

**WATER RESOURCES INVESTIGATIONS
IN TENNESSEE :**

**PROGRAMS AND ACTIVITIES OF THE
U.S. GEOLOGICAL SURVEY, 1986–1987**

by Ferdinand Quinones, Barbara H. Balthrop, and E.G. Baker

U.S. GEOLOGICAL SURVEY

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A MESSAGE FROM THE TENNESSEE DISTRICT CHIEF:

Excellence in scientific investigations, staff, and resources are the trademarks of the Tennessee District of the U.S. Geological Survey, Water Resources Division. Recently appointed to direct the operations of the District, I feel fortunate to work with the dedicated scientists, technicians, and support staff that collaborate in our mission.

The scope of the mission of the U.S. Geological Survey in Tennessee is to provide support to local and federal agencies in assessing the water resources of the State. This support is accomplished through water-resources investigations conducted in cooperation with State and other Federal agencies, or through direct federal programs.

During 1986-87 the District was involved in a variety of projects related to the quantity, quality, use, and movement of the surface and ground water in Tennessee. The backbone of the District's work is the operation of streamflow, ground- and quality-of-water long-term networks as part of the Hydrologic Data Section. Our field offices in Nashville, Knoxville, and Memphis maintain extensive networks equipped with state-of-the-art equipment such as real-time satellite telemetry instrumentation. The basic data collected from these networks is essential for the management of Tennessee's water resources by State agencies. Equally important are the intensive areal studies conducted by the engineers, geologists, geomorphologists, and other scientists in the Hydrologic Investigations Section. These investigations address critical problems such as potential contamination of the Memphis Sand aquifer, radioactive materials in burial grounds in Oak Ridge, and environmental conditions at Reelfoot Lake, among others.

This report summarizes the projects and activities in which the Tennessee District was involved during 1986-87. The variety of activities reflects the complex nature of water-resources issues in Tennessee. The success of the program is also a reflection of the State and Federal agencies participating in the cooperative program that make possible these projects. These investigations are crucial for the proper definition of Tennessee's most important resource. As partners in these investigations, we all can be proud of the achievements of the program.

Ferdinand Quinones
District chief, WRD
Tennessee District

WATER RESOURCES INVESTIGATIONS IN TENNESSEE: PROGRAMS AND ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY, 1986-1987

Ferdinand Quinones, Barbara H. Balthrop, and E.G. Baker

HYDROLOGIC DATA SECTION

Hydrologic data, or basic data as it is commonly named, is the backbone of the investigations conducted by the U.S. Geological Survey (USGS). The basic data programs conducted by the Tennessee District provide streamflow, quality of water, and ground-water levels information essential to the assessment and management of the State's water resources. Long-term streamflow, quality of water, and ground-water levels networks are operated as part of the Hydrologic Data Section. Field operations are about equally divided among field offices in Memphis, Nashville, and Knoxville. A staff of about 40 engineers, hydrologists, and hydrologic technicians labor in the operation of the long-term network as well as short-term efforts in support of areal investigations. The data collected as part of the networks are published in the series of annual data reports entitled "Water Resources Data for Tennessee." Engineer Jeff May is the chief of the Hydrologic Data Section, assisted by engineers W. Harry Doyle in Memphis, Delmer O'Connell in Nashville, and Bob Livesay in Knoxville.



SURFACE-WATER MONITORING NETWORK

The Tennessee District operates a network of continuous streamflow gaging stations throughout Tennessee. In 1986, the network included 99 continuous streamflow gages and 12 continuous stream or lake water-level only gages. Additionally, 22 continuous rainfall stations were operated in conjunction with other research or lake-level gages. Continuous streamflow data are recorded and disseminated for many purposes, including:

- assessment of water available for many and variable uses,
- operation of impoundment and pumping structures,
- flood or drought monitoring and forecasting,
- waste disposal and control,
- legal requirements and enforcement, and
- research and hydrologic trends or other special studies.

Changes to this network in 1986 included adding 11 stations and discontinuing 2 stations.

Program cooperators that supported this network in 1986 were:

Tennessee Department of Health and Environment (TDHE)

Tennessee Valley Authority (TVA)

U.S. Army Corps of Engineers, Nashville District (COE)

Tennessee Wildlife Resources Agency (TWRA)

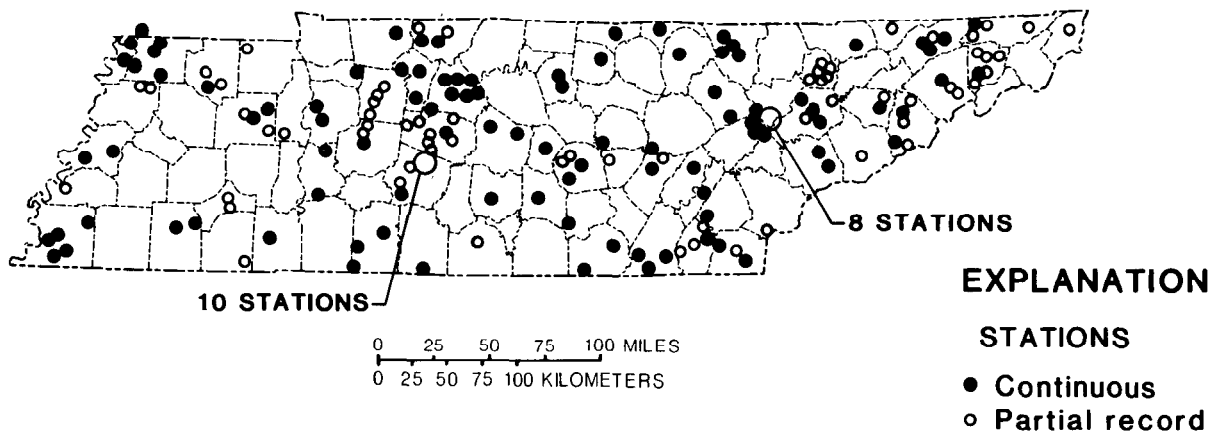
Cities of: Alcoa, Bartlett, Lawrenceburg, Memphis,
Metropolitan Government of Nashville and
Davidson County, and Murfreesboro.

U.S. Department of Energy (DOE)

National Park Service (NPS)

Shelby County

Memphis Light, Gas and Water (MLGW)



Location of streamflow stations in Tennessee.

LOW-FLOW INVESTIGATIONS

Another important surface-water network includes the partial-record stations where field measurements of streamflow are made periodically during low-flow conditions. These measurements are correlated with continuous streamflow records to compute potential streamflow during drought conditions--for

example, the average 3-day flow with a statistical probability of recurrence once in 20-years, based on an average over a long period of time. Low-flow data are used for many of the same purposes as the continuous streamflow records.

The Tennessee Department of Health and Environment is the program cooperator for this network. In 1986, 80 stations across the State comprised this network, which is maintained as an ongoing program at about the same level from year-to-year. Hydrologist Jerry Lowery is the project chief for the low-flow program.

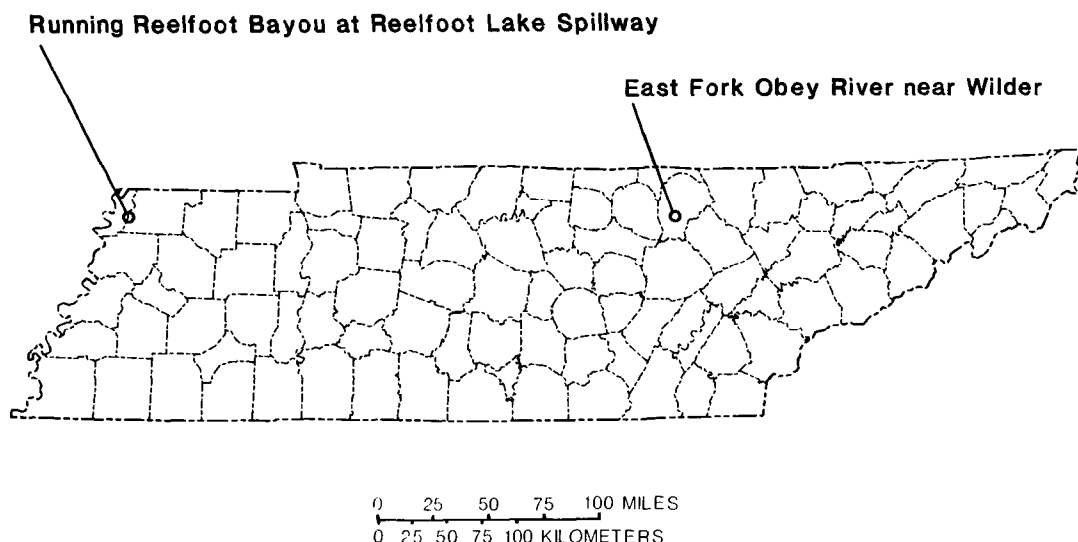
FLOODS

CREST-STAGE NETWORK

In cooperation with the Tennessee Department of Transportation and the Metropolitan Government of Nashville and Davidson County, the USGS is conducting flood investigations in Tennessee. The objective of this program is to appraise and define the flood characteristics of Tennessee streams and to delineate flood profiles along specific reaches for design and flood plain management purposes.

A network of about 90 crest-stage partial-record stations is operated on small streams and in parts of the State where additional flood data are desirable. Statewide flood-frequency relations will be developed by multiple-regression techniques using flood-peak data from both crest-stage and continuous gaging stations and numerous basin characteristics. The program will allow the investigation of outstanding floods at ungaged streams, preparation of site reports, and verification of hydraulic-techniques at sites where bridge studies have been made previously.

During FY 1986, two hydraulic site analyses were completed, and 10 new crest-stage gages were installed. Many requests were answered from the TDOT for miscellaneous hydrologic information. Hydrologist Charles Gamble is the project chief of the crest-stage program.



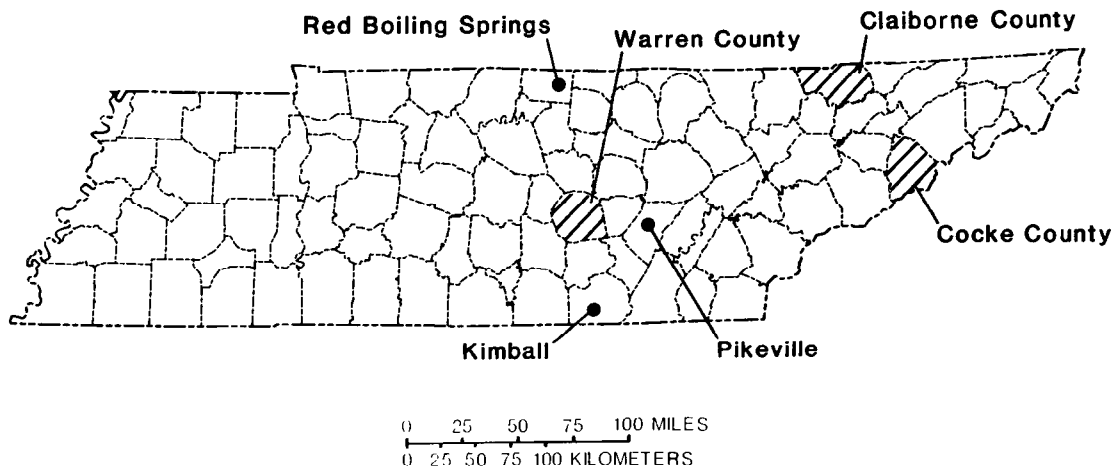
Location of hydraulic site analyses.

FLOOD MAPPING

The objective of this project is to conduct the necessary hydrologic and hydraulic evaluations and studies of areas of interest to the Federal Emergency Management Agency (FEMA). These investigations are required by the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973, which provide for the operation of a national flood insurance program.

Evaluations of hydraulic conditions are made using ground surveys or photogrammetric methods. Flood-discharge frequency relations are determined using local historical information, gaging station records, or other applicable information. Water-surface profiles are determined using step-backwater models or by other acceptable methods and reports are prepared to FEMA specifications.

During FY 1986, six flood insurance studies were completed by less-detailed methods within the communities of Kimball, Pikeville, Red Boiling Springs, Claiborne County, Cocke County, and Warren County. Meetings at Kimball and in Cocke County were attended to present the final results of flood insurance studies conducted for the two areas. Charles Gamble, hydrologist, was in charge of the FEMA programs.



Location of flood insurance studies.

FLOOD-FREQUENCY AND BRIDGE-SITE STUDIES

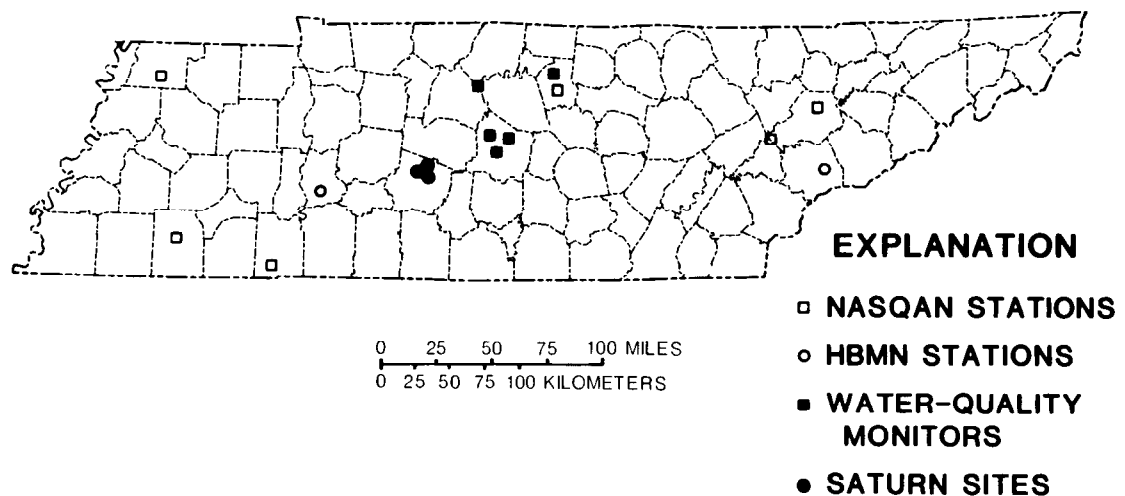
The USGS maintains an active flood-frequency and bridge-site cooperative program with the Tennessee Department of Transportation (TDOT) including:

- Operation of a network of crest-stage partial-record gages
- Development of statewide flood-frequency relations
- Investigation and documentation of outstanding floods
- Preparation of site analyses
- Verification of hydraulic techniques

The site analyses can be simple or complex, depending on the site and type of data needed by TDOT. At almost all sites, data on historical floods is required. Additional data requirements may be as simple as a stage-discharge relation at the site for the unconstricted valley. Complex sites where the roadway may parallel a stream may require flood-profile computations for a long reach of stream, and could include computation of flow through several bridges or culverts. Complex analyses at the Tennessee River at Savannah, where TDOT proposed to shorten all relief bridges across the valley by about 50 percent, involved demonstrating to TVA's satisfaction that velocities in the main channel would not be significantly increased to affect barge traffic through the reach. Charles Gamble, hydrologist, is the project chief for these activities.

WATER-QUALITY NETWORK

The USGS monitors water quality at 16 surface-water stations in Tennessee. Six stations compose part of the federally funded National Stream Quality Accounting Network (NASQAN). NASQAN data-collection sites are located at or near the downstream end of hydrologic accounting units. A comprehensive list of physical and chemical characteristics are measured quarterly or bimonthly to fulfill information needs of water-resources planners and managers. Two sites within the State are part of the National Hydrologic Bench-Mark Network (HBMN). At HBMN sites, the USGS assesses the natural streamflow and water quality of small river basins that are known to be relatively little affected by man's activities. In cooperation with the U.S. Army Corps of Engineers, water-quality monitors are operated at four sites along the Cumberland River and its tributaries in Middle Tennessee. A fifth monitor is located at the wastewater treatment plant for the City of Murfreesboro. These instruments record hourly values for water temperature and specific conductance, and in some cases, pH and dissolved-oxygen concentrations. Water quality also is assessed quarterly at three sites in Maury County near the new Saturn industrial facility. Hydrologist Robert Broshears, Ph.D., is the coordinator of the water-quality programs in the District.



