlain by biotite-gneiss. A narrow northeast trending belt of schist adjoins the gneiss. The most predominant unit, Henderson granite-gneiss occurs in a northeast trending belt covering the central half. In the southeastern quarter a complex of granite gneiss, schist, hornblende gneiss and quartzite outcrops.

Much of the gentle undulating land most suitable for ground-water development is underlain by Henderson Gneiss. According to available well records, this unit is the best aquifer in the county. The maximum reported yield of drilled wells is 80 gpm and several yields were reported as "couldn't pump down." The average of reported yields is 24 gpm and the average depth is 118 feet with a range of 48 to 246 feet. For drilled wells in all rock units, the average yield is 18 gpm and the average depth is 118 feet.

The chemical quality of ground water is suitable for most uses with little or no treatment. Locally, iron concentrations may exceed 0.3 mg/1. Chemical analyses of water from fourteen wells are available and iron concentrations exceed 0.3 mg/1 in seven wells.

Ground water will continue to be an important source of supply for rural users. The potential ground water supply is also adequate, with proper planning and management for small industrial and municipal needs. It is estimated that if wells are drilled in favorable sites and spaced to prevent pumping interference, yields of 0.07 to 0.08 mgd can reasonably be expected.


HENDERSON COUNTY
82°45'
82°30'
82°15'
35°30'
35°15'
26
25
64
191
280
176
FLETCHER
HENDERSONVILLE
EAST FLAT ROCK
SALUDA
BALFOUR
ETOWAH
LAUREL SPRINGS
N. Fork Mills R.
S. Fork Mills R.
Mills River
Clear Cr.
BROAD RIVER
FRENCH
Mud Cr.
Green R.
Lake Summit
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

HENDERSONVILLE, HENDERSON COUNTY

OWNERSHIP:

Municipal. Also supplies Mountain Home, Mills River, Valley Hill, Flat Rock, Saluda, Balfour and Laurel Park. Total population supplied, about 25,000 in 1973 (7,146 metered customers, 4,618 of which are in suburban areas).

SOURCES:

North Fork Mills River impounded by a low dam: The intakes are approximately 14.5 miles northwest of Hendersonville at lat 35°25'10", long 82°40'32". The drainage area at the dam is 11 square miles, approximately.

Bradley Creek impounded by a low dam: The intakes are approximately 13 miles northwest of Hendersonville at lat 35°22'15", long 82°40'17". The drainage area at the dam is 8.3 square miles approximately.

Mills River: The intakes are approximately 8 miles northwest of Hendersonville at lat 35°23'29", long 82°34'07". The drainage area at the intakes is 70 square miles, approximately.

RAW-WATER STORAGE:

Reservoir on North Fork Mills River, approximately 3.5 million gallons.

Reservoir on Bradley Creek, approximately 3 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of North Fork Mills River is 2.7 mgd with a storage of 3.5 million gallons.

Estimated allowable draft of Bradley Creek is 2.1 mgd with a storage of 3 million gallons.

Estimated allowable draft of Mills River is 15.3 mgd with no storage.

TOTAL USE:

Average (1973) 4.5 mgd, metered; maximum daily (8-31-73) 5.9 million gallons.

INDUSTRIAL USE:

2.0 mgd, estimated. Principal users include Berkely Mills Corporation, General Electric Company, and Consolidated Aluminum Corporation.

TREATMENT:

North Fork Mills River and Bradley Creek: chlorination.

Mills River: Prechlorination, coagulation with alum and soda ash, sedimentation, rapid-sand filtration, and post chlorination.

RATED CAPACITY OF TREATMENT PLANT:

Mills River plant, 3.0 mgd.

HENDERSONVILLE, HENDERSON COUNTY

PUMPING CAPACITY:

North Fork Mills River and Bradley Creek: Raw water, gravity; finished water gravity with 3.5 mgd booster pump in line.

Mills River: Raw water, 3.6 mgd; finished water, 3.0 mgd.

FINISHED-WATER STORAGE:

One clear well, 250,000 gallons; one reservoir 10,000,000 gallons.

FUTURE PLANS:

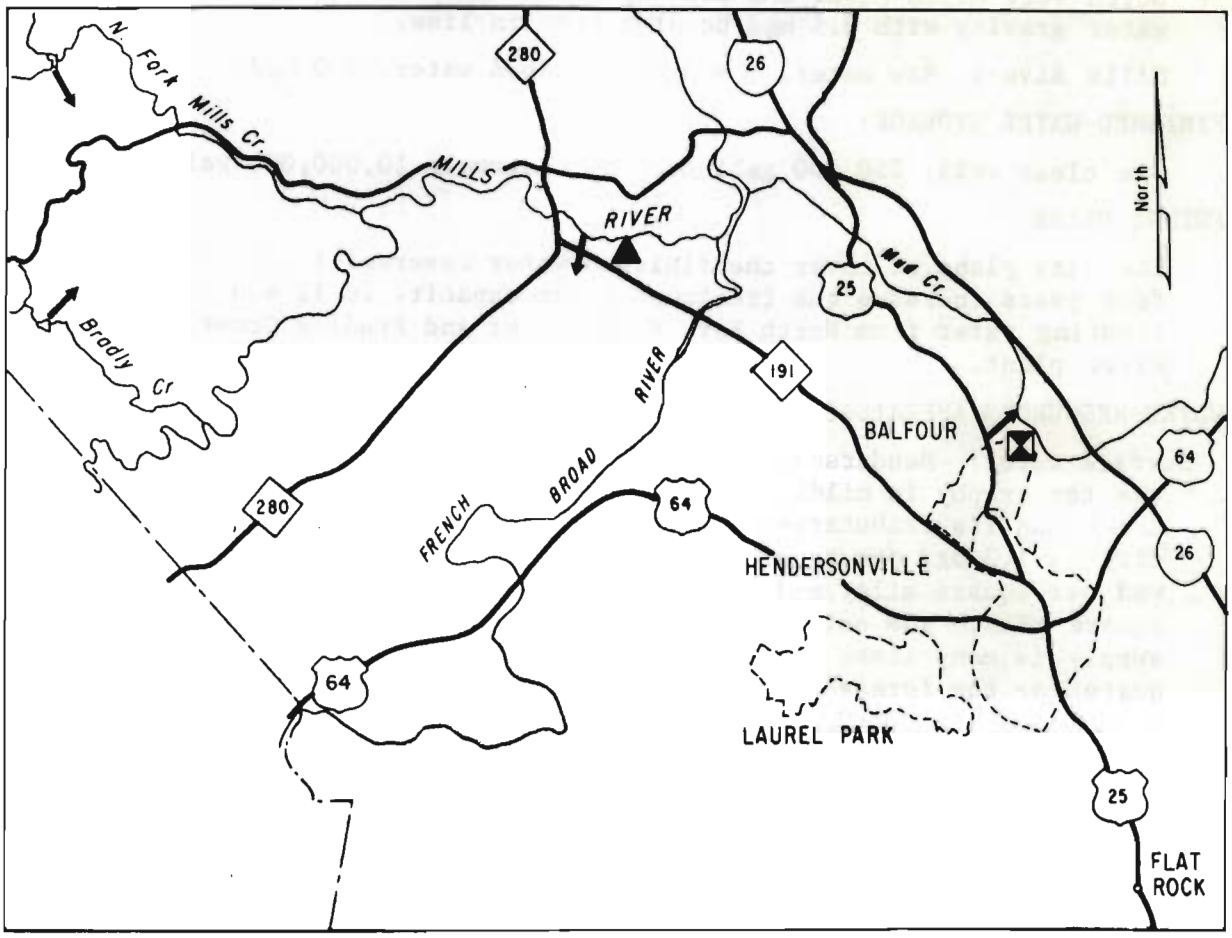
The city plans to cover the finished water reservoir; and within the next four years increase the treatment plant capacity to 12 mgd and begin treating water from North Fork Mills River and Bradley Creek at the Mills River plant.

WATER-RESOURCES APPRAISAL:

Surface water: Hendersonville is in the center of Henderson County where the topography is mildly rolling and hilly. The city is drained by Mud Creek and its tributaries. The average discharge of streams draining the city is 1.3 mgd per square mile, the 7-day, 2-year low flow averages 0.4 mgd per square mile, and minimum flows generally exceed 0.2 mgd per square mile. The estimated allowable draft of the present sources of supply is many times greater than current use and these should be adequate for the foreseeable future.

Ground water: Hendersonville is underlain by rocks of the Henderson Gneiss. Wells in the Hendersonville vicinity in this rock unit average 118 feet deep and the average reported yield is 24 gpm. With the abundance of surface water available, it is not likely that Hendersonville will use ground water as a source of supply. However, the amount of ground water available is sufficient for small industrial or air-conditioning use.

CITY OF HENDERSONVILLE



HENDERSONVILLE, HENDERSON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	N.F.Mills R. Finished	Mills R. Raw	Mills R. Finished	
Date of collection.....	6-13-63	1- 7-74	1- 7-74	
Copper (Cu).....	--------	0.018	0.001	
Cobalt (Co).....	--------	.000	.001	
Zinc (Zn).....	--------	.020	.008	
Chromium (Cr).....	--------	.017	.005	
Boron (B).....	--------	.000	.000	
Strontium (Sr).....	--------	.000	.000	
Barium (Ba).....	--------	.000	.000	
Mercury (Hg).....	--------	.0000	.0000	
Lead (Pb).....	--------	.006	.005	
Lithium (Li).....	--------	.000	.000	
Cadmium (Cd).....	--------	.006	.005	
Arsenic (As).....	--------	.002	.000	
Chloride (Cl).....	2.9	1.8	3.7	
Manganese (Mn).....	.00	.000	.000	
Iron (Fe).....	.01	.000	.000	
Calcium (Ca).....	1.0	1.2	3.0	
Magnesium (Mg).....	.4	.4	.3	
Sodium (Na).....	1.4	.9	11	
Potassium (K).....	.4	.4	.7	
Fluoride (F).....	.0	.0	.0	
Silica (SiO2).....	6.5	5.5	5.6	
Bicarbonate (HCO3).....	7	6	21	
Carbonate (CO3).....	0	0	0	
Sulfate (SO4).....	.6	1.4	11	
Nitrate (NO3).....	.0	.18	.18	
Dissolved Solids.....	17	28	50	
Hardness as CaCO3:				
Total.....	4	5	9	
Noncarbonate.....	0	0	0	
Alkalinity as CaCO3.....	6	5	17	
Specific conductance (micromhos at 25°C)....	18	15	74	
pH.....	6.7	6.9	8.3	
Temperature (°C).....	-------	--------	--------	

JACKSON COUNTY

WATER-RESOURCES APPRAISAL

Jackson County is in the mountain province in western North Carolina. The North Carolina-South Carolina State line is the southern boundary. The topography ranges from low rolling hills to rugged mountains. The area along the Tuckasegee River in the central part of the county is characterized by low rolling hills. The Tuckasegee River, which flows northwestward through the center of the county, and its tributaries drain all but the southernmost portion, which is drained by the Horsepasture, Whitewater, and Chattooga Rivers and their tributaries. Runoff of streams in the southern third of the county is among the greatest in the State. For streams in the south, the average discharge is 2.6 mgd per square mile, the 7-day, 2-year low flow is 0.55 mgd per square mile, and minimum flows generally exceed 0.3 mgd per square mile. Runoff in the north is considerably less. For streams in the north, the average discharge is 1.5 mgd per square mile, the 7-day, 2-year low flow is 0.4 mgd per square mile, and minimum flows generally exceed 0.2 mgd per square mile. Five reservoirs, East Fork Lake, Wolf Creek Lake, Bear Creek Lake, Cedar Cliff Lake, and Thorpe Reservoir, regulate the flow of the Tuckasegee River.

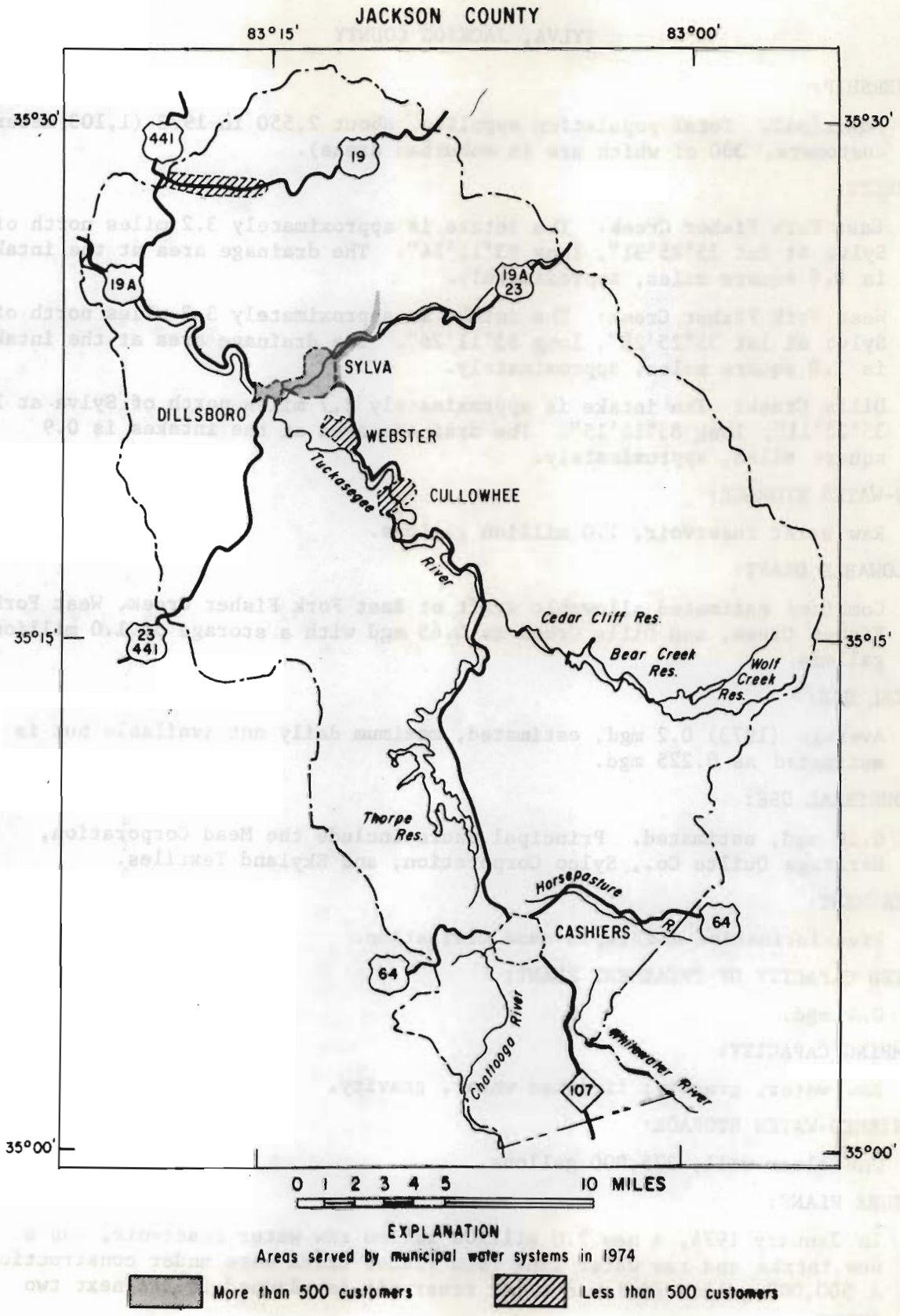
Sylva and the Western North Carolina University system obtain their water supply from surface sources. The Cherokee System serving an area along U. S. 19 also uses surface water. Dillsboro and other smaller communities use ground water. The county population in 1970 was 21,593.

Geologically, Jackson County is divisible into three sections. The southern half is underlain by roughly equal amounts of biotite gneiss and granite gneiss. North of this intermixed area, is a large area in which biotite gneiss is almost the only rock type. The northern quarter is underlain by several northeast trending belts of biotite gneiss, quartzite, mica-schist, and granite gneiss. The overlying weathered material and alluvium is more than 100 feet thick in some of the valleys. Springs are numerous and many are used for domestic supplies in remote areas. There are insufficient well records to make an appraisal of the water-bearing characteristics of the various rock units in the county. However, wells in the granite gneiss gnerally have higher yields.

Wells are normally drilled between 50 and 300 feet deep. For 35 drilled wells, the average depth is 149 feet, with a range of 20 to 427 feet. One well 250 feet deep in Webster was reportedly pumped 12 hours at 100 gpm with no drawdown. The yields of several wells used for commercial and municipal purposes exceed 50 gpm and yields exceeding 30 gpm are not uncommon.

The chemical quality of ground water is good and suitable for most uses with little or no treatment. The water is usually soft or only moderately hard, slightly acidic, and contains less than 0.3 mg/l of iron.

The amount of ground water available for development is adequate, with proper planning and management, for small industrial and municipal needs. Wells drilled in carefully selected sites, such as draws, sags, and topographically low areas, can reasonably be expected to yield 0.05 to 0.07 mgd per well.


JACKSON COUNTY
83°15'
83°00'
35°30'
35°15'
35°00'
441
19
19A
19A
23
SYLVA
DILLSBORO
WEBSTER
Tuckasegee River
CULLOWHEE
23
441
Cedar Cliff Res.
Bear Creek Res.
Wolf Creek Res.
Thorpe Res.
Horsepasture River
CASHIERS
64
64
Chattooga River
Whitewater River
107
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

SYLVA, JACKSON COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 2,550 in 1973 (1,103 metered customers, 300 of which are in suburban areas).

SOURCES:

East Fork Fisher Creek: The intake is approximately 3.2 miles north of Sylva at lat 35°25'31", long 83°11'14". The drainage area at the intake is 0.6 square miles, approximately.

West Fork Fisher Creek: The intake is approximately 3.3 miles north of Sylva at lat 35°25'28", long 83°11'26". The drainage area at the intake is 1.0 square miles, approximately.

Dills Creek: The intake is approximately 2.7 miles north of Sylva at lat 35°25'11", long 83°12'15". The drainage area at the intakes is 0.9 square miles, approximately.

RAW-WATER STORAGE:

Raw water reservoir, 1.0 million gallons.

ALLOWABLE DRAFT:

Combined estimated allowable draft of East Fork Fisher Creek, West Fork Fisher Creek, and Dills Creek is 0.65 mgd with a storage of 1.0 million gallons.

TOTAL USE:

Average (1973) 0.2 mgd, estimated, maximum daily not available but is estimated as 0.225 mgd.

INDUSTRIAL USE:

0.10 mgd, estimated. Principal users include the Mead Corporation, Heritage Quilts Co., Sylco Corporation, and Skyland Textiles.

TREATMENT:

Prechlorination and rapid-sand filtration.

RATED CAPACITY OF TREATMENT PLANT:

0.4 mgd.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity.

FINISHED-WATER STORAGE:

One clear well, 375,000 gallons.

FUTURE PLANS:

In January 1974, a new 7.0 million gallon raw water reservoir, and a new intake and raw water line from Fisher Creek were under construction. A 500,000 gallon finished water reservoir is planned in the next two years.

SYLVA, JACKSON COUNTY

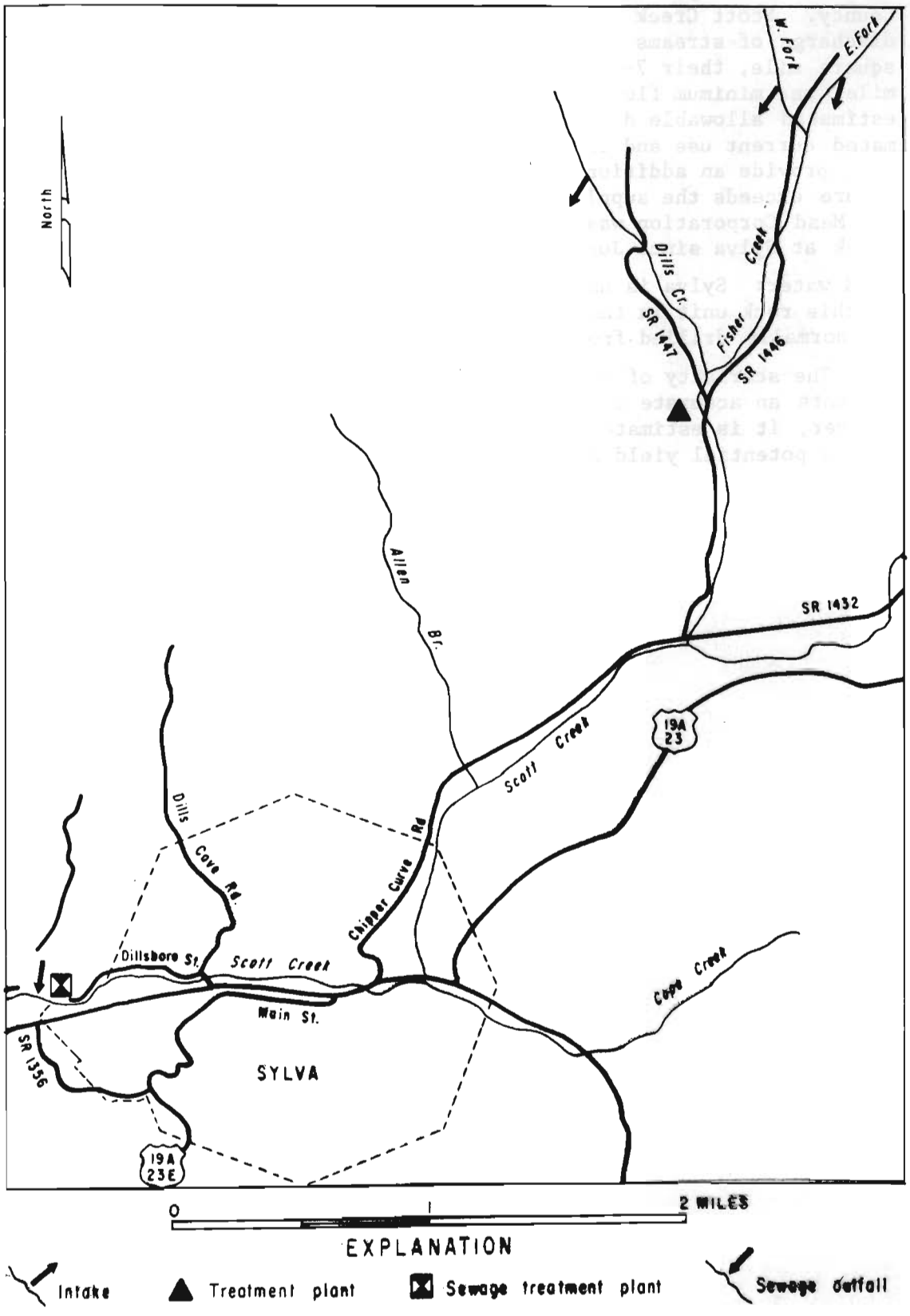
WATER-RESOURCES APPRAISAL:

Surface water: Sylva is in a relatively narrow valley in northern Jackson County. Scott Creek and its tributaries drain the city. The average discharge of streams draining the immediate vicinity is 1.5 mgd per square mile, their 7-day, 2-year low flow averages 0.45 mgd per square mile, and minimum flows generally exceed 0.20 mgd per square mile. The estimated allowable draft of the current sources is three times the estimated current use and the planned 7.0 million gallon raw water reservoir will provide an additional margin of safety. However, if demand in the future exceeds the supply, water could be obtained from Scott Creek above the Mead Corporation waste outfall. The minimum daily flow of Scott Creek at Sylva since June 1941 was 14.2 mgd in 1954, a very dry year.

Ground water: Sylva is underlain by biotite gneiss. Reported well yields in this rock unit in the immediate vicinity are as high as 50 gpm. Wells are normally drilled from 50 to 300 feet and average 150 feet.

The scaricity of records of drilled wells of tested capacity prevents an accurate appraisal of ground-water conditions in the city. However, it is estimated that wells drilled in carefully selected sites have a potential yield of 0.06 mgd.

CITY OF SYLVA



SYLVA, JACKSON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)... Date of collection.....	Combined[a/] Finished 9 -8-65	Combined[b/] Finished 1-11-74		
Copper (Cu).....	--------	0.004		
Cobalt (Co).....	--------	.003		
Zinc (Zn).....	--------	.040		
Chromium (Cr).....	--------	.000		
Boron (B).....	--------	.040		
Strontium (Sr).....	--------	.000		
Barium (Ba).....	--------	.000		
Mercury (Hg).....	--------	.0000		
Lead (Pb).....	--------	.039		
Lithium (Li).....	--------	.000		
Cadmium (Cd).....	--------	.000		
Arsenic (As).....	--------	.006		
Chloride (Cl).....	1.9	1.6		
Manganese (Mn).....	.00	.017		
Iron (Fe).....	.00	.050		
Calcium (Ca).....	1.2	--------		
Magnesium (Mg).....	.2	--------		
Sodium (Na).....	.9	--------		
Potassium (K).....	.3	--------		
Fluoride (F).....	.1	--------		
Silica (SiO2).....	7.2	--------		
Bicarbonate (HCO3).....	5	--------		
Carbonate (CO3).....	0	--------		
Sulfate (SO4).....	.8	--------		
Nitrate (NO3).....	.3	--------		
Dissolved Solids.....	15	--------		
Hardness as CaCO3:				
Total.....	4	--------		
Noncarbonate.....	0	--------		
Alkalinity as CaCO3.....	4	--------		
Specific conductance (micromhos at 25° C)....	15	--------		
pH.....	6.1	--------		
Temperature (°C).....	--------	--------		

[a/] Dills and Fisher Creek combined.
[b/] E. F. Fisher Creek, W. F. Fisher Creek and Dills Creek combined.

MACON COUNTY

WATER-RESOURCES APPRAISAL

Macon County is in the mountains in western North Carolina. The North Carolina-Georgia State line is the southern boundary. The topography is mostly mountainous except for a relatively low hilly area along the Little Tennessee River Valley. Practically the entire county is drained by the Nantahala and Little Tennessee Rivers and their tributaries. Tributaries of the Chatooga River drain a small area along the southern boundary. The average discharge of streams is among the highest in the State, with some streams averaging as much as 2.8 mgd per square mile. For all streams, the average discharge is 2.1 mgd per square mile. Minimum flows generally exceed 0.25 mgd per square mile, and 7-day, 2-year low flows average 0.5 mgd per square mile.

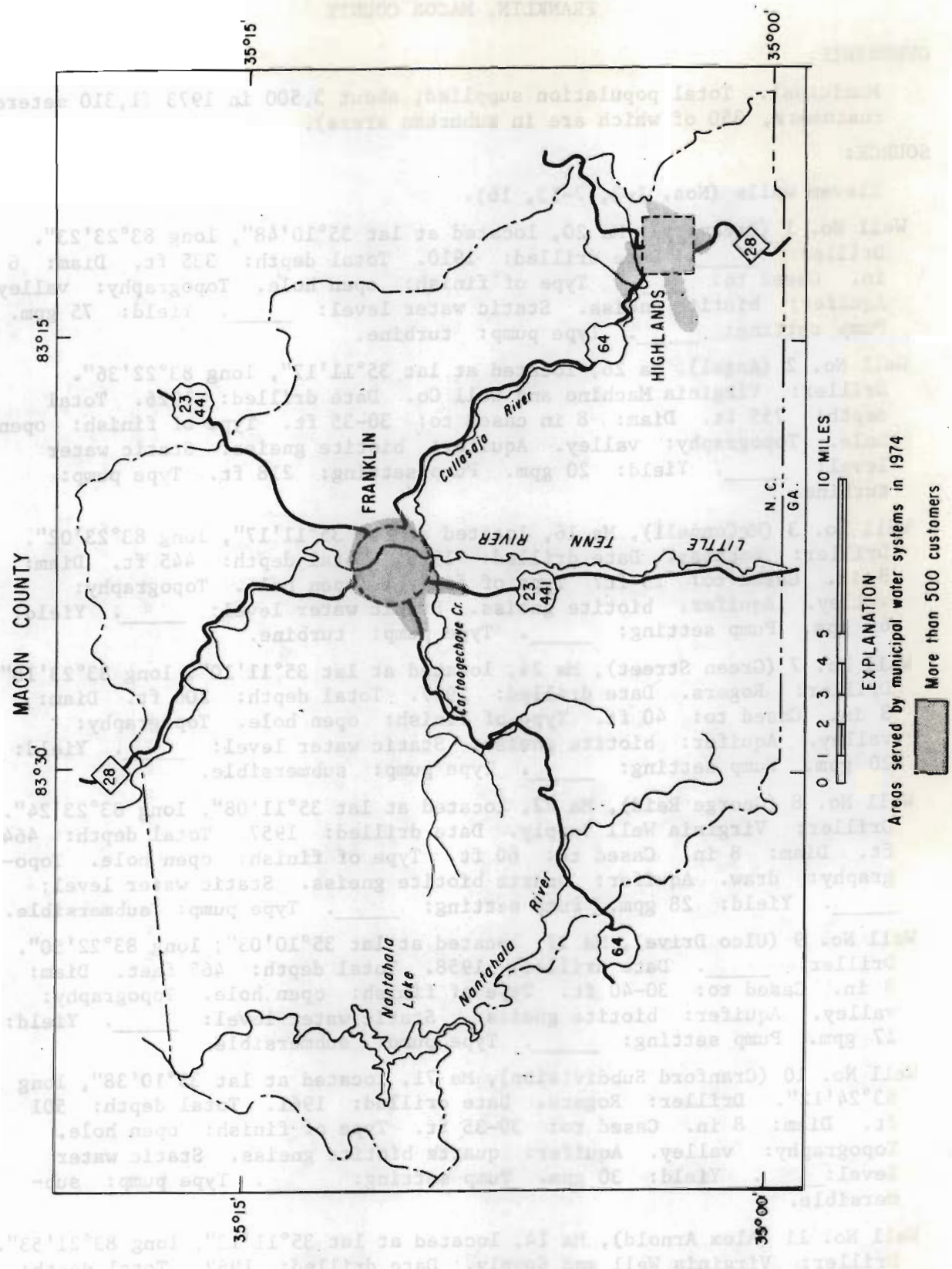
Highlands obtains its water from surface sources. Franklin is currently using ground water but is considering using Cartoogechaye Creek as a source. These are the only municipal water systems in the county and they serve approximately 7,000 of the county population of 15,788 (1970).

Three rock types predominate in Macon County: granite gneiss in the southeast corner; quartzite along the northwest border; and most abundant of all, biotite gneiss in the remainder of the county. The overlying mantle of weathered rock and alluvium is non-existent in places and more than 100 feet thick in some of the larger stream valleys. Available records do not allow an accurate appraisal of the water-bearing characteristics of the various rock units; however, the highest reported yields are for wells drilled in the granite gneiss.

Drilled wells obtain water from joints, faults, and other fractures in the bedrock. Generally, the number and size of openings in the bedrock decrease with depth and drilling to great depths is not warranted. As a general rule, if water has not been obtained at 300 feet, the chances of obtaining water by drilling deeper are slim. However, the maximum reported yield in available records is 165 gpm from a well 800 feet deep in the Highlands area.

