672SERBSF10,638

672SERBSF10,638

Site Name (Subject):	SPANN PROPERTY
Site ID (Document ID):	NCD986180917
Document Name (DocType):	Preliminary Assessment/Site Inspection (PA/SI)
Report Segment:	
Description:	Site Inspection
Date of Document:	8/25/1994
Date Received:	
Box: *Enter SF and # with no spaces*	SF10,638
Access Level:	PUBLIC
Division:	WASTE MANAGEMENT
Section:	SUPERFUND
Program (Document Group):	SERB (SERB)
Document Category:	FACILITY

Print Report for Record | Go to New Blank Record | Go to New Record - (default to last record values) | Delete Record

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Solid Waste Management

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
William L. Meyer, Director

DEHNR

August 25, 1994

Ms. Cynthia Gurley
EPA NC CERCLA Project Officer
EPA Region IV Waste Division
345 Courtland Street, NE
Atlanta, Georgia 30365

Subject: Site Inspection
Spann Property
Hendersonville, Henderson County, NC
NCD 986 180 917

Dear Ms. Gurley:

The enclosed report summarizes the results of a Site Inspection of the Spann Property on US 25 North of Hendersonville in Henderson County, North Carolina, as completed by North Carolina Superfund Section. Results of the SI and the previously completed Preliminary Assessment both indicate the potential presence of polychlorinated biphenyls (PCBs), tetrachloroethene, and toluene at the site. Circumstantial evidence supporting this conclusion includes solid waste transport and disposal records released by the General Electric Company in East Flat Rock, NC, as well as reported on-site activity as described by the disposal contractor. Additional support is lent by the results of the CERCLA investigation of the related GE Shepherd Farm Site, which is currently a candidate for NPL listing due to offsite PCB and solvent contamination.

Reported disposal activity consisted of burning some wastes (mostly cardboard) and burying the remainder at a knoll and adjacent swamp at the site. Although PCB and solvent disposal is suspected at the Spann Property, more recent use of the site as a scrapyard has obscured any visible evidence of past burning and disposal activities there. The SI sampling operation focussed on the groundwater and surface water pathways at the periphery of the site, to determine whether any detectible contamination had occurred there. The nearest domestic well to the site was sampled, and surface water and sediment samples were collected to evaluate potential contamination of wetland areas and fisheries downstream of the site.

P.O. Box 27687, Raleigh, North Carolina 27611-7687 Telephone 919-733-4996 FAX 919-715-3605
An Equal Opportunity Affirmative Action Employer 50% recycled/ 10% post-consumer paper

Laboratory analysis detected no PCBs or other organic contaminants in any of the samples collected during the SI. The only elevated contaminants in the surface water pathway were barium, zinc, and possibly lead. Zinc was elevated above 3 times background concentration in 1 sediment sample collected from a large wetland area adjacent to the site. Barium was elevated in the same sample and in another sediment sample collected below wetlands further downstream. Elevated lead is questionable because all the lead concentrations were either at or below the sample quantitation limit.

No metals contamination was detected in any samples collected during the GE Shepherd Farm investigation, suggesting that metals detected during the Spann Property SI might not be attributable to the disposal of GE wastes. Although disposal of GE paint sludges at the Spann Property could potentially have released lead and zinc, the highest detected sample concentrations of the metals were well within their natural ranges for soils and stream sediment.

Barium, lead, selenium, and zinc were detected in the nearest groundwater well sample, but concentrations of all 4 elements were below both EPA health-based benchmark concentrations and the NC Subchapter 2L standards for groundwater. The majority of residents within 1 mile of the site use the Hendersonville municipal water supply rather than drinking from wells.

Although disposal of PCBs and solvents is suspected at the site, sampling results to date do not generally indicate drinking water or environmental contamination by these compounds. The only possible exception was the detection of a low concentration of toluene in one sediment sample adjacent to the site. Attribution of the compound to the site is questionable. Apparently, the site's 1 to 2 years of use for disposal have not had the same impact as the 11 year history of disposal at the GE Shepherd Farm.

On the basis of the above findings, the North Carolina Superfund Section does not recommend the Spann Property for further action under CERCLA. A designation of No Further Remedial Action Planned (NFRAP) is recommended. If you have any questions, please contact me at (919) 733-2801.

Sincerely,

Stuart F. Parker, Jr.
Hydrogeologist,
NC Superfund Section

STATE OF NORTH CAROLINA

Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
Superfund Section

SITE INSPECTION

Spann Property
Henderson County, Hendersonville, NC
NCD 986 180 917
Reference No. 05522

August 1994

Stuart Parker, Hydrogeologist
Division of Solid Waste Management
Superfund Section

SITE INSPECTION

SPANN PROPETY
NCD 986 180 917
Hendersonville, Henderson County, North Carolina

August 1994

Superfund Section
Division of Solid Waste Management
North Carolina Department of Environment, Health and Natural Resources

Prepared by:

Stuart Parker
Hydrogeologist

Reviewed by:

Pat DeRosa
CERCLA Branch Head

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. INTRODUCTION 1

2. SITE DESCRIPTION 1

3. WASTE/SOURCE SAMPLING 6

4. GROUNDWATER PATHWAY 6

5. SURFACE WATER PATHWAY 10

6. SOIL EXPOSURE AND AIR PATHWAYS 17

7. SUMMARY AND CONCLUSION 18

LIST OF REFERENCES

PHOTOGRAPHS

APPENDIX A

REFERENCES

LIST OF TABLES

TABLE I. GROUNDWATER POPULATION DATA 9

TABLE II. ANALYTICAL RESULTS (WATER SAMPLES) 11

TABLE III. ANALYTICAL RESULTS (SEDIMENT/SOIL SAMPLES 16

LIST OF FIGURES

FIGURE 1 TOPOGRAPHIC MAP 2

FIGURE 2 SITE PLAN 3

FIGURE 3 SENSITIVE ENVIRONMENTS MAP 14

EXECUTIVE SUMMARY

During the late 1960s, the Spann Property was used to dispose of an unknown quantity of industrial waste from General Electric Company. GE disposal records and the disposal contractor indicate that past disposal practices at the site may have included the destruction of electrical components containing polychlorinated biphenyls (PCBs).

Wastes reportedly were hauled to the Spann Property on a regular basis, then burned and/or buried at unspecified locations on a knoll and adjacent floodplain. The knoll has since been covered by an automobile scrapyard, and much of the ground surface there is not readily accessible for visual examination or sampling. The exact location of GE waste disposal could not be identified, either by visual survey or by the disposal contractor.

The GE/Shepherd Farm site (NCD 986 170 686) was used by the same contractor for GE waste disposal. Offsite groundwater and environmental samples collected at the Shepherd Farm in 1988 contained chlorinated solvents and PCBs, and this site was subsequently proposed for the National Priorities List. Because of the nature of the GE wastes and the apparent similarity of disposal practices at the 2 sites, contamination is also suspected at the Spann Property.

The primary potential hazards posed by the site are groundwater pollution by chlorinated hydrocarbon compounds, and pollution of the surface water pathway by PCBs, solvents, semi-volatile organic compounds, and possibly metals. Groundwater wells still supply approximately half of the study area with drinking water. No surface drinking water intakes are reported at present within 15 miles downstream of the site, however, the entire 15-mile pathway is a fishery, and mapped wetlands are present both onsite and downstream. A family of 3 lives at the site, and 3 part-time employees work at the scrapyard. The nearest offsite residence is over 200 feet away. The site is partially fenced but is accessible from the direction of Mud Creek.

No semi-volatile organic compounds, pesticides, or PCBs were detected in samples collected during the Spann Property SI. Toluene was detected in one stream sediment sample collected adjacent to the site, but was not detected in soil or wetland sediment in the channels draining the site. Barium and zinc were detected at elevated concentrations in a sediment sample from a ditch which drains the site via a 14-acre wetland. Barium and zinc were also detected in soil from a dry runoff channel that drains the site, and at slightly lower concentration in a sediment sample collected below wetlands, 1.3 miles downstream of the site. Lead was detected in the above samples at or below its 20 mg/l quantitation limit.

No inorganic contaminants were detected in samples collected at the GE/Shepherd Farm site, and the metals detected in the Spann Property samples were present at concentrations common in natural soils and sediment. The analytes detected at the Spann Property therefore might not be attributable to the site. Sampling and onsite observations to date do not indicate release of PCBs or solvents at the site. The lack of detected contamination at the Spann Property may be due to its 1 to 2 year disposal period, compared with the 11-year disposal history of the GE/Shepherd Farm site.

1.0 INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the North Carolina Superfund Section conducted a Site Inspection (SI) at the Spann Property in Henderson County, NC. The purpose of this investigation was to collect information concerning conditions at the Spann Property sufficient to assess the threat posed to human health and the environment and to determine the need for additional investigation under CERCLA or other authority. The scope of this investigation included a file review and sampling of waste and environmental media to test Preliminary Assessment (PA) hypotheses and to document Hazard Ranking System (HRS) factor values and scores, collecting additional non-sampling information, and interviewing nearby residents.

2.0 SITE DESCRIPTION

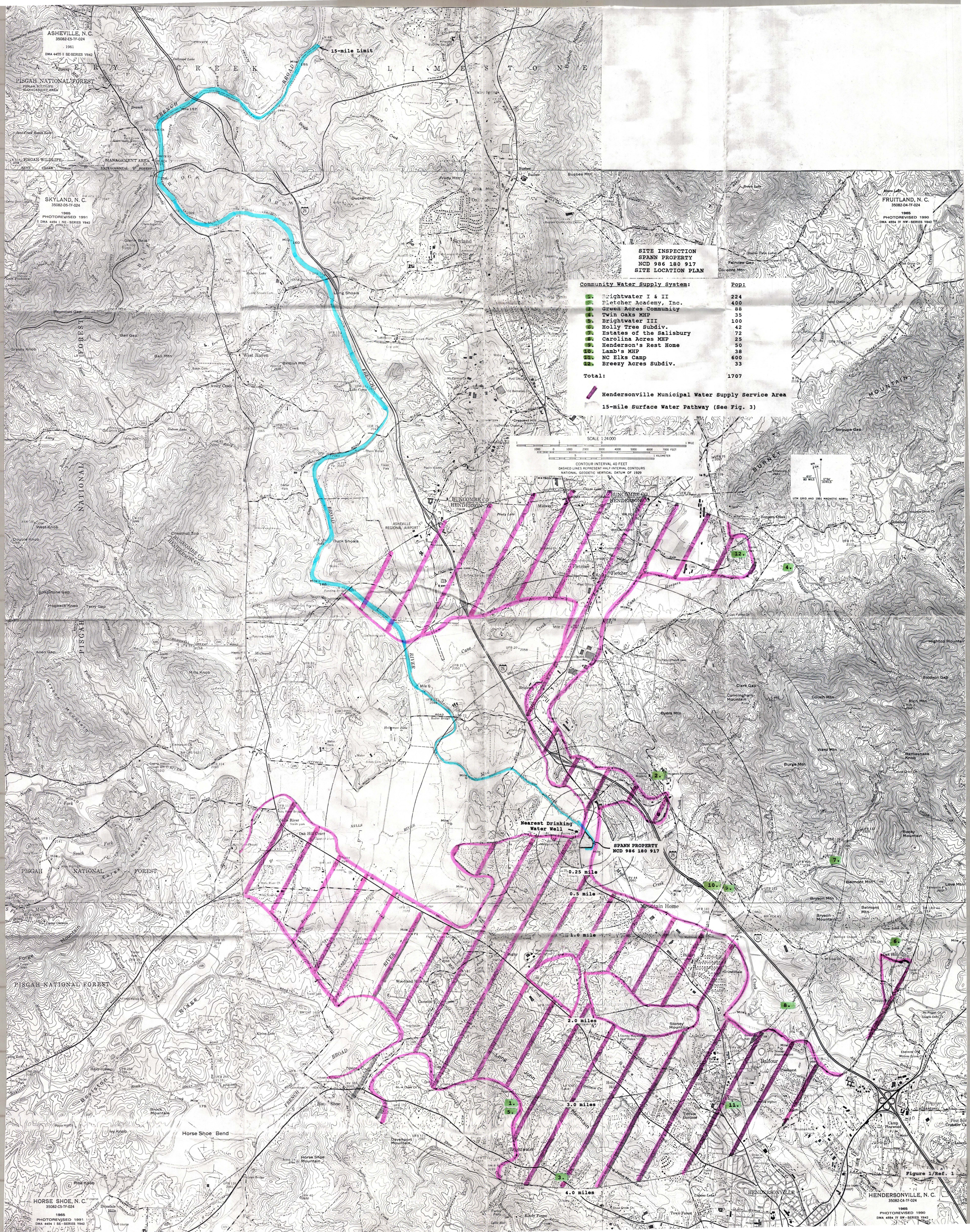
2.1 Location

The Spann Property site is located on US Highway 25, 5 miles north of Hendersonville in Henderson County, North Carolina (Ref. 1; Fig. 1). The geographic coordinates of the site are 35° 23' 06" N latitude and 82° 30' 10.5" W longitude (Ref. 2). To access the site from Asheville, NC, travel south on I-26 to the US 25 Exit. The site is located on the left (east) side of US 25 approximately 1 mile south of the interstate and across from Shepherd Memorial Park (Figs. 1-2). The site occupies the triangular land area between the highway and Mud Creek.

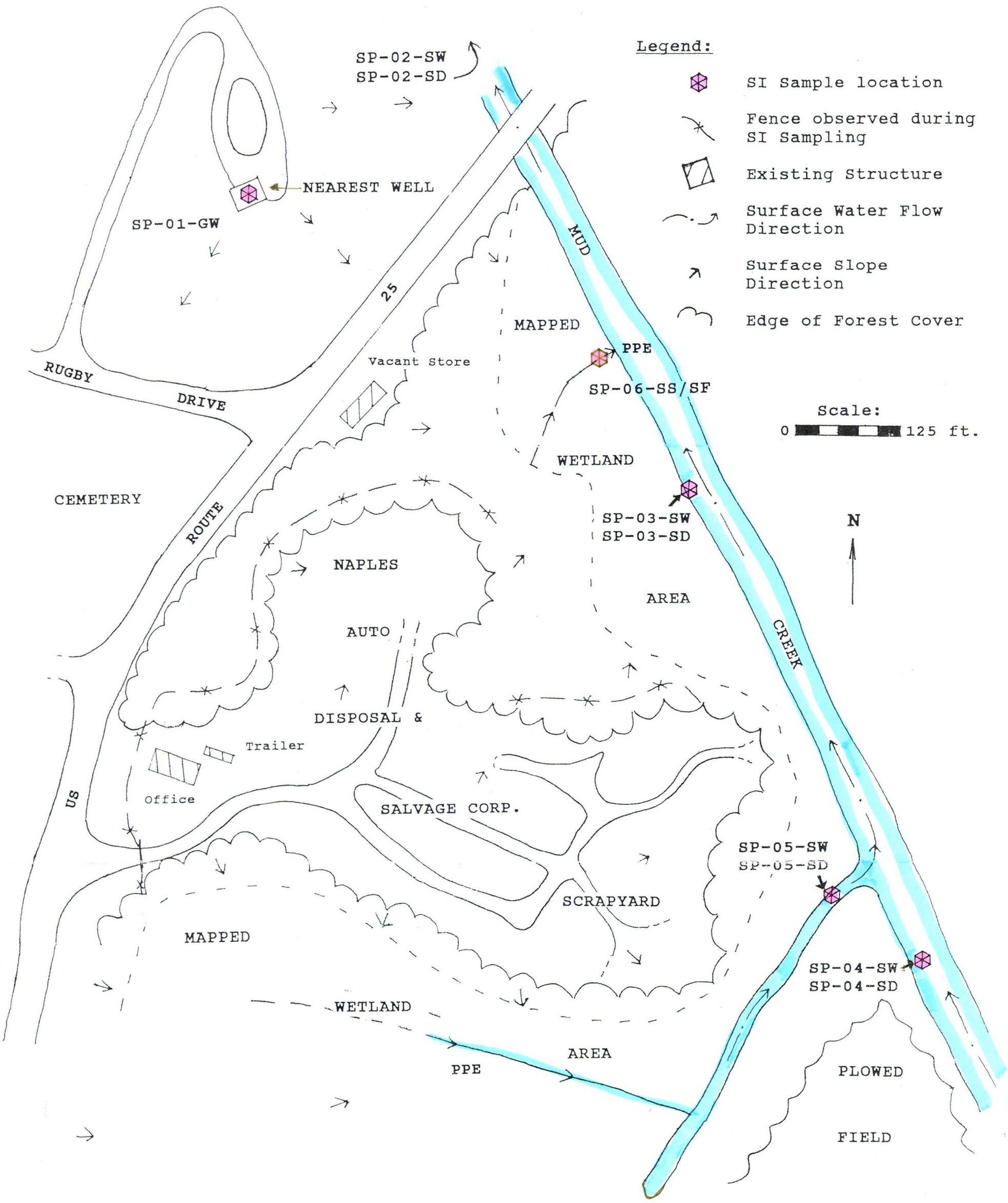
The climate of Henderson County is influenced strongly by elevation and irregular topography, which causes large differences in climate within the county (Ref. 3, p. 1). Summers are warm and humid with average July temperatures of 76 F. The winter months are generally mild with average January temperatures of 44 F (Ref. 4, pp. 94, 98). Mean annual precipitation is 56 inches and mean annual lake evaporation is 36 inches, therefore, net precipitation for the area is 20 inches per year (Ref. 5).

2.2 Site Description

The Spann Property site consists of a triangular 8-acre parcel. An approximately 7-10 feet high knoll extends southeast from Route 25 across the southern portion of the site. The northern portions of the site and the lands to the south of the knoll are mapped wetlands on the Mud Creek floodplain (Ref. 1; Ref. 43; Figs. 1-3). Currently, the knoll is occupied by an automotive scrapyard (Photo 1). Waste observed on site during the SI Reconnaissance included automobiles and miscellaneous automobile and engine parts, old flatbed trucks, tires, scrap metal, piles of cinders, discarded stoves, refrigerators, and water heaters, farm machinery, sheet metal and house gutters(Ref. 6, p. 4).


ASHEVILLE, N.C.
35082-E5-TF-024
1961
DMA 4455 II SE-SERIES V842
SKYLAND, N.C.
35082-D5-TF-024
1965
PHOTOREVISED 1991
DMA 4454 I NE-SERIES V842
FRUITLAND, N.C.
35082-D4-TF-024
1965
PHOTOREVISED 1990
DMA 4554 IV NW-SERIES V842
HORSE SHOE, N.C.
35082-C5-TF-024
1965
PHOTOREVISED 1991
DMA 4454 I SE-SERIES V842
HENDERSONVILLE, N.C.
35082-C4-TF-024
1965
PHOTOREVISED 1990
DMA 4554 IV SW-SERIES V842
SITE INSPECTION
SPANN PROPERTY
NCD 986 180 917
SITE LOCATION PLAN
Community Water Supply System: Pop:
1. Brightwater I & II 224
2. Fletcher Academy, Inc. 400
3. Green Acres Community 88
4. Twin Oaks MHP 35
5. Brightwater III 100
6. Holly Tree Subdiv. 42
7. Estates of the Salisbury 72
8. Carolina Acres MHP 25
9. Henderson's Rest Home 50
10. Lamb's MHP 38
11. NC Elks Camp 600
12. Breezy Acres Subdiv. 33
Total: 1707
Hendersonville Municipal Water Supply Service Area
15-mile Surface Water Pathway (See Fig. 3)
SCALE 1:24 000
CONTOUR INTERVAL 40 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
UTM GRID AND 1991 MAGNETIC NORTH
15-mile Limit
Nearest Drinking Water Well
SPANN PROPERTY
NCD 986 180 917
0.25 mile
0.5 mile
1.0 mile
2.0 miles
3.0 miles
4.0 miles
PISGAH NATIONAL FOREST
BUNCOMBE CO
HENDERSON CO
ASHEVILLE REGIONAL AIRPORT
Skyland
Fletcher
Mountain Home
Balfour
HENDERSONVILLE
Figure 1/Ref. 1

SITE INSPECTION
SPANN PROPERTY
NCD 986 180 917
SITE PLAN



1. Illustration based on aerial photographs (Ref. 14). Scale approximate.

FIG. 2

During the February 1991 PA Reconnaissance, NC Superfund Section personnel also observed 40 unlabelled 55-gallon drums, some believed to contain tar, and discarded x-ray tables. These items were not observed during the 1994 SI, however, 2 blue, sealed, empty 55-gallon drums marked "370-100 251 Keep from freezing" were observed (Ref. 6, pp. 3-4).

The site is bordered by US 25 on the west and by Mud Creek on the east (Figs. 1-2). The scrapyard office building and the operator's residence are located on the property. The south and northwest boundaries of the junkyard are fenced with a locked gate at the entrance (Ref. 7), but the junkyard is accessible from the direction of the creek (Ref. 6, p. 3).

2.3 Site Regulatory History

The property has been used for various types of waste disposal. The scrap yard, which has operated since the late 1960s, holds an operation permit dated October 1987 from the Henderson County Health Department (Ref. 8). Except for the Preliminary Assessment completed by the NC Superfund Section on August 17, 1992, no environmental investigations have apparently been conducted at the Spann property.

The Preliminary Assessment of the Spann property resulted from the findings of a separate PA, completed at the General Electric/Shepherd Farm site (NCD 986 170 686), located on Roper Road in East Flat Rock, NC. During the periods 1956-1962 and 1965-1967, waste handling contractor Eugene Shepherd had used his own farm property to dispose of cardboard and other wastes generated by General Electric Corporation in East Flat Rock (Ref 10, pp. 3, 6, 7). The Shepherd property was proposed for the National Priorities List after sampling operations detected PCBs, toluene, and tetrachloroethene there in 1988 (Ref. 9, pp. 1-3; Ref. 11, p. 1; Ref. 12).

During the PA of the Spann Property, the NC Superfund Section confirmed that Mr. Shepherd had leased portions of the property for disposal of GE wastes (Ref. 13, p. 3). Based on GE's and Shepherd's descriptions, disposal practices at the Spann property were similar to those at the Shepherd Farm site (Refs 10, p. 3, p. 6; Ref. 13, pp. 2-3). The NC Superfund Section therefore concluded that the Spann Property was also potentially contaminated by PCBs and solvents, and accordingly recommended the site for a Site Inspection (Ref. 13, p. 8). The likelihood that PCBs were transported onsite is further supported by GE reports to US EPA (Ref. 10, pp. 3, 6, 7, 9).

2.4 Operational History and Waste Characteristics

The Spann Property site was formerly owned by John J. Spann. After his death, property ownership passed to his daughters, including Ms. Mary Beck (Ref. 7). Aerial photographs indicate that the site was covered by forest and cropland until at least 1960 (Ref. 14).
The site may have been used by Gerber Food Company for waste disposal during the early 1960s (Ref. 7). The first confirmed disposal at the site reportedly began when Herbert Hodge, the current occupant, began storing and salvaging automobiles there in 1966. The Naples Auto Disposal and Salvage Corporation has officially operated at the site since 1977 (Ref. 7).

From 1968 to 1970, Mr. Eugene Shepherd reportedly transported GE waste materials to the site (Ref. 10, pp. 3, 6, 7, 9). The waste was transported in a 26 - 28 cubic yard truck stored on GE property. The amount transported daily ranged from a norm of 2 - 3 loads to a maximum of 5 loads (Ref. 16, p. 1). The materials generally were dumped from the truck, then burned and/or buried (Ref. 17, p. 10). Shepherd indicated that the wastes were disposed in the swampy areas from the edge of the knoll at the center of the site, but could not recall the exact distance and direction of disposal in relation to the knoll (Ref. 15). The disposal areas could not be identified during the PA or SI reconnaissances (Ref. 6, p. 4; Ref. 13, p. 3).

According to Mr. Shepherd, the GE waste materials consisted of cardboard, wood, office paper, drums containing a used buffing compound, metal, and electrical parts (Ref. 15; Ref. 16, p. 4). He estimates that 95% of the waste brought there was cardboard. The buffing compound, which was described as flammable, had reportedly been used to buff aluminum lamp shades (Ref. 11, p. 9). The compound and the cardboard were burned at the site until the practice was prohibited. The rest of the waste was buried. Mr. Shepherd also reported that occasionally "small electrical insulators" were taken to the site and broken open to salvage copper (Ref. 15). Mr. Shepherd is not known to have held any waste disposal permit during the years of hauling the GE wastes.

According to a GE Representative, Mr. Lee Humphrey, the Material Safety Data Sheet for the buffing compound indicated "no hazardous ingredients". Mr. Humphrey reported that all PCB oil arrived at the GE plant in railroad tank cars and was stored at the plant after use. He also stated that it was unlikely that PCB-containing oil was hauled off the GE property, but did indicate that waste solvents such as trichloroethylene and tetrachloroethylene may have been transported by Mr. Shepherd (Ref. 11, p. 8).

Additional information regarding offsite waste disposal was submitted by GE to the US EPA. The submittal includes a summary of wastes transported from GE during various time periods. The 1969-1970 listing referred to "Fain's Dump", the Spann property location, 5 miles north of Hendersonville near Route 25. The summary described the transported waste materials as paint sludge, cotton and aluminum buffing waste, epoxy compounds, hydrocarbons from dye casting molds, acrylic hydrocarbon paint, and phenolic residue. Additionally, the list specified that small capacitors containing PCBs were included in the waste (Ref. 10, p. 6).

Quantities of waste removed from GE varied with waste type. An estimated total of 50 barrels of epoxy compounds, 50-150 barrels of paint sludge, and 250 pounds per week of phenolic plastic residue were reportedly transported to the Spann Property (aka "Fains Dump")(Ref. 10, p. 3, p. 6). The remaining wastes, including the PCB capacitors, were not quantified.

Sampling at the GE/Shepherd Farm site has revealed PCB contamination in soils at burning and disposal areas, in downgradient stream sediment, and in a 55-gallon drum of solidified material at the property. Chlorinated solvents, including tetrachloroethene (PCE), and traces of 1,1,1-trichloroethane (TCA) and dichloroethane (DCA), were detected in nearby drinking water wells and in a downgradient surface water sample. Traces of TCA were also detected in the 55-gallon drum sampled at the site (Ref. 11, p. 3, 5). NC Superfund Section and NUS Corporation reconnaissance teams visited the Shepherd Farm Site in February 1989 and May 1990, respectively. Both teams observed transformer parts and other electrical components there, items which were the possible PCB source (Ref. 11, p. 3; Ref. 18, p. 4). These results and findings were of concern because similar disposal practices may have occurred at the Spann Property, indicating the potential for PCB release there as well.

3.0 WASTE/SOURCE SAMPLING

No waste or source sampling has occurred to date at the Spann Property. When questioned by NC Superfund Section personnel, Eugene Shepherd reportedly could not recall the specific locations of burning and disposal areas at the site. The automobile junkyard currently operating at the site has obscured much of the ground surface, and no visible evidence of the GE waste disposal areas was observed during the SI reconnaissance and sampling.

4.0 GROUNDWATER PATHWAY

4.1 Hydrogeologic Setting

Henderson County lies within the Blue Ridge Mountain Physiographic Province. The Mountain Province bedrock includes several types of igneous and metamorphosed igneous and sedimentary rocks (Ref. 19, p. 18, 21). The greater part of Henderson County, including the site, is underlain by Henderson Gneiss, a Cambrian-age metamorphic rock which varies in composition from granite to biotite gneiss to quartzite. The broad valleys of the French Broad River, Mud Creek, and Hooper Creek generally coincide with areas of Henderson Gneiss, which is reported to underlie the site (Ref. 20, p. 91-93, Fig. 5; Ref. 21). Based on the cased depth of the nearest well, the local depth to bedrock beneath the site is on the order of 100 feet (See Section 4.3).

In the Blue Ridge Mountain Physiographic Province, a layer of saprolite generally overlies the bedrock, ranging in thickness from 1 to 2 feet near bedrock outcrops to more than 100 feet elsewhere. The saprolite consists of unconsolidated granular material, including coarse sands, gravels, and clays, which is derived from the bedrock by in-situ weathering (Ref. 19, p. IV, p. 26-27). At the land surface, the saprolite has weathered to a variety of soil types.

The Spann property contains 3 different mapped soil types: Codorous loam; Hayesville loam (7 to 15 per cent slope); Arents loamy soil (Ref. 3, Sheet # 7). Codorous loam is a moderately well to somewhat poorly drained, nearly level soil typically formed in floodplains. This soil type is present along Mud Creek. A typical Codorous soil profile consists of a 12-inch surface layer of brown loam, underlain by a 33-inch subsoil composed of dark brown loam and mottled grayish brown fine sandy clay loam. Further down, to a depth of 60 inches, is dark gray loamy sand with thin strata of sand and gravel. Permeability is moderate, available water capacity is medium, and shrink-swell potential is low (Ref. 3, p. 34). The typical hydraulic conductivity for this type of soil is 10(-6) cm/sec (Ref. 22, p. 51601).

Hayesville loam, which covers the western half of the site, is described as a well-drained, moderately permeable, gently sloping to moderately steep soil formed from decomposition of granite, schist, or gneiss (Ref. 3, p. 36). A typical profile consists of 2, 4-inch surface layers of brown to dark brown loam, underlain from 8 to 44 inches by up to 5 layers of red to yellowish red clay loam. The basal saprolite occurs from 44 to 112 inches deep and consists of a red and a gray stratum, both of sandy loam texture (Ref. 3, p. 37). Typical hydraulic conductivity is expected to range from 10(-6) to 10(-8) cm/sec (Ref. 22, p. 51601).

Arents loamy soil is mapped atop the knoll, underlying the scrapyard. The soil unit is generally well-drained loam whose original profile has been altered by cutting, filling, or grading (Ref. 3, p. 5, Plate 7).

Large-capacity wells supplying institutions and subdivisions in Henderson County are generally drilled into the Henderson Gneiss. Groundwater has also been withdrawn from the overlying saprolite layer for domestic use (Ref. 20, p. 92-93). Water in the saprolite is found in the pore spaces, while water in the gneiss occurs in joints, fractures and bedding planes. The saprolite and bedrock are hydraulically connected (Ref. 19, p. 27-29), behaving as a single, unconfined aquifer. Recharge to the groundwater tends to be in the interstream areas as precipitation percolates downward to the water table. The groundwater discharges into the perennial streams and lakes, and the lowest points on the water table are at these places (Ref. 19, p. 14, p. 41). Because of the site's topographic relief and its proximity to Mud Creek, groundwater beneath much of the site is probably within 5 feet of the ground surface (Ref. 1).

4.2 Groundwater Targets

No municipal water supply wells are located within 4 miles of the site (Ref. 23). The majority of the population within a 4-mile radius of the site relies on a surface water intake located 4.5 miles upstream of the site near Mills River Bridge and operated by Hendersonville Water Treatment Authority (Refs. 23-24). A review of 1994 community supply well database indicates that 12 community wells supply approximately 1707 residents within a 4-mile radius of Spann Property (Ref. 26). No wellhead protection areas (WHPAs) are designated in NC (Ref. 42).

Residences not connected to the Hendersonville public water supply system or to community wells rely on private wells for their drinking water. An estimated 4508 residents within a 4-mile radius of the site use private wells for drinking water supply. In total, an estimated 6215 residents use groundwater within 4 miles of the site (Refs. 25-27; Table 1).

Two domestic wells are located within 0.25 mile of the site, and an estimated 96 wells supply an estimated 235 people within a 1-mile radius. The nearest residential water supply well to the site is located on a hill by the intersection of Route 25 and Rugby Drive (Ref. 1; Ref. 6, p. 1; Figs. 1-2). Fletcher Academy, the nearest school supplied by a groundwater well, is located approximately 1 mile northeast of the site (Ref. 1; Ref. 8).

4.3 Sample Locations

During the site reconnaissance and sampling operation, NC Superfund Section personnel sampled the nearest domestic well (SP-01-GW) (Ref. 6, p. 1; Figs. 1-2). The well is located on a hill 20-30 feet above the Spann Property and the adjacent floodplain. The well is cased to 125 feet, indicating probable bedrock at that depth, and suggesting a 100-foot bedrock depth at the site. The well is approximately 320 feet from Mud Creek, and is downriver of the site. Assuming no groundwater mounding beneath the hilltop, the well's location relative to groundwater flow from the site is therefore across-gradient.

TABLE 1
SPANN PROPERTY
NCD 986 180 917
GROUNDWATER POPULATION DATA

Distance (miles)	Number of Houses	Population	Community Well Population	Total Groundwater Population
0-0.25	2	5	0	5
0.25-0.5	14	34	0	34
0.5-1.0	80	196	0	196
1.0-2.0	574	1406	488	1894
2.0-3.0	404	990	97	1087
3.0-4.0	766	1877	1122	2999
Total:	1840	4508	1707	6215

4.4 Analytical Results

The sample, SP-01-GW, was analyzed for volatile and semi-volatile organic compounds, inorganic analytes, pesticides and PCBs at the State Laboratory for Public Health in Raleigh, NC. No volatile or semi-volatile organic compounds, pesticides or PCBs were detected (Appendix A). The elements barium, lead, selenium, and silver were detected in the sample, but none of the inorganic concentrations exceeded their present health-based benchmark values for drinking water (Ref. 39; Appendix A; Table 2).

4.5 Groundwater Conclusions

The reported onsite burial of waste and the presence of a shallow water table indicate a high probability of release of any buried hazardous substances to the unconfined aquifer. Sampling results from the nearest well, however, do not indicate the presence of any contaminants in excess of health-based benchmark concentrations for drinking water. No water supply wells are located directly downgradient of the site. Based on local hydrogeologic conditions and the sampling results, the likelihood of human exposure to any on-site contaminants appears limited.

5.0 SURFACE WATER PATHWAY

5.1 Hydrologic Setting

Overland drainage from the northern and central portions of the site flows northeast across a mapped wetland area, discharging to Mud Creek via a shallow runoff channel. Drainage from the steep southern edge of the site flows to another wetland directly south of the site. This second wetland in turn drains east to Mud Creek via a ditch at the southeast corner of the site (Fig. 2).

Mud Creek flows approximately 1.75 miles northwest from the site to French Broad River, which flows north toward the City of Asheville. The 15-mile surface water pathway extends another 13.25 miles north along the French Broad River (Fig. 1; Fig. 3). Mud Creek flows at a mean annual rate of 180.6 cfs and French Broad River averages 1041 cfs (Refs. 28-30).

TABLE 2
SITE INSPECTION
SPANN PROPERTY
NCD 986 180 917
ANALYTICAL RESULTS (WATER SAMPLES)

Designation:	SP-01-GW	SP-02-SW	SP-03-SW	SP-04-SW	SP-05-SW	Lowest Benchmark Value (2)
Location:	Dom. Well	Rugbee Rd	Site	Upstream	PPE (Ditch)	
Medium:	Groundwater	Surface Water				
Date:	4/4/94	4/5/94				
VOLATILE ORGANIC COMPOUNDS (ug/l)						
Acetone	3(JB)	--	--	--	--	3,500
SEMIVOLATILE ORGANIC COMPOUNDS (ug/l) (1)						
PESTICIDES/PCBS (1)						
INORGANIC PARAMETERS (mg/l)						
Arsenic	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.00002
Barium	0.10	0.04	0.04	0.04	0.07	2
Cadmium	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.005
Chromium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1
Lead	0.01	< 0.005	< 0.005	< 0.005	< 0.005	0.015
Mercury	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.002
Selenium	0.009	0.01	0.009	0.01	0.009	0.05
Silver	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.18
Zinc	0.10	< 0.05	< 0.05	< 0.05	< 0.05	11

-- Parameter not detected, or below quantitation limit.

(J) Indicates estimated value. Result may be semiquantitative.
(B) Parameter detected in trip blank.

1. No semi-volatile organic compounds, pesticides, or PCBs detected in samples.
2. Cancer Risk Screen Determination, MCL/MCLG, or Reference Dose Screen Concentration for Drinking water, from 1993 Superfund Chemical Data Matrix.
3. See Appendix A for Sample Analyses.

For a distance of 0 to 11.9 miles downstream of the site, both Mud Creek and the French Broad River are class WS-IV streams. The French Broad River is class WS-IV CA from 11.9 to 13.5 miles downstream and is class C for the remainder of the 15-mile surface water pathway (Ref. 31, pp 17, 20, 22). Class C describes waterways protected for fish and wildlife propagation, secondary recreation and agriculture. WS-IV indicates water supplies, generally in a moderately to highly developed watershed, where point-source treated discharges of wastewater are regulated, and where local programs to control nonpoint source and storm sewer discharge are required (Ref. 31, p. i). Class WS-IV is suitable for all Class C uses. The CA modifier indicates that the interval is located within 0.5 linear miles of an existing or proposed water supply intake whose location is within the main river channel.

The local 2 year, 24 hour precipitation is 4 inches (Ref. 32). Most of the site is located within mapped 100-year floodplain (Ref. 43).

5.2 Surface Water Targets

The City of Asheville has proposed construction of a new municipal intake approximately 12 miles downstream of the site, however, no surface water intakes currently exist along the 15-mile surface water pathway downstream of the site (Ref 33). Local municipal water is supplied by the Hendersonville municipal water system. The Hendersonville surface water intake is located on the Mills River, 4.5 miles upstream of the mouth of Mud Creek (Ref. 24; Ref. 26; Ref. 33). Residents not served by the municipal water supply obtain drinking water from individual private or public wells (Ref. 20, pp. 92-93).

Both Mud Creek and the French Broad River are fisheries. Mud Creek is fished primarily for catfish, while the French Broad River is angled for trophy muskellunge, smallmouth bass, pickerel, and nongame fish such as carp, catfish, suckers, and redbreast sunfish (Ref 34; Photo 4). Fishing and evidence of fishing was observed on Mud Creek at the time of the reconnaissance (Ref. 6, pp. 3-4).

The first probable point of entry (PPE 1), for runoff from the southern edge of the site, is located in the Palustrine forested wetland area bordering the site (Ref. 6, pp. 5-6; Ref. 35; Fig. 3). At the time of the SI reconnaissance this wetland was saturated and ponded by recent heavy rainfall (Ref. 6, p. 6). The wetland area's mapped perimeter measures approximately 0.8 mi. and its area is approximately 14 acres. The wetland area drains to Mud Creek via a ditch which separates the site from an adjacent farm field. The ditch joins Mud Creek at the southeast corner of the site, also within a mapped wetland area (Ref. 6, p. 6; Fig. 2; Photos 5-6).

The bank of Mud Creek along the entire NE site boundary is mapped as Palustrine scrub-shrub wetland. The mapped perimeter and area of this wetland onsite are 0.4 mi. and approximately 5 acres, respectively. This area drains to Mud Creek at the second probable point of entry (PPE 2) via a shallow ditch which crosses the mapped area and empties over the creek bank. A total of 1.5 additional miles of wetland frontage are mapped downstream of the site on Mud Creek and the French Broad River (Ref. 30; Ref. 35; Fig. 3). Available wetland maps do not cover the 15-mile surface water pathway at a distance greater than 12 miles downstream of the site.

No Critical Habitats for endangered species are designated within 15 miles downstream of the site (Ref. 37). The NC Natural Heritage Program has listed a total of 9 rare plant and animal species within the 15-mile surface water pathway, the nearest located 5.6 miles downstream of the site (Fig. 3). None of the species are listed as Endangered, either in NC or the US. The amphibians Cryptobranchus alleghaniensis (Hellbender) and Necturus maculosis (Mudpuppy) have been identified 5.6 miles and 5.9 miles downstream of the site, respectively. The fish species Percina macrocephala (Longhead Darter) exists 9.7 miles downstream, and the bird Vireo gilvus (Warbling Vireo) is 10.0 miles from the site. Clemmys muhlenbergii (Bog Turtle), Ambystoma talpoideum (Mole Salamander), and Hemidactylium scutatum (Four-toed Salamander) are all located 11.7 miles downstream. Sorex hoyii winnemana (Southern Pygmy Shrew) has been recorded along the French Broad River at a downstream distance of 12.5 miles (Ref. 36). In addition, the Pisgah Wildlife Management Area is located directly west of the French Broad River 12 miles downstream of the site (Ref. 1).

5.3 Sample Locations

During the April 4-5, 1994 SI reconnaissance, NC Superfund Section personnel collected surface water and sediment samples at a total of 5 locations along the surface water pathway. Samples SP-02-SW and SP-02-SD were located at the Rugby Road crossing, 1.2 miles downstream of the site, and downstream of approximately 0.4 mile of mapped wetland frontage (Fig. 1; Fig. 3; Photo 2). Samples SP-03-SW and SP-03-SD were located in Mud Creek, adjacent to the site and between the 2 identified PPEs (Fig. 2; Photo 3). These samples were collected to test for contamination in the fishery or wetlands along Mud Creek. Samples SP-04-SW and SP-04-SD were collected upstream of the site on the creek to serve as background samples (Fig. 2; Photo 4).

SP-05-SW and SP-05-SD were collected between PPE 1 and Mud Creek, in the ditch which drains the wetland area south of the site (Figs. 2-3; Photos 5-6). Soil/sediment sample SP-06 SS/SF was collected from the bottom of the dry ditch in the northern part of the site, approximately 20 feet upgradient of PPE 2. SP-05-SD and SP-06-SD were collected to test for wetland contamination at the site and to aid in attribution of any downstream contaminants to the site. All of the surface water and sediment samples were submitted to the NC State Laboratory of Public Health for analysis.

15-mile Limit

Limit of National Wetlands Inventory Mapping

SITE INSPECTION
SPANN PROPERTY
NCD 986 180 917
SENSITIVE ENVIRONMENTS

Species Name:

1.	Synosma suaveolens	(Sweet Indian Plantain)
2.	Cryptobranchus alleghaniensis	(Hellbender)
3.	Necturus maculosis	(Mudpuppy)
4.	Vireo gilvus	(Warbling Vireo)
5.	Percina macrocephala	(Longhead Darter)
6.	Clemmys muhlenbergii	(Bog Turtle)
7.	Ambystoma talpoideum	(Mole Salamander)
8.	Hemidactylium scutatum	(Four-toed Salamander)
9.	Sorex hoyi winnemana	(Southern Pygmy Shrew)

Legend:

15-mile Surface Water Pathway

Mapped Wetland Area (per CERCLA/SARA)
(See Refs. 3 and 40 for Hydric Soils)

SCALE 1:24000

1 acre — 10 acres — 20 acres
ACREAGE GUIDE

SPANN PROPERTY
NCD 986 180 917

0.25 mile
0.5 mile
1.0 mile
2.0 miles
3.0 miles
4.0 miles

Figure 3

DRAFT

SPECIAL NOTE
This document was prepared primarily by stereoscopic analysis of high altitude aerial photographs. Wetlands were identified on the photographs based on vegetation, visible hydrology, and geography, in accordance with Classification of Wetlands and Deepwater Habitats of the United States (FWS/OBS - 79/31 December 1979). The aerial photographs typically reflect conditions during the specific season and year shown on the photographs and may vary from a seasonal or other change in the use of the aerial photographs. Thus, a detailed on the ground and historical analysis in accordance with the manual may reveal additional wetland boundaries established through photographic interpretation. In addition, some small wetlands and those located in dense forest cover may not be included on this document.
Federal, State and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no intent by the U.S. Fish and Wildlife Service, by this inventory, to define the limits of preliminary jurisdiction of any Federal, State or local government or to establish the jurisdiction of any regulatory agency over any wetland in question. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State or local agencies concerning specified agency regulatory or other land preliminary jurisdictions that may affect such activities.

NOTES TO THE USER
Wetlands which have been field examined and mapped on the map by an asterisk (*).
Other information including a wetlands information report on this map are solicited. Please forward such information to the address indicated.
Wetlands are classified according to Water Regimes Subsystems, Classes, Subclasses, and Dominants for NATIONAL or Karlo were developed specifically.
Wetlands are NOT classified by Cowardin.
Some areas designated as PABS, NABW, OR NABJ (INTERMITTENT STREAMS) may not meet the definition of a wetland.
This map uses the class Unconsolidated Shore (US). On earlier NWI maps that class was designated Beach/Bar (BB) or Flat (FL). Subclasses remain the same in both versions.

Other information including a narrative report concerning the wetland resources depicted on this document may be available. For information, contact:

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Prepared by National Wetlands Inventory

TECHNICAL RESPONSIBILITY

	NAME	DATE
TASK		
TS	Sandy B. Kobs	6-26-87
STR QC		7-23-87
FINAL P QC	Conner	7-27-87
ITS CORRECTION	C. Hughes	6-15-90
CORRECTION CHECK	D. Barclay	6-28-90
F W S ACCEPT	Jim Tefay	8-2-90

1:100,000 SCALE
ELEVATION (FEET)
FRONT SCALE
REAR SCALE

AERIAL PHOTOGRAPHY
DATE 3 83
SCALE 1:58,000
TYPE OR

SYSTEM: M — MARINE
SUBSYSTEM: 1 — SUBTIDAL; 2 — INTERTIDAL
CLASS: RB — ROCK BOTTOM; UB — UNCONSOLIDATED BOTTOM; AB — AQUATIC BED; RF — REEF; RS — ROCKY SHORE; US — UNCONSOLIDATED SHORE; OW — OPEN WATER (Unknown Bottom)
Subclass: 1 Bedrock, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Algal, 2 Aquatic Vascular, 3 Attached Invertebrate, 4 Suspension/Filter Feeder; 1 Coral, 2 Mollusc; 1 Aquatic Bed, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic

SYSTEM: E — ESTUARINE
SUBSYSTEM: 1 — SUBTIDAL; 2 — INTERTIDAL
CLASS: RB — ROCK BOTTOM; UB — UNCONSOLIDATED BOTTOM; AB — AQUATIC BED; RF — REEF; SB — STREAMBED; RS — ROCKY SHORE; US — UNCONSOLIDATED SHORE; EM — EMERGENT; SS — SCRUB-SHRUB; FO — FORESTED
Subclass: 1 Algal, 2 Aquatic Vascular, 3 Attached Invertebrate, 4 Unknown Submergent, 5 Unknown Emergent; 1 Coral, 2 Mollusc; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Aquatic Bed, 2 Reef, 3 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Broad Leaved Deciduous, 2 Needle Leaved Deciduous, 3 Broad Leaved Evergreen, 4 Needle Leaved Evergreen, 5 Dead, 6 Deciduous, 7 Evergreen, 8 Unknown

SYSTEM: R — RIVERINE
SUBSYSTEM: 1 — TIDAL; 2 — LOWER PERENNIAL; 3 — UPPER PERENNIAL; 4 — INTERMITTENT; 5 — UNKNOWN PERENNIAL
CLASS: RB — ROCK BOTTOM; UB — UNCONSOLIDATED BOTTOM; AB — AQUATIC BED; RS — ROCKY SHORE; US — UNCONSOLIDATED SHORE; EM — EMERGENT; OW — OPEN WATER (Unknown Bottom)
Subclass: 1 Bedrock, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Algal, 2 Aquatic Vascular, 3 Attached Invertebrate, 4 Suspension/Filter Feeder, 5 Unknown Submergent; 1 Aquatic Bed, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Persistent, 2 Nonpersistent

SYSTEM: L — LACUSTRINE
SUBSYSTEM: 1 — LIMNETIC; 2 — LITTORAL
CLASS: RB — ROCK BOTTOM; UB — UNCONSOLIDATED BOTTOM; AB — AQUATIC BED; OW — OPEN WATER (Unknown Bottom); RS — ROCKY SHORE; US — UNCONSOLIDATED SHORE; EM — EMERGENT; OW — OPEN WATER (Unknown Bottom)
Subclass: 1 Bedrock, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Aquatic Bed, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Persistent, 2 Nonpersistent

SYSTEM: P — PALUSTRINE
CLASS: RB — ROCK BOTTOM; UB — UNCONSOLIDATED BOTTOM; AB — AQUATIC BED; US — UNCONSOLIDATED SHORE; EM — EMERGENT; SS — SCRUB-SHRUB; FO — FORESTED; OW — OPEN WATER (Unknown Bottom)
Subclass: 1 Bedrock, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Algal, 2 Aquatic Vascular, 3 Attached Invertebrate, 4 Suspension/Filter Feeder, 5 Unknown Submergent, 6 Emergent; 1 Aquatic Bed, 2 Rubble; 1 Cobble Gravel, 2 Sand, 3 Mud, 4 Organic; 1 Broad Leaved Deciduous, 2 Needle Leaved Deciduous, 3 Broad Leaved Evergreen, 4 Needle Leaved Evergreen, 5 Dead, 6 Deciduous, 7 Evergreen, 8 Unknown; 1 Broad Leaved Deciduous, 2 Needle Leaved Deciduous, 3 Broad Leaved Evergreen, 4 Needle Leaved Evergreen, 5 Dead, 6 Deciduous, 7 Evergreen, 8 Unknown

MODIFIERS
In order to more adequately describe wetland and deepwater habitat within many of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The former modifier may also be applied to the ecological system.