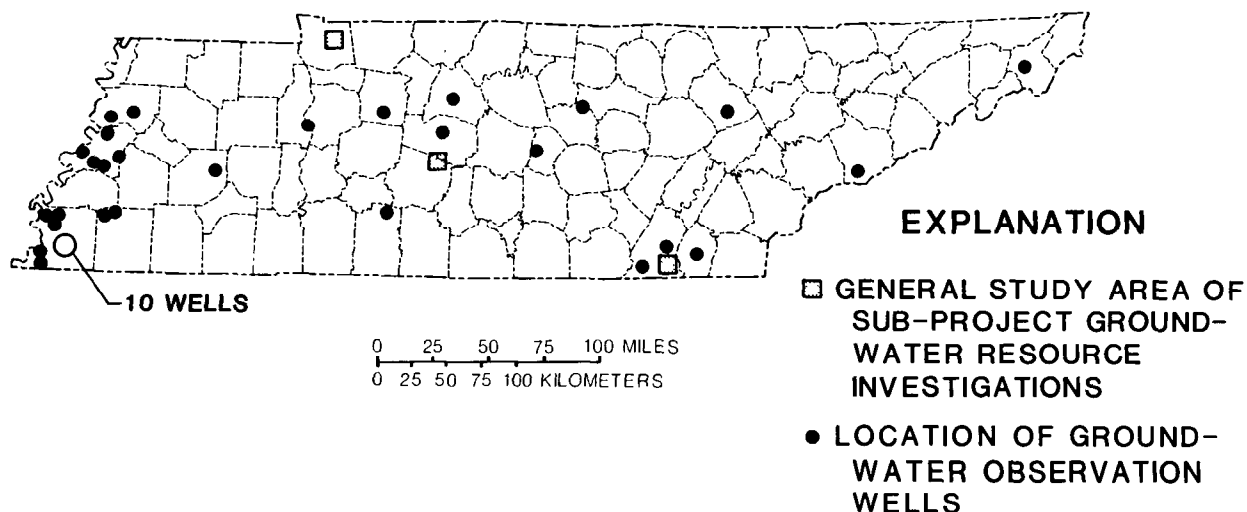
Water-quality data-collection sites in Tennessee.

GROUND-WATER-LEVELS NETWORK

In cooperation with the Office of Water Management of the Tennessee Department of Health and Environment (TDHE), the USGS operates 30 observation wells in the statewide ground-water level network. Recording instruments at these wells monitor water-level fluctuations in response to either man-made or natural stresses. Information from the network was a key element in a regionwide effort to monitor the effects of the 1986 drought on ground-water levels.

An additional 18 observation wells comprise the Memphis-area aquifer network to monitor response to pumpage by the Memphis Light, Gas and Water Division. The City of Memphis is the largest user of ground water in the State, withdrawing more than 190 million gallons per day for public supply.

Four investigations were conducted as subprojects under the ground-water basic data project. Three of the studies were designed to investigate ground-water occurrence and availability in the limestone aquifers of Middle and East Tennessee. These included (1) North Stewart County and the Mississippian Carbonate aquifer; (2) North Maury County and the Ordovician Carbonate aquifer of the Central Basin; and (3) southeast Hamilton County and the Valley and Ridge Carbonate aquifer of East Tennessee. The fourth subproject investigated the potential for vertical leakage down to the Memphis Sand aquifer in an area near the Shelby County landfill. Hydrologist Mike Bradley is in charge of the ground-water monitoring program, while geologist Pat Hollyday oversees the detailed subprojects.



Location of observation wells in Tennessee.

GROUND-WATER-QUALITY MONITORING

Monitoring of ground-water quality in Tennessee is not accomplished on a routine basis by the USGS. The potential for contamination is significant, as indicated by the identification of as many as 250 toxic waste disposal sites within the State. The USGS is involved in specific projects at two of the most

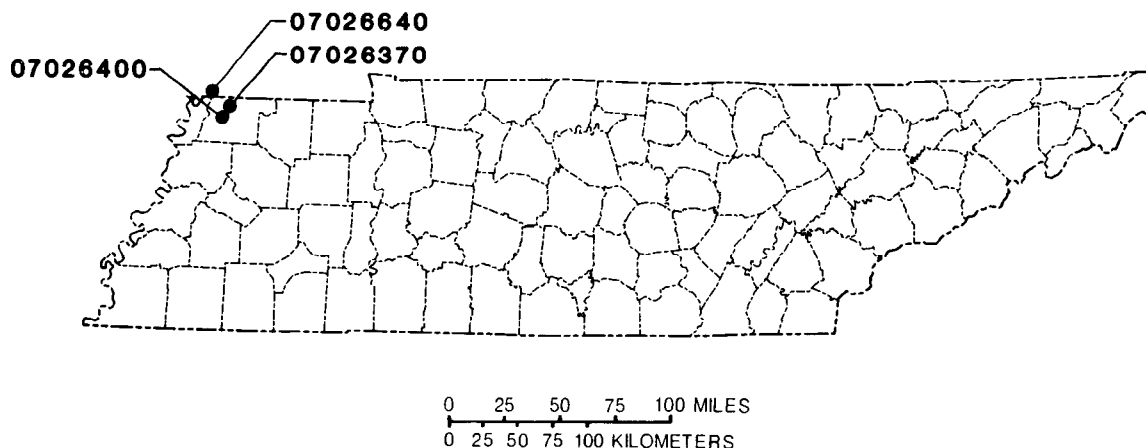
critical sites (Hollywood Dump near Memphis and Genesco Plant near Brentwood). At these sites, intensive ground-water-quality data are collected.

A statewide ground-water monitoring network is one of the elements of the proposed Tennessee ground-water protection strategy. A preliminary proposal for such a network is part of the USGS cooperative program with the TDHE in federal fiscal year 1988.

SUSPENDED-SEDIMENT NETWORK

In cooperation with the Office of Water Management of the Tennessee Department of Health and Environment, the USGS conducts sediment transport investigations in Tennessee. The program provides sediment data to define sediment loads, concentrations, and transport characteristics for Tennessee streams. The data are also used to define the effects of impoundments on transport characteristics, to define long-term trends, and to provide a data bank for programs in water management and monitoring.

Three daily-record stations in the Reelfoot Lake drainage basin (North Reelfoot Creek at State Highway 22, near Clayton, Tenn.; South Reelfoot Creek near Clayton, Tenn.; and Running Slough near Ledford, Ky.) were in operation in 1986-87. The purpose of these stations is to monitor the suspended-sediment discharge into Reelfoot Lake. Hydrologist Bill Carey is in charge of the sediment programs.



Location of sediment stations in Tennessee.

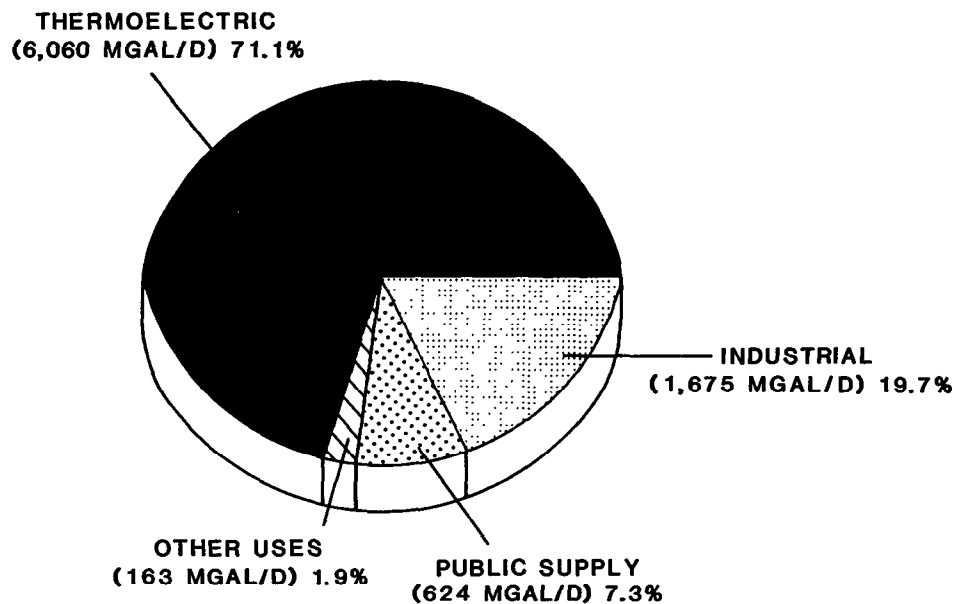
WATER-USE PROGRAM

The collection of water-use information is one of the most important basic data programs conducted by the USGS. In cooperation with the TDHE and the MLGW Division, the USGS water-use program has the following objectives:

- Establish a reliable State data base on water use along with water-use categories.
- Maintain and improve the data base through annual data inputs.
- Prepare and publish reports about water use in Tennessee and its importance as part of the hydrologic cycle.

During 1985, water-use data were collected for the categories of agriculture, irrigation, commercial, domestic, industrial, mining, public supply, sewage returns, and hydroelectric power generation. Site-specific investigations on irrigation use and water supply were completed at two sites. Data banks were made accessible to the Office of Water Management through a direct link to the USGS computers. Hydrologist Susan Hutson, from the Memphis office, directs the water-use program.

ESTIMATED SELF-SUPPLIED WATER USE IN TENNESSEE IN 1985 (8,522 MGAL/D)

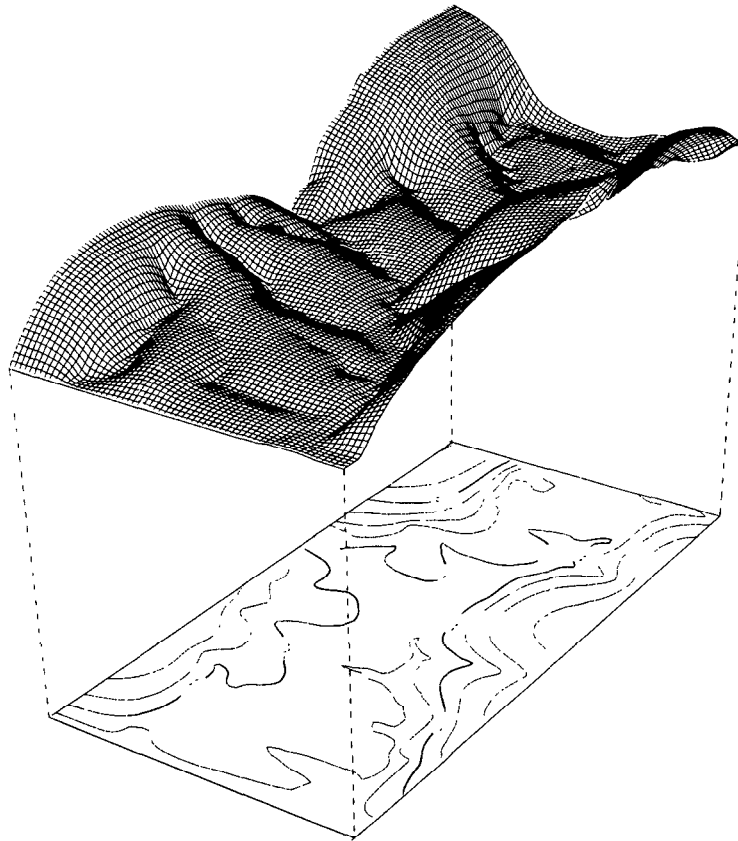


HYDROLOGIC INVESTIGATIONS SECTION

The Hydrologic Investigations Section of the Tennessee WRD District is responsible for the design and execution of interpretive areal water-resources investigations. Surface, ground, and quality of water studies throughout the State are conducted in support of federal and cooperative programs. Projects range in duration from 1 to 6 years, include areas as large as several thousand square miles, and can cost as much as several million dollars.

The staff of the Hydrologic Investigations Section includes about 20 highly qualified and experienced geologists, engineers, biologists, and technicians. The high caliber of the staff is reflected in the number of scientists with doctoral degrees (4), master degrees (8), and other advanced college work. Experienced hydrologists and technicians are supported by a strong staff of recently hired engineers and scientists. State-of-the-art equipment is utilized in complex hydrological investigations.

In 1986, the Hydrologic Investigations Section was involved in 14 areal studies. Four projects were completed and four were initiated. The section staff produced more than 32 reports, journal papers, and symposia articles.



STABILITY OF SELECTED CHANNEL REACHES IN WEST TENNESSEE

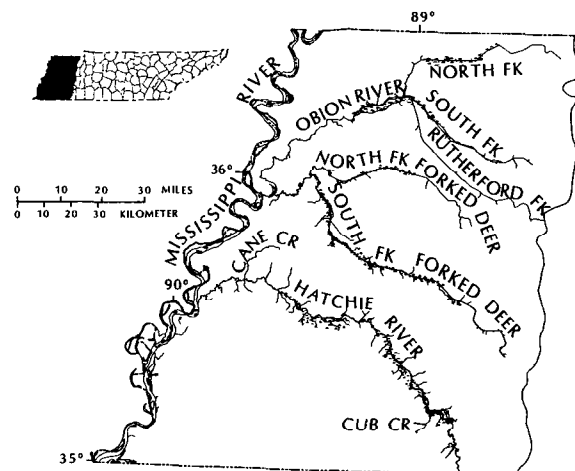
In cooperation with the Tennessee Department of Transportation (TDOT), the USGS has conducted investigations of channel stability characteristics as part of TDOT's program of bridge designs. Like the bridge-site reports that delineate hydraulic and hydrologic characteristics of specific sites, these studies are designed to address questions concerning channel bed and bank stability. The vast majority of the sites investigated from year to year are located in West Tennessee where channel instability is a significant problem.

From six to eight site studies are done each year and usually consist of various combinations of the following tasks:

- Channel surveys,
- Review of available data (such as hydrologic, construction plans)
- Bed- and bank-material sampling,
- Shear-strength testing,
- Slope-stability analysis,
- Bed response analysis (based on West Tennessee bed model),
- Dendrochronologic analysis of riparian vegetation, and
- Analysis of rates of bank widening or accretion.

This is a continuing study that benefits both TDOT and the USGS by supplying a means of acquiring channel information on streams other than those included in the larger channel evolution studies. It also allows for continuing technology transfer between the USGS and the TDOT.

Most channel reaches encountered during this study are to some extent, unstable. Bank conditions are assessed through slope-stability analyses and then tested for various alignments and water-table heights. Factors of safety for these various conditions are then reported to TDOT as part of the site-study report. Andrew Simon, geomorphologist, is the project chief.



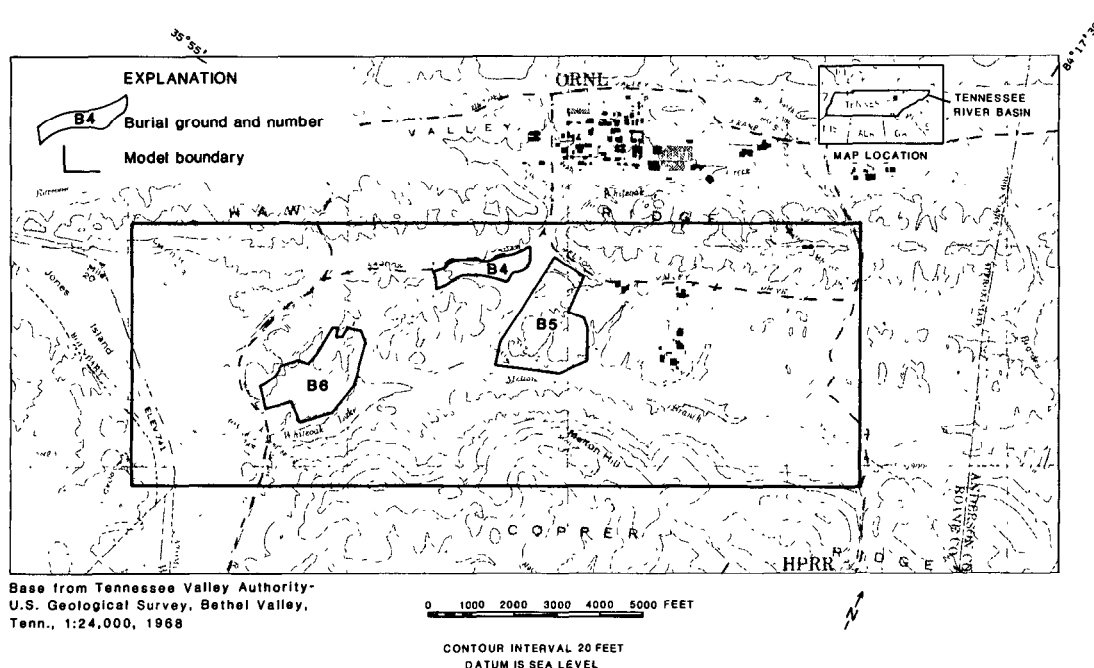
Location of study streams
in West Tennessee.