The topography of a well site is more significant to yield than rock type. Water flowing over the land surface tends to carve draws and valleys along the lines of least resistance, such as fault or fractures zones, and usually these openings are more abundant in valley floors. In Macon County, wells in draws and valleys, on the average, yield about 2 1/2 times as much water as wells on hills. It is estimated that wells drilled in carefully selected sites and spaced to prevent pumping interference, could reasonably be expected to yield 0.04 to 0.05 mgd per well.

The chemical quality of ground water is generally good. The water is usually slightly acidic, soft to moderately hard, and locally may contain iron concentrations in excess of 0.3 mg/l.


35°15'
35°00'
83°15'
83°30'
MACON COUNTY
FRANKLIN
HIGHLANDS
Cullasaja River
LITTLE TENN RIVER
Cartoogechaye Cr.
Nantahala River
Nantahala Lake
N.C.
GA.
23
441
28
64
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers

FRANKLIN, MACON COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,500 in 1973 (1,310 metered customers, 350 of which are in suburban areas).

SOURCE:

Eleven wells (Nos. 1-3, 7-13, 16).

Well No. 1 (Creamery), Ma 20, located at lat 35°10'48", long 83°23'23". Driller: _____. Date drilled: 1910. Total depth: 335 ft. Diam: 6 in. Cased to: _____. Type of finish: open hole. Topography: valley. Aquifer: biotite gneiss. Static water level: _____. Yield: 75 gpm. Pump setting: _____. Type pump: turbine.

Well No. 2 (Angel), Ma 26, located at lat 35°11'17", long 83°22'36". Driller: Virginia Machine and Well Co. Date drilled: 1926. Total depth: 755 ft. Diam: 8 in cased to: 30-35 ft. Type of finish: open hole. Topography: valley. Aquifer: biotite gneiss. Static water level: _____. Yield: 20 gpm. Pump setting: 218 ft. Type pump: turbine.

Well No. 3 (McConnell), Ma 16, located at lat 35°11'17", long 83°23'02". Driller: Robbins. Date drilled: 1938. Total depth: 445 ft. Diam: 8 in. Cased to: 25 ft? Type of finish: open hole. Topography: valley. Aquifer; biotite gneiss. Static water level: _____. Yield: 65 gpm. Pump setting: _____. Type pump: turbine.

Well No. 7 (Green Street), Ma 24, located at lat 35°11'10", long 83°23'18". Driller: Rogers. Date drilled: 1957. Total depth: 200 ft. Diam: 8 in. Cased to: 40 ft. Type of finish: open hole. Topography: valley. Aquifer; biotite gneiss. Static water level: _____. Yield: 20 gpm. Pump setting: _____. Type pump: submersible.

Well No. 8 (George Reid), Ma 22, located at lat 35°11'08", long 83°23'24". Driller: Virginia Well Supply. Date drilled: 1957. Total depth: 464 ft. Diam; 8 in. Cased to: 60 ft. Type of finish: open hole. Topography: draw. Aquifer: quartz biotite gneiss. Static water level: _____. Yield: 28 gpm. Pump setting: _____. Type pump: submersible.

Well No. 9 (Ulco Drive), Ma 17, located at lat 35°10'03", long 83°22'50". Driller: _____. Date drilled: 1958. Total depth: 465 feet. Diam: 8 in. Cased to: 30-40 ft. Type of finish: open hole. Topography: valley. Aquifer: biotite gneiss. Static water level: _____. Yield: 17 gpm. Pump setting: _____. Type pump: submersible.

Well No. 10 (Cranford Subdivision), Ma 71, located at lat 35°10'38", long 83°24'12". Driller: Rogers. Date drilled: 1961. Total depth: 501 ft. Diam: 8 in. Cased to: 30-35 ft. Type of finish: open hole. Topography: valley. Aquifer: quartz biotite gneiss. Static water level:_____. Yield: 30 gpm. Pump setting: _____. Type pump: submersible.

Well No. 11 (Alex Arnold), Ma 14, located at lat 35°11'13", long 83°21'53". Driller: Virginia Well and Supply. Date drilled: 1962. Total depth: 616 ft. Diam: 8 in. Cased to: 43 ft. Type of finish: open hole.

FRANKLIN, MACON COUNTY

Topography: slope. Aquifer: quartz biotite gneiss. Static water level: _____. Yield: 49 gpm. Pump setting: _____. Type pump: submersible.

Well No. 12 (Alsup), Ma 25, located at lat 35°10'48", long 83°24'22". Driller: Virginia Well and Supply. Date drilled: 1962. Total depth: 515 ft. Diam: 8 in. Cased to: _____ ft. Type of finish: open hole. Topography: valley. Aquifer: quartz biotite gneiss. Static water level: _____ ft. Yield: 90 gpm. Pump setting: _____. Type pump: turbine.

Well No. 13 (Georgia Road), Ma 69, located at lat 35°09'38", long 83°23'40". Driller: Virginia Well and Supply. Date drilled: 1967. Total depth: 600 ft. Diam: 8 in. Cased to: _____. Type of finish: open hole. Topography: valley. Aquifer: _____. Static water level: _____. Yield: 42 gpm. Pump setting: _____. Type pump: submersible.

Well No. 16 (Belden well), Ma 70, located at lat 35°09'57", long 83°23'32". Driller: Hedden Brothers. Date drilled: 1972. Total depth: 250 ft. Diam: 8 in. Cased to: _____. Type of finish: open hole. Aquifer: _____. Static water level: _____. Yield: 120 gpm. Pump setting: _____. Type pump: submersible.

TOTAL USE:

Average (1973) 0.39 mgd, metered; maximum daily not available.

INDUSTRIAL USE:

0.04 mgd, estimated. Principal users include Franklin Mineral Products, Blue Bell, Inc., and Electric Cord Products Co.

TREATMENT:

None.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Raw water, not available. Combined reported yield of wells is 0.74 mgd. For short periods, pumping capacity probably exceeds 1.0 mgd.

FINISHED-WATER STORAGE:

One elevated tank, 60,000 gallons; five stand pipes, 120,000, 120,000, 153,000, 200,000 and 300,000 gallons.

FUTURE PLANS:

Construction of a filter plant and use of Cartoogechaye Creek as a source of supply are under consideration.

WATER-RESOURCES APPRAISAL:

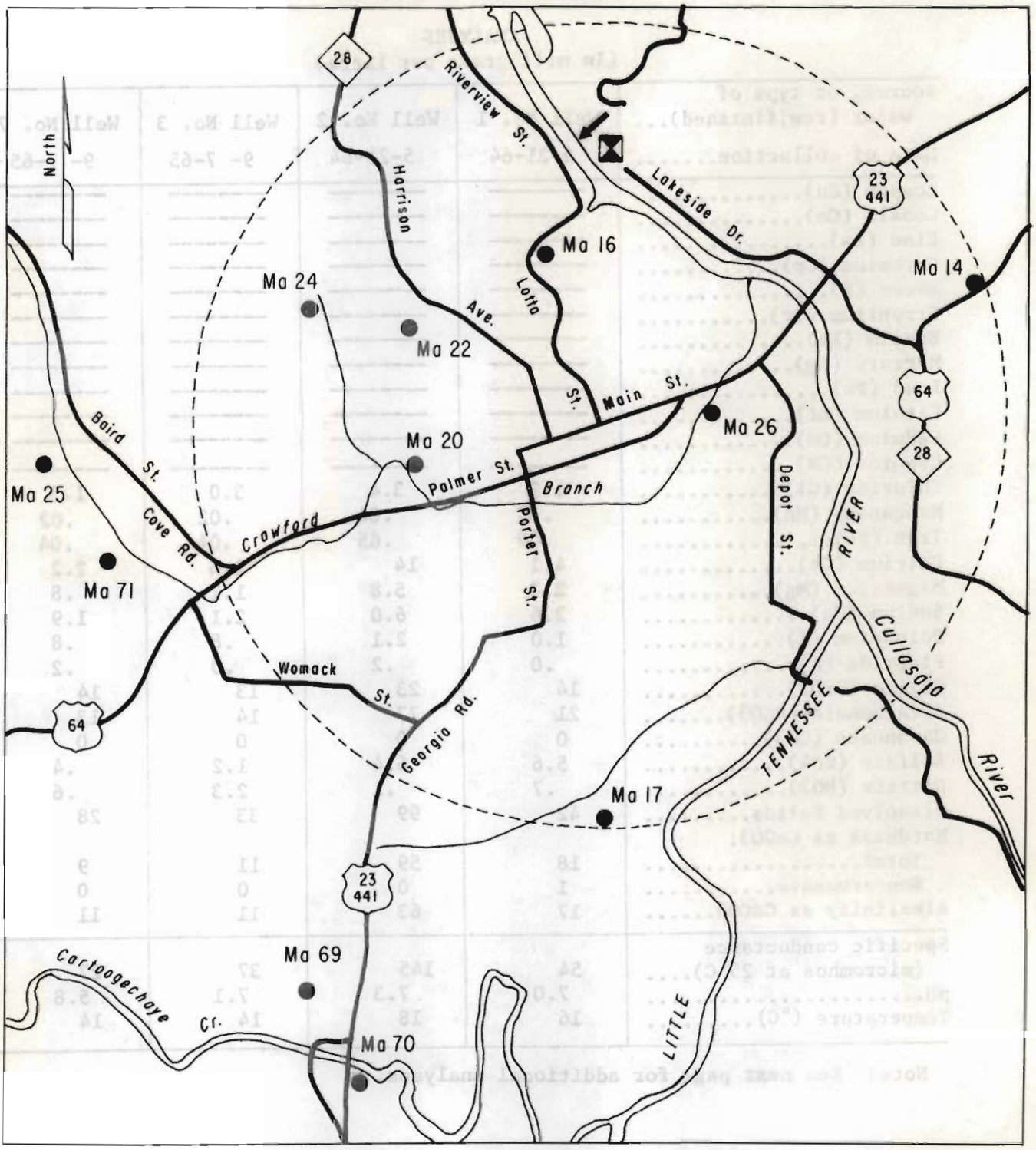
Surface water: Franklin is in east-central Macon County in the valley of the Little Tennessee River. The topography is characterized as a valley

flat with rolling hills and surrounding mountains. The city is drained by the Little Tennessee River, and its tributaries. The Cullasaja River flows into the Little Tennessee at the southeast side of the city. The average discharge of streams draining the immediate vicinity is 1.9 mgd per square mile. The 7-day, 2-year low flow averages 0.55 mgd per square mile, and minimum flow generally exceeds 0.2 mgd per square mile. There is an abundant supply of surface water available for municipal supply. Cartoogechaye Creek is presently being considered as a source of supply. The minimum discharge recorded since 1961 at a Geological Survey gaging station on Cartoogechaye Creek near Franklin was 21 mgd.

Ground water: Metamorphic rocks, principally biotite gneiss, underlie Franklin. Records of well casing lengths indicate that the thickness of overlying weathered rock and aluvium is as much as 65 feet in the city. The eleven wells supplying the city range in depth from 200 to 755 feet, averaging 452 feet, and range in yield from 17 to 120 gpm. Well Nos. 4, 5, 6, 14 and 15 have been abandoned due to low yield or high iron content.

The chemical quality of ground water is somewhat variable. The water is soft to moderately hard, and dissolved solids range from 28 to 99 mg/1. Iron concentrations in one well were as high as 0.96 mg/1.

CITY OF FRANKLIN



EXPLANATION

Ma 69 ● Well and number

Sewage treatment plant

Sewage outfall

FRANKLIN, MACON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 1	Well No. 2	Well No. 3	Well No. 7
Date of collection.....	5-21-64	5-21-64	9- 7-65	9- 7-65
Copper (Cu).....	-------	-------	-------	-------
Cobalt (Co).....	-------	-------	-------	-------
Zinc (Zn).....	-------	-------	-------	-------
Chromium (Cr).....	-------	-------	-------	-------
Boron (B).....	-------	-------	-------	-------
Strontium (Sr).....	-------	-------	-------	-------
Barium (Ba).....	-------	-------	-------	-------
Mercury (Hg).....	-------	-------	-------	-------
Lead (Pb).....	-------	-------	-------	-------
Lithium (Li).....	-------	-------	-------	-------
Cadmium (Cd).....	-------	-------	-------	-------
Cyanide (CN).....	-------	-------	-------	-------
Chloride (Cl).....	1.9	3.4	3.0	1.3
Manganese (Mn).....	.02	.04	.02	.02
Iron (Fe).....	.09	.65	.04	.04
Calcium (Ca).....	4.1	14	2.6	2.2
Magnesium (Mg).....	2.0	5.8	1.1	.8
Sodium (Na).....	2.6	6.0	2.1	1.9
Potassium (K).....	1.0	2.1	.8	.8
Fluoride (F).....	.0	.2	.0	.2
Silica (SiO_2).....	14	23	13	14
Bicarbonate (HCO_3).....	21	77	14	13
Carbonate (CO_3).....	0	0	0	0
Sulfate (SO_4).....	5.6	6.4	1.2	.4
Nitrate (NO_3).....	.7	.1	2.3	.6
Dissolved Solids.....	42	99	33	28
Hardness as $CaCO_3$:				
Total.....	18	59	11	9
Noncarbonate.....	1	0	0	0
Alkalinity as $CaCO_3$.....	17	63	11	11
Specific conductance (micromhos at 25° C)....	54	145	37	27
pH.....	7.0	7.3	7.1	5.8
Temperature (°C).....	16	18	14	14

Note: See next page for additional analyses.

FRANKLIN, MACON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 8	Well No. 9	Well No.10	Well No.11
Date of collection.....	9- 7-65	9- 7-65	5-21-64	9- 7-65
Copper (Cu).....	--------	--------	--------	--------
Cobalt (Co).....	--------	--------	--------	--------
Zinc (Zn).....	--------	--------	--------	--------
Chromium (Cr).....	--------	--------	--------	--------
Boron (B).....	--------	--------	--------	--------
Strontium (Sr).....	--------	--------	--------	--------
Barium (Ba).....	--------	--------	--------	--------
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	--------	--------
Lithium (Li).....	--------	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------	--------
Cyanide (CN).....	--------	--------	--------	--------
Chloride (Cl).....	3.0	2.2	1.9	1.6
Manganese (Mn).....	.08	.05	.03	.06
Iron (Fe).....	.30	.20	.07	.43
Calcium (Ca).....	12	12	8.7	14
Magnesium (Mg).....	4.0	1.7	1.6	5.4
Sodium (Na).....	5.1	4.0	5.1	4.2
Potassium (K).....	3.0	1.7	1.3	3.4
Fluoride (F).....	.1	.2	.1	.2
Silica (SiO2).....	23	22	22	24
Bicarbonate (HCO3).....	47	44	39	71
Carbonate (CO3).....	0	0	0	0
Sulfate (SO4).....	12	11	7.4	5.6
Nitrate (NO3).....	.1	.2	.1	.2
Dissolved Solids.....	90	77	66	97
Hardness as CaCO3:				
Total.....	46	38	28	56
Noncarbonate.....	8	2	0	0
Alkalinity as CaCO3.....	39	36	32	58
Specific conductance (micromhos at 25°C)....	126	100	84	134
pH.....	6.6	7.1	7.0	7.2
Temperature (°C).....	16	16	20	14

Note: See next page for additional analyses.

FRANKLIN, MACON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No.12	Well No.16		
Date of collection.....	9- 7-65	1- 9-74		
Copper (Cu).....	-------	0.004		
Cobalt (Co).....	-------	.003		
Zinc (Zn).....	-------	.050		
Chromium (Cr).....	-------	.000		
Boron (B).....	-------	.000		
Strontium (Sr).....	-------	.000		
Barium (Ba).....	-------	.000		
Mercury (Hg).....	-------	.0000		
Lead (Pb).....	-------	.009		
Lithium (Li).....	-------	.000		
Cadmium (Cd).....	-------	.004		
Arsenic (As).....	-------	.002		
Chloride (Cl).....	1.5	1.8		
Manganese (Mn).....	.02	.014		
Iron (Fe).....	.02	.100		
Calcium (Ca).....	2.3	11		
Magnesium (Mg).....	1.0	2.2		
Sodium (Na).....	2.8	4.8		
Potassium (K).....	1.1	2.0		
Fluoride (F).....	.1	.0		
Silica (SiO_2).....	15	23		
Bicarbonate (HCO_3).....	16	51		
Carbonate (CO_3).....	0	0		
Sulfate (SO_4).....	1.2	7.3		
Nitrate (NO_3).....	.2	.08/		
Dissolved Solids.....	33	89		
Hardness as $CaCO_3$:				
Total.....	10	37		
Noncarbonate.....	0	0		
Alkalinity as $CaCO_3$.....	13	42		
Specific conductance (micromhos at 25°C)....	28	107		
pH.....	6.2	7.1		
Temperature (°C).....	14	-------		

/Nitrate (NO_2 + NO_3 as N).

HIGHLANDS, MACON COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,500 in 1973 (1,050 metered customers, 500 of which are in suburban areas).

SOURCES:

Houston Branch impounded in Houston Lake: The intakes are approximately 3.2 miles north of Highlands at lat 35°05'55", long 83°12'17". The drainage area at the intakes is 0.2 square miles, approximately.

Big Creek impounded by a low dam: The intakes are approximately 1.6 miles west of Highlands at lat 35°04'07", long 83°13'06". The drainage area at the intakes is 4.9 square miles, approximately.

RAW-WATER STORAGE:

Houston Lake, 2 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Houston Branch is 0.09 mgd with a storage of 2 million gallons.

Estimated allowable draft of Big Creek is 0.8 mgd with negligible storage.

TOTAL USE:

Average (1973) 0.35 mgd, estimated; maximum daily (10-22-73) 0.435 million gallons. Estimate of average use based on estimated capacity of the gravity line from Houston Branch (0.23 mgd) plus average water treated at the plant (0.12 mgd).

INDUSTRIAL USE:

None.

TREATMENT:

Big Creek: Prechlorination, coagulation with alum and lime, sedimentation, rapid-sand filtration, adjustment of pH with soda ash, and post chlorination.

Houston Branch: Chlorination.

RATED CAPACITY OF TREATMENT PLANT:

0.5 mgd.

PUMPING CAPACITY:

Houston Branch: gravity. Big Creek: raw water, 0.9 mgd; finished water, 0.5 mgd.

FINISHED-WATER STORAGE:

One clear well, 100,000 gallons; four ground storage tanks, 110,000, 100,000, and two of 25,000 gallons each.

HIGHLANDS, MACON COUNTY

FUTURE PLANS:

Plan to construct a 200,000 gallon finished water reservoir and increase treatment plant capacity to 1.0 mgd.

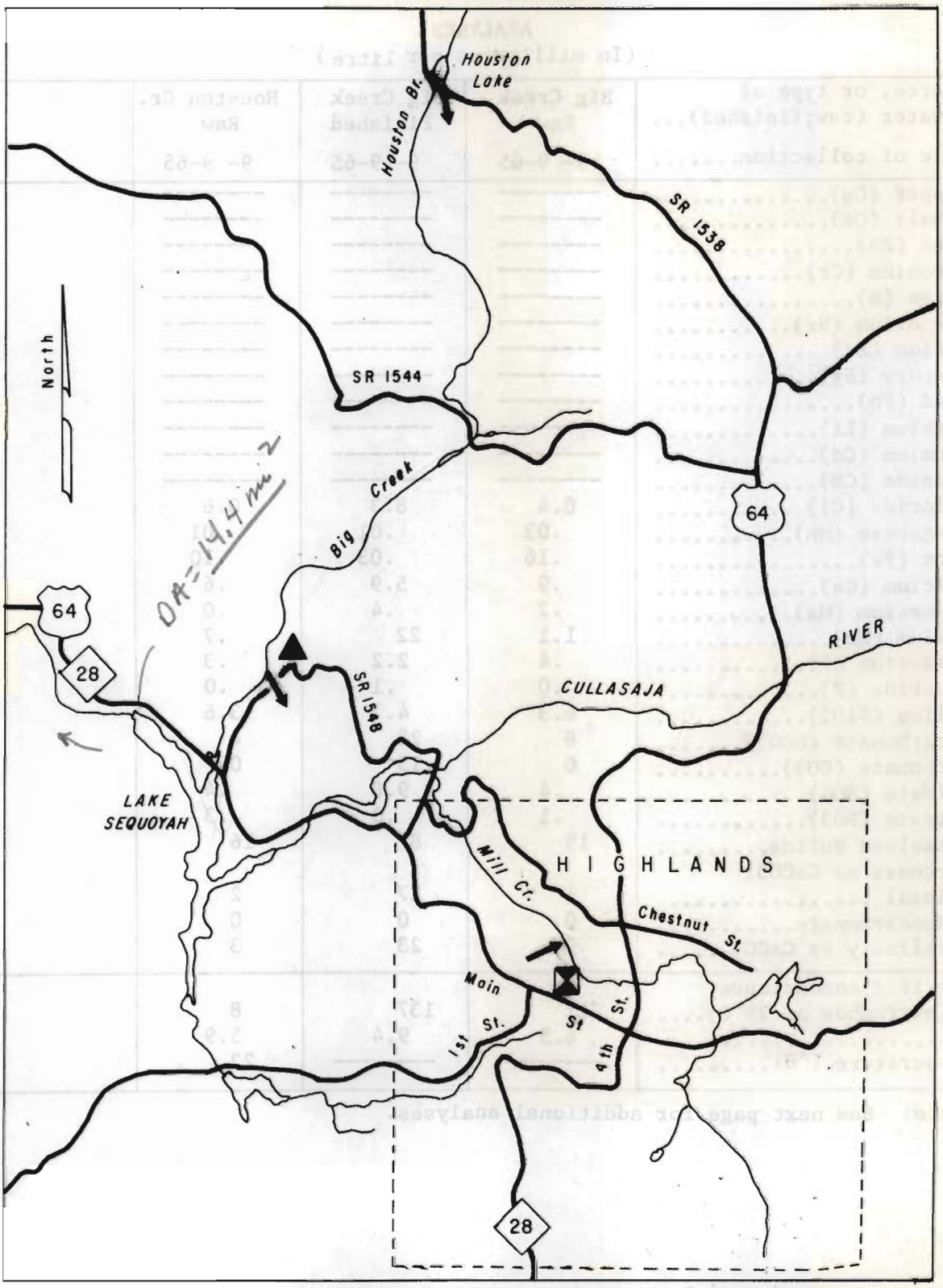
WATER-RESOURCES APPRAISAL:

Surface water: Highlands is in the mountains in southeastern Macon County. The Tennessee Valley Divide closely approximates the south and east city limits. Tributaries of the Cullasaja River of the Tennessee River basin drain all but two small areas along the southern city limits. Streams in the immediate vicinity of Highlands have above average yields. The low flow yield of streams generally exceeds 0.2 mgd per square mile. The average discharge of streams is 2.5 mgd per square mile and the 7-day, 2-year low flow averages 0.45 mgd per square mile. The estimated allowable draft of the present sources of water is more than twice current use. Additional draft could be obtained by providing raw water storage on Big Creek.

Ground water: Highlands is predominantly underlain by biotite gneiss and granite gneiss. The city formerly used 4 wells as part of their water supply. These wells ranged in depth from 500 to 800 ft and in yield from 14 to 45 gpm. Water from the highest yielding well was reported contaminated by surface water and though bacteriologically safe was unfit to drink. One well 800 feet deep at the Highlands Country Club was reported to yield 165 gpm.

Generally, the water is of good chemical quality and suitable for most uses with little or no treatment. The water is usually soft to moderately hard and slightly acidic.

CITY OF HIGHLANDS



HIGHLANDS, MACON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Big Creek Raw	Big Creek Finished	Houston Cr. Raw	
Date of collection.....	9- 9-65	9- 9-65	9- 9-65	
Copper (Cu).....	--------	--------	--------	
Cobalt (Co).....	--------	--------	--------	
Zinc (Zn).....	--------	--------	--------	
Chromium (Cr).....	--------	--------	--------	
Boron (B).....	--------	--------	--------	
Strontium (Sr).....	--------	--------	--------	
Barium (Ba).....	--------	--------	--------	
Mercury (Hg).....	--------	--------	--------	
Lead (Pb).....	--------	--------	--------	
Lithium (Li).....	--------	--------	--------	
Cadmium (Cd).....	--------	--------	--------	
Cyanide (CN).....	--------	--------	--------	
Chloride (Cl).....	0.4	8.3	0.6	
Manganese (Mn).....	.03	.01	.01	
Iron (Fe).....	.16	.03	.10	
Calcium (Ca).....	.9	5.9	.6	
Magnesium (Mg).....	.2	.4	.0	
Sodium (Na).....	1.1	22	.7	
Potassium (K).....	.4	2.2	.3	
Fluoride (F).....	.0	.1	.0	
Silica (SiO2).....	6.3	4.7	3.6	
Bicarbonate (HCO3).....	8	28	4	
Carbonate (CO3).....	0	15	0	
Sulfate (SO4).....	.4	9.8	.4	
Nitrate (NO3).....	.1	.0	.3	
Dissolved Solids.....	19	87	16	
Hardness as CaCO3:				
Total.....	4	17	2	
Noncarbonate.....	0	0	0	
Alkalinity as CaCO3.....	7	23	3	
Specific conductance (micromhos at 25° C)....	11	137	8	
pH.....	6.5	9.4	5.9	
Temperature (°C).....	--------	--------	23	

Note: See next page for additional analyses.

HIGHLANDS, MACON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Big Creek Raw	Big Creek Finished		
Date of collection.....	1- 8-74	1- 8-74		
Copper (Cu).....	0.120	0.005		
Cobalt (Co).....	.023	.000		
Zinc (Zn).....	.020	.020		
Chromium (Cr).....	.005	.000		
Boron (B).....	.040	.000		
Strontium (Sr).....	.000	.001		
Barium (Ba).....	.000	.000		
Mercury (Hg).....	.0000	.0000		
Lead (Pb).....	.007	.003		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.003	.000		
Arsenic (As).....	.002	.000		
Chloride (Cl).....	.7	4.6		
Manganese (Mn).....	.014	.000		
Iron (Fe).....	.150	.100		
Calcium (Ca).....	--------	--------		
Magnesium (Mg).....	--------	--------		
Sodium (Na).....	--------	--------		
Potassium (K).....	--------	--------		
Fluoride (F).....	--------	--------		
Silica (SiO_2).....	--------	--------		
Bicarbonate (HCO_3).....	--------	--------		
Carbonate (CO_3).....	--------	--------		
Sulfate (SO_4).....	--------	--------		
Nitrate (NO_3).....	--------	--------		
Dissolved Solids.....	--------	--------		
Hardness as $CaCO_3$:				
Total.....	--------	--------		
Noncarbonate.....	--------	--------		
Alkalinity as $CaCO_3$.....	--------	--------		
Specific conductance (micromhos at 25° C)....	11	72		
pH.....	--------	--------		
Temperature (°C).....	--------	--------		

MADISON COUNTY

WATER-RESOURCES APPRAISAL

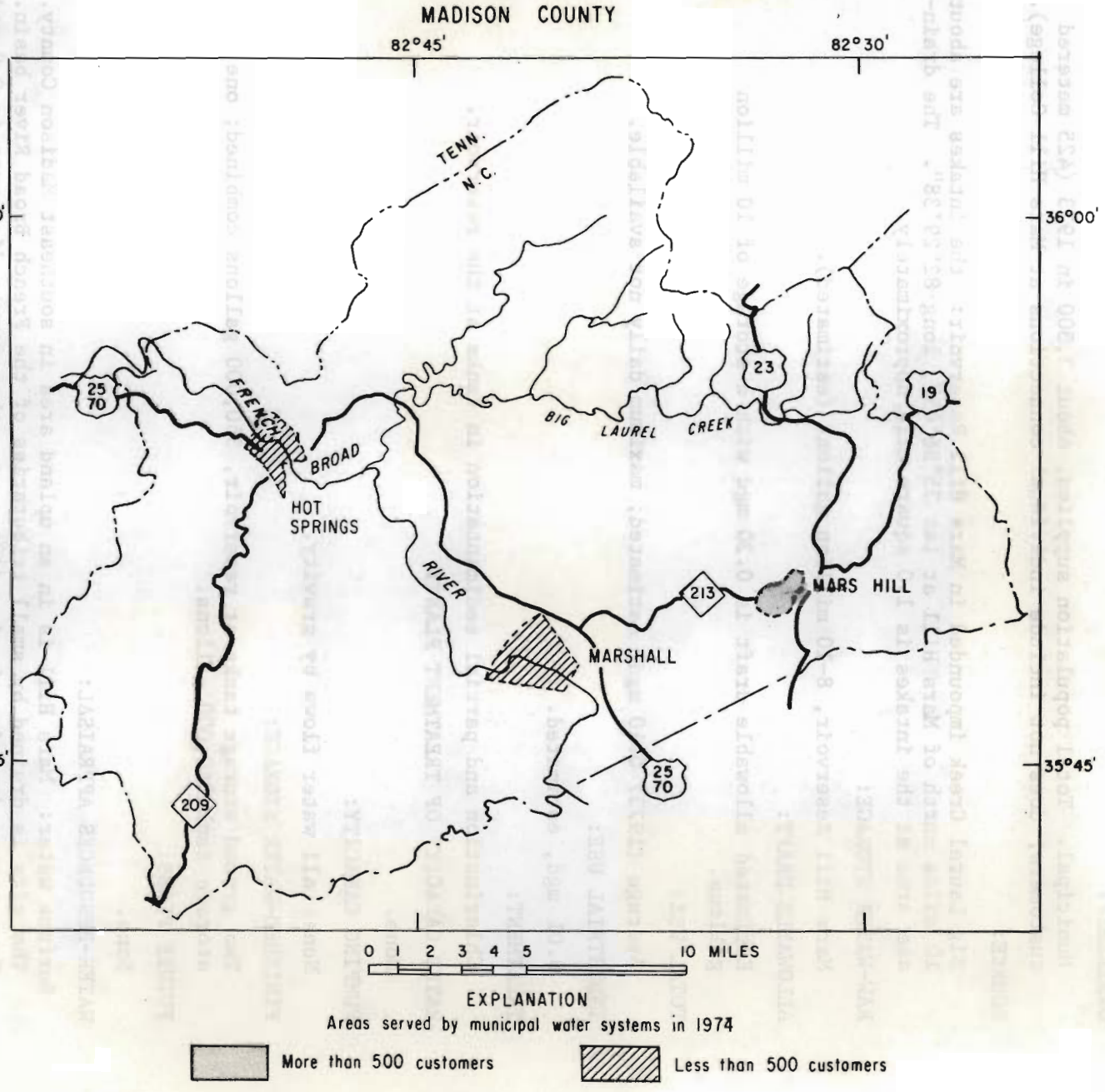
Madison County is in the Blue Ridge province in western North Carolina. The North Carolina-Tennessee State line is the north and west boundary. The topography is characterized by rugged mountains and generally narrow valleys. Land and stream slopes are steep and streams are swift. The French Broad River and its tributaries drain the county. Stream runoff is the smallest in the mountain region in North Carolina. The average discharge of streams varies from 0.7 to 1.1 mgd per square mile. Minimum flows generally exceed 0.08 mgd per square mile, and 7-day, 2-year low flows average 0.2 mgd per square mile. A significant amount of industrial and municipal waste in the French Broad River makes it undesirable as a source of water supply. However, there are many other streams that are excellent sources. Marshall and Mars Hill obtain their supply from surface sources. Hot Springs uses both surface and ground water. Springs, where available, and wells are used by rural residents. The county population in 1970 was 16,003.

