Information Circular No. 8
Georgia Department of Forestry and Geological Development
DIVISION OF GEOLOGY
Atlanta, Georgia

WATER, GEORGIA'S UNKNOWN NATURAL RESOURCE

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Reprinted from Forestry-Geological Review, Vol. 6, No.7
July, 1936

Do you know that Georgia's largest natural resource and the one about which she knows the least is the water supply in her streams and under the ground? We know the location of our streams but we have practically no measurements of the quantity of water that they carry in flood time or in dry time or of the chemical purity of that water. Are these measurements important? They decidedly are if Georgia is to make the industrial progress to which she is entitled. Every state in the Southeast except Georgia has recognized the need for these FACTS on stream flow and is collecting them year in and year out.

A recent cartoon in Collier's Magazine showed engineers busily constructing a large dam in a dry valley in the West. In the foreground two natives are saying: "Maybe we ought to tell them that's just a mirage they saw." Georgia has for years been trying to get industries into the State with promises of "plenty of water" that in some cases were but little better than a mirage in the desert. Any industry or municipality intending to use a stream as a water supply must have FACTS as to the average, minimum, and maximum volume of water they can depend on. A classic example of the value of the stream flow records to a state is the experience of the Aluminum Company of America in locating its large plants in the Southeast. Some thirty or more years ago when the Aluminum Company first came into this section, they examined several possible plant sites in the mountains of North Carolina and Georgia. When they inquired for the stream flow redords that were necessary to plan their large hydro-electric p ower plants they found that no records had been collected in these states, but that Tennessee had been collecting such records for a number of years. Their main plant was therefore built near Maryville, Tennessee. The state of North Carolina immediately saw its mistake and began an extensive stream gaging campaign that is still going on today, and some of the more recent power plants of the Aluminum Company have been located in North Carolina on the basis of these records.

How Records of Stream Flow are Obtained

The measurement of the flow of streams is a function of the Water Resources Branch of the United States Geological Survey. Except for a few gaging stations maintained on the larger navigable streams for the purpose of predicting floods or for the regulation of inter-state hydro-electric power, this work is done only in states that cooperate by paying at least half of the expense.

The engineers of the U.S. Geological Survey obtain redords of stream flow by maintaining gaging stations at certain places on the rivers, where records of stage, or height of water, and discharge, or quantity and rate of movement, are obtained by the use of various types of measuring equipment.

Records of stage on rivers that rise and fall slowly are usually read by a local observer from a staff gage. The simplest form of staff gage consists of a scale graduated to feet and hundredths set vertically where it will be in the water at all stages. The observer reads the height of the surface of the water on this gage once, twice, or oftener each day. Where there is no local observer or where the river is "flashy", rising and falling quickly after showers, it is necessary to install an automatic water-stage recorder that continually records on paper the height of the water.

To determine the discharge of the stream an engineer must visit the gaging station and measure the area of the cross section of the flowing water and the velocity of the water at different stages from the lowest to the highest. Where there is a bridge at the site of the gaging station the observer works from the bridge. Where there is no bridge a cableway is erected to span the river at a height above its maximum stage. Soundings are made at short intervals across the river by means of a heavy torpedo-shaped lead weight suspended by a small wire cable., From these the cross section is calculated. Velocity readings are made at each sounding station by means of an electric current meter. Having measured the area of the dross section of the flowing water and the velocity, he can easily compute the rate of flow in cubic feet per second. Each record of discharge is accompanied by a record of the stage at that time, and the complete record shows the discharge for all stages. From this record a rating table is prepared, showing the discharge corresponding to any particular height of the stream.

To rate a station for all stages may take years. Floods may come at night or at times when the engineer is not at the station. It is sometimes necessary to wait a long time for a certain critical stage to be repeated, but by a system of telegraph and telephone reports from its observers the Survey endeavors to keep posted on the

river's behavior, so that an engineer can be sent to the station in time to get the information. A single measurement of discharge may take from half and hour to a day or more, depending upon the size of the stream and the working conditions.

The chemical quality of the water is determined by taking samples at the gaging stations during various stages of the water throughout the year and analyzing them for turbidity or suspended matter and for the dissolved mineral matter. This sampling does not need to be continued over a long period of years as is the case with stream flow measurements.

Use of Stream-Flow Records

Industrial Water Supplies: Water for industrial processes is needed in large quantities, and for some uses it must meet specific requirements of composition. The chemical character varies with the origin of the water and the volume of the stream. Analyses may show that a sample of water taken from a stream at one stage may be widely different from a sample taken at another stage. Stream discharge varies all the time, and a continuous record of flow is necessary in order that the analyses may not be misleading.