HYDROGEOLOGY OF THE BURIAL GROUNDS AT THE OAK RIDGE RESERVATION

The migration of radionuclides in ground water within the Oak Ridge Reservation is being investigated in cooperation with the U.S. Department of Energy. Shallow-land burial of low-level radioactive wastes has been practiced at the Oak Ridge Reservation since 1944. Radionuclides have been leached and transported by ground water away from burial areas to surface discharge points. The project was initiated in 1975 and is due for completion in 1989.

The objectives of the study are to provide: (1) descriptions of the ground-water flow system of the burial grounds and surrounding areas; (2) descriptions of the quality of ground and surface water in the burial areas; and (3) technical information for the development of an integrated ground-water and surface-water monitoring system. During the past year, several surface-geophysical methods, including direct-current resistivity, terrain conductivity, and seismic reflection were used to provide information on subsurface stratigraphy and structure. Twenty-four augered wells were installed to determine depth to bedrock and to provide information on the configuration of the water table in areas outside of the burial grounds. Drilling was started on 16 paired wells that will provide information on vertical movement of ground water and will better define hydrologic boundaries of the ground-water system. Water-levels and precipitation data continue to be collected in the burial grounds and adjacent areas. Work for FY87 includes completion of drilling, collection of water-quality data, ground-water modeling, and final interpretation of geophysical data.

The study is directed by H.H. Zehner, geologist, with the assistance of D.A. Webster and Patrick Tucci, geologists.



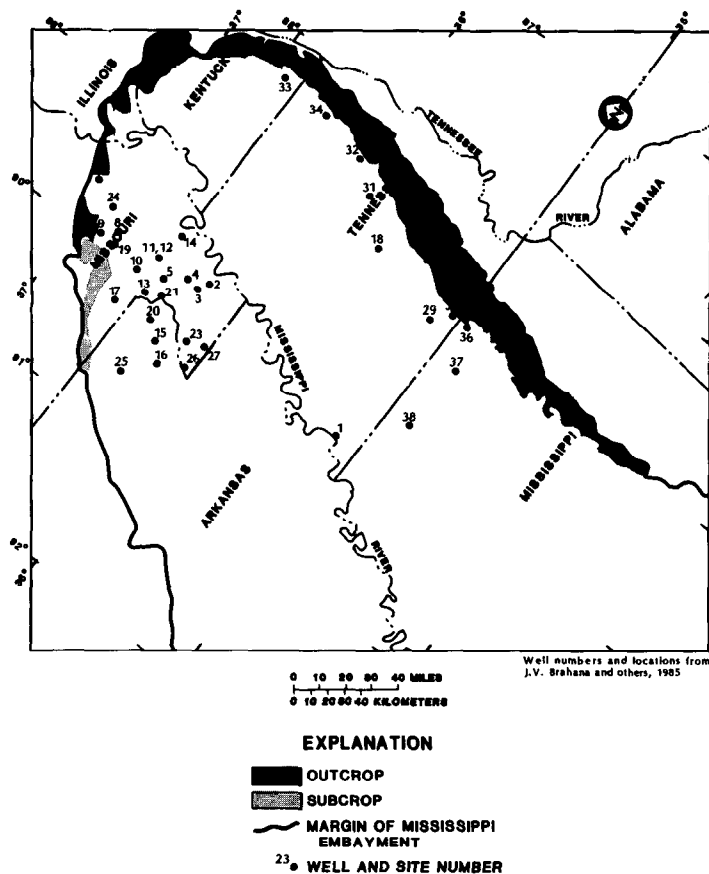
Study area and location of burial grounds.

HYDROGEOLOGY OF THE UPPER CRETACEOUS AQUIFER IN WEST TENNESSEE

The USGS, as part of a National program, is conducting a series of regional aquifer system analyses (RASA) investigations. One of the projects (Gulf Coast Regional Aquifer System Analysis) includes the ground-water system in the northern Mississippi embayment in western Tennessee.

Flow modeling used in conjunction with a geochemical sampling program has helped refine preliminary understanding of the complex flow system in the Upper Cretaceous aquifer in the northern Mississippi embayment. The Upper Cretaceous aquifer occurs in a tectonically active area. It is deeply buried and has discharge boundaries that are covered by younger sediments and cannot be observed directly. Hydrologic data are sparse; but by simulating flow and geochemistry of the deep aquifers using models, project chief Dr. John Van Brahana (geologist) has delineated discharge areas and quantified the major components of the hydrologic budget for this system.

Major accomplishments in calendar year 1986 include: publication of a water-quality data report in January; determination and reconciliation of flow across common boundaries with other RASA projects; development of new research techniques, and completion of sampling using $^{228}\text{Ra}/^{226}\text{Ra}$ ratios to delineate discharge zones. A preliminary flow modeling report was approved in December 1986.

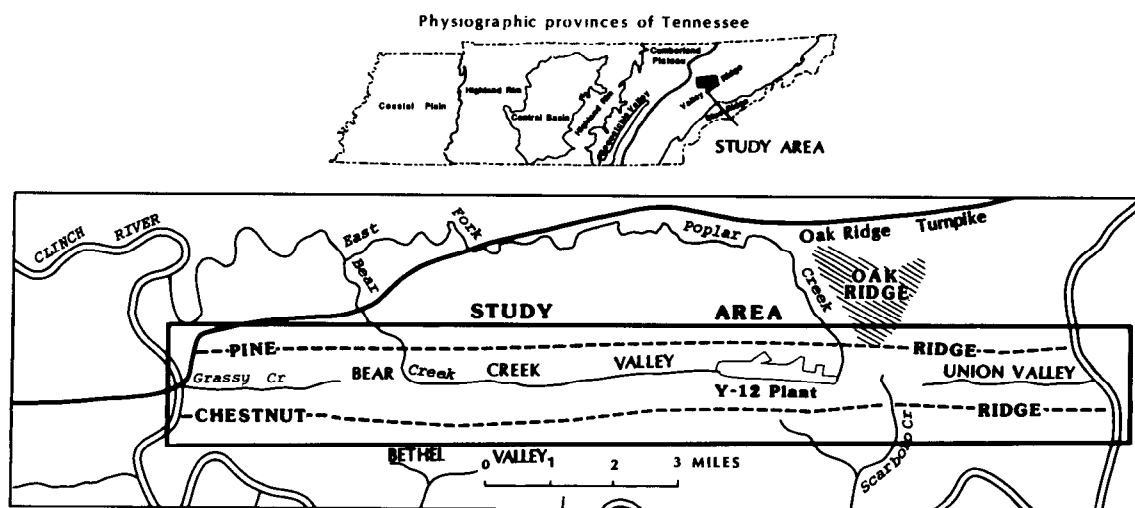


Location of wells where ground-water quality data were collected from the Upper Cretaceous aquifer in the northern Mississippi embayment.

HYDROGEOLOGY IN THE VICINITY OF THE Y-12 PLANT AT THE OAK RIDGE RESERVATION

Several hazardous-waste disposal sites where contaminants are leaching into ground and surface water are located in Bear Creek Valley, within the Oak Ridge Reservation. An investigation of the area is being conducted in cooperation with DOE. The objectives of the investigation of the hydrogeology of the valley are to formulate an understanding of the ground-water flow system, and thereby, to determine the potential extent of contaminant migration. Initial phases of the project, begun in 1984, included assessment of existing geologic and hydrologic data, collection of surface-water flow and quality data, installation of well clusters on the hydrologic boundaries of the valley, and formulation of a preliminary concept of the ground-water flow system. Four data reports and two interpretive reports have been published.

Activities during 1986 included statistical analyses of available hydraulic-conductivity data, parameter-estimation modeling, geochemical analyses and interpretation, and calibration of a three-dimensional model of ground-water flow. Results of the statistical analyses and parameter-estimation modeling and the geochemical data will be published in separate reports. A final report will summarize the hydrogeologic findings of the study and present the results of the ground-water flow modeling. The project is directed by Zelda Bailey (geologist) assisted by Roger Lee (geochemist), and Anne Hoos and Joseph Connell (engineers).



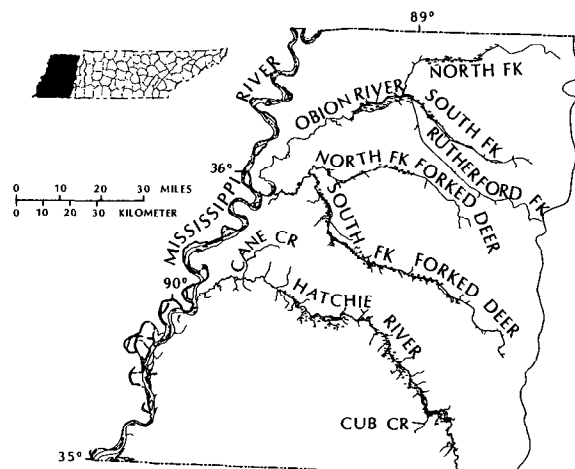
Location of Bear Creek Valley study area.

CHANNEL EVOLUTION INVESTIGATIONS IN WEST TENNESSEE STREAMS

Channel modifications throughout much of West Tennessee's alluvial streams have caused large-scale channel adjustments such as upstream degradation, downstream aggradation, and bank failures. As a result of these adjustments, a number of highway bridges have collapsed, in some cases, leading to the loss of life. The primary objective of this study, conducted in cooperation with the Tennessee Department of Transportation, is to quantitatively assess ongoing and future channel changes through the development of empirical models of alluvial-channel evolution.

Results have shown that degradation occurs for 10 to 15 years at a site, followed by an equal period but lesser amount of aggradation. Reaches close to the area of maximum disturbance are the most severely effected with the magnitude of the response decreasing with distance upstream. Changes on the channel bed are closely tied to subsequent changes of the channel banks and, together, have been organized into a six-stage model of channel evolution. Bank widening does not occur until degradation and fluvial undercutting of the banks has heightened and steepened the channel banks beyond their critical conditions. Bank-failure thresholds and rates of channel widening are assessed through shear-strength testing, field surveys, and dendrochronology.

The majority of the channels are still unstable. Those that have been recently redredged, such as the South Fork Forked Deer River, will remain unstable for a long time to come. The project staff, headed by Andrew Simon (geomorphologist) with the assistance of Dr. Cliff Hupp (botanist) and Bradley Bryan (hydrologist), is now completing quantitative descriptions of channel changes such as widening, timing to initial bank stability, critical conditions of bank stability, and hydraulic characteristics of each stage of the model. These individual subroutines of the model will be combined into an empirical model of channel evolution over time and space. The project is due for completion during 1987.



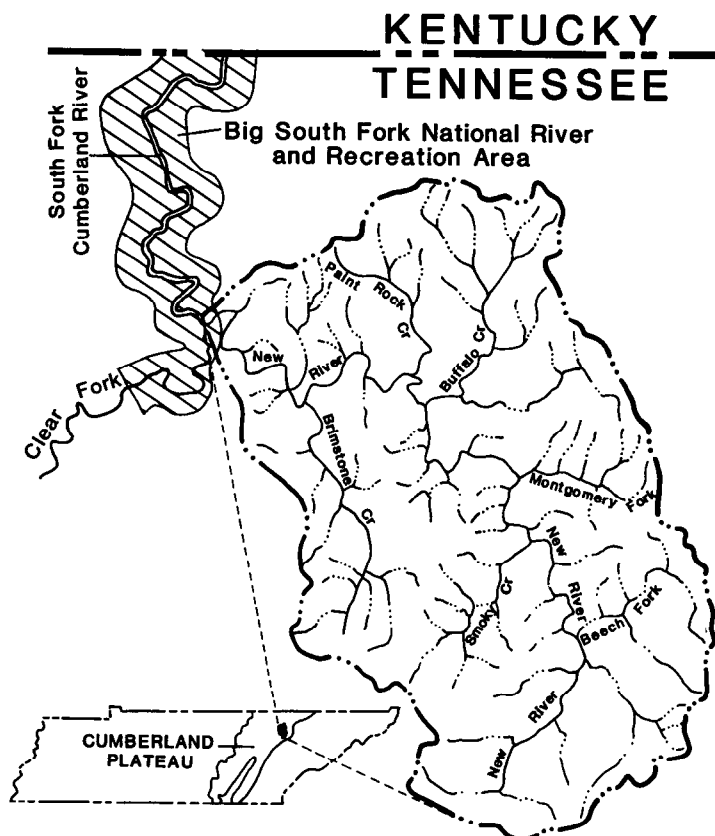
Location of study streams
in West Tennessee.

IMPACT OF STRIP MINING ON CHANNEL GEOMETRY AND SEDIMENT TRANSPORT IN THE UPPER SOUTH FORK CUMBERLAND RIVER BASIN

Disturbance by surface mining in the Appalachian coal province is generally acknowledged to be a cause of greatly increased yields of fluvial sediment. Recent studies are showing that while the coarse load may account for only 10 to 15 percent of the total sediment load, it has a pronounced effect on the channel morphology. Among the typical impacts of increased coarse material discharge are channel widening and extensive deposition of sand-size and coarser sediment as in-channel bars. The most prominent point-bar deposition is occurring immediately downstream of mined tributary basins. Generally where point-bar deposition is occurring, cut banks are receding into premining flood-plain deposits on the opposite side of the channel.

Evidence indicates that the coarse material has been accumulating in the channel network since the onset of surface mining in the New River basin and that a substantial amount of this material is mobilized during high flows on New River. Potential impacts of this coarse material movement in the Big South Fork National River and Recreation Area include destruction of aquatic habitat due to deposition in spawning areas and deposition at access points along the channel.

Objectives of the study are to determine if fluvial-geomorphic processes in the major tributaries to New River are similar; to gather reconnaissance data on these processes throughout the upper South Fork Cumberland-New River basins and to gather detailed information at specific locations selected from the reconnaissance data; and to estimate the probability of significant movement of this material in the upper South Fork Cumberland basin and its probable impact on the Recreation Area. Brad Bryan (hydrologist) is the project chief.



Location of study area in the upper South Fork
Cumberland River basin.

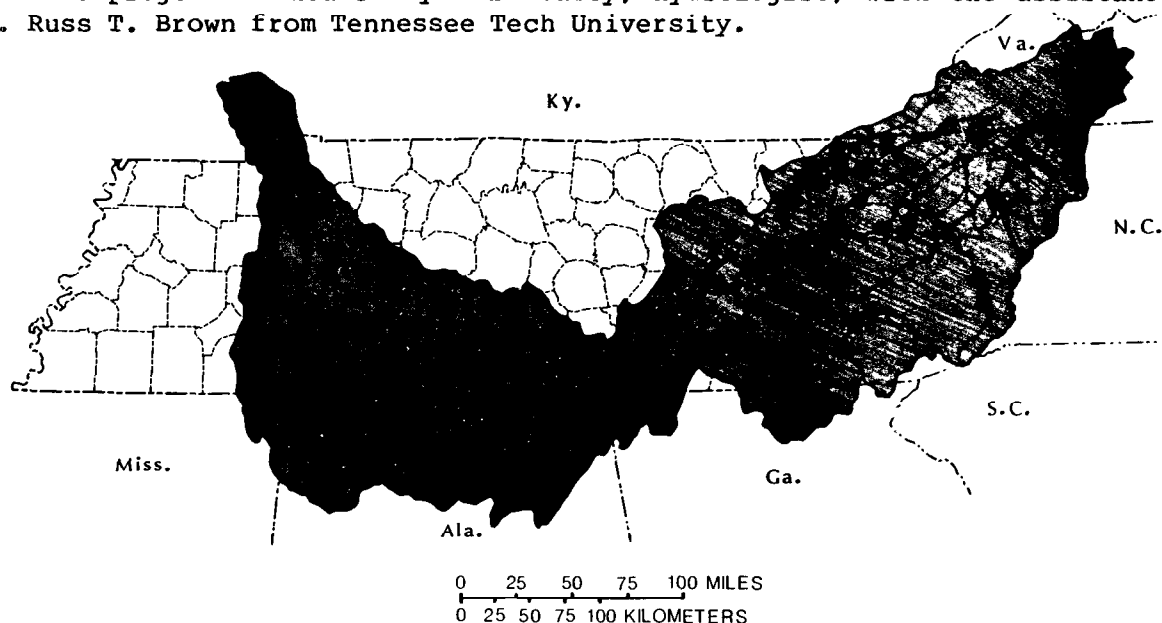
SEDIMENT YIELDS IN THE TENNESSEE RIVER BASIN, 1930-60

Historical records of suspended-sediment data in the Tennessee and Cumberland River basins are being compiled as part of a project in cooperation with Tennessee Tech University. The primary objective of the project is to compile and enter into computer storage suspended-sediment data that were collected by the Tennessee Valley Authority during sampling efforts in the late 1930's and mid-1960's. These data consist of daily record for 48 stations obtained during the 1930's and daily record for 10 stations obtained during the 1960's. A second objective is to use the data to assess the sediment transport characteristics and yields of the basins sampled.