Geologically, Madison County may be divided into two areas. The smaller area, the northwestern quarter, is underlain by a complex group of metasedimentary rocks including shale, limestone, dolomite, marble, slate, argillite, and ultramafic rocks. In the second area, granite gneiss, the most predominant rock in the county, extends in a broad band northwestward across the central part. South and southeast of the granite gneiss, the rock is predominantly hornblende gneiss containing small ultramafic bodies, and biotite injection gneiss. Numerous faults are found along the contact of the two areas and in the metasedimentary rocks.

The scarcity of records of drilled wells of tested capacity prevents an accurate appraisal of the water-bearing characteristics of the various rock units. From available well records, the average depth is 103 feet and the average yield is 13.8 gpm. The average yield is probably low because it was based on yields of domestic wells which are normally drilled in sites selected for convenience of use rather than for high yield. If wells are drilled in carefully selected sites, and spaced to prevent pumping interference, yields of 35 gpm or more may be reasonably expected.

An area of thermal springs is located at Hot Springs. Additional supplies of hot mineralized water probably can be developed by drilling wells into the dolomite near the present thermal springs.

The chemical quality of ground water is generally good. Locally, concentrations of iron, chloride, and nitrate are higher than desirable. Water from the thermal springs is highly mineralized containing over 600 mg/l of dissolved solids in places.


MADISON COUNTY
82°45'
82°30'
36°00'
35°45'
TENN.
N.C.
25
70
FRENCH BROAD
HOT SPRINGS
BIG LAUREL CREEK
23
19
RIVER
213
MARS HILL
MARSHALL
209
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

MARS HILL, MADISON COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,300 in 1973 (425 metered customers; does not include individual connections at Mars Hill College).

SOURCE:

Big Laurel Creek impounded in Mars Hill Reservoir: the intakes are about 10 miles north of Mars Hill at lat 35°56'45", long 82°29'38". The drainage area at the intakes is 1.0 square mile, approximately.

RAW-WATER STORAGE:

Mars Hill Reservoir, 8-10 million gallons (estimated).

ALLOWABLE DRAFT:

Estimated allowable draft is 0.30 mgd with a storage of 10 million gallons.

TOTAL USE:

Average (1973) 0.10 mgd, estimated; maximum daily not available.

INDUSTRIAL USE:

0.01 mgd, estimated.

TREATMENT:

Chlorination and partial sedimentation in tanks at the reservoir.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

None; all water flows by gravity.

FINISHED-WATER STORAGE:

Two ground storage tanks at reservoir, 350,000 gallons combined; one storage tank 360,000 gallons.

FUTURE PLANS:

None.

WATER-RESOURCES APPRAISAL:

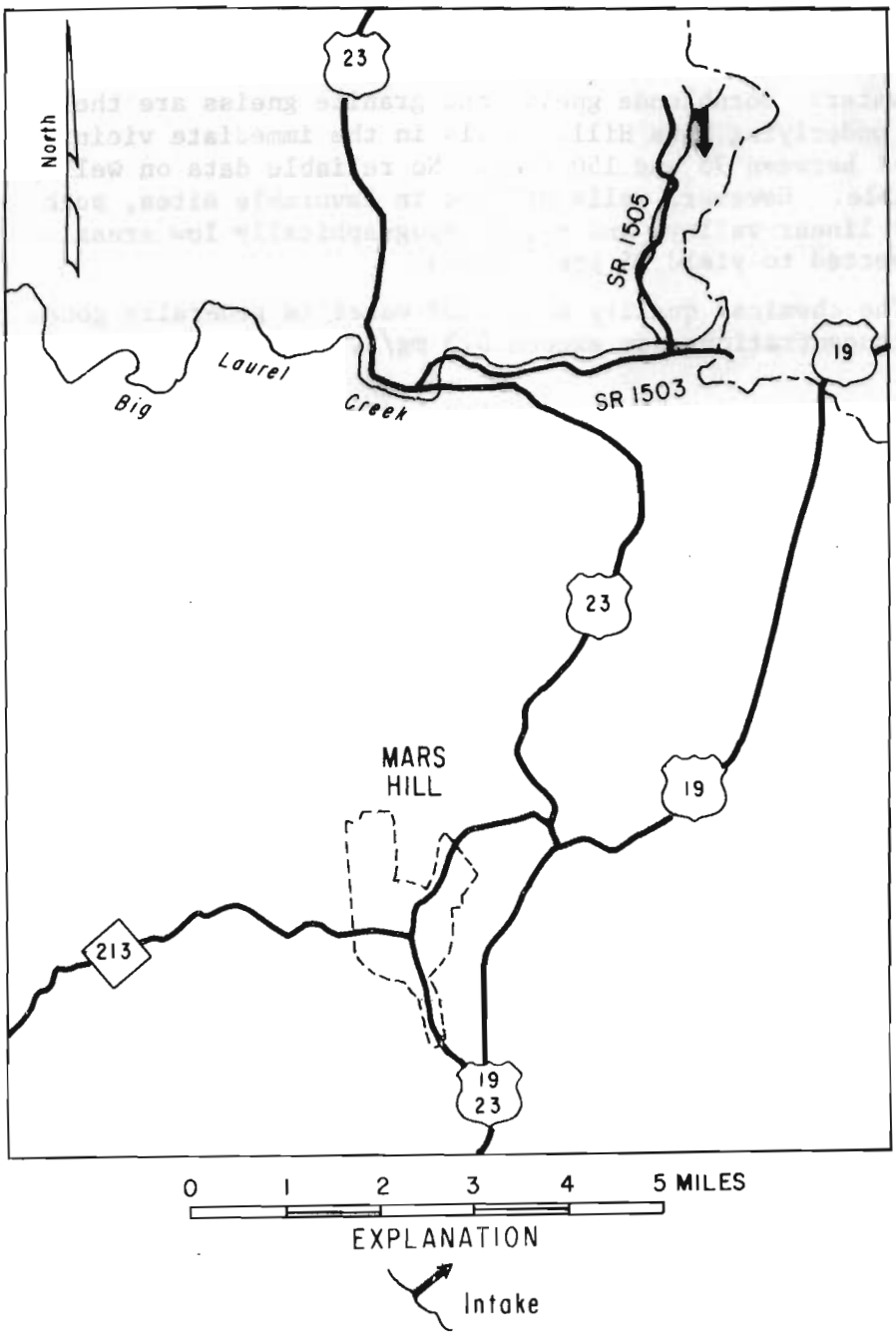
Surface water: Mars Hill is in an upland area in southeast Madison County. The city is drained by small tributaries of the French Broad River basin. For streams draining the immediate area, the average discharge is 0.9 mgd per square mile, the 7-day, 2-year low flow averages 0.20 mgd per square mile, and minimum flows generally exceed 0.08 mgd per square mile. The present source of water is a protected watershed about 10 miles north of the city. The estimated allowable draft is about three times the average use and should be adequate unless demand increases significantly.

MARS HILL, MADISON COUNTY

Ground water: Hornblende gneiss and granite gneiss are the predominant rocks underlying Mars Hill. Wells in the immediate vicinity are normally drilled between 75 and 150 feet. No reliable data on well yields is available. However, wells drilled in favorable sites, such as draws, narrow linear valleys and other topographically low areas can reasonably be expected to yield 35 gpm or more.

The chemical quality of ground water is generally good, but locally iron concentrations may exceed 0.3 mg/1.

CITY OF MARS HILL



MARS HILL, MADISON COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw; finished).....	Big Laurel Cr. Finished	Big Laurel Cr. Finished		
Date of collection.....	9-10-65	1-30-74		
Copper (Cu).....	--------	0.260		
Cobalt (Co).....	--------	.001		
Zinc (Zn).....	--------	.060		
Chromium (Cr).....	--------	.000		
Boron (B).....	--------	.130		
Strontium (Sr).....	--------	.000		
Barium (Ba).....	--------	.000		
Mercury (Hg).....	---------	.0000		
Lead (Pb).....	--------	.008		
Lithium (Li).....	--------	.000		
Cadmium (Cd).....	--------	.000		
Arsenic (As).....	--------	.000		
Chloride (Cl).....	3.4	3.0		
Manganese (Mn).....	.4	--------		
Iron (Fe).....	.02	.080		
Calcium (Ca).....	2.2	--------		
Magnesium (Mg).....	.4	--------		
Sodium (Na).....	1.2	--------		
Potassium (K).....	.5	--------		
Fluoride (F).....	.0	--------		
Silica (SiO2).....	8.8	--------		
Bicarbonate (HCO3).....	9	--------		
Carbonate (CO3).....	0	--------		
Sulfate (SO4).....	.8	--------		
Nitrate (NO3).....	.2	--------		
Dissolved Solids.....	22	--------		
Hardness as CaCO3:				
Total.....	8	--------		
Noncarbonate.....	0	--------		
Alkalinity as CaCO3.....	7	--------		
Specific conductance (micromhos at 25° C)....	21	--------		
pH.....	6.6	--------		
Temperature (°C).....	--------	--------		

MCDOWELL COUNTY

WATER-RESOURCES APPRAISAL

McDowell County is partly in the Blue Ridge province and partly in the Piedmont province in western North Carolina. The northwest boundary closely approximates the eastern continental divide. The topography is characterized by monadnock-like hills with moderately wide valleys in the southeast part and rugged mountain slopes along the Blue Ridge front in the northwestern part. The Catawba River and its tributaries drain all of McDowell County except for a small area in the south which is drained by tributaries of the Broad River. The average discharge of streams varies from 1.7 mgd per square mile along the Blue Ridge front to 0.95 mgd per square mile in the southeast. The 7-day, 2-year low flow averages 0.35 mgd per square mile. Minimum flows generally exceed 0.15 mgd per square mile and streams rarely go dry.

Marion and Old Fort obtain their water supply from surface sources. Most community and rural domestic supplies use ground water. The use of springs is common in the Blue Ridge portion of the county. The county population in 1970 was 30,648, about one-third of which is served by the municipal systems of Marion and Old Fort.

A complex group of metamorphic rocks underlie the county. Mica-gneiss is the predominant rock. Layered gneiss, granitic gneiss, and quartzite are also prominent. A deeply weathered residual mantle of weathered rock as much as 150 feet thick in places overlies most of the Piedmont part of the county. The mantle of weathered rock is thin or absent on the Blue Ridge front.

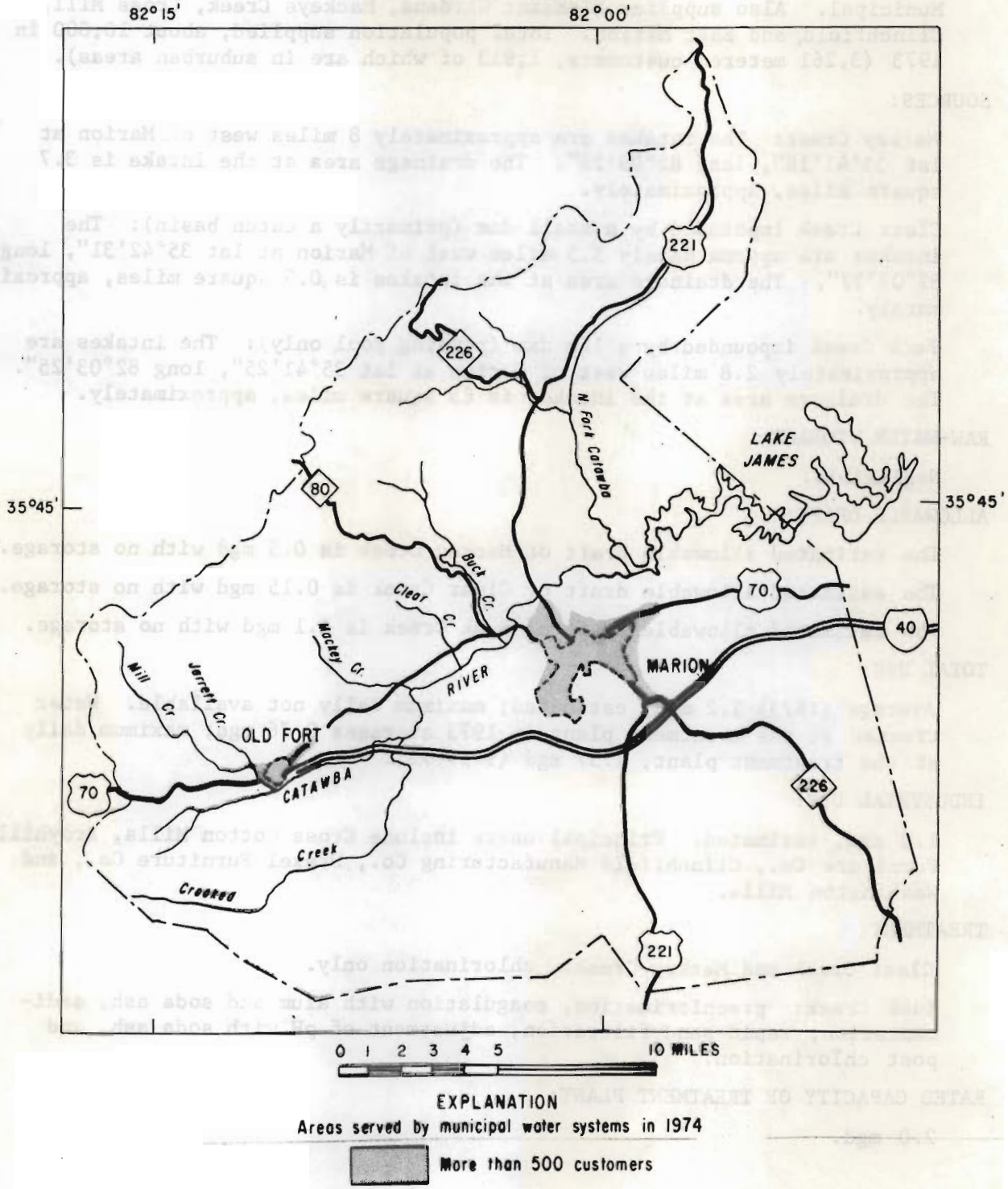
Drilled wells obtain water from the fractures in the bedrock. Water is fed to the fractures from the water stored in the overlying layer of weathered rock. The yield of wells depends largely on the number and size of fractures penetrated by the well and the thickness of the overlying weathered rock where water is stored. The topographic situation is an indicator of the factors affecting well yield. The following table based on available well records shows how yield varies with topography and well depth.

Topography	Average depth (feet)	Average yield (gpm)
Flat	110	18
Draw	167	25
Slope	156	10
Hilltop	151	8.5

The potential supply of ground water is adequate, with proper planning and management, for small municipal and industrial supplies. It is estimated that the amount of ground water available is on the order of 0.5 to 0.6 mgd per square mile. The maximum reported yield in available records is 75 gpm.

The chemical quality of ground water is generally good. Locally iron concentrations may exceed 0.3 mg/l. The water is usually soft to moderately hard and slightly acidic.

MC DOWELL COUNTY



MARION, MCDOWELL COUNTY

OWNERSHIP:

Municipal. Also supplies Pleasant Gardens, Mackeys Creek, Cross Mill, Clinchfield, and East Marion. Total population supplied, about 10,000 in 1973 (3,261 metered customers, 1,913 of which are in suburban areas).

SOURCES:

Mackey Creek: The intakes are approximately 8 miles west of Marion at lat 35°41'18", long 82°09'29". The drainage area at the intake is 3.7 square miles, approximately.

Clear Creek impounded by a small dam (primarily a catch basin): The intakes are approximately 5.5 miles west of Marion at lat 35°42'31", long 82°07'27". The drainage area at the intakes is 0.9 square miles, approximately.

Buck Creek impounded by a low dam (pumping pool only): The intakes are approximately 2.8 miles west of Marion at lat 35°41'25", long 82°03'25". The drainage area at the intakes is 25 square miles, approximately.

RAW-WATER STORAGE:

Negligible.

ALLOWABLE DRAFT:

The estimated allowable draft of Mackey Creek is 0.5 mgd with no storage.

The estimated allowable draft of Clear Creek is 0.15 mgd with no storage.

The estimated allowable draft of Buck Creek is 4.1 mgd with no storage.

TOTAL USE:

Average (1973) 2.2 mgd, estimated; maximum daily not available. Water treated at the treatment plant in 1973 averages 0.76 mgd; maximum daily at the treatment plant, 1.57 mgd (9-14-73).

INDUSTRIAL USE:

1.0 mgd, estimated. Principal users include Cross Cotton Mills, Broyhill Furniture Co., Clinchfield Manufacturing Co., Drexel Furniture Co., and Washington Mills.

TREATMENT:

Clear Creek and Mackey Creek: chlorination only.

Buck Creek: prechlorination, coagulation with alum and soda ash, sedimentation, rapid-sand filtration, adjustment of pH with soda ash, and post chlorination.

RATED CAPACITY OF TREATMENT PLANT:

2.0 mgd.

MARION, MCDOWELL COUNTY

PUMPING CAPACITY:

Clear Creek: gravity, estimated capacity of line is 0.4 mgd.

Mackey Creek: gravity, estimated capacity of line is 1.0 mgd.

Buck Creek: Raw water, 1.6 mgd; finished water, 1.5 mgd.

FINISHED-WATER STORAGE:

One clear well, 220,000 gallons; one reservoir, 1,100,000 gallons.

FUTURE PLANS:

None.

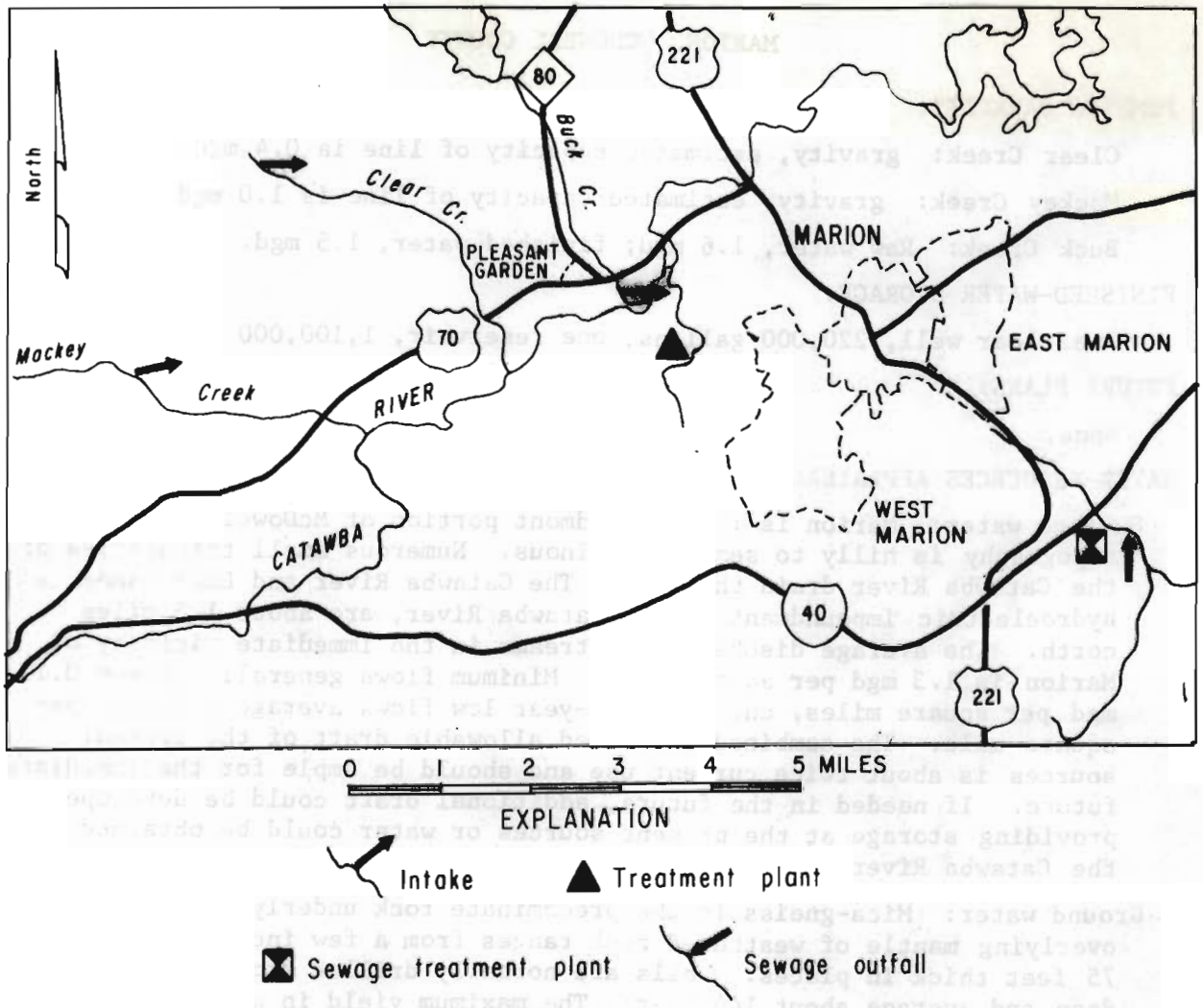
WATER-RESOURCES APPRAISAL:

Surface water: Marion is in the Piedmont portion of McDowell County. The topography is hilly to semi-mountainous. Numerous small tributaries of the Catawba River drain the city. The Catawba River and Lake James, a hydroelectric impoundment on the Catawba River, are about 1.5 miles north. The average discharge of streams in the immediate vicinity of Marion is 1.3 mgd per square mile. Minimum flows generally exceed 0.13 mgd per square miles, and 7-day, 2-year low flows average 0.35 mgd per square mile. The combined estimated allowable draft of the present sources is about twice current use and should be ample for the immediate future. If needed in the future, additional draft could be developed by providing storage at the present sources or water could be obtained from the Catawba River.

Ground water: Mica-gneiss is the predominate rock underlying Marion. The overlying mantle of weathered rock ranges from a few inches to more than 75 feet thick in places. Wells are normally drilled from 75 to 200 feet deep and average about 140 feet. The maximum yield in available records is 25 gpm and the average yield is 15 gpm. The reported yields are for wells used for domestic purposes and are probably low. If wells are drilled in carefully selected sites, yields of 35 gpm or more can reasonably be expected.

The chemical quality of ground water is suitable for most uses without treatment. The water is usually soft and slightly acidic, but locally may contain iron concentrations in excess of 0.3 mg/1.

CITY OF MARION



MARION, MCDOWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Mackey Cr.	Clear Cr.	Buck Cr. Raw	Buck Cr. Finished
Date of collection.....	11-26-62	11-26-62	11-26-62	11-26-62
Copper (Cu).....	--------	--------	--------	--------
Cobalt (Co).....	--------	--------	--------	--------
Zinc (Zn).....	--------	--------	--------	--------
Chromium (Cr).....	--------	--------	--------	--------
Boron (B).....	--------	--------	--------	--------
Strontium (Sr).....	--------	--------	--------	--------
Barium (Ba).....	--------	--------	--------	--------
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	--------	--------
Lithium (Li).....	--------	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------	--------
Cyanide (CN).....	--------	--------	--------	--------
Chloride (Cl).....	2.3	2.7	0.9	6.2
Manganese (Mn).....	.00	.00	.00	.02
Iron (Fe).....	.00	.00	.02	.00
Calcium (Ca).....	1.0	.4	2.0	2.6
Magnesium (Mg).....	.2	.3	.6	.2
Sodium (Na).....	1.0	.7	1.3	9.3
Potassium (K).....	.5	.5	.7	.9
Fluoride (F).....	.1	.0	.2	.0
Silica (SiO_2).....	8.0	6.7	7.4	7.3
Bicarbonate (HCO_3).....	5	3	11	21
Carbonate (CO_3).....	0	0	0	0
Sulfate (SO_4).....	.8	.8	2.2	6.2
Nitrate (NO_3).....	.0	.1	.2	.1
Dissolved Solids.....	20	16	24	43
Hardness as $CaCO_3$:				
Total.....	4	2	8	8
Noncarbonate.....	0	0	0	0
Alkalinity as $CaCO_3$.....	4	2	9	17
Specific conductance (micromhos at 25° C)....	18	12	22	62
pH.....	6.4	5.8	6.4	7.4
Temperature (°C).....	--------	--------	--------	--------

Note: See next page for additional analyses.

MARION, MCDOWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Buck Cr. Raw	Buck Cr. Finished		
Date of collection.....	1-31-74	1-31-74		
Copper (Cu).....	0.015	0.004		
Cobalt (Co).....	.000	.001		
Zinc (Zn).....	.005	.090		
Chromium (Cr).....	.000	.000		
Boron (B).....	.000	.000		
Strontium (Sr).....	.000	.000		
Barium (Ba).....	.000	.000		
Mercury (Hg).....	.0000	.0000		
Lead (Pb).....	.005	.005		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.000	.001		
Arsenic (As).....	.000	.011		
Chloride (Cl).....	1.1	3.0		
Manganese (Mn).....	.010	.010		
Iron (Fe).....	.050	.010		
Calcium (Ca).....	———	———		
Magnesium (Mg).....	———	———		
Sodium (Na).....	———	———		
Potassium (K).....	———	———		
Fluoride (F).....	———	———		
Silica (SiO_2).....	———	———		
Bicarbonate (HCO_3).....	———	———		
Carbonate (CO_3).....	———	———		
Sulfate (SO_4).....	———	———		
Nitrate (NO_3).....	———	———		
Dissolved Solids.....	———	———		
Hardness as $CaCO_3$:				
Total.....	———	———		
Noncarbonate.....	———	———		
Alkalinity as $CaCO_3$.....	———	———		
Specific conductance (micromhos at 25° C)....	23	61		
pH.....	———	———		
Temperature (°C).....	———	———		

Now in 5 deep wells - appx 5 years jpm 7/17/86

OLD FORT, MCDOWELL COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 1,200 in 1973 (500 metered customers, 250 of which are in suburban areas).

SOURCE:

Jarretts Creek impounded: The intakes are at the dam 1.9 miles northwest of Old Fort at lat 35°38'25", long 82°12'00". The drainage area at the dam is 3.8 square miles, approximately.

RAW-WATER STORAGE:

Jarretts Creek Reservoir, approximately 10 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 0.8 mgd with a storage of 10 million gallons.

TOTAL USE:

Average (1973) 0.57 mgd, metered; maximum daily (9-4-73) 0.75 million gallons.

INDUSTRIAL USE:

0.05 mgd, estimated. Principal users include Collins and Aikman Corporation, Pine Valley Furniture Co., Cohama Knitting Mills, and Pine Valley Warehouse.

TREATMENT:

Chlorination.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity supplemented by pumping in distribution system.

FINISHED-WATER STORAGE:

None.

FUTURE PLANS:

None.

WATER-RESOURCES APPRAISAL:

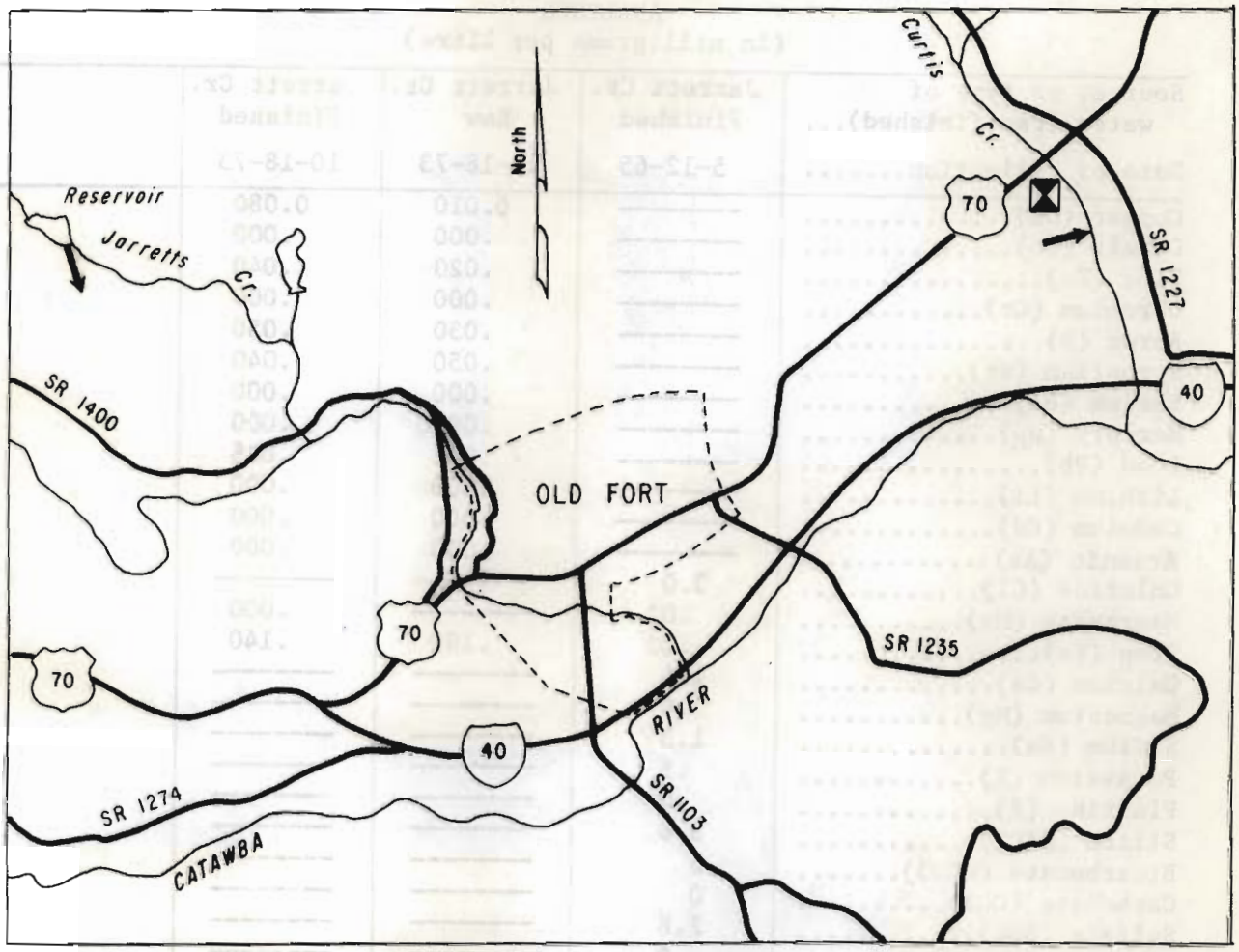
Surface water: Old Fort is in the Catawba River valley at the base of the Blue Ridge Front in western McDowell County. Mill Creek and the Catawba River drain the town. The low-flow yield of streams in the immediate vicinity of Old Fort generally exceeds 0.10 mgd per square mile. The average discharge is 1.2 mgd per square mile, and the 7-day, 2-year low flow averages 0.30 mgd per square mile. The reservoir currently in use has a capacity large enough to meet current needs. If demand increases significantly, a new source will be necessary. Mill Creek or the Catawba

River are potential future sources; however, treatment would be required.

Ground water: Metamorphic rocks, principally mica-gneiss and layered gneiss, underlie Old Fort. These rocks weather to various shades of red clay containing decayed mica. The overlying mantle of weathered rock and alluvium probably exceeds 50 feet in places along the Catawba River. Wells in these rocks in the immediate vicinity of Old Fort are normally drilled less than 200 feet deep and maximum reported yield in available records is 75 gpm. Wells drilled in carefully selected sites, such as draws, low flat areas, and narrow linear valleys, can reasonably be expected to yield 35 gpm or more. This amount of water is adequate for small industrial and supplementary supplies.