We now know, thanks to Dr. Herty's experiments, that excellent white newsprint and book paper and rayon can be manufactured from cheap southern pine and gum of only a few years growth. The next ten of fifteen years willsee the establishment of a number of large paper mills , first on the coast, then inland, Dr. Herty states: "The paper mills will come to areas where there is pulpwood and the right kind of water in sufficient quatities, and the supply of water is just as important as the supply of pulp wood. The timber cruises made by the U.S. Forest Service under Captain Eldridge will give us definite figures of our supply of pulp wood in the various sections of the State. But if Georgia does not wish to lose these mills to her sister states she must start at once the all-important work of gaging the flow of her streams and analyzing the water."

Water for use in boilers of industrial plants should have certain qualities to prevent scale or erosion. Condenser water for steam plants is needed in large quantities, and its temperature and quality must be known. Temperature, chemical quality, and turbidity are all influenced by changes in the volume of water flowing.

Municipal Water Supplies: The water supplies of most of the larger cities and towns in Georgia come from surface streams. Well water, except in parts of the Coastal Plain, is limited in quantity, and heavy draft may deplete the underground supply, preventing further extension of its use. Griffin a few years ago abandoned its wells and went to the Flint River for its water supply. Several other Georgia cities will in the next few years have to change from deep wells to surface streams, and unless they have stream flow records over a number of years they may make the same mistake made a few years ago by the city of Durham, North Carolina. Durham considered two possible streams, Flat River and Eno River, on neither of which had stream flow measurements been made. On the basis of local testimony they chose Flat River and built an impounding reservoir on it. Subsequent stream-flow records showed that the original estimates of the flow of the river were entirely too large, but that the low-water flow of the Eno River was five times that of the Flat River.

Even certain cities in the Coastal Plain that now apparently have an adequate supply of water from artesian wells will in future years find that although their demand for water is increasing, the yeild from their artesian wells is decreasing, or that the wells are being ruined by encroaching salt water. They will then suddenly want years of records of the flow of their nearest surface stream.

Bridges and highways: Bridges and highway approaches to them are constructed with the expectation that storm waters will pass without interrupting traffid or backing up so as to cause injury to property. If a bridge opening is too small it will not pass the required amount of water, and as a result the bridge and approach fills may wash out or property upstream may be damaged by backwater. If the bridge opening is unnecessarily large, money has been wasted in its construction. The Georgia Highway Department, lacking stream-flow records, has been forced to guess the volume of flood water that must be allowed for in building its bridges. They have usually played safe by building the openings larger than was necessary, but in bad floods of a few years ago several expensive bridges and fills washed out because the openings were too small. The loss of money in replacing these bridges was much larger than would have been the cost of maintianing gaging stations on these streams for several years.

Other Uses: Stream flow records over many years are equally necessary to intelligently plan flood control projects, for building hydro-electric power plants, for controlling soil erosion, for planning drainage canals, for maintianing uninterrupted navigation on our larger streams, and for the adjudication of inter-state water rights.

The Plan in Georgia

The United States Geological Survey is prepared to cooperate with the State in obtaining and publishing the records of stream flow so vital to growth and progress. The Survey has a trained personnel and has the most modern instruments and equipment for the purpose. Every dollar that Georgia appropriates for this purpose will be matched by an equal dollar of Federal money.

At present the United States Geological Survey is operating for Federal purposes 16 gaging stations in Georgia or on its border streams and these will be maintained without State co-operation. Stations have maintained in the past at 23 other places in the State where it is highly desirable that these stations should be re-established. For a general survey of the streams at least 19 more stations are needed in addition to those stations now in operation and to those that should be re-established. This will require an appropriation by the State of at least $10,000 per year over a period of several years. Another $5,000 per year State appropriation will be necessary to collect and analyze samples of water at regular intervals for a year or two at each station in order to find out the chemical quality of the Water of our streams.

Under existing law cooperation may be arranged by agreement between the Diredtor of the Geological Survey and the cooperation State organization. The scope of investigation and the areas to be studied are determined by mutual agreement between the representatives of the Survey and the cooperating State officials. The Survey retains direct supervision of the investigation and of the preparation of the data for publication. It publishes the stream-flow records in its annual water supply papers. If Georgia appropriates at least $10,000 for stream gaging work the Survey will locate a District Office in Atlanta to handle the work in Georgia.

Teh Georgia Forestry Association and the Georgia Chamber of Commerce secretaries have realized the great nees for this water survey in Georgia and are sorking for an adequate appropriation from the State Legislature. Every Georgian should inform his local State Representative and Senator of the vital need for this appropriation.

REPRINTED SEPTEMBER, 1963

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