A draft version of a master index to sediment data in the Tennessee and Cumberland River basins has been prepared. The index consists of a table for each basin that lists information about available data for each station. These tables will be included in a report that discusses the history of sediment sampling in the two basins and describes the available data. A preliminary outline of this data inventory report has been prepared.

Tennessee Technological University has created daily values files of concentration for 52 stations. These files are currently being read into and stored on the WATSTORE system, and preliminary statistical analyses are being performed.

The project is headed by Bill Carey, hydrologist, with the assistance of Dr. Russ T. Brown from Tennessee Tech University.



EXPLANATION

- ▲ TENNESSEE RIVER STATIONS SAMPLED
IN LATE 1930's AND EARLY 1940's
- TRIBUTARY STATIONS SAMPLED ONLY IN
LATE 1930's AND EARLY 1940's
- WATSHEDS OF STREAMS INCLUDED IN SUSPENDED
SEDIMENT STUDIES 1935-1937 AND 1963-1965

Location of suspended-sediment stations in the
Tennessee River basin.

GEOMORPHIC CHANGES IN THE CHANNEL OF CANE CREEK IN WEST TENNESSEE

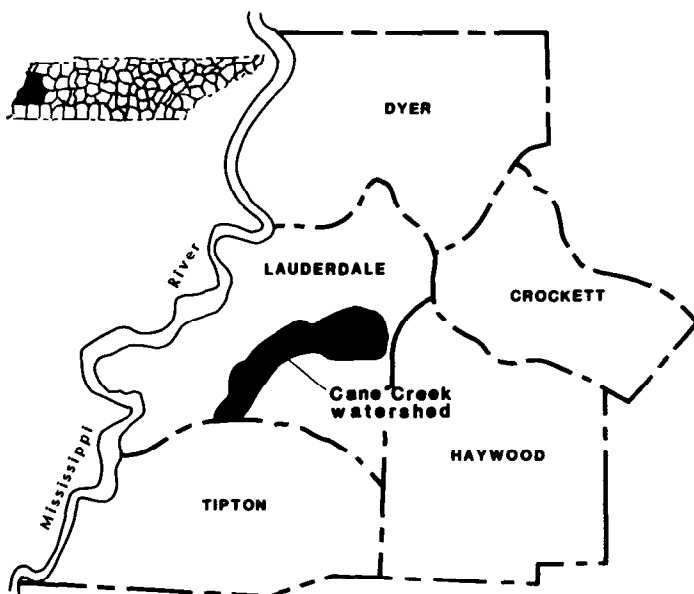
Channel straightening and dredging along Cane Creek, Lauderdale County, Tennessee, in 1969 and 1970 increased channel gradients from about 0.0005 to about 0.0009 foot per mile. This increased stream power has led to channel degradation that has affected the main stem, tributary channels, and adjacent lands. Up to 17 feet of downcutting and widening in excess of three times the premodified width has occurred in some locations along Cane Creek.

In cooperation with the U.S. Soil Conservation Service, the USGS is conducting a study to determine the present state of channel morphology, to estimate future channel changes due to natural adjustment processes, and to evaluate alternative measures for regaining stable conditions. Assessment of channel adjustment trends and estimation of future channel geometry is necessary to adequately protect river-crossing structures, arable farmland, and human life.

Bed profiles indicate that over the past 15 years Cane Creek has degraded almost to Hatchie River base level. Bed degradation appears to be controlled by county road bridge sites stabilized with rip-rap. Bed-level adjustment trends indicate there may be 1.0 to 5.0 feet of additional degradation at some locations through the year 2000. Extreme bank heights, some as great as 35 feet, coupled with the weak and dispersive channel-bank material, have led to rapid, large-scale bank widening. Slope-stability and soil-strength analyses indicate that bank slopes as low as 3.5 feet horizontal to 1.0 foot vertical (16 degrees) will be necessary to achieve stability. Mean bank angles currently range between 35 and 45 degrees.

Hydraulic analyses for Cane Creek have been completed using adjusted regional flow equations. Prior to modification, Cane Creek overflowed its banks several times per year. Hydraulic routing through the channel as it now exists indicates that flows in excess of the 100-year recurrence interval will be contained within banks. Channel stabilizing alternatives such as grade-control structures and energy dissipating baffles will be evaluated as to their affect on stream power and on sediment deposition. Reduced stream power will result in slower degradation and may induce aggradation, resulting in lower bank heights which would minimize bank failure and channel widening.

The project leader is Andy Simon, geomorphologist, assisted by Dr. Cliff Hupp, botanist, and Bradley Bryan, hydrologist.



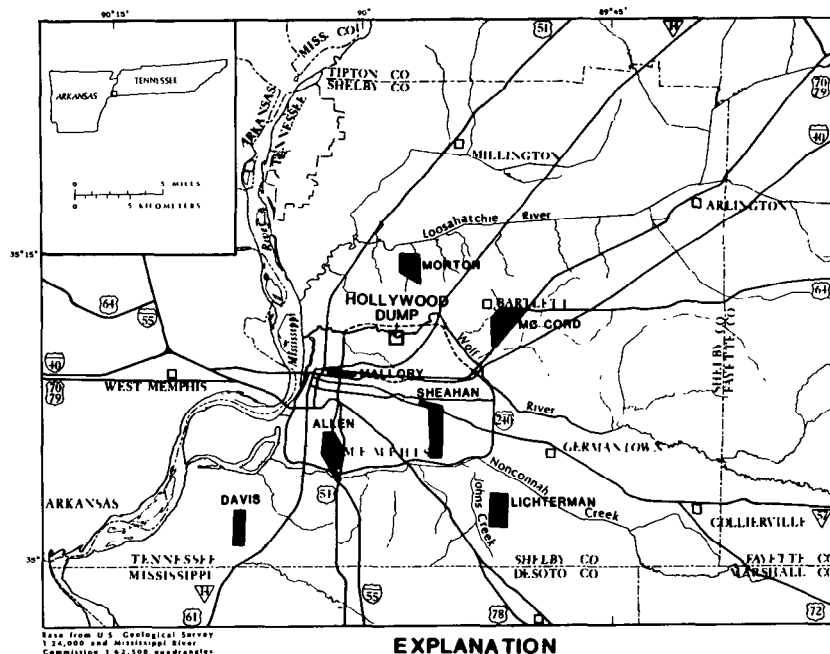
Location of Cane Creek in Lauderdale County, West Tennessee.

GEOHYDROLOGY AND PESTICIDE TRANSPORT AT THE HOLLYWOOD DUMP NEAR MEMPHIS

In cooperation with the City of Memphis, the USGS is conducting an investigation at the former North Hollywood municipal-industrial landfill. The North Hollywood Dump is Tennessee's top-ranking site on the U.S. Environmental Protection Agency's "Superfund" list. Carcinogenic chemicals and residues of pesticides have been detected in local soils, sediments, biota, and in ground and surface waters. The objectives of the study are to describe the current extent of contamination at the site and to estimate the potential for migration of toxic constituents toward points of human exposure. The City of Memphis is particularly concerned with the possible contamination of its drinking-water aquifer, which supplies a population of almost a million people.

A network of 50 monitoring wells has been established at the site. During FY86, water-quality samples were collected quarterly and water-level measurements were made at least monthly; three wells were equipped with continuous water-level recorders. Surface geophysics, including resistivity and electromagnetic techniques, also have contributed to an understanding of the local geology and the extent of aquifer contamination. Initial water-quality sampling efforts have outlined a diffuse plume extending from the dump down-gradient toward the Wolf River. The highest concentrations of organochlorine pesticides include 37 ug/L of lindane and 24 ug/L of chlordane.

Laboratory research to be conducted in cooperation with Vanderbilt University will define the sorptive and other geochemical behavior of these waste constituents. In FY87, sampling of ground water is planned within a dense network of drive-point wells. When the local geohydrological and geochemical systems have been adequately characterized, a digital model will be used to simulate ground-water flow, and the potential for contaminant transport will be estimated. The project chief is Mike Bradley, geologist, assisted by Dr. Robert Broshears.

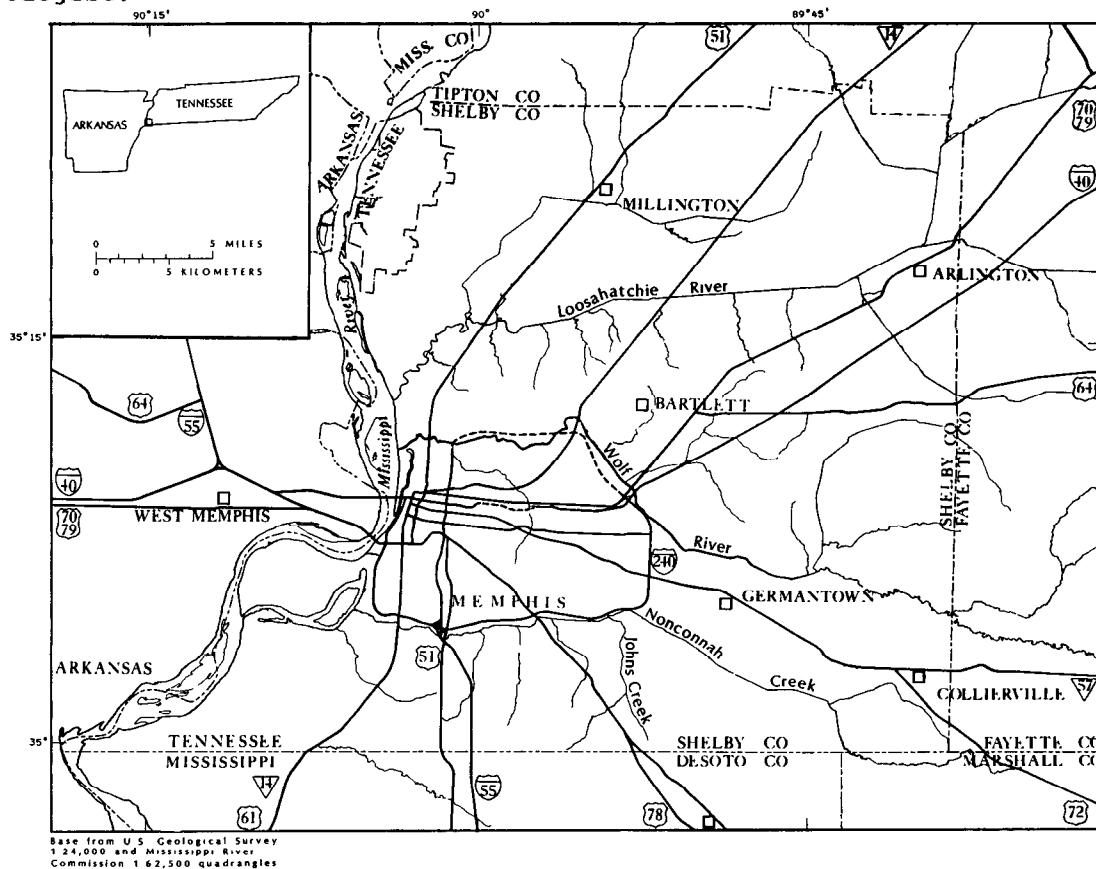


**Hollywood Dump and Memphis Light, Gas and
Water municipal well fields.**

INVESTIGATION OF GROUND-WATER QUALITY AND POTENTIAL FOR CONTAMINATION IN THE SHALLOW SAND AQUIFER IN THE MEMPHIS AREA

Results of studies of dumps in the Memphis area indicate that leachates from the dumps are entering the shallow water-table aquifer. Water-quality data indicate that concentrations of several constituents exceeded the Environmental Protection Agency (EPA) drinking-water standards. Traces of a few compounds on the EPA priority pollutant list have also been found. Background data on levels of constituents found naturally in water in the water-table aquifer levels or organics that may have been introduced by waste-disposal and agricultural practices is needed.

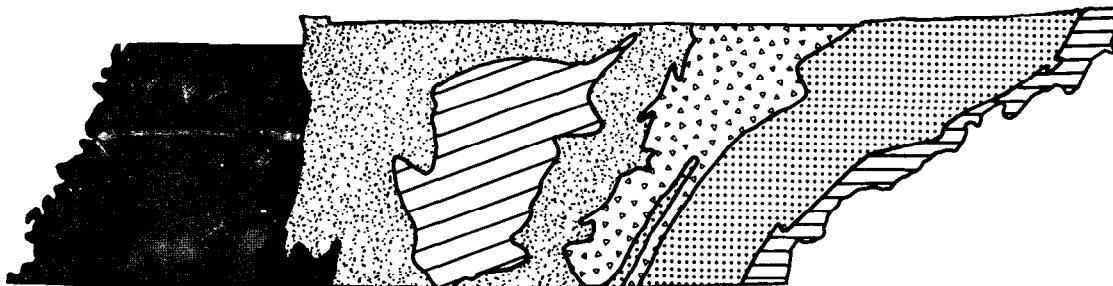
In cooperation with Shelby County and the City of Memphis, the USGS is conducting a study to provide additional background information. Tests will be completed for trace constituents and organic compounds in the shallow water-table aquifer in areas away from the dump site. Previous investigations dealing with the ground-water quality of the Memphis area will be reviewed in an attempt to determine "background" water quality. Well records will be reviewed to locate and select wells for sampling in urban, suburban, and rural areas around Memphis. About 40 wells will be sampled to obtain water-quality data on selected constituents and compounds. The project chief is Bruce McMasters, hydrologist.



Area of study for the shallow water-table aquifers,
Memphis area, Tennessee.

INVESTIGATION OF RECHARGE AND WATER-SUPPLY POTENTIAL OF AQUIFERS IN TENNESSEE UTILIZING BASE FLOW OF STREAMS

In cooperation with the Tennessee Governor's Safe Growth Team, the USGS began in 1985 a study to assess recharge, hydraulic characteristics, and long-term water-supply potential of selected unconfined aquifers in Middle and East Tennessee. Quantification of the hydrologic and hydraulic properties of these aquifers is essential for wide development of ground-water resources in areas of increasing water demand. During FY86, estimates of recharge rate, storage coefficient, and transmissivity were made for representative low-, average-, and high-flow years for 66 drainage basins. Net annual recharge was approximated by the base flow component of the annual streamflow hydrograph. Basin-specific estimates of aquifer hydraulic diffusivity were derived from the estimates of the streamflow recession index and drainage density for 75 drainage basins. The storage coefficient was estimated for 10 drainage basins from a hydrologic analysis of isochronal water-level and streamflow hydrographs. Basin-specific and site-specific estimates of transmissivity were computed from estimates of hydraulic diffusivity and single-well aquifer tests, respectively. The next phase of the project will include the interpretation and regionalization of basin-specific estimates to assign values to aquifer units on a regional scale. The project leader is Anne Hoos, engineer.