WATER REGIME	WATER CHEMISTRY	SOIL	SPECIAL MODIFIERS
Non-Tidal: 1 Temporary Flooded; 2 Seasonally Flooded; 3 Semipermanently Flooded; 4 Intermittently Exposed; 5 Permanently Flooded; 6 Artificially Flooded. Tidal: 7 Irregularly Flooded; 8 Regularly Flooded; 9 Irregularly Flooded. Coastal Halinity: 10 Diurnal; 11 Semidiurnal; 12 Exclusively Lunar. Inland Salinity: 13 Hyperhaline; 14 Euhaline; 15 Oligohaline; 16 Mixohaline (Brackish); 17 Fresh. pH Modifiers for pH Fresh Water: 18 Acid; 19 Circumneutral; 20 Alkaline. *These water regimes are used only in tidally influenced freshwater wetlands.	1 Acid; 2 Circumneutral; 3 Alkaline	1 Organic; 2 Mineral	1 Beaver; 2 Partly Drained/Ditched; 3 Farmed; 4 Artificial; 5 Diked/Impounded; 6 Spoil; 7 Excavated

5.4 Analytical Results

No semi-volatile organic compounds, pesticides, or PCBs were detected in the samples. Barium was detected at more than 3 times the background concentration in sediment samples SP-05-SD and SP-02-SD, the PPE 1 and downstream Rugby Road samples. Lead was also reported in these 2 sediment samples, and in on-site sample SP-06-SS/SD at its quantitation limit of 20 mg/kg. Lead in the background sample was quantified as < 20 mg/kg. Zinc was detected in SP-05-SD at just over 3 times its background concentration, but was less than 3 times background level in the samples adjacent to the site (SP-03-SD) and downstream at Rugby Road (SP-02-SD) (Table 3; Appendix A)..

Toluene was detected at a concentration of 11 ug/l in sediment sample SP-03-SD, adjacent to the site on Mud Creek. No toluene was detected in the other sediment/soil samples, including those from the 2 wetland-draining channels (SP-05-SD, SP-06-SD). Attribution of the toluene to the site is therefore uncertain, although groundwater seepage could potentially have transported subsurface contaminant from the site to the creekbed.

Analyses of the surface water samples collected during the SI did not detect any contaminants at concentrations significantly elevated above background levels (Table 3; Appendix A).

5.5 Surface Water Conclusions

No visible evidence of past disposal or incineration of GE waste was observed at the Spann Property during the SI reconnaissance, however, the ground surface at the site was largely obscured by the present-day scrapyard. Although PCBs may have been buried in onsite wetlands, no visible evidence of release was observed along the surface water pathway.

Sediment sampling results indicate that zinc levels are elevated above background in sediment and soil samples (SP-05-SD and SP-06-SD) where runoff drains from wetlands adjacent to the site. The zinc concentration was only slightly reduced in sediment collected 1.2 miles farther downstream (SP-02-SD). This lack of attenuation with distance would be unexpected for point source discharge of contaminated sediment to a river. At the same time, contaminant levels in a closer river sediment sample (SP-03-SD) were intermediate between the other samples and the background sample. Significantly, all of the various metals concentrations detected in the samples were well within their natural ranges for soils and stream sediments (Refs. 44-45).

No PCBs , pesticides, or semi-volatile organic compounds were detected in the surface water pathway of the Spann Property during the SI. Metals were not detected at the GE/Shepherd Farm site, so their presence at the Spann Property is probably not attributable to the disposal of GE waste. Although elevated metals might originate from the scrapyard, or potentially (in the case of zinc) from waste paint sludge, the metals concentrations in creek and wetland sediments downgradient of the Spann Property remain within their natural ranges. Attribution of metals to the site is therefore questionable.

TABLE 3
SITE INSPECTION
SPANN PROPERTY
NCD 986 180 917
ANALYTICAL RESULTS (SEDIMENT/SOIL SAMPLES)

Designation:	SP-02-SD	SP-03-SD	SP-04-SD	SP-05-SD	SP-06-SS/SF
Location:	Rugbee Rd	Site	Upstream	PPE (Ditch)	Overland
Medium:	Sediment				Soil
Date:	4/5/94				
VOLATILE ORGANIC COMPOUNDS (ug/kg)					
Toluene	--	11	--	--	--
SEMIVOLATILE ORGANIC COMPOUNDS (ug/kg)					
PESTICIDES/PCBS					
INORGANIC PARAMETERS (mg/kg)					
Arsenic	< 1.9	< 1.9	< 1.9	< 1.9	< 1.9
Barium	63	41	20	70	55
Cadmium	< 10	< 10	< 10	< 10	< 10
Chromium	< 10	< 10	< 10	< 10	< 10
Lead	20	< 20	< 20	20	20
Mercury	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Selenium	< 1	< 1	< 1	< 1	< 1
Silver	< 10	< 10	< 10	< 10	< 10
Zinc	47	31	16	53	49

-- Parameter not detected, or below quantitation limit.

1. No semi-volatile organic compounds, pesticides, or PCBs detected in samples.
2. No applicable benchmark values for sediment.
3. See Appendix A for Sample Analyses.

The low concentration of toluene detected in a Mud Creek sediment sample adjacent to the site may be attributable to groundwater seepage from the site, however, no other evidence of toluene was detected in surface water, sediment or soil downgradient and downstream of the site. Based on the SI sampling results, no significant contaminant release attributable to the site is believed to have occurred to the surface water pathway .

6.0 SOIL EXPOSURE AND AIR PATHWAYS

6.1 Physical Condition

The approximately 5-acre junkyard area within the site is covered with automobile debris, construction debris and wastes, with some bare soil exposed along vehicle routes and between junk piles. The remainder of the site is vegetated with grass, weeds, shrubs and trees. The property is partially fenced with a locked gate to prevent access from Route 25, but can be entered on foot from the direction of Mud Creek.

6.2 Soil and Air Targets

Three residents currently live on the property, within the fence. Three employees typically work at the site (Ref. 7). Fletcher Academy, located approximately one mile northeast of the site, is the nearest school, with approximately 400 students and faculty (Ref. 8; Ref. 26). The nearest day care facilities are located in Fletcher, Mountain Home, and Naples, NC. All are believed to be located more than 0.25 mile from the site (Ref. 46). Ten residences were identified within 0.25 mile of the site (Ref. 14). The total population within a 4-mile radius of the site is estimated at 19,997 (Ref. 38).

Approximately 95 acres of mapped or potential wetland area are located within a 0.5 mile radius. An approximately 5-acre portion of this total area is mapped within the site boundaries (Ref. 3; Ref. 35). No critical habitats for endangered species are designated within 4 miles of the site (Ref. 37). Two sensitive environments are located within a 4-mile radius of the site: Cryptobranchus allenganiensus (Hellbender) is located 2.5 miles from the site and the plant species Synosma suaveolens (Sweet Indian plantain) grows in bottomlands located 2.25 miles from the site (Ref. 36; Fig. 3).

6.3 Sample Locations

One soil sample, SP-06-SF, was collected from the bottom of the dry, shallow runoff channel which drains the northern portion of the site (Ref. 6, p. 6). The sample was located approximately 20 feet upgradient of PPE 2, where the channel empties over the bank of Mud Creek (Fig. 2; Photos 7-8).

No formal air sampling was conducted onsite during the SI reconnaissance, however, an OVA flame ionization detector was used onsite to monitor the air for elevated volatile organic compounds.

6.4 Analytical Results

No volatile or semi-volatile organic compounds, pesticides, or PCBs were detected in the runoff channel soil sample. Metals detected in the sample included zinc, and lead. The concentrations of these analytes were similar to those detected in SP-05-SD, the sediment sample collected from the ditch that drains the wetland south of the site (Table 3). Both samples had zinc concentrations more than 3 times greater than the upstream sediment sample (SP-04-SD) (Sections 5.3 - 5.4). The upstream lead concentration was below the quantitation limit of 20 mg/kg., and lead concentrations in SP-05-SD and SP-06-SF were both at the detection limit (Appendix A). . The concentrations of barium and zinc detected in the soil sample were less than 0.1 percent of their respective benchmark levels for human soil exposure. No such benchmark currently exists for lead (Ref. 39).

Air monitoring conducted during the SI reconnaissance detected no elevated volatile organic compounds. No unusual odors, blowing dust, or exposed wastes (other than the solid waste listed in Section 2.2) were observed onsite (Ref. 6, p. 4).

6.5 Soil Exposure and Air Pathway Conclusions

Barium, zinc and possibly lead were detected in onsite soil but do not pose a significant health threat. Metals were not detected in the PCB source at the GE Shepherd Farm Site, and may not be attributable to GE waste disposal at the Spann Property (Ref. 11, p. 6). Metals (particularly lead and zinc) could originate from the automobile scrapyard or from waste paint sludge dumped at the property. However, the metals concentrations in soil and those detected in the surface water pathway all fall within natural ranges (See Section 5.5) (Ref. 44-45). Based on surface conditions observed at the site and on the limited soil sampling conducted during the SI, the threat of human exposure to suspected PCBs or waste solvents at the site appears to be limited.

7.0 SUMMARY AND CONCLUSIONS

During the late 1960s, the Spann Property was used to dispose of an unknown quantity of industrial waste from General Electric Company. GE disposal records and interviews with the disposal contractor indicate that past disposal practices may have included the on-site destruction of electrical components containing PCBs, as well as possible disposal of toluene and chlorinated solvents. At the GE/Shepherd Farm site, previously used by the same contractor, sampling has revealed onsite PCB contamination of soil and offsite contamination of groundwater by solvents and of stream sediment by solvents and PCBs. The Spann Property was therefore investigated to see if PCB and solvent contamination was present there.

Wastes were reportedly hauled to the Spann Property on a regular basis, then burned and/or buried at unspecified locations on a knoll and adjacent floodplain. The knoll has since been covered by an automobile scrapyard, and much of the ground surface there is not readily accessible for visual examination or sampling. The exact location of GE waste disposal could not be identified during the NC Superfund Section's PA and SI reconnaissances, or by consulting with the contractor.

The main potential hazards posed by the site are groundwater contamination by toluene and chlorinated solvents, and surface water pathway contamination by solvents and PCBs . Groundwater wells still supply a large portion of the study area with drinking water. No surface drinking water intakes are reported at present within 15 miles downstream of the site, however, the entire 15-mile pathway supports fisheries, and mapped wetlands are present both on site and downstream. A family of 3 lives at the site, and 3 people work part-time at the scrapyard. The nearest offsite residence is over 200 feet away. The site is partially fenced but is accessible from the direction of Mud Creek.

No semi-volatile organic compounds, pesticides, or PCBs were detected in samples collected during the Spann Property SI. Zinc was detected at elevated concentrations in a sediment sample from a mapped wetland south of the site. Barium and zinc were also detected in soil from a dry runoff channel in a mapped wetland area draining the northern part of the site. Barium was also present in a sediment sample collected, 1.2 miles downstream of the site. Lead was detected in the above samples at or below its 20 mg/l quantitation limit.

No inorganic contaminants were detected in samples collected at the GE/Shepherd Farm site, and the metals detected in the Spann Property samples were present at concentrations common in natural soils and sediment. The analytes detected at the Spann Property therefore may not be attributable to the site. Sampling and onsite observations to date do not indicate release of PCBs or solvents at the site, which was used for a much shorter time period (2-3 tears) than the contaminated GE/ Shepherd Farm site. Based on the above results and findings, the NC Superfund Section does not recommend the Spann Property for additional remedial action under CERCLA.

REFERENCE LIST

1. United States Tennessee Valley Authority: Asheville, NC, 1961 (Photorevised 1991); Fruitland, NC, 1965 (Photorevised 1990); Hendersonville, NC, 1965 (Photorevised 1990); Horse Shoe, NC, 1965 (1991); (Photorevised 198); Skyland, NC, 1965 (Photorevised 1991); 7.5 minute quadrangles, 1:24,000.

2. Parker, Stuart F., NC Superfund Section, Latitude and Longitude Worksheet, from Guidance for Performing Preliminary Assessments Under CERCLA, EPA Pub .9345.0-01A.

3. US Department of Agriculture, Soil Conservation Service, Soil Survey of Henderson County, North Carolina, April, 1980.

4. North Carolina Atlas: Portrait of a Changing Southern State. University of North Carolina Press, Chapel Hill, NC, 1975.

5. US Department of Commerce, Climatic Atlas of the United States, Climatic Data Center, Asheville, NC, 1979.

6. Parker, Stuart F., NC Superfund Section, Memorandum to File: Site Inspection (SI) Site Reconnaissance, and attached Field Notes, April 4-5, 1994.

7. Parker, Stuart F., NC Superfund Section, Memorandum to File: Telecommunications with Mary Beck, Site Owner, and Herbert Hodge, Onsite Scrapyard Operator, March 24, 1994.

8. Parker, Stuart F., NC Superfund Section, Memorandum to File: Telecommunications with Henderson County Health Department, May 24, 1994.

9. Wallingford, Edward, NC DHR, Preliminary Assessment Report, Shepherd Farm (NCD 986 170 686, June 1989, and Attached PA Form, May 26, 1989.

10. General Electric Company, Response to 1990 EPA Region IV 104(e) Information Inquiry (No Date).

11. Nicholson, Grover; Butler, Jack; Lilley, David, NC Superfund Section, Memoranda to File Regarding GE/Shepherd Farm Site, December 1, 1988 through February 7, 1992.

12. US EPA Office of Solid Waste and Emergency Response, Background Information: National Priorities List, Final Rule, Publication 9320.7-041, May, 1994.

13. Spires, Holly, NC Superfund Section, Preliminary Assessment Report, Spann Property (NCD 986 180 917), August 17, 1992, and Attached PA Form, August 10, 1992.

14. Parker, Stuart F., NC Superfund Section, Memorandum to File: Aerial Photograph Interpretation, June 30, 1994.

NC Dept. of Transportation, Division of Highways, Photogrammetric Unit, Mission 1281, No. 21, February 17, 1977; Mission 2145, No. 12 April 28, 1987; Mission 2647, No. 28, April 23, 1991.

15. Parker, Stuart F., NC Superfund Section, Memorandum to File: Telecommunication with Eugene Shepherd, Former GE Waste Transporter, May 22, 1994

16. Vaughn-Wright, Deborah A., US EPA Region IV, Memorandum to EPA Project File: Trip Report, Shepherd's Farm Site, Flat Rock, North Carolina, and Attached Completed Questionnaire, July 10, 1991.

17. Lucius, Kirk, for Tobin, Patrick M., US EPA Region IV, Waste Management Division, 104(e) Information Inquiry Submitted to Eugene Shepherd, and Attached Reply, July 18, 1990.

18. Brock, Belinda, NUS Corporation, Field Notebook F4-2267, Shepherd Farm, TDD No. F4-9005-37, pp. 1-5, May 18, 1990.

19. Heath, R. C., US Geological Survey, Basic Elements of Groundwater Hydrology with Reference to Conditions in North Carolina, Open-file Report 80-44, Raleigh, NC, 1980.

20. Trapp, Henry, Jr., US Geological Survey, Geology and Ground-water Resources of the Asheville Area, North Carolina, Ground Water Bulletin No. 16, April 1970.

21. NC Department of Natural Resources and Community Development, Geological Survey, Geologic Map of North Carolina, 1985.

22. US EPA, Hazard Ranking System, Final Rule, Federal Register, Volume 55, No. 241, Book 2, 40 CFR 300, p. 51601, 51613, US Government printing Office, December 14, 1990.

23. Parker, Stuart F., NC Superfund Section, Memorandum to File: Municipal Surface Water Supplies within the Study Area, May 24, 1994.

24. NC Division of Health Services - Environmental Health Section - Water Supply Branch, Public Water Supply Data Sheet, Henderson County, NC Inventory Document PWSI.410, May 16, 1990.

25. Parker, Stuart F., NC Superfund Section, Memorandum to File: Groundwater Population Count, May 24, 1994.

26. Parker, Stuart F., NC Superfund Section, Memorandum to File: Community Water Well Database, June 30, 1994.

27. US Department of Commerce, Bureau of the Census, Census of Population and Housing, Summary Population and Housing Characteristics, North Carolina, 1990.

28. Drainage Areas of Selected Sites on Streams in North Carolina, US Geological Survey Open File Report 83-211, Raleigh, NC, 1983.

29. US Geological Survey, Map of Mean Annual Runoff for the Northeastern Southeastern, and Mid-Atlantic United States, Water Years 1951-1980, Water Resources Investigations Report 88-4094, 1990.

30. Parker, Stuart F., NC Superfund Section, Memorandum to File: Surface Water Pathway Definition, June 6, 1994.

31. NC DEHNR, Division of Environmental Management, Administrative Code Section 15A NCAC 2B .0304 - Classifications and Water Quality Standards Assigned to the Waters of the French Broad River Basin, February 1, 1993.

32. Herschfield, David M., Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years, Technical Paper No. 40, US Department of Commerce, 1961.

33. Parker, Stuart F., NC Superfund Section, Memorandum to File: Municipal Drinking Water Supplies within the Study Area, May 24, 1994.

34. Parker, Stuart F., NC Superfund Section, Memorandum to File: Fisheries on Mud Creek and French Broad River, May 20, 1994.

35. Parker, Stuart F., NC Superfund Section, Memorandum to File: Wetland Targets, June 30, 1994.

36. Parker, Stuart F., NC Superfund Section, Memorandum to File: Review of Natural Heritage Program Maps and File Information, October 27, 1993.

Legrand, Harry E., Natural Heritage Program List of The Rare Plant Species of North Carolina, North Carolina Natural Heritage Program, Division Of Parks and Recreation, 1993.

Legrand, Harry E., Natural Heritage Program List of The Rare Animal Species of North Carolina, North Carolina Natural Heritage Program, Division Of Parks and Recreation, 1993.

37. Parker, Stuart F., NC Superfund Section, Memorandum to NC Superfund Section Staff: Update on Critical Habitats in NC; April 14, 1994

38. Center for Geographic Information and Analysis (CGIA) report on Spann Property, Hendersonville, NC, February 18, 1994.

39. Superfund Chemical Data Matrix (SCDM), Appendix B, Hazardous Substance Benchmarks (329 Substances), March 1993 Version.

40. US Department of Agriculture, Soil Conservation Service, Hydric Soils, Henderson County, North Carolina, Technical Guide, Section II-A-2, June 1991.

41. NC Administrative Code, Title 15A, DEHNR, DEM, Subchapter 2L, Section .0200, Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina, pp. 21-22, November 8. 1993.

42. Stanley, Jeanette, NC Superfund Section, Memorandum to File: Update on Status of Well Head Protection Programs in NC, January 10. 1994.

43. Federal Emergency Management Agency, Henderson County, NC, Flood Insurance Rate Map, Comm. Panel 370125 0085B, March 1, 1982.

44. Shields, E. J., Pollution Control Engineer's Handbook, Revised and Expanded Edition, p. 101, Chemical Element Content of Natural Soils, 1990.

45. Parker, Stuart F., NC Superfund Section, Memorandum to File: Geochemical Atlas Interpretation, July 13, 1994, and attached Reference.

46. Parker, Stuart F., NC Superfund Section, Memorandum to File: Proximity of Day Care Centers to Site, August 18, 1994, and attached Reference.

PHOTOGRAPHS

1. Looking south toward automobile scrapyard, located on and around knoll on south half of Spann Property.

2. Collection of surface water sample SP-02-SW, beneath bridge where Rugby Road crosses Mud Creek.

K&M Division POLYVIN
Torrance, CA 90503 # PV119

3. Collection of sediment sample SP-03-SD, adjacent to Spann Property on Mud Creek.

4. Evidence of fishing on Mud Creek - note chair and forked stick support. Upstream (background) sample location SP-04 visible at left-center.

5. Collection of sediment sample SP-05-SD, where wetland south of site drains into Mud Creek (background) via ditch.

6. Wetland area south of Spann Property, viewed from US Route 25.

K&E Division PO
Torrance, CA 90503 # PV119

7. Mapped on-site wetland area, west of Mud Creek and northeast of automobile scrapyard .

8. Collection of soil/sediment sample SP-06-SS/SF, in overland drainage path from mapped on-site wetland.

PENDICES

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 718 [redacted]

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# _____ Date Collected 4/5/94 Time 0840

Agency: ___ Hazardous Waste ___ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-02-SW
X Surface water (2)	___ Liquid (6)	(MUD CRK AT RUBBER ROAD)
___ Soil (3)	___ Sludge (7)	(BELOW WETLAND ON
___ Other (4)	___ Other (8)	MUD CRK)

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WG Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-19-94 MW Lab Number 941023

DHS 3191 (Revised 2/91)

N.C. Department of Environment,
Health, & Natural Resources
Solid Waste Management Division

P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 715 [redacted]

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZINN ID# _____ Date Collected 4/4/94 Time 1930

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
X Ground water (1)	____ Solid (5)	GILLILAND
____ Surface water (2)	____ Liquid (6)	DOMESTIC WATER
____ Soil (3)	____ Sludge (7)	SUPPLY WELL
____ Other (4)	____ Other (8)	(DRINKING WATER)
		SP-01-GW

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received 4-7-94 Reported by John L. Neal

Date Extracted _____ Date Reported 5-4-94

Date Analyzed 4-19-94 4/18/94 Lab Number 941021

DHS 3191 (Revised 2/91)

#941021-941840

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

AM LE VALIST REQUEST

P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 71

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZINN ID# ____ Date Collected 4/4/94 Time 19:30

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
X Ground water (1)	____ Solid (5)	GILLILAND
____ Surface water (2)	____ Liquid (6)	DOMESTIC WATER
____ Soil (3)	____ Sludge (7)	SUPPLY WELL
____ Other (4)	____ Other (8)	(DRINKING WATER) SP-01-GW

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
X Acid:B/N Ext.	
____ MTBE	
X PESTICIDE/PCB	
PCBs	<0.0001
ENDRIN	<0.0001
LINDANE	<0.0002
METHOXYCHLOR	<0.001
TOXAPHENE	<0.002
CHLORDANE	<0.0002
HEPTACHLOR	<0.0001
HEXACHLORO-BENZENE	<0.0001

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WY Reported by ____
PEST+PCB: 4-8-94 VP, BD
Date Extracted BNA 4-8-94 SA, WG Date Reported ____
BNA PEST+PCB
Date Analyzed 4-11-94, 4-8-94 Lab Number 941022
BD VP

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16668

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZAPP ID# ____ Date Collected 4/4/94 Time 1935

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
X Ground water (1)	___ Solid (5)	GILLILAND
___ Surface water (2)	___ Liquid (6)	DOMESTIC WATER
___ Soil (3)	___ Sludge (7)	SUPPLY WELL
___ Other (4)	___ Other (8)	(DRINKING WATER) SP-01-GW

Organic Chemistry

Parameter	Results (mg/l)
___ P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l)
X Arsenic	<0.01
X Barium	0.10
X Cadmium	<0.002
___ Chloride	
X Chromium	<0.01
___ Copper	
___ Fluoride	
___ Iron	
X Lead	0.010
___ Manganese	
X Mercury	<0.0005
___ Nitrate	
X Selenium	0.009
X Silver	<0.05
___ Sulfates	
X Zinc	0.10
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results (mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005714 APR 8 94

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 720

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/M ZIPPN ID# _____ Date Collected 4/5/94 Time 0840

Agency: ___ Hazardous Waste ___ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-02-SW
X Surface water (2)	___ Liquid (6)	(MUD CRK AT MULBERRY)
___ Soil (3)	___ Sludge (7)	(BELOW WETLAND)
___ Other (4)	___ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
___ P&T:GC/MS	
X Acid:B/N Ext.	
___ MTBE	
X PESTICIDE/PCB	
PCB's	<0.0001
ENDRIN	<0.0001
LINDANE	<0.0002
Methoxychlor	<0.001
TOXAPHENE	<0.002
Chlordane	<0.0002
Heptachlor	<0.0001
HEXACHLOROBENZENE	<0.0001

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 VS Reported by _____

PEST+PCB's 4-8-94 VP, BD

Date Extracted BNA 4-8-94 SA, WG Date Reported _____

BNA PEST+PCB

Date Analyzed 4-1-94, 4-8-94 Lab Number 941024

DHS 3191 (Revised 2/91) BO VP

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16669

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZINN ID# ____ Date Collected 4/5/94 Time 0840

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-02-SW
X Surface water (2)	___ Liquid (6)	(MUD CREEK AT RUBBERD)
___ Soil (3)	___ Sludge (7)	
___ Other (4)	___ Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
___ P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) (~~mg/kg~~)
X Arsenic	<0.01
X Barium	0.04
X Cadmium	<0.002
~~X Chloride~~	
X Chromium	<0.01
___ Copper	
___ Fluoride	
___ Iron	
X Lead	<0.005
___ Manganese	
X Mercury	<0.0005
___ Nitrate	
X Selenium	0.010
X Silver	<0.05
___ Sulfates	
X Zinc	<0.05
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results (mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported 005715 APR 094

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 725

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / M ZIPP ID# ____ Date Collected 4/5/94 Time 0930

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-03-SW
X Surface water (2)	___ Liquid (6)	(MUD CREEK UPSTREAM
___ Soil (3)	___ Sludge (7)	OF AREA)
___ Other (4)	___ Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
___ P&T:GC/MS	
X Acid:B/N Ext.	
___ MTBE	
X PESTICIDE/PCB	
___ PCB's	<0.0001
___ ENDRIN	<0.0001
___ LINDANE	<0.0002
___ Methoxychlor	<0.001
___ TOXAPHENE	<0.002
___ Chlordane	<0.0002
___ Heptachlor	<0.0001
___ Hexachlorobenzene	<0.0001

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) (mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results (mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WB Reported by ____

PESTICIDES 4-8-94 VP BD

Date Extracted BNA 4-8-94 SA, WG Date Reported ____

BNA PESTICIDE

Date Analyzed 4-11-94, 4-8-94 Lab Number 941027

BD VP

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16671

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZINN ID# ____ Date Collected 4/5/94 Time 0930

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-03-SW
X Surface water (2)	____ Liquid (6)	(MUD CREK UPSTREAM
____ Soil (3)	____ Sludge (7)	OF SITE 25)
____ Other (4)	____ Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
____ P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) ~~(mg/kg)~~
X Arsenic	<0.01
X Barium	0.04
X Cadmium	<0.002
~~X Chloride~~	
X Chromium	<0.01
____ Copper	
____ Fluoride	
____ Iron	
X Lead	<0.005
____ Manganese	
X Mercury	<0.0005
____ Nitrate	
X Selenium	0.009
X Silver	<0.05
____ Sulfates	
X Zinc	<0.05
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results (mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005716 APR 894

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 733 [redacted]

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# _____ Date Collected 4/5/94 Time 1300

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-04-SW
X Surface water (2)	___ Liquid (6)	(MUD CREEK
___ Soil (3)	___ Sludge (7)	UPSTREAM OF SITE)
___ Other (4)	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 NW Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-21-94 NW Lab Number 941034

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 735

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# ____ Date Collected 4/5/94 Time 1300

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-04-SW
X Surface water (2)	____ Liquid (6)	(MUD CREEK UPSTREAM
____ Soil (3)	____ Sludge (7)	OF SITE)
____ Other (4)	____ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
X Acid:B/N Ext.	
____ MTBE	
X PESTICIDE/PCB	
PCB's	<0.0001
ENDRIN	<0.0001
LINDANE	<0.0002
Methoxychlor	<0.001
TOXAPHENE	<0.002
CHLORDANE	<0.0002
Heptachlor	<0.0001
HEXACHLOROBENZENE	<0.0001

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WS Reported by ____
PEST+PCB's 4-8-94 VP BD
Date Extracted BNA 4-8-94 SA, WG Date Reported ____
BNA PESTIPCB
Date Analyzed 4-11-94 4-8-94 Lab Number 941035
BD VP

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number [redacted]/1667J

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# ____ Date Collected 4/5/94 Time 1300

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-04-SW
X Surface water (2)	___ Liquid (6)	(MUD CREEK UPSTREAM
___ Soil (3)	___ Sludge (7)	OF SITE)
___ Other (4)	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
___ P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Inorganic Chemistry

Parameter	Results(mg/l) ~~(mg/kg)~~
X Arsenic	<0.01
X Barium	0.04
X Cadmium	<0.002
~~X Chloride~~	
X Chromium	<0.01
___ Copper	
___ Fluoride	
___ Iron	
X Lead	<0.005
___ Manganese	
X Mercury	<0.0005
___ Nitrate	
X Selenium	0.010
X Silver	<0.05
___ Sulfates	
X Zinc	<0.05
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005718 APR 094

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 728 [redacted]

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZINN ID# _____ Date Collected 4/5/94 Time 12 05

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-05-SW
X Surface water (2)	___ Liquid (6)	(SE DRAINAGE DITCH)
___ Soil (3)	___ Sludge (7)	
___ Other (4)	___ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 NW Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-21-94 NW Lab Number 941030

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 730

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZIPP ID# _____ Date Collected 4/5/94 Time 12 05

Agency: ___ Hazardous Waste ___ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP.05SW
X Surface water (2)	___ Liquid (6)	(SE DRAINAGE DITCH)
___ Soil (3)	___ Sludge (7)	
___ Other (4)	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
___ P&T:GC/MS	
X Acid:B/N Ext.	
___ MTBE	
X PESTICIDE/PCB	
___ PCB's	<0.0001
___ ENDRIN	<0.0001
___ LINDANE	<0.0002
___ METHOXYCHLOR	<0.001
___ TOXAPHENE	<0.002
___ CHLORDANE	<0.0002
___ HEPTACHLOR	<0.0001
___ HEXACHLOROBENZENE	<0.0001

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 KB Reported by _____
~~PESTY PCB'S 4-8-94 VP BD~~
Date Extracted BNA 4-8-94 SA WG Date Reported _____
BNA PESTY PCB
Date Analyzed 4-11-94 4-8-94 Lab Number 941031
BD VP

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16673

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/M ZINN ID# ____ Date Collected 4/5/94 Time 1205

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-05-SW
X Surface water (2)	____ Liquid (6)	(SE DRAINAGE DITCH)
____ Soil (3)	____ Sludge (7)	
____ Other (4)	____ Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
____ P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) ~~(mg/kg)~~
X Arsenic	<0.01
X Barium	0.07
X Cadmium	<0.002
~~X Chloride~~	
X Chromium	<0.01
____ Copper	
____ Fluoride	
____ Iron	
X Lead	<0.005
____ Manganese	
X Mercury	<0.0005
____ Nitrate	
X Selenium	0.009
X Silver	<0.05
____ Sulfates	
X Zinc	<0.05
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results (mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005717 APR 8 94

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 721 - [redacted]

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZINN ID# _____ Date Collected 4/5/94 Time 0848

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-02-SD
___ Surface water (2)	___ Liquid (6)	(MUD CREEK AT MEBANE RD)
___ Soil (3)	___ Sludge (7)	
X Other (4) SEDIMENT	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 NB Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-21-94 NW Lab Number 941025

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 722

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# ____ Date Collected 4/5/94 Time 0848

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-02-SD
___ Surface water (2)	___ Liquid (6)	(MUD CREEK AT MUGGY RD)
___ Soil (3)	___ Sludge (7)	
X Other (4) SEDIMENT	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
___ P&T:GC/MS	
X Acid:B/N Ext.	
___ MTBE	
X PESTICIDE/PCB	
___ PCB's	<0.10 ppm
___ ENDRIN	<0.10 ppm
___ LINDANE	<0.20 ppm
___ Methoxychlor	<1.0 ppm
___ TOXAPHENE	<2.0 ppm
___ CHLORDANE	<0.20 ppm
___ Heptachlor	<0.10 ppm
HEXACHLOROBENZENE	0.10 ppm

↑ This is a non-detect as per John Neal, 5/17/94

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	

Radiochemistry

Parameter	Results
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WB Reported by ____

PEST+PCB's 4-14-94 VP

Date Extracted BNA 4-11-94 SA Date Reported ____

BNA PCB+PEST

Date Analyzed 4-12-94, 4-15-94 Lab Number 941026

BQ VP

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16670

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPP ID# ____ Date Collected 4/5/94 Time 0848

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP02-SD
____ Surface water (2)	____ Liquid (6)	(MUD CREEK AT MIGBEE RD)
____ Soil (3)	____ Sludge (7)	
X Other (4) SEDIMENT	____ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results ~~(mg/l)~~ (mg/kg)
X Arsenic	<1.9
X Barium	63
X Cadmium	<10
Chloride	
X Chromium	<10
Copper	
Fluoride	
Iron	
X Lead	20
Manganese	
X Mercury	<0.09
Nitrate	
X Selenium	<1
X Silver	<10
Sulfates	
X Zinc	47
pH	
Conductivity	
TDS	
TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported 26 Apr 94

005719 APR 894

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 726

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPP ID# _____ Date Collected 4/15/94 Time 0938

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-03-SD
____ Surface water (2)	____ Liquid (6)	(MUD CRK UPSTREAM
____ Soil (3)	____ Sludge (7)	OF RTE 25)
X Other (4) SEDIMENT	____ Other (8)	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Chemistry

Parameter	Results (mg/l)
X P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Inorganic Chemistry

Parameter	Results (mg/l) (mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

Organic Compounds	Results (mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Date Received 4-7-94 WB Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-21-94 MW Lab Number 941028

LHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 727

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZIPPN ID# ____ Date Collected 4/5/94 Time 0938

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-03-SD
____ Surface water (2)	____ Liquid (6)	(MUD CRK UPSTREAM
____ Soil (3)	____ Sludge (7)	OF RTE 25)
X Other (4) SEDIMENT	____ Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
____ P&T:GC/MS	
X Acid:B/N Ext.	
____ MTBE	
X PESTICIDE/PCB	
PCB's	<0.10 ppm
ENDRIN	<0.10 ppm
LINDANE	<0.20 ppm
Methoxychlor	<1.0 ppm
TOXAPHENE	<2.0 ppm
Chlordane	<0.20 ppm
Heptachlor	<0.10 ppm
HEXACHLOROBENZENE	<0.10 ppm

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) (mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results (mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received 4-7-94 Reported by ____
PEST+PCB's 4-14-94 VP
Date Extracted BNA 4-11-94 SA Date Reported ____
BNA PCB+PEST
Date Analyzed 4-12-94, 4-15-94 Lab Number 941029
BD VP

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number [redacted] 16672

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZIPP ID# _____ Date Collected 4/5/94 Time 0938

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-03-SD
____ Surface water (2)	____ Liquid (6)	(MUD CRK UPSTREAM
____ Soil (3)	____ Sludge (7)	OF RTE 25)
X Other (4) SEDIMENT	____ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results ~~(mg/l)~~ (mg/kg)
X Arsenic	<1.9
X Barium	41
X Cadmium	<10
____ Chloride	
X Chromium	<10
____ Copper	
____ Fluoride	
____ Iron	
X Lead	<20
____ Manganese	
X Mercury	<0.09
____ Nitrate	
X Selenium	<1
X Silver	<10
____ Sulfates	
X Zinc	31
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received _____ Reported by _____

Date Extracted _____ Date Reported _____

005720 APR 094

Date Analyzed _____ Lab Number _____

DHS 3291 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 736

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPP ID# _____ Date Collected 4/5/94 Time 1308

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-04-SD
___ Surface water (2)	___ Liquid (6)	(MUD CREEK UPSTREAM
___ Soil (3)	___ Sludge (7)	OF SITE)
X Other (4) SEDIMENT	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results (mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) (mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Organic Compounds	Results (mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WR Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-21-94 MW Lab Number 941036

LHS 3[illegible] (Rev. 4/2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 737

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZIPPN ID# ____ Date Collected 4/5/94 Time 1308

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-04-SD
___ Surface water (2)	___ Liquid (6)	(MUD CRK UPSTREAM
___ Soil (3)	___ Sludge (7)	OF SITE)
X Other (4) SEDIMENT	___ Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
___ P&T:GC/MS	
X Acid:B/N Ext.	
___ MTBE	
X PESTICIDE/PCB	
___ PCBs	<0.10 ppm
___ ENDRIN	<0.10 ppm
___ LINDANE	<0.20 ppm
___ Methoxychlor	<1.0 ppm
___ TOXAPHENE	<2.0 ppm
___ Chlordane	<0.20 ppm
___ Heptachlor	<0.10 ppm
Hexachlorobenzene	<0.10 ppm

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) (mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results (mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WB Reported by ____

Date Extracted PEST+PCBs 4-14-94 VP BNA 4-11-94 SA BNA PCBs+Pest Date Reported ____

Date Analyzed 4-12-94, 4-15-94 BO VP Lab Number 941037

DHS 3191 (Revised 2/93)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 11676

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# ____ Date Collected 4/5/94 Time 1308

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-04-SD
____ Surface water (2)	____ Liquid (6)	(MUD CRK UPSTREAM
____ Soil (3)	____ Sludge (7)	OF SITE)
X Other (4) SEDIMENT	Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results ~~(mg/l)~~ (mg/kg)
X Arsenic	<1.9
X Barium	20
X Cadmium	<10
____ Chloride	
X Chromium	<10
____ Copper	
____ Fluoride	
____ Iron	
X Lead	<20
____ Manganese	
X Mercury	<0.09
____ Nitrate	
X Selenium	<1
X Silver	<10
____ Sulfates	
X Zinc	16
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005722 APR 894

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 731

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPPN ID# ____ Date Collected 4/5/94 Time 12 00

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-05-SD
____ Surface water (2)	____ Liquid (6)	(SE DRAINAGE DITCH)
____ Soil (3)	____ Sludge (7)	
X Other (4) SEDIMENT	Other (8)	

Organic Chemistry

Parameter	Results (mg/l)
X P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results (mg/l) (mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results (mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results (mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WB Reported by ____

Date Extracted ____ Date Reported ____

Date Analyzed 4-21-94 MW Lab Number 941032

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number LS 732

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZIPP ID# ____ Date Collected 4/5/94 Time 12 00

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-05-SD
____ Surface water (2)	____ Liquid (6)	(SE DRAINAGE DITCH)
____ Soil (3)	____ Sludge (7)	
X Other (4) SEDIMENT	____ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
X Acid:B/N Ext.	
____ MTBE	
X PESTICIDE/PCB	
____ ENdrin	<0.10 ppm
____ LINDANE	<0.20 ppm
____ Methoxychlor	<1.0 ppm
____ TOXAPHENE	<2.0 ppm
____ Chlordane	<0.20 ppm
____ Heptachlor	<0.10 ppm
____ Hexachlorobenzene	<0.10 ppm
____ PCB's	<0.10 ppm

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chloride	
____ Chromium	
____ Copper	
____ Fluoride	
____ Iron	
____ Lead	
____ Manganese	
____ Mercury	
____ Nitrate	
____ Selenium	
____ Silver	
____ Sulfates	
____ Zinc	
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WD Reported by ____

Date Extracted PCB's+PEST 4-14-94 VP BNA 4-11-94 SA Date Reported ____

Date Analyzed BNA 4-12-94 PCB+PEST 4-15-94 BD VP Lab Number 941033

DHS 3191 (Revised 2/91)

C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16674

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER / H ZIPP ID# ____ Date Collected 4/5/94 Time 12 00

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
____ Ground water (1)	____ Solid (5)	SP-05-SD
____ Surface water (2)	____ Liquid (6)	(SE DRAINAGE DITCH)
____ Soil (3)	____ Sludge (7)	
X Other (4) SEDIMENT	Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
____ P&T:GC/MS	
____ Acid:B/N Ext.	
____ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
____ Gross Alpha	
____ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results ~~(mg/l)~~ (mg/kg)
X Arsenic	<1.9
X Barium	70
X Cadmium	<10
____ Chloride	
X Chromium	<10
____ Copper	
____ Fluoride	
____ Iron	
X Lead	20
____ Manganese	
X Mercury	<0.09
____ Nitrate	
X Selenium	<1
X Silver	<10
____ Sulfates	
X Zinc	53
____ pH	
____ Conductivity	
____ TDS	
____ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
____ Arsenic	
____ Barium	
____ Cadmium	
____ Chromium	
____ Lead	
____ Mercury	
____ Selenium	
____ Silver	

Organic Compounds	Results(mg/l)
____ benzene	
____ carbon tetrachloride	
____ chlordane	
____ chlorobenzene	
____ chloroform	
____ o-cresol	
____ m-cresol	
____ p-cresol	
____ cresol	
____ 1,4-dichlorobenzene	
____ 1,2-dichloroethane	
____ 1,1-dichloroethylene	
____ 2,4-dinitrotoluene	
____ heptachlor	
____ hexachlorobenzene	
____ hexachlorobutadiene	
____ hexachloroethane	
____ methyl ethyl ketone	
____ nitrobenzene	
____ pentachlorophenol	
____ pyridine	
____ tetrachloroethylene	
____ trichloroethylene	
____ 2,4,5-trichlorophenol	
____ 2,4,6-trichlorophenol	
____ vinyl chloride	
____ endrin	
____ lindane	
____ methoxychlor	
____ toxaphene	
____ 2,4-D	
____ 2,4,5-TP (Silvex)	

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005721 APR 894

Date Analyzed ____ Lab Number ____

DHS 3391 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 738

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/M ZINN ID# ____ Date Collected 4/5/94 Time 1345

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-06-SS
___ Surface water (2)	___ Liquid (6)	(N DRAINAGE DITCH)
X Soil (3)	___ Sludge (7)	
___ Other (4)	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Date Received 4-7-94 MW Reported by ____

Date Extracted ____ Date Reported ____

Date Analyzed 4-22-94 MW Lab Number 941038

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15 739

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZINN ID# ____ Date Collected 4/5/94 Time 1345

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP.06.SS
___ Surface water (2)	___ Liquid (6)	(N DRAINAGE DITCH)
X Soil (3)	___ Sludge (7)	
___ Other (4)	___ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
___ P&T:GC/MS	
X Acid:B/N Ext.	
___ MTBE	
X PESTICIDE/PCB	
___ PCBS	<0.10 ppm
___ ENDRIN	<0.10 ppm
___ LINDANE	<0.20 ppm
___ Methoxychlor	<1.0 ppm
___ TOXAPHENE	<2.0 ppm
___ Chlordane	<0.20 ppm
___ Heptachlor	<0.10 ppm
___ HEXACHLOROBENZENE	<0.10 ppm

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 WB Reported by ____

Date Extracted PCBS+PEST 4-14-94 VP BNA 4-11-94 SA Date Reported ____

Date Analyzed BNA PCBS+PEST 4-12-94, 4-15-94 BO VP Lab Number 941039

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 16677

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZINN ID# ____ Date Collected 4/5/94 Time 1345

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	SP-06-SS
___ Surface water (2)	___ Liquid (6)	(N DRAINAGE DITCH)
X Soil (3)	___ Sludge (7)	
___ Other (4)	___ Other (8)	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Chemistry

Parameter	Results(mg/l)
___ P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Inorganic Chemistry

Parameter	Results(~~mg/l~~)(mg/kg)
X Arsenic	<1.9
X Barium	55
X Cadmium	<10
___ Chloride	
X Chromium	<10
___ Copper	
___ Fluoride	
___ Iron	
X Lead	20
___ Manganese	
X Mercury	<0.09
___ Nitrate	
X Selenium	<1
X Silver	<10
___ Sulfates	
X Zinc	49
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Date Received ____ Reported by ____

Date Extracted ____ Date Reported ____

005723 APR 894

Date Analyzed ____ Lab Number ____

DHS 3191 (Revised 2/91)

N.C. Department of Environment, Health, & Natural Resources
Solid Waste Management Division

SAMPLE ANALYSIS REQUEST

State Laboratory of Public Health
P.O. Box 28047, 306 N. Wilmington Street
Raleigh, North Carolina 27611

Site Number NCD 986 180 917 Field Sample Number 15740 [redacted]

Name of Site SPANN PROPERTY Site Location HENDERSONVILLE, NC

Collected By SF PARKER/H ZIPP ID# _____ Date Collected 4/5/94 Time TRIP BLANK

Agency: ____ Hazardous Waste ____ Solid Waste X Superfund

Sample Type

Environmental	Concentrate	Comments
___ Ground water (1)	___ Solid (5)	TRIP BLANK
___ Surface water (2)	___ Liquid (6)	
___ Soil (3)	___ Sludge (7)	
X Other (4)	___ Other (8)	

Organic Chemistry

Parameter	Results(mg/l)
X P&T:GC/MS	
___ Acid:B/N Ext.	
___ MTBE	

Radiochemistry

Parameter	Results (PCi/l)
___ Gross Alpha	
___ Gross Beta	

Microbiology

Parameter	Results (Col/100ml)

Inorganic Chemistry

Parameter	Results(mg/l)(mg/kg)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chloride	
___ Chromium	
___ Copper	
___ Fluoride	
___ Iron	
___ Lead	
___ Manganese	
___ Mercury	
___ Nitrate	
___ Selenium	
___ Silver	
___ Sulfates	
___ Zinc	
___ pH	
___ Conductivity	
___ TDS	
___ TOC	

TCLP Compounds

Inorganic Compounds	Results(mg/l)
___ Arsenic	
___ Barium	
___ Cadmium	
___ Chromium	
___ Lead	
___ Mercury	
___ Selenium	
___ Silver	

Organic Compounds	Results(mg/l)
___ benzene	
___ carbon tetrachloride	
___ chlordane	
___ chlorobenzene	
___ chloroform	
___ o-cresol	
___ m-cresol	
___ p-cresol	
___ cresol	
___ 1,4-dichlorobenzene	
___ 1,2-dichloroethane	
___ 1,1-dichloroethylene	
___ 2,4-dinitrotoluene	
___ heptachlor	
___ hexachlorobenzene	
___ hexachlorobutadiene	
___ hexachloroethane	
___ methyl ethyl ketone	
___ nitrobenzene	
___ pentachlorophenol	
___ pyridine	
___ tetrachloroethylene	
___ trichloroethylene	
___ 2,4,5-trichlorophenol	
___ 2,4,6-trichlorophenol	
___ vinyl chloride	
___ endrin	
___ lindane	
___ methoxychlor	
___ toxaphene	
___ 2,4-D	
___ 2,4,5-TP (Silvex)	

Date Received 4-7-94 KS Reported by _____

Date Extracted _____ Date Reported _____

Date Analyzed 4-21-94 MW Lab Number 941040

DHS 3191 (Revised 2/91)

(1)

STATE LABORATORY OF PUBLIC HEALTH
PO BOX 28047 - 306 N. WILMINGTON ST., RALEIGH, NC 27611

ORGANIC CHEMICAL ANALYSIS

PURGEABLE COMPOUNDS	LAB NO	941021	941023	941025	941028	941030	941032
	FIELD NO	15715	15718	15721	15726	15728	15731
COMPOUND	TYPE	(1)	(2)	(4)	(4)	(2)	(4)
	UNITS	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg
CHLOROMETHANE	20ppb	u	u	u	u	u	u
VINYL CHLORIDE	10						
BROMOMETHANE	20						
CHLOROETHANE	10						
TRICHLOROFLUOROMETHANE	10						
ACETONE	50	3J,B					
1,1-DICHLOROETHENE	5	u					
IODOMETHANE	10						
METHYLENE CHLORIDE	5						
CARBON DISULFIDE							
TRANS-1,2-DICHLOROETHENE							
ACRYLONITRILE	200						
1,1-DICHLOROETHANE	5						
2-BUTANONE	50						
CIS-1,2-DICHLOROETHENE	5						
CHLOROFORM							
1,1,1-TRICHLOROETHANE							
CARBON TETRACHLORIDE	10						
BENZENE	5						
1,2-DICHLOROETHANE							
TRICHLOROETHANE							
1,2-DICHLOROPROPANE							
BROMODICHLOROMETHANE	10						
	↑ MDL ↑						

B - BACKGROUND PRESENT IN LAB BLANKS.
J - Estimated value
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected. The number is the Minimum Detection Limit.
NA - Not analyzed.
1/ - Tentative identification.
2/ - On NRDC List of Priority Pollutants.
H - COMPOUND REWABLY DETECTABLE ONLY AT HIGH CONCENTRATIONS.
C - POSSIBLE LAB CONTAMINATION.