Ground water is usually soft, and slightly acidic. Locally iron concentrations may exceed 0.3 mg/1.

CITY OF OLD FORT



OLD FORT, MCDOWELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Jarrett Cr. Finished	Jarrett Cr. Raw	Jarrett Cr. Finished	
Date of collection.....	5-12-65	10-18-73	10-18-73	
Copper (Cu).....	--------	0.010	0.080	
Cobalt (Co).....	--------	.000	.000	
Zinc (Zn).....	--------	.020	.040	
Chromium (Cr).....	--------	.000	.000	
Boron (B).....	--------	.030	.050	
Strontium (Sr).....	--------	.050	.040	
Barium (Ba).....	--------	.000	.000	
Mercury (Hg).....	--------	.0000	.000	
Lead (Pb).....	--------	.002	.005	
Lithium (Li).....	--------	.000	.000	
Cadmium (Cd).....	--------	.000	.000	
Arsenic (As).....	--------	.000	.000	
Chloride (Cl).....	3.0	-------	-------	
Manganese (Mn).....	.02	-------	.000	
Iron (Fe).....	.02	.190	.140	
Calcium (Ca).....	1.4	-------	-------	
Magnesium (Mg).....	.4	-------	-------	
Sodium (Na).....	1.3	-------	-------	
Potassium (K).....	.5	-------	-------	
Fluoride (F).....	.0	-------	-------	
Silica (SiO_2).....	8.8	-------	-------	
Bicarbonate (HCO_3).....	5	-------	-------	
Carbonate (CO_3).....	0	-------	-------	
Sulfate (SO_4).....	2.8	-------	-------	
Nitrate (NO_3).....	.0	-------	-------	
Dissolved Solids.....	24	-------	-------	
Hardness as $CaCO_3$:				
Total.....	5	-------	-------	
Noncarbonate.....	1	-------	-------	
Alkalinity as $CaCO_3$.....	4	-------	-------	
Specific conductance (micromhos at 25° C)....	19	-------	-------	
pH.....	6.6	-------	-------	
Temperature (°C).....	-------	-------	-------	

MITCHELL COUNTY

WATER-RESOURCES APPRAISAL

Mitchell County is in the Blue Ridge province in western North Carolina with the North Carolina-Tennessee State line as the northern boundary. The topography is rolling, hilly, and mountainous. Land and stream slopes are steep and drainage is good. The North Toe and Nolichucky Rivers of the Tennessee River basin and their tributaries drain the county. Streamflow, on the average, is lower than in adjoining counties but is still relatively high. The average discharge of streams ranges from 1.3 to 1.9 mgd per square mile. Minimum flows generally exceed 0.10 mgd per square mile, and 7-day, 2-year low flows average 0.35 mgd per square mile.

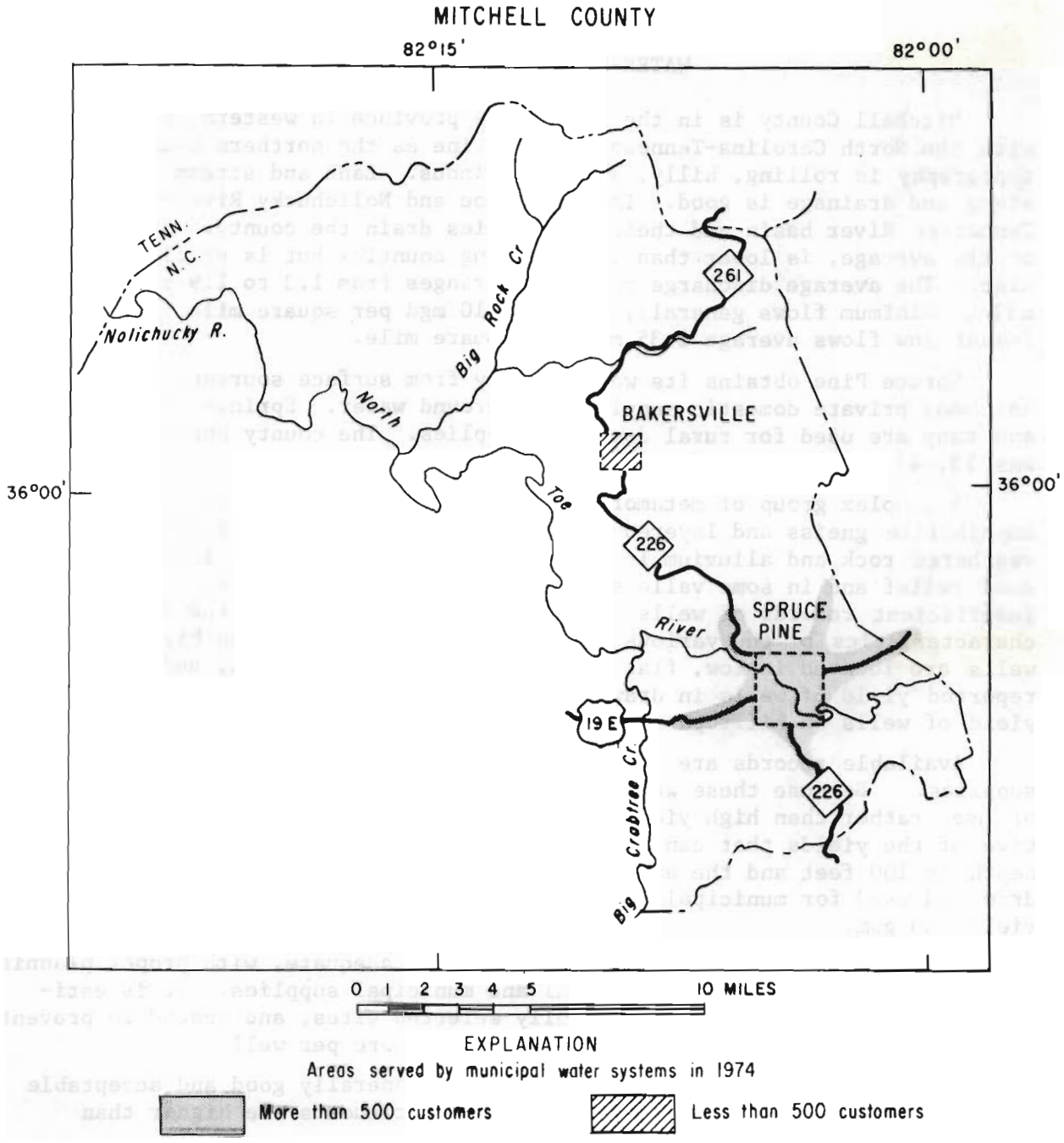
Spruce Pine obtains its water supply from surface sources. Bakersville and many private domestic supplies use ground water. Springs are abundant and many are used for rural domestic supplies. The county population in 1970 was 13,447.

A complex group of metamorphic and igneous rocks underlie the county. Amphibolite gneiss and layered gneiss predominate. The overlying mantle of weathered rock and alluvium is generally thin or absent but in areas of subdued relief and in some valleys is as much as 100 feet thick. There are insufficient records of wells of tested capacity to assess the water-bearing characteristics of the various rock units, but generally the higher-yielding wells are located in low, flat areas, narrow linear valleys, and draws. The reported yield of wells in draws is about 5 times as great as the reported yield of wells on hilltops.

Available records are largely of wells used for individual domestic supplies. Because these wells are drilled in sites selected for convenience of use rather than high yield, their yields are usually low and not indicative of the yields that can be developed. For 22 such wells, the average depth is 100 feet and the average yield is 8.5 gpm. One well located in a draw and used for municipal supply by the city of Bakersville is reported to yield 200 gpm.

The quantity of ground water available is adequate, with proper planning and management, for small industrial and municipal supplies. It is estimated, that wells drilled in carefully selected sites, and spaced to prevent pumping interference, would yield 0.05 mgd or more per well.

The chemical quality of ground water is generally good and acceptable for most uses. Locally, hardness-causing constituents are higher than desirable.


MITCHELL COUNTY
82°15'
82°00'
36°00'
36°00'
TENN.
N.C.
Nolichucky R.
North Toe River
Big Rock Cr
Big Crabtree Cr
261
226
19 E
226
BAKERSVILLE
SPRUCE PINE
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

SPRUCE PINE, MITCHELL COUNTY

OWNERSHIP:

Municipal. Total population supplied about 3,000 in 1973 (970 metered customers, 260 of which are in suburban areas).

SOURCES:

Beaver Creek impounded: The intakes are at the dam approximately 2.7 miles north of Spruce Pine at lat 35°57'21", long 82°03'47". The drainage area at the dam is 2.2 square miles, approximately.

Crystal Falls Creek impounded: The intakes are at the dam approximately 1.7 miles southwest of Spruce Pine at lat 35°53'29", long 82°05'06". The drainage area at the dam is 0.7 square mile approximately.

RAW-WATER STORAGE:

Crystal Falls Creek Reservoir, 5.0 million gallons.

Beaver Creek Reservoir, 12-15 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Crystal Falls Creek is 0.3 mgd with a storage of 5 million gallons.

Estimated allowable draft of Beaver Creek is 0.8 mgd with a storage of 12 million gallons.

TOTAL USE:

Average (1973) 0.75 mgd, metered; maximum daily, not available.

INDUSTRIAL USE:

0.15 mgd, estimated. Principal users include Henredon Furniture Industries, Feldspar Corporation, Ellen Knitting Mill, Sobin Chemicals, Inc., Karen Dale Knitting Co., and Diamond Mica Co.

TREATMENT:

Micro-strainers at the intakes and chlorination.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Beaver Creek: gravity.

Crystal Falls Creek: 0.7 mgd.

FINISHED-WATER STORAGE:

Four storage tanks; 100,000 gallons, 400,000, 500,000 and 500,000 gallons; one elevated tank, 200,000 gallons.

FUTURE PLANS:

None.

SPRUCE PINE, MITCHELL COUNTY

WATER-RESOURCES APPRAISAL:

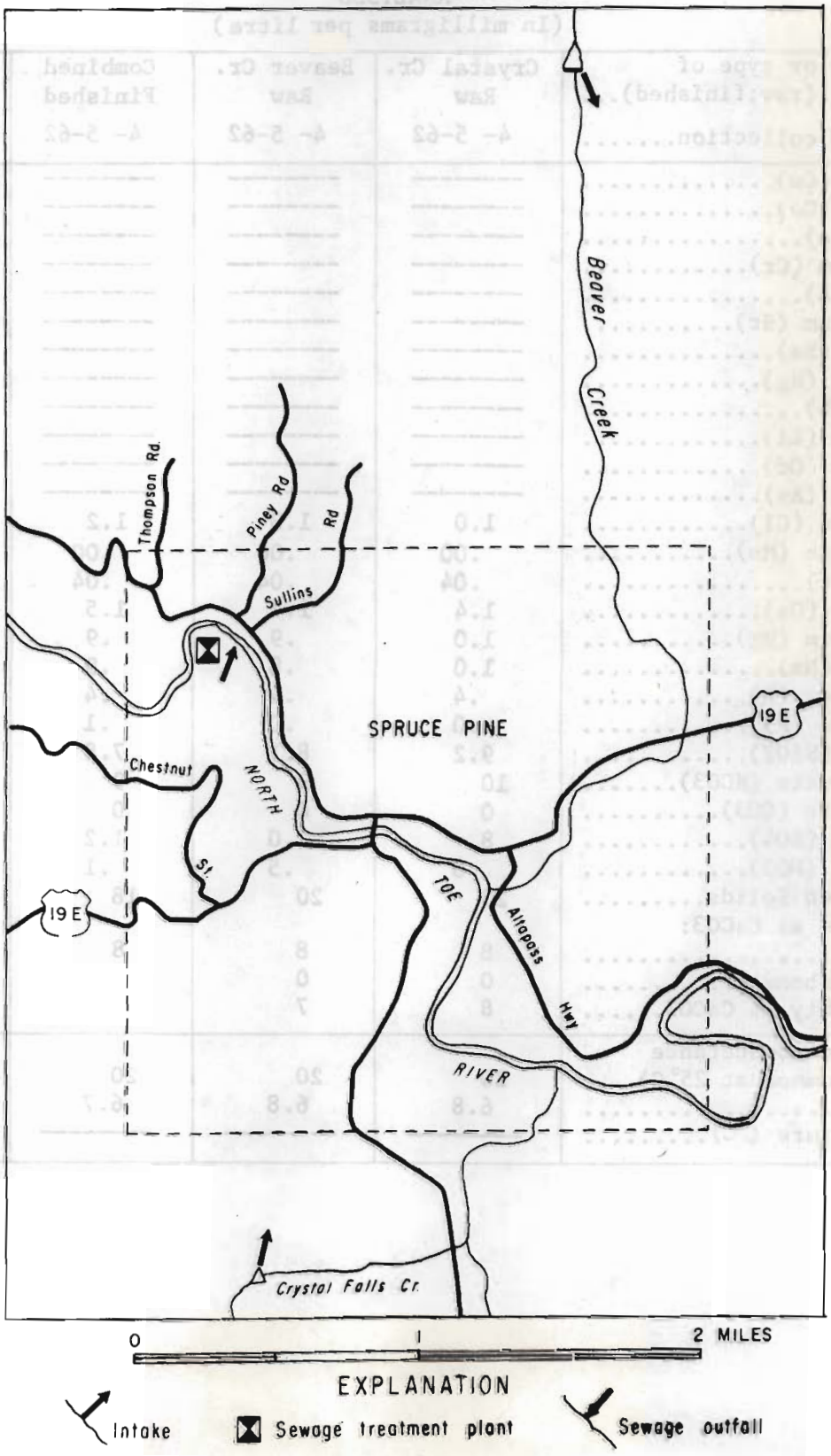
Surface water: Spruce Pine is on the banks of the North Toe River in southern Mitchell County. Tributaries of the North Toe River drain the city. The low-flow yield of streams draining the immediate vicinity of Spruce Pine generally exceeds 0.15 mgd per square mile. For all streams, the average discharge is 1.4 mgd per square mile, and the 7-day, 2-year low flow averages 0.35 mgd per square mile. The combined estimated allowable draft of the present sources is about 1.5 times current use. If demand continues to grow additional water will be required. The most abundant source would be the North Toe River but treatment would be required.

Ground water: Mica gneiss and alkasite underlie Spruce Pine. Records of well casing lengths indicate the overlying mantle of weathered rock and alluvium is as much as 75 feet thick in places. Wells are normally drilled from 50 to 150 feet deep. Reported well yields are low, ranging from 2 to 15 gpm.

It is likely that wells drilled in carefully selected sites would yield considerably more water.

The chemical quality of ground water is generally good. Locally, the water may contain concentrations of hardness-causing constituents which are higher than desirable.

CITY OF SPRUCE PINE



SPRUCE PINE, MITCHELL COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Crystal Cr. Raw	Beaver Cr. Raw	Combined Finished	Combined Finished
Date of collection.....	4- 5-62	4- 5-62	4- 5-62	1-30-74
Copper (Cu).....	--------	--------	--------	0.010
Cobalt (Co).....	--------	--------	--------	.001
Zinc (Zn).....	--------	--------	--------	.010
Chromium (Cr).....	--------	--------	--------	.000
Boron (B).....	--------	--------	--------	.000
Strontium (Sr).....	--------	--------	--------	.000
Barium (Ba).....	--------	--------	--------	.000
Mercury (Hg).....	--------	--------	--------	.0000
Lead (Pb).....	--------	--------	--------	.003
Lithium (Li).....	--------	--------	--------	.000
Cadmium (Cd).....	--------	--------	--------	.000
Arsenic (As).....	--------	--------	--------	.002
Chloride (Cl).....	1.0	1.3	1.2	2.0
Manganese (Mn).....	.00	.00	.00	.000
Iron (Fe).....	.04	.04	.04	.070
Calcium (Ca).....	1.4	1.7	1.5	--------
Magnesium (Mg).....	1.0	.9	.9	--------
Sodium (Na).....	1.0	.8	.9	--------
Potassium (K).....	.4	.4	.4	--------
Fluoride (F).....	.0	.0	.1	--------
Silica (SiO_2).....	9.2	8.1	7.8	--------
Bicarbonate (HCO_3).....	10	9	9	--------
Carbonate (CO_3).....	0	0	0	--------
Sulfate (SO_4).....	8	2.0	1.2	--------
Nitrate (NO_3).....	.0	.5	.1	--------
Dissolved Solids.....	20	20	18	--------
Hardness as $CaCO_3$:				
Total.....	8	8	8	--------
Noncarbonate.....	0	0	0	--------
Alkalinity as $CaCO_3$.....	8	7	7	--------
Specific conductance (micromhos at 25° C)....	20	20	20	25
pH.....	6.8	6.8	6.7	--------
Temperature (°C).....	--------	--------	--------	--------

POLK COUNTY

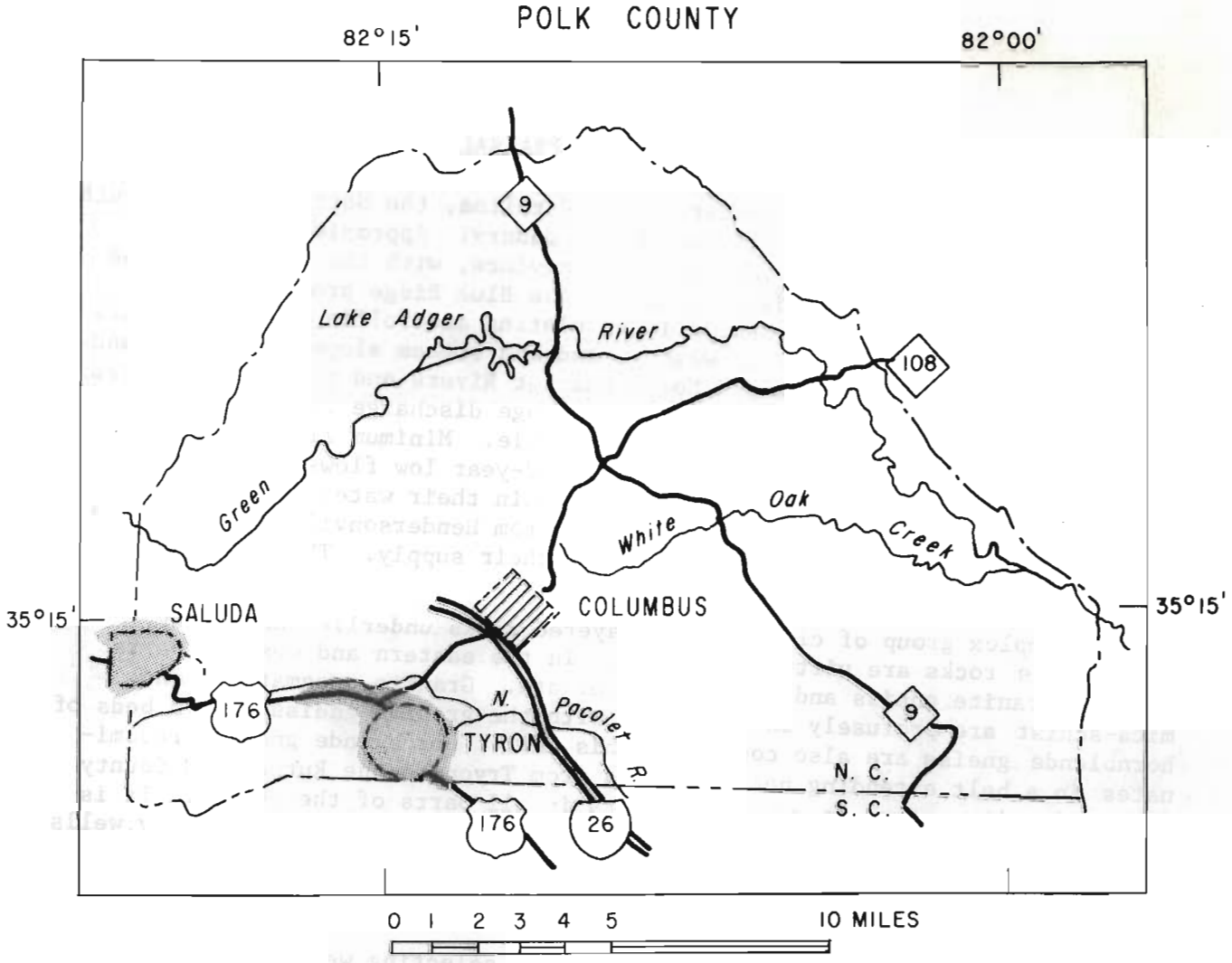
WATER-RESOURCES APPRAISAL

Polk County is in southwestern North Carolina, the North Carolina-South Carolina State line forming its southern boundary. Approximately three-fourths of the county is in the Piedmont province, with the remainder, the area along the western boundary, being in the Blue Ridge province. The topography of the Piedmont portion is undulating and rolling, becoming more hilly near the mountains in the west. Land and stream slopes are steep and drainage is good. The Green and North Pacolet Rivers and their tributaries drain the county. For all streams, the average discharge ranges from 0.95 mgd per square mile to 1.30 mgd per square mile. Minimum flows generally exceed 0.25 mgd per square mile, and 7-day, 2-year low flows average 0.45 mgd per square mile. Tryon and Columbus obtain their water supply from surface sources. Saluda obtains its water from Hendersonville. Most rural domestic supplies use springs or wells for their supply. The county population in 1970 was 11,735.

A complex group of closely interlayered rocks underlie the county. Homogeneous rocks are virtually absent. In the eastern and western parts biotite-granite gneiss and schist predominate. Granite, pegmatite, and mica-schist are profusely interlayered with the granite-gneiss. Thin beds of hornblende gneiss are also common in this unit. Hornblende gneiss predominates in a belt extending northeastward from Tryon to the Rutherford County line. Granite occurs in varying amounts in all parts of the county. It is difficult to say which rock is the better water-bearing unit since many wells penetrate one or more layers of different rocks. All the rocks are extensively fractured, and they probably rate above average in their water-bearing qualities.

Topography is a good indicator to use in selecting well sites for higher yields. Wells drilled in draws, valleys, and sags generally produce about four times or more water than wells on hills and slopes. It is estimated that the potential supply of ground water available for development ranges from 0.50 mgd per square mile in the east to 0.65 mgd per square mile in the west.

The chemical quality of ground water is good. Dissolved solids are usually less than 100 mg/1 and hardness less than 25 mg/1. Locally, iron concentrations may be higher than desirable.


POLK COUNTY
82°15'
82°00'
35°15'
35°15'
9
Lake Adger
River
108
Green
White
Oak
Creek
SALUDA
COLUMBUS
176
N. Pacolet R.
TYRON
9
N. C.
S. C.
176
26
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

TRYON, POLK COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 6,000 in 1973 (1,800 metered customers, 900 of which are in suburban areas).

SOURCES:

Colt Creek: The intake is 4.6 miles west of Tryon at lat 35°12'59", long 82°19'59". The drainage area at the intake is 2.7 square miles, approximately.

Fork Creek: The intake is 4.2 miles west of Tryon at lat 35°13'05", long 82°19'33". The drainage area at the intake is 2.2 square miles, approximately.

Big Fall Creek: The intake is 2.8 miles west of Tryon at lat 35°13'05", long 82°17'59". The drainage area at the intake is 1.6 square miles, approximately.

Little Fall Creek: The intake is 2.1 miles west of Tryon at lat 35°12'59", long 82°17'18". The drainage area at the intake is 0.5 square mile, approximately.

Vaughn Creek tributary No. 1: The intake is 1.9 miles southwest of Tryon at lat 35°11'16", long 82°16'49". The drainage area at the intake is 0.6 square mile, approximately.

Vaughn Creek tributary No. 2: The intake is 1.6 miles southwest of Tryon at lat 35°11'47", long 82°16'46". The drainage area at the intakes is 0.4 square mile, approximately.

Vaughn Creek tributary No. 3: The intake is 1.1 miles southwest of Tryon at lat 35°12'07", long 82°16'19". The drainage area at the intake is 0.1 square mile, approximately.

RAW-WATER STORAGE:

Town Lake on Big Fall Creek, approximately 5-10 million gallons.

ALLOWABLE DRAFT:

Combined estimated allowable draft of the 7 creeks is 2.9 mgd with a storage of 10 million gallons.

TOTAL USE:

Average (1972) 0.58 mgd, metered; maximum daily (several days in 1973) 1.0 million gallons.

INDUSTRIAL USE:

0.24 mgd, estimated. Principal users include Southern Mercerizing Co., Carolina Yarns Processors, Inc., Burnette Southern, and Tryon Processing Co.

TREATMENT:

Prechlorination, coagulation with alum and lime, sedimentation, rapid sand filtration, adjustment of pH with lime, and post chlorination.

TRYON, POLK COUNTY

RATED CAPACITY OF TREATMENT PLANT:

1.0 mgd.

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity except water is pumped to a tank serving 40 customers.

FINISHED-WATER STORAGE:

Four ground storage tanks, 500,000, 200,000, 40,000 and 12,000 gallons.

FUTURE PLANS:

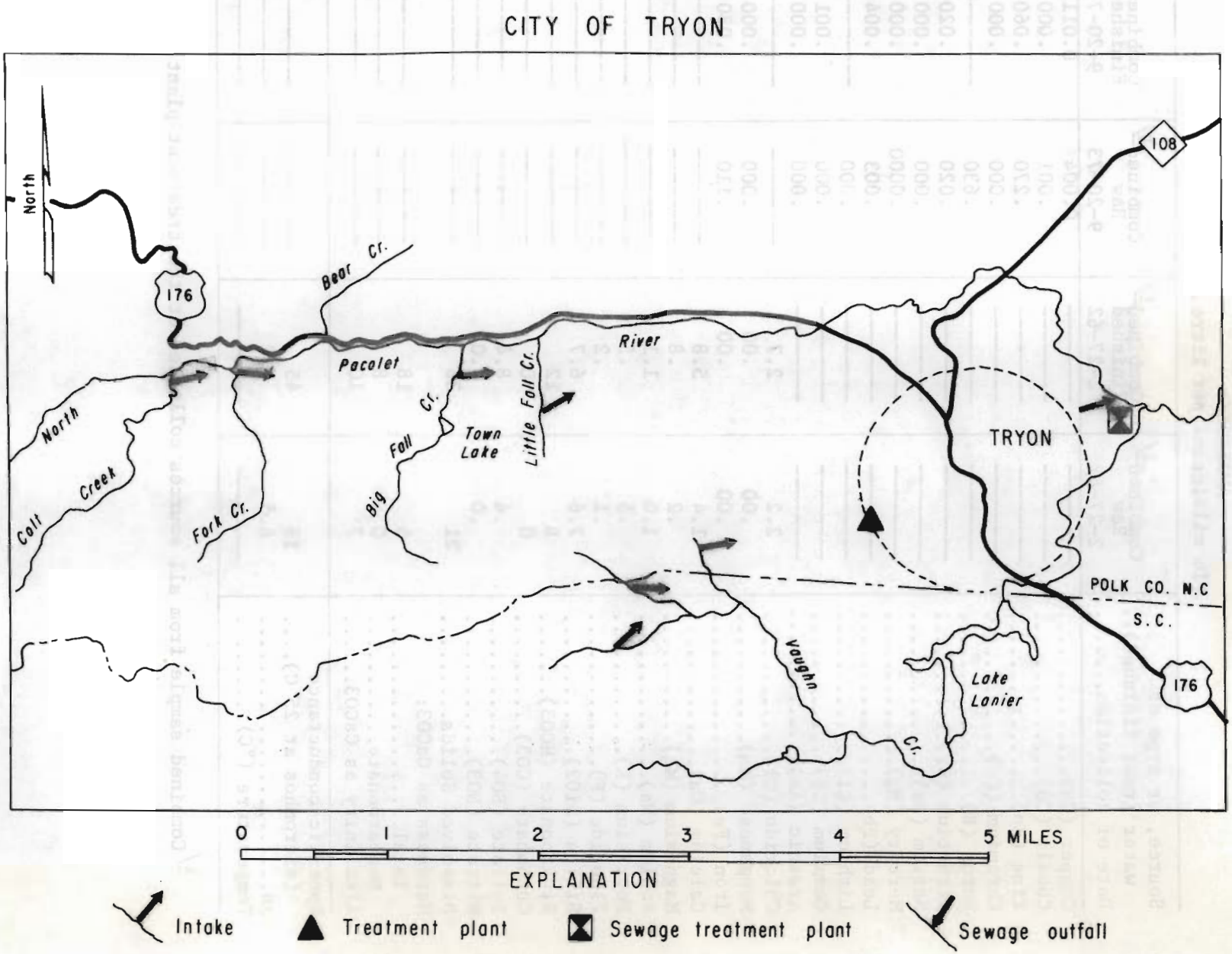
Plans include: (1) construction of a 500,000 and a 50,000 finished water tank; (2) modernization and addition of about 25 miles to the distribution system; and (3) within next five years, construction of a new 3.0 mgd treatment plant.

WATER-RESOURCES APPRAISAL:

Surface water: Tryon is located at the toe of the Blue Ridge front in southern Polk County. The topography is hilly to semi-mountainous. The city is drained by many small tributaries of the North Pacolet River. The low-flow yield of streams in the immediate vicinity of Tryon generally exceeds 0.20 mgd per square mile. The average discharge of streams is 0.95 mgd per square mile, and the 7-day, 2-year low flow averages 0.45 mgd per square mile. The estimated allowable draft is several times current use and should be adequate for the immediate future. If needed in the future, additional draft could be developed by providing storage at the larger of the current sources or by obtaining water from the North Pacolet River.

Ground water: Granite gneiss, interlain with hornblende gneiss, is the predominate rock underlying Tryon. The rocks are extensively fractured and probably rate above average in their water-bearing qualities. Flood plain deposits along the North Pacolet river are reported to range from 20 to 60 feet thick. It is estimated that wells drilled in favorable sites, and spaced to prevent pumping interference, can reasonably be expected to yield 0.05 to 0.6 mgd or more per well.

The chemical quality of ground water is excellent. The water is usually soft and contains less than 100 mg/l of dissolved solids.