EXPLANATION

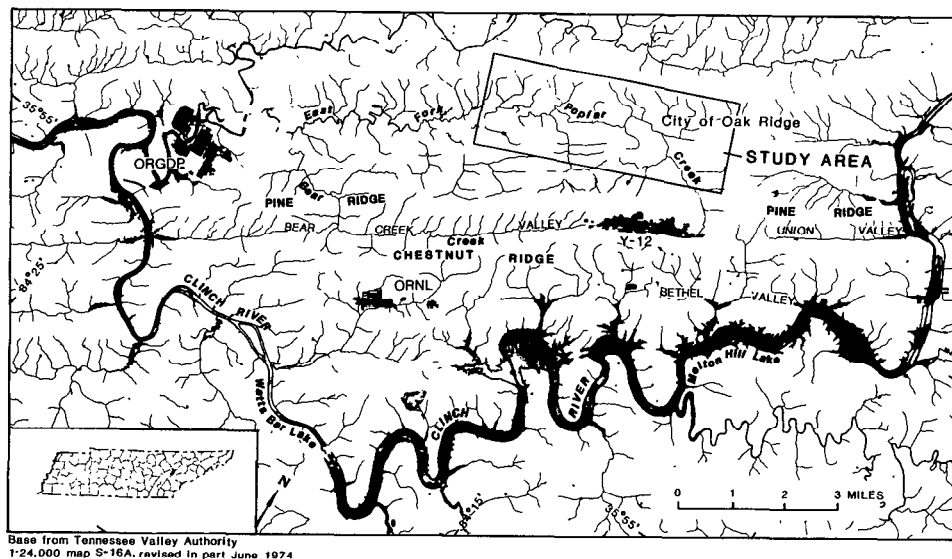
	UNDIFFERENTIATED WEST TENNESSEE AQUIFERS		ORDOVICIAN CARBONATE AQUIFER
	PENNSYLVANIAN SANDSTONE AQUIFER		CAMBRO-ORDOVICIAN CARBONATE AQUIFER
	MISSISSIPPIAN CARBONATE AQUIFER		CRYSTALLINE ROCK AQUIFER

Major unconfined aquifers in Tennessee.

GROUND-WATER QUALITY IN THE SHALLOW AQUIFER NEAR EAST FORK POPLAR CREEK AT OAK RIDGE

In cooperation with the U.S. Department of Energy, the USGS is conducting a study to determine the presence and concentration of contaminants dissolved in ground water of the flood plain of East Fork Poplar Creek, near the Oak Ridge Reservation. Shallow wells were installed at selected sites within the flood plain of the creek and at background sites outside the flood plain. Soil samples from borings adjacent to wells were collected during 1986. Analyses of these samples for mercury and other metals concentrations were completed by TVA and Oak Ridge Associated University laboratories.

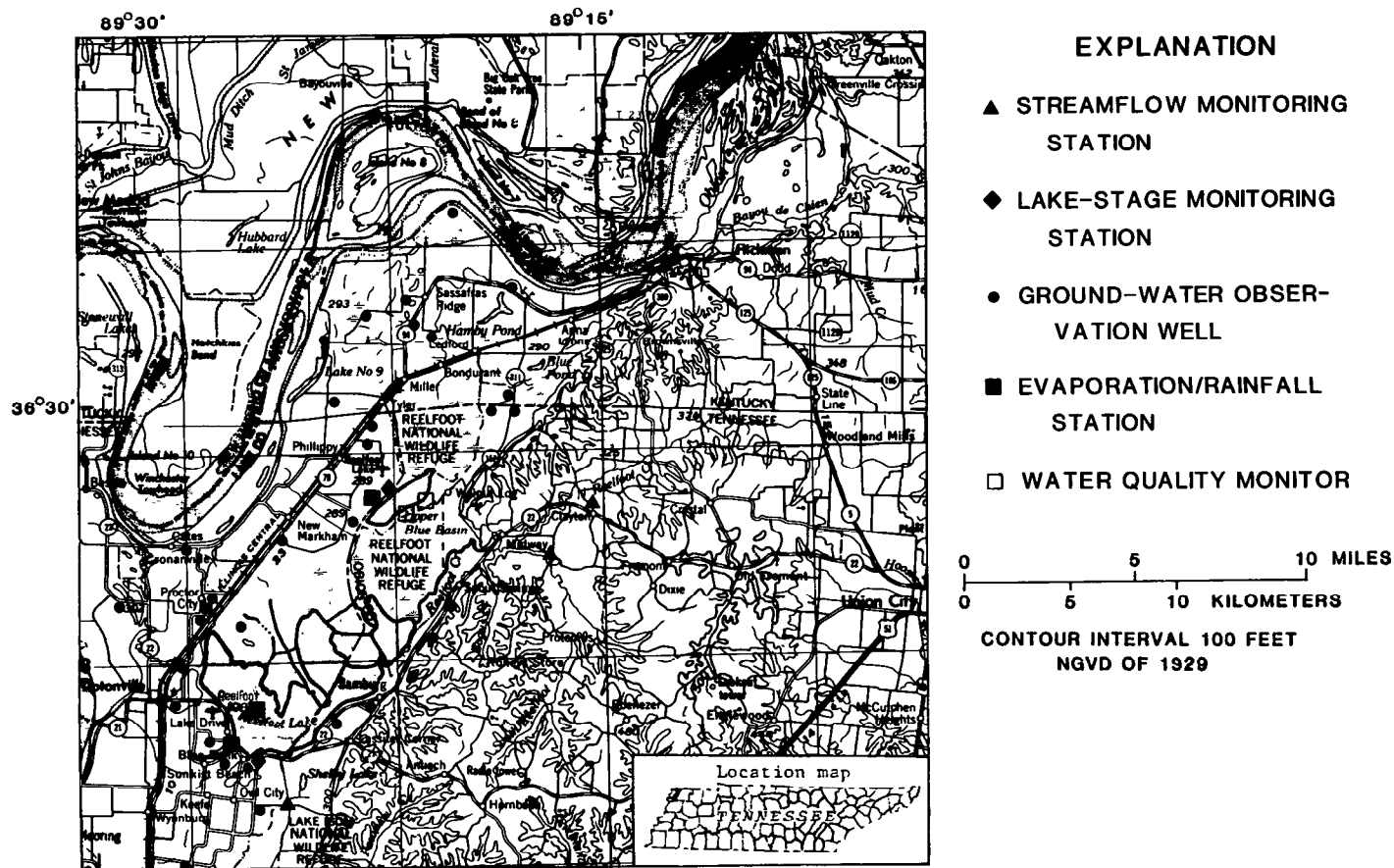
Half of the wells were fully developed and are ready for sampling. Lack of rainfall has caused water levels in the wells to be too low for proper development. Samples from five wells were collected for total mercury analysis and scans of organic compounds were made by the USGS laboratory in Ocala, Fla. Other wells will be sampled during 1987. The project, directed by John Carmichael, hydrologist, is scheduled for completion in 1987.



Location of East Fork Poplar Creek study area.

EFFECTS OF PROPOSED DIVERSIONS ON REELFOOT LAKE IN WEST TENNESSEE

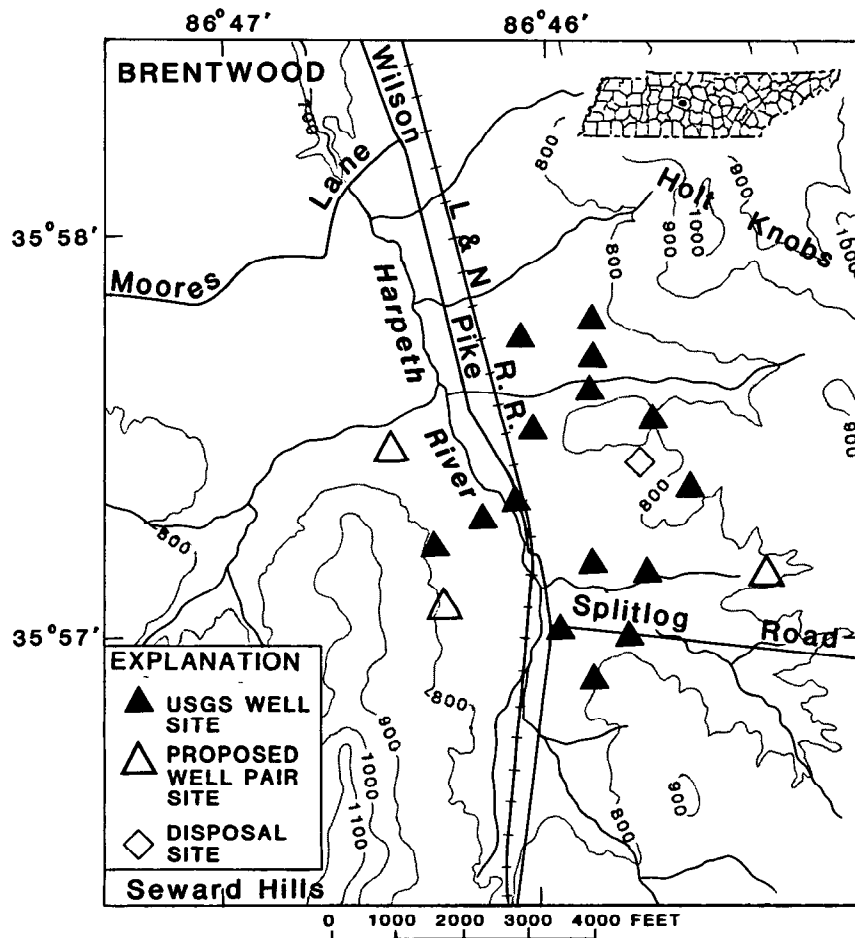
Reelfoot Lake, in northwestern Tennessee, is a valuable natural resource that is threatened by sedimentation, eutrophication, and deterioration of the quality of the water. An investigation was begun by the USGS in 1986 to quantitatively define the surface-water and ground-water hydrology of Reelfoot Lake basin, and to determine the impacts of various management strategies. This information is needed to evaluate available water supplies to the lake and the potential environmental impacts of lake-level manipulation and pumpage from the alluvial aquifer for agricultural irrigation or for other needs. These objectives will be accomplished by analyses of data from extensive climatic, surface-water, and ground-water data-collection networks using energy budget and mass-transfer equations, calibrated streamflow synthesis models, and finite-difference ground-water flow models. These data and analyses will provide an insight into the geohydrologic system supporting Reelfoot Lake. The project is being conducted in cooperation with the Tennessee Wildlife Resources Agency (TWRA) and is scheduled for completion in 1988. W. Harry Doyle (engineer), subdistrict chief of the USGS office in Memphis, is the project leader.



Location of project area, Reelfoot Lake, and data-collection stations.

INVESTIGATION OF GROUND-WATER CONTAMINATION NEAR BRENTWOOD, MIDDLE TENNESSEE

In cooperation with the Division of Superfund of the TDHE, the USGS is conducting a comprehensive 2-year investigation of ground-water contamination in the vicinity of the Genesco plant, south of Brentwood. The project includes delineation of the hydrogeology of the area, drilling and sampling of test wells, and modeling of ground-water flow. Pioneering research in the area of bacterial bioassays as indicators of contaminant presence is being conducted as part of the project. Occurrence of contaminants in the unsaturated zone is also part of the investigation. The project, under the leadership of Roger Lee (geochemist), is one of several pioneering research investigations conducted by the USGS nationwide.



CONTOUR INTERVAL 100 FEET

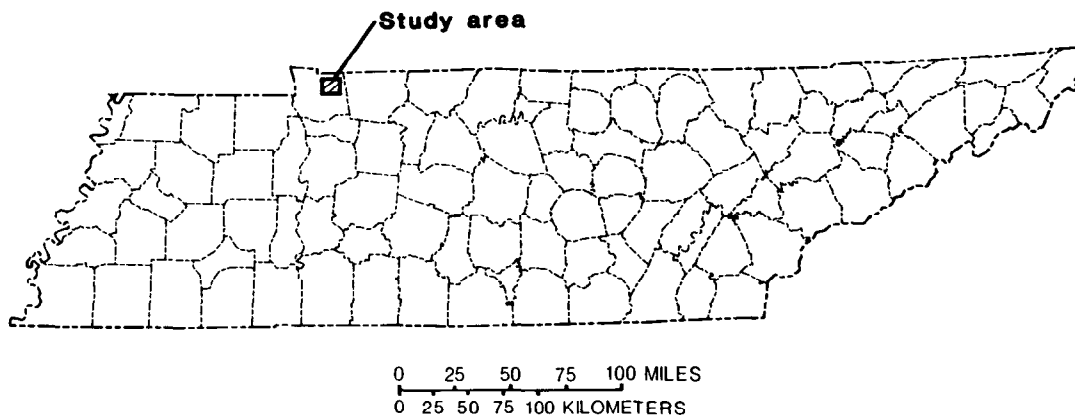
NATIONAL GEODETIC VERTICAL DATUM OF 1929

**Locations of existing USGS monitoring wells
and locations of proposed sites.**

GROUND-WATER RESOURCES OF NORTHERN STEWART COUNTY

The occurrence and availability of ground water for public supply in North Stewart County was investigated in cooperation with North Stewart Utility District. A seepage study of streams in the area was conducted, and five test wells were drilled by the cooperator to determine the occurrence of ground water in the alluvium and underlying limestone formations.

The alluvium consisted of as much as 130 feet of clay with some gravel in a tight clay matrix. The primary water-bearing zones are solution openings in the underlying limestone. Well yields ranged from essentially zero in the clay alluvium to more than 300 gallons per minute from two wells feeding from solution openings. Aquifer tests were conducted at the two highest producing wells. The North Stewart Utility District is developing this source of water and will use the two wells for public-water supply. Pat Hollyday, geologist, was in charge of the project, completed late in 1986.

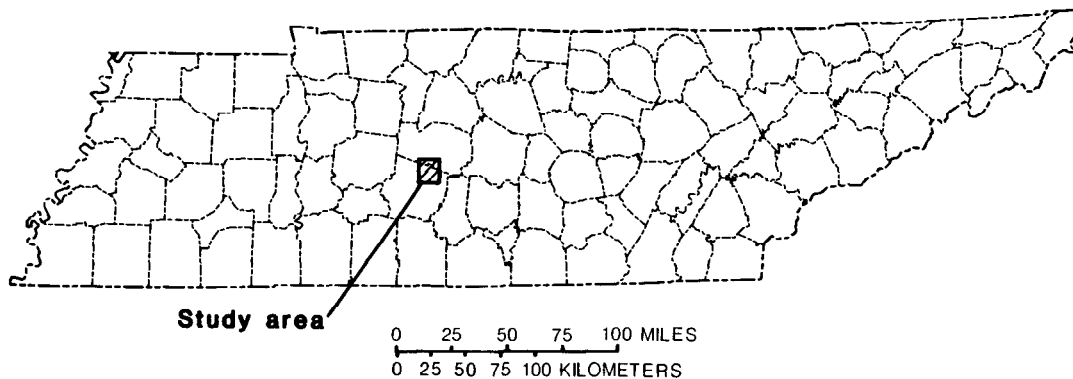


Location of study area in Tennessee.

GROUND-WATER AVAILABILITY IN THE SPRING HILL AREA, NORTHERN MAURY COUNTY

In cooperation with the Division of Ground Water Protection of the Tennessee Department of Health and Environment, the USGS conducted an appraisal of the availability of ground water in the Spring Hill area near the site of the Saturn automotive plant. The study provided basic data on ground-water occurrence, quantity, and quality on the limestone aquifers of Middle Tennessee.

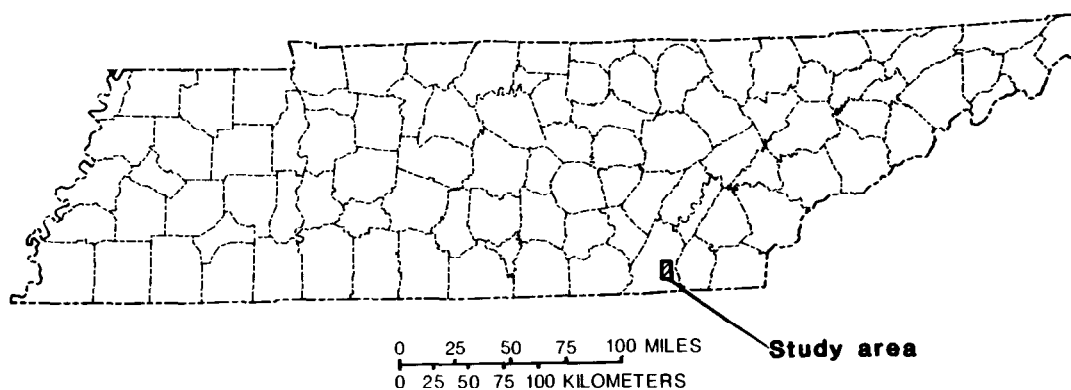
A surface-water seepage investigation was conducted to provide information on gaining and losing stream reaches during base-flow conditions. Fifteen test wells were drilled to investigate ground-water occurrence. Well yields ranged from less than 5 to more than 70 gallons per minute. An 8-hour aquifer test was conducted and water samples were collected at one well. The project was conducted by Pat Hollyday, geologist.