DEHNR 3065-O (10/93)

PURGCOM.ORG

(2)

STATE LABORATORY OF PUBLIC HEALTH
PO BOX 28047 - 306 N. WILMINGTON ST., RALEIGH, NC 27611

ORGANIC CHEMICAL ANALYSIS

PURGEABLE COMPOUNDS	LAB NO	941021	941023	941025	941028	941030	941032
	FIELD NO	15715	15718	15721	15726	15728	15731
COMPOUND	TYPE	(1)	(2)	(4)	(4)	(2)	(4)
	UNITS	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg
DIBROMOMETHANE	5 ppb	u	u	u	u	u	u
4-METHYL-2-PENTANONE	50						
CIS-1,3-DICHLOROPROPENE	5				↓		
TOLUENE	↓				11		
TRANS-1,3-DICHLOROPROPENE	↓				u		
1,1,2,2-TETRACHLOROETHANE	10						
1,1,2-TRICHLOROETHANE	5						
2-HEXANONE	50						
TETRACHLOROETHENE	5						
DIBROMOCHLOROMETHANE	10						
ETHYLENE DIBROMIDE	5						
CHLOROBENZENE	↓						
1,1,1,2-TETRACHLOROETHANE	10						
ETHYL BENZENE	5						
XYLENES	10						
STYRENE	5						
BROMOFORM	10						
H TRANS-1,4-DICHLORO-2-BUTENE	80						
H 1,2,3-TRICHLOROPROPANE	200						
1,4-DICHLOROBENZENE	10						
1,2-DICHLOROBENZENE	↓						
H 1,2-DIBROMO-3-CHLOROPROPANE	200						
H VINYL ACETATE	↓	↓	↓	↓	↓	↓	↓
	↑MDL↑						

B - BACKGROUND PRESENT IN LAB BLANKS.
J - Estimated value
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected. The number is the Minimum Detection Limit.
NA - Not analyzed.
1/ - Tentative identification.
2/ - On NRDC List of Priority Pollutants.
H - COMPOUND RELIABLY DETECTABLE ONLY AT HIGH CONCENTRATIONS.
C - POSSIBLE LAB CONTAMINATION.

DEHNR 3068-O (10/93)

PURGCOM.ORG

3

STATE LABORATORY OF PUBLIC HEALTH
PO BOX 28047 - 306 N. WILMINGTON ST., RALEIGH, NC 27611

ORGANIC CHEMICAL ANALYSIS

PURGEABLE COMPOUNDS	LAB NO	941034	941036	941038	941040		
	FIELD NO	15733	15736	15738	15740		
COMPOUND	TYPE	(2)	(4)	(3)	(4)	( )	( )
	UNITS	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg	µg/l µg/kg
CHLOROMETHANE	20ppb	u	u	u	u		
VINYL CHLORIDE	10						
BROMOMETHANE	20						
CHLOROETHANE	10						
TRICHLOROFLUOROMETHANE	10						
ACETONE	50						
1,1-DICHLOROETHENE	5						
IODOMETHANE	10						
METHYLENE CHLORIDE	5						
CARBON DISULFIDE	↓						
TRANS-1,2-DICHLOROETHENE	↓						
ACRYLONITRILE	200						
1,1-DICHLOROETHANE	5						
2-BUTANONE	50						
CIS-1,2-DICHLOROETHENE	5						
CHLOROFORM	↓						
1,1,1-TRICHLOROETHANE	↓						
CARBON TETRACHLORIDE	10						
BENZENE	5						
1,2-DICHLOROETHANE	↓						
TRICHLOROETHANE	↓						
1,2-DICHLOROPROPANE	↓						
BROMODICHLOROMETHANE	10	↓	↓	↓	↓		
	↑ MDL ↑						

B - BACKGROUND PRESENT IN LAB BLANKS.
J - Estimated value
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected. The number is the Minimum Detection Limit.
NA - Not analyzed.
1/ - Tentative identification.
2/ - On NRDC List of Priority Pollutants.
H - COMPOUND RELIABLY DETECTABLE ONLY AT HIGH CONCENTRATIONS.
C - POSSIBLE LAB CONTAMINATION.

(4)

STATE LABORATORY OF PUBLIC HEALTH
PO BOX 28047 - 306 N. WILMINGTON ST., RALEIGH, NC 27611

ORGANIC CHEMICAL ANALYSIS

PURGEABLE COMPOUNDS	LAB NO	941034	941036	941038	941040		
	FIELD NO	15733	15736	15738	15740		
COMPOUND	TYPE	(2)	(4)	(3)	(4)	( )	( )
	UNITS	(µg/l) µg/kg	µg/l (µg/kg)	µg/l (µg/kg)	(µg/l) µg/kg	µg/l µg/kg	µg/l µg/kg
DIBROMOMETHANE	5 ppb	u	u	u	u		
4-METHYL-2-PENTANONE	50						
CIS-1,3-DICHLOROPROPENE	5						
TOLUENE	↓						
TRANS-1,3-DICHLOROPROPENE	↓						
1,1,2,2-TETRACHLOROETHANE	10						
1,1,2-TRICHLOROETHANE	5						
2-HEXANONE	50						
TETRACHLOROETHENE	5						
DIBROMOCHLOROMETHANE	10						
ETHYLENE DIBROMIDE	5						
CHLOROBENZENE	↓						
1,1,1,2-TETRACHLOROETHANE	10						
ETHYL BENZENE	5						
XYLENES	10						
STYRENE	5						
BROMOFORM	10						
H TRANS-1,4-DICHLORO-2-BUTENE	80						
H 1,2,3-TRICHLOROPROPANE	200						
1,4-DICHLOROBENZENE	10						
1,2-DICHLOROBENZENE	↓						
H 1,2-DIBROMO-3-CHLOROPROPANE	200						
H VINYL ACETATE	↓	↓	↓	↓	↓		
	↑MDL↑						

B - BACKGROUND PRESENT IN LAB BLANKS.
J - Estimated value
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected. The number is the Minimum Detection Limit.
NA - Not analyzed.
1/ - Tentative identification.
2/ - On NRDC List of Priority Pollutants.
H - COMPOUND RELIABLY DETECTABLE ONLY AT HIGH CONCENTRATIONS.
C - POSSIBLE LAB CONTAMINATION.

(1)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON, ST., RALEIGH, N.C. 27611

ORGANIC CHEMICAL ANALYSIS

BASE/NEUTRAL AND ACID EXTRACTABLES	LAB NO	941022	941024	941026	941027	941029	941031
	FIELD #	15717	15720	15722	15725	15727	15730
COMPOUND	TYPE	(1)	(2)	(4)	(2)	(4)	(2)
	UNITS	µg/l ~~µg/kg~~	µg/l ~~µg/kg~~	~~µg/l~~ µg/kg	µg/l ~~µg/kg~~	~~µg/l~~ µg/kg	µg/l ~~µg/kg~~
-nitrosodimethylamine	10/330	U	U	U	U	U	U
s(2-chloroethyl)ether							
2-chlorophenol							
phenol							
3-dichlorobenzene							
1,4-dichlorobenzene							
1,2-dichlorobenzene							
s(2-chloroisopropyl)ether							
xachloroethane							
N-nitroso-di-n-propylamine							
trobenzene							
ophorone							
2-nitrophenol							
2,4-dimethylphenol							
s(2-chloroethoxy)methane							
2,4-dichlorophenol							
1,2,4-trichlorobenzene							
phthalene							
xachlorobutadiene							
4-chloro-m-cresol							
xachlorocyclopentadiene							
4,6-trichlorophenol							
2-chloronaphthalene							
acenaphthylene							
methyl phthalate							
2,6-dinitrotoluene							
acenaphthene	↓						
4-dinitrophenol	50/1650						
4-dinitrotoluene	10/330						
4-nitrophenol	50/1650						
uorene	10/330						
chlorophenylphenylether							
diethyl phthalate	↓						
4,6-dinitro-o-cresol	50/1650						
phenylamine	10/330						
azobenzene							
4-bromophenylphenylether							
xachlorobenzene	↓						
ntachlorophenol	50/1650						
phenanthrene	10/330						
thracene							
butyl phthalate		↓	↓	↓	↓	↓	↓
fluoranthene	↓						

MDL
H_2O/SOIL

- Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
- Material was analyzed for but not detected. The number is the Minimum Detection Limit. MDL
- Not analyzed.
/ - Tentative identification.
Z/ - On NRDC List of Priority Pollutants.

N C. Division of Health Services
DHS 3068-0 (4/86 Laboratory)

(2)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON, ST., RALEIGH, N.C. 27611

ORGANIC CHEMICAL ANALYSIS

BASE/NEUTRAL AND ACID EXTRACTABLES	LAB NO	941022	941024	941026	941027	941029	941031
	FIELD #	15717	15720	15722	15725	15727	15730
COMPOUND	TYPE	(1)	(2)	(4)	(2)	(4)	(2)
	UNITS	µg/l ~~mg/kg~~	µg/l ~~mg/kg~~	~~mg/l~~ µg/kg	µg/l ~~mg/kg~~	~~mg/l~~ µg/kg	µg/l ~~mg/kg~~
pyrene	10/330	U	U	U	U	U	U
benzidine	50/1650						
butyl benzyl phthalate	10/330						
benz(a)anthracene							
chrysene							
3,3-dichlorobenzidine	50/1650						
bis(2-ethylhexyl)phthalate	10/330						
di-n-octyl phthalate	10/330						
benzo(b)fluoranthene	50/1650						
benzo(k)fluoranthene							
benzo(a)pyrene							
indeno(1,2,3-cd)pyrene							
dibenzo(a,h)anthracene							
benzo(g,h,i)perylene							
aniline	50/1650	U	U	U	U	U	U
benzoic acid							
benzyl alcohol							
4-chloroaniline							
dibenzofuran	10/330						
2-methylnaphthalene							
2-methylphenol							
4-methylphenol							
2-nitroaniline	50/1650						
3-nitroaniline							
4-nitroaniline							
2,4,5-trichlorophenol							

MDL
H_2O/501L

J - Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected. The number is the Minimum Detection Limit. MDL
NA - Not analyzed.
1/ - Tentative identification.
2/ - On NRDC List of Priority Pollutants.

N.C. Division of Health Services
DHS 3068-0 (4/86 Laboratory)

(3)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON, ST., RALEIGH, N.C. 27611

ORGANIC CHEMICAL ANALYSIS

BASE/NEUTRAL AND ACID EXTRACTABLES	LAB NO	941033	941035	941037	941039		
	FIELD #	15732	15735	15737	15739		
COMPOUND	TYPE	(4)	(2)	(4)	(3)	( )	( )
	UNITS	~~µg/l~~ µg/kg	µg/l ~~µg/kg~~	~~µg/l~~ µg/kg	~~µg/l~~ µg/kg	µg/l µg/kg	µg/l µg/kg
[redacted]nitrosodimethylamine	10/330	u	u	u	u		
[redacted]s(2-chloroethyl)ether	↓	↓	↓	↓	↓		
2-chlorophenol							
[redacted]henol							
[redacted]3-dichlorobenzene							
[redacted],4-dichlorobenzene							
1,2-dichlorobenzene							
[redacted]s(2-chloroisopropyl)ether							
[redacted]xachloroethane							
N-nitroso-di-n-propylamine							
[redacted]itrobenzene							
[redacted]ophorone							
2-nitrophenol							
2,4-dimethylphenol							
[redacted]s(2-chloroethoxy)methane							
[redacted],4-dichlorophenol							
1,2,4-trichlorobenzene							
[redacted]phthalene							
[redacted]xachlorobutadiene							
4-chloro-m-cresol							
[redacted]xachlorocyclopentadiene							
[redacted]4,6-trichlorophenol							
2-chloronaphthalene							
acenaphthylene							
[redacted]methyl phthalate							
[redacted],6-dinitrotoluene							
acenaphthene	↓						
[redacted]4-dinitrophenol	50/1650						
[redacted]4-dinitrotoluene	10/330						
4-nitrophenol	50/1650						
[redacted]uorene	10/330						
[redacted]chlorophenylphenylether	↓						
diethyl phthalate	↓						
4,6-dinitro-o-cresol	50/1650						
[redacted]phenylamine	10/330						
[redacted]obenzene	↓						
4-bromophenylphenylether	↓						
[redacted]xachlorobenzene	↓						
[redacted]ntachlorophenol	50/1650						
phenanthrene	10/330						
[redacted]thracene	↓						
[redacted]butyl phthalate	↓						
fluoranthene	↓	✓	✓	✓	✓		

MDL
H_2O/SOIL

[redacted] - Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
[redacted] - Material was analyzed for but not detected. The number is the Minimum Detection Limit. MDL
[redacted] - Not analyzed.
[redacted] - Tentative identification.
2/ - On NRDC List of Priority Pollutants.

[redacted]C. Division of Health Services
DHS 3068-0 (4/86 Laboratory)

(4)

STATE LABORATORY OF PUBLIC HEALTH
DIVISION OF HEALTH SERVICES, N.C. DEPARTMENT OF HUMAN RESOURCES
P.O. BOX 28047 - 306 N. WILMINGTON, ST., RALEIGH, N.C. 27611

ORGANIC CHEMICAL ANALYSIS

BASE/NEUTRAL AND ACID EXTRACTABLES	LAB NO	941033	941035	941037	941039		
	FIELD #	15732	15735	15737	15739		
COMPOUND	TYPE	(4)	(2)	(4)	(3)	( )	( )
	UNITS	~~µg/l~~ µg/kg	µg/l ~~µg/kg~~	~~µg/l~~ µg/kg	~~µg/l~~ µg/kg	µg/l µg/kg	µg/l µg/kg
pyrene	10/330	u	u	u	u		
benzidine	50/1650	↓	↓	↓	↓		
butyl benzyl phthalate	10/330	↓	↓	↓	↓		
benz(a)anthracene	↓	↓	↓	↓	↓		
chrysene	↓	↓	↓	↓	↓		
3,3-dichlorobenzidine	50/1650	↓	↓	↓	↓		
bis(2-ethylhexyl)phthalate	10/330	↓	↓	↓	↓		
di-n-octyl phthalate	10/330	↓	↓	↓	↓		
benzo(b)fluoranthene	50/1650	↓	↓	↓	↓		
benzo(k)fluoranthene	↓	↓	↓	↓	↓		
benzo(a)pyrene	↓	↓	↓	↓	↓		
indeno(1,2,3-cd)pyrene	↓	↓	↓	↓	↓		
dibenzo(a,h)anthracene	↓	↓	↓	↓	↓		
benzo(g,h,i)perylene	↓	↓	↓	↓	↓		
aniline	50/1650	u	u	u	u		
benzoic acid	↓	↓	↓	↓	↓		
benzyl alcohol	↓	↓	↓	↓	↓		
4-chloroaniline	↓	↓	↓	↓	↓		
dibenzofuran	10/330	↓	↓	↓	↓		
2-methylnaphthalene	↓	↓	↓	↓	↓		
4-methylphenol	↓	↓	↓	↓	↓		
2-methylphenol	↓	↓	↓	↓	↓		
2-nitroaniline	50/1650	↓	↓	↓	↓		
3-nitroaniline	↓	↓	↓	↓	↓		
4-nitroaniline	↓	↓	↓	↓	↓		
2,4,5-trichlorophenol	↓	↓	↓	↓	↓		

MDL
H2O/SOIL

J - Estimated value.
K - Actual value is known to be less than value given.
L - Actual value is known to be greater than value given.
U - Material was analyzed for but not detected. The number is the Minimum Detection Limit. MDL
NA - Not analyzed.
1/ - Tentative identification.
2/ - On NRDC List of Priority Pollutants.

N.C. Division of Health Services
DHS 3068-0 (4/86 Laboratory)

NC-DEHNR
Division of Solid Waste Management
☐ Superfund Section
☐ Hazardous Waste Section
☐ Solid Waste Section

Organics Lab: X
Inorganics Lab: ____

CHAIN OF CUSTODY RECORD

Project Name: SPANN PROPERTY
Site ID # (NCD#) 986 180 917
Location: Route 25 Hendersonville NC
Address: ____

Sampled by: Stuart Parker Superfund Section
Sampler ID —
Telephone: (919) 733 2801
Date Sampled: 4/4-5/94
Time Sampled: —

Sample Types: Soil X Water X Waste ____ Other SEDIMENT

Remarks: 15723 DESTROYED 4/6/94

Field Sample Numbers

15715	15717	15718	15720	15721	15722	15725
15726	15727	15728	15730	15731	15732	15733
15735	15736	15737	15738	15739	15740 (MP)	

Relinquished by: [signature] (Signature) Date: 4/7/94 Time: 1435

Received by: William C Glenn Jr (Signature) Date: 4-7-94 Time: 14:35

Relinquished by: ____ (Signature) Date: ____ Time: ____

Received by: ____ (Signature) Date: ____ Time: ____

Relinquished by: ____ (Signature) Date: ____ Time: ____

Received by: ____ (Signature) Date: ____ Time: ____

Results Reported: John R. Neal (Signature) Date: 5-4-94 Time: ____
#941021-941040

(A:\COCR.FRM)

NC-DEHNR
Division of Solid Waste Management
☐ Superfund Section
☐ Hazardous Waste Section
☐ Solid Waste Section

Organics Lab: ~~X~~
Inorganics Lab: X

RECEIVED
JUN - 2 1994
SUPERFUND SECTION

CHAIN OF CUSTODY RECORD

Project Name: SPANN PROPERTY
Site ID # (NCD#) 986 180 917
Location: Route 25 Hendersonville NC
Address:

Sampled by: Stuart Parker Superfund Section
Sampler ID —
Telephone: (919) 733 2801
Date Sampled: 4/4-5/94
Time Sampled: —

Sample Types: Soil X Water X Waste Other SEDIMENT

Remarks:

Field Sample Numbers: ~~16666~~ (rpo) ~~16667~~ 16668 16669 16670 16671 16672 16673 16674 16675 16676 16677

Relinquished by: Stuart D Parker Jr (Signature) Date: 4/7/94 Time: 1450

Received by: Joyce Davis (Signature) Date: 4/7/94 Time: 2:51

Relinquished by: (Signature) Date: Time:

Received by: (Signature) Date: Time:

Relinquished by: (Signature) Date: Time:

Received by: (Signature) Date: Time:

Results Reported: (Signature) Date: 7/15/94 Time:

(A:\COCR FRM)

REFERENCES

LATITUDE AND LONGITUDE CALCULATION WORKSHEET #2
LI USING ENGINEER'S SCALE (1/60)

SITE NAME: SPANN PROPERTY CERCLIS #: NCD 986 180 917

AKA: SSID:

ADDRESS: US ROUTE 25

CITY: HENDERSONVILLE STATE: NC ZIP CODE: 28739

SITE REFERENCE POINT: DUMP SITE ROADWAY

USGS QUAD MAP NAME: SKYLAND TOWNSHIP: ____ N/S RANGE: ____ E/W

SCALE: 1:24,000 MAP DATE: 1991 SECTION: ____1/4 ____1/4 ____1/4

MAP DATUM: 1927 1983 (CIRCLE ONE) MERIDIAN:

COORDINATES FROM LOWER RIGHT (SOUTHEAST) CORNER OF 7.5' MAP (attach photocopy):

LONGITUDE: 82 ° 30 ' 00 " LATITUDE: 35 ° 22 ' 30 "

COORDINATES FROM LOWER RIGHT (SOUTHEAST) CORNER OF 2.5' GRID CELL:

LONGITUDE: 82 ° 30 ' 00 " LATITUDE: 35 ° 22 ' 30 "

CALCULATIONS: LATITUDE (7.5' QUADRANGLE MAP)

A) NUMBER OF RULER GRADUATIONS FROM LATITUDE GRID LINE TO SITE REF POINT: 109

B) MULTIPLY (A) BY 0.3304 TO CONVERT TO SECONDS:

A x 0.3304 = 36 . 0 "

C) EXPRESS IN MINUTES AND SECONDS (1'= 60"): 0 ' 36 . 0 "

D) ADD TO STARTING LATITUDE: 35 ° 22 ' 30 . 0 " + 0 ' 36 . 0 =

SITE LATITUDE: 35 ° 23 ' 06 . 0 "

109 33
45.4

CALCULATIONS: LONGITUDE (7.5' QUADRANGLE MAP)

A) NUMBER OF RULER GRADUATIONS FROM RIGHT LONGITUDE LINE TO SITE REF POINT: 32

B) MULTIPLY (A) BY 0.3304 TO CONVERT TO SECONDS:

A x 0.3304 = 10 . 5 "

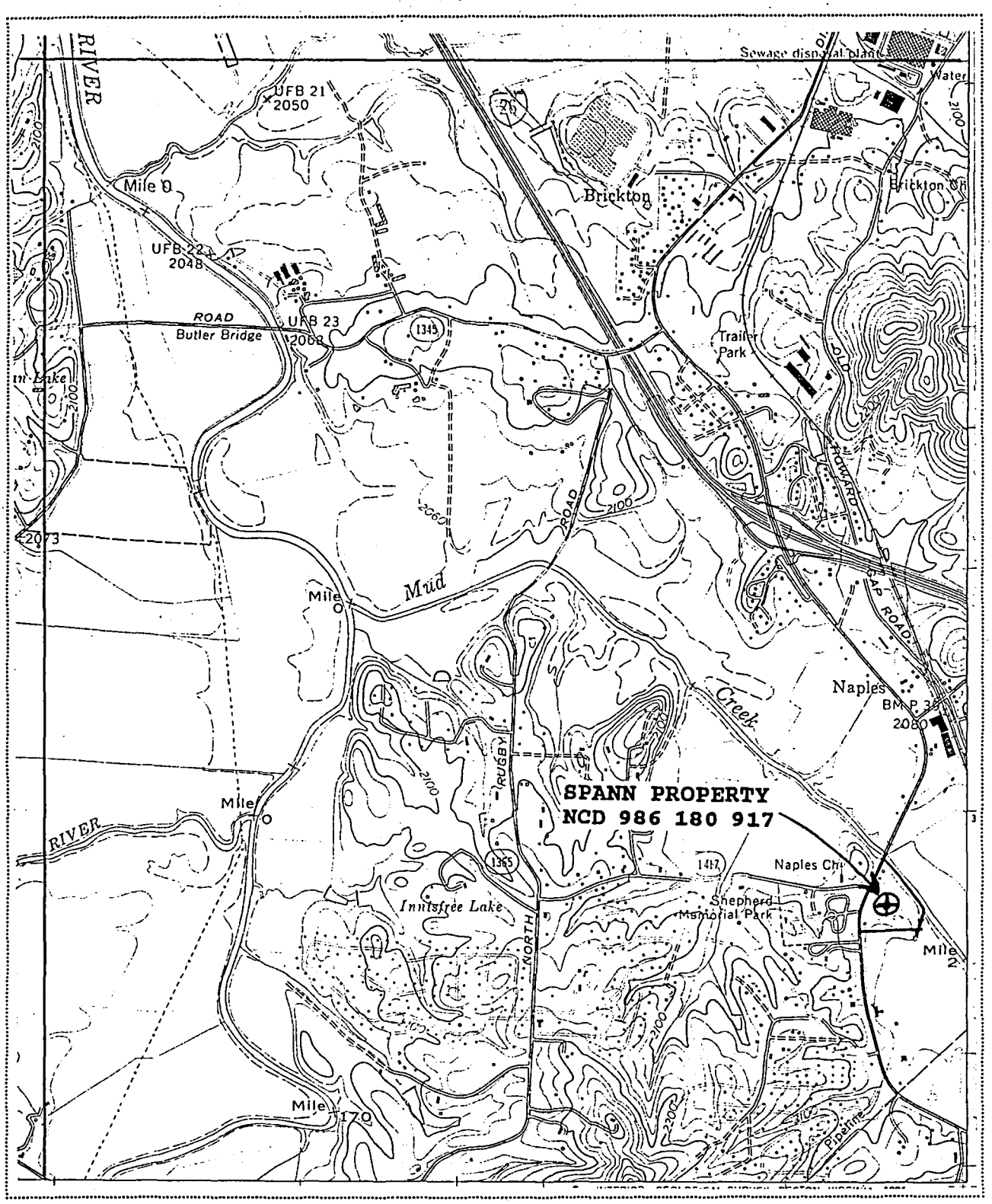
C) EXPRESS IN MINUTES AND SECONDS (1'= 60"): 0 ' 10 . 5 "

D) ADD TO STARTING LONGITUDE: 82 ° 30 ' 0 . 0 " + 0 ' 10 . 5 =

SITE LONGITUDE: 82 ° 30 ' 10 . 5 "

INVESTIGATOR: [signature] DATE: 2/28/94

SITE NAME: SPANN PROPERTY NUMBER: NCD 986 180 917



TOPOGRAPHIC MAP QUADRANGLE NAME: SKYLAND NC 7½ MINUTE SCALE: 1:24,000

COORDINATES OF LOWER RIGHT-HAND CORNER OF 2.5-MINUTE GRID:

LATITUDE: 35° 22' 30" LONGITUDE: 82° 30' 00"

Ref. 3

SOIL SURVEY O

Henderson County, North Carolin

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
North Carolina Agricultural Experiment Stati

Contents

	Page
Index to soil mapping units	iv
Summary of tables	v
Foreword	vii
Climate	1
Physiography, relief, and drainage	2
Water supply	2
How this survey was made	2
Soil map for general planning	3
1. Codorus-Toxaway-Rosman association	3
2. Evard-Edneyville-Ashe association	3
3. Hayesville-Bradson association	4
4. Fannin-Talladega association	4
5. Ashe-Porters association	4
Soil maps for detailed planning	5
Soil descriptions and potentials	5
Planning the use and management of the soils	21
Crops and pasture	22
Yields per acre	23
Capability classes and subclasses	23
Woodland management and productivity	24
Engineering	24
Building site development	25
Sanitary facilities	26
Construction materials	27
Water management	27
Recreation	28
Wildlife habitat	28
Soil properties	30
Engineering properties	30
Physical and chemical properties	31
Soil and water features	31
Engineering test data	32
Classification of the soils	32
Soil series and morphology	32
Ashe series	33
Bradson series	33
Brevard series	33
Chandler series	34
Clifton series	34
Codorus series	34
Comus series	34
Delanco series	35
Edneyville series	35
Elsinboro series	35
Evard series	36
Fannin series	36
Hatboro series	36
Hayesville series	36
Kinkora series	37
Porters series	37
Rosman series	38
Spivey series	38
Suncook series	38
Talladega series	38
Tate series	39
Toxaway series	39
Tusquitee series	39
Classification	40
Formation of the soils	40
Factors of soil formation	40
Parent material	40
Climate	41
Plant and animal life	41
Relief	41
Time	41
References	42
Glossary	42
Illustrations	45
Tables	51

Issued April 1980

SOIL SURVEY OF HENDERSON COUNTY, NORTH CAROLINA

By John M. King, Jr., Soil Conservation Service

Soils Surveyed By John M. King, Jr., and John W. Turpin, Soil Conservation Service, and Charles H. Young, Forest Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with the North Carolina Agricultural Experiment Station

Henderson County is in the southwestern part of North Carolina (see facing page). The county is 241,664 acres, or approximately 377 square miles, in size. According to the 1970 census, the population of the county was 42,804. Hendersonville, the county seat, had a population of 25,018.

Henderson County is in the Blue Ridge Mountains physiographic province. Elevation ranges from 1,400 feet above sea level near Bat Cave to 5,200 feet on Little Pisgah Ridge. The elevation at Hendersonville is 2,153 feet. The mean annual temperature at Hendersonville averages 56 degrees, and precipitation averages about 56 inches.

About 18,400 acres in the survey area is in the Pisgah National Forest, and about 11,383 acres is in urban and built-up areas. Land other than that used for crops and pasture makes up 13,000 acres. According to the Conservation Needs Inventory of North Carolina, in 1967 more than 140,000 acres was used for woodland.

Climate

By A. V. HARDY, climatologist for North Carolina, National Weather Service, U. S. Department of Commerce.

The climate of Henderson County is influenced strongly by elevation; irregular topography causes large differences in climate within the county. Latitude, location on the continent, and other lesser factors help to control the general climatic features. Temperature and precipitation data for Henderson County are shown in table 1. Weather data in this survey are from Hendersonville. Data are representative of the climate in the main farming areas of the French Broad River valley and tributary valleys and in similar areas that are level to moderately rolling and are between 2,000 and 2,300 feet above sea level. More mountainous parts of the county, which have peaks ranging to 3,000 feet or more, have lower average temperatures and in some places greater average precipitation.

The average length of the freeze-free growing season is about 180 days. Table 2 gives information on the probability of freezing temperatures in spring and fall. T time and intensity of freezes late in spring and early fall vary considerably from year to year and from pla to place within the county. The lowest temperature record at Hendersonville is 9 degrees F below zero, but most years winter passes without temperatures reachi zero. The highest temperature of record is 100 degre but this has occurred only once in 80 years. A tempe ture of 90 degrees or higher occurs on an average about 15 days each summer, but in some years summ passes without the temperature reaching 90 degrees.

Henderson County is in the eastern part of the wett area of North Carolina and of the eastern United Stat Although observed data at Hendersonville and n Fletcher do not reflect the high precipitation recorded stations in adjoining counties near the Georgia bord these data show an average of more than 3 inches each month and more than 50 inches for the year. M of the rainfall during the growing season comes fr summer thunderstorms. Precipitation may vary c siderably from week to week, from year to year, and e from place to place; however, there is rarely a month t has less than 1 or 2 inches except September and tober. Rain early in summer is fairly dependa Precipitation in winter usually results from low press storms which frequently pass through or near the a and is even less variable than that in summer.

Most winter months have snow cover on 1 to 15 d but usually on fewer than 5 days. The greatest accum tion in most winters is less than 1 foot, but there some heavier accumulations of as much as 2 feet higher elevations.

Cloudiness is variable; an average of about 1 day or 4 is essentially fair, 1 is cloudy, and 1 or 2 are pa cloudy. The area receives about half the total poss sunshine and slightly more than half late in spring an summer. The average relative humidity is about 90 cent at sunrise and about 55 percent at midafternoon.

Westerly winds prevail in summer, and northwest winds prevail during the other seasons. Wind directio the surrounding area is influenced to some extent by

Soil Maps for Detailed Planning

The kinds of soil (mapping units) shown on the detailed soil maps at the back of this publication are described in this section. These descriptions together with the soil maps can be useful in determining the potential of soil and in managing it for food and fiber production, in planning land use and developing soil resources, and in enhancing, protecting, and preserving the environment. More detailed information for each soil is given in the section "Planning the Use and Management of the Soils."

Preceding the name of each mapping unit is the symbol that identifies the unit on the detailed soil map. Each mapping unit description includes general facts about the soil and a brief description of the soil profile. The potential of the soil for various major land uses is estimated. The principal hazards and limitations are indicated, and the management concerns and practices for the major uses are discussed.

A mapping unit represents an area on the landscape and consists of a dominant soil or soils for which the unit is named. Most mapping units have one dominant soil, but some have two or more dominant soils. A mapping unit commonly includes small, scattered areas of other soils. The properties of some included soils can differ substantially from those of the dominant soil or soils and thus greatly influence the use of the dominant soil. How the included soils may affect the use and management of the mapping unit is discussed.

In most areas surveyed there is land that has little or no identifiable soil and supports no vegetation. This land, called miscellaneous areas, is delineated on the map and given descriptive names. Arents, loamy, is an example. Areas too small to be delineated are identified by special symbols on the soil maps.

The acreage and proportionate extent of each mapping unit are given in table 3, and additional information on each unit is given in interpretive tables in other sections (see "Summary of Tables"). Many of the terms used in describing soils are defined in the Glossary.

Soil Descriptions and Potentials

Ae—Arents, loamy. Arents, loamy, consists of areas where the original soil has been cut, filled, graded, paved, or changed to the extent that a soil series is not recognized. The soil material is mainly loamy and well drained. These areas are used for schools, playgrounds, shopping centers, and airports.

Careful management of these soils is necessary to help reduce runoff and aid in controlling erosion. Erosion is a major concern when these areas are not protected by plant cover or impervious material. Runoff from paved areas needs to be disposed of in a manner that will prevent gully or excessive erosion.

Because of the variable characteristics of these soils, onsite evaluation is needed to predict soil behavior. Not assigned to capability subclass or woodland group.

AhE—Ashe stony sandy loam, 15 to 25 pe slopes. This somewhat excessively drained soil is on narrow, convex tops of mountains. Most areas are l than they are wide and are 5 to 50 acres in size. S cover 5 to 15 percent of the surface.

Typically, the surface layer is stony sandy lo inches thick. It is dark brown in the upper part an lowish brown in the lower part. The subsoil is yell brown sandy loam 14 inches thick. The underlying to a depth of 30 inches, is gray saprolite that crusl sandy loam. Moderately hard granite-gneiss rock is depth of 30 inches.

Included with this soil in mapping are some small of soils that have a surface layer of loam. Also inc are small areas of Edneyville and Tusquitee soils a few small areas of rock outcrop.

The organic-matter content of the surface layer i to medium. Permeability is moderately rapid, ava water capacity is low, and shrink-swell potential is Reaction is very strongly acid or strongly acid throu unless the soil is limed. Depth to bedrock is 20 inches. The seasonal high water table is more than deep.

Most areas of this soil are wooded or are reverti woodland. A few summer cottages or vacation have been built where sites are accessible or esthetic value.

This soil has a low potential for cultivated crop apples. It is limited by steep slopes, stoniness, and runoff. This soil has a medium potential for gr pasture forages such as bluegrass or sericea lespede

This soil has a low potential for most urban uses limited by slope and depth to bedrock. Onsite eval and planning are needed when this soil is used for tank filter fields, roads, or dwellings.

This soil has a medium potential for pines or conifers. Slope and surface stones are the main limit for woodland use and management. Capability su VIs; woodland group 3x.

AhF—Ashe stony sandy loam, 25 to 45 p slopes. This somewhat excessively drained soil rough side slopes that are dissected by numerous drainageways. Areas of this soil are irregularly and are 15 to 75 acres in size. Stones cover 5 to 1 cent of the surface.

Typically, the surface layer is stony sandy l inches thick. It is dark brown in the upper part a lowish brown in the lower part. The subsoil is ye brown sandy loam 14 inches thick. The underlying to a depth of 30 inches, is gray saprolite that crus sandy loam. Moderately hard granite-gneiss rock depth of 30 inches.

Included with this soil in mapping are a few smal of soils that have a surface layer of loam, small a soils that do not have stones on the surface, smal of Edneyville soils, and a few very small ar Tusquitee soils.

this soil is used for septic tank absorption fields, roads, or dwellings.

This soil has medium potential for pines or other conifers. Slope and stoniness are the significant limitations to woodland use and management. Capability subclass VIIs; woodland group 3x.

CfE—Clifton stony loam, 15 to 25 percent slopes. This well drained soil is on ridgetops. Areas are somewhat elongated and are 6 to 35 acres in size. Stones cover 2 to 15 percent of the surface.

Typically, the surface layer is dark brown stony loam 4 inches thick. The subsurface layer is dark reddish brown loam 5 inches thick. The subsoil is 33 inches thick. The upper part is yellowish red clay loam, the middle part is red clay loam, and the lower part is red loam. Hard, dark-colored gneiss is at a depth of about 42 inches.

Included with this soil in mapping are small areas of Evard and Porters soils.

The organic-matter content of the surface layer is medium. Permeability is moderate, and available water capacity is medium. Shrink-swell potential is low. Reaction is slightly acid or medium acid throughout the profile unless the soil is limed. Depth to bedrock is 40 to 60 inches. The seasonal high water table is at a depth of more than 6 feet.

Most areas of this soil are wooded or are reverting to woodland. A few summer cottages or vacation cabins have been built on sites that are accessible and have esthetic value.

This soil has low potential for cultivated crops and apples because of steep slopes, stoniness, and rapid runoff. This soil has medium potential for pasture plants such as bluegrass and sericea lespedeza.

This soil has low potential for most urban uses because of slope and stoniness. Onsite evaluation and planning are needed where this soil is used for septic tank absorption fields, roads, or dwellings.

This soil has high potential for hardwoods and pines or other conifers. Slope and stoniness are the major limitations to the use and management of this soil for woodland. Capability subclass VIe; woodland group 2x.

CfF—Clifton stony loam, 25 to 45 percent slopes. This well drained soil is on sides of mountains. Areas are irregular in shape and are 10 to 40 acres in size. Stones cover 2 to 15 percent of the surface.

Typically, the surface layer is dark brown stony loam 4 inches thick. The subsurface layer is dark reddish brown loam 5 inches thick. The subsoil is 33 inches thick. The upper part is yellowish red clay loam, the middle part is red clay loam, and the lower part is red loam. Hard, dark-colored gneiss is at a depth of about 42 inches.

Included with this soil in mapping are small areas of Evard and Porters soils.

The organic-matter content of the surface layer is medium. Permeability is moderate, and available water capacity is medium. Shrink-swell potential is low. Reaction is slightly acid or medium acid throughout the profile unless the soil is limed. Depth to bedrock is 40 to 60 inches. The seasonal high water table is at a depth of more than 6 feet.

Almost all areas of this soil are wooded. A few areas are used for pasture. A few summer cottages or vacation cabins have been built on sites that are accessible and have esthetic value.

This soil has low potential for the production of cultivated crops, pasture forages, and apples because of slope and stoniness.

This soil has low potential for most urban uses because of slope. Onsite evaluation and planning are needed where this soil is used for septic tank absorption fields, roads, or dwellings.

This soil has high potential for hardwoods and pines or other conifers. Slope and stoniness are the major limitations to the use and management of this soil for woodland. Capability subclass VIIs; woodland group 2x.

Co—Codorus loam. This moderately well drained to somewhat poorly drained, nearly level soil is in slightly depressional areas on wide flood plains and on narrow flood plains. In many places this soil makes up an entire flood plain. Areas are somewhat elongated and are 4 to 40 acres in size.

Typically, the surface layer is brown loam 12 inches thick. The subsoil is dark brown loam and mottled grayish brown fine sandy clay loam 33 inches thick. The underlying layer, to a depth of 60 inches, is dark gray loamy sand.

Included with this soil in mapping are small areas of soils that have a surface layer of fine sandy loam and a few small areas of Comus, Rosman, Toxaway, and Hatboro soils.

The organic-matter content of the surface layer is low to medium. Permeability is moderate, and available water capacity is medium. Shrink-swell potential is low. Reaction is medium acid or slightly acid throughout the profile unless the soil is limed. Depth to bedrock is more than 60 inches. The seasonal high water table is at a depth of 1 to 2 feet for 2 to 6 months in most years. This soil is subject to frequent flooding.

This soil has medium potential for the production of water-tolerant row crops and hay and pasture forages, but in places flooding damages these crops. Cabbage, green beans, squash, and corn can be grown continuously, but minimum tillage, cover crops, and a conservation cropping system that includes grasses and legumes will help to maintain tilth and production. Tillage can be delayed in spring because of the seasonally high water table. Drainage is required in places to remove excess water from the lower and wetter areas. The production potential for apples is low because of the hazard of flooding and a seasonal high water table.

This soil has low potential for most urban uses such as dwellings, roads, and septic tank absorption fields. The hazard of flooding is difficult and costly to overcome.

This soil has high potential for hardwoods and pines or other conifers. Wetness is the main limitation to woodland use and management. Capability subclass IIIw; woodland group 1w.

Typically, the surface layer is dark grayish brown loam 12 inches thick. The subsoil is dark gray loam 24 inches thick. The underlying layer, to a depth of 62 inches, is dark grayish brown loamy sand and grayish brown sand.

Included with this soil in mapping are small areas of Toxaway and Codorus soils.

The organic-matter content of the surface layer is medium. Permeability is moderate, and available water capacity is high. Shrink-swell potential is low. Reaction is slightly acid to strongly acid throughout the profile unless the soil is limed. Depth to bedrock is more than 60 inches. The seasonal high water table is at or near the surface. This soil is subject to frequent flooding.

Most areas of this soil have been cleared and are used for crops or pasture. A few areas are wooded.

This soil has moderate production potential for water-tolerant row crops and hay and pasture plants. Because of flooding, however, these crops may be damaged. Cabbage, green beans, squash, and corn can be grown continuously. Minimum tillage, using cover crops, and including grasses and legumes in the conservation cropping system help to maintain soil tilth and production. The production potential for apples is low because of the hazard of flooding and a seasonal high water table. Winter crops, such as wheat, are commonly damaged by excessive wetness.

This soil has low potential for most urban uses, such as dwellings, roads, and septic tank absorption fields. The hazard of flooding and a seasonal high water table are difficult and costly to overcome.

This soil has high potential for water-tolerant hardwoods and pines. Wetness is the main limitation to woodland use and management. Capability subclass IIIw; woodland group 1w.

HyB—Hayesville loam, 2 to 7 percent slopes. This well drained soil is on broad, smooth ridgetops at the lower elevations in the county. Areas are somewhat elongated and are 6 to 35 acres in size.

Typically, the surface layer is dark brown loam 4 inches thick. The subsurface layer is brown loam 4 inches thick. The subsoil is 36 inches thick. The upper part is yellowish red clay loam, the middle part is yellowish red and red clay loam, and the lower part is red sandy clay loam and sandy loam. The underlying layer is 68 inches thick. The upper part is red saprolite that crushes to sandy loam, the lower part is gray and light gray soft saprolite that crushes to sandy loam.

Included with this soil in mapping are small areas of soils that have a surface layer of fine sandy loam. Also included are a few areas of eroded soils and a few small areas of Evard, Bradson, and Fannin soils.

The organic-matter content of the surface layer is medium. Permeability is moderate, and available water capacity is medium to high. Shrink-swell potential is low. Reaction is very strongly acid or strongly acid throughout the profile unless the soil is limed. Depth to bedrock is more than 60 inches. The seasonal high water table is at a depth of more than 6 feet.

Most areas of this soil have been cleared and are used for crops. Some areas are used as building sites and farmsteads.

This soil has high production potential for row crops such as corn, tobacco, cabbage, potatoes, beans, and squash and for pasture and hay plants such as Kentucky bluegrass, fescue, orchardgrass, sericea lespedeza, and alfalfa. Erosion is a hazard if cultivated crops are grown. Minimum tillage, contour farming, using cover crops, including grasses and legumes in the cropping system, and grassing of waterways are practices that help to reduce runoff and control erosion. The production potential for apples is high on this soil (fig. 3).

This soil has moderate potential for most urban uses. Permeability limits the performance of septic tank absorption fields, but this limitation can be reduced in places by modifying the field or increasing the size of the filter area. When this soil is used for dwellings or local roads, low shear strength limits performance and increases maintenance needs.

This soil has high potential for hardwoods and pines or other conifers. There are no major limitations to woodland use or management. Capability subclass IIe; woodland group 2o.

HyC—Hayesville loam, 7 to 15 percent slopes. This well drained soil is on broad, smooth, rolling foot ridges at the lower elevations. Areas are irregularly shaped and are 6 to 50 acres in size.

Typically, the surface layer is dark brown loam 4 inches thick. The subsurface layer is brown loam 4 inches thick. The subsoil is 36 inches thick. The upper part is yellowish red clay loam, the middle part is yellowish red and red clay loam, and the lower part is red sandy clay loam and sandy loam. The underlying layer is 68 inches thick. The upper part is red saprolite that crushes to sandy loam, and the lower part is gray and light gray soft saprolite that crushes to sandy loam.

Included with this soil in mapping are areas of soils that have a surface layer of fine sandy loam and a few areas of eroded soils. Also included are small areas of Bradson, Evard, and Fannin soils.

The organic-matter content of the surface layer is medium. Permeability is moderate, and available water capacity is medium to high. Shrink-swell potential is low. Reaction is very strongly acid or strongly acid throughout the profile unless the soil is limed. Depth to bedrock is more than 60 inches. The seasonal high water table is at a depth of more than 6 feet.

Almost all areas of this soil have been cleared and are used for crops or pasture. Some areas are used for building sites and farmsteads.

This soil has medium potential for row crops such as corn, tobacco, potatoes, squash, green beans, and cabbage. Erosion is a hazard when this soil is cultivated, but practices such as minimum tillage, using a conservation cropping system that includes legumes and grasses, contour farming, grassing of waterways, stripcropping, and constructing terraces and diversions help to prevent ex-

cessive soil losses. The production potential is high for hay and pasture plants such as tall fescue, bluegrass, orchardgrass, clover, and sericea lespedeza. The potential for apples is high, but slope is a limitation when the soil is used for this purpose.

This soil has moderate potential for most urban uses. Permeability and slope limit the performance of septic tank absorption fields, but this limitation can be reduced in places by modifying the field or increasing the size of the filter area. Low shear strength and slope limit performance and increase maintenance needs when this soil is used for dwellings or local roads.

This soil has high potential for hardwoods and pines or other conifers. There are no major limitations to woodland use and management. Capability subclass IIIe; woodland group 2o.

HyE—Hayesville loam, 15 to 25 percent slopes. This well drained soil is on smooth ridges at the lower elevations. Areas are irregularly shaped and are 6 to 30 acres in size.