CITY OF TRYON
North
176
Bear Cr.
Pacolet
River
Little Fall Cr.
Town Lake
Big Fall Cr.
North Colt Creek
Fork Cr.
108
TRYON
POLK CO. N.C
S.C.
Vaughn Cr.
Lake Lanier
176
0 1 2 3 4 5 MILES
EXPLANATION
Intake
Treatment plant
Sewage treatment plant
Sewage outfall

TRYON, POLK COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw; finished)..	Combined[1/] Raw	Combined[1/] Finished	Combined[1/] Raw	Combined[1/] Finished
Date of collection.....	2-27-62	2-27-62	9-20-73	9-20-73
Copper (Cu).....	--------	--------	0.004	0.011
Cobalt (Co).....	--------	--------	.001	.000
Zinc (Zn).....	--------	--------	.270	.060
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.630	--------
Strontium (Sr).....	--------	--------	.020	.020
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	.0000	.000
Lead (Pb).....	--------	--------	.003	.004
Lithium (Li).....	--------	--------	.000	--------
Cadmium (Cd).....	--------	--------	.000	.001
Arsenic (As).....	--------	--------	.000	.000
Chloride (Cl).....	2.2	2.7	--------	--------
Manganese (Mn).....	.00	.00	.000	.000
Iron (Fe).....	.00	.00	.110	.080
Calcium (Ca).....	1.4	5.8	--------	--------
Magnesium (Mg).....	.2	.8	--------	--------
Sodium (Na).....	1.0	1.1	--------	--------
Potassium (K).....	.5	.5	--------	--------
Fluoride (F).....	.1	.2	--------	--------
Silica (SiO_2).....	7.6	6.7	--------	--------
Bicarbonate (HCO_3).....	8	12	--------	--------
Carbonate (CO_3).....	0	0	--------	--------
Sulfate (SO_4).....	.4	8.4	--------	--------
Nitrate (NO_3).....	.0	.0	--------	--------
Dissolved Solids.....	21	36	--------	--------
Hardness as $CaCO_3$:				
Total.....	5	18	--------	--------
Noncarbonate.....	0	8	--------	--------
Alkalinity as $CaCO_3$.....	7	10	--------	--------
Specific conductance (micromhos at 25°C)....	18	45	--------	--------
pH.....	6.5	7.2	--------	--------
Temperature (°C).....	--------	--------	--------	--------

[1/] Combined sample from all sources collected at the treatment plant.

RUTHERFORD COUNTY

WATER-RESOURCES APPRAISAL

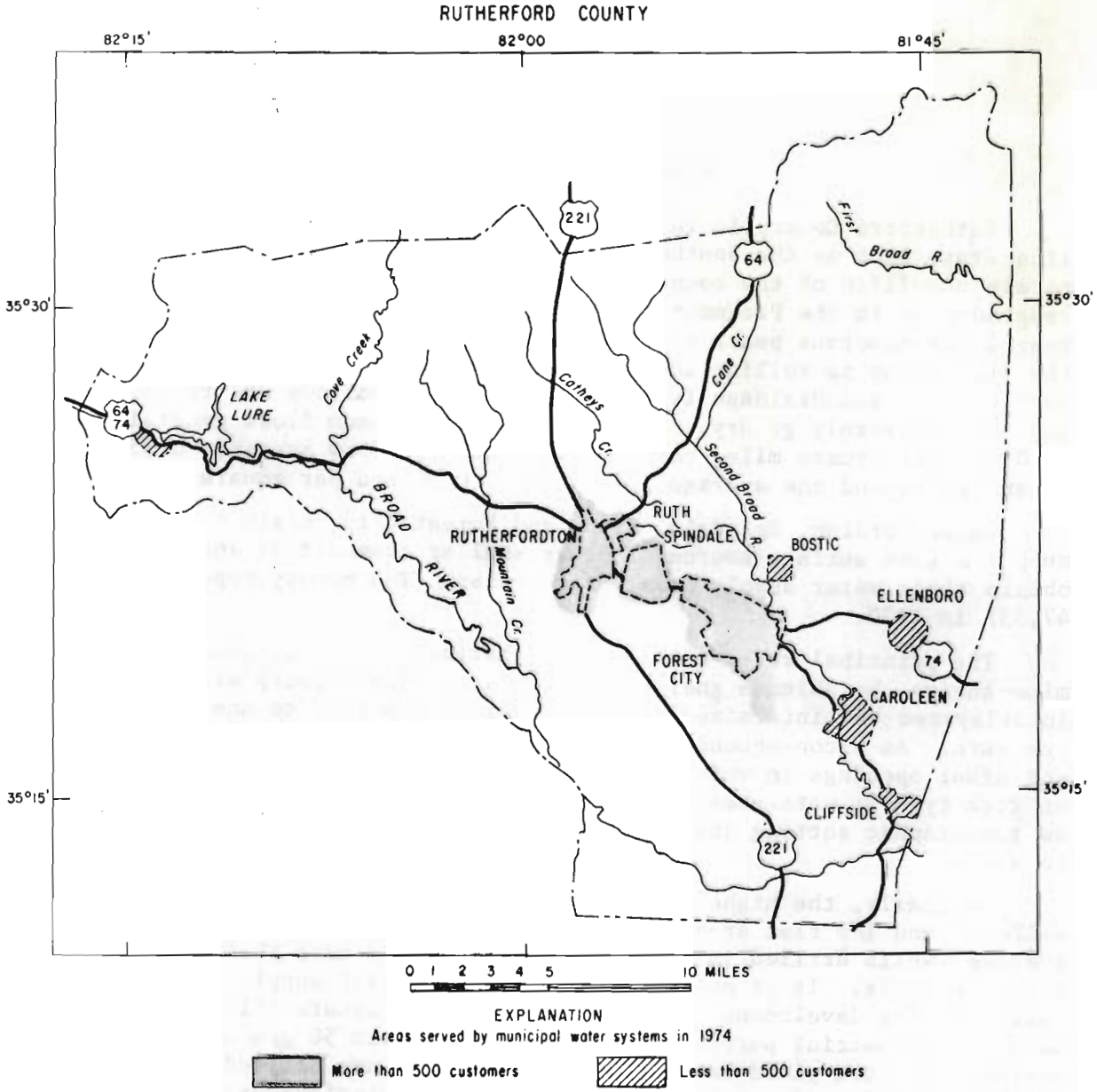
Rutherford County is in southwestern North Carolina with the South Carolina State line as the southern boundary. The northwest corner, approximately one-fifth of the county, is in the Blue Ridge province and the remainder is in the Piedmont. The topography in the mountainous area is rugged and numerous peaks of bald granite are found, whereas, in the Piedmont, the topography is rolling to hilly. Most streams have cut relatively-narrow deep valleys and drainage is good. Minimum streamflows are relatively high and streams rarely go dry. For all streams, minimum flows generally exceed 0.20 mgd per square mile, the 7-day, 2-year low flow averages 0.35 mgd per square mile, and the average discharge is 0.90 mgd per square mile.

Rutherfordton, Spindale, Ruth, and Forest City obtain their water supplies from surface sources. Other smaller communities and rural residents obtain their water supply from ground water. The county population was 47,337 in 1970.

The principal rocks underlying Rutherford County include mica-schist, mica-gneiss, hornblende gneiss, and granite. These rocks are complexly interlayered and intermixed, and large areas confined to any one rock type are rare. As a consequence of the complex interlayering, joints, fractures, and other openings in which water moves are abundant, and the significance of rock type to water-bearing characteristics is obscure. Other factors such as topographic setting and thickness of the soil mantle are more significant to yield.

Generally, the higher yielding wells are drilled in draws, sags, valleys, and low flat areas, where thick soil cover is present. On the average, wells drilled in draws and valleys yield more than twice as much as wells on hills. It is estimated that the potential supply of ground water available for development averages 0.55 mgd per square mile. Several wells used for industrial purposes are reported to yield 50 gpm or more with the maximum reported yield being 250 gpm. If wells are drilled in carefully selected sites, and spaced to prevent pumping interference, yields of 40 gpm or more may reasonably be expected.

The chemical quality of ground water is excellent and suitable for most uses with little or no treatment. The water usually contains less than 100 mg/l of dissolved solids, but locally may contain iron concentrations in excess of 0.3 mg/l.


RUTHERFORD COUNTY
82°15'
82°00
81°45'
35°30'
35°15'
221
64
74
First Broad R
Second Broad R
Cane Ck
Cathey's Ck
Cove Creek
LAKE LURE
BROAD RIVER
Mountain Ck
RUTHERFORDTON
RUTH
SPINDALE
BOSTIC
ELLENBORO
FOREST CITY
CAROLEEN
CLIFFSIDE
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

FOREST CITY, RUTHERFORD COUNTY

OWNERSHIP:

Municipal. Also supplies the Sandymush Water District. Total population supplied, about 8,000 in 1973 (2,900 metered customers, 60 of which are in suburban areas).

SOURCE:

Second Broad River: The intakes are approximately 2.5 miles north of Forest City at lat 35°22'50", long 81°51'40". The drainage area at the intakes is 92 square miles, approximately.

RAW-WATER STORAGE:

None.

ALLOWABLE DRAFT:

Estimated allowable draft is 13 mgd with no storage.

TOTAL USE:

Average (1972), 1.80 mgd, metered; maximum daily (7-26-72) 2.496 million gallons.

INDUSTRIAL USE:

0.8 mgd, estimated. Principal users include General Fireproofing Co., Cone Mills Corporation, United Southern Industries, Inc., Decorative Components, Inc., and Fieldcrest Mills.

TREATMENT:

Prechlorination, coagulation with alum, sedimentation, addition of carbon for control of taste and odor when necessary, rapid-sand filtration, adjustment of pH with soda ash, post chlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

2.0 mgd. Plant capacity being expanded to 8.0 mgd. Expansion scheduled for completion March 1974.

PUMPING CAPACITY:

Raw water, 2.4 mgd; finished water 2.4 mgd.

FINISHED-WATER STORAGE:

Two clear wells, 1,000,000 and 300,000 gallons; four elevated tanks, 500,000, 250,000, 200,000 and 75,000 gallons.

FUTURE PLANS:

Plant capacity, including raw and finished water pumping capacity is being enlarged. No further plans at present.

FOREST CITY, RUTHERFORD COUNTY

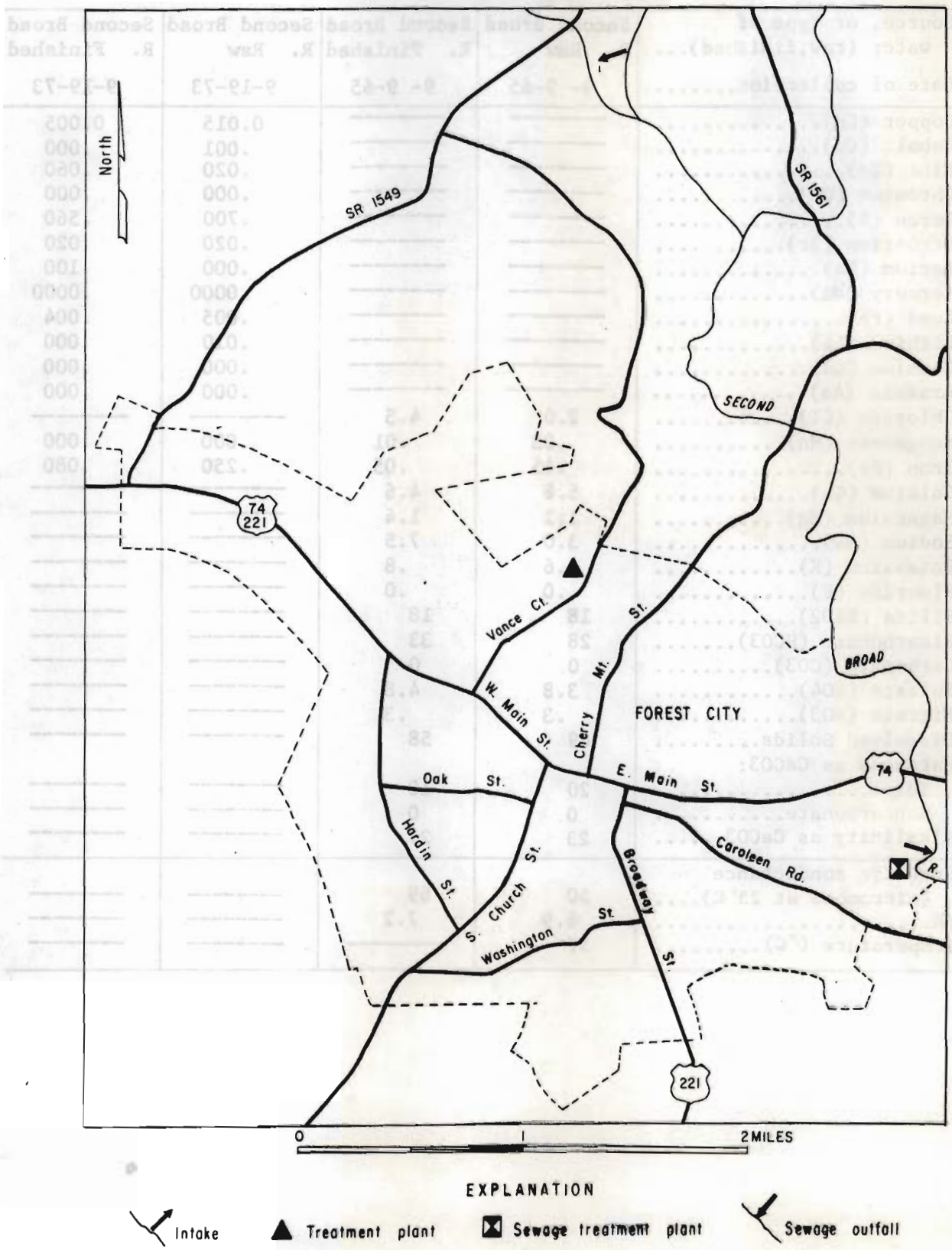
WATER-RESOURCES APPRAISAL:

Surface water: Forest City is in an upland area in the Piedmont section of eastern Rutherford County. The city is drained by small tributaries of the Broad and Second Broad Rivers. The Second Broad River, which flows south across the county, is the eastern city limit. The low-flow yield of streams draining the immediate area generally exceeds 0.18 mgd per square mile. The average discharge is 0.90 mgd per square mile, and the 7-day, 2-year low flow averages 0.30 mgd per square mile. The estimated allowable draft of the Second Broad River is more than 5 times the maximum daily use and should be adequate for the foreseeable future.

Ground water: The bedrock underlying Forest City is predominately mica-schist interlain with granite. Wells in the vicinity of the city are normally drilled between 75 and 250 feet deep and reported yields are as high as 60 gpm. Wells drilled in favorable locations can reasonably be expected to yield 40 gpm or more.

The chemical quality of ground water is generally good, but locally iron concentrations may be higher than desirable.

CITY OF FOREST CITY



EXPLANATION

Intake ▲ Treatment plant ⊠ Sewage treatment plant Sewage outfall

FOREST CITY, RUTHERFORD COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Second Broad R. Raw	Second Broad R. Finished	Second Broad R. Raw	Second Broad R. Finished
Date of collection.....	9- 9-65	9- 9-65	9-19-73	9-19-73
Copper (Cu).....	-------	-------	0.015	0.005
Cobalt (Co).....	-------	-------	.001	.000
Zinc (Zn).....	-------	-------	.020	.060
Chromium (Cr).....	-------	-------	.000	.000
Boron (B).....	-------	-------	.700	.560
Strontium (Sr).....	-------	-------	.020	.020
Barium (Ba).....	-------	-------	.000	.100
Mercury (Hg).....	-------	-------	.0000	.0000
Lead (Pb).....	-------	-------	.005	.004
Lithium (Li).....	-------	-------	.010	.000
Cadmium (Cd).....	-------	-------	.000	.000
Arsenic (As).....	-------	-------	.000	.000
Chloride (Cl).....	2.0	4.5	-------	-------
Manganese (Mn).....	.03	.01	.000	.000
Iron (Fe).....	.45	.05	.250	.080
Calcium (Ca).....	5.8	4.6	-------	-------
Magnesium (Mg).....	1.1	1.4	-------	-------
Sodium (Na).....	3.0	7.5	-------	-------
Potassium (K).....	.6	.8	-------	-------
Fluoride (F).....	.0	.0	-------	-------
Silica (SiO2).....	18	18	-------	-------
Bicarbonate (HCO3).....	28	33	-------	-------
Carbonate (CO3).....	0	0	-------	-------
Sulfate (SO4).....	3.8	4.8	-------	-------
Nitrate (NO3).....	.3	.3	-------	-------
Dissolved Solids.....	49	58	-------	-------
Hardness as CaCO3:				
Total.....	20	18	-------	-------
Noncarbonate.....	0	0	-------	-------
Alkalinity as CaCO3.....	23	27	-------	-------
Specific conductance (micromhos at 25° C)....	50	69	-------	-------
pH.....	6.9	7.2	-------	-------
Temperature (°C).....	17	-------	-------	-------

SPINDALE, RUTHERFORDTON, RUTH, RUTHERFORD COUNTY

OWNERSHIP:

Duke Power Company. Also supplies Broyhill Community Water System. Total population supplied, about 8,000 in 1973 (3,324 metered customers).

SOURCE:

Catheys Creek impounded by a low dam (basically a pumping pool): The intakes are approximately 1.5 miles north of Spindale at lat 35°23'22", long 81°54'42". The drainage area at the intakes is 31 square miles, approximately. Hollands Creek (supplementary source): The intakes are approximately 0.5 mile north of Spindale at lat 35°23'00", long 81°55'11". The drainage area at the intake is 5.4 square miles, approximately.

RAW-WATER STORAGE:

Duke Power Reservoir, an off-river storage reservoir, 113 million gallons. Water normally is pumped direct from Catheys Creek to the treatment plant except when the creek is muddy. During periods when the creek is muddy, water is pumped from the reservoir.

ALLOWABLE DRAFT:

Estimated allowable draft of Catheys Creek is 10 mgd with a storage of 113 million gallons. Estimated allowable draft of Hollands Creek is 0.9 mgd with no storage.

TOTAL USE:

Average (1972), 3.02 mgd, metered; maximum daily (7-25-72) 5.57 million gallons.

INDUSTRIAL USE:

2.4 mgd, estimated. Principal users include Stonecutter Mills Corporation, Spinners Processing Co., and Spindale Mills, Inc.

TREATMENT:

Prechlorination, coagulation with alum and caustic soda, sedimentation, rapid sand filtration, adjustment of pH with caustic soda, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

7.0 mgd.

PUMPING CAPACITY:

Raw water, 5.7 mgd; finished water, 6.8 mgd. From Holland Creek, 1.4 mgd.

FINISHED-WATER STORAGE:

Three clear wells, 1,000,000, 500,000 and 500,000 gallons; two elevated tanks 750,000 and 500,000 gallons; one stand pipe, 400,000 gallons.

FUTURE PLANS:

Additional finished water storage is under consideration.

SPINDALE, RUTHERFORDTON, RUTH, RUTHERFORD COUNTY

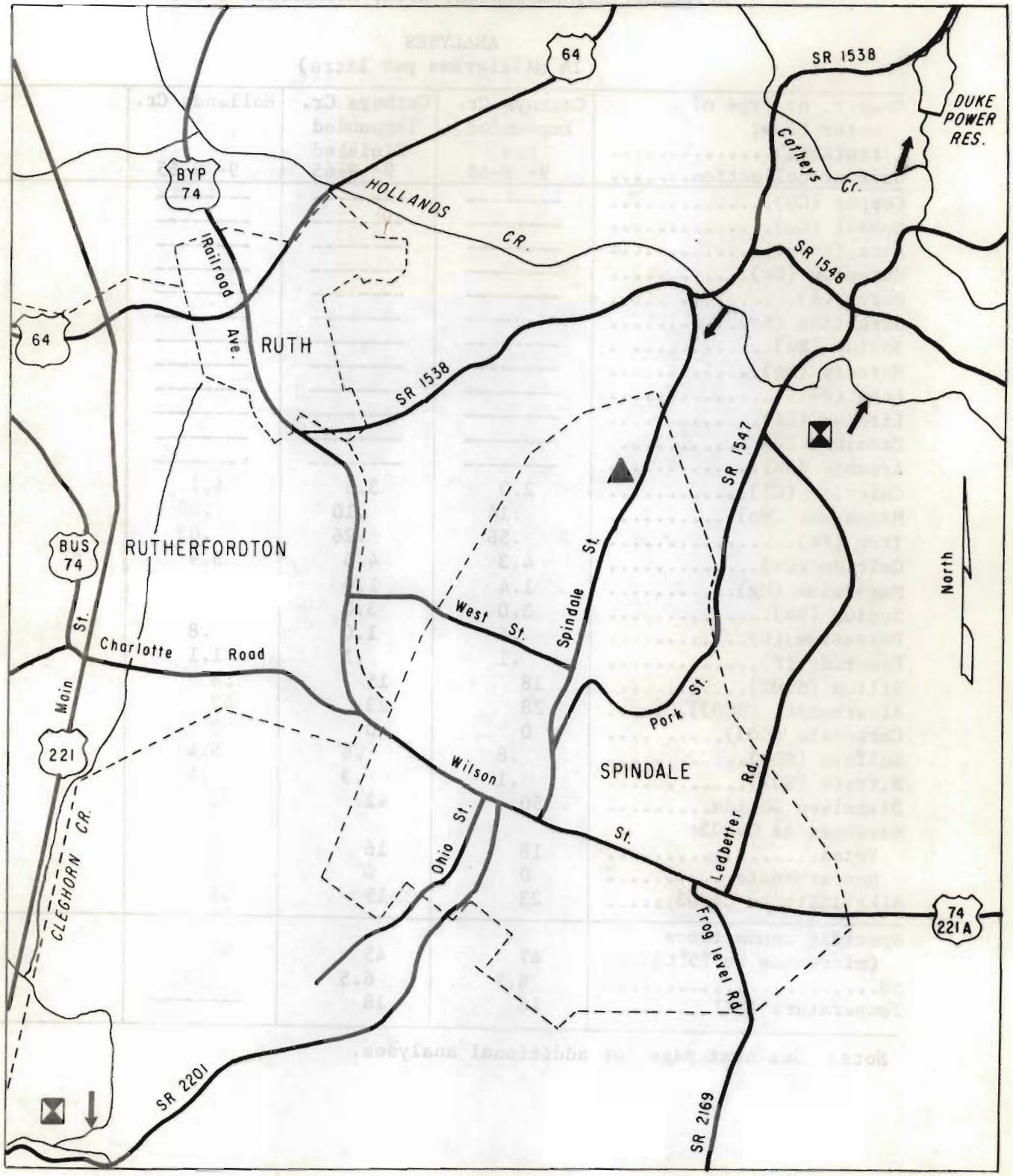
WATER-RESOURCES APPRAISAL:

Surface water: Spindale, Rutherfordton, and Ruth are in the Piedmont portion of Rutherford County. The cities are located on the basin divide of the Broad and Second Broad Rivers and small tributaries of these rivers drain the area. The low-flow yield of streams generally exceeds 0.20 mgd per square mile. The average discharge is 0.85 mgd per square mile, and the 7-day, 2-year low flow averages 0.35 mgd per square mile. The estimated allowable draft of the present sources is more than twice current use and should be adequate for the immediate future. If needed in the future, additional draft can be developed by providing for additional raw water storage at either source.

Ground water: Mica-schist and hornblende gneiss interlain with granite are the predominate rocks underlying the area served by the Duke Power Company water system. Wells in the immediate area are normally drilled from 75 to 200 feet deep and yields in excess of 100 gpm have been reported. With the abundance of surface water available, it is not likely that Duke Power Company will use ground water for the public supply. However, the amount of ground water available is adequate for small industrial, air-conditioning, or supplementary supplies. Wells drilled in carefully selected sites can reasonably be expected to yield 35 gpm or more.

The chemical quality of ground water is generally good. Locally, the water may contain iron concentrations in excess of 0.3 mg/l.

CITY OF RUTHERFORDTON, RUTH, AND SPINDALE



SPINDALE, RUTHERFORDTON, RUTH, RUTHERFORD COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw; finished).....	Catheys Cr. Impounded Raw	Catheys Cr. Impounded Finished	Hollands Cr.
Date of collection.....	9- 9-65	9- 9-65	9- 9-65
Copper (Cu).....	--------	--------	--------
Cobalt (Co).....	--------	--------	--------
Zinc (Zn).....	--------	--------	--------
Chromium (Cr).....	--------	--------	--------
Boron (B).....	--------	--------	--------
Strontium (Sr).....	--------	--------	--------
Barium (Ba).....	--------	--------	--------
Mercury (Hg).....	--------	--------	--------
Lead (Pb).....	--------	--------	--------
Lithium (Li).....	--------	--------	--------
Cadmium (Cd).....	--------	--------	--------
Arsenic (As).....	--------	--------	--------
Chloride (Cl).....	2.0	3.5	4.1
Manganese (Mn).....	.14	.10	.00
Iron (Fe).....	.56	.26	.02
Calcium (Ca).....	4.3	4.3	5.9
Magnesium (Mg).....	1.4	1.0	1.1
Sodium (Na).....	3.0	3.0	13
Potassium (K).....	.6	1.0	.8
Fluoride (F).....	.1	.1	1.1
Silica (SiO_2).....	18	15	18
Bicarbonate (HCO_3).....	28	23	43
Carbonate (CO_3).....	0	0	0
Sulfate (SO_4).....	.8	.6	5.4
Nitrate (NO_3).....	.1	.3	.4
Dissolved Solids.....	50	42	71
Hardness as $CaCO_3$:			
Total.....	18	16	20
Noncarbonate.....	0	0	0
Alkalinity as $CaCO_3$.....	23	19	35
Specific conductance (micromhos at 25° C)....	47	45	95
pH.....	6.9	6.5	7.3
Temperature (°C).....	18	18	--------

Note: See next page for additional analyses.

SPINDALE, RUTHERFORDTON, RUTH, RUTHERFORD COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Catheys Cr. Raw	Catheys Cr. Finished		
Date of collection.....	9-19-73	9-19-73		
Copper (Cu).....	0.018	0.010		
Cobalt (Co).....	.000	.000		
Zinc (Zn).....	.000	.010		
Chromium (Cr).....	.000	.000		
Boron (B).....	.180	.210		
Strontium (Sr).....	.030	.020		
Barium (Ba).....	.000	.000		
Mercury (Hg).....	.0000	.0000		
Lead (Pb).....	.023	.008		
Lithium (Li).....	.000	.000		
Cadmium (Cd).....	.001	.001		
Arsenic (As).....	.000	.000		
Chloride (Cl).....	--------	--------		
Manganese (Mn).....	.100	.000		
Iron (Fe).....	.280	.040		
Calcium (Ca).....	--------	--------		
Magnesium (Mg).....	--------	--------		
Sodium (Na).....	--------	--------		
Potassium (K).....	--------	--------		
Fluoride (F).....	--------	--------		
Silica (SiO_2).....	--------	--------		
Bicarbonate (HCO_3).....	--------	--------		
Carbonate (CO_3).....	--------	--------		
Sulfate (SO_4).....	--------	--------		
Nitrate (NO_3).....	--------	--------		
Dissolved Solids.....	--------	--------		
Hardness as $CaCO_3$:				
Total.....	--------	--------		
Noncarbonate.....	--------	--------		
Alkalinity as $CaCO_3$.....	--------	--------		
Specific conductance (micromhos at 25° C)....	--------	--------		
pH.....	--------	--------		
Temperature (°C).....	--------	--------		

SWAIN COUNTY

WATER-RESOURCES APPRAISAL

Swain County is in the Blue Ridge province in western North Carolina. The North Carolina-Tennessee State line is the north boundary. Most of the population is centered in the projecting southern portion and on the Cherokee Reservation. The Great Smoky Mountain National Park occupies approximately the northern two-thirds of the county. Rugged mountains with narrow valleys characterize the topography. The Little Tennessee River and its tributaries, principally the Oconaluftee, Tuskasegee, and Nantahala Rivers, drain the county. Fontana Lake, a Tennessee Valley Authority multipurpose reservoir, is mostly in the county. The population was 7,861 in 1970.

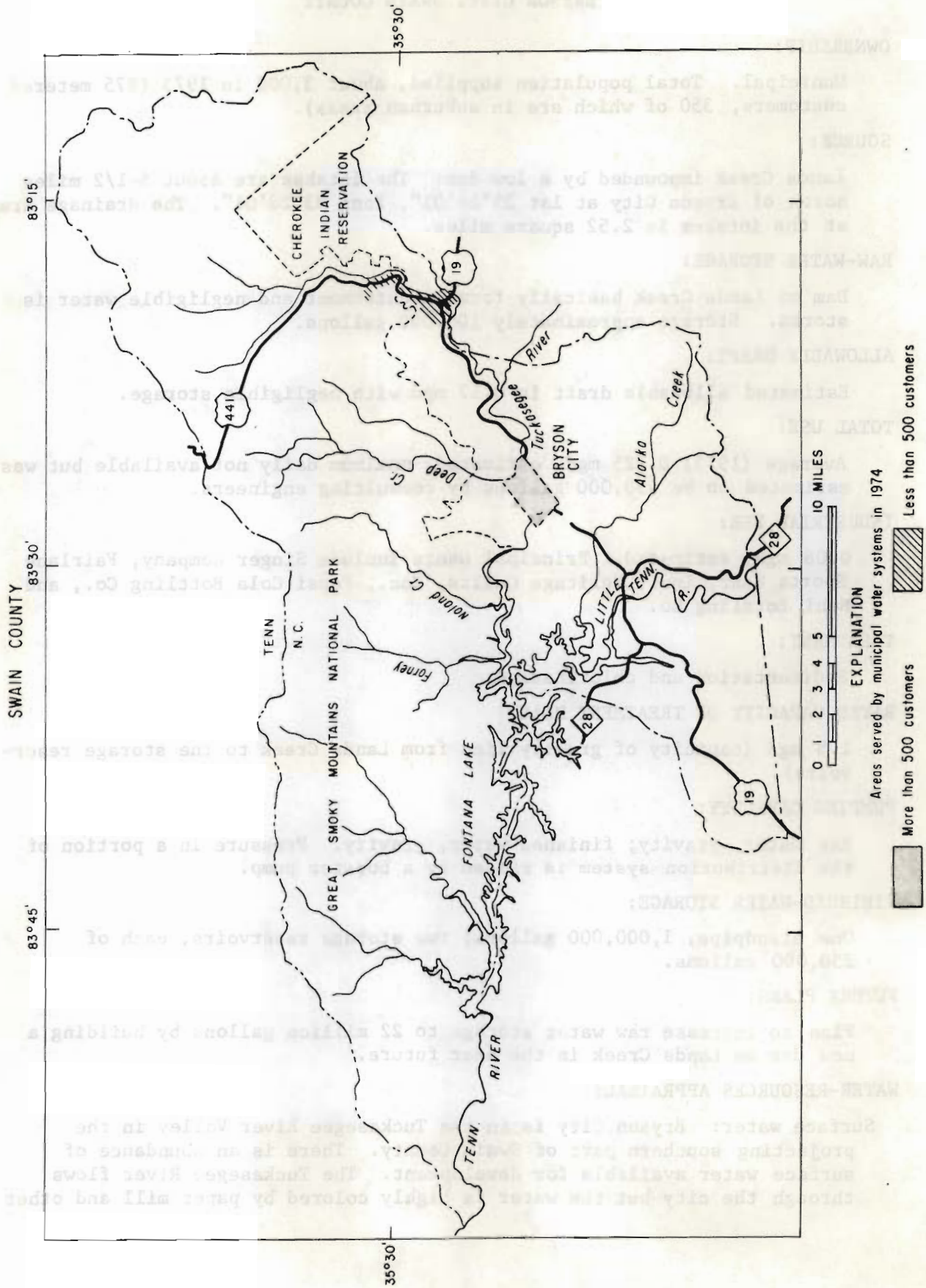
There is an abundance of surface water available for public water supplies. Streamflow varies with elevation, being greater at higher elevations. For all streams the average discharge is 1.9 mgd per square mile. Minimum flows generally exceed 0.2 mgd per square mile, and 7-day, 2-year low flows average 0.45 mgd per square mile. Bryson City and part of Cherokee's water supply is obtained from surface sources. The remainder of the Cherokee Supply is from wells.