Location of study area in Tennessee.

GROUND-WATER AVAILABILITY IN THE OOLTEWAH AREA, SOUTHEASTERN HAMILTON COUNTY

In cooperation with the Eastside Utility District, the USGS investigated the occurrence and availability of ground water in the Knox Group of southeast Hamilton County. Well sites were selected on the basis of areal photography and linear features. Test wells (five) were drilled at four sites where solution openings in the limestone bedrock are the main source of ground water. One site was selected by the Eastside Utility District for the location of a production well. During an 8-hour aquifer test, the production well yielded more than 400 gallons per minute with less than 1 foot of drawdown in water levels. A water sample was also collected from the well and analyzed for common constituents. Based on the results of the aquifer tests and water-quality analyses, the Eastside Utility District plans to use the well for public-water supply. Pat Hollyday, geologist, conducted the project.

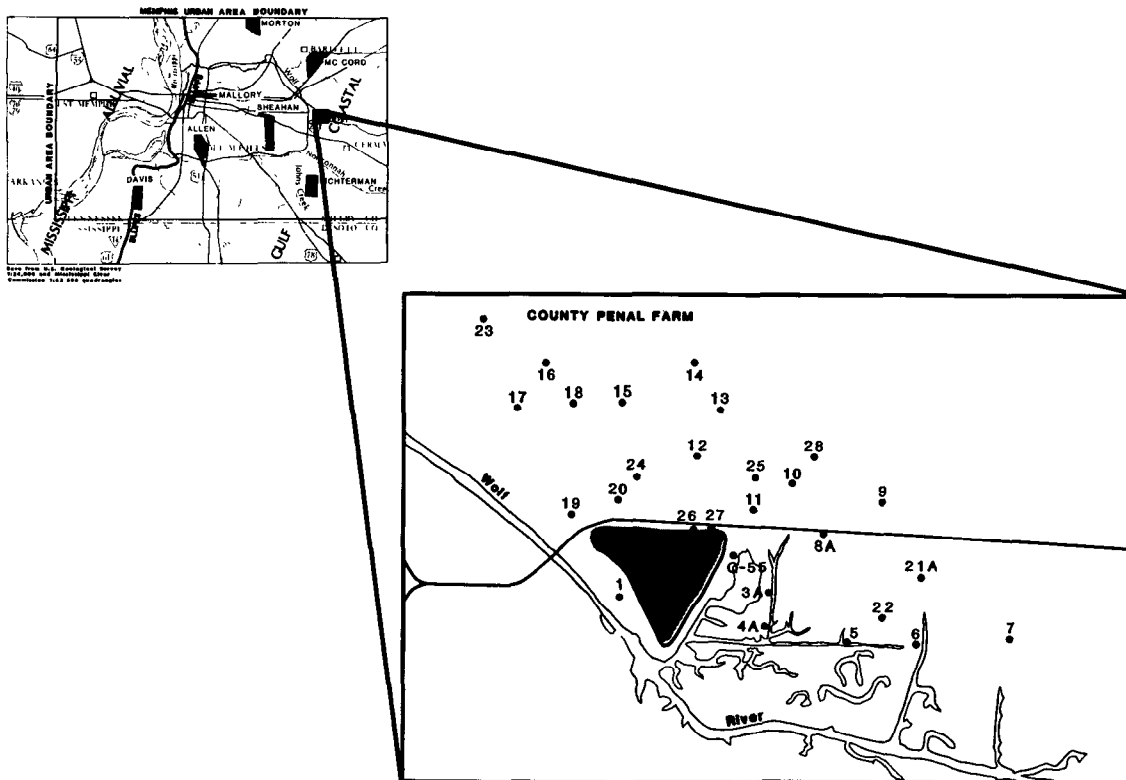


Location of study area in Tennessee.

ASSESSMENT OF LEAKAGE INTO THE MEMPHIS SAND AQUIFER AT THE SHELBY COUNTY LANDFILL NEAR MEMPHIS

The objectives of this investigation are to determine the potential for leakage from the alluvial aquifer and to evaluate the effect any leakage would have on the water quality of the underlying Memphis Sand aquifer. The primary source of drinking water for the City of Memphis is the Memphis Sand aquifer, supplying about 196 Mgal/d to the nearly one million residents of the city and Shelby County. Protection of the aquifer is of high priority to the city and county managers. This study is conducted in cooperation with the Shelby County Department of Public Works and the Tennessee Division of Solid Waste Management of the TDHE.

Thirty-six wells have been constructed in the landfill area east of the city. Thirty wells were completed in the alluvial aquifer, four wells in the confining unit, and 2 wells in the underlying Memphis Sand. Water levels have been measured at all wells and the water-table configuration has been mapped. Low-flow stream measurements have been conducted on the Wolf River on two occasions. These data and a depression in the water-table surface north of the existing landfill indicate that vertical leakage of water from the alluvial aquifer may be occurring down to the underlying Memphis Sand. Water-quality samples have been collected at 10 shallow wells around and downgradient of the landfill. The analyses will identify the presence of any leachate migrating from the landfill into the alluvial aquifer. The project leader is Mike Bradley, geologist.

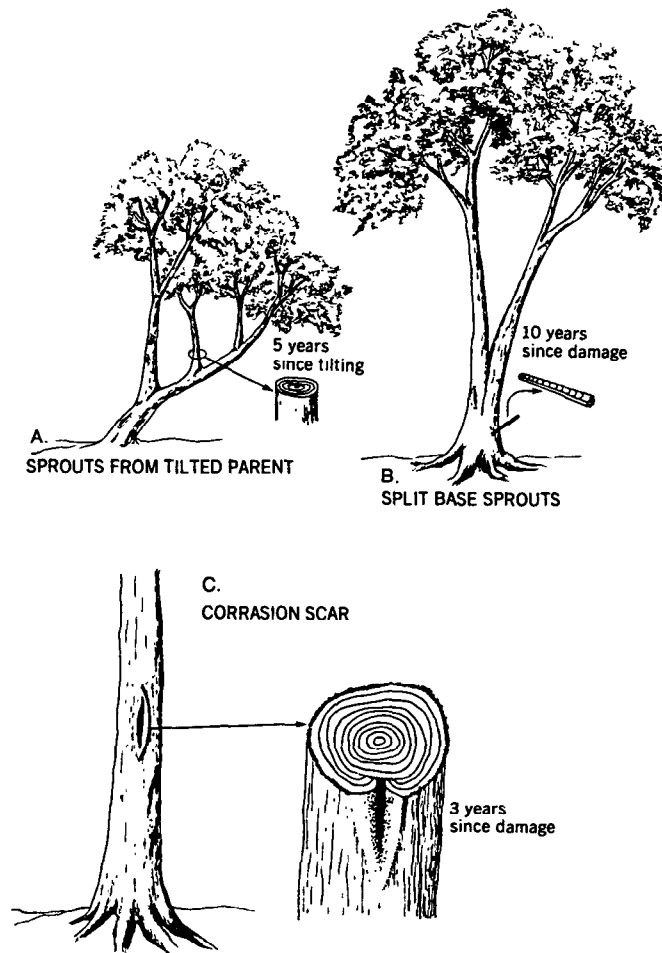


**Shelby County Landfill area
and location of well sites.**

FLOOD-FREQUENCY INVESTIGATIONS AT UNGAGED STREAMS UTILIZING BOTANICAL TECHNIQUES

The objectives of this study by Dr. Cliff R. Hupp, project leader, are to substantiate the value of botanical paleoflood information in extending flood records, in reducing standard error, and, in particular, in developing flood-frequency curves for ungaged basins.

Four to six streams will be selected for intensive study considering existent mature woody vegetation, basin geomorphic characteristics, feasibility for regional flood analyses to establish a short reasonably accurate record, and the relative need for more accurate flood-frequency estimation. At least one of these streams selected will be gaged to define long-term streamflow records and will serve as a control to test the results. The project is financed from federal funds provided by the Office of Surface Water of the USGS.



Botanical evidence of floods.

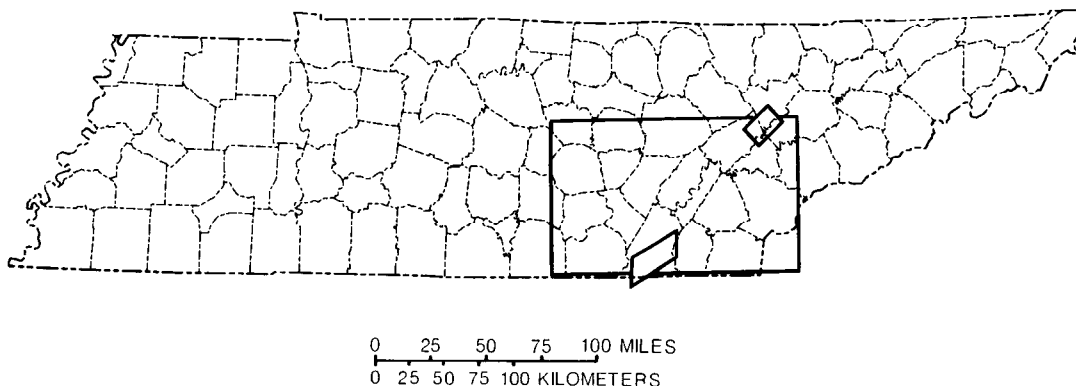
SIDE-LOOKING AIRBORNE RADAR DATA FOR USE IN ESTIMATING SUSCEPTIBILITY FOR GROUND-WATER CONTAMINATION

The objective of this project is to test the usefulness of remote-sensing data, particularly side-looking airborne radar, for mapping ground-water pollution susceptibility in the Valley and Ridge physiographic province of East Tennessee.

Interpretation of ground-truth data and supporting data collected by E.F. Hollyday (hydrologist), project chief, indicates the presence of at least two generalized hydrologic environments having different pollution susceptibility characteristics. The mudstone, siltstone, and calcareous shale in the valleys and sandstone and siltstone in the narrow ridges contain water in fractures in the upper 100 feet of rock, as well as in intergranular openings in 5 to 30 feet of the overlying saturated clay-rich saprolite. Pollutants are free to infiltrate directly to the shallow water table and move laterally a few tens or hundreds of feet per year. These discharge to streams several tens to several hundreds of feet from the source. Clays are capable of adsorbing a large percentage of most radionuclides and trace metals.

In contrast, the dolomite and limestone in the broad, dissected ridges contain water in solution-enlarged openings in the bedrock and in intergranular openings in the 5 to 300 feet of the overlying, mostly-unsaturated regolith. Given enough time, pollutants are free to infiltrate directly to the deep water table and move laterally at rates up to 1/4 mile per day in occasional solution openings in the upper part of bedrock to discharge to streams several hundreds to several thousands of feet from the source.

A report has been written on radar data processing in support of this investigation, and work is underway to correlate the remote-sensing data with the hydrogeologic environments in order to use the remote-sensing data base for mapping pollution susceptibility. The project is supported from federal funds from the USGS headquarters in Reston, Va.



**Location of radar test site in East Tennessee showing the 2°
quadrangle covered by a radar mosaic and two smaller
sites covered by digital radar data.**

OTHER ACTIVITIES

COMPUTER UNIT AND CAPABILITIES

The Tennessee District continued to improve and expand its computer capabilities in support of its programs and cooperators. During 1986, the following milestones were accomplished:

1. Acquisition of additional hardware and software to improve the District's graphic production capabilities.
2. Installation of software in support of the real-time network operated by the USGS for the Nashville Corps of Engineers (36 stations).
3. Computer links to allow staff of the Department of Energy at Oak Ridge and the Office of Water Management of the TDHE to communicate directly with the USGS computers.
4. Develop plans for further enhancement of the on-site system through upgrading of the existing minicomputer, acquisition of microcomputers, and procurement of software and hardware for an on-site geographic information system.

Bill Barron, engineer, is the site manager for the USGS Prime computer facilities.

REGIONAL PUBLICATIONS CENTER

The results of the USGS projects and investigations are published in several formats and series of reports: Professional Papers, Water-Supply Papers, Water-Resources Investigations Reports, Open-File Reports, and in various outside journals and symposium proceedings. In calendar year 1986, the Tennessee Regional Publication Center prepared for publication 1 Professional Paper, 1 Water-Supply Paper, 22 Water-Resources Investigations Reports, 4 journal articles and 4 articles for symposia proceedings.

In addition to handling the Tennessee District's publication requirements, the Publication Center acts as the Regional Clearinghouse for graphics preparation needed by other Southeastern Region Districts. The printing contract held by the Tennessee District makes possible the rapid printing of Tennessee and other Southeastern Region Districts' reports. Barbara Balthrop is the Chief of Tennessee's Southeastern Region Cartographic Clearinghouse.

RECENT PUBLICATIONS

- Bingham, R.H., 1986, Regionalization of low-flow characteristics of Tennessee streams, WRIR 85-4191.
- Bingham, R.H., 1986, Regionalization of winter low-flow characteristics of Tennessee streams, WRIR 86-4007.
- Bingham, R.H., and Gamble, C.R., 1986, Floods during the summer of 1982 in central and east Tennessee, WRIR 84-4365.
- Bradfield, A.D., 1986, Benthic invertebrate population characteristics as affected by water quality in coal-bearing regions of Tennessee, WRIR 85-4227.
- Bradfield, A.D., 1986, Evaluation of coal-mining impacts using numerical classification of benthic invertebrate data from streams draining a heavily mined basin in eastern Tennessee, WRIR 85-4289.
- Bradley, M.W., 1986, Preliminary evaluation of the Highland Rim aquifer system in Tennessee for receiving injected wastes, WRIR 85-4252.
- Bradley, M.W., 1986, Preliminary evaluation of the Knox Group in Tennessee for receiving injected wastes, WRIR 85-4304.
- Brahana, J.V., and Bradley, M.W., 1986, Preliminary delineation and description of the regional aquifers of Tennessee--the Central Basin aquifer system: WRIR 82-4002.
- Brahana, J.V., and Bradley, M.W., 1986, Preliminary delineation and description of the regional aquifers of Tennessee--Highland Rim aquifer system, WRIR 82-4054.
- Brahana, J.V., Bradley, M.W., Macy, J.A., and Mulderink, Dolores, 1986, Preliminary delineation and description of the regional aquifers of Tennessee--Basal sandstone west of the Valley and Ridge province, WRIR 82-762.
- Brahana, J.V., Bradley, M.W., and Mulderink, Dolores, 1986, Preliminary delineation and description of the regional aquifers of Tennessee--Tertiary aquifer system, WRIR 83-4011.
- Brahana, J.V., Macy, J.A., Mulderink, Dolores, and Zemo, Dawn, 1986, Preliminary Delineation and Description of the Regional Aquifers of Tennessee--Cumberland Plateau aquifer system, WRIR 82-338.
- Brahana, J.V., Mulderink, Dolores, and Bradley, M.W., 1986, Preliminary delineation and description of the regional aquifers of Tennessee--the Cretaceous aquifer system of West Tennessee, WRIR 83-4039.
- Brahana, J.V., Mulderink, Dolores, Macy, J.A., and Bradley, M.W. 1986, Preliminary delineation and description of the regional aquifers of Tennessee--the East Tennessee aquifer system, WRIR 82-4091.