Typically, the surface layer is dark brown loam 4 inches thick. The subsurface layer is brown loam 4 inches thick. The subsoil is 36 inches thick. The upper part is yellowish red clay loam, the middle part is yellowish red and red clay loam, and the lower part is red sandy clay loam and sandy loam. The underlying layer is 68 inches thick. The upper part is red saprolite that crushes to sandy loam, and the lower part is gray and light gray soft saprolite that crushes to sandy loam.

Included with this soil in mapping are small areas of soils that have a surface layer of fine sandy loam, and in some places there are some small areas of eroded soils. Also included are small areas of Evard and Fannin soils.

The organic-matter content of the surface layer is medium. Permeability is moderate, and available water capacity is medium to high. Shrink-swell potential is low. Reaction is very strongly acid or strongly acid throughout the profile unless the soil is limed. Depth to bedrock is more than 60 inches. The seasonal high water table is at a depth of more than 6 feet.

Most areas of this soil have been cleared and are used for crops or pasture.

This soil has medium potential for most locally grown crops such as corn, tobacco, beans, and cabbage, but the hazard of erosion is very severe when the soil is cultivated. Practices such as minimum tillage, using a conservation cropping system that has long-term sod crops, contour farming, grassing of waterways, and establishing diversions help to reduce soil losses, conserve moisture, and maintain production. The production potential is medium for hay and pasture plants such as tall fescue, bluegrass, orchardgrass, clover, and sericea lespedeza. Proper pasture management helps to insure adequate protective cover. The potential for apples is medium, but slope is a limitation to the operation of spraying and harvesting equipment.

This soil has low potential for most urban uses, such as septic tank absorption fields and dwellings and roads, because of slope. Extensive modification of the soil o major planning, special design, and intensive maintenanc are generally required to overcome the limitation of slope Erosion is a hazard where ground cover is removed Permeability and slope limit the performance of septi tank filter fields.

This soil has high potential for hardwoods and pines o other conifers. Slope is the main limitation to woodlan use and management. Capability subclass IVe; woodlan group 2r.

Ko—Kinkora loam. This poorly drained, nearly leve soil is on low terraces along the larger streams. Areas ar irregularly shaped and are 4 to 20 acres in size.

Typically, the surface layer is dark gray loam 7 inche thick. The subsoil is mottled gray clay loam or clay 2 inches thick. The underlying layer, to a depth of 6 inches, is mottled gray clay.

Included with this soil in mapping are small areas o Hatboro and Delanco soils and a few areas of a soil tha is not so wet as Kinkora soils.

The organic-matter content of the surface layer is lo to medium. Permeability is moderately slow, and availabl water capacity is high. Shrink-swell potential is moderate Reaction is very strongly acid or strongly acid throughou the profile unless the soil is limed. Depth to bedrock i more than 72 inches. The seasonal high water table is a or near the surface for 2 to 6 months each year. This soi is subject to occasional, brief flooding.

Most areas of this soil are cleared and used for crops o pasture.

This soil has medium production potential for corn an water-tolerant plants such as tall fescue, clover, and ree canarygrass. Production is limited because of flooding an a seasonal high water table.

This soil is slow to warm up in spring. Managemen practices such as minimum tillage, using cover crops, in cluding legumes and grasses in the conservation croppin system, and draining the surface help to maintain so tilth and production potential. Wetness limits the use o this soil for apple orchards. Winter crops, such as wheat are commonly damaged by excessive wetness.

This soil has low potential for most urban uses. Slo permeability, a seasonal high water table, and floodin limit the use of the soil for building sites, septic tank ab sorption fields, and roads. The limitation of flooding an the moderate shrink-swell potential are difficult an costly to overcome. Special design and intensive main tenance are needed for roads and dwellings.

This soil has high potential for water-tolerant har woods and pines. Wetness is the main limitation t woodland use and management. Capability subclass IVw woodland group 2w.

PoE—Porters stony loam, 15 to 25 percent slope This well drained soil is on mountainsides. Areas are elo gated and are 6 to 25 acres in size. Stones cover 5 to 1 percent of the surface.

Typically, the surface layer is very dark grayish brow stony loam 6 inches thick. The subsoil is 26 inches thic

Chandler Series

The Chandler series consists of somewhat excessively drained, moderately rapidly permeable, very steep soils that formed in residuum weathered from mica schist, mica gneiss, phyllite, and similar rocks. Slopes are 45 to 70 percent.

Typical pedon of Chandler stony loam, 45 to 70 percent slopes, in a wooded area about 15 miles northwest of Hendersonville, 0.5 mile west of Bent Gap and 0.2 mile southeast of Blue Ridge Parkway overlook, and 300 feet southwest of Parkway along a logging road:

O2—1 inch to 0, mat of decomposing organic material with many fine roots, moss, and lichens.

A1—0 to 5 inches, dark brown (7.5YR 4/4) stony loam; weak fine granular structure; very friable; common fine and few medium roots; common fine flakes of mica; 10 percent stones; strongly acid; clear smooth boundary.

B2—5 to 26 inches, strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; very friable; common fine roots in upper part and few in lower part; many fine flakes of mica; strongly acid; clear wavy boundary.

C—26 to 54 inches, dark yellowish brown (10YR 4/4) micaceous saprolite that crushes to sandy loam; friable; very strongly acid.

R—54 inches, moderately hard schist rock.

The solum is 20 to 40 inches thick. Depth to bedrock is 40 to 60 inches. About 5 to 15 percent of the surface is covered with stones. The profile is very strongly acid or strongly acid throughout, unless limed.

The A horizon is dark grayish brown, grayish brown, dark brown, or brown stony loam, loam, or fine sandy loam.

The B2 horizon is strong brown or yellowish brown loam or sandy loam.

The C horizon is micaceous saprolite that crushes to sandy loam or loam.

Clifton Series

The Clifton series consists of well drained, moderately permeable, moderately steep and steep soils that formed in residuum weathered from rocks that are high in ferromagnesian minerals. Slopes are 15 to 45 percent.

Typical pedon of Clifton stony loam, 15 to 25 percent slopes, in an apple orchard about 2.5 miles south of Ottanola Baptist Church, 20 feet north of a farm road and 0.4 mile east of State Road 1714.

A1—0 to 4 inches, dark brown (7.5YR 3/2) stony loam; weak fine granular structure; friable; few fine flakes of mica; 10 percent stones; medium acid; clear smooth boundary.

A2—4 to 9 inches, dark reddish brown (5YR 3/4) stony loam; weak fine granular structure; very friable; few fine flakes of mica; 10 percent stones and gravel; medium acid; gradual smooth boundary.

B1—9 to 13 inches, yellowish red (5YR 4/6) clay loam; weak medium subangular blocky structure; few fine flakes of mica; 15 percent stones and gravel; medium acid; gradual wavy boundary.

B2t—13 to 36 inches, red (2.5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; few fine flakes of mica; 25 percent gravel and stones; medium acid; gradual wavy boundary.

B3—36 to 42 inches, red (2.5YR 4/8) loam; weak medium subangular blocky structure; friable; thin discontinuous clay films on faces of peds; many soft weathered coarse fragments and pockets of clay loam; common fine flakes of mica; slightly acid; abrupt clear boundary.

R—42 inches, hard dark colored gneiss.

The solum is 20 to 48 inches thick. Depth to bedrock is 40 to 60 inches. About 2 to 15 percent of the surface is covered with stones. The profile is slightly acid or medium acid throughout, unless limed. It is 5 to 25 percent stones and gravel fragments.

The A1 horizon is dark reddish brown, very dark brown, or dark brown loam or fine sandy loam.

The B1 horizon is yellowish red, strong brown, or reddish brown loam or clay loam. The B2t horizon is yellowish red or red clay loam or sandy clay loam. The B3 horizon, if present, is red or yellowish red loam, sandy clay loam or fine sandy loam.

The B horizon is underlain by hard rock or a C horizon of gneiss saprolite.

Codorus Series

The Codorus series consists of moderately well drained to somewhat poorly drained, moderately permeable, nearly level soils that formed in alluvium containing medium to large amounts of mica. Slopes are 0 to 2 percent.

Typical pedon of Codorus loam, about 1 mile east of Hendersonville, in a pasture, 150 yards east of Tracy Grove Road bridge and 200 feet south of Devil's Fork creek, 0.4 mile south of U.S. Highway 64:

Ap—0 to 12 inches, brown (10YR 4/2) loam; weak fine and medium granular structure; friable; common fine flakes of mica; neutral; clear smooth boundary.

B21—12 to 30 inches, dark brown (10YR 3/3) loam; weak medium subangular blocky structure; friable; slightly sticky; common fine flakes of mica; medium acid; clear smooth boundary.

B22—30 to 45 inches, grayish brown (10YR 5/2) fine sandy clay loam; common fine distinct yellowish brown mottles in root channels; weak medium subangular blocky structure; friable; slightly sticky and slightly plastic; common fine flakes of mica; medium acid; clear smooth boundary.

C—45 to 60 inches, dark gray (10YR 4/1) loamy sand with thin strata of sand and gravel; medium acid.

The profile is 3 1/2 to 5 feet deep to stratified sand and gravel. Depth to bedrock is more than 60 inches. The profile is medium acid or slightly acid throughout, unless limed. Flakes of mica range from common to many throughout the solum.

The Ap horizon is brown, dark brown, or dark grayish brown loam or fine sandy loam.

The B21 horizon is brown or dark brown, and the B22 horizon is dark grayish brown or grayish brown loam, fine sandy loam, or fine sandy clay loam.

The C horizon commonly is gray or dark gray loam or loamy sand, but is sandy or gravelly unconsolidated alluvial deposits in places.

Comus Series

The Comus series consists of well drained, moderately permeable, nearly level soils that formed in recent alluvium containing moderate to large amounts of mica. Slopes are less than 2 percent.

Typical pedon of Comus fine sandy loam in a cultivated field about 1 mile south of Fletcher, 150 feet west of U.S. Highway 25 and 200 feet south of Cane Creek:

Ap—0 to 10 inches, brown (10YR 4/3) fine sandy loam; weak fine and medium granular structure; very friable; common fine flakes of mica; medium acid; gradual smooth boundary.

A12—10 to 20 inches, brown (10YR 4/3) fine sandy loam; weak fine and medium granular structure; very friable; slightly sticky; common fine flakes of mica; medium acid; gradual smooth boundary.

B2—20 to 36 inches, yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; slightly sticky; common fine flakes of mica; strongly acid; gradual smooth boundary.

The solum is 28 to 40 inches thick. Depth to bedrock is more than 72 inches. The profile is strongly acid or very strongly acid throughout, unless limed. Flakes of mica range from few to common throughout the solum. Gravel content ranges from 0 to 20 percent on the surface and throughout the solum.

The Ap horizon is brown or dark brown.

The B2t horizon is yellowish brown, brownish yellow, or strong brown clay loam or loam. The B3 horizon is sandy clay loam or loam.

The C horizon is unconsolidated sandy and gravelly alluvial material.

Evard Series

The Evard series consists of well drained, moderately permeable, sloping to very steep soils that formed in residuum weathered from granite or gneiss. Slopes are 7 to 70 percent.

Typical pedon of Evard sandy loam in an area of Evard soils, 25 to 45 percent slopes, in a wooded area, 3/4 mile south of the Buncombe County line, and on the north side of a logging road 0.3 mile east of State Road 1423:

O1—1 1/2 inches to 1/2 inch, partially decomposed leaves and twigs.

O2—1/2 inch to 0, black mat of humus and fine live roots.

A1—0 to 2 inches, dark brown (10YR 4/3) sandy loam; weak fine granular structure; friable; many fine and medium roots; few fine flakes of mica; 5 percent gravel fragments; strongly acid; abrupt smooth boundary.

A2—2 to 6 inches, dark brown (7.5YR 4/4) sandy loam; weak medium granular structure; very friable; many medium roots; common fine flakes of mica; 5 percent gravel pieces; strongly acid; clear smooth boundary.

B2t—6 to 18 inches, yellowish red (5YR 4/6) sandy clay loam; weak medium subangular blocky structure; friable; few fine roots; common fine flakes of mica; 15 percent gravel fragments; strongly acid; gradual wavy boundary.

B3—18 to 30 inches, yellowish red (5YR 4/8) sandy loam; weak medium subangular blocky structure; very friable; few fine roots; common fine flakes of mica; 20 percent gravel fragments; strongly acid; gradual wavy boundary.

C—30 to 53 inches, yellowish red (5YR 4/8) saprolite that crushes to sandy loam; rock controlled structure; about 50 percent hard coarse fragments of gravel, cobble, and stone size; strongly acid.

R—53 inches, hard quartz mica gneiss that has small amounts of soil material in fractures.

The solum is 20 to 40 inches thick. Depth to bedrock is more than 48 inches. The profile is strongly acid or very strongly acid throughout, unless limed.

The A1 horizon is very dark grayish brown or dark brown sandy loam, fine sandy loam, or loam. The A2 horizon is dark brown, brown, or yellowish brown sandy loam or fine sandy loam.

The B2t horizon is yellowish red or red. The B3 horizon is yellowish red or red sandy clay loam or sandy loam.

Fannin Series

The Fannin series consists of well drained, moderately permeable, sloping to steep soils that formed in residuum weathered mainly from mica schist and mica gneiss, and to a lesser extent from chlorite schist, phyllites, and other rocks that have a high content of mica. Slopes are 7 to 45 percent.

Typical pedon of Fannin silt loam, 7 to 15 percent slopes, about 0.5 mile west of Fletcher, in a wooded area 0.3 mile west of U.S. Highway 25, 50 feet east of St. John Road:

A1—0 to 6 inches, dark brown (7.5YR 3/2) silt loam; weak fine and medium granular structure; very friable; many fine and medium roots; about 10 percent small platy fragments; strongly acid; abrupt smooth boundary.

B2t—6 to 27 inches, yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; thin continuous clay films on faces of peds; about 10 percent small platy fragments; many fine flakes of mica; strongly acid; clear smooth boundary.

B3—27 to 36 inches, yellowish red (5YR 4/8) silt loam; weak medium subangular blocky structure; very friable; about 50 percent soft platy fragments; many fine flakes of mica; strongly acid; gradual wavy boundary.

C—36 to 60 inches, yellowish red (5YR 4/8) to strong brown (7.5YR 5/6) schist saprolite that crushes to loam.

R—60 inches, fragmental schist rock.

The solum is 20 to 40 inches thick. Depth to bedrock is more than 60 inches. The profile is very strongly acid or strongly acid throughout, unless limed. Flakes of mica range from common to many throughout the profile.

The A horizon is dark grayish brown, dark brown, brown, and strong brown silt loam or loam.

The Bt horizon is yellowish red or red silty clay loam or clay loam. If present, the B3 horizon is silt loam or loam.

The C horizon is schist saprolite.

Hatboro Series

The Hatboro series consists of poorly drained, moderately permeable, nearly level soils that formed in alluvium from schist, gneiss, and other metamorphic and crystalline rocks. Slopes are 0 to 2 percent.

Typical pedon of Hatboro loam about 1 mile east of Hendersonville and 0.5 mile south of U.S. Highway 64, and 100 feet east of Mud Creek in a field:

Ap—0 to 12 inches, dark grayish brown (10YR 4/2) loam; weak fine and medium granular structure; friable; slightly sticky; medium acid; clear smooth boundary.

B2g—12 to 36 inches, dark gray (10YR 4/1) loam; weak medium and coarse subangular blocky structure; friable; slightly sticky; common fine flakes of mica; strongly acid; clear smooth boundary.

IIC1—36 to 48 inches, dark grayish brown (10YR 4/2) loamy sand; single grained; loose; few fine flakes of mica; slightly acid; gradual smooth boundary.

IIC2—48 to 62 inches, grayish brown (10YR 5/2) sand; single grained; loose few fine flakes of mica; slightly acid.

Depth to stratified sand and gravel ranges from 3 to 5 feet. The profile is strongly acid to slightly acid throughout, unless limed. Flakes of mica range from few to many throughout the soil.

The A horizon is dark grayish brown, very dark grayish brown, dark gray, and very dark gray loam, fine sandy loam, and silt loam.

The B horizon is dark gray, very dark gray, and dark grayish brown loam, silt loam, or silty clay loam.

The C horizon is loamy and sandy, gravelly, stratified alluvial deposits.

Hayesville Series

The Hayesville series consists of well drained, moderately permeable, gently sloping to moderately steep soils that formed in residuum from rocks such as granite, gneiss, and schist. Slopes are 2 to 25 percent.

Typical pedon of Hayesville loam, 7 to 15 percent slopes, about 8 miles northwest of Hendersonville, in a wooded area 125 feet south of the Fanning Bridge Road

opposite the driveway of the Mountain Horticultural Experiment Station:

A1—0 to 4 inches, dark brown (10YR 3/3) loam; moderate fine granular structure; very friable; high in organic matter content; numerous medium and fine roots; few fine flakes of mica; strongly acid; clear smooth boundary.

A2—4 to 8 inches, brown (7.5YR 4/4) loam; weak fine subangular blocky structure; very friable; common medium and fine roots; many medium and fine pores; few fine flakes of mica; strongly acid; clear smooth boundary.

B1—8 to 16 inches, yellowish red (5 YR 5/6) clay loam; weak medium subangular blocky structure; friable; few medium and fine roots; few fine pores; few thin patchy clay films on faces of peds; few fine flakes of mica; few quartz gravel; strongly acid; clear smooth boundary.

B21t—16 to 24 inches, yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; few medium and fine roots; few fine pores; thin continuous clay films on faces of peds; few flakes of mica; few quartz gravel; strongly acid; clear smooth boundary.

B22t—24 to 35 inches, red (2.5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; few medium and fine roots; few fine and medium pores; thin continuous clay films on faces of peds; common medium and fine flakes of mica; common quartz gravel; strongly acid; gradual wavy boundary.

B31—35 to 39 inches, red (10R 4/6) sandy clay loam; moderate medium angular blocky structure; friable; slightly sticky; few fine roots; few distinct clay films on faces of peds; common to many flakes of mica; common bodies of saprolite; strongly acid; gradual irregular boundary.

B32—39 to 44 inches, red (10R 4/6) sandy loam; weak medium angular blocky and platy rock structure; very friable; few fine roots; few thin patchy clay films and dark coatings on vertical faces of peds; common flakes of mica; common quartz gravel; strongly acid; gradual irregular boundary.

C1—44 to 72 inches, red (10R 4/6) saprolite that crushes to sandy loam; rock controlled structure; very friable; few fine roots; small amounts of clay in cracks; common bodies of dark minerals; common flakes of mica; strongly acid; gradual irregular boundary.

C2—72 to 112 inches, gray (10YR 5/1) and light gray (10YR 7/1) soft saprolite that crushes to sandy loam; rock controlled structure; very friable; few dark coatings on faces of structural units; few interbedded ledges of mica schist; strongly acid.

The solum is 40 to 60 inches thick. Depth to bedrock is more than 60 inches. The profile is very strongly acid or strongly acid throughout, unless limed.

The A1 horizon is brown, dark brown, reddish brown, or dark reddish brown loam or fine sandy loam. The A2 horizon is brown, dark brown, or reddish brown loam or fine sandy loam.

The B1 horizon is clay loam, sandy clay loam, or loam. The B2t horizon is yellowish red or red. The B3 horizon is red or yellowish red sandy clay loam or sandy loam.

The C horizon is gneiss or schist saprolite that crushes to sandy loam or loam.

The B1 horizon is clay loam, sandy clay loam,

Kinkora Series

The Kinkora series consists of poorly drained, moderately slowly permeable, nearly level soils that formed in old alluvium, mainly from areas of acid crystalline rocks. Slopes are 0 to 2 percent.

Typical pedon of Kinkora loam in an idle field in the Mills River Community along N.C. Highway 191, 1.2 miles west of the French Broad River and 1,000 feet north of highway on field road, 30 feet east of field road:

Ap—0 to 7 inches, dark gray (10YR 4/1) loam; weak medium and coarse granular structure; friable; slightly sticky and slightly plastic; many fine roots; very strongly acid; clear smooth boundary.

B21tg—7 to 16 inches, gray (10YR 5/1) clay loam; few fine distinct yellowish brown mottles; weak medium subangular blocky structure; friable; sticky and slightly plastic; common fine roots; continuous clay films on faces of peds and in channels; few fine flakes of mica; very strongly acid; gradual smooth boundary.

B22tg—16 to 33 inches, gray (10YR 5/1) clay; few fine distinct yellowish brown mottles; weak medium and coarse subangular blocky structure; firm; sticky and plastic; few fine roots; thin continuous clay films on faces of peds and in channels; few fine flakes of mica; very strongly acid; gradual smooth boundary.

Cg—33 to 60 inches, gray (10YR 5/1) clay; few fine distinct yellowish brown mottles; massive; firm; sticky and plastic; common fine flakes of mica; very strongly acid.

The solum is 24 to 40 inches thick. Depth to bedrock is more than 72 inches. The profile is very strongly acid or strongly acid throughout, unless limed.

The A horizon is dark gray, gray, or dark grayish brown loam or silt loam.

The B2t horizon is gray or light gray clay loam, clay, silty clay, or silty clay loam.

The C horizon is gray or light gray unconsolidated alluvial deposits.

Porters Series

The Porters series consists of well drained, moderately permeable, moderately steep to very steep soils that formed in material derived from rocks containing a relatively large amount of ferromagnesian minerals. Slopes are 15 to 70 percent.

Typical pedon of Porters stony loam, 25 to 45 percent slopes, in a wooded area about 1.5 miles west of Bear Wallow Mountain Fire Tower, 0.2 mile north of State Road 1594, and 75 feet east of State Road 1596:

O1—1 inch to 0, layer of leaves and green moss.

A1—0 to 6 inches, very dark grayish brown (10YR 3/2) stony loam; weak fine granular structure; very friable; slightly sticky and slightly plastic; many fine roots; few fine flakes of mica; 10 percent stones; strongly acid; clear smooth boundary.

B1—6 to 10 inches, dark brown (10YR 3/3) loam; weak medium subangular blocky structure; very friable; slightly sticky and slightly plastic; common fine roots; few fine flakes of mica; medium acid; clear smooth boundary.

B2t—10 to 23 inches, yellowish brown (10YR 5/4) clay loam; weak medium subangular blocky structure; friable; sticky and slightly plastic; few fine roots; few thin clay films on faces of peds; few moderately hard and soft coarse rock fragments; few fine flakes of mica; strongly acid; gradual wavy boundary.

B3—23 to 32 inches, yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; very friable; slightly sticky; few fine roots; common moderately hard and soft rock fragments; few fine flakes of mica; strongly acid; clear irregular boundary.

C—32 to 42 inches, brown (10YR 5/3) saprolite that crushes to sandy loam; moderately hard rock in places; medium acid; clear irregular boundary.

R—42 inches, hard gneiss with common fractures.

The solum is 20 to 40 inches thick. Depth to bedrock is 40 to 72 inches. Stones cover 5 to 15 percent of the surface. The profile is medium acid or strongly acid throughout, unless limed.

The A1 horizon is very dark grayish brown, dark brown, or very dark brown.

The B1 horizon is dark brown or brown loam or sandy clay loam. The B2t horizon is yellowish brown, dark yellowish brown, or strong brown loam, sandy clay loam, or clay loam. The B3 horizon, if present, is yellowish brown, dark yellowish brown, or brown loam or sandy clay loam.

The C horizon, if present, is brown or brownish yellow.

N

(Joins sheet 3)
(Joins sheet 8)
(Joins sheet 11)
Brickton
Naples
Hollands Lake
Cane Creek
McDowell Ha
Mills River
Mills River
Branch
Shepherd Park Memorial
SPANN PROPERTY
NCD 986 180 917
610 000 FEET
955 000 FEET
5000 4000 3000 2000 1000 0 5000 Feet
1 .5 0 1 Kilometer

NORTH CAROLINA ATLAS

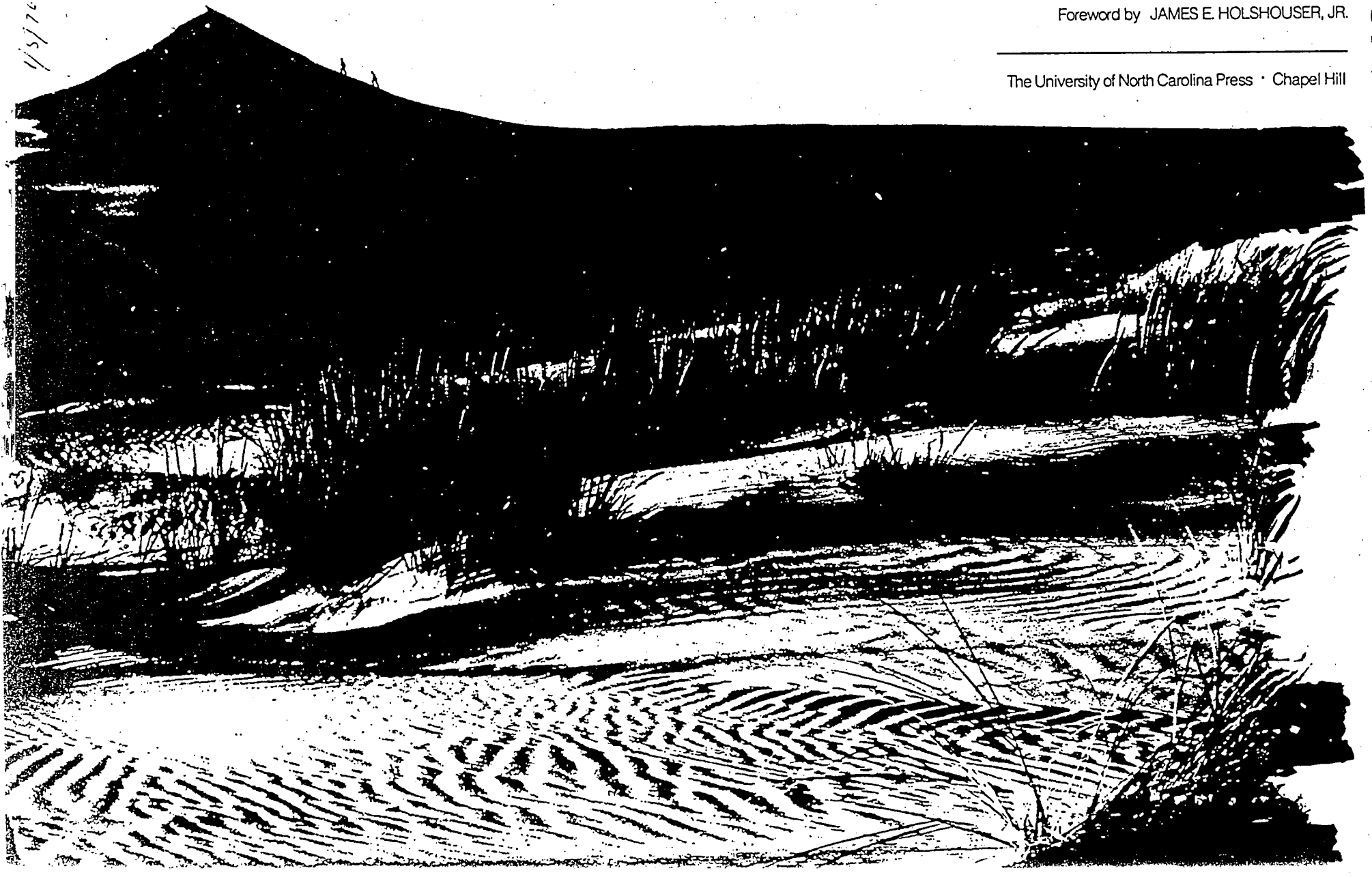
PORTRAIT OF A CHANGING SOUTHERN STATE

PUBLIC HEALTH LIBRARY
DIVISION OF HEALTH SERVICES
P. O. BOX 2091
RALEIGH, NORTH CAROLINA 27602

Edited by JAMES W. CLAY
DOUGLAS M. ORR, JR.
ALFRED W. STUART

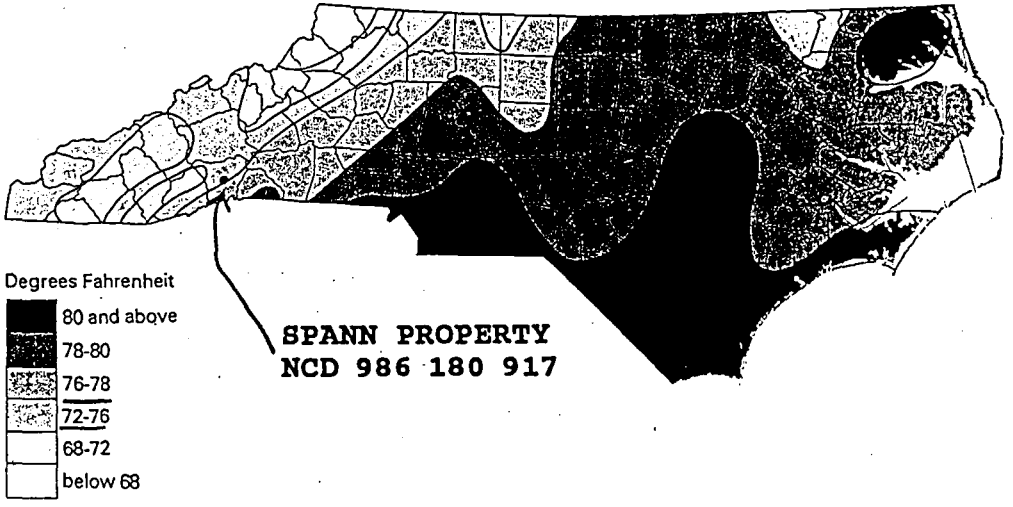
Foreword by JAMES E. HOLSHOUSER, JR.

The University of North Carolina Press · Chapel Hill



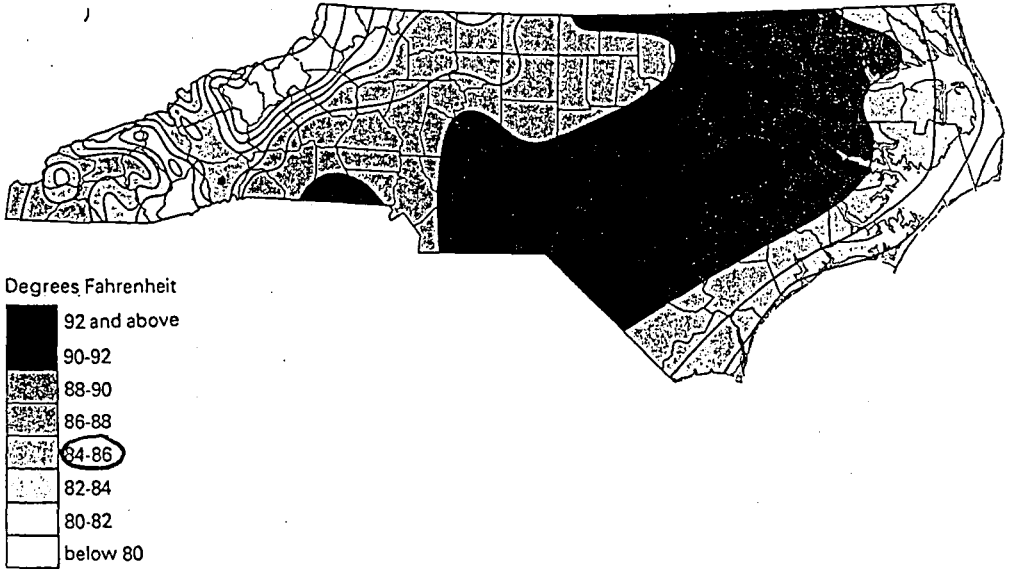
Ref. 4

Fi, 5.9. Average July Temperature in N.C.



Source: U.S. Department of Commerce, *Weather and Climate in North Carolina,* 1972.

Figure 5.10. Mean Maximum July Temperature in N.C.



Source: U.S. Department of Commerce, *Weather and Climate in North Carolina,* 1972.

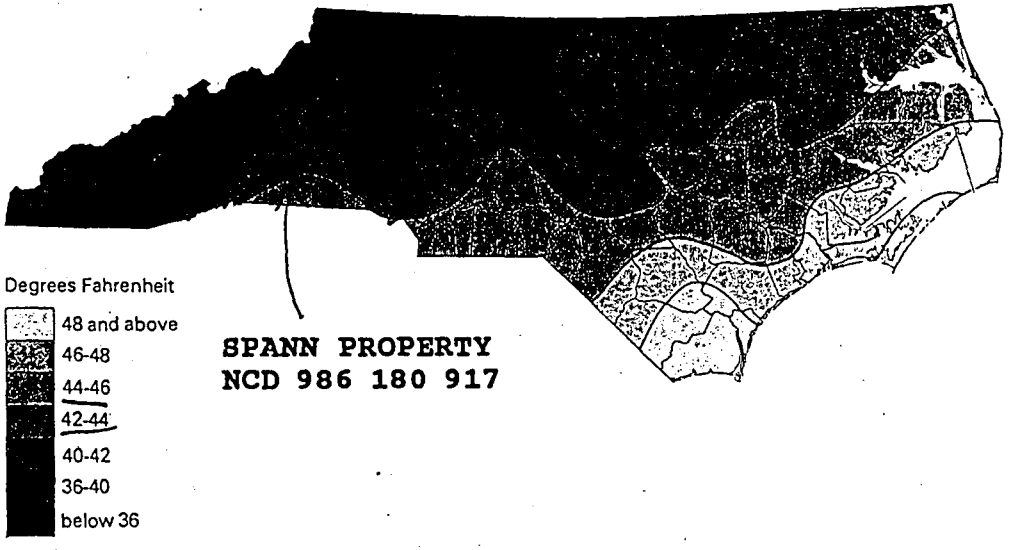
These strip-like regions have longer freeze seasons and thereby show earlier dates for the end of the freeze period than their surroundings. They support frost-susceptible vegetation long after the greenery has disappeared in nearby areas. Often in early winter or even in midwinter a contrasting belt of green flanked above and below by brown may be seen. These green belts are characteristically located along slopes that face the winter sun, are protected from cold northern winds, and have cold air drainage to lower valleys. The blossoming of dogwood and redbud moves across the state in a pattern similar to that of the end of the freeze season to blanket North Carolina with color and beauty.

Summer Summer is characterized by its high temperatures, high humidities, high amounts of rainfall, and high physiological stress. Except for the amelioration of these climatic elements in the Mountains, and the relief afforded by sea breezes along the coast, elsewhere in the state summer is a season of extremes. Mean monthly minimum temperatures for July and August are in the upper seventies and eighties and mean maximum temperatures reach into the nineties.

However, to quote a popular adage, "it's not the heat but the humidity," and North Carolina's temperatures in combination with the high water vapor amounts prevalent during the summer months are definitely uncomfortable. In addition, high sunshine percentages and a predominance of southerly winds tend to aggravate an already unpleasant climatic condition. Only the periodic passage of cool, dry air masses from the north and sea breezes in the coastal areas alleviate the discomfort of summer weather for North Carolina's low-lying counties.

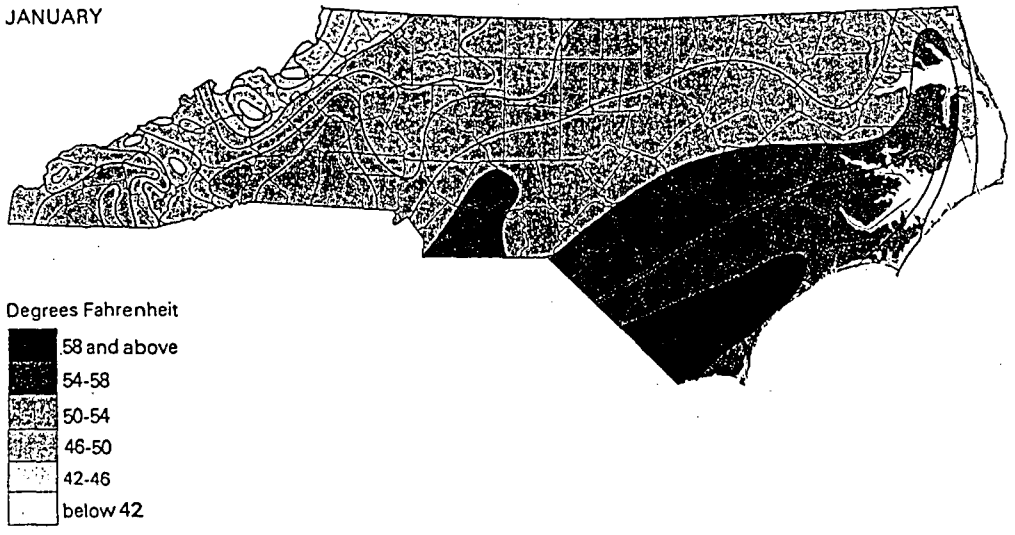
July Average Temperatures The pattern of mean temperatures in July is similar to the pattern in January (Figure 5.9). However, in the Piedmont and Coastal Plain, isotherms are fewer in number and farther apart. In the Mountains, the reverse is true. The widespread isotherms east of the Mountains indicate that temperature averages across central and eastern North Carolina exhibit little contrast. From the western Piedmont to the coast, the difference in mean temperatures is only 4° F. Although the influence of the ocean is not evident in the arrangement of isotherms, the high temperatures of the Coastal Plain are made less severe by the cooling power of the sea breeze. Hatteras, on the Outer Banks, records a temperature of 90° F. on the average of only one day each year, while Wilmington, a short distance from the coast, has an occurrence of 90° F. temperatures about twenty-four days annually. In contrast with these locations, Raleigh and Winston-Salem mean temperatures for July are slightly lower, but the average number of days on which a temperature of 90° F. or above is experienced increases to more than forty.

Figure 5.2. . ɜrage January Temperatures in N.C.



Source: U.S. Department of Commerce, *Weather and Climate in North Carolina,* 1972.

Figure 5.3. Mean Maximum Temperature in N.C.



Source: U.S. Department of Commerce, *Weather and Climate in North Carolina,* 1972.

Seasonal Changes in Climate

Winter The alternate passage of low- and high-pressure systems over the state during winter months results in changing weather conditions. Moisture and warmer temperatures are characteristically associated with frequently passing low-pressure cells. Lows are followed by polar highs, which bring lower temperatures and clear skies. However, even when under the influence of these polar highs, temperatures seldom fall below 10° F., and midday temperatures reach into the forties, making the winter season very tolerable by northern standards.

January average temperatures shown in Figure 5.2 illustrate the mildness of winters. Only at the highest elevations do temperatures average below freezing. The mean temperature for January at Mount Mitchell is 28.7° F., the lowest in the state. Yet, at Asheville, located on the lee side of the mountains, temperatures for January average 39.4° F.

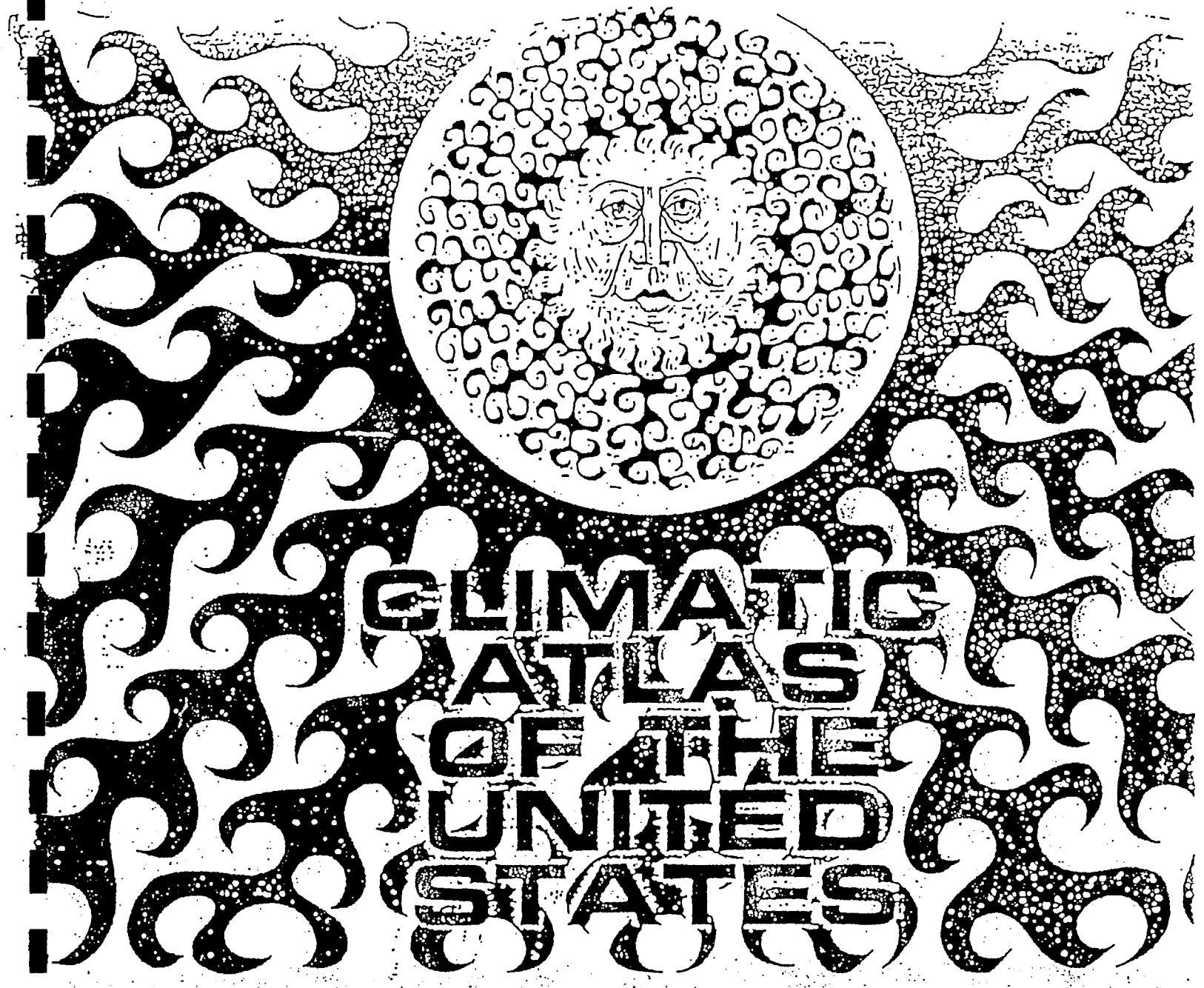
Nowhere else in North Carolina is the local contrast in temperatures as great as in the western counties. Temperature contrasts are least where the climate is mildest. Hatteras, on the Outer Banks, has a January mean of 48.0° F., and only thirteen days each year when temperatures of 32° F. and below are recorded.

The tendency for January isotherms to parallel the coast shows the influence of the Atlantic Ocean. Wilmington, in southeastern North Carolina, the most subtropical area in the state, exemplifies the maritime effect. This coastal city has a January mean temperature of 47.8° F., and an average of only eight days during January when temperatures dip to 32° F. or less, as compared with eighteen days at Raleigh and nineteen at Asheville.

In the Piedmont, latitude is the primary control on temperature, and the isotherms maintain a zonal pattern. As might be expected, temperature averages lie between those exhibited by the surrounding regions. Charlotte has a mean January temperature of 42.3° F., Greensboro, 39.0° F., and Raleigh, 42.7° F.

However, whereas Asheville averages eighty-three days each year when temperatures drop below freezing, Winston-Salem has freezing temperatures eighty-eight days annually, and Greensboro has eighty-four days with freezing temperatures.