Complexly folded and interbedded metamorphic rocks underlie the county. Quartzite, metagraywacke, and metaconglomerate predominate with lesser amounts of phylitte, slate, schist, and gneiss being found. Rocks of the Murphy Marble belt are found in the Nantahala Gorge. The overlying mantle of weathered rock is thin or non-existent except in the larger stream valleys where unconsolidated, poorly sorted, aluvium and weathered rock is as much as 100 feet thick in places. Springs are numerous and many are used for rural domestic water supply.

The chief aquifers are the fracture zones in the various rock units. The higher yielding wells are usually those drilled in the fractured rock near the contact zones between the rock units. There are solution cavities (usually small) in the marble in Nantahala Gorge and wells penetrating these openings are usually productive. Wells are normally drilled between 50 and 150 feet deep. Very little data on the yield of drilled wells are available. The maximum yield in available records is 100 gpm, and the average reported yield of 20 wells is 23 gpm.

The chemical quality of ground water is good and suitable for most uses with little or no treatment. The water is usually soft to moderately hard, acidic, but locally may contain iron concentrations in excess of 0.3 mg/1.

The amount of ground water available is adequate, with proper planning and management, for small industrial, supplemental, and small municipal supplies. Wells drilled in favorable locations, such as draws and valleys, and spaced to prevent pumping interference, would probably yield 0.07 to 0.08 mgd per well.


35°30'
83°15'
83°30'
83°45'
35°30'
SWAIN COUNTY
CHEROKEE INDIAN RESERVATION
19
441
Tuckasegee River
BRYSON CITY
Deep Cr.
Alarka Creek
28
TENN
N.C.
GREAT SMOKY MOUNTAINS NATIONAL PARK
Noland Cr.
Forney
LITTLE TENN R.
FONTANA LAKE
TENN. RIVER
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

BRYSON CITY, SWAIN COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 3,000 in 1973 (875 metered customers, 350 of which are in suburban areas).

SOURCE:

Lands Creek impounded by a low dam: The intakes are about 5-1/2 miles north of Bryson City at lat 35°28'01", long 83°28'01". The drainage area at the intakes is 2.52 square miles.

RAW-WATER STORAGE:

Dam on Lands Creek basically forms a catchment and negligible water is stored. Storage approximately 100,000 gallons.

ALLOWABLE DRAFT:

Estimated allowable draft is 0.17 mgd with negligible storage.

TOTAL USE:

Average (1973) 0.225 mgd, estimated; maximum daily not available but was estimated to be 450,000 gallons by consulting engineers.

INDUSTRIAL USE:

0.08 mgd, estimated. Principal users include Singer Company, Fairlane Sports Wear, Inc., Heritage Quilts, Inc., Pepsi Cola Bottling Co., and Nehi Bottling Co.

TREATMENT:

Sedimentation and chlorination.

RATED CAPACITY OF TREATMENT PLANT:

1.5 mgd (capacity of gravity line from Lands Creek to the storage reservoirs).

PUMPING CAPACITY:

Raw water, gravity; finished water, gravity. Pressure in a portion of the distribution system is raised by a booster pump.

FINISHED-WATER STORAGE:

One standpipe, 1,000,000 gallons; two storage reservoirs, each of 250,000 gallons.

FUTURE PLANS:

Plan to increase raw water storage to 22 million gallons by building a new dam on Lands Creek in the near future.

WATER-RESOURCES APPRAISAL:

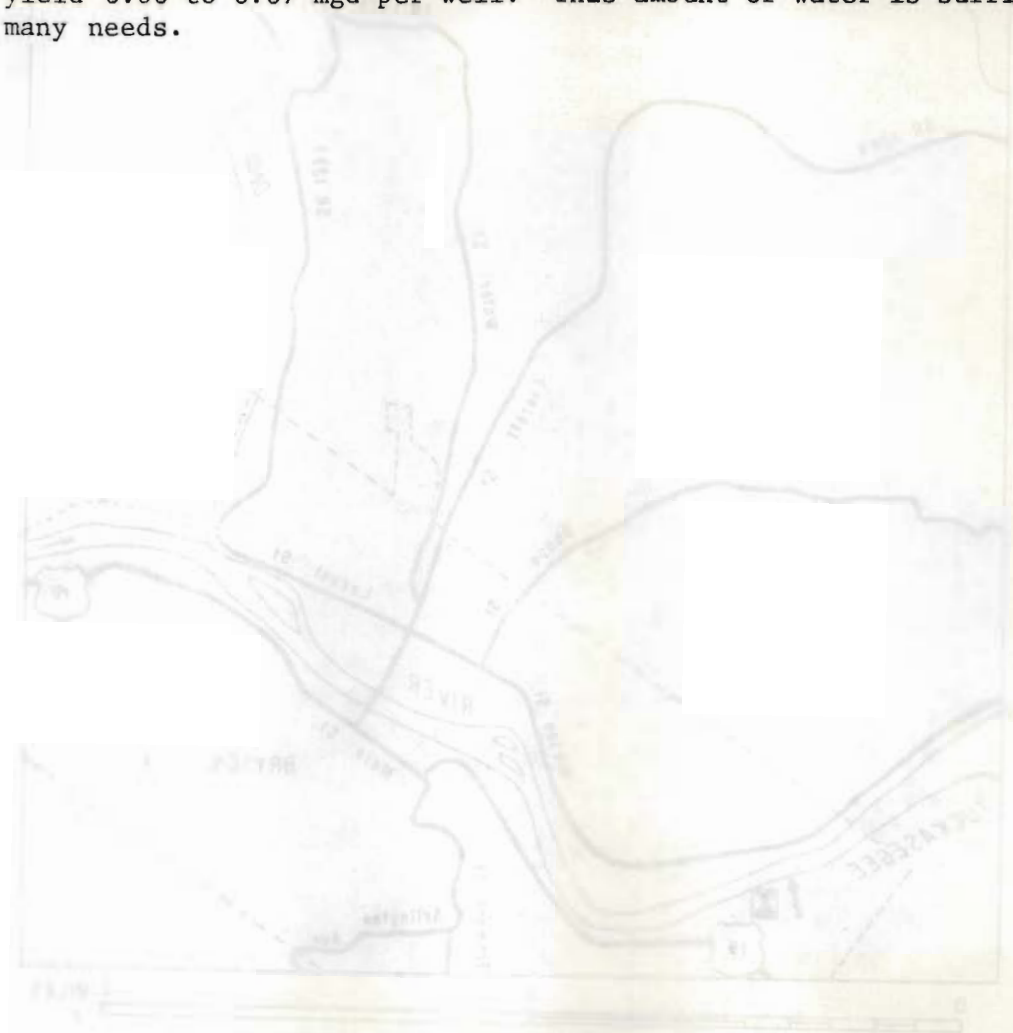
Surface water: Bryson City is in the Tuckasegee River Valley in the projecting southern part of Swain County. There is an abundance of surface water available for development. The Tuckasegee River flows through the city but the water is highly colored by paper mill and other

wastes and would be difficult to treat.

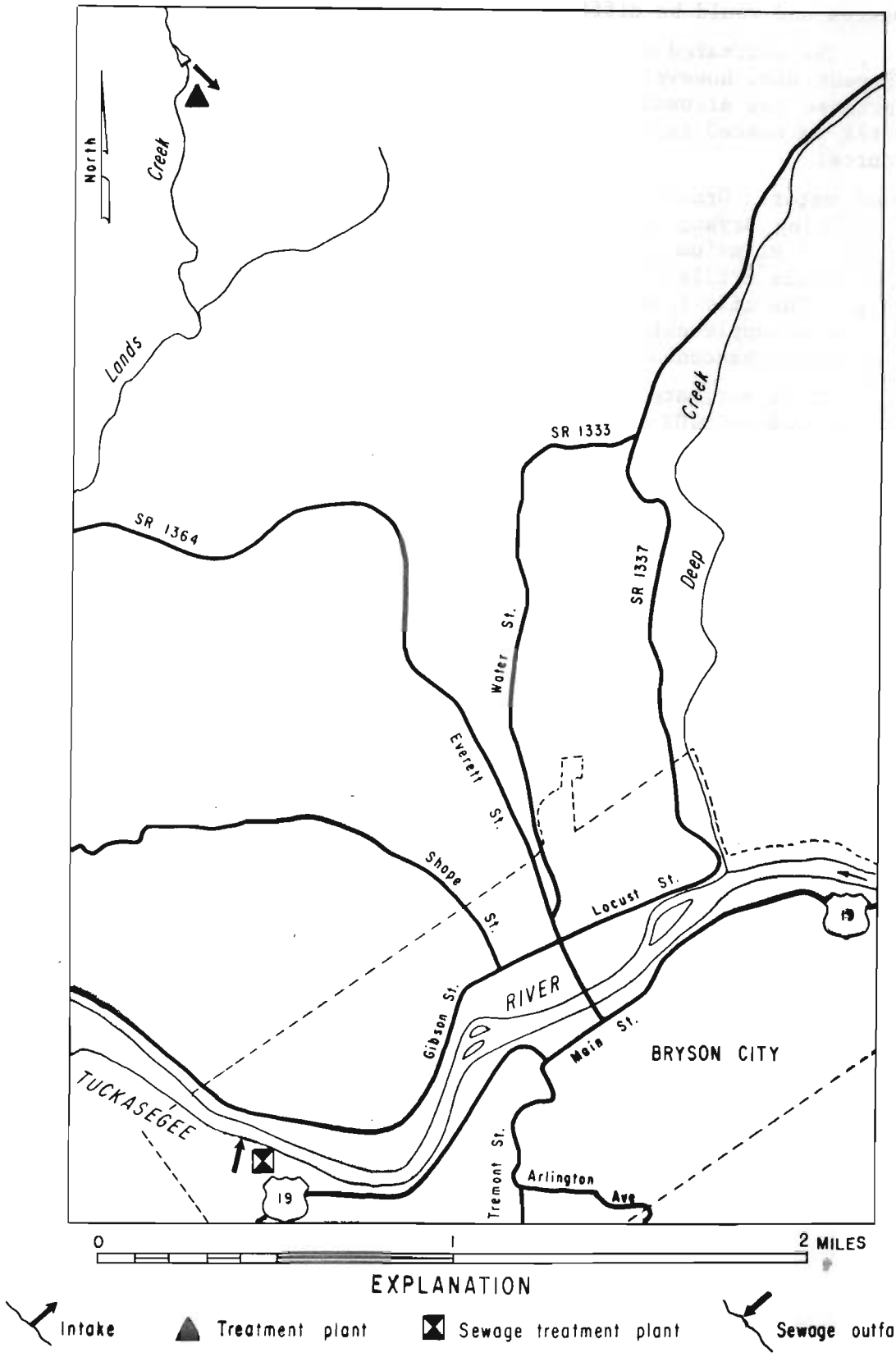
The estimated allowable draft of the present source is less than current use, however, the proposed 22 million gallon reservoir will increase the allowable draft to approximately 0.8 mgd. If additional water is needed in the future, Deep Creek would probably be the best source.

Ground water: Granite-gneiss and mica-schist are the predominant rocks underlying Bryson City. Based on records of well casing lengths, the depth of alluvium and weathered rock is as much as 100 feet in places. Most wells drilled in the Bryson City vicinity are from 75 to 150 feet deep. The city formerly used a well 500 feet deep reported to yield 100 gpm as a supplemental supply. The water was of good quality but the well had to be abandoned because of its proximity to a sewer line.

It is estimated that wells drilled in carefully selected sites would yield 0.06 to 0.07 mgd per well. This amount of water is sufficient for many needs.



CITY OF BRYSON CITY



BRYSON CITY, SWAIN COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Lands Cr. Finished	Lands Cr. Finished		
Date of collection.....	9- 8-65	1-10-74		
Copper (Cu).....	--------	0.006		
Cobalt (Co).....	--------	.000		
Zinc (Zn).....	--------	.008		
Chromium (Cr).....	--------	.002		
Boron (B).....	--------	.050		
Strontium (Sr).....	--------	.000		
Barium (Ba).....	--------	.000		
Mercury (Hg).....	--------	.0000		
Lead (Pb).....	--------	.008		
Lithium (Li).....	--------	.000		
Cadmium (Cd).....	--------	.006		
Arsenic (As).....	--------	.000		
Chloride (Cl).....	2.0	.9		
Manganese (Mn).....	.01	.000		
Iron (Fe).....	.01	.000		
Calcium (Ca).....	1.2	--------		
Magnesium (Mg).....	1.2	--------		
Sodium (Na).....	1.0	--------		
Potassium (K).....	.5	--------		
Fluoride (F).....	.0	--------		
Silica (SiO_2).....	7.4	--------		
Bicarbonate (HCO_3).....	6	--------		
Carbonate (CO_3).....	0	--------		
Sulfate (SO_4).....	1.8	--------		
Nitrate (NO_3).....	.1	--------		
Dissolved Solids.....	18	--------		
Hardness as $CaCO_3$:				
Total.....	8	--------		
Noncarbonate.....	4	--------		
Alkalinity as $CaCO_3$.....	2	--------		
Specific conductance (micromhos at 25° C)....	17	13		
pH.....	6.7	--------		
Temperature (°C).....	--------	--------		

TRANSYLVANIA COUNTY

WATER-RESOURCES APPRAISAL

Transylvania County is in the Blue Ridge province in western North Carolina. The North Carolina-South Carolina State line is the south boundary. The topography is hilly and mountainous, except for the relatively flat French Broad River and lower parts of the Little River and Davidson River valleys. The French Broad River (head of the Tennessee River basin) and its tributaries drain all but the southwest corner which is drained by the headwaters of the Savannah River. The average discharge of streams in the county is high, ranging from 1.6 mgd per square mile in the northeast to 2.6 mgd per square mile in the southwest and averaging 2.1 mgd per square mile. Minimum flows are also high generally exceeding 0.4 mgd per square mile. The 7-day, 2-year low flow averages 0.7 mgd per square mile. There is an abundance of good quality surface water available for development for public water supplies. Brevard, with the only municipal water system in the county, obtains its water from surface sources. Numerous community water systems use ground water. The population in 1970 was 19,713.

A wide variety of crystalline rocks underlie the county but they may be grouped into four northeast trending belts. The northwesternmost of these includes the Pisgah Ridge and is predominantly biotite gneiss and whiteside granite. A narrow belt of Brevard Schist trending northeastward through the center of the county adjoins the granite and gneiss. The contact between these belts is sharp and may represent a fault. Southeast of the Brevard Schist is a belt of Henderson Gneiss, and granite adjoins the Henderson Gneiss. In the French Broad River valley, unconsolidated deposits of alluvium and weathered rock as much as 70 feet thick overlie the bedrock.

There are insufficient records of drilled wells to assess the water-bearing characteristics of all rock units in the county. However, using the available records and record from wells in the same rock units in adjoining counties, the following table showing typical yields and average depth of wells in some rock units was assembled:

Rock unit	Yield (gpm)		Average depth (feet)
	Maximum	Average	
Biotite gneiss	60	18	119
Brevard Schist	55	14	137
Henderson Gneiss	120	33	212

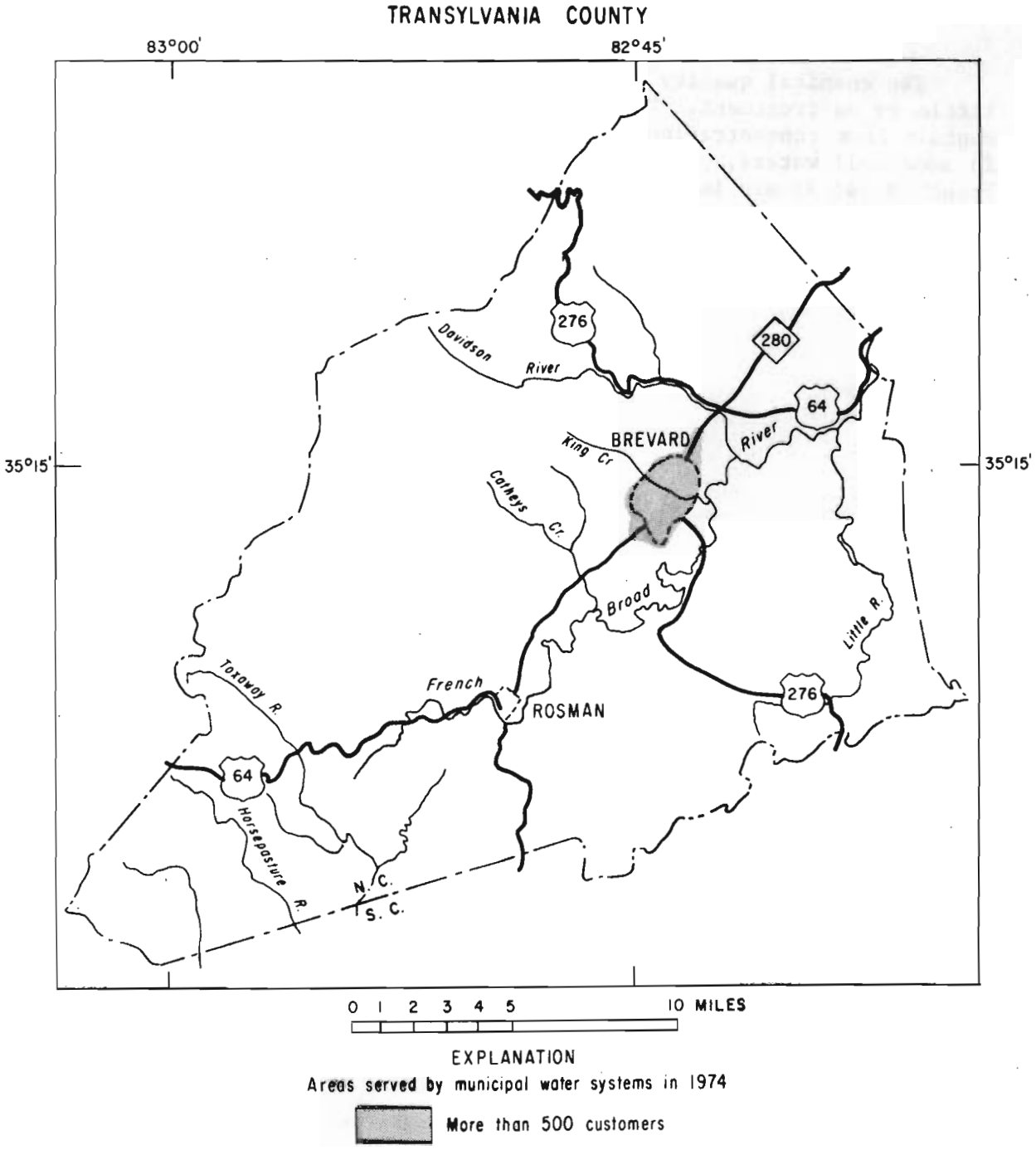
Most wells are drilled between 60 and 150 feet deep. For 52 drilled wells, the average depth is 106 feet and the average yield is 17.1 gpm.

The amount of ground water available is adequate, with proper planning and management, for small industrial, air-conditioning, or supplemental supplies. It is estimated that wells drilled in favorable sites, such as draws and valleys, could reasonably be expected to yield 35 gpm or more.

TRANSYLVANIA COUNTY

WATER-RESOURCES APPRAISAL

The chemical quality of ground water is suitable for most uses with little or no treatment. The water is usually soft, acidic, and locally may contain iron concentrations in excess of 0.3 mg/1. Turbidity is a problem in some well waters, particularly in the flood plains of the Davidson and French Broad Rivers in the Pisgah Forest vicinity.


TRANSYLVANIA COUNTY
83°00'
82°45'
35°15'
35°15'
Davidson River
276
280
64
BREVARD
King Cr.
River
Calhoys Cr.
Broad
Little R.
French
ROSMAN
276
Toxaway R.
64
Horsepasture R.
N. C.
S. C.
0 1 2 3 4 5
10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers

BREVARD, TRANSYLVANIA COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 7,000 in 1973 (2,200 metered customers, 600 of which are in suburban areas).

SOURCE:

Kings Creek impounded by a low dam (pumping pool only): The intakes are approximately 1.6 miles northwest of Brevard at lat 35°15'27", long 82°45'45". The drainage area at the intakes is 1.3 square miles, approximately.

Brushy Creek (auxilliary supply) impounded by a low dam (pumping pool only): The intakes are approximately 1.0 mile northwest of Brevard at lat 33°13'44", long 82°45'38". The drainage area at the intakes is 0.4 square miles, approximately.

RAW-WATER STORAGE:

Concrete reservoir, 270,000 gallons.

ALLOWABLE DRAFT:

Combined estimated allowable draft of Kings and Brushy Creeks is 0.7 mgd with a storage of 270,000 gallons.

TOTAL USE:

Average (1973) 0.8 mgd, estimated; maximum daily (8-31-73) 1.5 million gallons.

INDUSTRIAL USE:

Negligible.

TREATMENT:

Chlorination, sedimentation, and addition of phosphate compounds for corrosion control.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

None. Water flows by gravity.

FINISHED-WATER STORAGE:

Two reservoirs, each 1.0 million gallons.

FUTURE PLANS:

No definite plans at present. The town has a well drilling permit and all necessary equipment in case additional water is required.

WATER-RESOURCES APPRAISAL:

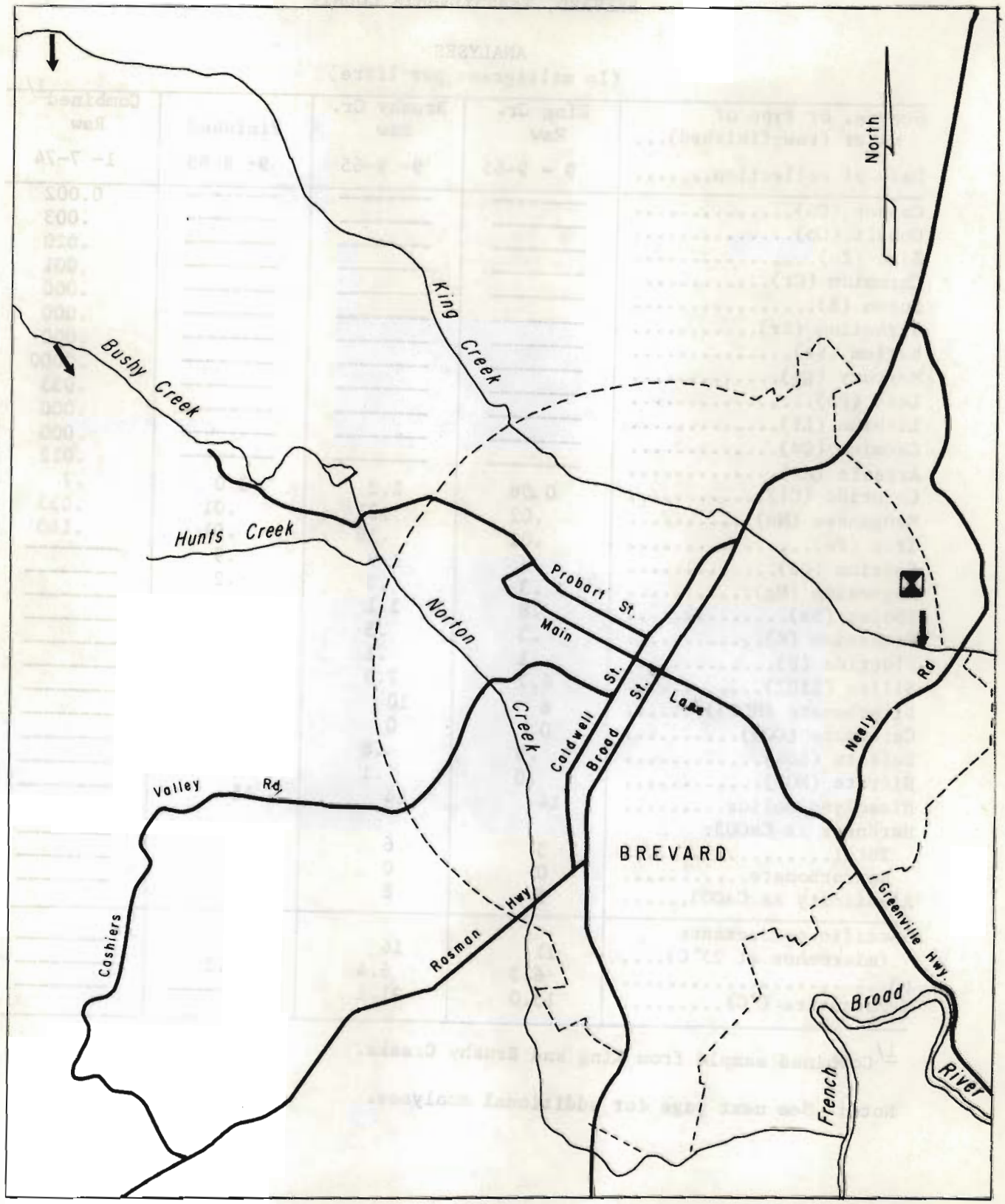
Surface water: Brevard is in the French Broad River valley in central Transylvania County. The topography is mildly rolling with mountains on the northwest side of town. The town is drained by many small

tributaries of the French Broad River which flows within 1,000 feet of the south boundary. The low-flow yield of streams is relatively high, generally exceeding 0.35 mgd per square mile. The average discharge of all streams is 2.0 mgd per square mile, and the 7-day, 2-year low flow averages 0.7 mgd per square mile. The present use exceeds the estimated allowable draft indicating that in dry years water shortages may occur. If additional water is needed in the future, Catheys Creek about 3 miles southwest or the French Broad River could be used.

Ground-water: Rocks grouped as Henderson Gneiss (granite, biotite gneiss, hornblende gneiss, and mica schist) underlie Brevard. No records of drilled wells in Brevard are available and only those used for domestic supplies are available in the surrounding area. Wells in the vicinity are normally less than 250 feet deep and the maximum reported yield is 25 gpm.

The scarcity of records of drilled wells of tested capacity prevents an accurate appraisal of ground water conditions. However, it is estimated that wells drilled in favorable sites would yield on the order of 0.06 to 0.07 mgd per well. The chemical quality of ground water is generally good. However, locally the water may be turbid and contain iron concentrations in excess of 0.3 mg/1.

CITY OF BREVARD



BREVARD, TRANSYLVANIA COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	King Cr. Raw	Brushy Cr. Raw	Finished	Combined[1/] Raw
Date of collection.....	9 - 9-65	9- 9-65	9- 9-65	1- 7-74
Copper (Cu).....	--------	--------	--------	0.002
Cobalt (Co).....	--------	--------	--------	.003
Zinc (Zn).....	--------	--------	--------	.020
Chromium (Cr).....	--------	--------	--------	.001
Boron (B).....	--------	--------	--------	.000
Strontium (Sr).....	--------	--------	--------	.000
Barium (Ba).....	--------	--------	--------	.000
Mercury (Hg).....	--------	--------	--------	.0000
Lead (Pb).....	--------	--------	--------	.033
Lithium (Li).....	--------	--------	--------	.000
Cadmium (Cd).....	--------	--------	--------	.000
Arsenic (As).....	--------	--------	--------	.012
Chloride (Cl).....	0.08	1.2	3.0	.7
Manganese (Mn).....	.02	.01	.01	.033
Iron (Fe).....	.01	.10	.01	.180
Calcium (Ca).....	.7	1.9	.9	--------
Magnesium (Mg).....	.3	.3	.2	--------
Sodium (Na).....	.8	1.1	.8	--------
Potassium (K).....	.3	.5	.2	--------
Fluoride (F).....	.1	.1	.1	--------
Silica (SiO_2).....	6.7	7.9	6.8	--------
Bicarbonate (HCO_3).....	6	10	4	--------
Carbonate (CO_3).....	0	0	0	--------
Sulfate (SO_4).....	.8	.8	.4	--------
Nitrate (NO_3).....	.0	.1	.0	--------
Dissolved Solids.....	14	24	15	--------
Hardness as $CaCO_3$:				
Total.....	3	6	4	--------
Noncarbonate.....	0	0	1	--------
Alkalinity as $CaCO_3$.....	5	8	3	--------
Specific conductance (micromhos at 25° C)....	11	16	13	--------
pH.....	6.3	6.4	6.2	--------
Temperature (°C).....	15.0	21.1	--------	--------

[1/] Combined sample from King and Brushy Creeks.

Note: See next page for additional analyses.