- Evaldi, R.D., and Lewis, J.G., 1986, Water-quality appraisal of NASQAN stations below impoundments, eastern Tennessee, WRIR 85-4171.
- Graham, D.D., and Parks, W.S., 1986, Potential for leakage among principal aquifers in the Memphis area, Tennessee, WRIR 85-4295.
- Hoos, A.B., and Bailey, Z.C., 1986, Reconnaissance of surficial geology, regolith thickness, and configuration of the bedrock surface in Bear Creek and Union Valleys, near Oak Ridge, Tennessee, WRIR 86-4165.
- Lowery, J.F., Counts, P.H., Edmiston, H.L., and Edwards, F.D., 1986, Water resources data, Tennessee, water year 1985, TN-85-1.
- Mulderink, Dolores, and Bradley, M.W., 1986, Preliminary evaluation of the basal sandstone in Tennessee for receiving injected wastes, WRIR 85-4303.
- Neely, B.L., and Bingham, R.H., 1986, Investigation of the need for discharge adjustments for unsteady flow at selected gaging stations on streams in Tennessee, WRIR 84-4144.
- Robbins, C.H., 1986, Techniques for simulating flood hydrographs and estimating flood volumes for ungaged basins in central Tennessee, WRIR 86-4192.
- Robbins, C.H., Gamble, C.R., and Bingham, R.H., 1986, Flood of September 12-12, 1982 in Gibson, Carroll, and Madison Counties, western Tennessee (1 sheet), WRIR 85-4037.
- Tucci, Patrick, 1986, Ground-water flow in Melton Valley, Oak Ridge Reservation, Roane County, Tennessee--Preliminary model analysis, WRIR 85-4221.

WATER-RESOURCES INFORMATION CENTER

One of the principal missions of the USGS is to provide accurate and timely water resources data to users in Tennessee. The Tennessee District is one of a network of water resources information centers as part of the USGS National Water Data Exchange (NAWDEX). The District provides printed reports, published data, statistical analyses, and certain preliminary information on the monitoring networks and areal investigations. An average of 100 information requests are received monthly. The Tennessee District policy is to reply to all requests within a maximum of 5 working days unless special circumstances warrant a delay. Nominal charges are billed for printed publications and extensive data retrievals to other than non-profit organizations. Jerry Lowery, hydrologist, is the principal contact for hydrologic information (615/736-5424).

Requests for topographic and geologic maps are often received by the District. Although these maps are not stocked for distribution, copies are available in our library for inspection. The Tennessee Valley Authority, (615/751-6277 Chattanooga; 615/632-2717 Knoxville) and the Tennessee State Geologist (742-6705) sell topographic and geologic maps for a nominal fee. Maps can also be ordered directly from the U.S. Geological Survey, Map Distribution, Box 25285, Federal Center, Denver, CO 80225 (303/236-7477).

ADMINISTRATIVE SERVICES UNIT

Administrative services to the Tennessee District headquarters and field offices are provided by a unit of four employees directed by Nancy Tedder, Administrative Officer. Personnel management, payroll, training, procurement, inventory control, budgeting, and accounting services are efficiently handled through computerized systems.

APPENDIX 1

Active Recording Surface-Water Stations in Tennessee as of 10/1/86

Station		Drainage			Date
No.	Name	area	Lat	Long	began
		(mi ²)			
CUMBERLAND RIVER BASIN					
03407908	New River at Cordell	198	362010	842706	1977
03408500	New River at New River	382	362308	843317	1934
03409500	Clear Fork near Robbins	272	362318	843749	1930
03410210	South Fork Cumberland River	806	362838	844009	1983
	at Leatherwood Ford				
03414500	E Fork Obey River nr Jamestown	202	362458	850135	1942
03416000	Wolf River near Byrdstown	106	363337	850423	1942
03417500	Cumberland River at Celina	7,307	363315	853052	1922
03417600	Cumberland River at Penitentiary	7,440	362621	853542	
	Branch				
03418070	Roaring River above Gainsboro	210	362104	853245	1974
03421000	Collins River near McMinnville	640	354232	854346	1925
03422500	Caney Fork near Rock Island	1,678	354826	853744	1911
03425000	Cumberland River at Carthage	10,690	361453	855719	1922
03425100	Cumberland River at Rome	10,866	361550	860410	
03426800	East Fork Stones River at Woodbury	39.1	354941	860436	1962
03427500	East Fork Stones River nr Lascassas	262	355506	862002	1951
03428200	W Fork Stones River at Murfreesboro	128	355410	862548	1972-82, 1986
03428500	West Fork Stones River near Smyrna	237	355625	862754	1965
03430118	McCrary Cr at Ironwood Dr, at Donelson	7.31	360908	863901	1977
03431062	Mill Creek trib. at Glenrose Ave.,	1.17	360702	864337	1977
	at Woodbine				
03431490	Pages Branch at Avondale	2.01	361222	864624	1977
03431517	Cummings Branch at Lickton	2.40	361825	864800	1975
03431700	Richland Creek at Charlotte Avenue,	24.3	360904	865116	1964
	at Nashville.				
03431800	Sycamore Creek near Ashland City	97.2	361912	870304	1961
03432350	Harpeth River at Franklin	191	355514	865156	1974
03433500	Harpeth River at Bellevue	408	360316	865542	1920
03434500	Harpeth River near Kingston Springs	681	360719	870556	1925
03435000	Cumberland River below Cheatham Dam	14,163	361926	871332	1954
03435008	Cumberland River nr Clarksville	14,421	362956	871948	
03435770	Sulphur Fork Red River abv Springfield	65.6	363047	865144	1975
03436000	Sulphur Fork Red River near Adams	186	363055	850332	1939
03436100	Red River at Port Royal	935	363317	870831	1961
03436690	Yellow Creek at Ellis Mills	103	361839	873315	1980

APPENDIX 1--Continued

Active Recording Surface-Water Stations in Tennessee as of 10/1/86

Station No.	Name	Drainage	Lat	Long	Date began
		area (mi ²)			
TENNESSEE RIVER BASIN					
03455000	French Broad River near Newport	1,858	355854	830940	1900
03461200	Cosby Creek above Cosby	10.2	354658	831303	1966
03465500	Nolichucky River at Embreeville	805	361035	822727	1920
03466228	Sinking Creek at Afton	13.7	361155	824431	1977
03470500	French Broad River near Knoxville	5,101	355730	834626	1946
03487550	Reedy Creek at Orebank	36.3	363342	822736	1963
03490500	Holston River at Surgoinsville	2,874	362819	825050	1941
03491000	Big Creek near Rogersville	47.3	362534	825707	1957
03491300	Beech Creek at Kepler	47.0	362406	825309	1965
03495500	Holston River near Knoxville	3,747	360056	834954	1930
03497300	Little River above Townsend	106	353952	834241	1963
03498500	Little River near Maryville	269	354710	835304	1951
03498860	Little River at Alcoa Water Plant nr Maryville	301	354832	835545	
03528000	Clinch River above Tazewell	1,474	362530	832354	1918
03535000	Bullrun Creek near Halls Crossroads	68.5	360652	835916	1957
03535912	Clinch River at Melton Hill Dam	3,343	355307	841803	1936
03536380	Whiteoak Creek near Wheat				1987
03536450	First Creek near Oak Ridge				1987
03536550	Whiteoak Creek bl Melton Valley Drive near Oak Ridge	3.28	355510	841902	1985
03537100	Melton Branch near Melton Hill, nr Oak Ridge	.52	355459	841753	1985
03538225	Poplar Creek near Oak Ridge	82.5	355955	842023	1960
03538250	East Fork Poplar Creek near Oak Ridge	19.5	355758	842130	1960
035382672	Bear Creek trib. abv Bear Creek Road near Wheat	.30	355641	841927	1986
035382673	Bear Creek near Wheat	3.20	355639	841927	1986
035382677	Bear Creek tributary near Wheat	.14	355628	841955	1987
03538270	Bear Creek at State Hwy 95 near Oak Ridge		355617	842029	1985
03538272	Bear Creek trib. at Hwy 95 near Wheat	.14	355626	842032	1986
03538273	Bear creek at Pine Ridge near Wheat	5.00	355632	842037	1986
03539800	Obed River near Lancing	518	360453	844015	1957-68, 1973
03540500	Emory River at Oakdale	764	355859	843329	1927

APPENDIX 1--Continued

Active Recording Surface-Water Stations in Tennessee as of 10/1/86

Station No.	Name	Drainage area (mi ²)	Lat	Long	Date began
TENNESSEE RIVER BASIN--continued					
03543500	Sewee Creek near Decatur	117	353453	844453	1934
03560500	Davis Mill Creek at Copperhill	5.16	345943	842256	1940-41, 1948-78, 1986
03563000	Ocoee River at Emf	524	350548	843207	1913
03564500	Ocoee River at Parksville	595	350548	843915	1911-16, 1921
03565300	South Chestuee Creek near Benton	31.8	351002	844259	1957
03565500	Oostanaula Creek near Sanford	57.0	351939	844219	1954
03566000	Hiwassee River at Charleston	2,298	351716	844507	1898-1903, 1914-40, 1963
03566420	Wolftever Creek near Ooltewah	18.8	350343	840359	1964
03567500	South Chickamauga Creek nr Chickamauga	428	350051	851235	1928-78, 1980
03567900	Tennessee River at Citico Bar at Chattanooga	21,372	350319	861704	--
03568000	Tennessee River at Chattanooga	21,380	350512	851643	1874
03571000	Sequatchie River near Whitwell	402	351222	852948	1920
03571850	Tennessee River at South Pittsburg	22,640	350041	854151	1930
03572000	Tennessee River at Widows Bar, near Brickport, Ala.	22,820	345302	854506	
03578000	Elk River near Pelham	65.6	351748	855212	1951
03584500	Elk River near Prospect	1,784	350139	865652	1904-08, 1919
03588000	Shoal Creek at Lawrenceburg	55.4	351440	872102	1932-34, 1967
03588400	Chisholm Creek at Westpoint	43.0	350804	873145	1962
03588500	Shoal Creek at Iron City	348	350127	873444	1925
03593005	Tennessee River at Pickwick Landing Dam	32,820	350354	881508	1975
03593500	Tennessee River at Savannah	33,140	351329	881526	1930
03596000	Duck River below Manchester	107	352815	860718	1934
03598000	Duck River near Shelbyville	481	352849	862957	1934
03600088	Carters Creek at Butler Rd at Carters Creek	20.1	354302	865945	1986
03600500	Big Bigby Creek at Sandy Hook	17.5	352919	871359	1953

APPENDIX 1--Continued

Active Recording Surface-Water Stations in Tennessee as of 10/1/86

Station No.	Name	Drainage area (mi ²)	Lat	Long	Date began
TENNESSEE RIVER BASIN--continued					
03602500	Piney River at Vernon	193	355216	873005	1925
03603000	Duck River above Hurricane Mills	2,557	355548	874435	1925
03604000	Buffalo River near Flat Woods	447	352945	874958	1920
03604500	Buffalo River near Lobelville	707	354846	874751	1927
03605555	Trace Creek above Denver	31.9	360308	875427	1963
03606500	Big Sandy River at Bruceton	205	360219	881342	1929
07024300	Beaver Creek at Huntingdon	55.5	355956	882601	1962
OBION RIVER BASIN					
07024500	South Fork Obion River nr Greenfield	383	360705	884839	1929
*07026000	Obion River at Obion	1,852	361504	891133	1929-58, 1966
*07026370	North Reelfoot Creek at State Hwy 22 nr Clayton	56.3	362750	891513	1980-83 1984
*07026400	South Reelfoot Creek near Clayton	38.6	362620	891537	1984
*07026640	Running Slough near Ledford, Ky.	10.8	363228	891859	1982-83, 1984
07026690	Reelfoot Lake near Phillipy	240	362759	892056	1984
07027000	Reelfoot Lake near Tiptonville	240	362109	892507	1940
07027010	Running Reelfoot Bayou near Owl City	247	361953	892402	1982-83, 1984
HATCHIE RIVER BASIN					
*07029500	Hatchie River at Bolivar	1,480	361631	885836	1929
*07030100	Cane Creek at Ripley	33.9	354525	893305	1958-62, 1986
*07030137	Cane Creek at Three Point	79.8	354136	894143	1986
LOOSAHATCHIE RIVER BASIN					
07030240	Loosahatchie River near Arlington	262	351837	893823	1969
070303573	Loosahatchie River at North Walkins Street, at Memphis	728	351515	900134	1986

APPENDIX 1--Continued

Active Recording Surface-Water Stations in Tennessee as of 10/1/86

Station No.	Name	Drainage area (mi ²)	Lat	Long	Date began
WOLF RIVER BASIN					
07031660	Wolf River at Walnut Grove Road, at Memphis	709	350758	895118	1986
07031694	Harrington Creek trib. at Elmore Park Road, at Bartlett	.33	351208	895126	1975
07031697	Harrington Creek trib. at Stage Road, at Bartlett	.91	351220	895305	1975
07031740	Wolf River at Hollywood St., at Memphis	788	351116	895832	1986
NONCONNAH CREEK BASIN					
07032200	Nonconnah Creek near Germantown	68.2	350259	894908	1969
07032251	Nonconnah Creek at Rivergate Road, at Memphis	182	350432	900355	1986

Active Surface-Water Low-Flow Stations in Tennessee as of 4-7-87

[*Also crest-stage gage]

CUMBERLAND RIVER BASIN					
03418935	Beaverdam Creek at Latana Road near Bellview	17.0	354407	851143	1979-81, 1983
03418950	Bee Creek near Herbert Domain	59.6	354624	851358	1985
03420116	Rocky River at Rocky River Road at Riverview	72.0	354204	853440	1979-81, 1983
03420470	North Prong Barren Fork at Oak Grove	29.8	354240	855725	1983
03420720	Hickory Creek near Viola	58.2	353432	855102	1954, 1979-81, 1983
03421150	Charles Creek at Daylight	13.8	354432	855112	1983
03432334	Harpeth River at Interstate Hwy 65 near Franklin	168	355332	864946	1975, 1986
*03432470	Murfrees Fork above Burwood	7.43	354858	865720	1975, 1986
03432474	West Prong Murfrees Fork near Burwood	4.93	354940	865755	1975, 1986
03432495	Murfrees Fork above Leipers Fork	26.3	355157	865738	1975, 1986
*03432925	Little Harpeth River at Granny White Pike at Brentwood	22.0	360130	864909	1978
03433660	South Harpeth River at Fernvale	27.6	355715	870443	1974-75, 1978
03433902	Big Turnbull Creek near Liberty Hill	12.5	355759	871156	1981, 1983
03434620	Town Branch near Charlotte	8.33	361044	871815	1974-76, 1978
*034351113	Honey Run Creek below Cross Plains	25.8	363231	864214	1985
03435320	Red River at Adams	594	363537	870333	1937, 1983

APPENDIX 1--Continued

Active Surface-Water Low-Flow Stations in Tennessee as of 4-7-87--Continued

Station No.	Name	Drainage	Lat	Long	Date began
		area (mi ²)			
TENNESSEE RIVER BASIN					
03455050	Clear Creek at Parrotville	-	350036	830545	1986
034611996	Crying Creek above Cosby	2.94	354654	831301	1983
03461450	English Creek near Newport	9.74	355447	831242	1983
03465603	Little Cherokee Creek at Garber	-	361256	822803	1986
03465620	Clark Creek at Graham Mill	-	361004	823227	1986
*03465780	Clear Fork near Fairview	10.5	361933	823347	1983
03465800	Muddy Fork at Fairview	9.86	361852	823238	1955-73, 1986
03466256	College Creek at Tusculum	-	360955	824517	1986
*03466295	Camp Creek at Camp Creek	9.99	360539	824537	1961, 1983-86
*03467993	Cedar Creek near Valley Home	-	360803	831847	1986
*03467998	Sinking Fork at White Pine	-	360721	831744	1986
03469610	Cove Creek at Hatchertown	2.64	354347	833743	1983
03476515	Beidleman Creek near Caywood Ford	27.4	363128	820753	1975-81, 1983
*03481600	Corn Creek at Mountain City	5.34	362923	814852	1986
03486313	Sinking Creek at Johnson City	-	361908	821917	1986
03487509	Bear Creek at Sullivan Gardens	-	362823	823550	1986
03487545	Boozy Creek near Orebank	10.8	363424	822444	1966, 1986
03490530	Forgey Creek near Surgoinsville	4.59	362720	825139	1962, 1986
*03494990	Flat Creek at Luttrell	-	361145	834444	1986
03495400	Roseberry Creek at Shipetown	-	360443	834614	1986
03495550	Love Creek at Knoxville	-	360030	835020	1986
*03527800	Big War Creek near Luther	-	362718	831429	1986
03528385	Fall Creek at Licksillet	-	361715	834800	1986
*03528390	Crooked Creek near Maynardville	-	361536	835025	1986
03534927	Bullrun Creek near Luttrell	-	361418	834443	1986
03534975	North Fork Bullrun Creek below Maynardville	-	361347	834918	1986
03534990	Raccoon Creek at Paulette	-	361112	835319	1986
03555882	Barney Creek near Coker Creek	4.29	351429	841904	1983
03556610	Junebug Creek at Reliance	-	351124	843022	1986
03566111	Little South Mouse Creek near Charleston	5.58	351613	844655	1967, 1986
03566200	Brymer Creek near McDonald	9.68	350720	845700	1983
03566253	Greasy Creek at Hopewell	3.12	351217	845311	1979-81, 1983
03582205	Norris Creek below Howell	15.1	351333	863356	1952, 1975, 1978-81, 1983
03593115	Lick Creek near Michie	9.93	350430	882547	1982
03599960	Aenon Creek near Spring Hill	14.2	354339	865420	1986