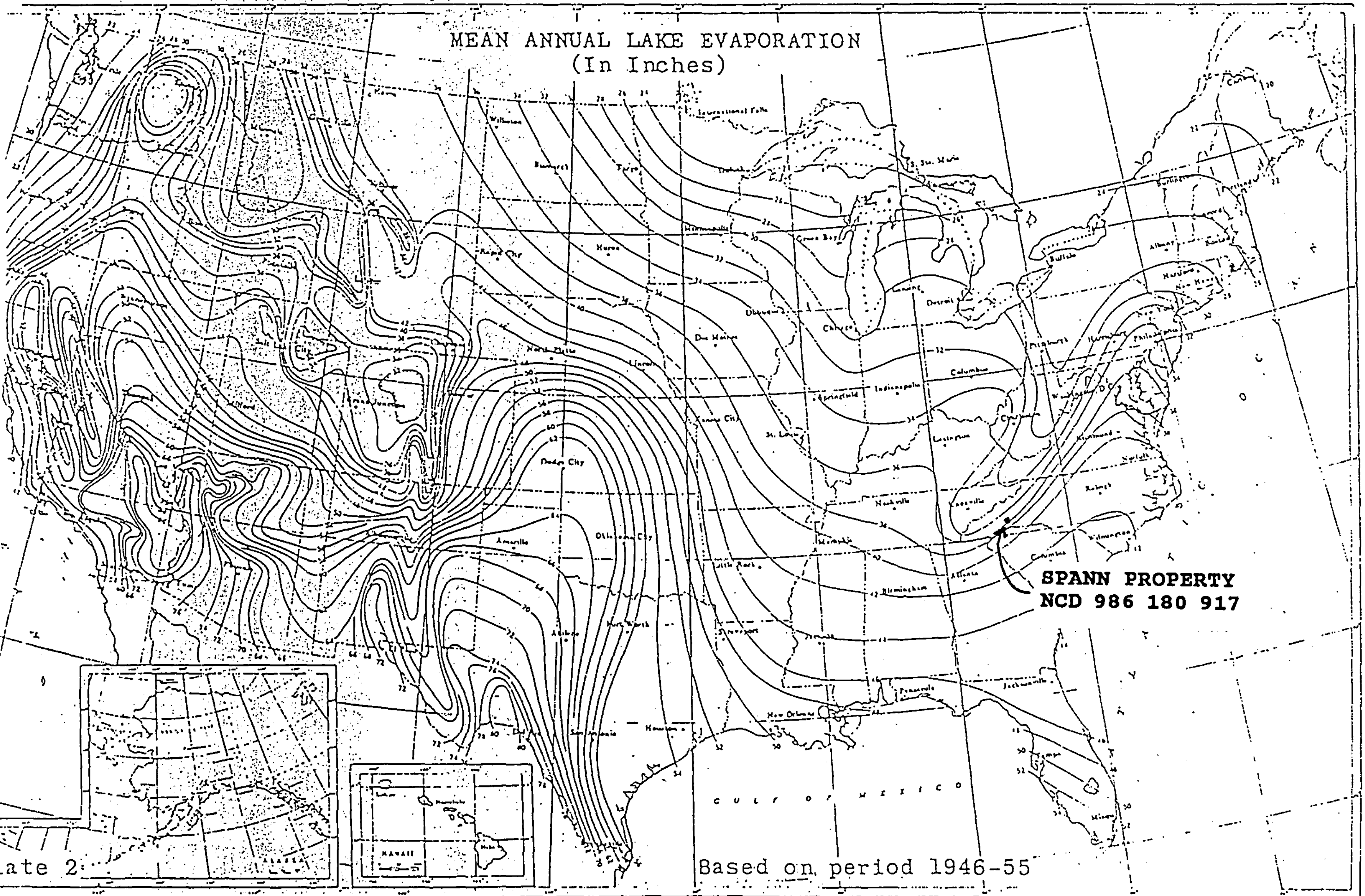
Ref. 5

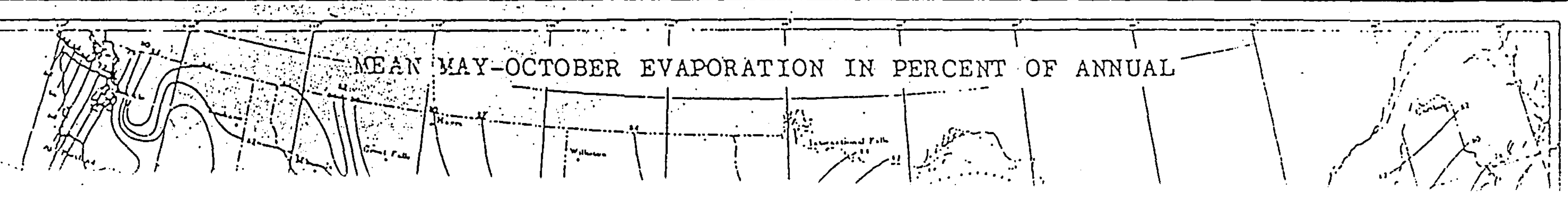


RCE . Environmental Science Services Administration . Environmental Data Service

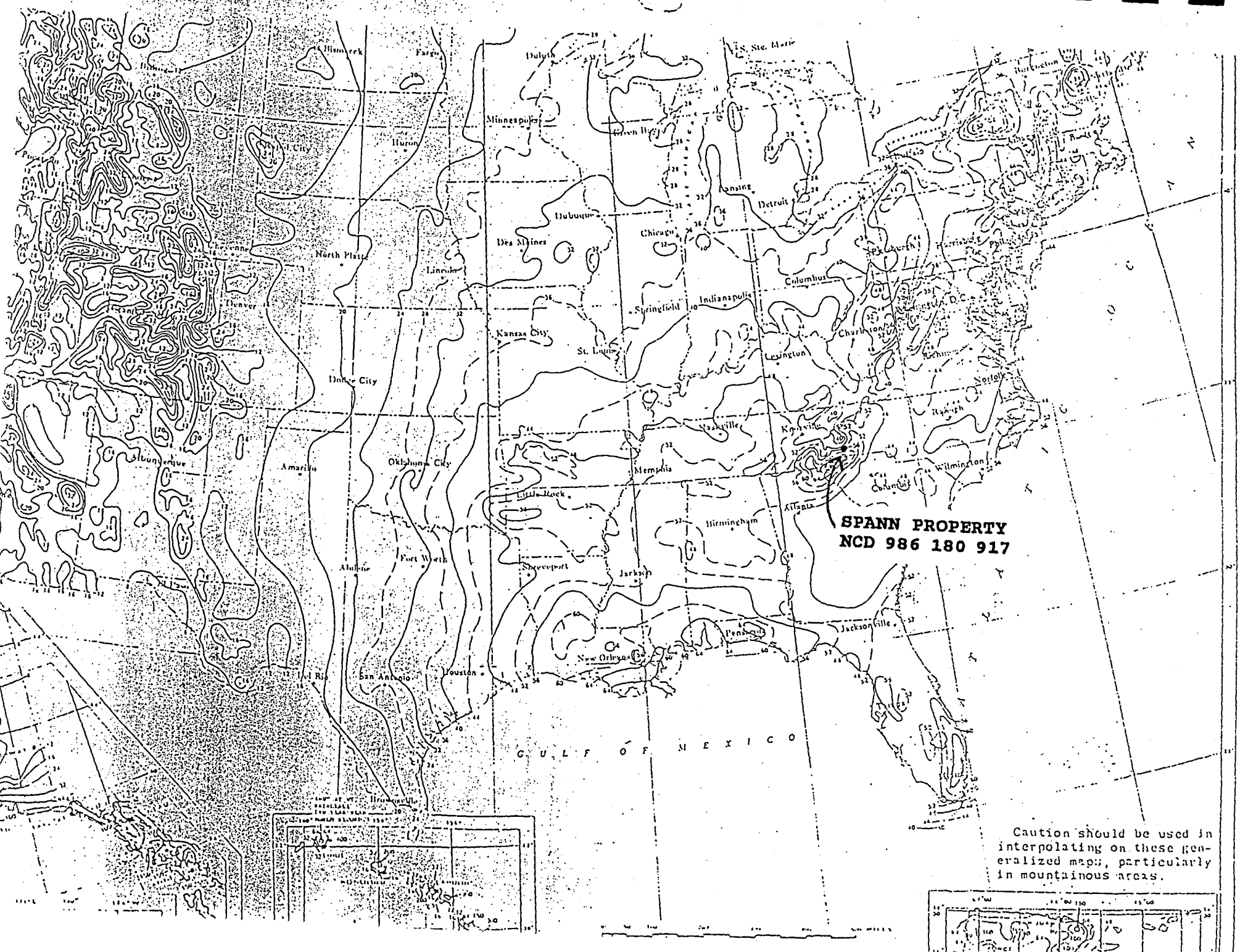
United States Department of Commerce, 1979, Climatic Atlas of the United States, National Climatic Center, Asheville, NC.

EVA[redacted]





NORMAL ANNUAL TOTAL PRECIPITATION (INCHES)



Caution should be used in interpolating on these generalized maps, particularly in mountainous areas.

B1

SPANN PROPERTY
NCD 981 180 917
HENDERSONVILLE NC
HENDERSON ~~VILLE~~ CO

4/4/94

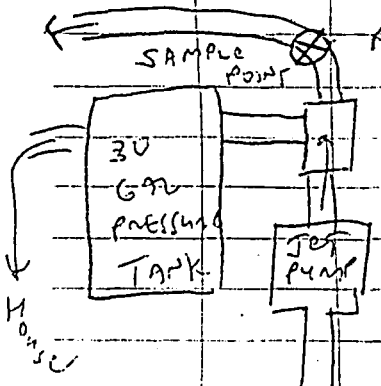
1830 ARRIVED HVINC, DMUL BY SITE

CHECKED RUGBY ROAD HOUSES FOR WELLS LOCATED 1 WELL AT HOUSE ON HILLTOP EAST OF CHURCH, APPROX ~~[illegible]~~ 250 FT NW FROM SITE

- SAMPLE LOCATION SP 01 GW
DOMESTIC GROUNDWATER WELL
RAYMOND GILLILAND RTE 8 BOX 123
MARGARET, HENDERSONVILLE

2 RESIDENTS — MR + MRS
692 8431

STARTED PURGING 19:15 STOPPED 1930



PURGED THROUGH OUTSIDE HOSE FROM SPIGOT BETWEEN WELLHEAD AND PRESSURE TANK, BYPASSING TANK

APPROX 3 GPM IS MIN
45 GAL EST.

MG: 125' OF ~~PIPE~~ CASING REPORTEDLY PUT IN WELL
120 ~~FT~~ TO RK ?

1940 - 2030 EXAMINE ROCK, TT TO MOTEL

B2

MR GILLILAND INDICATED THAT J SPANN ONCE HAD LARGE HOUSE WHERE JUNKYARD IS NOW.

AREA CONDEMNED (?) HOUSES TORN DOWN

SPANN DEAD. REMAINING BLDG WAS NEWED BY WOMAN FROM CALIF. BUT NOW A STORE

4/5/94 TRAVELLED 0800 - 0824 TO NORTH RUGBEE RD CROSSING OF MUD CRK

HIZENN SAMPLED / SPP DOCUMENTED + PHOTOED.

SAMPLE LOCATION SP 02 SW BENEATH BRIDGE AT PILINGS (CONCRETE) SEDIMENT SAMPLE SP 02 SD COLLECTED USING SCOOP AND EXT POLE FROM VENEER OF DEPOSITED SILT/CLAY AT BANK, SAME LOCATION
SP 02 SW 08:40 SP 02 SD 08:48

PHOTOS 1-3 SW AND SD SAMPLE LOCATIONS

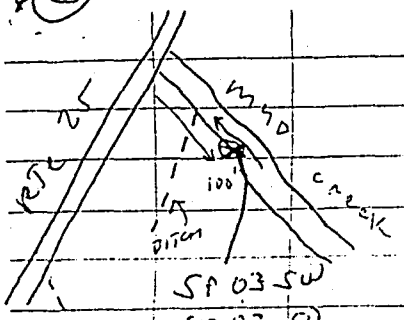
0910: DEPARTED TO LOCATION SP 03, AT RT 25 CROSSING OF MUD CREEK.

LOCATION: 100 FT UPSTREAM OF RT 25 S. BANK
SAMPLED ~~[illegible]~~ SP 03 SW 0930
SAMPLED SP 03 SD 0938 JUST UPSTREAM WHERE RIPPLE MARKS

PHOTOS —, —, —

Ref. 6

#3



ENCOUNTERED TEEN-AGED PASSERBY WHILE SAMPLING SITE DOWNGRADIENT READILY ACCESSIBLE AT LOC SP 03

SITE

OBSERVED FISHERMAN JUST DOWNSTREAM OF BRIDGE ON 4/4, PM

1014 — ENTERED JUNKYARD, NOW OPEN
MET W/ MRS HODGE WHO OK'd ENTRY,
SET UP OVA. FILE BOOTS ON.

MAX ONSITE RELIEF OVER 10 FT.
GENTLE SLOPES TO LOWLAND.
CARS AND SCRAP METAL, FEW APPLIANCES, (OVENS, ETC) VISIBLE.
RIVER EDGE OF PROPERTY HAS INCOMPLETE FENCE W/ OPEN AREA.
SET BACKGROUND OVA TO 1 ~~PPM~~ UNIT
ALARM AT 7 ~~PPM~~ UNITS

Steve Gy 4/5/94

(4)

PHOTO — DRAINAGE DITCH FLOWING INTO MUD CREEK.

PHOTO — 2 CHAIRS ARRANGED ON BANK WITH FORKED STICK PLANTED IN FRONT → FISHERY EVIDENCE

PHOTO — DUMP FROM GATE (RIVER SIDE)
— NO VISUAL EVIDENCE OF SHEPHERDS DINNER ON DRIVE.
— TRAVERSED ACROSS LOWER DUMP TO UPPER PART OF DITCH. SAW PILES OF TIRES AND MORE AUTO DEBRIS, PILES OF CINDERS, FARM MACHINERY, OLD FLATBED TRUCKS, ENGINE PARTS, BATTERIES
— 55 GAL DRUM (2) EMPTY, SEALED MARKED "300-100 251 KEEP FROM FREEZING"

PHOTO — DUMP VIEWED FROM NORTH.
THE 10 DRUMS REPORTED PREVIOUSLY WERE NOT SEEN.
TOURED AREA W/ OVA NO ELEVATED READINGS ABOVE BACKGROUND CALIBRATION

1100 PREPARED TO SAMPLE UPSTREAM OF SITE ON MUD CREEK AND SAMPLE ON DRAINAGE DITCH (SP-04 AND SP-05, RESPECTIVELY.

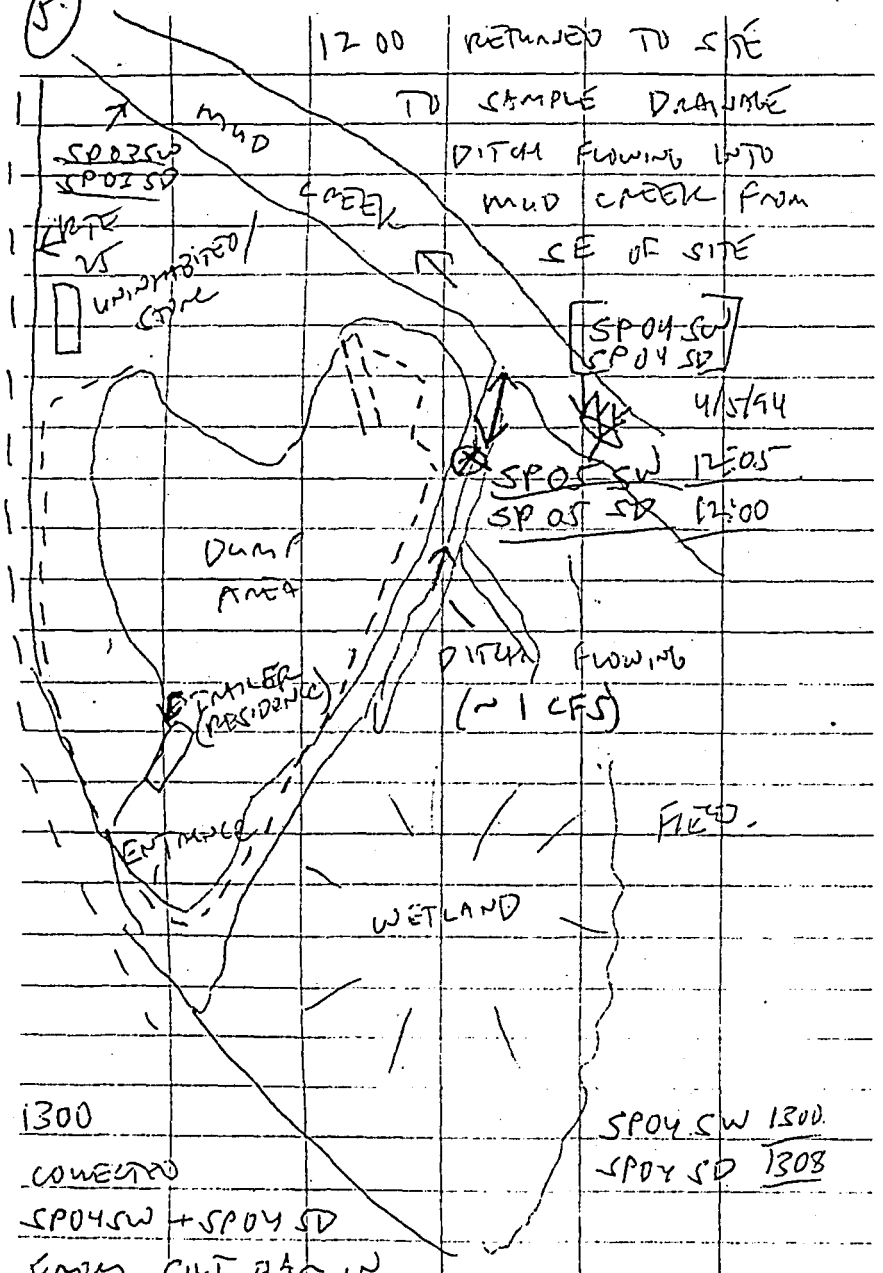
1115 (SNACK)
STOPPED TO GET LUNCH, AND RESERVE HOTEL ROOMS FOR 2nd NIGHT

Steve Gy 4/5/94

(5)

12 00 RETURNED TO SITE

TO SAMPLE DRAINAGE DITCH FLOWING INTO MUD CREEK FROM SE OF SITE



4/5/94

12:05

12:00

1300

CONNECTED SP04SW + SP04SD FROM SILT BAR IN MIDDLE OF ~~BIG~~ MUD CREEK (UPSTREAM BACKGROUND)

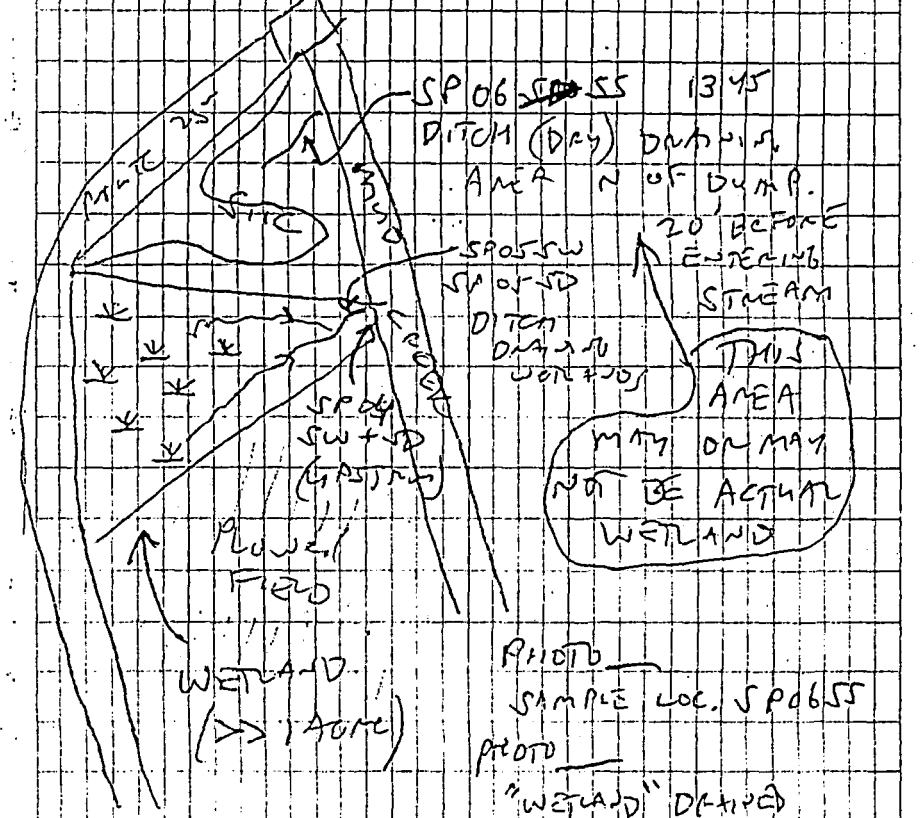
SP04SW 1300
SP04SD 1308

(6)

PHOTOS — UPSTREAM SAMPLE LOCATION SP04

PHOTO — WETLAND AREA S OF SITE

FIELD TEAM CROSSED THIS AREA, IT IS BOGGY WITH EVIDENCE OF PONDING CONDITIONS. AREA ABUTS SITE



SP06SS 1345
DITCH (DRY) DRAINING AREA N OF DUMP.

PHOTO — SAMPLE LOC. SP06SS

PHOTO — "WETLAND" DRAINED PAST SP06SS

4/5/94

(7)

STOPPED BY HENDERSONVILLE
WATER + SEWER FACILITIES
RETRACED EXTENT OF LINE
COVERAGE — 3 WATER INTAKES IN FOREST
BRADLEY CREEK S FORK 20"
FLETCHER CREEK N FORK 16"
BIG CREEK
ALSO 2 30" MAINS RIVER
FMH TRACED OUTLINE OF SERVICE AREA FOR VFC
- STOPPED BY SCS, LAND RECORDS TREW
BY ASCS TO LOOK AT PHOTOS
ONLY 1 PHOTO, DATED N 1960S.
BLURRY, SHOWS CAULIFLOWER SHAPED
AREA OF HIGH ALBEDO. NO DETAIL.
CLEARED AREA E OF ENTRANCE ROAD.

LEFT HENDERSONVILLE 1600

TT 1530 → 2030 MINUS ½ DINNER
2130-2145 JAMMED TO COOLEN
LEFT VFFC 2200

Left 8M, 4/5/94

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: March 24, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Telecommunications with Mary Beck, Site Owner,
and Herbert Hodge, On-site Scrap Yard Operator.

SFP telephoned Mary Beck, owner of the Spann Property (704-693-7557) on 3/21/94 for permission to visit and sample at the site. She gave permission and advised to contact Herbert Hodge for access, as the site is normally locked.

SFP telephoned Herbert Hodge (Asheville yard tel. no. 704-252-1689) to advise him of the situation. He reported that his scrapyard at the Spann Property is open Tuesdays through Fridays. SFP inquired about the age of the facility. Mr. Hodge said that he had crushed cars there since approximately 1966, but the facility had been an auto yard operated as Naples Auto Disposal and Salvage since 1977. He reported that they typically accumulate several junk cars at a time, then cut up and sell them en masse.

Usually, 3 workers at a time are present during site operation. He and his family of 2 live on the property. He was not familiar with prior use of the site except that he believed that the Gerber Food Company had disposed of waste at the site during the 1950s and 1960s. SFP indicated the initial date planned for the recon.

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 24, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Henderson County Health Department Correspondences

Robert Smith, Environmental Health Supervisor, Henderson County Health Department (704-692-4228) telephoned SFP on 3/24/94 in response to a prior telecommunication requesting permitting data on the Naples Auto Disposal and Salvage Corporation at the Spann Property. Mr. Smith reported that information on the facility was limited to sanitary, rodent, and tree planting inspections, and to correspondence regarding the need for a permit. The facility has an unnumbered junkyard permit dated 10/30/87.

SFP telephoned Mark Jones, (same number) on 5/24/94 to confirm the location of the nearest school as reported in the Preliminary Assessment. He confirmed that Fletcher Academy is the nearest school to the site, and that the facility uses a water supply well.

NORTH CAROLINA

DHR/DHS

Shepherd Farm
NCD986170686
Preliminary Assessment

June 1989

By Edward Wallingford
Environmental Chemist
SUPERFUND BRANCH
SOLID WASTE MANAGEMENT SECTION

GE/SHEPARD FARM
RESPONSE FROM GE FOR
INFORMATION INQUIRY

3/30/92

Pat,

Enclosed is part of the response from GE for the 104(e) information inquiry sent to them two years ago by the Region. F.Y.I.
It has some information on other disposal sites in area used by GE.

Debbie V-W

104(e) Question #15

Answerer: Lee A. Humphrey
Michael J. Bush

I. Shepherd Farm

(b) Our records reveal the Gene Shepherd of Shepherd garbage service was our trash hauler from 1955 to 1962 and 1965 to 1970. This disposal site was used by Mr. Shepherd during 1956-1962 and 1965-1970.

c,d,e See attached survey of GE hazardous waste disposal practices, conversation with Mr. Gene Shepherd, and groundwater sampling data.

(f) GELS identified residents adjacent to the Shepherd property with actual and potential contamination in the wells. Without admitting any liability, GELS responded by supplying those residents with bottled water and by extending City water lines into the area.

(g) Investigations by the North Carolina Department of Environment, Health, and Natural Resources revealed groundwater and soil contamination in the area. GELS then initiated a groundwater study of the area.

II. Seldon Clark Property

Interview with Mr. Seldon Clark and conversations with Fate Jones and Dan A. Yarborough revealed that the Seldon Clark property, at the intersection of US 176 and Tabor Road, was used as a fill area for construction rubble from the Site.

III. Western North Carolina Fairgrounds

Conversations with Dan A. Yarborough, Charlie Henderson, and Fate Jones revealed that the following activities involving GELS occurred:

1. GELS had several company picnics at the fairgrounds, however, all material brought to the fairgrounds was removed at the end of the picnic.

2. GELS had a sale of office equipment at the fairgrounds in 1980. This could account for the reports of GE trucks carrying items to the fairgrounds.

3. GELS donated materials and fuel to train local fire departments. This training was conducted at the fairgrounds.

We have no other knowledge of any materials being taken to the fairgrounds.

IV. Grandview Memorial Gardens

We have no knowledge of any GELS waste being disposed of at this site.

V. Jesse Staton Farm

Conversations with Jesse Staton, fork truck garage work leader at GELS and Dan A. Yarborough, indicate that only construction rubble was landfilled at the farm site.

VI. Henderson County Landfill

(b) 1970-1979

(c) (i) capacitors; (ii) paint sludge in barrels; (iii) epoxy gunk; (iv) Al and Fe slurry from dust collectors; (v) water based acrylic paint cans; (vi) heavy petroleum grease; (vii) varnish residues; (viii) buffing waste; (ix) wire drawing lubricant; and (x) phenolic plastic residue.

(d) landfill

(e) (i) 5000-15000 per year until 1976; (ii) 50-150 level per year to 1973; (iii) 4000 lbs/wk (last four years); (iv) 1-10 per week; (v) 2 barrels per week; (vi) 4-10 barrels/year; (vii) 200-1000 lbs/week; (ix) 300-500 gallons/year; and (x) 1000 lbs/ week.

VII. Fains Dump

(b) 1969-1970

(c) miscellaneous plant waste including (pail sludge, small capacitors, buffing waste, epoxy compounds, die cast mold release, paint cans (acrylic hydrocarbon paint), ~~phenolic plastic residue.~~

(d) landfill

(e) estimates for - paint sludge 50-150 barrels
epoxy compounds - 50 barrels
phenolic plastic residue - 250 lbs/week

SURVEY OF GE HAZARDOUS WASTE DISPOSAL PRACTICES

Under authority of the Resource Conservation and Recovery Act (RCRA), the Environmental Protection Agency has proposed regulations to control the future disposal of hazardous wastes (43FR58946, December 18, 1978). There is also growing public and legislative concern about the current impact of past waste disposal practices, an issue not covered by RCRA.

The purpose of this survey is to estimate the impact upon GE facilities of the proposed regulations and of public concern with the problems created by hazardous wastes in abandoned landfills.

Please complete the survey form based upon current knowledge within your component of both past and present waste disposal practices. Where such knowledge is not currently available, do not attempt to reconstruct it from related information, such as data on past plant production. Do not solicit information from sources outside the Company.

I. IDENTIFICATION

A. Name of component Lighting Systems Department

Address _____

B. GE organizational Affiliation (where appropriate)

Sector _____

Group _____

Division _____

Department _____

Other _____

C. Name, title, and dial comm of key individual knowledgeable about waste disposal at your location:

E. F. Stenstrom, Manager - Reclamation 8-282-2502

Responsibility from 1969 to present date. No factual knowledge prior to that date or any known records other than name of contractor to haul away plant waste.

II. WASTE SURVEY

A. Has a survey ever been made to determine the types and quantities of wastes generated at your site, their points of origin, and the methods used for their disposal? _____ NO _____

B. If your answer to A is "Yes", please

1. Give date of survey _____

2. Give name of initiating organization (if non-GE) _____

_____

3. Attach survey results.

III. HAZARDOUS WASTES

- Please review the Appendix, which lists, by broad categories, the types of wastes considered by EPA as hazardous.

A. Has your plant ever generated or disposed of wastes such as those in Appendix? _____ YES _____

B. If your answer to A is "No", you have completed this questionnaire.

C. If your answer to A is "Yes", please fill out Tables 1 and/or 2 as applicable.

- Use Table 1 to list all facilities (e.g. landfills, lagoons, incinerators) on your plant site that contain or that have been used to dispose of any of the types of waste listed in the Appendix.

- Use Table 2 to list sites not on GE property that have been used for the disposal of wastes from your plant site.

E Compo[redacted] Lighting Systems Department

ocation Hendersonville, N. C.

TABLE 2

WASTE DISPOSAL PRACTICES OFF GE PROPERTY

'ame and location of ff-site disposer	Type* of disposal facility	Dates when used	Types and approximate quantities of waste disposed of **
Fain's Dump - approximately five miles north of Hendersonville near US 25	Private landfill	1969-1970 No records were kept of this activity - all figures are best estimates	Contract waste disposal service by Gene Shepherd. 1) Total plant waste including A) Estimated 50-150 barrels paint slu *B) Polychlorinated biphenyls article (small capacitors) C) Buffing waste - cotton, aluminum, and grit D) Epoxy compounds - estimated 50 bar E) Die cast mold release - hydrocarbo F) Miscellaneous one and five gallon paint cans partial to full with acrylic hydrocarbon paint G) Phenolic residue from deflashing a floor sweeping - estimated 250 pou per week
Hendersonville Waste Treatment	Sanitary waste treatment system	1969 - 5/79	20,000 to 30,000 gallons per day typical sanitary waste 20,000 to 30,000 gallons per day - 600 par per million biochemical oxygen demand wate process solution - no toxic metals, all wa processed through oil and water separator before sent.

Type of disposal facility includes e.g. landfill, lagoon, incinerator,

Conversation with Mr. Gene Shepherd and wife of Shepherd Garbage Service (692-1394) on April 14, 1989.

I informed Mr. Shepherd of my purpose for talking with him:

1) To find out the disposal practices used on the wastes he hauled from the GE facility.
2) To find out other information, both past and present, that would relate to the area or GE.

1) What years did you haul for GE?

Shepherd began hauling when the plant was first built in 1955. During 1955 Shepherd hauled the material to the County Dump (At this time the dump was not in the present location. Mr. Shepherd stated that the County, City of Hendersonville and others disposed of trash at the area that is now the City Park.) After 1955 the volume that Mr. Shepherd was bringing in became too large for the landfill to handle. In 1956 Mr. Shepherd began bringing the material to his property on Roper Road. He continued bringing the material to his property until 1962. In 1962 Mr. Shepherd lost his contract to Sternburg of Asheville. Sternburg hauled the trash from 1962 - 1964, Mr. Shepherd did not know where this material was taken. In 1964 Mr. Shepherd regained his contract and continued to take the material to his property on Roper Road until 1967. In 1967 the Henderson county Health Department stopped Mr. Shepherd from burning the trash on his property. From 1967 through October 1970 Mr. Shepherd transported the GE wastes to some land he leased north of Hendersonville, off of Highway 25. Mr Shepherd stated that this land was owned by Mr. Paynes (Our records show Fains). The area is now a junk yard. Mr. Shepherds records show that the last date of employment of one of his employees devoted to the GE facility was October 1970. Mr. Shepherd did not think that he hauled any material for GE after October 1970.

2) What type of material was brought to the Roper Road site?

Mr. Shepherd stated that it was mostly wood, paper, almost all of the solid waste, pallets and office paper.

3) Did you bring any drums to the Roper Road site?

Mr. Shepherd stated that he had, but not very often. When he would recieve a drum (or other valuable items such as good paint, wood, and metal, some of the GE employees knew about it and would come and get them before they were burned.) The GE employees would take the materials and dump the drums out and take them also.

4) Do you remember what was in the drums?

Mr. Shepherd stated that it was mostly buffing compound, the material was like grit and dirt. Also he would get some drums that contained " water that they used to clean parts in".

5) Could you describe this water?

It was a brown soapy water, Mr. Shepherd did not think it had an odor.

6) Did you have any other customers' trash hauled here?

No, I served some residents but that trash went elsewhere.

7) Did you haul for any dry cleaners, mechanic/machine shops, auto body shops or other industries?

No, the only trash I brought here was GE's. Because it was a short distance, large volume and burnt well.

8) Have you sold any land that had material disposed on it?

No, I sold that area behind me for a trailer park eight years ago. But I never used it for dumping.

9) What areas/people are on city water?

The water main runs north on Roper to the trailer park road. The trailer park is on city water. Mr. Shepherd has been on city water for the last six months. Another water main runs south on Roper Road to about the creek. The Hills and thier other two houses are not on city water(the Raglands and Maybins).

10) Do you have any records of what was disposed of here?

No.

11) Do you have any other records?

Some but not many. (For example the contract ending date was given as the last date of employment of one of his employees.)

12) Has the State or County contacted you?

No, a woman called that rents one of the Hill's houses and talked about her water. (Raglands)

1955 -1970 DISPOSAL HISTORY

YEAR	TRANSPORTER	DISPOSAL LOCATION, ETC.
1955	SHEPHERD	HENDERSON COUNTY LANDFILL, WHICH AT THIS TIME WAS IN THE AREA OF THE CITY PARK.
1956 TO 1962	SHEPHERD	SHEPHERD PROPERTY ON ROPER ROAD.
1962 TO 1965	STERNBURG	DISPOSAL LOCATION IS UNKNOWN, STERNBURG WAS FROM ASHEVILLE.
1965 THRU 1967	SHEPHERD	SHEPHERD PROPERTY ON ROPER ROAD.
1968 THRU 1970	SHEPHERD	FAINS DUMP, A LOT THAT MR. SHEPHERD LEASED NORTH OF HENDERSONVILLE OFF HIGHWAY 25.

PER MR. SHEPHERD, OCTOBER, 1970 WAS THE LAST DATE OF BUSINESS WITH GE.

20 December 1988

TO: File

FROM: Grover Nicholson

RE: Trip Report
Gene Shepherd Farm

On 30 November 1988, Stan Atwood and Grover Nicholson of the NC Superfund Branch conducted a site visit to the farm of Eugene Shepherd, Box 255, East Flat Rock, NC, 28726. Mr. Shepherd was contacted by telephone on 17 November 1988 and again on 28 November 1988 and in both instances he granted permission for the Branch personnel to enter onto and sample his property.

Atwood and Nicholson arrived on the site at about 1100 hours and met Mr. Shepherd. Shortly afterward, Keith Masters of the Hazardous Waste Branch arrived. Atwood, Nicholson, Masters, and Shepherd discussed past waste handling and disposal practices. Mr. Shepherd then led the others on a walking tour of the property and pointed out areas where waste was burned and piled.

During and after the walkover, Atwood and Nicholson monitored the proposed sampling areas with an HNu. Samples of drum contents, soil, water, sediment, and groundwater were taken at the following locations.

Sample No.	Sample Type	Property Owner
1	Sludge contents of drum	Gene Shepherd
2	Background Soil	"
3	Composite Surface Soil in old burn area	" "
4	Groundwater	Lanny Maybin home
5	Composite Surface Soil in old disposal area	Spring Haven Inc. John Harris, Mgr.

6	Creek water downslope of old disposal area	Spring Haven Inc. John Harris, Mgr.
7	Creek sediment downslope of old disposal area	"
8	Groundwater	Sheldon Hill home

Samples were taken and preserved using established sampling and sample preservation techniques. The site safety plan was followed during the visit. Photographs were taken during sampling. The team departed the site at about 1530 hours and returned to Raleigh. On 1 December 1988, the samples were taken to the State Laboratory for Public Health for organic and inorganic analyses.

GN/pb/36 doc.

Date: 23 February 1989

To: Lee Crosby

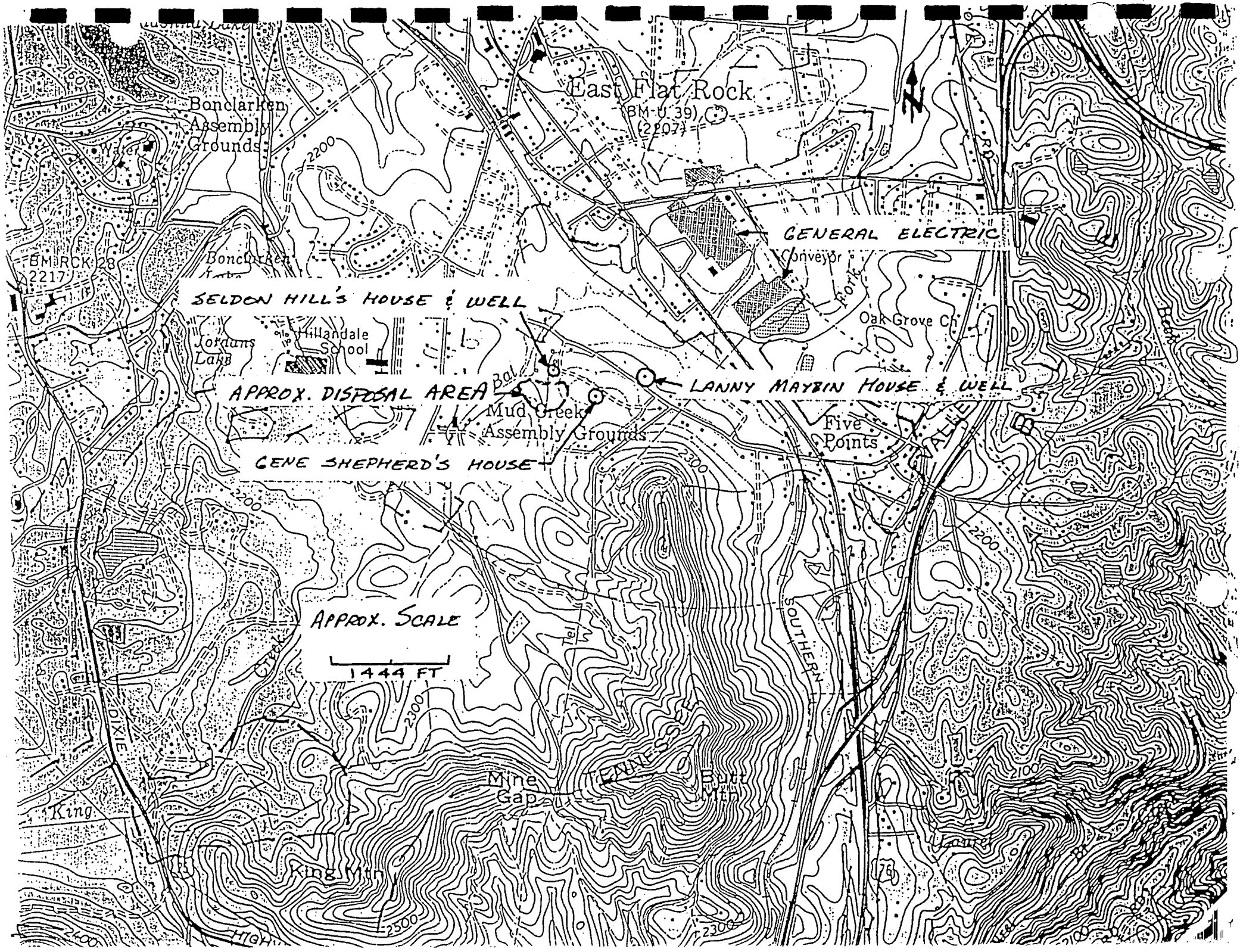
From: Grover Nicholson

Re: Contamination of private drinking water wells
Shepherd Farm, East Flat Rock, Henderson Co., NC.

On 30 November 1988 samples were taken of soil, drum contents, creek sediment, creek water, and well water from on and around the Shepherd Farm property. This site was reportedly used as a disposal and burning area for wastes from the General Electric plant in East Flat Rock. In fact, Mr. Gene Shepherd, the land owner, hauled wastes from the GE plant from about 1955 until about 1970. During the sampling, drums of a hardened substance and electrical-type wastes (insulators, etc.) were observed.

Sample analyses returned on 22 February 1989 showed no inorganic contamination, some PCB contamination in the drum contents, soils and creek sediment, and organic chemical contamination in the creek water and water from two nearby wells. In particular, the Maybin well is contaminated with 5 ug/l tetrachloroethene and the Hill well is contaminated with 193 ug/l tetrachloroethene and a trace of trichloroethylene.

I am attaching a summary of the sample analyses results and copies of the sample analyses for the two wells. I request a health risk assessment of the contamination so that the health department may be properly notified.


East Flat Rock
(BM-U 39)
(2207)
Bonclarken
Assembly
Grounds
Water
2200
BM RCK 28
2217
Bonclarken
GENERAL ELECTRIC
Conveyor
Fork
Oak Grove Ch
SELDON HILL'S HOUSE & WELL
Jordans
Lake
Hillandale
School
APPROX. DISPOSAL AREA
Bat
Mud Creek
Assembly Grounds
LANNY MAYBIN HOUSE & WELL
Five
Points
GENE SHEPHERD'S HOUSE
2300
2200
APPROX. SCALE
1444 FT
Creek
DIXIE
SOUTHERN
Mine
Gap
Butt
Mtn
King
King Mtn
2300
2400

SAMPLE ANALYSES RESULTS
SHEPHERD FARM

Sample #1 Contents of drum	No inorganic contamination, 0.43ppm PCB #1260. No ext. organics. Trace 1,1,1-trichloroethane, 32 ug/kg toluene
Sample #2 Background soil	No inorganic contamination. No PCB. No ext. organics. Trace of toluene.
Sample #3 Burn area Surface Soil composite	No inorganic contamination. 86.5 ppm PCB #1016. No ext. organics. No purgeable organics.
Sample #4 Maybin Well	No inorganic contamination. No PCB. 5 ug/l tetrachloroethene. No ext. organics.
Sample #5 Disposal area Surface soil	No inorganic contamination 13.9 ppm PCB #1254 and #1016. NO ext. organics. No purgeable organics.
Sample #6 Creek water Downslope	No inorganic contamination. No PCB. No ext. organics. Trace of 1,2-dichloroehtane Trace of 1,1,1-tricloroehtane, 6 ug/l toluene.
Sample #7 Creek sediment Downslope	No inorganic contamination. 0.63 ppm PCB #1254 and #1016 No ext. or purgeable organics.
Sample #8 Hill well	No inorganic contamination. No PCB. No ext. organics. Trace of trichloroethylene. 193 ug/l tetrachloroethene.

DATE: 10 April 1989

TO: File

FROM: Grover Nicholson

RE: Shepherd Farm Property
Private Well

On 6 March 1989 the Henderson County Health Department sampled a private well near the site. On 5 April 1989 the lab reported that the sampled showed 237.4 ug/l tetrachlorothene present.

On 7 April 1989 I contacted Dr. Ted Taylor by telephone and asked for his assessment. He said that the residents should not drink the water and asked that I pass this word on to the health department. I immediately called Thomas Johnson, Henderson County Health Director, and reported the contamination and Dr. Taylor's telephonic assessment to him.

On 10 April 1989 I wrote a memo from Lee to Dr. Freeman requesting a formal assessment of the water.

7 February 1992

TO: File

FROM: Jack Butler JBB

SUBJECT: G.E. Shepards Farm

Ms. Diane Barrett, EPA Region IV (404/347-7791), contacted our office on this date to inform us that the subject site was proposed as a NPL site in update 12 on this date. Ms. Barrett added that Ms. Denise Blayfield, Hendersonville Times-News had contacted EPA concerning a story she is doing on this site.

JB/dk/1

December 1, 1988

TO: File

FROM: David Lilley DBC

RE: Telephone conversation with Mr. Lee Humphrey, Environmental Specialist, General Electric, Hendersonville, North Carolina

On November 28, 1988, I contacted Mr. Lee Humphrey at General Electric's Hendersonville plant (telephone 904-693-2000) regarding GE's waste disposal at Gene Shepherd's Farm. According to Mr. Shepherd, cardboard, wood, office paper, and a buffing compound used to buff aluminum lamp shades was burned and buried on his farm. Mr. Humphrey located the Material Safety Data Sheet on the buffing compound; it read "no hazardous ingredients". When asked about the possibility of PCB containing oil being hauled to Gene Shepherd's farm, he said this was very unlikely, all PCB oil arrived at GE in railroad tank cars and was stored in on-site tanks after use. Mr. Humphrey said that waste solvents were probably what Mr. Shepherd hauled to his farm. Trichloroethylene and perchloroethylene were possible, along with any other solvent commonly used during that time period.

DL/ds/ibm.2

17 November 1988

TO: File

FROM: Grover Nicholson Grover Nicholson

RE: Potential CERCLIS site in Hendersonville, NC
Henderson County

Today I contacted Gene Shepherd by telephone. He gave me the following information about his garbage collection activities.

From 1955 until about 1970, Mr. Shepherd hauled wood, cardboard, office paper, and buffing compound residue from the GE plant in East Flat Rock to his farm about 1/2 mile away. Mr. Shepherd estimates that during those years he hauled off about 50 cubic yards of cardboard per day, about two truckloads of wood per week, and about two barrels of buffing compound residue per week. The buffing compound was used to machine buff aluminum light shades and was flammable. Shepherd took the waste to his farm, put it on a dry pond bed, poured the buffing compound residue on it, and set it afire. He did not haul off any oils or other petroleum products from GE.

In about 1976, Mr. Shepherd built a trailer park on part of the property and sold that park in about 1980. He helped me locate his farm on the topographic map. The farm is located on Roper Road in East Flat Rock, but his mailing address is Box 255, East Flat Rock, NC, 28726. To reach the farm, turn west onto Roper Road from US 176. Turn left off Roper Road at the Spring Haven Trailer Park sign. His house is located on the first driveway to the right.

GCN/pb/3

NPL-FRU12-6-1

Ref. 12

United States Environmental Protection Agency | Office of Solid Waste and Emergency Response | Publication 9320.7-041 May 1994

EPA

Background Information: National Priorities List, Final Rule

Office of Emergency and Remedial Response
Hazardous Site Evaluation Division (5204G)

Intermittent Bulletin
Volume 4, Number 1

The U.S. Environmental Protection Agency (EPA) is adding 42 sites to the National Priorities List (NPL) in a rule published in the *Federal Register* in May 1994. Of the 42 sites in Final Rule #12, 18 are in the General Superfund Section and 24 in the Federal Facilities Section. The sites are in 22 States. Washington is adding seven sites; Massachusetts is adding six sites; Florida and Maryland are adding three sites; Alaska, California, Kentucky, Pennsylvania, and Virginia are adding two sites; and a number of States are adding one site.

The status of the NPL is as follows:

	General	Federal	Total
Proposed	48	6	54
Final	1,082	150	1,232
Final Rule #12	(18)	(24)	
Previous Final	(1,064)	(126)	
Proposed Plus Final			1,286

EPA is not the lead agency at Federal facility sites, and its role at such sites is accordingly less extensive than at sites in the General Superfund Section. Under Executive Order 12580 and CERCLA Section 120, each Federal agency is responsible for carrying out most response actions at facilities under its own jurisdiction, custody, or control, although EPA is responsible for scoring Federal facility sites.

The NPL identifies uncontrolled hazardous waste sites that warrant further investigation to determine if long-term "remedial action" is necessary. The sites in the General Superfund Section of the NPL are eligible for remedial action funded under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), enacted on December 11, 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA), enacted on October 17, 1986. SARA authorized a "Hazardous Substances Superfund" totalling $8.5 billion over 5 years to pay costs for overseeing work by those responsible for cleaning up waste sites, and to pay costs not assumed by responsible parties for cleanup at sites in the General Superfund Section of the NPL. In October 1990, SARA was extended to September 30, 1994 to provide an additional $5.1 billion.

EPA's goals for the Superfund program are to:

- Address the worst sites and the worst problems first
- Make sites safe by immediately controlling acute threats to people and the environment
- Develop and use new technologies for more effective cleanups

EPA continually seeks ways to evaluate and clean up sites more quickly. The new "Superfund Accelerated Cleanup Model" (SACM) involves several pilot projects aimed at streamlining the Superfund process. EPA will describe any changes to the process resulting from SACM as they are identified.