BREVARD, TRANSYLVANIA COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Finished			
Date of collection.....	1- 7-74			
Copper (Cu).....	0.006			
Cobalt (Co).....	.000			
Zinc (Zn).....	.370			
Chromium (Cr).....	.000			
Boron (B).....	.010			
Strontium (Sr).....	.000			
Barium (Ba).....	.000			
Mercury (Hg).....	.0000			
Lead (Pb).....	.023			
Lithium (Li).....	.000			
Cadmium (Cd).....	.000			
Arsenic (As).....	.008			
Chloride (Cl).....	3.0			
Manganese (Mn).....	.000			
Iron (Fe).....	.630			
Calcium (Ca).....	--------			
Magnesium (Mg).....	--------			
Sodium (Na).....	--------			
Potassium (K).....	--------			
Fluoride (F).....	--------			
Silica (SiO_2).....	--------			
Bicarbonate (HCO_3).....	--------			
Carbonate (CO_3).....	--------			
Sulfate (SO_4).....	--------			
Nitrate (NO_3).....	--------			
Dissolved Solids.....	--------			
Hardness as $CaCO_3$:				
Total.....	--------			
Noncarbonate.....	--------			
Alkalinity as $CaCO_3$.....	--------			
Specific conductance (micromhos at 25° C)....	--------			
pH.....	--------			
Temperature (°C).....	--------			

WATAUGA COUNTY

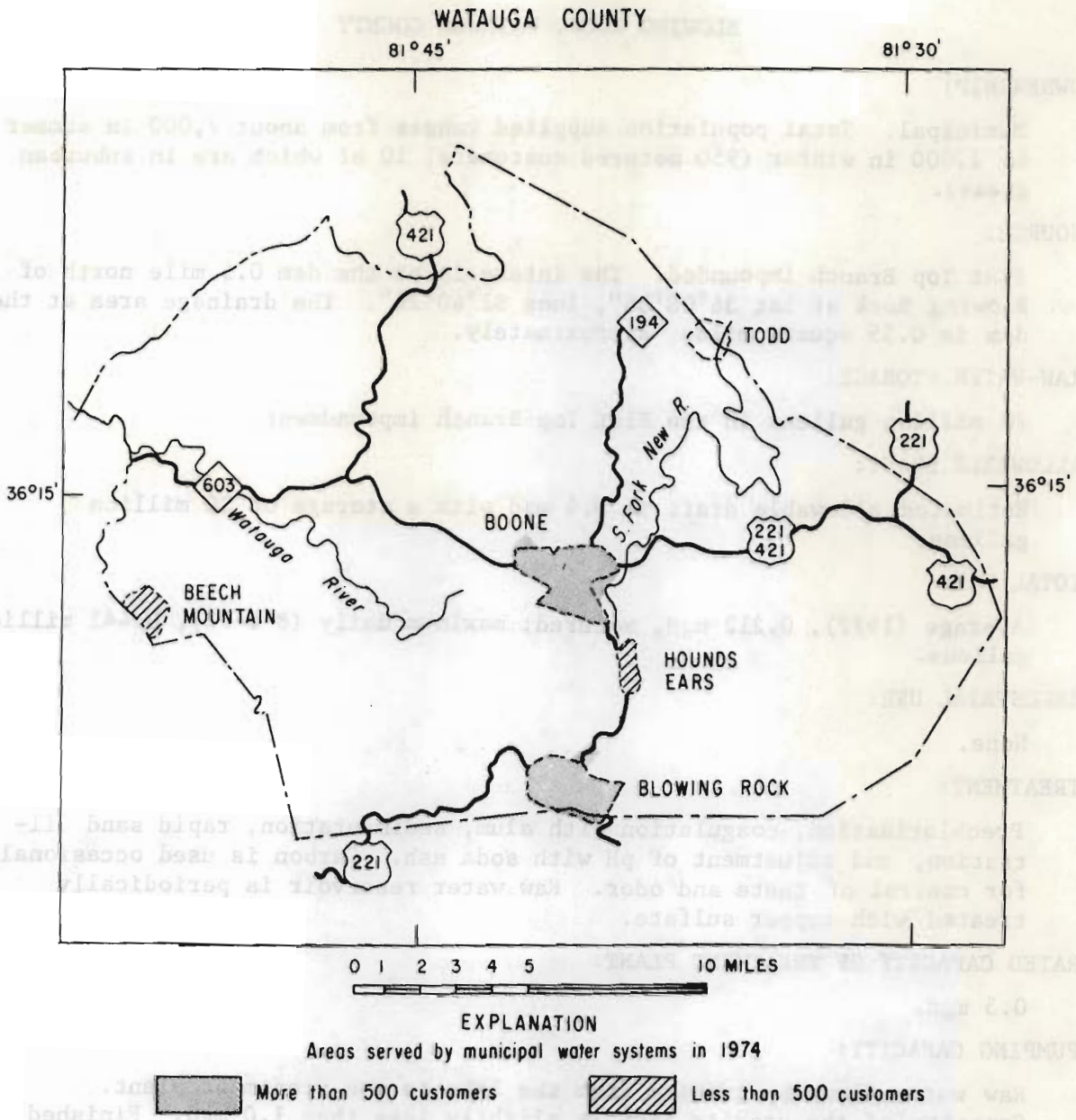
WATER-RESOURCES APPRAISAL

Watauga County is in the Blue Ridge physiographic province in northwestern North Carolina. The topography is varied, ranging from moderately broad valleys and subdued hills to highly dissected, rugged mountains. Stream slopes are steep and drainage is good. Tributaries of four major river basins drain the county. The western half is drained by the Watauga River of the Tennessee River basin, the central third by North and South Fork New River of the Kanawha River basin, the southeastern portion by tributaries of the Yadkin River basin and a small area along the south boundary by tributaries of the Catawba River basin. The average discharge of streams varies from 1.3 to 2.0 mgd per square mile and averages 1.6 mgd per square mile. Minimum flows generally exceed 0.15 mgd per square mile and the 7-day, 2-year low-flow averages 0.35 mgd per square mile. There is an abundance of relatively pure surface water available for development.

Boone uses a combination of surface water and ground water as a source of supply. Blowing Rock uses surface water and has two standby wells. Appalachian College and small communities use ground water. The county population in 1970 was 23,404.

A wide variety of metamorphic rocks, predominately layered gneiss and amphibolite gneiss, underlie Watauga County. The overlying weathered material ranges in thickness from a few inches to more than 100 feet in places. Most wells drilled in the county are less than 200 feet deep. From records of 94 drilled wells, the average depth is 146 feet, and the average reported yield is 19.6 gpm. The maximum reported well yield in available records is 140 gpm. Generally, the higher-yielding wells are those located in draws, sags, and low flat areas where the layer of weathered rock is thickest. On the average, wells drilled in these areas yield about three times as much water as those on hills and ridges.

The chemical quality of ground water is generally good and suitable for most uses with little or no treatment. However, in places, the water is slightly hard and may contain iron concentrations slightly in excess of 0.3 mg/l.


WATAUGA COUNTY
81°45'
81°30'
36°15'
36°15'
421
194
TODD
221
603
Watauga River
S. Fork New R.
BOONE
221
421
421
BEECH MOUNTAIN
HOUNDS EARS
BLOWING ROCK
221
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

BLOWING ROCK, WATAUGA COUNTY

OWNERSHIP:

Municipal. Total population supplied ranges from about 7,000 in summer to 1,000 in winter (950 metered customers, 10 of which are in suburban areas).

SOURCE:

Flat Top Branch impounded: The intake is at the dam 0.5 mile north of Blowing Rock at lat 36°08'36", long 81°40'20". The drainage area at the dam is 0.55 square miles, approximately.

RAW-WATER STORAGE:

20 million gallons in the Flat Top Branch impoundment.

ALLOWABLE DRAFT:

Estimated allowable draft is 0.4 mgd with a storage of 20 million gallons.

TOTAL USE:

Average (1972), 0.212 mgd, metered; maximum daily (8-6-72), 0.441 million gallons.

INDUSTRIAL USE:

None.

TREATMENT:

Prechlorination, coagulation with alum, sedimentation, rapid sand filtration, and adjustment of pH with soda ash. Carbon is used occasionally for control of taste and odor. Raw water reservoir is periodically treated with copper sulfate.

RATED CAPACITY OF TREATMENT PLANT:

0.5 mgd.

PUMPING CAPACITY:

Raw water flows by gravity from the lake to the treatment plant. Capacity of the gravity line is slightly less than 1.0 mgd. Finished water, 0.5 mgd.

FINISHED-WATER STORAGE:

One clear well, 50,000 gallons; two stand pipes, 200,000 and 175,000 gallons; one underground storage tank, 50,000 gallons.

FUTURE PLANS:

An engineering consultant is currently making an appraisal of the water system. Tentative proposals include enlarging the treatment plant capacity to 0.75 mgd and construction of a raw water impoundment on Middle Fork.

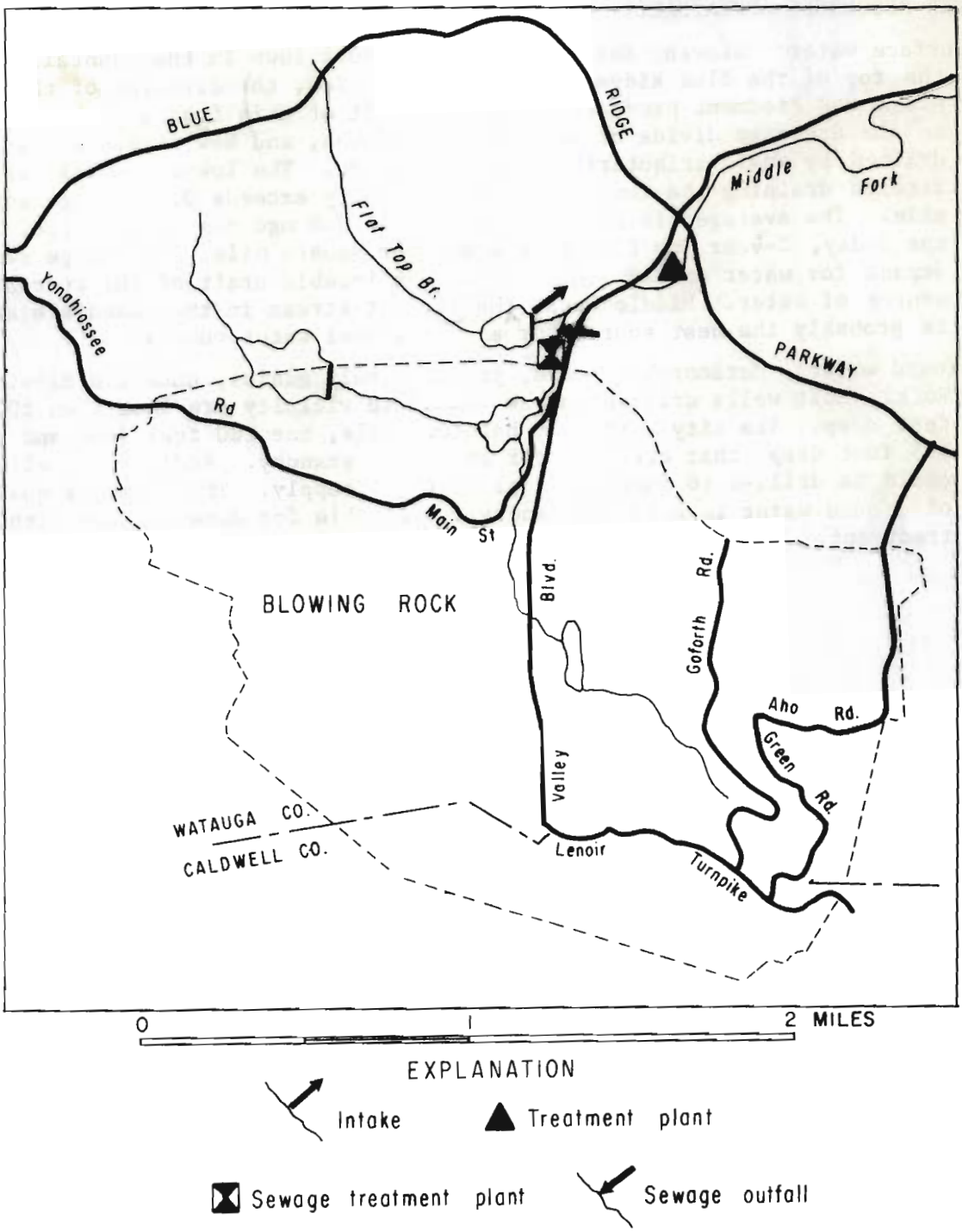
BLOWING ROCK, WATAUGA COUNTY

WATER-RESOURCES APPRAISAL:

Surface water: Blowing Rock is a summer resort town in the mountains at the top of the Blue Ridge front (by definition, the division of the Blue Ridge and Piedmont provinces is at the foot of this front). The city is on the drainage divide of the Yadkin, Catawba, and New Rivers and is drained by small tributaries of these rivers. The low-flow yield of streams draining the immediate area generally exceeds 0.2 mgd per square mile. The average discharge of streams is 2.0 mgd per square mile, and the 7-day, 2-year low flow is 0.4 mgd per square mile. The large summer demand for water exceeds the estimated allowable draft of the current source of water. Middle Fork, the largest stream in the immediate area, is probably the best source for an additional water supply.

Ground water: Metamorphic rocks, predominately gneiss, underlie Blowing Rock. Most wells drilled in the immediate vicinity are less than 200 feet deep. The city currently has two wells, one 200 feet deep and one 125 feet deep, that are used for emergency standby. Additional wells could be drilled to further supplement the supply. The chemical quality of ground water is good and generally suitable for domestic use without treatment.

CITY OF BLOWING ROCK



BLOWING ROCK, WATAUGA COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Flat Top Cr. Raw	Flat Top Cr. Finished	Flat Top Cr. Raw	Flat Top Cr. Finished
Date of collection.....	6- 4-64	6- 4-64	9-19-73	9-19-73
Copper (Cu).....	--------	--------	0.120	0.013
Cobalt (Co).....	--------	--------	.001	.001
Zinc (Zn).....	--------	--------	.030	.010
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.390	.220
Strontium (Sr).....	--------	--------	.040	.050
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	----------	--------
Lead (Pb).....	--------	--------	.003	.002
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.008	.000
Chloride (Cl).....	1.3	3.6	--------	--------
Manganese (Mn).....	.01	.03	.020	.000
Iron (Fe).....	.06	.01	.150	.010
Calcium (Ca).....	1.1	5.5	--------	--------
Magnesium (Mg).....	.2	1.7	--------	--------
Sodium (Na).....	1.0	1.0	--------	--------
Potassium (K).....	.6	.6	--------	--------
Fluoride (F).....	.0	.1	--------	--------
Silica (SiO_2).....	5.7	5.1	--------	--------
Bicarbonate (HCO_3).....	7	9	--------	--------
Carbonate (CO_3).....	0	0	--------	--------
Sulfate (SO_4).....	1.2	13	--------	--------
Nitrate (NO_3).....	.2	.0	--------	--------
Dissolved Solids.....	18	38	--------	--------
Hardness as $CaCO_3$:				
Total.....	4	21	--------	--------
Noncarbonate.....	0	14	--------	--------
Alkalinity as $CaCO_3$.....	6	7	--------	--------
Specific conductance (micromhos at 25° C)....	15	55	--------	--------
pH.....	6.4	7.2	--------	--------
Temperature (°C).....	--------	--------	--------	--------

BOONE, WATAUGA COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 8,700 in 1973 (1,640 metered customers, 50 of which are located in suburban areas).

SOURCES:

5 wells (Nos. 1-5) and Winkler Creek impounded. The Winkler Creek intakes are at the dam about 3 miles south of Boone at lat 36°10'28", long 81°39'06". The drainage area at the dam is 0.8 square miles, approximately.

Well No. 1 (Warehouse well), Wt-102, located at lat 36°12'58", long 81°41'07". Driller: Wayne Gragg. Date drilled: _____. Total depth: 300 feet. Diam: 8 in. Cased to: _____. Type of finish: open hole. Topography: valley. Aquifer: _____. Static water level: _____. Yield: 65 gpm. Pump setting: 280 ft. Type pump: submersible.

Well No. 2 (IRC well), Wt-103, located at lat 36°11'53", long 81°40'07". Driller: Wayne Gragg. Date drilled: _____. Total depth: 300 ft. Diam: 8 in. Cased to: _____. Type of finish: open hole. Topography: valley. Aquifer: _____. Static water level: _____. Yield: 60 gpm. Pump setting: 280 ft. Type pump: submersible.

Well No. 3 (Popular Hill), Wt-104, located at lat 36°12'12", long 81°40'36". Driller: Wayne Gragg. Date drilled: _____. Total depth: 300 ft. Diam: 8 in. Cased to: _____. Type of finish: open hole. Topography: draw. Aquifer: _____. Static water level: _____. Yield: 22 gpm. Pump setting: _____. Type of pump: submersible.

Well No. 4 (Trivette well), Wt-105, located at lat 36°12'09", long 81°39'11". Driller: Wright Well and Pump Co. Date drilled: 10-9-72. Total depth: 400 ft. Diam: 6-1/4 in. Cased to: 28 ft. Type of finish: open hole. Topography: valley. Aquifer: granite and quartz. Static water level: 10 ft. Yield: 60 gpm. Pump setting: 385 ft. Type of pump: submersible.

Well No. 5 (Trivette well), Wt-106, located at lat 36°12'14", long 81°39'04". Driller: Wright Well and Pump Co. Date drilled: 10-10-72. Total depth: 400 ft. Diam: 6-1/4 in. Cased to: 20 ft. Type of finish: open hole. Topography: valley. Aquifer: granite and shale. Static water level: 10 ft. Yield: 80 gpm. Pump setting: 385 ft. Type of pump: submersible.

RAW-WATER STORAGE:

Winkler Creek impoundment, 39 million gallons.

ALLOWABLE DRAFT:

Estimated allowable draft of Winkler Creek is 0.5 mgd with an adjusted storage of 37 million gallons.

TOTAL USE:

Average (1973) 1.3 mgd, estimated; maximum daily, not available.

BOONE, WATAUGA COUNTY

INDUSTRIAL USE:

0.1 mgd, estimated. Principal users include Vermont American Corporation, IRC, Boone Division of TWR, Inc., Shadow Line, Inc., and Blue Ridge Shoe Co.

TREATMENT:

Well water, none. Winkler Creek reservoir is treated with copper sulfate monthly and the water is chlorinated.

RATED CAPACITY OF TREATMENT PLANT:

None.

PUMPING CAPACITY:

Water from Winkler Creek flows by gravity. Pumping capacity of the wells is estimated at 0.9 mgd.

FUTURE PLANS:

None.

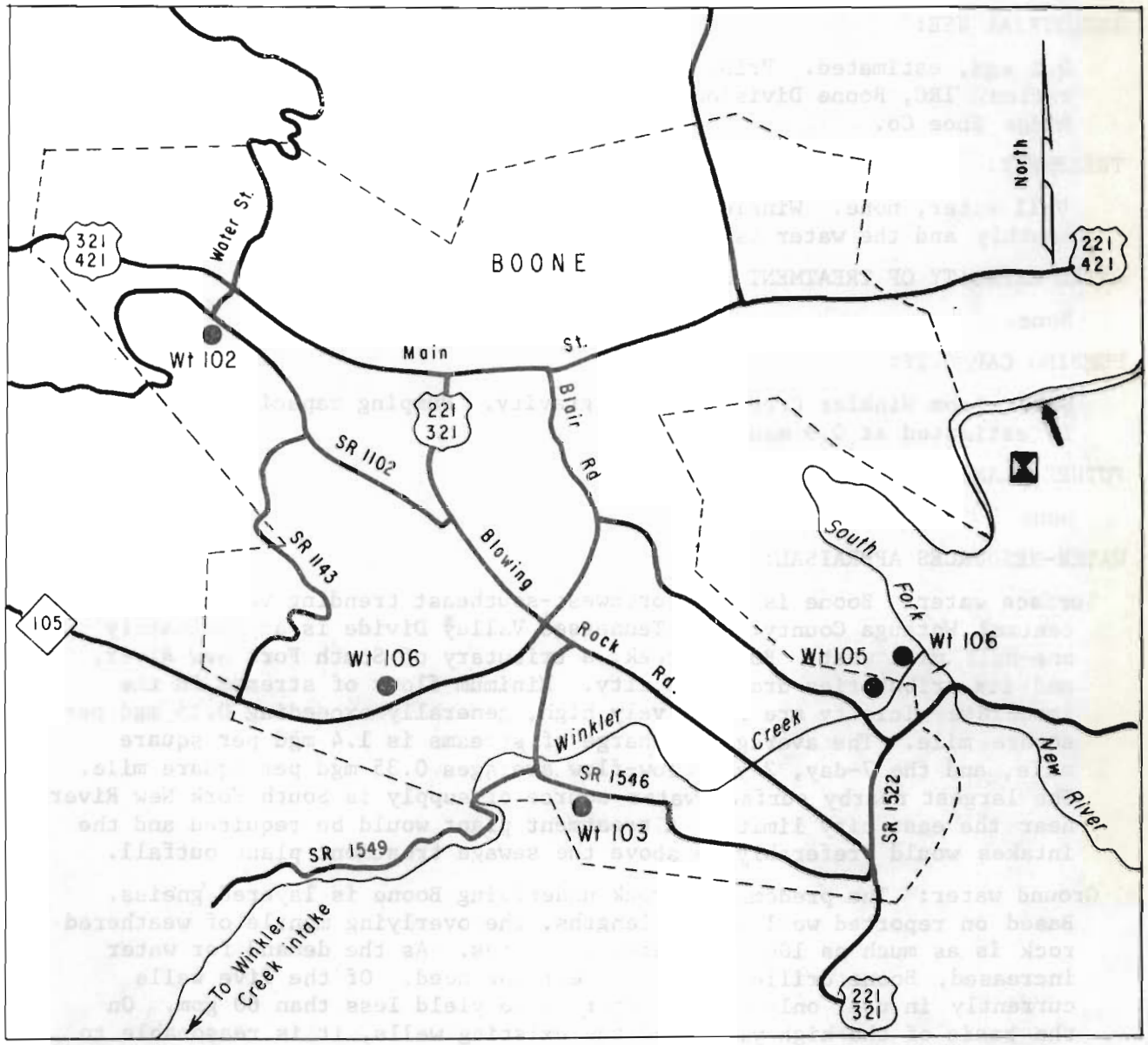
WATER-RESOURCES APPRAISAL:

Surface water: Boone is in a northwest-southeast trending valley in central Watauga County. The Tennessee Valley Divide is approximately one-half mile west. Boone Creek, a tributary of South Fork New River, and its tributaries drain the city. Minimum flows of streams in the immediate vicinity are relatively high, generally exceeding 0.15 mgd per square mile. The average discharge of streams is 1.4 mgd per square mile, and the 7-day, 2-year low-flow averages 0.35 mgd per square mile. The largest nearby surface-water source of supply is South Fork New River near the east city limits. A treatment plant would be required and the intakes would preferably be above the sewage treatment plant outfall.

Ground water: The predominant rock underlying Boone is layered gneiss. Based on reported well casing lengths, the overlying mantle of weathered rock is as much as 100 feet thick in places. As the demand for water increased, Boone drilled wells to meet the need. Of the five wells currently in use, only one is reported to yield less than 60 gpm. On the basis of the high yields of the existing wells, it is reasonable to assume that, with careful site selection, and spacing to prevent pumping interference, new wells may each yield 0.07 to 0.08 mgd on a sustained basis.

The chemical quality of ground water is good, and is acceptable for most uses without treatment.

CITY OF BOONE



BOONE, WATAUGA COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Well No. 1	Well No. 2	Well No. 3	
Date of collection.....	9- 6-66	9- 5-66	9- 6-66	
Copper (Cu).....	--------	--------	--------	
Cobalt (Co).....	--------	--------	--------	
Zinc (Zn).....	--------	--------	--------	
Chromium (Cr).....	--------	--------	--------	
Boron (B).....	--------	--------	--------	
Strontium (Sr).....	--------	--------	--------	
Barium (Ba).....	--------	--------	--------	
Mercury (Hg).....	--------	--------	--------	
Lead (Pb).....	--------	--------	--------	
Lithium (Li).....	--------	--------	--------	
Cadmium (Cd).....	--------	--------	--------	
Cyanide (CN).....	--------	--------	--------	
Chloride (Cl).....	5.9	0.2	5.4	
Manganese (Mn).....	.00	.03	.02	
Iron (Fe).....	.09	.37	.01	
Calcium (Ca).....	20	7.5	19	
Magnesium (Mg).....	1.8	1.5	2.2	
Sodium (Na).....	5.3	4.2	7.7	
Potassium (K).....	1.6	.5	6.2	
Fluoride (F).....	.1	.1	.4	
Silica (SiO2).....	17	15	19	
Bicarbonate (HCO3).....	72	39	68	
Carbonate (CO3).....	0	0	0	
Sulfate (SO4).....	5.4	2.8	14	
Nitrate (NO3).....	.9	.1	2.1	
Dissolved Solids.....	96	54	113	
Hardness as CaCO3:				
Total.....	58	26	58	
Noncarbonate.....	0	0	2	
Alkalinity as CaCO3.....	59	32	56	
Specific conductance (micromhos at 25° C)....	143	69	166	
pH.....	6.6	7.5	7.9	
Temperature (°C).....	12	12	12	

Note: See next page for additional analyses.

BOONE, WATAUGA COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Winkler Cr. Raw	Winkler Cr. Finished	Well No. 4	
Date of collection.....	9- 5-66	9- 6-66	9-19-73	
Copper (Cu).....	--------	--------	0.008	
Cobalt (Co).....	--------	--------	.002	
Zinc (Zn).....	--------	--------	.360	
Chromium (Cr).....	--------	--------	.000	
Boron (B).....	--------	--------	.240	
Strontium (Sr).....	--------	--------	.110	
Barium (Ba).....	--------	--------	.000	
Mercury (Hg).....	--------	--------	--------	
Lead (Pb).....	--------	--------	.003	
Lithium (Li).....	--------	--------	.000	
Cadmium (Cd).....	--------	--------	.001	
Arsenic (As).....	--------	--------	.000	
Chloride (Cl).....	1.6	3.4	4.0	
Manganese (Mn).....	.01	.02	.000	
Iron (Fe).....	.02	.10	.020	
Calcium (Ca).....	1.7	7.5	11	
Magnesium (Mg).....	.2	1.0	1.9	
Sodium (Na).....	1.5	2.8	7.0	
Potassium (K).....	.4	.8	1.6	
Fluoride (F).....	.2	.1	.1	
Silica (SiO_2).....	5.3	7.1	21	
Bicarbonate (HCO_3).....	8	38	48	
Carbonate (CO_3).....	0	0	0	
Sulfate (SO_4).....	.8	1.8	2.5	
Nitrate (NO_3).....	.3	.2	2.2/	
Dissolved Solids.....	20	51	86	
Hardness as $CaCO_3$:				
Total.....	6	24	35	
Noncarbonate.....	0	0	0	
Alkalinity as $CaCO_3$.....	7	31	.039	
Specific conductance (micromhos at 25° C)....	19	77	110	
pH.....	6.3	7.3	7.0	
Temperature (°C).....	18	--------	--------	

/Nitrate (NO_2 + NO_3 as N).

WILKES COUNTY

WATER-RESOURCES APPRAISAL

Wilkes County is in the mountain and Piedmont Provinces in northwestern North Carolina. The northwest county boundary closely follows the top of the Blue Ridge front (by definition, the foot of this front is the dividing line between the mountains and Piedmont physiographic provinces). The topography is mountainous to semi-mountainous, stream slopes are relatively steep, and streams are free flowing. The Yadkin River and its tributaries drain the county. W. Kerr Scott Dam and Reservoir, a multipurpose Corps of Engineers project on the Yadkin River, is in the county. The average discharge of unregulated streams ranges from 0.9 mgd per square mile for streams along the southern boundary to 1.4 mgd per square mile for streams draining the Blue Ridge front. The 7-day, 2-year low flow of unregulated streams averages 0.4 mgd per square mile, and minimum flows generally exceed 0.2 mgd per square mile.

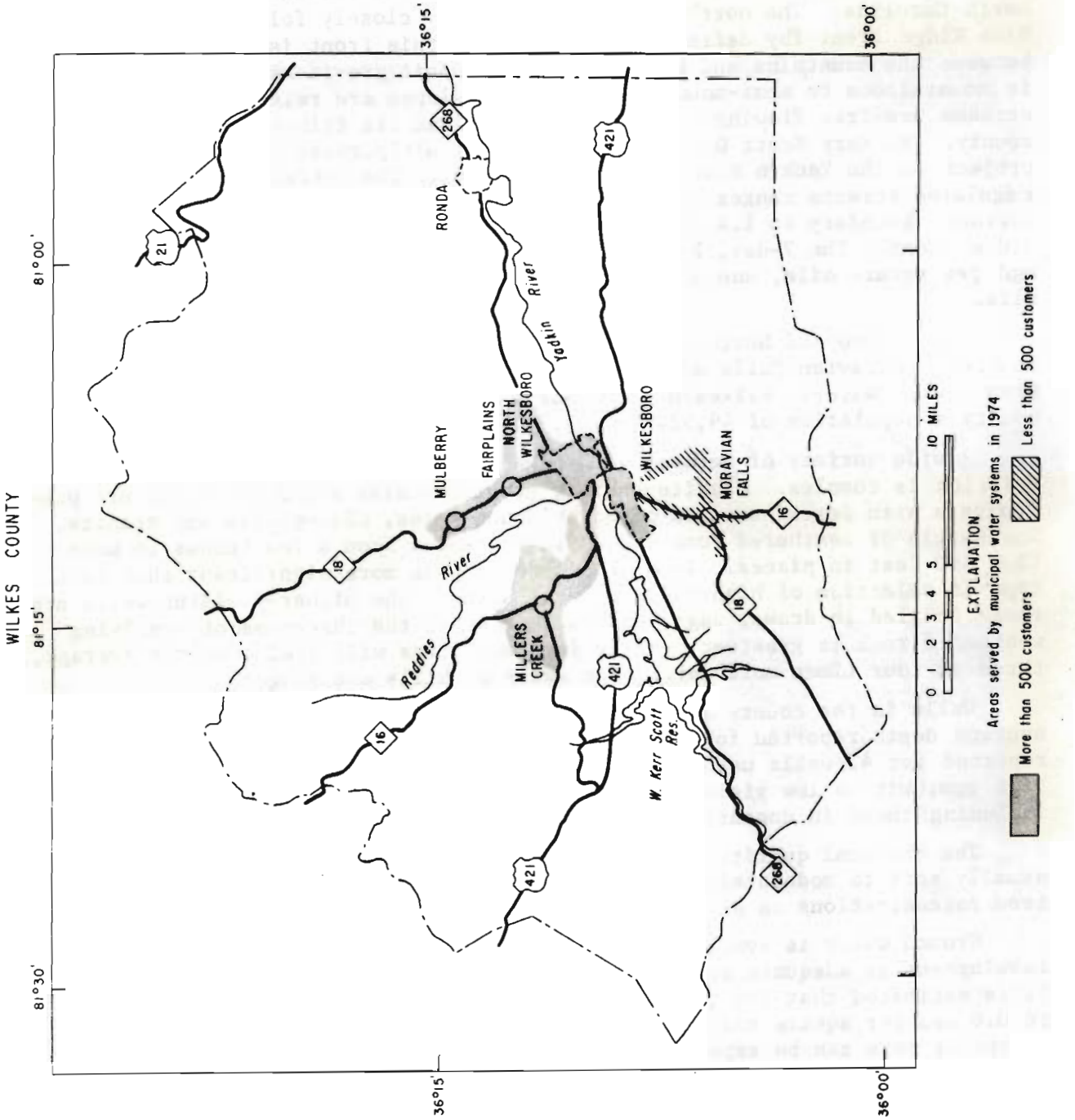
Wilkesboro and North Wilkesboro obtain their water supplies from surface sources. Moravian Falls and other small communities obtain their supplies from ground water. Wilkesboro and North Wilkesboro serve about 13,000 of the county's population of 49,524 (1970).

A wide variety of metamorphic rocks underlie the county and their relation is complex. Granite-schist, granite gneiss and mica-schist are predominate with lesser amounts of hornblende gneiss, mica-gneiss and granite. The mantle of weathered rock ranges in thickness from a few inches to more than 100 feet in places. Topographic setting is more significant than rock type in selection of high-yielding well sites. The higher-yielding wells are those drilled in draws, sags, and valleys where the thickness of overlying weathered rock is greatest. Wells in these areas will yield, on the average, three to four times more water than wells on hills and ridges.

Wells in the county are normally less than 300 feet deep, with the average depth reported for 242 wells being 215 feet. The average yield reported for 42 wells used for industrial, public and commercial supplies is 54.6 gpm, with a low yield of 5 gpm and a high of 336 gpm. For 228 wells, including those in domestic use, the average yield is 27.2 gpm.

The chemical quality of ground water is generally good. The water is usually soft to moderately hard and slightly acidic, but locally may contain iron concentrations in excess of 0.3 mg/l.

Ground water is available, with proper planning and management, for the development of adequate supplies for small industrial and municipal needs. It is estimated that the quantity of ground water available ranges from 0.4 to 0.6 mgd per square mile. In wells drilled in favorable sites, yields of 40 gpm or more can be expected from about 50 percent of those drilled.


WILKES COUNTY
81°00'
81°15'
81°30'
36°15'
36°00'
RONDA
MULBERRY
FAIRPLAINS
NORTH WILKESBORO
WILKESBORO
MORAVIAN FALLS
MILLERS CREEK
Yadkin River
River
Reddies
W. Kerr Scott Res.
268
421
21
18
16
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers
Less than 500 customers

NORTH WILKESBORO, WILKES COUNTY

OWNERSHIP:

Municipal. The City has 1,346 metered customers, 25 of which are in suburban areas. Also supplies Crickett-Millers Creek Water Association, Inc. (1,228 metered customers), Mulberry-Fairplains Water Association, Inc. (1,258 metered customers), and Blue Ridge Water Association (739 metered customers). Total population supplied, about 17,800 in 1973.