APPENDIX 1--Continued

Active Surface-Water Low-Flow Stations in Tennessee as of 4-7-87--Continued

Station No.	Name	Drainage area (mi ²)	Lat	Long	Date began
TENNESSEE RIVER BASIN--Continued					
03599965	Rutherford Creek near Spring Hill	39.3	354257	865502	1986
03599970	McCutcheon Creek near Spring Hill	10.2	354339	865527	1986
03599980	Rutherford Creek near Neapolis	58.2	354136	865706	1986
03600085	Carters Creek at Petty Lane near Carters Creek	16.6	354339	865919	1986
03600086	Carters Creek tributary near Carters Creek	2.94	354334	865919	1986
03600093	Carters Creek near Darks Mill	32.7	354125	870033	1960, 1986
03600360	Snow Creek near Sante Fe	11.1	354331	870736	1962-63, 1965, 1986
03600370	Snow Creek near Williamsport	23.2	354141	871118	1944, 1953-54, 1986
03600380	Leipers Creek at Williamsport	37.5	354143	871210	1944, 1953-54, 1986
03601100	Big Bigby Creek at Needmore	48.3	353243	871405	1934, 1969, 1972-73, 1978-81, 1983
03602192	West Piney River near Dickson	21.2	360140	872700	1950-52, 1962-63, 1965, 1979-81, 1983
03602194	West Piney River below State Highway 48 near Dickson	25.7	360043	872633	1981, 1984
03602209	Piney River near Oak Grove	44.1	360036	872638	1984
03602230	Piney River above Pinewood	77.5	355711	872753	1984
03602265	Piney River at Pinewood	150	355437	872804	1984
03604750	Birdsong Creek at Holladay	15.7	355253	880839	1975-78, 1980
03606350	Big Sandy River at Westport	110	355334	881832	1975-78, 1980
OBION RIVER BASIN					
07024310	Rock Creek near Huntingdon	4.51	360023	882717	1986
07024760	Spring Creek near Greenfield	93.4	361124	884553	1955, 1975-78, 1980
07025190	Mud Creek near Sharon	45.6	361559	885005	1958, 1975-78, 1980
07025300	North Fork Obion River at Jones Mill	83.7	362646	882757	1958-61, 1964, 1975-78, 1980
07026090	Cool Springs Branch near Trimble	10.7	361115	891103	1986
07026100	Reeds Creek near Trimble	51.8	361048	891515	1975-78, 1980
07027270	Tar Creek at Oak Grove	16.4	352402	883454	1982
07027280	Jacks Creek at Jacks Creek	17.9	352816	883121	1975-78, 1980

APPENDIX 1--Continued

Active Surface-Water Low-Flow Stations in Tennessee as of 4-7-87--Continued

		Drainage			
Station		area			Date
No.	Name	(mi ²)	Lat	Long	began
HATCHIE RIVER BASIN					
07030160	Indian Creek at Gilt Edge	65.9	353309	894920	1976-78, 1980-81, 1983

Active Crest-Stage Stations in Tennessee as of 4-7-87

[* , Also low-flow station; # , Operated as a continuous-record station]

CUMBERLAND RIVER BASIN

03409000	White Oak Creek at Sunbright	13.5	361438	844014	1934, 1955-82, 1985
03418201	Doe Creek at Gainesboro	5.72	362123	853920	1978
03420360	Mud Creek tributary No. 2 near Summitville	2.28	353610	860133	1967
03420600	Owen Branch near Centertown	4.60	354230	855305	1955
03421200	Charles Creek near McMinnville	31.1	354300	854605	1955
03424900	Mulherrin Creek near Gordonsville	26.9	361128	855711	1982, 1986
03425045	Peyton Creek at Monoville	44.7	361837	855921	1986
03425357	Darwin Branch tributary at Hartsville	.66	362354	860908	1986
03425365	Second Creek near Walnut Grove	3.47	362401	861248	1986
03425500	Spring Creek near Lebanon	35.3	361049	861429	1955-61#, 1962
03425700	Spencer Creek near Lebanon	3.32	361420	862403	1955
03426874	Brawleys Fork below Bradyville	15.4	354444	861014	1983
034269424	Reed Creek near Bradyville	3.52	354444	861231	1983
03428043	Lytle Creek at Sanbyrne Drive at Murfreesboro	17.6	354938	862328	1978
03430400	Mill Creek at Nolensville	12.0	355732	864031	1965
03431000	Mill Creek near Antioch	64.0	360454	864050	1954-61#, 1962-63, 1964-75#, 1976
03431040	Sevenmile Creek at Blackman Road at Nolensville	12.2	360421	864400	1965
03431060	Mill Creek at Thompson Lane, near Woodbine	93.4	360704	864308	1965
03431120	West Fork Browns Creek at General Bates Drive, at Nashville	3.30	360629	864707	1965
03431240	East Fork Browns Creek at Baird-Ward Printing Company, at Nashville	1.58	360633	864600	1965
03431340	Browns Creek at Factory Street, at Nashville	13.2	360826	464531	1965

APPENDIX 1--Continued

Active Crest-Stage Stations in Tennessee as of 4-7-87

Station No.	Name	Drainage	Lat	Long	Date began
		area (mi ²)			
CUMBERLAND RIVER BASIN--Continued					
03431550	Earthman Fork at Whites Creek	6.29	361555	864951	1965
03431573	Ewing Creek at Richmond Hill Drive at Parkwood	2.17	361350	864628	1976
03431575	Ewing Creek at Brick Church Pike at Parkwood	3.02	361358	864654	1976
03431578	Ewing Creek at Gwynwood Drive near Jordonia	9.98	361358	864732	1976
03431581	Ewing Creek below Knight Road, near Bordeaux	13.3	361355	864814	1976
03431677	Sugartree Creek at YMCA Access Road, at Green Hills	1.51	360613	864912	1976
03431679	Sugartree Creek at Abbott Martin Road, at Green Hills	2.19	360623	864917	1976
03431795	Bednigo Branch trib. at Chestnut Grove	0.47	362510	865411	1986
*03432470	Murfrees Fork above Burwood	7.43	354858	865720	1986
*03432925	Little Harpeth River at Granny White Pike, at Brentwood	22.0	360130	864909	1978
03434590	Jones Creek near Burns	13.3	360615	871905	1984
03434616	Hall Branch near Charlotte	0.50	361148	872030	1984
034350021	Bartons Creek near Cumberland Furnace	22.29	361502	872000	1984
0343500213	Bartons Creek tributary near Stayton	0.51	361519	871912	1984
03435030	Red River near Portland	15.1	363324	863414	1966-75, 1976
*034351113	Honey Run Creek below Cross Plains	25.8	363231	864214	1986
03435930	Spring Creek tributary near Cedar Hill	1.40	363208	865926	1986
03436700	Yellow Creek near Shiloh	124	362055	873220	1957-80#, 1982
TENNESSEE RIVER BASIN					
03461230	Caney Creek near Cosby	1.62	354703	831211	1967
03465607	Cherokee Creek near Embreeville	22.9	361224	822923	1984
*03465780	Clear Fork near Fairview	10.5	361933	823347	1983
*03466295	Camp Creek at Camp Creek	9.99	360539	824537	1983
03466865	Roaring Fork north of Greeneville	16.1	361245	825015	1983
03466890	Lick Creek near Albany	172	361454	825534	1984
03467480	Bent Creek at Taylor Gap	2.18	361408	830641	1986
03467992	Carter Branch near White Pine	-	360705	831855	1986
*03467993	Cedar Creek near Valley Home	-	360803	831847	1986
*03467998	Sinking Fork at White Pine	-	360721	831744	1986

APPENDIX 1--Continued

Active Crest-Stage Stations in Tennessee as of 4-7-87--Continued

Station No.	Name	Drainage		Lat	Long	Date began
		area (mi ²)				
03470215	Dumplin Creek at Mt. Hareb	-		360459	832551	1986
03476960	Indian Creek at Childress	6.79		362538	821554	1983
03478615	Evans Creek near Blountville	2.50		363119	821812	1983
*03481600	Corn Creek at Mountain City	5.34		362923	814852	1959-61, 1963
03487507	Horse Creek at Sullivan Gardens	26.0		362813	823552	1983
03490522	Forgey Creek at Zion Hill	-		362912	825308	1986
03491490	Dodson Creek tributary near Rogersville	0.32		362119	825703	1983
03491540	Robertson Creek near Persia	14.6		362024	830227	1986
03494714	Dry Land Creek trib. near New Market	-		360333	833413	1986
*03494990	Flat Creek at Luttrell	-		361145	834444	1986
03519610	Baker Creek tributary near Binfield	2.10		354156	840246	1966-77, 1979
03519640	Baker Creek near Greenback	16.0		354021	864628	1965-75#, 1976
*03527800	Big War Creek at Luther	-		362718	831429	1986
*03528390	Crooked Creek near Maynardville	-		361556	835025	1986
03534000	Coal Creek at Lake City	24.5		361314	840927	1932-34#, 1955
03535180	Willow Fork near Halls Crossroads	3.23		360559	835427	1967
03555900	Coker Creek near Ironsburg	22.4		351305	842028	1983
03566599	North Chickamauga Creek at Greens Mill, near Hixson	99.5		351030	851340	1925, 1944, 1953-56, 1980
03569168	Stringers Branch at Leawood Drive, at Red Bank	1.54		350700	851728	1980
03571500	Little Sequatchie River at Sequatchie	116		350747	853510	1925, 1929-30, 1932-34#, 1944, 1951-54, 1965, 1979
03571730	Standifer Branch at Jasper	15.3		350422	853656	1982
03571800	Battle Creek near Monteagle	50.4		350803	854615	1955
03583200	Chicken Creek at McBurg	7.66		351103	864847	1955
03583300	Richland Creek near Cornersville	47.5		351910	865220	1962-68#, 1969
035944242	Owl Creek at Lexington	2.50		353826	882213	1984
03597300	Wartrace Creek above Bell Buckle	4.99		353745	862122	1966
03599200	East Rock Creek at Farmington	43.1		353005	864250	1954
03602170	West Piney River at Hwy 70 nr Dickson	2.16		360521	872812	1984
03604070	Coon Creek tributary near Hohenwald	0.51		353407	874002	1967
03604080	Hugh Hollow Branch near Hohenwald	1.52		353459	874036	1967
03604090	Coon Creek above Chop Hollow, near Hohenwald	6.02		353519	874109	1967
03604580	Blue Creek near New Hope	13.2		360352	873858	1984
03604595	Little Blue Creek trib. near Gorman	0.62		361944	874213	1984
03605880	Cane Creek at Stewart	4.12		361909	875021	1984

APPENDIX 1--Continued

Active Crest-Stage Stations in Tennessee as of 4-7-87--Continued

Station		Drainage			Date
No.	Name	area	Lat	Long	began
		(mi ²)			
OBION RIVER BASIN					
07024225	Neil Ditch near Henry	4.07	361019	882333	1984
07024370	Little Reedy Creek near Huntingdon	0.91	355544	882950	1984
07029090	Lewis Creek near Dyersburg	25.5	360314	892142	1955-78, 1980-83, 1985

APPENDIX 2

Active ground-water network in Tennessee as of 2/2/85

Station No.	Local well No.	Lat	Long	Date began
RECORDER--60-MINUTE PUNCH INTERVAL				
361738082132900	Ct:H-1	361738	821329	1964
360835086441100	Dv:L-10	360835	864411	1985
360429087233602	Di:F-19	360429	872336	1960
350234085181200	Hm:G-36	350234	851812	1981
351428085003600	Hm:O-15	351428	850036	1975
360020087573300	Hs:H-1	360020	875733	1962
353839089493500	Ld:F-4	353839	894935	1966
354158089384300	Ld:G-12	354158	893843	1980
354357089271701	Ld:J-5	354357	892717	1982
354552089455900	Ld:L-2	354552	894559	1980
355251089350500	Ld:S-2	355251	893505	1980
352610087182401	Ln:R-014	352610	871824	1985
360543084343101	Mg:F-5	360543	843431	1984
360521085432601	Pm:C-1	360521	854326	1968
353922083345600	Sv:E-2	353922	833456	1979
350514089553700	Sh:K-75	350514	895537	1948
351435090005200	Sh:O-1	351435	900052	1940
351320089535800	Sh:P-1	351320	895358	1940
350735089593300	Sh:P-76	350735	895933	1928
350900089482300	Sh:Q-1	350900	894823	1940
350958090173800	Ar:C-1	350958	901738	1983
350344090130000	Ar:H-2	350344	901300	1983
351349090062800	Ar:O-1	351349	900628	1983
TAPE DOWN				
350503084505000	Br:E-1	350503	845050	1950-1955, 1964
360200089280100	Dy:H-1	360200	892801	1955
352226089330101	Fa:R-1	352226	893301	1949
354223088380200	Md:N-1	354223	883802	1949
352112089571300	Sh:U-2	352112	895713	1953
354823086104400	Cn:D-1	354823	861044	1967
360147089230700	Dy:H-7	360147	892307	1954
352226089330102	Fa:R-2	352226	893301	1949
352112089571200	Sh:U-1	352112	895712	1946
355505086541100	Wm:M-1	355505	865411	1950

APPENDIX 3

List of water-quality and suspended-sediment stations

[Q, chemical; B, bacteriological; S, sediment]

Station No.	Name	Drainage area (mi ²)	Lat	Long	Date began	Data type
CUMBERLAND RIVER BASIN						
03418420	Cumberland River below Cordell Hull Dam	8,095	361712	855627	1980	Q
03425000	Cumberland River at Carthage	10,690	361453	855719	1975	Q,B,S
03426310	Cumberland River at Old Hickory Dam (Tailwater)	11,673			1979	Q
03427500	East Fork Stones River nr Lascassas	262	355506	862002	1975	Q
03428200	W Fork Stones River at Murfreesboro	177	355410	862548	1986	Q
03428500	West Fork Stones River near Smyrna	237	355625	862754	1965	Q
TENNESSEE RIVER BASIN						
03495500	Holston River near Knoxville	3,747	360056	834954	1965, 1977	Q,B,S
03497300	Little River above Townsend	106	353952	834241	1964-82, 1986	Q,B,S
03535912	Clinch River at Melton Hill Dam	3,343	355307	841803	1973	Q,B,S
03593005	Tennessee River at Pickwick Landing Dam	32,820	350354	881508	1975	Q,B,S
03600085	Carters Creek at Petty Lane near Carters Creek	16.6	354340	865920	1986	Q,B,S
03600086	Carters Creek Trib near Carters Creek	2.94	354334	865920	1986	Q,B,S
03600088	Carters Creek at Butler Road at Carters Creek	20.1	354303	865945	1986	Q,B,S
03604000	Buffalo River near Flat Woods	447	352945	874958	1964	Q,B,S
OBION RIVER BASIN						
07026000	Obion River at Obion	1,852	361504	891133	1975	Q,B,S
07026370	North Reelfoot Creek at State Hwy 22 nr Clayton	56.3	362750	891513	1980-83, 1984	S
07026400	South Reelfoot Creek near Clayton	38.6	362620	891537	1964, 1983	S
07026640	Running Slough near Ledford, Ky.	10.8	363228	891859	1982-83, 1984	S
HATCHIE RIVER BASIN						
07029500	Hatchie River at Bolivar	1,480	361631	885836	1964, 1968, 1977	Q,B,S
07030100	Cane Creek at Ripley	33.9	354525	893305	1986	S
07030137	Cane Creek at Three Point	79.8	354136	894143	1986	S

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