National Priorities List
Final and Proposed Sites (by State)
May 1994

St	Site Name	Location	Date Proposed[a]	Date Final	Notes[b]
	Idaho Pole Co.	Bozeman	10/84	06/86	
	Libby Ground Water Contamination	Libby	12/82	09/83	
	Milltown Reservoir Sediments	Milltown	12/82	09/83	
	Montana Pole and Treating	Butte	06/86	07/87	
	Mouat Industries	Columbus	10/84	06/86	
	Silver Bow Creek/Butte Area	Sil Bow/Deer Lodge	12/82	09/83	
	8 General Superfund Sites + 0 Federal Facility Sites = 8				
NC	General Superfund Sites				
	ABC One Hour Cleaners	Jacksonville	06/88	03/89	
	Aberdeen Pesticide Dumps	Aberdeen	01/87	03/89	
	Benfield Industries, Inc.	Hazelwood	06/88	10/89	
	Bypass 601 Ground Water Contamination	Concord	10/84	06/86	
	Cape Fear Wood Preserving	Fayetteville	06/86	07/87	
	Carolina Transformer Co.	Fayetteville	01/87	07/87	
	Celanese Corp. (Shelby Fiber Operations)	Shelby	10/84	06/86	
	Charles Macon Lagoon & Drum Storage	Cordova	01/87	07/87	
	Chemtronics, Inc.	Swannanoa	12/82	09/83	
	FCX, Inc. (Statesville Plant)	Statesville	06/88	02/90	
	FCX, Inc. (Washington Plant)	Washington	06/88	03/89	
	Geigy Chemical Corp. (Aberdeen Plant)	Aberdeen	06/88	10/89	
	General Electric Co/Shepherd Farm	East Flat Rock	02/92		
	JFD Electronics/Channel Master	Oxford	06/88	10/89	
	Jadco-Hughes Facility	Belmont	10/84	06/86	
	Koppers Co. Inc. (Morrisville Plant)	Morrisville	06/88	03/89	
	Martin-Marietta, Sodyeco, Inc.	Charlotte	12/82	09/83	
	NC State University(Lot 86,Farm Unit #1)	Raleigh	10/84	06/86	
	National Starch & Chemical Corp.	Salisbury	04/85	10/89	
	New Hanover Cnty Airport Burn Pit	Wilmington	06/88	03/89	
	Potter's Septic Tank Service Pits	Maco	06/88	03/89	
	Federal Facility Sites				
	Camp Lejeune Military Reservation	Onslow County	06/88	10/89	F
	21 General Superfund Sites + 1 Federal Facility Sites = 22				
ND	General Superfund Sites				
	Arsenic Trioxide Site	Southeastern ND	10/81	09/83	S
	Minot Landfill	Minot	06/88	03/89	
	2 General Superfund Sites + 0 Federal Facility Sites = 2				
NE	General Superfund Sites				
	10th Street Site	Columbus	10/89	08/90	
	American Shizuki/Ogallala Electronics Co	Ogallala	10/92		
	Bruno Co-op Association/Associated Prop	Bruno	10/92		
	Cleburn Street Well	Grand Island	07/91	10/92	
	Hastings Ground Water Contamination	Hastings	10/84	06/86	
	Lindsay Manufacturing Co.	Lindsay	10/84	10/89	
	Nebraska Ordnance Plant (Former)	Mead	10/89	08/90	
	Sherwood Medical Co.	Norfolk	07/91	10/92	
	Waverly Ground Water Contamination	Waverly	10/84	06/86	
	Federal Facility Sites				
	Cornhusker Army Ammunition Plant	Hall County	10/84	07/87	F
	9 General Superfund Sites + 1 Federal Facility Sites = 10				
NH	General Superfund Sites				
	Auburn Road Landfill	Londonderry	12/82	09/83	
	Coakley Landfill	North Hampton	10/84	06/86	
	Dover Municipal Landfill	Dover	12/82	09/83	
	Fletcher's Paint Works & Storage	Milford	06/88	03/89	
	Kearsarge Metallurgical Corp.	Conway	09/83	09/84	

Preliminary Assessment
Spann Property
Hendersonville, Henderson County
NCD 986 180 917

State of North Carolina
Department of Environment, Health, and Natural Resources
Division of Solid Waste Management
P.O. Box 27687 · Raleigh, North Carolina 27611-7687

James G. Martin, Governor
William W. Cobey, Jr., Secretary

William L. Meyer
Director

August 17, 1992

Mr. Craig Benedikt
NC CERCLA Project Officer
EPA Region IV Waste Division
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Subject: Preliminary Assessment
Spann Property
Hendersonville, Henderson, NC
NCD 986 180 917

Dear Mr. Benedikt:

This letter contains findings of the Preliminary Assessment of the Spann Property site on US 25 North of Hendersonville in Henderson County, North Carolina.

INTRODUCTION

Under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), the North Carolina Superfund Section conducted a Preliminary Assessment (PA). The purpose of this investigation was to collect information concerning conditions at the Spann Property site sufficient to assess the threat posed to human health and the environment and to determine the need for additional CERCLA/SARA or other appropriate action. The scope of the investigation included review of available file information, a comprehensive target survey and a site reconnaissance (February 20, 1991).

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: June 30, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Aerial Photograph Interpretation

On 2/17/94, SFP visited the NC Department of Transportation, Photogrammetric Unit Office in Raleigh, to review available aerial photographs of the site. On 4/5/94, SFP also visited the Henderson County Soil Conservation Service and the County Tax Assessor's Office in Hendersonville, but did not find any additional photographs that clearly revealed surface conditions at the site. SFP reviewed DOT photos dating from 1960 to 1994 and obtained enlargements of photos dating from 2/17/77, 4/28/87, and 1/23/91.

A photo dated 3/27/60 indicates that the site was being used for agriculture at that time. Houses were visible on the property, as well as plowed farm fields. The remainder (40 percent) of the site was covered by forest.

In 1977, the site was still vegetated and the houses were still present, however, the fields were gone, and a single, straight, cul de sac with a loop at the end ran west-east along the top of the knoll, parallel to the south edge of the site. By this time, the site was ostensibly being used as a scrapyard (See also Ref. 7)

By 1991 the scrapyard and its dirt roads had expanded approximately 40 percent, having spread (to their present extent) into the lower-lying areas to the north and east of the knoll. SFP was unable to identify Eugene Shepherd's burning and disposal areas during examination of these or any other photos.

LOGBOOK REQUIREMENTS
REVISED - NOVEMBER 28, 1988

NOTE: ALL LANGUAGE SHOULD BE FACTUAL AND OBJECTIVE

1. Record on front cover of the Logbook: TDD No., Site Name, Site Location, Project Manager.
2. All entries are made using ink. Draw a single line through errors. Initial and date corrections.
3. Statement of Work Plan, Study Plan, and Safety Plan discussion and distribution to field team with team members' signatures.
4. Record weather conditions and general site information.
5. Sign and date each page. Project Manager is to review and sign off on each logbook daily.
6. Document all calibration and pre-operational checks of equipment. Provide serial numbers of equipment used onsite.
7. Provide reference to Sampling Field Sheets for detailed sampling information.
8. Describe sampling locations in detail and document all changes from project planning documents.
9. Provide a site sketch with sample locations and photo locations.
10. Maintain photo log by completing the stamped information at the end of the logbook.
11. If no site representative is on hand to accept the receipt for samples, an entry to that effect must be placed in the logbook.
12. Record I.D. numbers of COC and receipt for sample forms used. Also record numbers of destroyed documents.
13. Complete SMO information in the space provided.

This logbook is an extension of logbook #42266. Entries will be made in this logbook by Robert Brock. Robert Brock

5/18/90 Robert Brock

Arrived at the Shepherd Farm site at 8:00 am to photograph sampling locations & take photos.

SS-12 + SB12 is located 90 ft off the southern point of the Shepherd House at 30° S.W.

BB 5/18/90

SS-10 + SB10 is located on the x coordinate of 9 and the y coordinate of 4 (see geophysics map)

SS-09 + SB09 is located on x coordinate of 3 and the y coordinate of 7 (see geophysics map) dead tree area

SS-08 + SB08 is located on x coordinate of 7 and the y coordinate of 5.5 (see geophysics map) dead tree area

5/18/90 Beluth Buck

SS 11 + SB11 are located up gradient of dead tree area,

SS 07 + SB07 are located BB 5/18/90 down gradient of the dead tree area near the stream.

SS 13 + SB 13 are location x coordinate 5 and y coordinate is 3 (see geophysics map)

The site is located behind the Shepherd residence and the Hill residence and toward the Spring Haven trailer park. Some of the disposal areas may be in the trailer park. The site is easily accessible, there are no fences and no collection systems, no fence + drum, toward intermittent creek + Bat Fork Creek.

5/18/90 Beluth Buck

4

10:45 am
Spoke with Joyce the Spring Haven Trailer Park manager. There are approximately 85 trailers in the park, 70 are occupied.

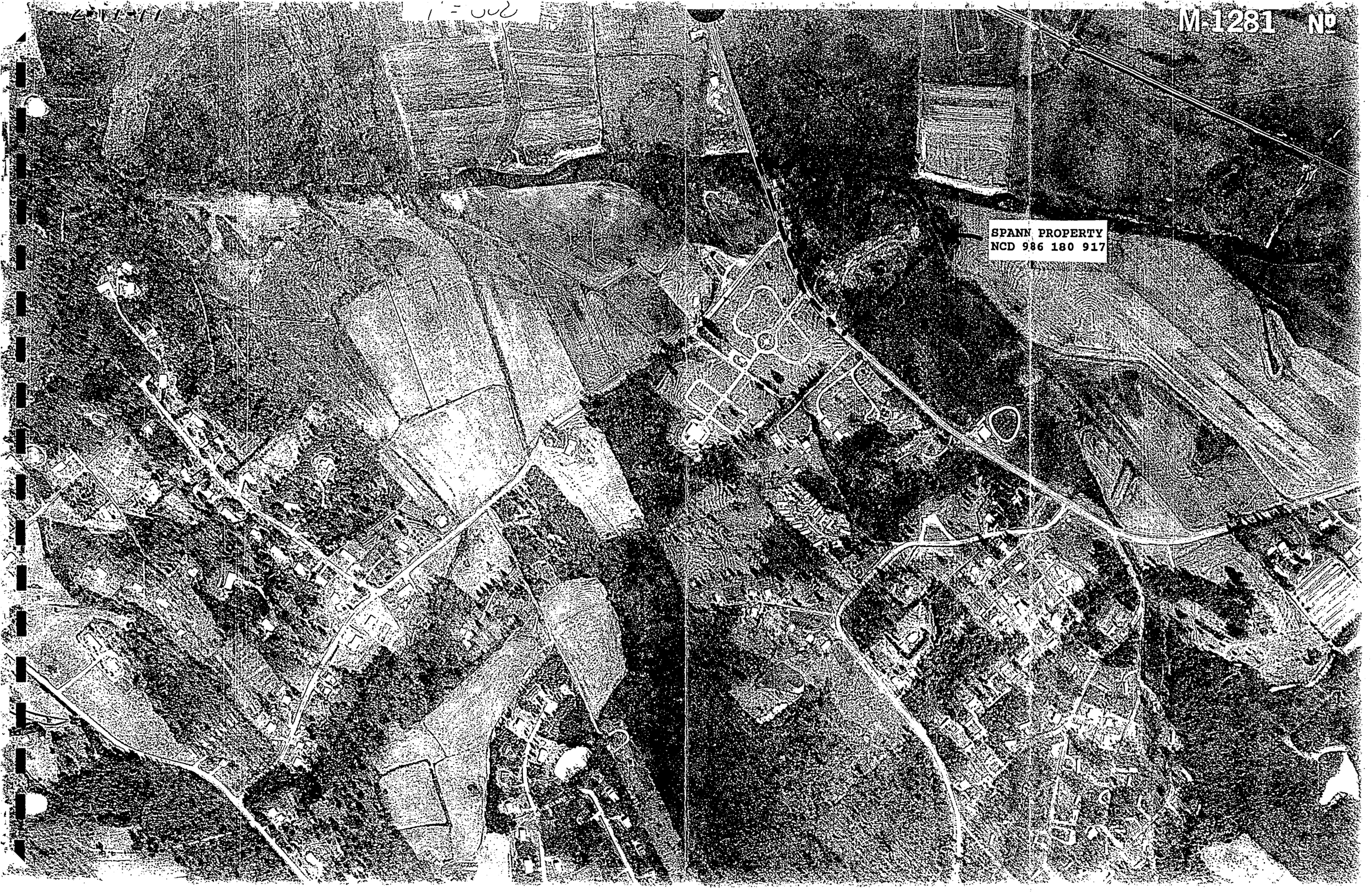
In the disposal areas behind the Shepherd house some areas appear to be an open dump with drums exposed. Some transformer parts were visible. The majority of the area is heavily wooded except for the trailer park area and an area behind the Hill residence that has dead trees and no vegetation.

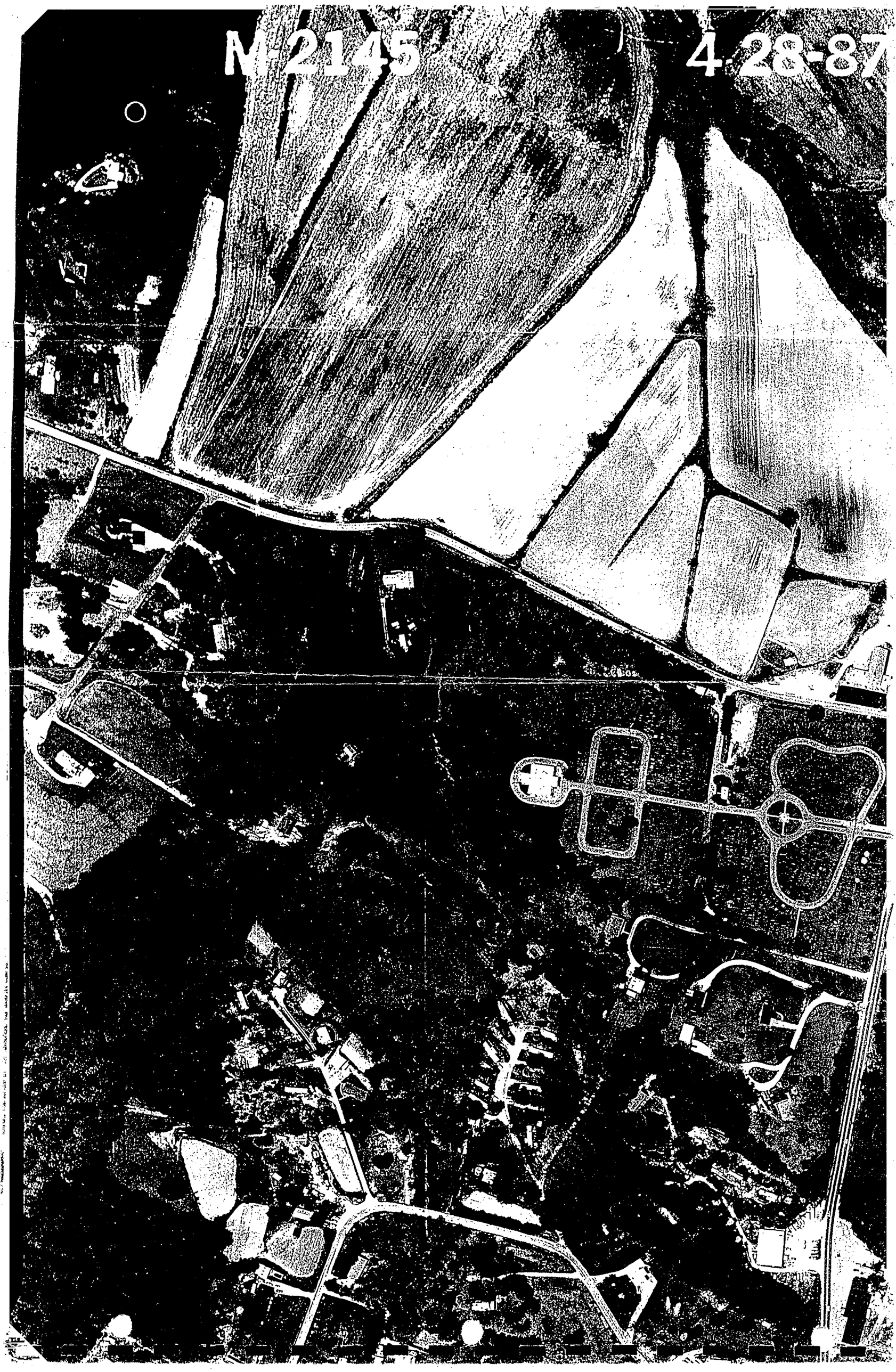
5/18/90 Belinda Brooks

3:15 pm
Went to Saluda City Hall to get water information. Met with Doris Marion. Water lines are mainly within the city limits, some go out Fox Rd, Thompson Rd, & Substation Rd. About 20 homes are serviced outside the city limits. They get their water from the city of Hendersonville. Left at 3:30 pm.

5/18/90 Belinda Brooks

M-1281 №




M-2145
4-28-87

4-28-87
N
SPANN PROPERTY
NCD 986 180 917
1" = 250'

1" = 125
1-23-91
NC-DOT DIV HWYS PHIGM UNIT
SPANN PROPERTY
NCD 986 180 917
N

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 22, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Telecommunication with Eugene Shepherd, Former GE Waste Transporter

SFP telephoned Eugene Shepherd of Flat Rock, NC (704-693-0559) on 5/22/94 to confirm information reported in the PA (but not documented by signed memoranda) regarding past GE waste disposal at the Spann Property.

Shepherd confirmed that the waste that was regularly hauled to the site consisted of about 95 percent cardboard, and additionally contained wooden pallets, a waste buffing compound, paint, and possibly solvents. In addition, he broke open small electrical parts to salvage copper. He did not recall whether any oils or other materials were released from the components.

Shepherd could not specify the locations of burning or burial, except to say that material was pushed into the swamps from the knoll. When asked in which direction relative to the entrance, he said he couldn't recall. According to Shepherd, the burning of waste materials at the property was eventually banned by Henderson County.

DATE: July 10, 1991

SUBJECT: Trip Report
Shepherd's Farm Site, Flat Rock, North Carolina

FROM: Deborah A. Vaughn-Wright
Project Manager

TO: Site File

On July 9, 1991, Katherine Yost, Region IV Civil Investigator, and I traveled to Flat Rock, North Carolina to interview the owner/operator of the Shepherd Farm Site, Mr. Eugene Shepherd. The interview was conducted to determine what types of wastes were disposed at the Shepherd Farms Site and generators of that waste.

Mr. and Mrs. Shepherd participated in the interview and completed a brief questionnaire that I provided. In summary, Mr. Shepherd was in the trash hauling business from the early 1940's until 1990. He is currently unemployed. He hauled waste generated by General Electric, East Flat Rock, North Carolina, off and on between 1957 and 1970. General Electric was the only industrial waste they hauled. I questioned if they hauled from any type of industry such as dry cleaners, furniture manufacturers, carpet manufactures, metal plating, essentially any industry or manufacturer he could think of. His reply was GE was the only industrial waste hauled.

For waste generated at GE Mr. Shepherd used a 26 - 28 cubic yard truck that remained on GE property. He generally took 2 - 3 truck loads per day to either his or John Span's property. On special occasions, ie. when GE was expecting corporate representatives, he would haul as many as 5 truck loads. I neglected to ask what kind of truck he used for the other garbage/trash hauled.

He repeated several times that all other waste he hauled was taken to the County Dump or a dump owned by Bob McCombs. The county dump apparently refused to accept GE waste because of the volume generated. Some household garbage did go to the Shepherd Farm site, but not on a routine basis.

The questionnaire was completed by both Mr. and Mrs. Shepherd. It was signed and witnessed in front of a Notary Public that same day.

Attachment

DV-W:m:7/12/91x5065 Disk: V-Wright #4 Doc: shepherd.mem

VAUGHN-WRIGHT DEIHL
7/12

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

Date: July 9, 1991

Name: Sam Shepherd

Address: Box 255 East Flat Rock, NC 28726

Telephone Number: 693-0559

Occupation: none

EPA Interviewers: Katherine A. Yost Civil Investigator
Deborah A. Vaughn-Wright, Project Manager

Question: For what years did you haul waste?

Answer: Hauled ~~res~~ household garbage from 1970 till 1990. Hauled S.E. waste starting in 1957 off and on til 03.1970

Reference #6

Printed on Recycled P.

Question: Whose waste did you haul?

Answer: No industrial waste hauled other than General Electric Co.

Question: Where did you haul waste? If possible, list firm and location waste was deposited.

Answer: Household waste hauled to Bob McCombs dump, ~~John Span dump~~ and Caldwell dump. General Electric waste hauled to Shepherd Farm and John Span's on Asheville Hwy.

Question: For what years did you haul waste to your property located off Tabor Road, known as the Shepherd Farm Site?

Answer: Off and on from 1957 to 1970.

Question: Whose waste was taken to the Shepherd Farm Site? (both industrial, municipal and/or private)

Answer: ~~Nothing~~ No industrial waste other than General Electric waste was hauled to Shepherd Farm Site.

Questions: What types of waste were taken to the Shepherd Farm Site? (garbage, paper, construction debris, drums, etc)

Answer: Wood, drums, electrical parts, metal, buffing compound, paper

Question: Did you have any State/County/City Permits to haul waste? To operate a dump/landfill?

Answer: No state but had county permit #8.

Signature: Ruth Shepherd 7-9-91

Signature: Ann Shepherd 7-9-91

Witnesses: Katherine A. Yost 7-9-91

Debra A. Vaught-Wright 7-9-91

Witness my hand and official Seal this 9 day of July 1991

John L. Capps Jr

Notary Public

Hendersonville N.C.

My Comm Exp Dec. 27 1996

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

Ref. 17

JUL 18 1990

4WD-WPB

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Eugene Shepherd
P.O. Box 255
East Flat Rock, North Carolina 28726

RE: Shepherd Farm Site
Roper Road
East Flat Rock, North Carolina
NCD986170686

Dear Mr. Shepherd:

The United States Environmental Protection Agency (EPA) is investigating the disposal of hazardous substances at the Shepherd Farm Site, located on Roper Road, East Flat Rock, North Carolina (hereinafter, referred to as "the Site"). This investigation is being undertaken pursuant to the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Public Law 99-499 and pursuant to the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6921, et seq., as amended. Hazardous substances are those defined by CERCLA Section 101(14).

To assist in defining the nature and extent of contamination at your facility, EPA is seeking to obtain certain information from you concerning your waste disposal practices. EPA's authority to seek such information is set forth under Section 104(e) of CERCLA, 42 U.S.C. 9604 as amended, and Section 3007 of 42 U.S.C. 6927, as amended. Specifically, these provisions provide the agency with the authority to require any person who generates, stores, treats, transports, disposes of, or otherwise handles or has handled hazardous wastes and substances to furnish information related to such wastes and substances. Pursuant to these statutory provisions, you are hereby required to answer the following requests and to provide copies of all documents used to answer the requests, or affirm in an affidavit the veracity of the information where it is impractical to provide copies of the documents.

YELLOW

1. Identify the person(s) answering these Questions on behalf of Respondent.

2. For each and every Question below, identify all persons consulted in the preparation of the answer.

3. For each and every Question below, identify all documents consulted, examined, or referred to in the preparation of the answer and provide true and accurate copies of all such documents.

4. List the EPA Identification Numbers of the Respondent.

5. Identify all property comprising the Site by boundaries such as roads, streams, etc.

6. Identify the type(s) of activity for which areas of the Site were used.

7. If you have reason to believe that there may be persons able to provide a more detailed or complete response to any Question contained herein or who may be able to provide additional responsive documents, identify such persons and the additional information or documents that they may have.

8. Identify the acts or ommisions of any persons, other than your employees, contractors, or agents, that may have caused the release or threat of release of hazardous substances at the Site and damages relating therefrom and identify such persons.

9. Identify all persons, including Respondent's employess, who have knowledge or information about the generation, transportation, treatment, disposal or other handling of hazardous substances at the Site.

10. State the dates during which you owned, operated or leased any portion of the Site.

11. Provide information about the physical characteristics of the Site including but not limited to the following:

    a. Surface structures (e.g., buildings, tanks, etc.).

    b. Ground water wells, including drilling logs.

    c. Past and present storm water drainage system, sanitary sewer system, including septic tank(s), subsurface disposal field(s) and trench(es).

d. Any and all additions, demolitions or changes of any kind to physical structures on, under or about the Site, or to the property itself (e.g., excavation work) and state the dates on which such changes occured.

12. Provide all technical and/or analytical information and manifests concerning any removal activities at the site including waste quantity removed, remaining waste quantity, types of wastes removed and remaining, location of wastes and containers found.

13. Did you ever use, purchase, generate, store, treat, dispose, transport or otherwise handle any hazardous substances at the Site? If the answer to the preceding question is anything but an unqualified "no," identify:

    a. The chemical composition, characteristics, physical state (e.g., solid, liquid) of each hazardous substance.

    b. The persons who supplied you with each such hazardous substance disposed or otherwise handled by you.

    c. How such hazardous substances were used, purchased, genetated, stored, treated, transported, disposed or otherwise handled by you.

    d. Where such hazardous substances were used, purchased, generated, stored, treated, transported, disposed or otherwise handled by you.

    e. The quantity of such hazardous substances used, purchased, generated, stored, treated, transported, dispose or otherwise handled by you.

14. Identify all leaks, spills or releases of any kind into the environment of any hazardous substances that have occurred at the Site (including but not limited to the area that is presently the recreational field at the site. In addition, identify:

    a. When such releases occurred.

    b. How the releases occurred.

    c. What hazardous substances were released.

    d. What amount of each hazardous substance was so released.

    e. Where such releases occurred.

f. Any and all activities undertaken in response to each such release or to threatened releases of hazardous substances at the Site.

g. Any and all investigations of the circumstances, nature, extent or location of each release or threatened release including, the results of any soil, water (ground and surface) or air testing that was undertaken.

h. All persons with information relating to these releases.

15. Identify all your hazardous substance disposal locations other that at the Site [including but not limited to; General Electric Company Lighting Systems Department, Seldon Clark Property (Tabor Road and U.S. Highway 176), Western North Carolina Fairgrounds, and Grandview Memorial Gardens]. In addition, identify:

a. Where such disposal occurred.

b. When such disposal occurred.

c. What hazardous substances were so disposed.

d. How hazardous substances were so disposed.

e. What amount of each hazardous substance was disposed.

f. Any and all activities undertaken in response to release or threatended releases of hazardous substances as a result of this disposal.

g. Any and all investigations of the circumstances, nature, extent of each releases or threatened releases including, the result of any soil, water (ground and surface) or air testing that was undertaken.

h. All persons with information relating to these disposals.

In answering any of the above questions, if information is obtained through employee interviews, indicate this in your letter and provide names, addresses, and telephone numbers of the employees interviewed. Site locations should be designated on a map.

Your answers to these questions must be sent to Mr. Robert Morris at the address provided below within fifteen (15) calendar days of your receipt of this letter.

Failure to comply with this request may result in enforcement against you by EPA pursuant to Section 104 of CERCLA, 42 U.S.C. 9604, and Section 3008 of RCRA, 42 U.S.C. 6928. You should note that each of these statutes permit EPA to seek imposition of penalties of up to twenty-five thousand dollars ($25,000.00) for each day of continued non-compliance.

Please be further advised that provision of false, fictitious, or fraudulent statements or representations may subject you to criminal penalties under 18 U.S.C. 1001.

Pursuant to Part 2, Subpart B of Title 40 of the Code of Federal Regulations, 40 C.F.R. Part 2, Subpart B, you may assert a confidential business information claim for all or part of the information provided in response to this Information Request. To assert a claim of business confidentiality, you must follow the requirements of 40 C.F.R. 2.203(b) and identify all information by paragraph and line which you believe to be confidential by describing such information on a cover page or by marking the face of the document which contains the information as "trade secrets", proprietary, business confidential, etc. Information for which such a claim is asserted will be disclosed only to the extent and by means of the procedures specified in 40 C.F.R. Part 2, Subpart B. EPA will construe the failure to furnish a confidentiality claim with your response to this letter as a waiver of that claim, and the Agency may make the information available to the public without further notice.

Because of the seriousness of this matter and the attendant legal ramifications, EPA encourages you to submit a written response within the time frame specified herein. We hope that you will give these matters your immediate attention. Your response should be sent to:

Mr. Robert Morris
Waste Program Branch
U.S. Environmental Protection Agency
Region IV
345 Courtland St., N.E.
Atlanta, GA 30365

If you have any legal questions, please direct such question to Ms. V. Anne Heard of the Office of Regional Counsel at:

345 Courtland Street N.E.
Atlanta, Georgia 30365
(404) 347-2641

If you have any technical questions, please direct such questions to Robert Morris, at the above address, or at (404) 347-5065.

Sincerely yours,

Patrick M. Tobin, Director
Waste Management Division

RM:sw:Doc Shep104:Disk Morris #3:6/4/90:x5065

4WD-SAS	4WD-SAS	ORC	4WD-SAS	4WD-WPB	4WD
MORRIS	DEIHL	BUSSEY	HANKE	LUCIUS	TOBIN

Reference #2

Mr. Robert Morris
Environmental Protection Agency
Region IV
345 Courtland St., N.E.
Atlanta, Ga. 30365

SISB/SAS
RECEIVED
AUG 02 1990
RECEIVED
EPA - REGION IV
ATLANTA, GA.

Re: Shepherd Farm Site
Roper Rd.
East Flat Rock, NC
NCD 986170686

Dear Mr. Morris:
Enclosed find my answers to the requests in Mr. Tobin's letter dated July 18, 1990.

Sincerely yours,
Eugene Shepherd
PO Box 255
E. Flat Rock, NC
28726

Ph. 704-693-0559

1. The respondent is Eugene Shepherd.
2. No persons were consulted in the preparation of these answers.
4. I have no EPA Identification Numbers that I know of.
3. I have no documents to consult in the preparati of these answers.
5. The Site was surrounded by the rest of my propert My property was joined by Seldon Hill on the north, Butt Mt. on the east and Mine Gap on the south and west.
6. The Site was used to dispose of General Elect Co.'s waste. I lived above the Site. The rest of my property was not used.
7. The EPA and General Electric Co. have am information needed in response to these questions.
8. General Electric Co. should know if their waste caused a threat of release of hazardous substances at the Site.
9. General Electric Co.
10. I moved to this property in 1957. I purchase the property in 1962. I operated the Site off and on until 1970. I started a mobile hom park in 1970, above the Site. I sold the park in 1981.

a. My home is adjacent the Site. I started a trailer park above the Site in 1970 and sold it in 1981.
b. The first stage of the park had a well. The new owners have city water.
c. Driveway drainage and septic tanks.
d. I started a mobile home park above the Site in 1970. I sold the park in 1981 and the new owners continued the development.

12. I have no information on any waste removed or remaining at the Site.

13. a. I do not know the chemical composition of the waste generated at General Electric Co.
b. General Electric Co. supplied the waste I disposed of.
c. The waste from General Electric Co. was hauled on a truck, then dumped, burned and buried.
d. The waste from General Electric was transported to and disposed of at the Site and to John Span's on Highway 25 north.
e. I do not remember the quantity of waste generated by G.E.

14. I know of no releases into the environment from the Site.

15. I disposed of G.E. waste at the Site and at John Span's on 25 north.
a. answered above

b. answered above

c. I don't know if a hazardous substance was disposed of at the Site.

d. The General Electric waste was dumped from a truck, burned and buried.

e. If a hazardous substance was disposed of at the Site General Electric Co. should have this information.

f. Interviews with E.P.A.

G. I have no information on the results of any testing done by the EPA or anyone else.

h. General Electric Co. & the E.P.A.

Nus Corp
field notes
Shepherd Farm

"Rite in the Rain"®

ALL-WEATHER

LEVEL

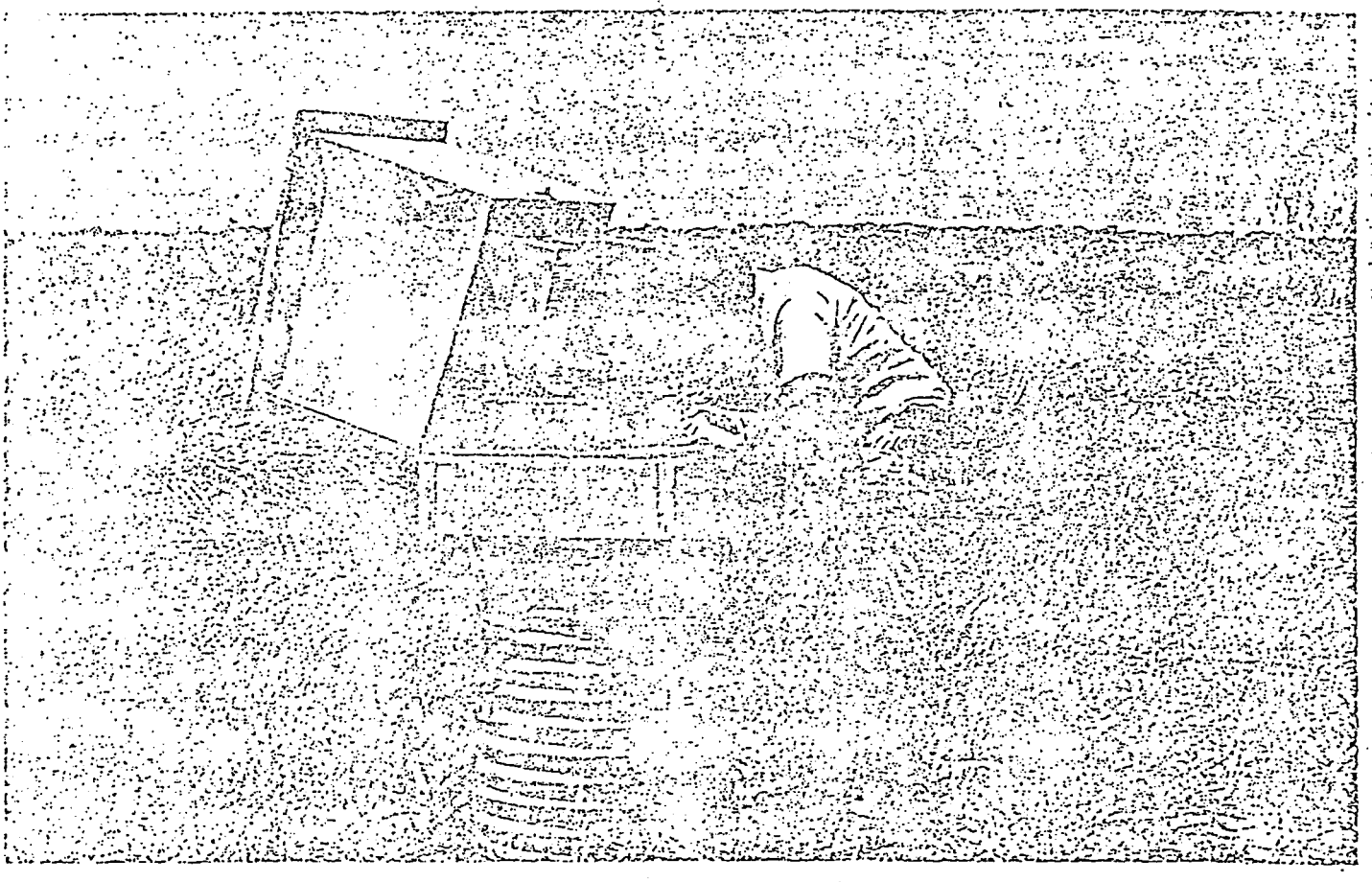
Notebook No. 311

F4-2267

Shepherd Farm
TDD No. F4-9005-37
Flat Rock Henderson Co. NC

Ref. 19

Basic Elements of Ground-Water Hydrology with Reference to Conditions in North Carolina



U.S. GEOLOGICAL SURVEY
WATER RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 80-44

Prepared in cooperation with the
North Carolina Department of Natural
Resources and Community Development

United States Department of the Interior
CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY
H. W. Menard, Director

For Additional Information Write to:
GEOLOGICAL SURVEY
Post Office Box 2857
Raleigh, North Carolina 27602

Copies of this report may be purchased from:
U.S. GEOLOGICAL SURVEY
Open-File Services Section
Branch of Distribution
Box 25425, Federal Center
Denver, Colorado 80225

Bob

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Basic Elements of Ground-Water Hydrology With Reference to Conditions in North Carolina

By Ralph C. Heath

U.S. Geological Survey
Water-Resources Investigations
Open-File Report 80-44

Prepared in cooperation with the
North Carolina Department of Natural
Resources and Community Development

Raleigh, North Carolina
1980

Definitions of Terms

Aquifer (p. 7)[1] A water-bearing bed that will yield water in a usable quantity.

Bedrock (p. 20) A collective term for the metamorphic and igneous rocks underlying the Piedmont and mountains.

Capillary fringe (p. 5) The zone above the water table in which water is held by surface tension. Water in the capillary fringe is under a pressure less than atmospheric.

Conductivity, hydraulic (p. 12) The capacity of a unit cube of rock to transmit water.

Cone of depression (p. 49) The depression of heads around a pumping well caused by the withdrawal of water.

Confining bed (p. 7) A layer of rock that hampers the movement of water.

Dispersion (p. 40) The extent to which a substance injected into an aquifer spreads as it moves through the aquifer.

Drawdown (p. 52) The reduction in head at a point caused by the withdrawal of water from an aquifer.

Equipotential line (p. 42) A line (on a map) or cross section along which total heads are the same.

Flow line (p. 42) The idealized path followed by particles of water.

Flow net (p. 42) The grid pattern formed by a network of flow lines and equipotential lines.

Formation (p. 22) A distinct rock layer named for a locality near which it occurs.

Gradient, hydraulic (p. 10) Change in head per unit of distance measured in the direction of the steepest change.

Head, total (p. 10) The height above a datum plane of the surface of a column of water. It is composed in a ground-water system of elevation head and pressure head.

Porosity (p. 8) The openings in a rock.

Saprolite (p. 20) The soil-like rock that occurs between land surface and bedrock in the Piedmont and mountains.

Specific retention (p. 9) The volume of water retained in a rock after gravity drainage.

Specific yield (p. 9) The volume of water that will drain under the influence of gravity from a saturated rock.

Storage coefficient (p. 38) The volume of water released from storage in a unit prism of an aquifer when the head is lowered a unit distance.

Stratification (p. 36) The layered structure of sedimentary rocks.

Transmissivity (p. 37) The capacity of an aquifer to transmit water. It equals the hydraulic conductivity times the aquifer thickness.

Water table (p. 5) The level in the zone of saturation at which the pressure is equal to the atmospheric pressure.

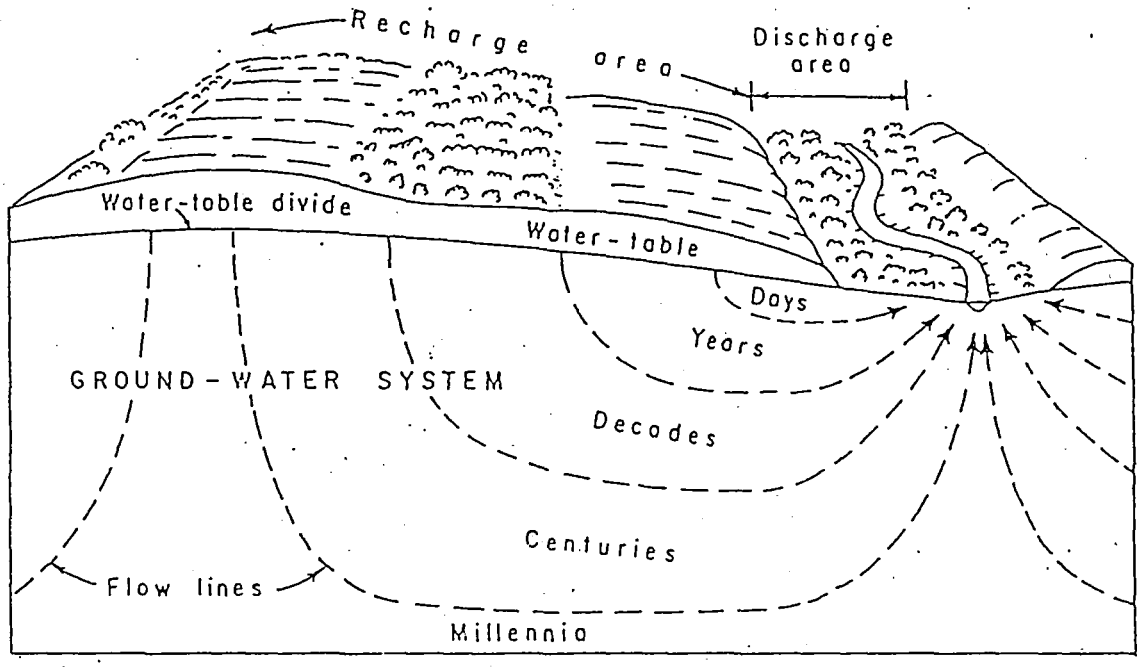
Zone, saturated (p. 5) Subsurface zone in which all interconnected openings are full of water.

Zone, unsaturated (p. 5) Subsurface zone, usually starting at the land surface, that contains both water and air.

---

[1]Page numbers refer to page on which the term is discussed.

Functions of Ground-Water Systems



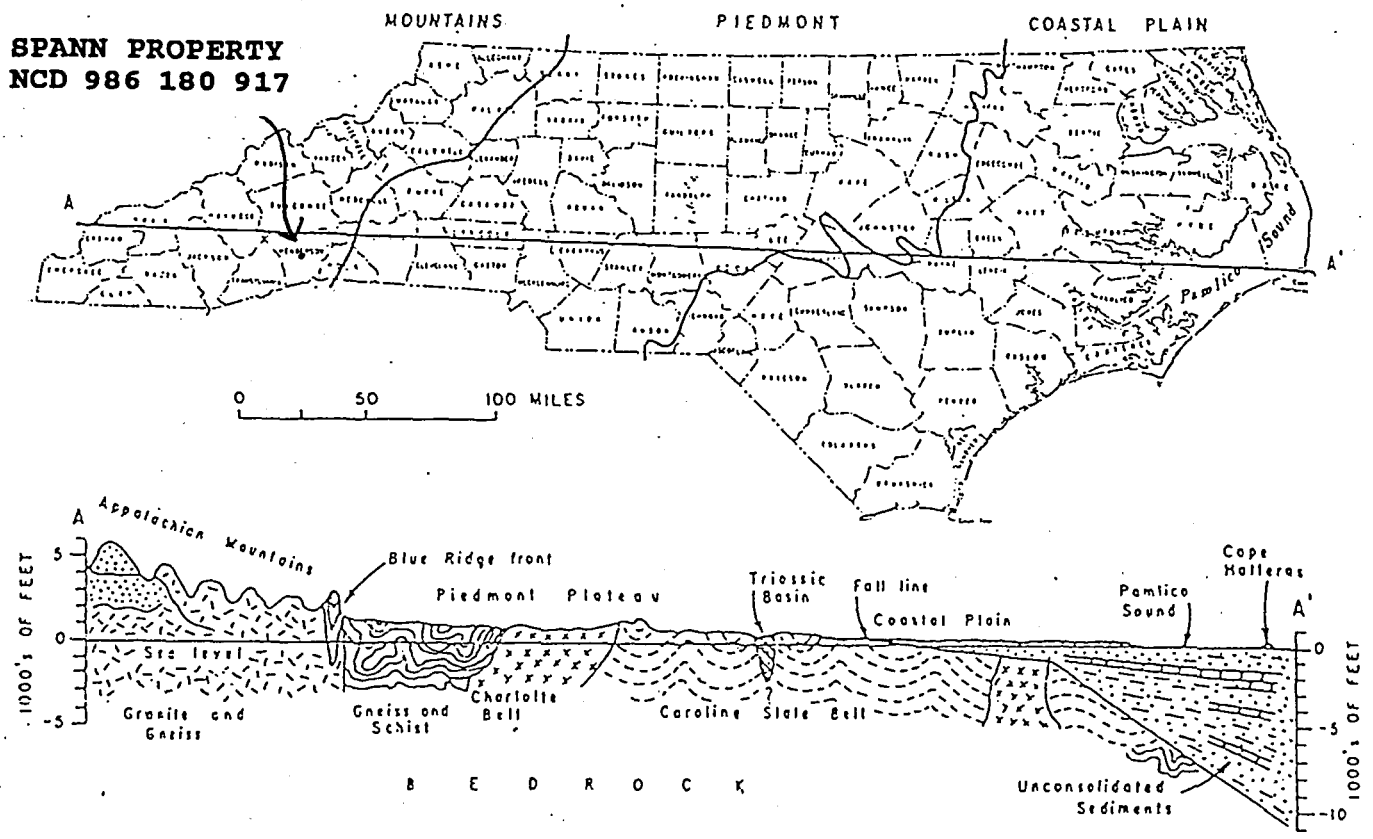
The aquifers and confining beds underlying any area comprise the *ground-water system* of the area. Hydraulically, this system serves two functions: (1) it stores water to the extent of its porosity, and (2) it transmits water from recharge areas to discharge areas. Thus, a ground-water system serves both as a reservoir and as a pipeline. With the exception of cavernous limestones and lava flows, ground-water systems are more effective as reservoirs than as pipelines.

Water enters ground-water systems in *recharge areas* and moves through them, as dictated by hydraulic gradients and hydraulic conductivities, to *discharge areas.*

The identification of recharge areas is becoming increasingly important because of the expanding use of the land surface for waste disposal. In a humid area, such as North Carolina, recharge occurs in all interstream areas - that is, in all areas except along streams and their adjoining flood plains. The streams and flood plains are, under most conditions, discharge areas.

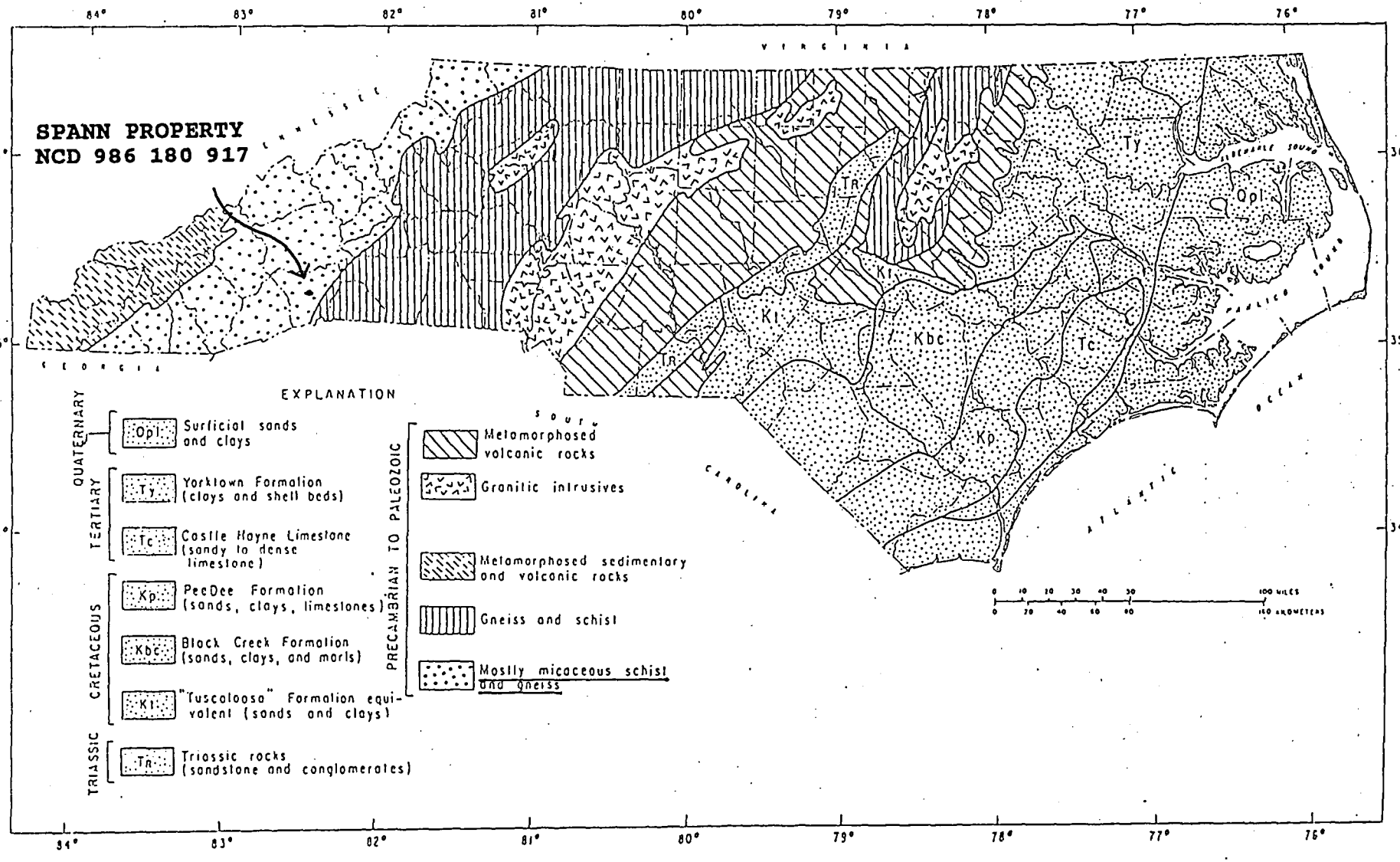
Recharge rates are generally expressed in terms of volume (such as gallons or ft^3), per unit of time (such as a day or a year), and per unit of area (such as a square mile or acre). When the units are reduced to their simpliest form, the result is recharge expressed as a depth of water on the land surface per unit of time. Recharge rates vary from year to year, depending on the amount of precipitation, its seasonal distribution, air temperature, and other factors. Among the other factors are land use. For example, recharge rates are much higher in forest than in cities.