SOURCE:

Reddies River impounded by a low dam. The intakes are on the north bank at the dam, 0.9 mile upstream from the mouth, at lat 36°09'44", long 81°09'14". The drainage area at the intakes is 95 square miles, approximately.

RAW-WATER STORAGE:

Reddies River impoundment, 50 million gallons, estimated.

ALLOWABLE DRAFT:

Estimated allowable draft is 21 mgd with a storage of 50 million gallons.

TOTAL USE:

Average (1972), 1.25 mgd, metered; maximum daily (4-11-73), 2.43 million gallons.

INDUSTRIAL USE:

0.15 mgd, estimated. Principal users include Gardner Mirror, Inc., and Carolina Mirror.

TREATMENT:

Prechlorination, coagulation with alum and lime, sedimentation, rapid-sand filtration, addition of phosphate compounds for corrosion control, adjustment of pH with lime, postchlorination, and fluoridation.

RATED CAPACITY OF TREATMENT PLANT:

3.0 mgd.

PUMPING CAPACITY:

Raw water, 6.0 mgd; finished water 5.7 mgd.

FINISHED-WATER STORAGE:

One clear well, 1,000,000 gallons; two elevated tanks, 200,000 and 100,000 gallons; two stand pipes, 300,000 and 170,000 gallons.

FUTURE PLANS:

None at present.

WATER-RESOURCES APPRAISAL:

Surface water: North Wilkesboro is on the north bank of the Yadkin River in Central Wilkes County . The topography is characterized as hilly to semi-mountainous. The Reddies River is the western city limit. There is

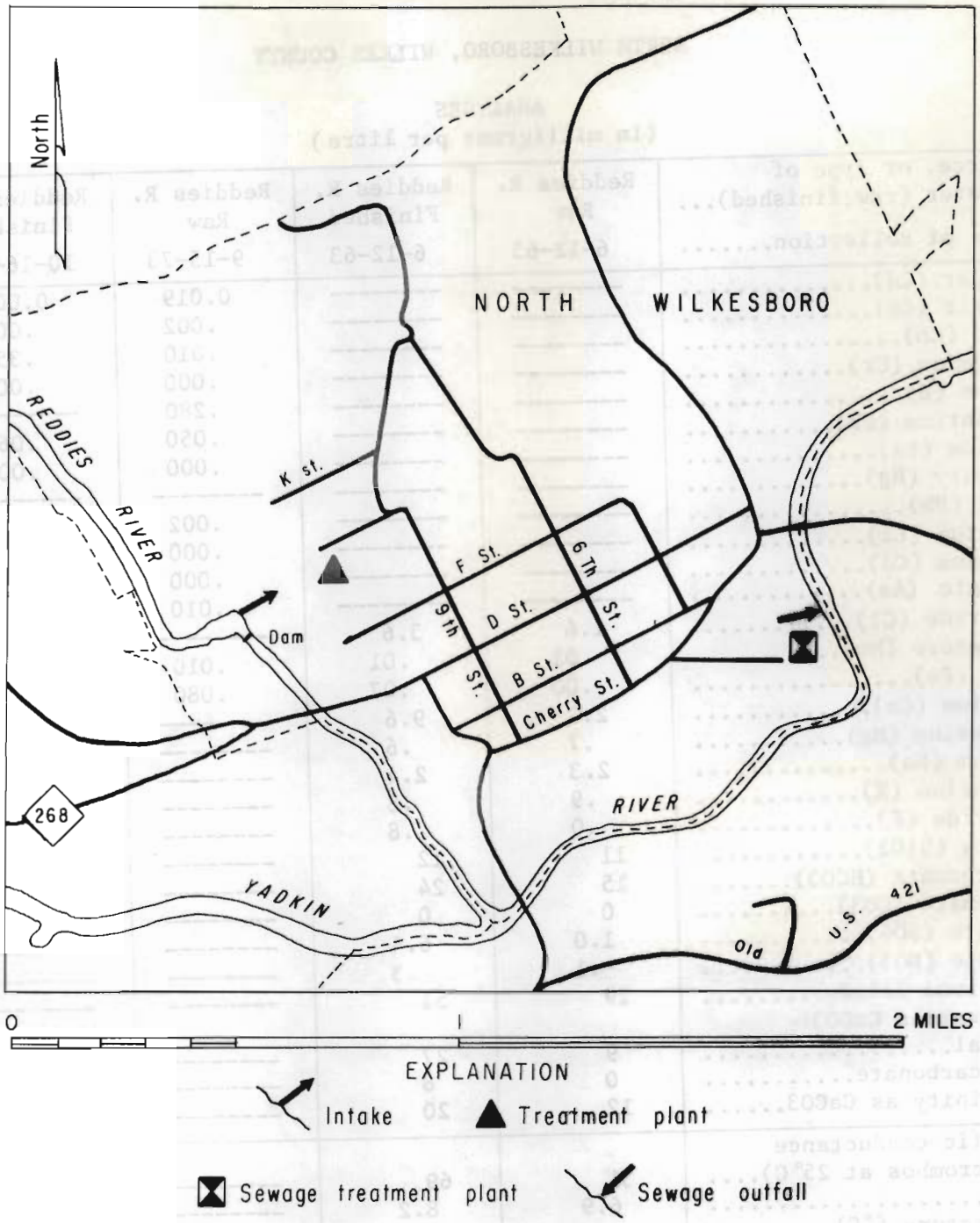
NORTH WILKESBORO, WILKES COUNTY

an abundance of surface water available for water supply. Records of streamflow of the Reddies river have been collected near the intake since 1939. The minimum flow recorded was 14.2 mgd in 1954, and this is more than 10 times current use. The proposed Corps of Engineers Reddies River project would contain storage for water supply.

Ground water: Granite-schist is the predominant rock underlying North Wilkesboro. There are several wells in the immediate vicinity used for industrial and commercial purposes that reportedly yield over 100 gpm. The average yield of wells drilled in the granite-schist rocks in the area is 34 gpm. With the abundance of surface water available it is not likely that ground water will be used for public water supply. However, there is sufficient ground water available for small industrial supplies.

The chemical quality of ground water is good. The water is soft to moderately hard, slightly acidic, and generally contains less than 0.3 mg/l of iron.

CITY OF NORTH WILKESBORO



NORTH WILKESBORO, WILKES COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Reddies R. Raw	Reddies R. Finished	Reddies R. Raw	Reddies R. Finished
Date of collection.....	6-12-63	6-12-63	9-15-73	10-16-73
Copper (Cu).....	--------	--------	0.019	0.008
Cobalt (Co).....	--------	--------	.002	.002
Zinc (Zn).....	--------	--------	.010	.350
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.280	--------
Strontium (Sr).....	--------	--------	.050	.060
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	.002	.001
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.001
Arsenic (As).....	--------	--------	.010	.007
Chloride (Cl).....	1.6	3.6	--------	--------
Manganese (Mn).....	.01	.01	.010	.000
Iron (Fe).....	.00	.07	.080	.020
Calcium (Ca).....	2.2	9.6	--------	--------
Magnesium (Mg).....	.7	.6	--------	--------
Sodium (Na).....	2.3	2.4	--------	--------
Potassium (K).....	.9	.8	--------	--------
Fluoride (F).....	.0	.8	--------	--------
Silica (SiO2).....	11	12	--------	--------
Bicarbonate (HCO3).....	15	24	--------	--------
Carbonate (CO3).....	0	0	--------	--------
Sulfate (SO4).....	1.0	6.4	--------	--------
Nitrate (NO3).....	.1	.3	--------	--------
Dissolved Solids.....	29	51	--------	--------
Hardness as CaCO3:				
Total.....	9	27	--------	--------
Noncarbonate.....	0	8	--------	--------
Alkalinity as CaCO3.....	12	20	--------	--------
Specific conductance (micromhos at 25° C)....	31	69	--------	--------
pH.....	6.9	8.2	--------	--------
Temperature (°C).....	--------	--------	--------	--------

WILKESBORO, WILKES COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 2,000 in 1973 (1,281 metered customers). Occasionally supplements the Moravian Falls Water Association, Inc.

SOURCE:

Yadkin River: The intakes are at the western city limits, 3-1/4 miles downstream from W. Kerr Scott Dam, 2-1/2 miles upstream from Reddies River, at lat 36°08'40", long 81°10'48". The drainage area at the intakes is 370 square miles, approximately.

RAW-WATER STORAGE:

None.

ALLOWABLE DRAFT:

Not determined. Natural low flow of Yadkin River is augmented by releases from W. Kerr Scott Reservoir. There is ample water for water supply.

TOTAL USE:

Average (1972) 2.74 mgd, metered; maximum daily (8-30-72) 4.24 million gallons.

INDUSTRIAL USE:

2.3 mgd, estimated. Principal users include Holly Farms Poultry Industries, Inc., Dairymen, Inc., and Ithaca Textiles, Inc.

TREATMENT:

Prechlorination, coagulation with alum and caustic soda, sedimentation, Micro-floc filtration, and adjustment of pH with caustic soda. Normally do not postchlorinate but equipment is available if necessary.

RATED CAPACITY OF TREATMENT PLANT:

5.0 mgd.

PUMPING CAPACITY:

Raw water, 5.0 mgd; finished water, 7.5 mgd.

FINISHED-WATER STORAGE:

One clear well, 1,000,000 gallons; one elevated tank, 250,000 gallons; two stand pipes, 200,000 and 500,000 gallons.

FUTURE PLANS:

None.

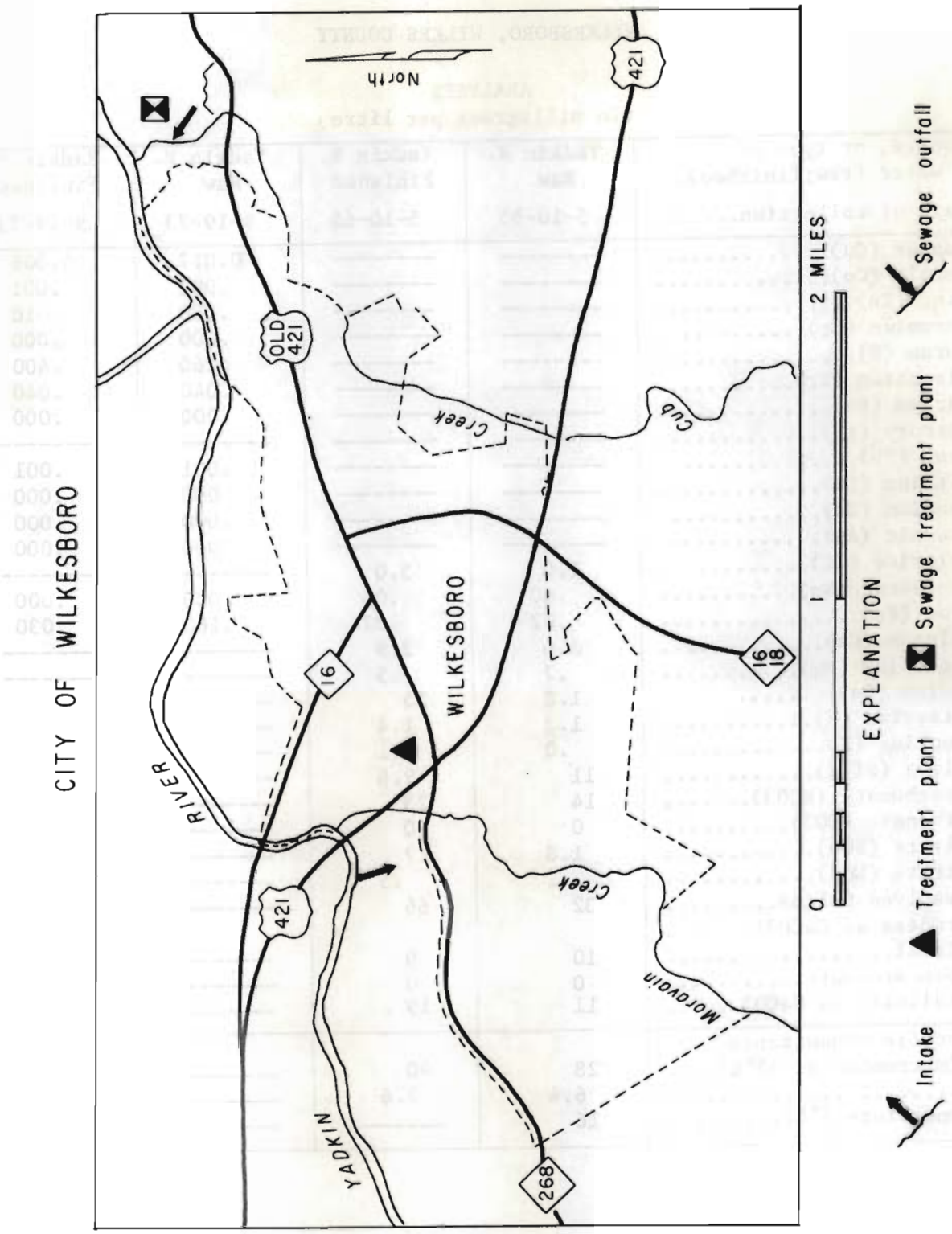
WATER-RESOURCES APPRAISAL:

Surface water: Wilkesboro is located on the south bank of the Yadkin River in central Wilkes County. Flow of the Yadkin River is regulated by W. Kerr Scott Dam, located about 5 miles upstream. Minimum natural

streamflow is augmented by releases from the reservoir. Minimum flows are many times present use and are adequate to meet the water-supply needs of Wilkesboro for the foreseeable future.

Ground water: Granite-schist and granite are the predominant rocks underlying Wilkesboro. Based on records of well casing lengths, the overlying thickness of weathered rock and alluvium is as much as 125 feet thick in places. Most wells in the area are drilled 150 to 400 feet deep. Several wells in the immediate vicinity used for industrial and commercial purposes are reported to yield more than 100 gpm. With the abundance of surface water available, it is unlikely that ground water will be used by the city. However, the amount of ground water available is adequate for small industrial needs.

The chemical quality of ground water is good, and suitable for most uses without treatment. Generally, the water is soft to moderately hard, slightly acidic, and iron concentrations are less than 0.3 mg/l.


CITY OF WILKESBORO
North
421
OLD 421
Creek
Cub
WILKESBORO
16
16 18
RIVER
421
Creek
Morgovin
YADKIN
268
0
1
2 MILES
EXPLANATION
Sewage outfall
Sewage treatment plant
Treatment plant
Intake

WILKESBORO, WILKES COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Yadkin R. Raw	Yadkin R. Finished	Yadkin R. Raw	Yadkin R. Finished
Date of collection.....	5-10-65	5-10-65	9-19-73	9-19-73
Copper (Cu).....	--------	--------	0.017	0.006
Cobalt (Co).....	--------	--------	.002	.001
Zinc (Zn).....	--------	--------	.080	.010
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.260	.400
Strontium (Sr).....	--------	--------	.040	.040
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	--------	--------
Lead (Pb).....	--------	--------	.001	.001
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.000
Arsenic (As).....	--------	--------	.000	.000
Chloride (Cl).....	1.0	5.0	--------	--------
Manganese (Mn).....	.00	.00	.030	.000
Iron (Fe).....	.02	.02	.160	.030
Calcium (Ca).....	2.6	2.9	--------	--------
Magnesium (Mg).....	.7	.5	--------	--------
Sodium (Na).....	1.8	15	--------	--------
Potassium (K).....	1.3	1.4	--------	--------
Fluoride (F).....	.0	.1	--------	--------
Silica (SiO_2).....	11	9.6	--------	--------
Bicarbonate (HCO_3).....	14	23	--------	--------
Carbonate (CO_3).....	0	0	--------	--------
Sulfate (SO_4).....	1.8	17	--------	--------
Nitrate (NO_3).....	.1	.5	--------	--------
Dissolved Solids.....	32	66	--------	--------
Hardness as $CaCO_3$:				
Total.....	10	9	--------	--------
Noncarbonate.....	0	0	--------	--------
Alkalinity as $CaCO_3$.....	11	19	--------	--------
Specific conductance (micromhos at 25° C)....	28	90	--------	--------
pH.....	6.4	7.6	--------	--------
Temperature (°C).....	16	--------	--------	--------

YANCEY COUNTY

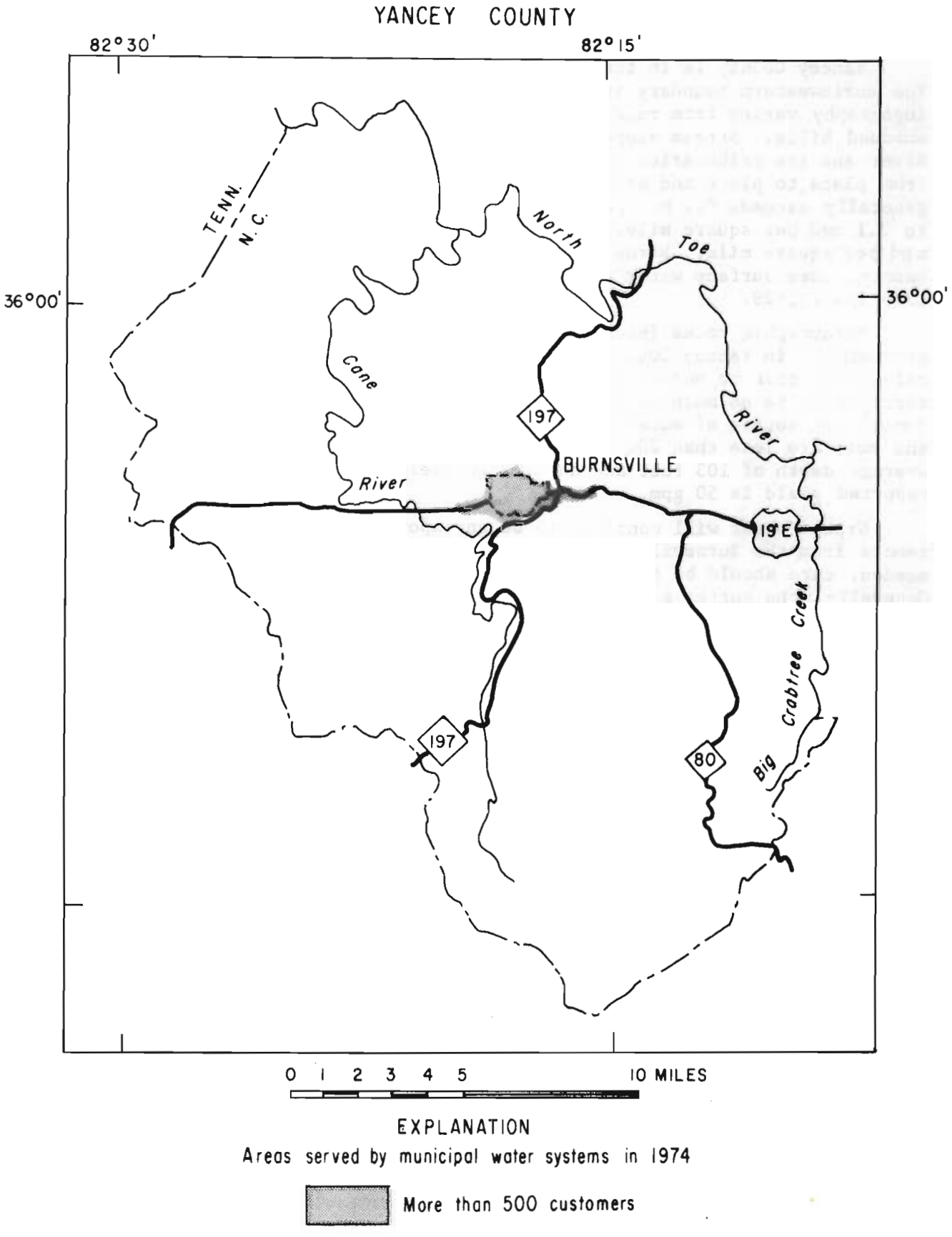
WATER-RESOURCES APPRAISAL

Yancey County is in the Blue Ridge Province in western North Carolina. The northwestern boundary is the Tennessee-North Carolina State line. The topography varies from rugged mountains to moderately wide valleys and subdued hills. Stream slopes are steep and drainage is good. The Nolichucky River and its tributaries drain the county. Streamflows are quite variable from place to place and are relatively high. The low-flow yield of streams generally exceeds 0.1 mgd per square mile. Average discharge ranges from 1.1 to 2.1 mgd per square mile, and the 7-day, 2-year low flow averages about 0.3 mgd per square mile. Burnsville, with the only public water supply in the county, uses surface water as its source of supply. The county population in 1970 was 12,629.

Metamorphic rocks (mica-gneiss, layered gneiss and amphibolite gneiss) predominate in Yancey County. The overlying mantle of weathered rock is relatively thin to non-existent. However, in some of the valleys it is reported to be as much as 40 feet thick. Springs are common and furnish a convenient source of water in rural areas. Drilled wells are not numerous and most are less than 200 feet deep. Reports for 18 drilled wells show an average depth of 103 feet and an average yield of 25 gpm. The maximum reported yield is 50 gpm.

Ground water will continue to be an important source of water in areas remote from the Burnsville water supply. Where higher-yielding wells are needed, care should be taken in the location and management of well fields. Generally, the better supplies are obtained from wells drilled in draws and small valleys where thick soil cover is present. Wells drilled in such sites would probably yield on the order of 0.04 to 0.05 mgd per well.

The chemical quality of ground water is excellent and suitable for most uses with little or no treatment. The water is usually soft and slightly acidic.


YANCEY COUNTY
82°30'
82°15'
36°00'
36°00'
TENN.
N.C.
North Toe River
Cane River
197
BURNSVILLE
19E
197
80
Big Crabtree Creek
0 1 2 3 4 5 10 MILES
EXPLANATION
Areas served by municipal water systems in 1974
More than 500 customers

BURNSVILLE, YANCEY COUNTY

OWNERSHIP:

Municipal. Total population supplied, about 2,100 in 1973 (810 metered customers, 229 of which are in suburban areas).

SOURCES:

Bowlens Creek: The intakes are approximately 3.5 miles south of Burnsville at lat 35°52'12", long 82°16'38". The drainage area at the intakes is 1.9 square miles, approximately.

Bowlens Creek tributary: The intakes are approximately 3.1 miles south of Burnsville at lat 35°52'32", long 82°16'43". The drainage area at the intake is 1.2 square miles approximately.

RAW-WATER STORAGE:

None.

ALLOWABLE DRAFT:

Combined estimated allowable draft is 0.6 mgd with no storage.

TOTAL USE:

Average (1973) 0.50 mgd, estimated; maximum daily not available.

INDUSTRIAL USE:

0.15 mgd, estimated. Principal users include Mohasco Industries Corporation and Glen Raven Mills.

TREATMENT:

Prechlorination, coagulation with alum and soda ash when needed, sedimentation, rapid anthracite filtration, adjustment of pH with lime and soda ash, and post chlorination.

RATED CAPACITY OF TREATMENT PLANT:

0.5 mgd.

PUMPING CAPACITY:

Raw water, gravity; finished water, 1.1 mgd.

FINISHED-WATER STORAGE:

One clear well, 275,000 gallons; one reservoir, 2,000,000 gallons.

FUTURE PLANS:

None. Treatment plant was renovated and expanded recently.

WATER-RESOURCES APPRAISAL:

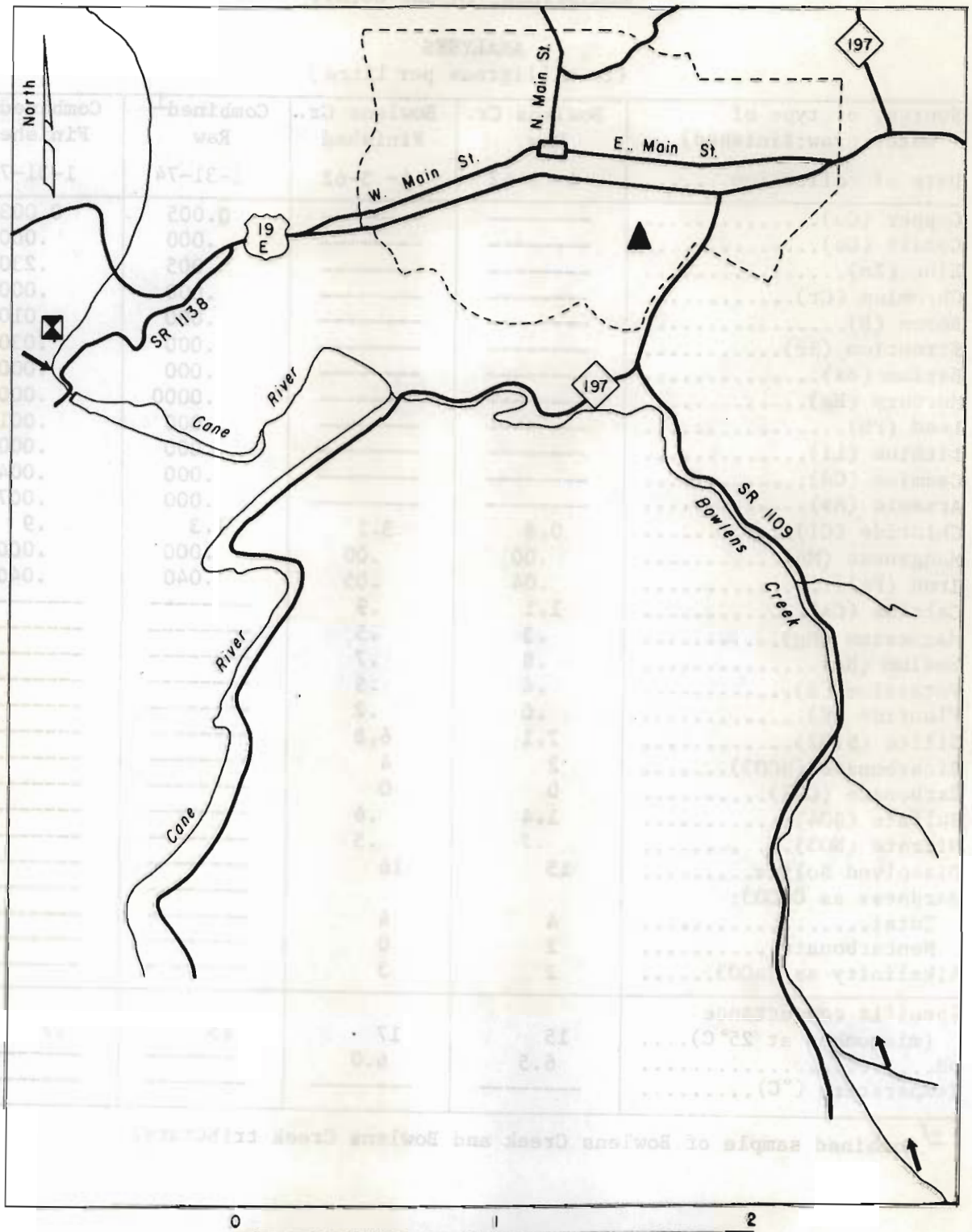
Surface water: Burnsville is in central Yancey County. The topography is characterized as a saddle between mountains on the north and south. The eastern half of town is drained by tributaries of the eastward flowing Little Crabtree Creek and the western half is drained by tributaries of the westward flowing Pine Swamp Branch. The low-flow yield of streams draining the immediate area generally exceeds 0.15 mgd per square mile.

BURNSVILLE, YANCEY COUNTY

The average discharge of streams is 1.4 mgd per square mile, and the 7-day, 2-year low-flow averages 0.3 mgd per square mile. If water usage increases significantly, the present source of water may not supply the demand in dry years; however, there is an abundance of surface water available, although pumping of raw water may be required.

Ground water: Mica gneiss and amphibolite gneiss are the predominate rocks underlying Burnsville. No records of wells in town are available. However, based on records of wells in the surrounding area, it is estimated that wells drilled in carefully selected sites could reasonably be expected to yield 25 gpm or more. Supplies of this magnitude are adequate for many purposes.

CITY OF BURNSVILLE



BURNSVILLE, YANCEY COUNTY

ANALYSES
(In milligrams per litre)

Source, or type of water (raw;finished)...	Bowlens Cr. Raw	Bowlens Cr. Finished	Combined[1] Raw	Combined[1] Finished
Date of collection.....	4- 5-62	4- 5-62	1-31-74	1-31-74
Copper (Cu).....	--------	--------	0.005	0.003
Cobalt (Co).....	--------	--------	.000	.000
Zinc (Zn).....	--------	--------	.005	.230
Chromium (Cr).....	--------	--------	.000	.000
Boron (B).....	--------	--------	.000	.010
Strontium (Sr).....	--------	--------	.000	.030
Barium (Ba).....	--------	--------	.000	.000
Mercury (Hg).....	--------	--------	.0000	.0001
Lead (Pb).....	--------	--------	.000	.001
Lithium (Li).....	--------	--------	.000	.000
Cadmium (Cd).....	--------	--------	.000	.004
Arsenic (As).....	--------	--------	.000	.007
Chloride (Cl).....	0.8	3.1	1.3	.9
Manganese (Mn).....	.00	.00	.000	.000
Iron (Fe).....	.04	.05	.040	.040
Calcium (Ca).....	1.1	.9	--------	--------
Magnesium (Mg).....	.3	.5	--------	--------
Sodium (Na).....	.8	.7	--------	--------
Potassium (K).....	.4	.5	--------	--------
Fluoride (F).....	.0	.2	--------	--------
Silica (SiO_2).....	7.1	6.8	--------	--------
Bicarbonate (HCO_3).....	2	4	--------	--------
Carbonate (CO_3).....	0	0	--------	--------
Sulfate (SO_4).....	1.4	.6	--------	--------
Nitrate (NO_3).....	.7	.5	--------	--------
Dissolved Solids.....	15	16	--------	--------
Hardness as $CaCO_3$:			--------	--------
Total.....	4	4	--------	--------
Noncarbonate.....	2	0	--------	--------
Alkalinity as $CaCO_3$.....	2	3	--------	--------
Specific conductance (micromhos at 25° C)....	15	17	15	17
pH.....	6.5	6.0	--------	--------
Temperature (°C).....	--------	--------	--------	--------

[1] Combined sample of Bowlens Creek and Bowlens Creek tributary.

INITIAL DISTRIBUTION LIST

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Raleigh, North Carolina 27611 (4)

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1119 North Main Street
Mooresville, North Carolina 28115

Field Office Manager
Dept. of Natural & Ec. Res.
3528 Vest Mill Road
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Raleigh, North Carolina 27602 (10)

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Ned J. Tucker, Director
102 Scotts Creek Road
Sylva,
North Carolina 28779

Region B Planning Commission
Robert E. Shepherd
Executive Director
Mountain Street
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Asheville, N. C. 28802

Region C-Isothermal Planning & Economic Development Comm.
Paul D. Hughes
Executive Director
306 Ridgecrest Avenue
Rutherfordton, N. C. 28139

Region D Council of Governments
Carl Tuttle
Executive Director
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Furman Road
Boone, North Carolina 28607

Region E-Western Piedmont Council of Governments
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Triple Communities Water
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Texas
76110

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Education, & Welfare, PHC.
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Cincinnati, Ohio 45202

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U. S. Army Engineer District
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South Carolina 29402

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