Physical Setting of the Ground-Water System

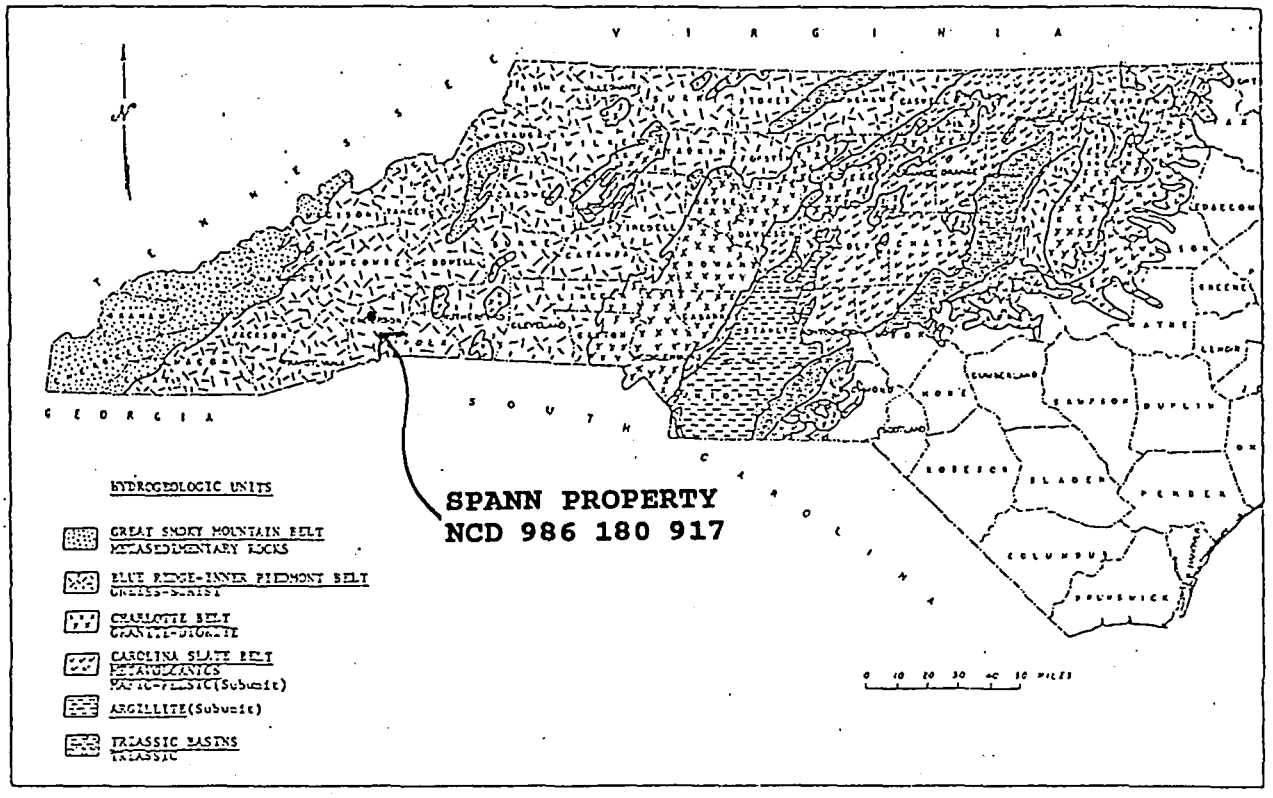


From the standpoint of ground-water hydrology, North Carolina may be divided into two zones, one zone consisting of the Coastal Plain and the other consisting of the Piedmont Plateau and the Appalachian Mountains. Because differences in the ground-water system coincide with the different topographic divisions of the State, it will be useful to briefly review these divisions.

As Jasper L. Stuckey, former North Carolina State Geologist, has said, "The State of North Carolina extends from the crest of the Great Smoky and Unaka mountains on the west, to the Atlantic Ocean on the east and lies across three major topographic provinces of the United States. As a result, it is divided into three natural divisions—the Coastal Plain on the east, the Piedmont Plateau in the center, and the Appalachian Mountains on the west. Beginning at sea level at the eastern edge of the State the surface of North Carolina rises gradually in elevation and increases in irregularity until it reaches its maximum height and ruggedness in the Appalachian Mountains on the west."


SPANN PROPERTY
NCD 986 180 917
VIRGINIA
GEORGIA
SOUTH CAROLINA
ATLANTIC OCEAN
EXPLANATION
QUATERNARY
Opl Surficial sands and clays
TERTIARY
Ty Yorktown Formation (clays and shell beds)
Tc Castle Hayne Limestone (sandy to dense limestone)
CRETACEOUS
Kp PeeDee Formation (sands, clays, limestones)
Kbc Black Creek Formation (sands, clays, and marls)
Kt "Tuscaloosa" Formation equivalent (sands and clays)
TRIASSIC
Tr Triassic rocks (sandstone and conglomerates)
PRECAMBRIAN TO PALEOZOIC
Metamorphosed volcanic rocks
Granitic intrusives
Metamorphosed sedimentary and volcanic rocks
Gneiss and schist
Mostly micaceous schist and gneiss
100 MILES
150 KILOMETERS

Rock Units and Aquifers in the Piedmont and Mountains



The rocks underlying the Piedmont and mountains can be divided into two groups: (1) bedrock, and (2) saprolite (or residuum). The saprolite underlies the land surface and ranges in thickness from a foot or two near bedrock outcrops to more than 100 ft. Bedrock underlies the saprolite and is the parent rock from which the saprolite was derived in the process referred to as weathering.

Many stream valleys, especially those of larger streams, are underlain by a layer of material similar in composition to saprolite. This material, which has been deposited by the streams during floods, is correctly referred to as *alluvium*. However, to avoid unnecessary complications, we will lump the alluvium in with the saprolite for the purpose of this discussion.

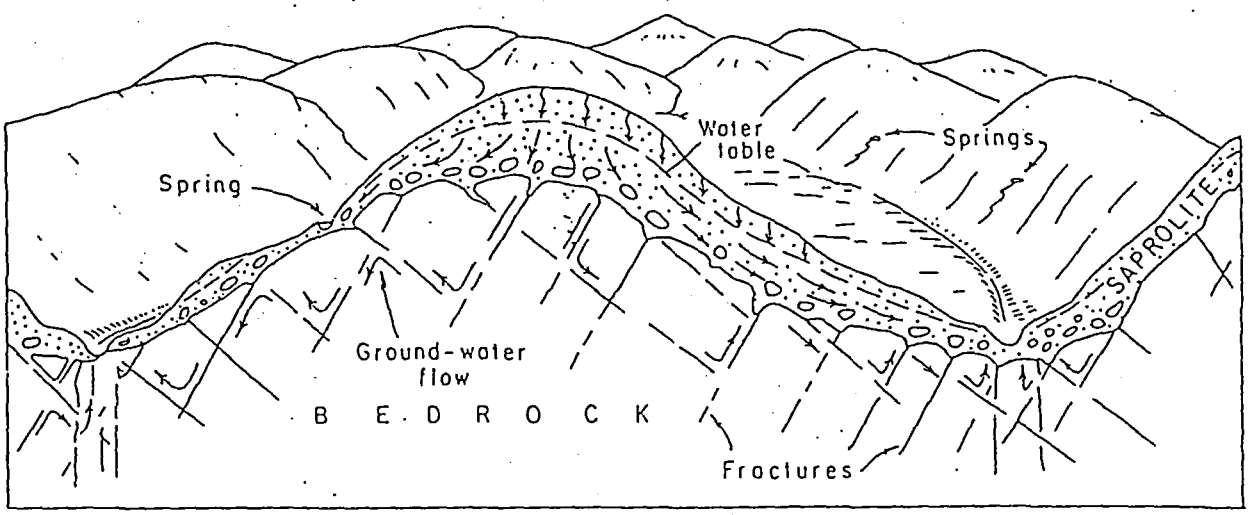
The bedrock underlying the Piedmont and mountains consists of many different types of igneous and metamorphosed igneous and sedimentary rocks. The Generalized Geological Map of North Carolina accompanying the discussion of WATER-BEARING ROCKS divides the bedrock in the Piedmont and mountains into six units. The 1:500,000 scale Geologic Map of North Carolina, published in 1958, divides the bedrock in the same area into 48 different units. But, a much larger number of units have been identified and are shown on large scale geologic maps.

The bedrock units differ from each other in mineral composition and other geologic characteristics. Fortunately, these differences do not result in large differences in hydraulic characteristics so that it is possible to combine the bedrock units into a relatively small number of hydrogeologic units.

The accompanying map shows the hydrogeologic units into which the bedrock in the Piedmont and mountains has been divided by the U.S. Geological Survey and the North Carolina Groundwater Section.

The most productive hydrogeologic units are the Great Smoky Mountain belt and the Blue Ridge-Inner Piedmont belt. The least productive units are the Carolina Slate Belt and the Triassic Basins. The Charlotte Belt is intermediate in productivity.

Ground-Water Situation in the Piedmont and Mountains



The *saprolite* (weathered rock) that forms the land surface in the Piedmont and mountains consists of unconsolidated granular material. It thus contains water in the pore spaces between rock particles.

The *bedrock*, on the other hand, does not have any significant intergranular (primary) porosity. It contains water, instead, in sheet-like openings formed along fractures (that is, breaks in the otherwise "solid" rock). Fractures in bedrock are of two types: (1) *joints*, which are breaks along which there has been no differential movement; and (2) *faults*, which are breaks along which the adjacent rocks have undergone differential movement.

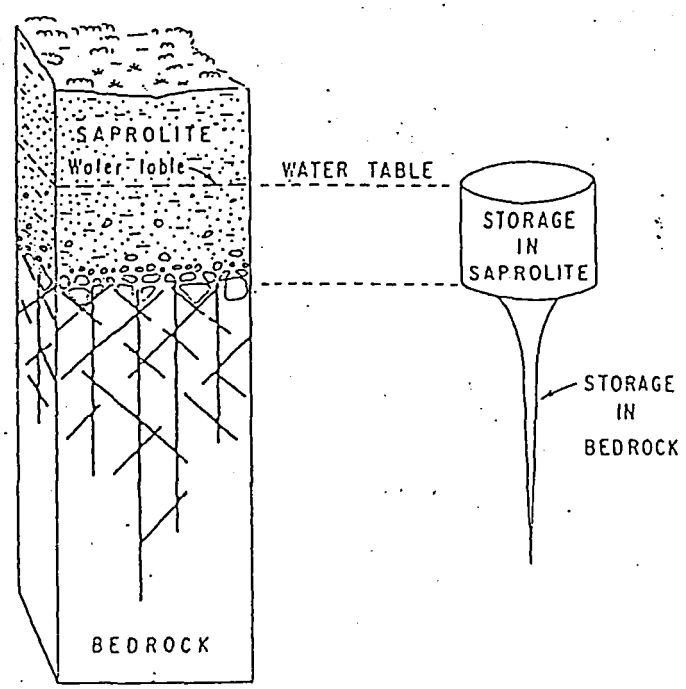
Faults are formed during earthquakes and generally contain larger and more extensive openings than those developed along joints. Joints, however, are far more numerous than faults.

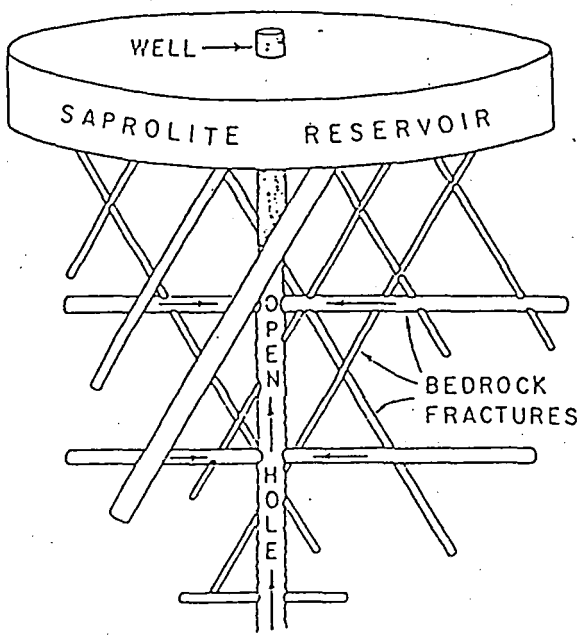
Fractures (joints and faults) are more abundant under valleys, draws, and other surface depressions than under hills. In fact, geologists assume that it is the presence of fractures that determined the position of valleys in the first place. Fractures tend to be more closely-spaced and the openings developed along them tend to be larger near the surface of the bedrock. Most fractures appear to be non water-bearing below a depth of 300 to 400 ft. Large water-bearing openings, penetrated below this depth are probably associated with faults.

The ground-water system in the Piedmont and mountains is recharged by precipitation on the interstream areas. A part of the precipitation infiltrates through the unsaturated zone to the water table, which normally occurs in the saprolite.

Ground water moves laterally and downward through the saprolite to points of ground-water seepage (springs) on the hillsides and to the streams in the adjacent valleys. Some of the water in the saprolite also moves downward into the bedrock and, thereafter, through the fractures to the adjacent valleys.

Hydraulic Characteristics of the Piedmont and Mountain Ground-Water System





One of the most basic concepts of ground-water hydrology is that aquifers function both as reservoirs, in which water is in storage, and as pipelines, which transmit water from one point to another. This is referred to as the *reservoir-pipeline concept.* This concept forms a useful basis on which to discuss the hydraulic characteristics of the Piedmont and mountain ground-water system.

The reservoir (storage) function of aquifers depends on the porosity. The pipeline function depends on the hydraulic conductivity and the thickness of the aquifer. The approximate range in porosity and hydraulic conductivity for the saprolite and bedrock is shown in the following table.

Rock type	Porosity in percent	Hydraulic conductivity in feet per day	
Saprolite	20-30	1-20	2.5×10^{-4} cm/s
Bedrock	0.1-1	1-20	7.0×10^{-3} cm/s

The above values suggest that the principal difference between saprolite and bedrock is in water-storage capacity. In other words, the saprolite has the capacity to store a much larger quantity of water than does the bedrock. This is not the entire story, however.

As we noted above, the capacity of an aquifer to transmit water depends both on hydraulic conductivity and on aquifer thickness. The part of the bedrock containing water-bearing fractures is several times thicker than the saprolite.

We can then, without great error, view the ground-water system in the Piedmont and mountains as consisting of a saprolite reservoir overlying a bedrock pipeline consisting of numerous small, interconnected pipes. In the vicinity of a pumping well the bedrock fractures ("pipes") convey water from the saprolite reservoir to the well.

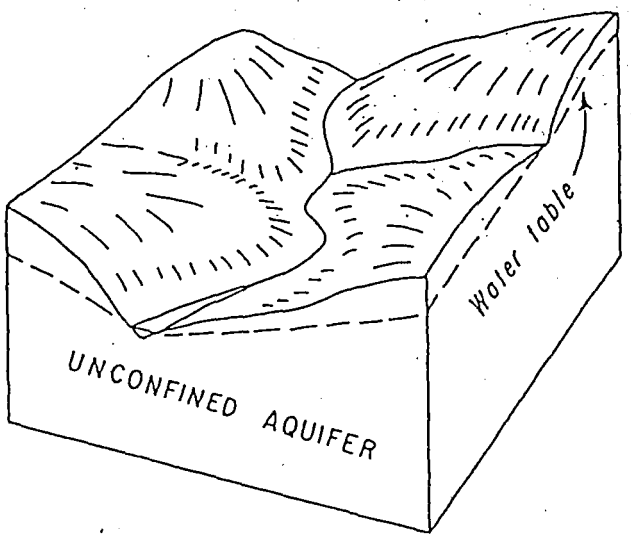
The yield of a well drawing from fractured bedrock depends on several factors. The most important of these are believed to be:

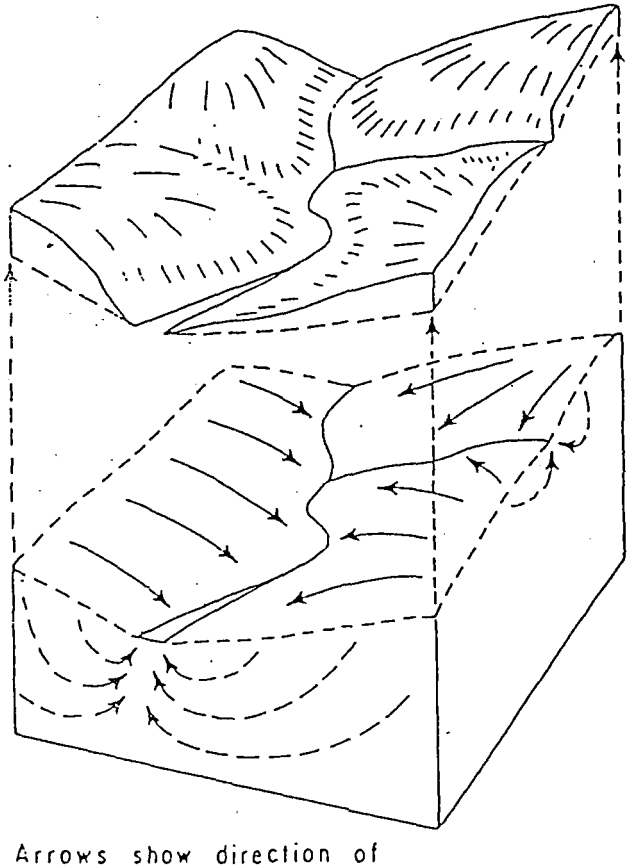
1. The number, size, areal extent, and degree of interconnection of the fractures penetrated by the well,
2. The thickness of saturated saprolite in the vicinity of the well and the specific yield of the saprolite, and
3. The hydraulic conductivity of the saprolite and the nature of the hydraulic connection between the saprolite and the bedrock.

The number and the size of the fractures control the rate at which water can enter the well. The areal extent and degree of interconnection of the fractures control the size of the area that supplies water to the well.

The thickness and the specific yield of the saprolite determines the volume of water available from storage in the saprolite. The hydraulic conductivity of the saprolite and the nature of the hydraulic connection between the saprolite and the bedrock determines the rate at which water can drain from the saprolite into the bedrock fractures.

Ground-Water Movement And Topography





Arrows show direction of ground-water movement.

It is desirable, wherever possible, to determine the position of the water table and the direction of ground-water movement by measuring the depth of water level in shallow wells. However, in humid areas like North Carolina, general, but very valuable, conclusions about the direction of ground-water movement can be derived from observations of land-surface topography.

We know that gravity is the dominant driving force in ground-water movement and that under natural conditions ground water moves "downhill" until, in the course of its movement, it reaches the land surface at a spring or through a seep along the side or bottom of a stream channel or an estuary.

Thus, ground water in the shallowest part of the saturated zone moves from interstream areas toward streams or the coast. If we ignore minor surface irregularities, we find that the land surface also slopes in these directions. The depth to the water table is greatest along the divide between streams and least beneath the floodplain. *In effect, the water table is a subdued replica of the land surface.*

In areas where ground water is used for domestic and other needs requiring good-quality water, septic tanks, sanitary landfills, waste ponds, and other waste disposal sites should not be located uphill from supply wells.

The potentiometric surface of confined aquifers, like the water table, also slopes from recharge areas to discharge areas. Shallow confined aquifers, which are relatively common along the Atlantic Coastal Plain, share both recharge and discharge areas with the surficial unconfined aquifer. This may not be the case with the deeper confined aquifers. The principal recharge areas for these are probably in their outcrop areas near the western border of the Coastal Plain. Their discharge areas are probably near the heads of the estuaries along the major streams. Thus, movement of water through these aquifers is in a general west to east direction, where it has not been modified by withdrawals.

Ref. 20

NC
GW-B-16

CERCLA

O S P
OFFICE LIBRARY
DEPARTMENT OF STATE PLANNING
DEPARTMENT OF ADMINISTRATION
WITHDRAWN

GEOLOGY AND GROUND-WATER RESOURCES OF THE ASHEVILLE AREA NORTH CAROLINA

ENVIRONMENTAL MANAGEMENT
LIBRARY
N.C. DEPT. OF NATURAL
RESOURCES & COMM. DEV.

DIVISION OF GROUND WATER

GROUND WATER BULLETIN NO. 16

NORTH CAROLINA

DEPARTMENT OF WATER AND AIR RESOURCES

CERCLA

RALEIGH
APRIL
1970

GEOLOGY AND GROUND-WATER RESOURCES OF THE ASHEVILLE AREA NORTH CAROLINA

By

HENRY TRAPP, JR.
GEOLOGIST, U. S. GEOLOGICAL SURVEY

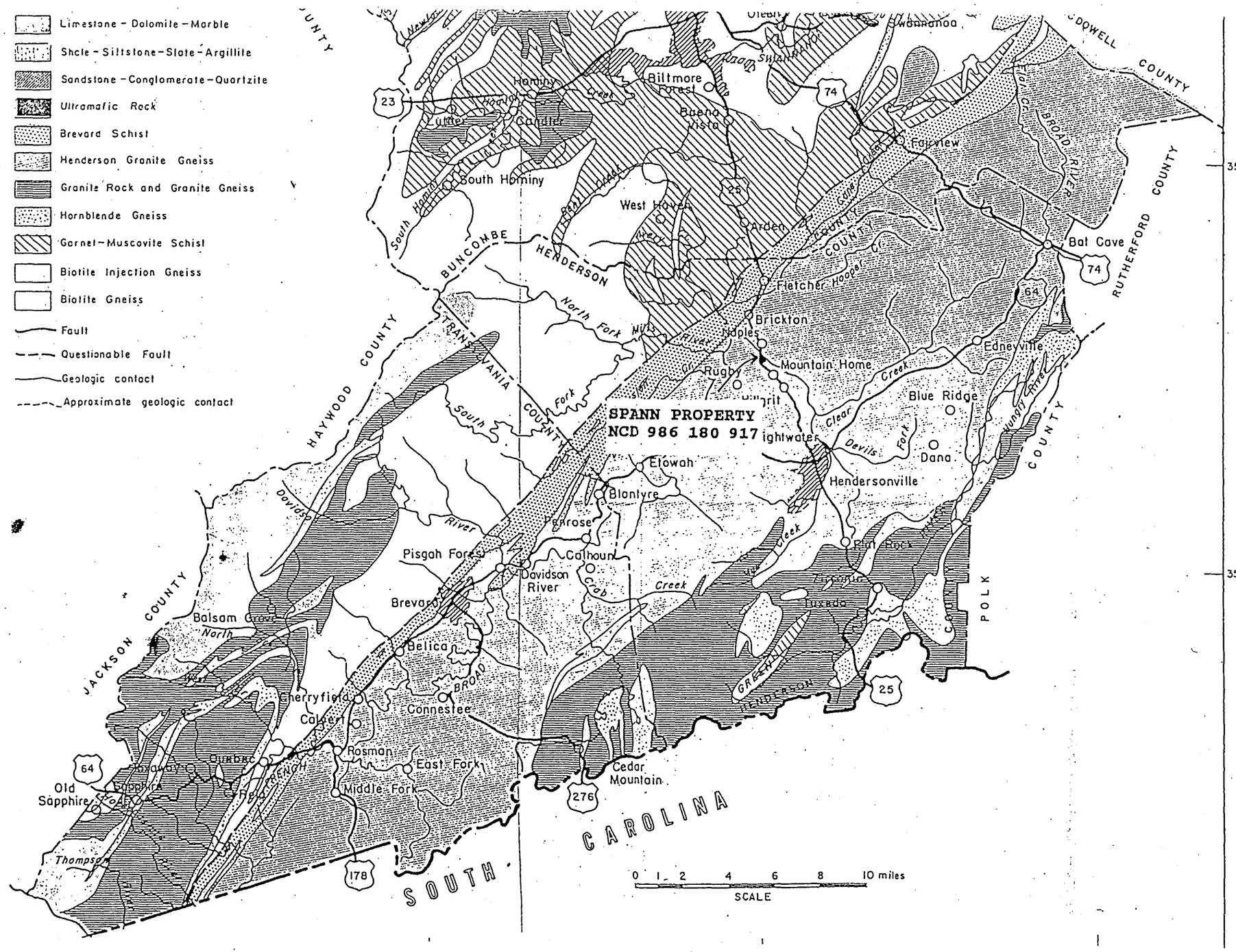
GROUND WATER BULLETIN NUMBER 16

NORTH CAROLINA
DEPARTMENT OF WATER AND AIR RESOURCES
George E. Pickett, *Director*

Division of Ground Water
Harry M. Peek, *Chief*

PREPARED COOPERATIVELY BY THE GEOLOGICAL SURVEY
UNITED STATES DEPARTMENT OF THE INTERIOR
AND THE NORTH CAROLINA
DEPARTMENT OF WATER AND AIR RESOURCES

APRIL 1970


Limestone - Dolomite - Marble
Shale - Siltstone - Slate - Argillite
Sandstone - Conglomerate - Quartzite
Ultramafic Rock
Brevard Schist
Henderson Granite Gneiss
Granite Rock and Granite Gneiss
Hornblende Gneiss
Garnet - Muscovite Schist
Biotite Injection Gneiss
Biotite Gneiss
Fault
Questionable Fault
Geologic contact
Approximate geologic contact
SPANN PROPERTY
NCD 986 180 917
35°30'
35°15'
35°
BUNCOMBE
HENDERSON
TRANSYLVANIA
HAYWOOD
JACKSON
POLK
RUTHERFORD
MCDOWELL
SOUTH CAROLINA
Biltmore Forest
Buena Vista
Fairview
Bat Cave
Fletcher
Brickton
Naples
Mountain Home
Edneyville
Blue Ridge
Dana
Hendersonville
Etowah
Blantyre
Balsam Grove
Pisgah Forest
Brevard
Davidson River
Calhoun
Rosman
East Fork
Middle Fork
Cherryfield
Connestee
Cedar Mountain
Old Sapphire
Sapphire
Lake Toxaway
Cashiers
Lake Jocassee
Table Rock
Zirconia
Tuxedo
0 1 2 4 6 8 10 miles
SCALE

Henderson County

(Area 382 square miles, population 36,163, 1960 census)

Geography

Henderson County lies in the southeastern part of the four-county area. It is bounded on the south by the State of South Carolina. The county seat is Hendersonville, with a population of 5,911. The only other incorporated town is Laurel Park, a residential suburb of Hendersonville. The county is characterized by a dissected central plateau (part of the Asheville plateau) bounded on the northwest by a well-defined, northeast-trending mountain range (the Pisgah Ridge), on the south by granite ridges, and on the east by the Blue Ridge front. The plateau has an average elevation of about 2,200 feet, but there are isolated knobs and ridges 2,500 to 2,600 feet in elevation. The lowest and most level parts of the plateau are the flood plains of the French Broad and Mills Rivers, and Cane, Mud, Clear, and Hooper Creeks. The Blue Ridge has a gentle slope on the west (French Broad River) side of the drainage divide. East of the divide, the topography is rugged. Southwest of Zirconia, the Blue Ridge has an eastward trend.

Altitudes range from about 1,400 feet above sea level where the Broad River leaves the county at Bat Cave to about 5,280 feet on Little Pisgah Mountain at the junction of Henderson, Buncombe, Transylvania, and Haywood Counties. Henderson County lies within the drainage basin of the French Broad River except for the areas along the eastern and southern boundaries, which are drained by the Broad and Green Rivers. The principal tributaries of the French Broad River in Henderson County are Boylston Creek, Mills River, Mud Creek, and Cane Creek. The Little Hungry and Hungry Rivers are tributaries of the Green River.

The Asheville-Spartanburg line of the Southern Railway traverses the county in a general north-south direction. There are interstate highways and many State, County, and Forest Service roads providing access to most parts of the county.

Henderson County produces more than half the apples grown in North Carolina. These are grown mostly in the area between Hendersonville and Edneyville, on hillsides and in small valleys. Commercial truck and dairy farms occupy most of the broad valleys. Livestock raising is also important, and corn and hay are the principal feed crops.

Manufacturing in Henderson County is centered around Hendersonville, and includes apparel, electrical equipment, and scientific instruments. There is a textile print works and a rug factory at Fletcher, and a textile mill at Toledo.

Bricks are manufactured from clay dug at Fletcher, and formerly at Etowah. The clay is from saprolite along the Henderson Gneiss-Brevard Schist contact. Two dolomite quarries are active at Fletcher in dolomitic marble of the Brevard Schist. The rock is used for aggregate and for agricultural lime. The Henderson Gneiss also has been quarried for crushed stone at various localities. Gold was formerly mined on the southeast flank of the Pisgah Ridge, 1 mile northeast of the Transylvania County line. It was found in granite and pegmatite dikes in quartz-biotite gneiss. Zircons were formerly mined at Zirconia from the Whiteside Granite.

Geology

The northwest corner of Henderson County is underlain mainly by biotite gneiss.

Southeast of the gneiss is a belt predominantly of muscovite schist. This belt is only about $1\frac{1}{2}$ miles wide at the Transylvania County line, and there consists entirely of Brevard Schist. The Brevard Schist includes quartzite, phyllite, argillite, slate, garnet-muscovite schist, marble, fine-grained gneiss, and pyroclastics. Its most distinctive rock type is sericite schist containing finely disseminated graphite. To the northeast, the schist belt broadens, with coarse garnet-muscovite schist intruded by pegmatite dikes separating the typical Brevard Schist on the southeast from the quartz-biotite gneiss on the northwest. The topography of the schist belt ranges from nearly flat to moderately rugged. The Brevard Schist lies largely in the valleys of Boylston and Cane Creeks.

The greater part of Henderson County, southeast of the Brevard Schist belt, is underlain by Henderson Gneiss which is characterized by feldspar porphyroblasts, locally broken and deformed into augen. The rock varies in composition from a granite gneiss to a biotite gneiss or quartzite with a few scattered feldspar porphyroblasts. The Henderson Gneiss varies considerably in topographic expression.

The broad valleys of the French Broad River, Mud Creek, and Hooper Creek lie mostly within the area of Henderson outcrops. The gently undulant area northwest of the Blue Ridge front from Upward to Edneyville is also in the Henderson Gneiss outcrop. Possibly the differences in topography are controlled by compositional variations of varying resistance to weathering and erosion.

South of the Henderson Gneiss is a gneissic granite, which has been correlated with the Whiteside Granite of western Transylvania County and Jackson County. The white gneissic granite contains biotite and isolated masses of hornblende gneiss and garnet-muscovite schist. The hornblende gneiss is intruded by granitic dikes.

Along the eastern edge of Henderson County is a complex of granite gneiss, pegmatite, hornblende gneiss, garnet-muscovite schist, biotite-injection gneiss, and quartzite. The granitic parts locally contain coarse feldspar crystals which give the rock an appearance similar to that of the Henderson Gneiss. Elsewhere, the rock more closely resembles the Whiteside Granite.

Regional dip averages about 40 degrees to the southeast, but is reversed on Pisgah Ridge, the topographic expression of an anticline aligned northeastward.

Ground-Water Hydrology

Henderson County is second in the four-county area in the number of public water systems, and it leads in the number of these which are supplied by ground-water sources.

Almost all rural homes depend on domestic ground-water supplies. Springs are used where available, particularly in the hills. Dug wells, used for many years, have been supplanted in importance by drilled wells.

Agricultural use of ground water is largely for watering livestock and washing dairy equipment.

Both the Cranston Print Works (Well No. 17) and the Mountain Rug Mills (Wells No. 15 and 16) use ground water. Cranston's well (No. 17) has a maximum yield of about 55 gpm. Wells No. 15 and 16, combined, are adequate for the needs of Mountain Rug Mills.

Potential sites for light industry in Henderson County should not be excluded from consideration because they are not within an

area served by a public water supply. In most parts of the county, wells can supply small factories with an adequate supply of water for fire protection and processing. The water requirements of factories may be comparable to ground water use in Grimesdale (Well Nos. 54, 55, 56, 57, and 58), the Mountain Sanitarium-Fletcher Academy (Well Nos. 8, 9) and the west Henderson School (Well No. 46). The large wells supplying the above institutions and subdivision were drilled in the Henderson Gneiss, which covers a large part of the county. Much of the gently undulant land in the county suitable for industrial development is underlain by Henderson Gneiss. Before an industrial site is located beyond public water supplies, the presence of adequate ground water should be confirmed by drilling and testing one or more wells.

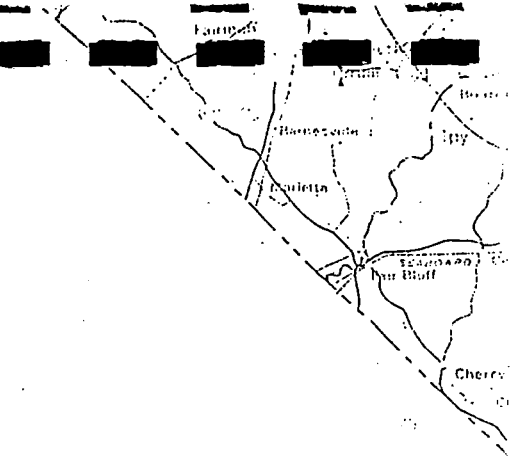
Turbidity occurs in water from some wells, particularly those drilled in deeply weathered Brevard Schist.

Most of the springs in Henderson County, used for domestic purposes have yields on the order of 1 gpm. An exception is Spring No. 2A. Few of the springs used for public supplies yield more than 5 to 10 gpm in dry seasons.

Inventoried drilled wells have an average depth of 118 feet and an average yield of 18.3 gpm, or 0.156 gpm per foot.

Quality of Ground Water in Henderson County

Analyses of ground water from Henderson County are shown in table 15. Water from Wells 3, 6, 11, 19, 24, 37, 48, and 60 have iron concentrations greater than 0.3 ppm. All but two of these wells are in the Henderson Gneiss. Wells 2, 18, 19, 33, 36, and Spring 5A have water with high chloride and/or nitrate concentrations.

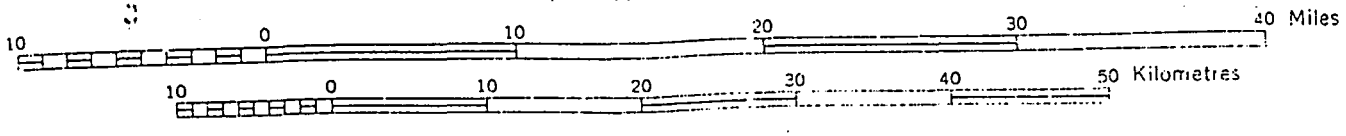


GEOLOGIC MAP OF NORTH CAROLINA

1985

Scale 1:500,000

1 inch equals approximately 8 miles



Ref. 21

DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
S. Thomas Rhodes, Secretary

Division of Land Resources
Stephen G. Conrad, Director and State Geologist

Compiled by

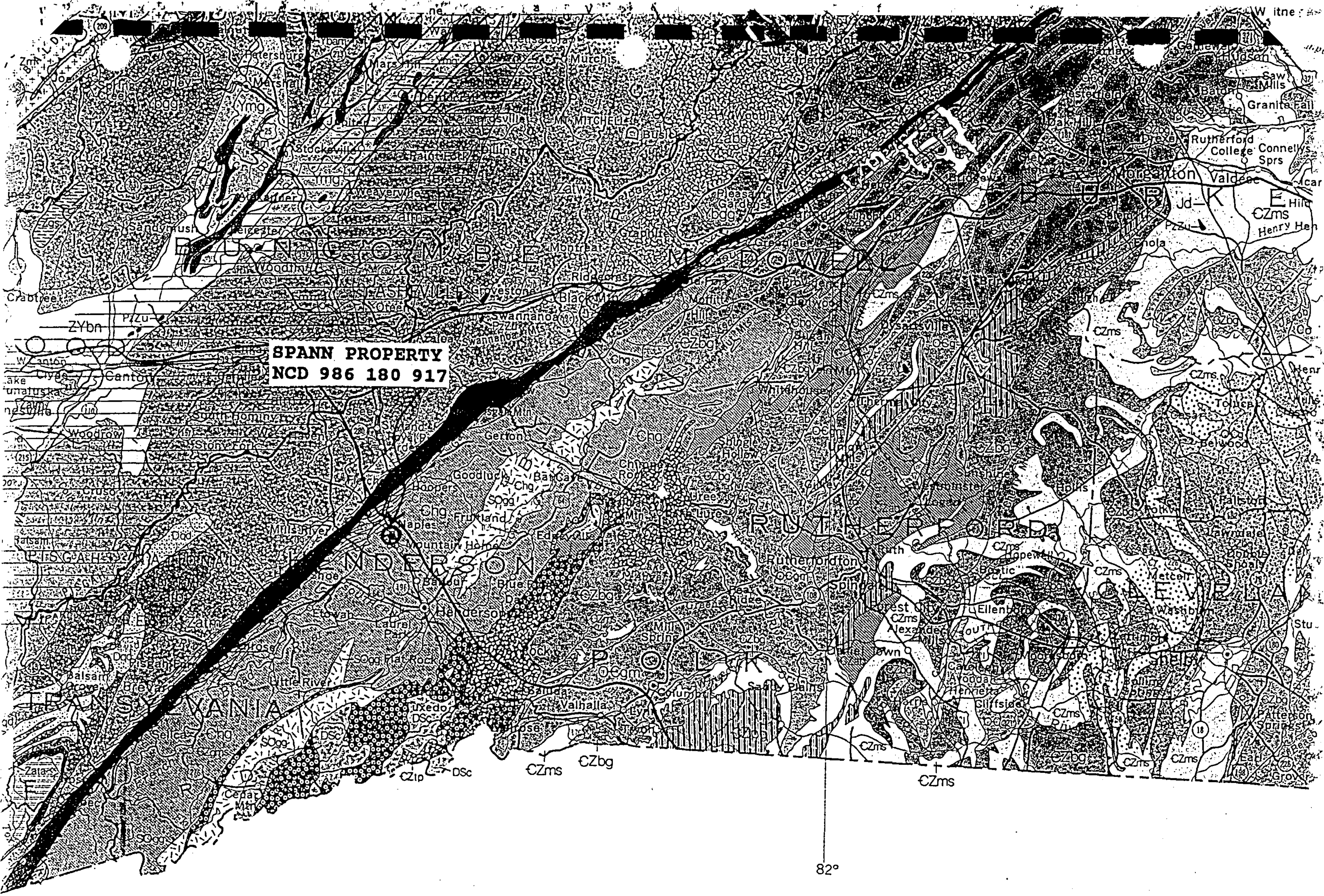
The North Carolina Geological Survey
Philip M. Brown, Chief Geologist

Edward R. Burt, III
P. Albert Carpenter, III
Rebecca M. Enos
Billie J. Flynt, Jr.
Patricia E. Gallagher
Charles W. Hoffman
Carl E. Merschat
William F. Wilson

and

John M. Parker, III
State Geologic Map Coordinator
in association with
The State Geologic Map Advisory Committee

Charles C. Almy, Jr.
J. Robert Butler
Paul D. Fullagar
Richard Goldsmith
Robert D. Hatcher, Jr.
S. Duncan Heron, Jr.
J. Wright Horton, Jr.
Roy L. Ingram
Stuart W. Maher
Richard L. Mauger
James A. Miller
Loren A. Raymond
Thomas E. Shufflebarger, Jr.
Norman F. Sohl
Scott W. Snyder
Edward F. Stoddard
Frederick M. Swain
Daniel A. Textoris
Paul A. Thayer
H. D. Wagener
Lauck W. Ward
Walter H. Wheeler
Steven P. Yurkovich
Victor A. Zullo


SPANN PROPERTY
NCD 986 180 917
BUNCOMBE
McDOWELL
RUTHERFORD
HENDERSON
POLK
TRANSYLVANIA
CLEVELAND
Asheville
Swannanoa
Black Mtn
Hendersonville
Flat Rock
Saluda
Tuxedo
Valhalla
Rutherfordton
Forest City
Morganton
Rutherford College
Connelly Sprs
Granite Falls
Canton
Clyde
Crabtree
Woodrow
Mills River
Etowah
Laurel Park
Gerton
Goodluck
Fruitland
Mountain Home
Edneyville
Little River
Cedar Mtn
Cliffside
Henrietta
Alexander Mills
Spindale
Ellenboro
Hopewell
Lattimore
Toluca
Belwood
Shelby
Patterson Springs
Earl
Grover
Sawmills
ZYbn
PzZu
Chg
SOgg
CZbg
CZms
CZtp
DSc
CZab
Zatw
Ymg
Jd
82°

rtz monzonitic orthogneiss;
includ[redacted]ton[redacted]es, i[redacted]
valents of the [redacted]andfather
Wilson Creek G[redacted]s

reenstone, and amphibolite

zoic, 680-710 my; 25,27) —
ivalent to Brown Mountain

ELT

S

ly foliated; minor layers of

t, locally with graphite, phyl-
le, amphibolite, and minor

ricite schist with metavolca-
e, kyanite-sillimanite quart-

Pennsylvanian to Permian,
igranular. High Shoals Gra-

1 my; 20,21) — Massive to

oliated to massive

€Zph — PHYLLITE AND SCHIST — Includes phyllonite and interlayered biotite [redacted] eiss [redacted]

€Zgb — INEQUIGRANULAR BIOTITE GNEI[redacted] — Weakly foliated to massive, contains plagioclase megacrysts and, rarely, larger megacrysts of quartz and feldspar

€Zp — PORPHYROBLASTIC GNEISS — Massive to foliated, granodioritic, migmatitic

€Zm — GARNET-MICA SCHIST — Interlayered with amphibolite

Yg — GRANITIC GNEISS (Middle Proterozoic, 1192 my; 27) — Megacrystic, in places contains amphibolite

INTRUSIVE ROCKS

Jd — DIABASE — Dikes, gray to black

Mc — CHERRYVILLE GRANITE (Mississippian, 351 my; 20,21) — Massive to weakly foliated; contains pegmatites, lithium-bearing on east side

DSc — CAESARS HEAD GRANITE GNEISS (Devonian to Silurian, 409 my: 13) — Equigranular to porphyritic, massive to well foliated; contains biotite and muscovite

SOgg — GRANITE GNEISS (Ordovician to Silurian, 438 my; 17) — Poorly foliated; interlayered with biotite augen gneiss

OCgm — MIGMATITIC GRANITIC GNEISS — Foliated to massive, granitic to quartz dioritic; biotite gneiss and amphibolite common

OCg — METAMORPHOSED GRANITIC ROCK (Cambrian to Ordovician, 455-540 my; 10) — Equigranular to megacrystic, foliated to massive. Includes Toluca Granite

€hg — HENDERSON GNEISS (Cambrian, 524 my; 10) — Monzonitic to granodioritic, inequigranular

PzZg — METAMORPHOSED GABBRO AND DIORITE — Foliated to massive

PzZu — META-ULTRAMAFIC ROCK — Metamorphosed dunite, local peridotite, serpentinite, soapstone, and other ultramafic rock. Only larger bodies shown

Zg — METAMORPHOSED GRANITIC ROCK (Late Proterozoic, 680-710 my; 18) Massive to foliated, locally mylonitic

[redacted] — GRANITIC ROCK — [redacted]

[redacted] — SHELTON [redacted]ANITE GNEISS (Silurian) lineated granitic to quartz monzonit[redacted]

PzZg — METAMORPHOSED QUARTZ DIORITE

PzZg — METAMORPHOSED GABBRO AND D[redacted]

[redacted] — METAMORPHOSED MAFIC ROCK — mafic plutonic-volcanic complexes

[redacted] — META-ULTRAMAFIC ROCK — Metam[redacted] serpentinite, soapstone, and other al[redacted] bodies shown

€Zg — METAMORPHOSED GRANITIC ROCK — locally contains hornblende

Contact

Fault

Fault — Showing relative

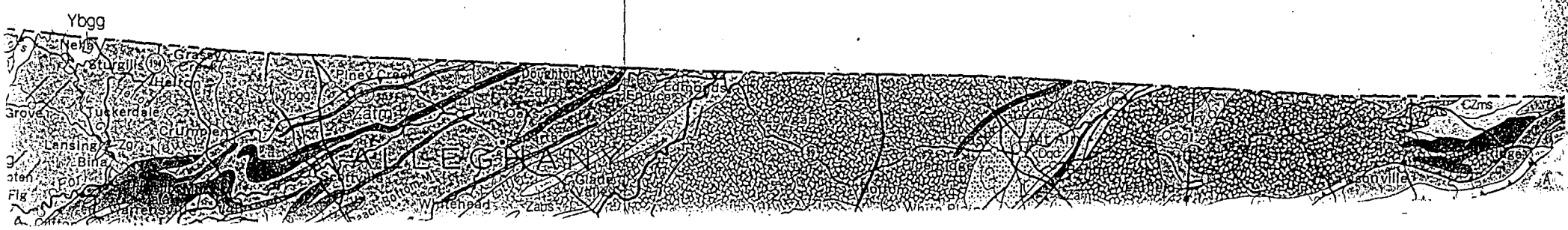
Normal fault — Bar and

Overturned normal fault

Thrust fault — Sawteet

Overturned thrust fault

81°



Ref. 22

12-14-90
Vol. 55 No. 241

federal register

Friday
December 14, 1990

Book 2

United States
Government
Printing Office
SUPERINTENDENT
OF DOCUMENTS
Washington, DC 20402

OFFICIAL BUSINESS
Penalty for private use, $300

SECOND CLASS NEWSPAPER

Postage and Fees Paid
U.S. Government Printing Office
(ISSN 0097-6326)

Federal Register

Friday
December 14, 1990

Part II

Environmental Protection Agency

40 CFR Part 300
Hazard Ranking System; Final Rule

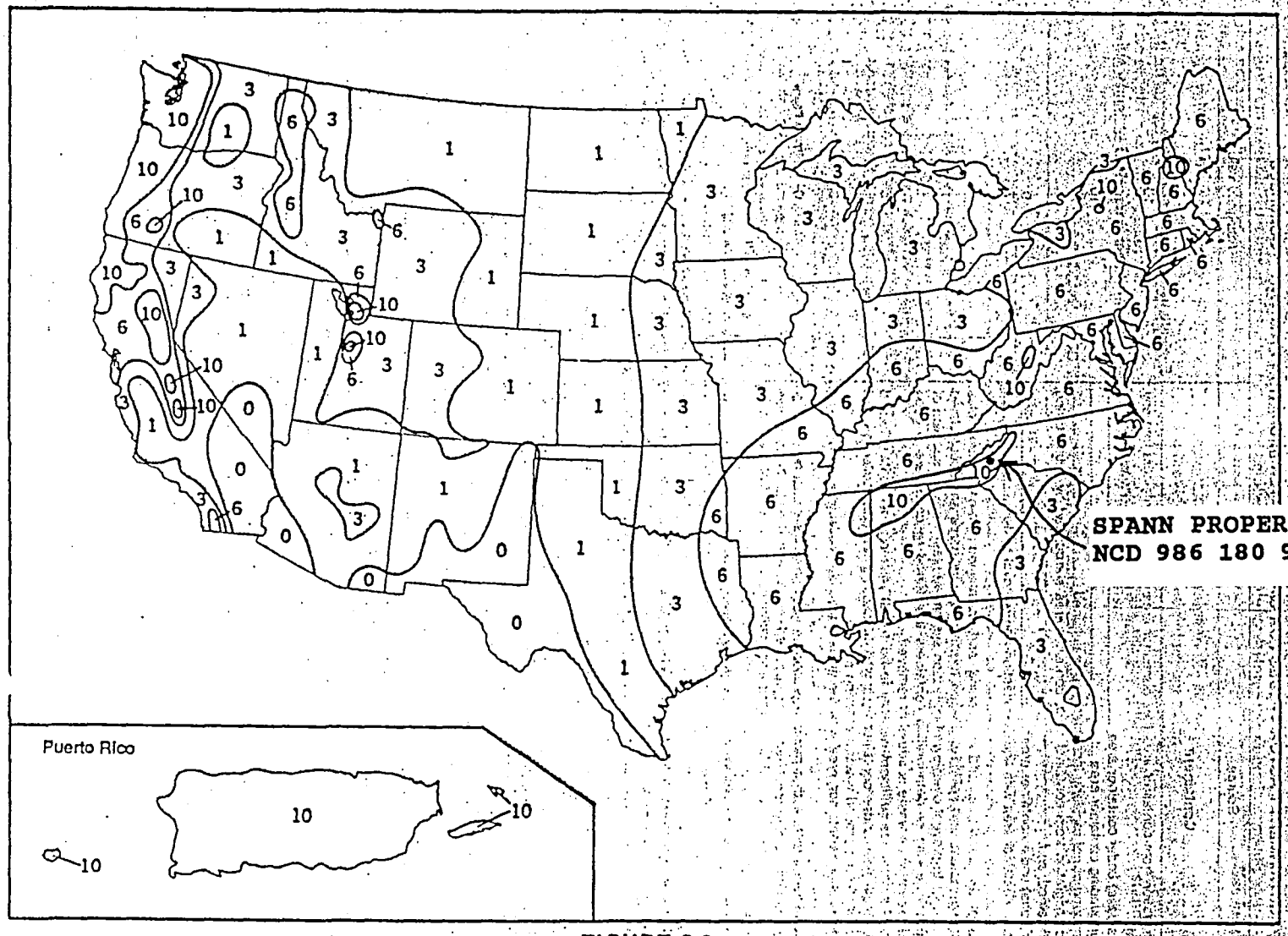


FIGURE 3-2
NET PRECIPITATION FACTOR VALUES

TABLE 3-6.—HYDRAULIC CONDUCTIVITY OF GEOLOGIC MATERIALS

Type of material	Assigned hydraulic conductivity [a] (cm/sec)
Clay; low permeability till (compact unfractured till); shale; unfractured metamorphic and igneous rocks	10^{-8}
Silt; loesses; silty clays; sediments that are predominantly silts; moderately permeable till (fine-grained, unconsolidated till, or compact till with some fractures); low permeability limestones and dolomites (no karst); low permeability sandstone; low permeability fractured igneous and metamorphic rocks	10^{-6}
Sands; sandy silts; sediments that are predominantly sand; highly permeable till (coarse-grained, unconsolidated or compact and highly fractured); peat; moderately permeable limestones and dolomites (no karst); moderately permeable sandstone; moderately permeable fractured igneous and metamorphic rocks	10^{-4}
Gravel; clean sand; highly permeable fractured igneous and metamorphic rocks; permeable basalt; karst limestones and dolomites	10^{-2}

[a] Do not round to nearest integer.

TABLE 3-7.—TRAVEL TIME FACTOR VALUES [a]

Hydraulic conductivity (cm/sec)	Thickness of lowest hydraulic conductivity layer(s) [b] (feet)			
	Greater than 3 to 5	Greater than 5 to 100	Greater than 100 to 500	Greater than 500
Greater than or equal to 10^{-3}	35	35	35	25
Less than 10^{-3} to 10^{-5}	35	25	15	15
Less than 10^{-5} to 10^{-7}	15	15	5	5
Less than 10^{-7}	5	5	1	1

[a] If depth to aquifer is 10 feet or less or if, for the interval being evaluated, all layers that underlie a portion of the sources at the site are karst, assign a value of 35.

[b] Consider only layers at least 3 feet thick. Do not consider layers or portions of layers within the first 10 feet of the depth to the aquifer.

Determine travel time only at locations within 2 miles of the sources at the site, except: if observed ground water contamination attributable to sources at the site extends more than 2 miles beyond these sources, use any location within the limits of this observed ground water contamination when evaluating the travel time factor for any aquifer that does not have an observed release. If the necessary subsurface geologic information is available at multiple locations, evaluate the travel time factor at each location. Use the location having the highest travel time factor value to assign the factor value for the aquifer. Enter this value in Table 3-1.

3.1.2.5 *Calculation of potential to release factor value.* Sum the factor values for net precipitation, depth to aquifer, and travel time, and multiply this sum by the factor value for containment. Assign this product as the potential to release factor value for the aquifer. Enter this value in Table 3-1.

3.1.3 *Calculation of likelihood of release factor category value.* If an observed release is established for an aquifer, assign the observed release factor value of 550 as the likelihood of release factor category value for that aquifer. Otherwise, assign the potential to release factor value for that aquifer as the likelihood of release value. Enter the value assigned in Table 3-1.

3.2 *Waste characteristics.* Evaluate the waste characteristics factor category for an aquifer based on two factors: toxicity/mobility and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to ground water. Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to ground water.
- All hazardous substances associated with a source that has a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

3.2.1 *Toxicity/mobility.* For each hazardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified in the following sections. Select the toxicity/mobility factor value for the aquifer being evaluated as specified in section 3.2.1.3.

3.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in Section 2.4.1.1.

3.2.1.2 *Mobility.* Assign a mobility factor value to each hazardous substance for the aquifer being evaluated as follows:

- For any hazardous substance that meets the criteria for an observed release by chemical analysis to one or more aquifers underlying the sources at the site, regardless of the aquifer being evaluated, assign a mobility factor value of 1.
- For any hazardous substance that does not meet the criteria for an observed release by chemical analysis to at least one of the aquifers, assign that hazardous substance a mobility factor value from Table 3-8 for the aquifer being evaluated, based on its water solubility and distribution coefficient (K_d).
- If the hazardous substance cannot be assigned a mobility factor value because data on its water solubility or distribution coefficient are not available, use other hazardous substances for which information is available in evaluating the pathway.

TABLE 3-8.—GROUND WATER MOBILITY FACTOR VALUES [a]

Water solubility (mg/l)	Distribution coefficient (K_d) (ml/g)			
	Karst [c]	≤10	>10 to 1,000	>1,000
Present as liquid [b]	1	1	0.01	0.0001
Greater than 100	1	1	0.01	0.0001
Greater than 1 to 100	0.2	0.2	0.002	2×10^{-5}
Greater than 0.01 to 1	0.002	0.002	2×10^{-5}	2×10^{-7}
Less than or equal to 0.01	2×10^{-6}	2×10^{-6}	2×10^{-7}	2×10^{-8}

[a] Do not round to nearest integer.

[b] Use if the hazardous substance is present or deposited as a liquid.

[c] Use if the entire interval from the source to the aquifer being evaluated is karst.

4.1.4.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.1.2.2.2 for the drinking water threat. Enter this value in Table 4–1.

4.1.4.2.3 *Calculation of environmental threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.1.4.2.1.4, use its ecosystem toxicity/persistence factor value and ecosystem bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the ecosystem toxicity/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^8. Then multiply this product by the ecosystem bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12}. Based on this second product, assign a value from Table 2–7 (section 2.4.3.1) to the environmental threat-waste characteristics factor category for the watershed. Enter this value in Table 4–1.

TABLE 4–22.—ECOLOGICAL-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN SURFACE WATER

- Concentration corresponding to EPA Ambient Water Quality Criteria (AWQC) for protection of aquatic life (fresh water or marine).
- Concentration corresponding to EPA Ambient Aquatic Life Advisory Concentrations (AALAC).
- Select the appropriate AWQC and AALAC as follows:
  - Use chronic value, if available; otherwise use acute value.
  - If the sensitive environment being evaluated is in fresh water, use fresh water value, except: if no fresh water value is available, use marine value if available.
  - If the sensitive environment being evaluated is in salt water, use marine value, except: if no marine value is available, use fresh water value if available.
  - If the sensitive environment being evaluated is in both fresh water and salt water, or is in brackish water, use lower of fresh water or marine values.

TABLE 4–23.—SENSITIVE ENVIRONMENTS RATING VALUES

Sensitive environment	Assigned value
Critical habitat [a] for Federal designated endangered or threatened species Marine Sanctuary National Park Designated Federal Wilderness Area Areas identified under Coastal Zone Management Act [b] Sensitive areas identified under National Estuary Program [c] or Near Coastal Waters Program [d] Critical areas identified under the Clean Lakes Program [e] National Monument [f] National Seashore Recreational Area National Lakeshore Recreational Area	100
Habitat known to be used by Federal designated or proposed endangered or threatened species National Preserve National or State Wildlife Refuge Unit of Coastal Barrier Resources System Coastal Barrier (undeveloped) Federal land designated for protection of natural ecosystems Administratively Proposed Federal Wilderness Area Spawning areas critical [g] for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time Terrestrial areas utilized for breeding by large or dense aggregations of animals [h] National river reach designated as Recreational	75
Habitat known to be used by State designated endangered or threatened species Habitat known to be used by species under review as to its Federal endangered or threatened status Coastal Barrier (partially developed) Federal designated Scenic or Wild River	50
State land designated for wildlife or game management State designated Scenic or Wild River State designated Natural Areas Particular areas, relatively small in size, important to maintenance of unique biotic communities	25
State designated areas for protection or maintenance of aquatic life [i]	5

[a] Critical habitat as defined in 50 CFR 424.02.
[b] Areas identified in State Coastal Zone Management plans as requiring protection because of ecological value.
[c] National Estuary Program study areas (subareas within estuaries) identified in Comprehensive Conservation and Management Plans as requiring protection because they support critical life stages of key estuarine species (Section 320 of Clean Water Act, as amended).
[d] Near Coastal Waters as defined in Sections 104(b)(3), 304(1), 319, and 320 of Clean Water Act, as amended.
[e] Clean Lakes Program critical areas (subareas within lakes, or in some cases entire small lakes) identified by State Clean Lake Plans as critical habitat (Section 314 of Clean Water Act, as amended).
[f] Use only for air migration pathway.
[g] Limit to areas described as being used for intense or concentrated spawning by a given species.
[h] For the air migration pathway, limit to terrestrial vertebrate species. For the surface water migration pathway, limit to terrestrial vertebrate species with aquatic or semiaquatic foraging habits.
[i] Areas designated under Section 305(a) of Clean Water Act, as amended.

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 24, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Municipal Drinking Water Supplies
within the Study Area.

SFP telephoned Mr. John Goolsby, Hendersonville Engineering Department (704-692-4228) on 2/17/94. He confirmed that no surface water intakes for public water supply are present on Mud Creek or on French Broad Creek within 15 miles downstream of the site. Their system's 3 intakes are located on the North Fork of Mills River, a tributary to French Broad River located upstream of Mud Creek (See also Ref. 24).

For confirmation/redocumentation of water line coverage for the groundwater population count, SFP visited F. R. Hayes' office in Hendersonville on 4/5/94, wherupon Hayes delineated the current service coverage on a field map.

SFP telephoned James Adams, Asst. Regional Engineer, Asheville Regional Office, NC Water Supply Division (704-669-3361) on 5/23/94. He confirmed that no surface water intakes for public water supply are present on Mud Creek or French Broad Creek within the 15-mi. surface water pathway, and that no municipal wells exist within 4 mi. of the site. He noted, however, that a proposed (but controversial) Asheville intake may be constructed on French Broad just downstream of the Blue Ridge Parkway crossing, 12 miles downstream of the site.

HENDERSON

DIVISION OF HEALTH SERVICES - ENVIRONMENTAL HEALTH SECTION - WATER SUPPLY BRANCH
* * * PUBLIC WATER SUPPLY DATA SHEET * * *ONLY SURFACE SOURCE

DATE OF RUN 05/16/90

NC INVENTORY DOCUMENT (PWSI.410) AS OF MAY 90

PWSI-ID RE-CO-SEQ	DATA LINE CODE				
01-45-010	03	NAME OF PUBLIC WATER SYSTEM HENDERSONVILLE WTR TRTMT PLT	RESPONSIBLE PERSON ADDRESS PO BOX 1760		
	04	RESPONSIBLE PERSON CITY HENDERSONVILLE	STATE NC	ZIP CODE 28739	PHONE-AREA CODE/NUMBER 704-891-7779
	17	RESPONSIBLE PERSON NAME SUPERINTENDENT WA & SEW DPT	LOCATION OF PUBLIC WATER SUPPLY NC-191 AT NC-280		UPDATE CODE C
	01	OWNERS NAME CITY OF HENDERSONVILLE	OWNERS STREET ADDRESS PO BOX 1760		
	02	OWNERS CITY HENDERSONVILLE	STATE NC	ZIP CODE 28739	OWNER TYPE C

05 CITY OR COMMUNITY SERVED — COUNTY CODE — IND RES — SERVICE AREA CHARACTERISTICS

CITY OR COMMUNITY SERVED	COUNTY CODE	IND RES	RES	COT	REC	MOH	INS	SCH	MOT	RET	SST	CAG	PIC	LOG	MRR	SKI	BAT	VIS	HWY	AIR	OTHER
HENDERSONVILLE	045	000	1																		

06 NO. CONSECUTIVE PURCHASING	INTERSTATE CARRIERS	PWS TYPE	POPULATION SERVED	NO. SERVICE CONNECTIONS	NUMBER METERS	CONSECUTIVE INDICATOR
00	N	C	000038500	0013000	0010500	0

07 AVERAGE PRODUCTION GAL/DAY	DESIGN GAL/DAY	EMERGENCY GAL/DAY	STORAGE CAPACITY/GALS.	MAXIMUM PRODUCTION GAL/DAY
0006500000	0009000000	0000000000	0011710000	0009000000

08 PWS BEGIN	LAST SURVEY DATE	BACTI AND TURBIDITY COMPLIANCE CYCLE	ACTIVITY INDICATOR	DEACTIVATION DATE	REASON	ACTIVITY DATE
06/77	12/21/87	01	A	00/00/00		032888

09 POST CODE	REG BY	STATE REG	STATE DIS	BACTI FLAG	MONTHLY MONITOR	NUMBER SAMPLES	SEASON BEGIN	SEASON END	DAILY CHECKS	SAMPLE FREQ	MCL CK SAMPLE	CHLORINE P P M	TURBIDITY FLAG	TURBIDITY UNITS
NC	B	01		L	Y	000	00/00	00/00	1	000	2	00	L	1.4

16 - - - - - - - - - SOURCE - - - - - - - -

NO.	NAME	CODE	NUMBER WELLS	AVL	RIVER BASIN	LATITUDE DEG	MIN	SEC	LONGITUDE DEG	MIN	SEC	PWSI-ID OF SELLER	WATER TREATMENTS 6	7	8	9	0	1	2	3	4	5	6	7	8
01	MILLS RIVER	S	00	P	0005	035	23	31	082	34	04	- -	Y	O	S	O	P		C					G	
02	PINK BEDS	S		P	0005	035	25	10	082	40	31	- -													

Ref. 24

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 24, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Groundwater Population Count

For confirmation/redocumentation of water line coverage for the groundwater population count, SFP visited F. R. Hayes' office in Hendersonville on 4/5/94, wherupon Hayes delineated the current service coverage on a field map.

Using USGS topographic maps (Ref. 1) and the description of current supply line coverage, SFP performed a population count to identify the population likely to use groundwater within a 4-mile radius of the site. Individual houses located within a 4-mile radius of the site but outside the water distribution network were counted on USGS quadrangles and summarized for distance increments to 0.25, 0.5, 1, 2, 3, and 4 miles. In an approximately 1 square mile area west of the Brightwater community (3.5-4 mi. SSW of the site) approximately 30 % of houses were reportedly connected to the municipal system, and the house count was adjusted accordingly.

The house counts for each distance increment were multiplied by the applicable 1990 Census average household population (Ref. 27). The population density reported for Hendersonville is 2.25 persons per household, however, a population density of 2.45 persons per household was reported for Mountain Home, which is closer to the site. The higher figure of 2.45 was used in the population estimate. The population drinking from private domestic wells within 4 mi. of the site numbers approximately 4508.

(next page)

SFP screened community water supply well listings in the NC Environmental Health Division database. Twelve community wells, with populations totalling 1707 people, were identified and confirmed within a 4-mile radius of the site (Ref. 26).

The resulting groundwater population count, tabulated according to distance increments, is as follows:

Distance (miles)	Number of Houses	Population	Community Well Population	Total Groundwater Population
0-0.25	2	5	0	5
0.25-0.5	14	34	0	34
0.5-1.0	80	196	0	196
1.0-2.0	574	1406	488	1894
2.0-3.0	404	990	97	1087
3.0-4.0	766	1877	1122	2999
Total:	1840	4508	1707	6215

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: June 30, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Community Water Well Database

SFP contacted Martha Moore, NC DEHNR, Division of Environmental Health (919-715-3243) on 4/28/94 to request a printout of public water supply database for the study area. SFP relayed the following boundary coordinates:

North	35°27'
South	35°19'30"
East	82°25'30"
West	82°35'

SFP reviewed the printout of the Public Water Supply Database, identifying entries whose reported geographic coordinates fell within a 4-mile radius of the site. In most cases these locations corresponded with identifiable features on US TVA/GS topographic maps of the study area. Where possible, data points not readily identifiable on the maps were confirmed by telephone.

A total of 12 water-supply wells, associated with housing subdivisions, mobile home parks, schools, rest homes, and an athletic camp, were identified within the 4-mile radius of the site. Based on the reported well locations (Ref. 1; Fig. 1), the population distribution is as follows:

Distance (mi)	Community Well Population
0-0.25	0
0.25-0.5	0
0.5-1.0	0
1.0-2.0	488
2.0-3.0	97
3.0-4.0	1122
Total:	1707

FMMGRID STATE N.C. PUBLIC WATER SUPPLY SYSTEM 04/28/94
ACTIVE SYSTEMS
GRID LATITUDE: 351930 / 352700, LONGITUDE: 0822530 / 0823500

	PWS ID	SYSTEM NAME	TYPE	POPULATION	RES.PERSON WORK PHONE	SOURCE NAME	SOURCE TYPE	SOURCE AVAIL.	LATITUDE	LONGITUDE
	111135	HOMESTEAD MOBILE VILLAGE	C	77		WELL #1	G	P	352650	823050
	111481	WORDS OF LIFE TABERNACLE CH	N	90	7046845570	WELL	G	P	352640	823430
	145010	HENDERSONVILLE, CITY OF	C	45400	7048917779	MILLS RIVER	S	P	352331	823404
	145030	LAUREL PARK, TOWN OF	C	2000	7046927568	HENDERSONVILLE	P	P	352331	823404
1	145105	BRIGHTWATER I & II	C	224	7048914742	WELL SUPPLY	G	P	352030	823115
		BRIGHTWATER I & II	C	224	7048914742	WELL SUPPLY	G	P	352030	823115
2	145113	FLETCHER ACADEMY INC	C	400	7046848501	WELL	G	P	352350	822905
		FLETCHER ACADEMY INC	C	400	7046848501	WELL	G	P	352350	822905
		FLETCHER ACADEMY INC	C	400	7046848501	WELL	G	P	352350	822905
		FLETCHER ACADEMY INC	C	400	7046848501	WELL	G	P	352350	822905
	145127	HOOPERS CREEK WTR SYSTEM	C	195	7042749468	HENDERSONVILLE	P	P	352330	823410
	145135	GRAHAMS MHP	C	50	7042985152	WELL	G	P	352615	823100
3	145138	GREEN ACRES COMM WTR SYSTEM	C	88	7046924668	WELL	G	P	351940	823030
	145140	HIGH VISTA ESTATES	C	250	7048913990	WELLS	G	P	352530	823500
		HIGH VISTA ESTATES	C	250	7048913990	WELLS	G	P	352530	823500
4	145145	TWIN OAKS MOBILE HOME PARK	C	35	7046845417	WELL	G	P	352555	822735
5	145146	BRIGHTWATER III	C	100	7048914742	WELL	G	P	352030	823115
	145149	FAIRFIELD APARTMENTS	C	110	7046842294	WELL	G	P	352400	823100
6	145157	HOLLY TREE S/D	C	42	7046936062	WELL	G	P	352200	822615
7	145164	ESTATES OF THE SALISBURY	C	72	8006271939	WELL #2	G	P	352251	822700
		ESTATES OF THE SALISBURY	C	72	8006271939	WELL #1	G	P	352251	822701
8	145166	CAROLINA ACRES MHP	C	25	7046924940	WELL #1	G	P	352125	822745
	145403	KANUGA CONFERENCE CENTER	C	375	7046929136	SPRING #2	G	P	352347	823457
	145420	MOUNTAIN VIEW REST HOME	C	44	7046929960	WELL	G	P	352300	822800
9	145421	HENDERSON'S REST HOME	C	50	7046922220	WELL	G	P	352235	822825
	145428	HORSESHOE REST	N	100	7048914000	WELL	G	P	352030	823310
	145430	JAKES DRIVING RANGE	N	75	7046848086	WELL	G	P	352300	823010
10	145441	LAMBS MHP	C	38	7046938889	WELL	G	P	352235	822830
		LAMBS MHP	C	38	7046938889	WELL	G	P	352235	822830
		LAMBS MHP	C	38	7046938889	WELL	G	P	352235	822830
	145443	SOUTH MILLS RIVER MHP	C	48	7048917257	WELL SUPPLY	G	P	352310	823350
	145455	CAMP HIGH LANDER	N	450		DRILLED WELL	G	P	352010	823340
	145457	CAMP SKY VALLEY	N	120		SPRING	G	P	352017	822915
	145460	FAIRFIELD TENNIS CAMP	N	75	7046870534	WELL	G	P	352410	823015
		FAIRFIELD TENNIS CAMP	N	75	7046870534	WELL	G	P	352410	823015
11	145461	NO CAROLINA ELKS CAMP	N	600		DRILLED WELL	G	P	352019	822843
12	145462	BREEZY ACRES SUB	N	33	7046842762	WELL	G	P	352620	822810
	145504	HENDERSON CO WEIGH STA--EBL	N	145	9197337872	WELL	G	P	352305	822910
	145505	HENDERSON CO WEIGH STA WBL	N	125	9197337872	WELL	G	P	352305	822910

RECEIVED
MAY - 2 1994

Economics and Statistics Administration
BUREAU OF THE CENSUS

Ref. 27

CENSUS '90

1990 Census of Population and Housing

Summary Population and Housing Characteristics

North Carolina

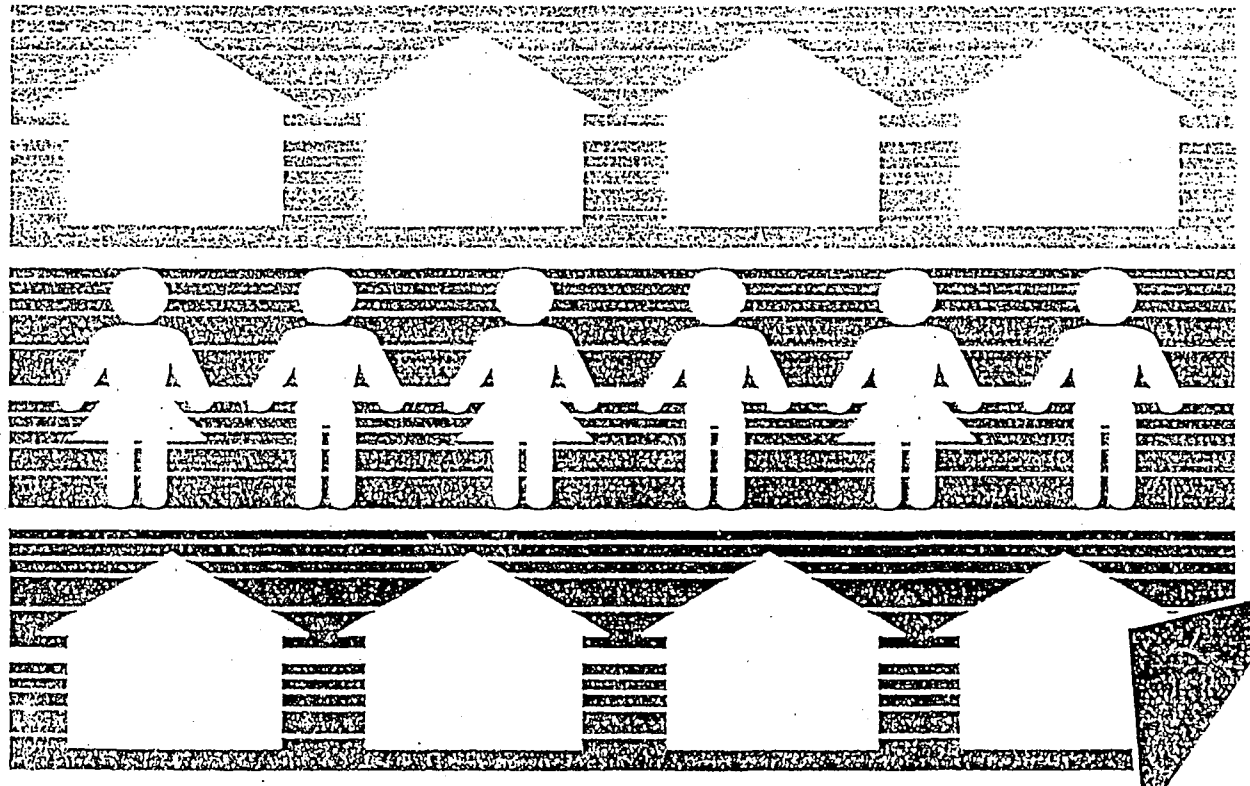


Table 5. Household, Family, and Group Quarters Characteristics: 1990—Con.

[For definitions of terms and meanings of symbols, see text]

State County County Subdivision Place	Persons in households	All households	Family households: Total	Family households: Married-couple family	Family households: Female householder, no husband present	Nonfamily households: Total	Nonfamily households: Householder living alone: Total	Nonfamily households: Householder living alone: 65 years and over: Total	Nonfamily households: Householder living alone: 65 years and over: Female	Persons per— Household	Persons per— Family	Persons in group quarters: Total	Persons in group quarters: Institutionalized persons	Persons in group quarters: Other persons in group quarters
Hornett County	65 340	25 150	18 529	14 489	3 154	6 621	5 773	2 438	1 962	2.60	3.06	2 482	1 240	1 2[illegible]
Anderson Creek township	9 435	3 435	2 647	2 163	380	788	569	100	83	2.75	3.10	–	–	
Averasboro township	12 813	5 108	3 610	2 616	843	1 498	1 388	682	561	2.51	3.06	288	238	[illegible]
Dunn city (pt.)	8 108	3 322	2 236	1 518	632	1 086	1 013	529	445	2.44	3.06	180	159	[illegible]
Erwin town (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
Barbecue township	3 712	1 403	1 081	884	139	322	293	115	85	2.65	3.05	–	–	
Black River township	5 239	2 034	1 503	1 165	255	531	469	176	142	2.58	3.01	36	31	
Angier town	2 230	901	637	449	154	264	236	97	86	2.48	2.98	5	–	
Buckhorn township	1 229	467	342	276	50	125	105	44	38	2.63	3.11	–	–	
Duke township	5 525	2 293	1 629	1 316	234	664	625	330	288	2.41	2.93	7	3	
Dunn city (pt.)	48	21	16	13	2	5	5	3	2	2.29	2.69	–	–	
Erwin town (pt.)	4 054	1 747	1 188	950	181	559	526	292	235	2.32	2.87	7	3	
Grove township	7 378	2 832	2 101	1 741	263	731	616	273	213	2.61	3.05	–	–	
Coats town	1 493	636	411	323	70	225	182	103	86	2.35	2.92	–	–	
Hectors Creek township	1 926	743	574	496	55	169	150	65	53	2.59	2.98	46	46	
Johnsonville township	2 986	1 072	847	659	143	225	198	69	49	2.79	3.16	–	–	
Lillington township	3 320	1 370	917	614	259	453	398	190	161	2.42	3.01	655	655	
Lillington town (pt.)	1 400	636	387	260	111	249	226	129	115	2.22	2.89	648	648	
Neills Creek township	3 357	1 368	944	787	112	424	360	126	100	2.45	2.96	1 538	176	1 [illegible]
Buies Creek CDP	933	427	234	194	29	193	154	43	37	2.19	2.87	1 152	–	1 [illegible]
Lillington town (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
Stewarts Creek township	3 024	1 028	802	569	184	226	201	90	69	2.94	3.42	3	–	
Upper Little River township	5 396	1 997	1 532	1 203	237	465	411	178	140	2.70	3.13	109	91	
Broadway town (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
Lillington town (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
Haywood County	46 152	19 211	14 120	11 831	1 774	5 091	4 601	2 337	1 884	2.40	2.83	790	751	
Beaverdam township	10 290	4 355	3 126	2 652	370	1 229	1 139	651	542	2.35	2.84	107	107	
Canton town	3 683	1 715	1 102	886	174	613	577	349	307	2.15	2.71	107	107	
West Canton CDP (pt.)	1 105	443	339	284	46	104	102	53	48	2.49	2.91	–	–	
Cataloochee township	41	18	11	11	–	7	7	4	4	2.28	3.09	–	–	
Cecil township	400	147	118	97	15	29	24	11	9	2.72	3.08	–	–	
Clyde township	5 118	2 078	1 545	1 319	178	533	467	182	132	2.46	2.89	100	100	
Clyde town	993	431	296	247	41	135	121	50	42	2.30	2.82	48	48	
Lake Junaluska CDP (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
West Canton CDP (pt.)	14	7	6	3	3	1	1	–	–	2.00	2.17	–	–	
Crabtree township	1 088	426	357	314	29	69	63	31	33	2.55	2.82	–	–	
East Fork township	1 302	521	413	356	46	108	101	54	39	2.50	2.85	109	109	
Fines Creek township	839	326	264	231	22	62	55	27	14	2.57	2.87	–	–	
Iron Duff township	825	331	262	236	15	69	57	20	18	2.49	2.79	–	–	
Ivy Hill township	3 122	1 388	1 007	862	108	381	326	158	113	2.25	2.65	15	–	
Lake Junaluska CDP (pt.)	148	63	51	44	7	12	12	6	5	2.35	2.67	–	–	
Maggie Valley town (pt.)	185	89	62	52	9	27	22	10	7	2.08	2.47	–	–	
Jonathan Creek township	1 515	589	443	369	49	146	128	49	26	2.57	2.95	22	–	[illegible]
Maggie Valley town (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
Pigeon township	4 234	1 649	1 316	1 145	126	333	307	144	134	2.57	2.91	26	26	
Waynesville township	17 073	7 270	5 164	4 160	807	2 106	1 900	1 001	827	2.35	2.81	411	409	
Hazelwood town	1 596	701	465	347	96	236	214	125	105	2.28	2.79	82	82	
Lake Junaluska CDP (pt.)	2 334	1 033	734	628	82	299	266	138	106	2.26	2.69	–	–	
Waynesville town	6 579	2 898	1 934	1 473	386	964	874	491	412	2.27	2.79	179	177	
White Oak township	305	113	94	75	9	19	17	5	3	2.70	2.77	–	–	
Henderson County	65 206	28 709	21 169	18 113	2 344	7 540	6 638	3 531	2 659	2.41	[illegible]	1 079	947	1[illegible]
Blue Ridge township	5 805	2 302	1 779	1 541	169	523	465	242	197	2.52	2.85	–	–	
East Flat Rock CDP (pt.)	48	21	14	9	2	7	7	1	–	2.29	2.77	–	–	
Clear Creek township	3 057	1 235	916	752	116	319	292	139	116	2.45	2.91	26	36	
Crab Creek township	2 760	1 067	845	744	71	222	189	82	53	2.59	2.91	70	70	
Valley Hill CDP (pt.)	–	–	–	–	–	–	–	–	–	–	–	–	–	
Edneyville township	2 427	952	714	616	60	238	212	103	83	2.54	2.96	–	–	
Green River township	3 137	1 159	956	854	75	203	180	97	61	2.71	3.03	–	–	
Saluda city (pt.)	3	2	1	1	–	1	1	–	–	1.50	2.00	–	–	
Hendersonville township	35 468	15 778	11 132	9 407	1 375	4 646	4 274	2 383	1 959	2.25	2.70	844	743	
Balfour CDP	1 118	494	344	280	51	150	132	55	47	2.26	2.72	–	–	
Barker Heights CDP	1 137	468	345	248	84	123	107	47	33	2.43	2.63	–	–	
East Flat Rock CDP (pt.)	3 170	1 363	948	731	161	415	380	156	127	2.33	2.83	–	–	
Hendersonville city	6 867	3 192	1 904	1 344	467	1 288	1 186	677	554	2.15	2.82	417	218	
Laurel Park town	1 322	628	450	422	23	178	167	106	89	2.11	2.50	–	–	
Mountain Home CDP	1 898	774	595	503	72	179	158	74	55	2.45	2.82	–	–	
Valley Hill CDP (pt.)	1 784	760	540	445	73	220	201	95	81	2.35	2.82	18	18	
Hoopers Creek township	7 380	2 996	2 236	1 895	264	758	665	263	222	2.46	2.87	129	116	
Fletcher town	2 787	1 135	846	710	110	289	252	88	77	2.46	2.87	–	–	
Mills River township	8 177	3 220	2 589	2 304	214	631	561	232	185	2.54	2.88	–	–	
Etowah CDP	1 997	852	637	574	52	216	195	82	67	2.34	2.74	–	–	
Hertford County	21 612	8 150	5 921	4 164	473	2 229	2 042	977	766	2.65	[illegible]	911	277	6
Ahoskie township	8 133	3 178	2 218	1 572	363	960	872	424	332	2.56	[illegible]	228	225	
Ahoskie town	4 258	1 769	1 164	770	256	605	574	272	229	2.41	3.07	133	[illegible]	
Harrellsville township	1 317	504	351	264	72	153	141	47	50	2.61	3.22	18	–	
Harrellsville town	106	44	32	28	4	12	12	[illegible]	6	2.41	2.91	–	–	
Maneys Neck township	1 460	520	402	264	111	118	107	49	35	2.81	3.25	24	12	
Como town	71	31	21	17	4	10	9	5	5	2.29	2.86	–	–	
Murfreesboro township	5 264	1 981	1 462	998	386	519	476	253	190	2.66	3.15	616	25	5
Murfreesboro town	1 993	854	588	452	117	266	247	125	126	2.33	2.87	587	4	5
St. Johns township	2 563	908	704	531	132	204	196	103	86	2.82	3.27	–	–	
Winton township	2 875	1 059	784	535	209	275	252	116	75	2.71	3.24	25	17	
Cofield village	407	150	105	58	35	45	38	23	11	2.71	3.25	–	–	
Winton town	771	302	218	141	69	84	78	34	28	2.55	3.10	25	17	
Hoke County	21 612	7 405	5 794	3 847	1 605	1 611	1 419	523	420	2.92	3.24	1 244	1 244	
Allendale township	358	106	84	61	22	22	20	[illegible]	7	3.38	3.90	–	–	
Antioch township	2 912	929	751	427	266	178	156	71	60	3.13	3.49	–	–	
Blue Springs township	1 172	367	304	204	72	63	56	15	11	3.19	3.55	–	–	
Fort Bragg Military Reservation township	–	–	–	–	–	–	–	–	–	–	–	–	–	
McLauchlin township	4 096	1 447	1 146	858	226	301	261	85	44	2.83	3.20	–	–	
Quewhiffle township	2 460	866	682	507	137	184	159	55	41	2.84	3.24	1 087	1 087	
Raeford township	9 099	3 179	2 429	1 487	813	750	674	280	231	2.86	3.34	157	157	
Raeford city	3 312	1 250	942	641	271	308	281	149	131	2.55	3.13	157	157	
Silver City CDP	1 343	434	327	151	154	107	97	46	34	3.09	3.68	–	–	
Stonewall township	1 515	511	398	303	75	113	100	32	26	2.96	3.41	–	–	

Ref. 28

U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 83-211

DRAINAGE AREAS OF SELECTED SITES ON STREAMS IN NORTH CAROLINA

Prepared in cooperation with the

North Carolina Department of Natural

Resources and Community Development

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DRAINAGE AREAS OF SELECTED SITES ON STREAMS IN NORTH CAROLINA

By Robert L. Meikle

Open-File Report 83-211

Prepared in cooperation with the

NORTH CAROLINA DEPARTMENT OF NATURAL
RESOURCES AND COMMUNITY DEVELOPMENT

Raleigh, North Carolina
1983

STATION NUMBER	STATION NAME	DRAINAGE AREA (SQ MI)	SITE TYPE	LAT	LONG	QUAD NAME	COUNTY CODE
0344150000	LITTLE R NR PENROSE	41.4	01	351323	823807	BREVARD	175
0344151125	HART B NR LITTLE RIVER	1.49	20	351350	823832	BREVARD	175
0344151130	CRAB C HEADWATERS NR JETER MTN TERRACE	4.5	20	351423	823431	STANDINGSTONE MOUNTA	089
0344151135	LITTLE C AT MTH NR JETER MTN TERRACE	1.00	20	351421	823557	STANDINGSTONE MOUNTA	089
0344151145	SHOAL C AT MTH NR JETER MTN TERRACE	2.42	20	351406	823556	STANDINGSTONE MOUNTA	089
0344151150	CRAB C NR LITTLE RIVER	12.4	20	351427	823810	BREVARD	175
0344250000	LITTLE R AT CALHOUN	60.1	02	351516	823835	PISGAH FOREST	175
0344265200	FRENCH BROAD R AT PENROSE	231.	02	351616	823814	PISGAH FOREST	175
0344267150	GASH C AT MTH NR BLANTYRE	1.57	20	351746	823726	HORSE SHOE	175
0344300000	FRENCH BROAD R AT BLANTYRE	236.	01	351756	823726	HORSE SHOE	175
0344300950	BRYSON C AT MTH NR BLANTYRE	1.69	20	351814	823711	HORSE SHOE	089
0344301250	BLYTHE MILL C AT MTH NR BLANTYRE	1.80	20	351810	823659	HORSE SHOE	089
0344301755	FOLLEY C AT MTH NR BOWMAN BLUFF	1.83	20	351708	823541	HORSE SHOE	089
0344301805	L WILLOW C AT MTH NR ETOWAH	4.57	20	351748	823458	HORSE SHOE	089
0344325105	S F BIG WILLOW C AT HEADWATERS NR BOWMAN BLUFF	1.80	20	351653	823213	HORSE SHOE	089
0344325250	SENTELL C AT MTH NR BOWMAN BLUFF	2.31	20	351707	823248	HORSE SHOE	089
0344326575	N F BIG WILLOW C AT MTH NR BOWMAN BLUFF	2.68	20	351746	823320	HORSE SHOE	089
0344326585	BIG WILLOW C TRIB AT DAM NR BOWMAN BLUFF	0.47	20	351742	823351	HORSE SHOE	089
0344326600	BIG WILLOW C NR BLANTYRE	9.11	02	351754	823346	HORSE SHOE	089
0344330015	GASH C AT US 64 AT ETOWAH	1.14	20	351900	823600	HORSE SHOE	089
0344332510	GASH C AT MTH NR ETOWAH	2.41	20	351835	823420	HORSE SHOE	089
0344336800	FRENCH BROAD R AT US 64 NR ETOWAH	321.	11	351941	823432	HORSE SHOE	089
0344336675	BROCK C AT MTH NR HOLLY SPRINGS	0.80	20	352023	823510	HORSE SHOE	089
0344350000	FRENCH BROAD R AT HORSESHOE	326.	02	352041	823138	HORSE SHOE	089
0344352050	MARSTON C AT MTH NR HORSESHOE	0.66	20	352148	823156	HORSE SHOE	089
0344352250	MILL POND C AT MTH NR HORSESHOE	3.62	20	352208	823227	HORSE SHOE	089
0344376425	BRIGHTWATER B AT MTH NR BRIGHTWATER	0.93	20	351938	823114	HORSE SHOE	089
0344376500	SHAW C AT HORSESHOE	5.36	02	352035	823303	HORSE SHOE	089
0344376550	BATTLE C AT SRR AR MTH AT HORSESHOE	1.86	20	352034	823311	HORSE SHOE	089
0344385050	BOYLSTON C AT SR 1323 NR PISGAH FOREST	5.20	20	351926	823308	PISGAH FOREST	089
0344385120	SUTTON C NR PISGAH FOREST	1.56	20	351835	824002	PISGAH FOREST	175
0344385125	BOYLSTON C AT PISGAH FOREST	3.64	20	351850	823930	PISGAH FOREST	175
0344385150	BOYLSTON C AT SR 1316 NR HOLLY SPRINGS	11.5	20	352115	823529	HORSE SHOE	089
0344397155	SWEETWATER B AT MTH NR HOLLY SPRINGS	1.16	20	352200	823449	HORSE SHOE	089
0344400000	BOYLSTON C NR HORSESHOE	14.8	01	352210	823350	HORSE SHOE	089
0344411100	FRENCH BROAD R NR MILLS RIVER	355.	11	352227	823221	HORSE SHOE	089
0344449305	THOMPSON C HEADWATERS NR THE PINK BEDS	1.06	20	352253	824437	DUNSMORE MOUNTAIN	175
0344450000	S F MILLS R AT THE PINK BEDS	3.93	01	352159	824420	PISGAH FOREST	175
0344452750	S F MILLS R AT WOLF FORD	13.3	20	352029	824333	PISGAH FOREST	175
0344452350	S F MILLS R BL CANTRELL C NR PISGAH FOREST	12.6	20	352033	824141	PISGAH FOREST	175
0344475000	S F MILLS R NR PISGAH FOREST	21.3	02	352034	823951	PISGAH FOREST	175
0344480750	S F MILLS R NR VINEYARD GAP	22.7	20	352118	823835	PISGAH FOREST	089
0344495045	BRADLEY C HEADWATERS THE PINK BEDS	2.01	20	352258	824253	DUNSMORE MOUNTAIN	175
0344495059	SLATE ROCK C AT MTH NR MILLS RIVER	2.76	20	352304	824132	DUNSMORE MOUNTAIN	089
0344495075	BRADLEY C BL LONG B NR PISGAH FOREST	10.3	20	352153	823951	PISGAH FOREST	089
0344495150	BRADLEY C AT CONFLUENCE WITH S F MILLS R NR PISGAH	12.0	20	352113	823834	PISGAH FOREST	089
0344495200	QUEEN C HEADWATERS NR THE PINK BEDS	1.32	20	352242	823847	DUNSMORE MOUNTAIN	089
0344495300	QUEEN C NR PISGAH FOREST	1.79	20	352220	823831	PISGAH FOREST	089
0344501550	BIG C HEADWATERS NR MILLS RIVER	3.75	20	352512	824213	DUNSMORE MOUNTAIN	089
0344521050	FLETCHER C HEADWATERS NR MILLS RIVER	2.05	20	352603	824105	DUNSMORE MOUNTAIN	089
0344521320	S F MILLS R AT MTH NR MILLS RIVER	41.5	20	352332	823637	SKYLAND	089
0344525050	MIDDLE F AT MTH NR MILLS RIVER	1.69	20	352539	824050	DUNSMORE MOUNTAIN	089
0344525600	FLETCHERS C NR MILLS RIVER	4.35	02	352511	824036	DUNSMORE MOUNTAIN	089
0344525650	N F MILLS R AT DAM NR MILLS RIVER	10.5	20	352510	824032	DUNSMORE MOUNTAIN	089
0344525700	BAD F AT MTH NR MILLS RIVER	0.91	20	352555	823923	DUNSMORE MOUNTAIN	089
0344526500	WASH C AB BEAR B NR MILLS RIVER	2.84	20	352532	823911	DUNSMORE MOUNTAIN	089
0344526550	WASH C AT MTH NR MILLS RIVER	4.33	20	352437	823902	DUNSMORE MOUNTAIN	089
0344535500	ROCKY F AB MILLS RIVER	1.73	20	352422	823859	DUNSMORE MOUNTAIN	089
0344537600	N F MILLS R AB MILLS RIVER	16.8	20	352424	823858	DUNSMORE MOUNTAIN	089
0344537705	SENIARD C AT MTH NR MILLS RIVER	1.32	20	352433	823739	DUNSMORE MOUNTAIN	089
0344550000	N F MILLS R AT THE PINK BEDS	23.1	01	352338	823730	DUNSMORE MOUNTAIN	089
0344555000	N F MILLS R NR MILLS RIVER	24.0	11	352338	823700	SKYLAND	089
0344600000	MILLS R NR MILLS RIVER	66.7	01	352355	823542	SKYLAND	089
0344600880	FOSTER C AT MTH NR MILLS RIVER	2.16	20	352348	823458	SKYLAND	089
0344600989	BRANDY B AT MTH NR MILLS RIVER	0.63	20	352315	823324	SKYLAND	089
0344604350	L MUD C AT DAM NR LAUREL PARK	1.55	20	351545	823058	HORSE SHOE	089
0344604450	L MUD C AT WOLF LAKE DAM NR KANUGA PINES	2.61	20	351557	822948	MILTON (VA.)	089
0344604475	GREER C AT MTH NR KANUGA PINES	2.67	20	351552	822910	MILTON (VA.)	089
0344604510	MUD C NR KANUGA PINES	12.4	20	351628	822838	MILTON (VA.)	089
0344604550	MUD C TRIB AT MTH NR FLAT ROCK	1.15	20	351640	822808	MILTON (VA.)	089
0344607910	FINLEY C AT MTH AT VALLEY HILL	2.21	20	351732	822856	MILTON (VA.)	089
0344607950	SHEPHERD C AT DAM AT VALLEY HILL	4.65	20	351752	822823	MILTON (VA.)	089
0344608150	WASH C AT MTH AT HENDERSONVILLE	2.13	20	351829	822734	MILTON (VA.)	089
0344608275	MUD C AT SRR AT HENDERSONVILLE	23.3	20	351907	822706	MILTON (VA.)	089
0344610350	BAT F AT SRR NR E FLAT ROCK	0.64	20	351617	822453	MILTON (VA.)	089
0344610625	DUNN C AT MTH NR E FLAT ROCK	3.06	20	351735	822440	MILTON (VA.)	089
0344610850	MILL R AT MTH NR HENDERSONVILLE	73.8	20	352319	823156	SKYLAND	089
0344614555	BAT F AT SR 1779 NR BARKER HEIGHTS	6.22	20	351826	822547	MILTON (VA.)	089
0344616050	KING C AT US 25 NR FLAT ROCK	1.91	20	351520	822612	MILTON (VA.)	089
0344616066	KING C AT RHETT MILL DAM NR FLAT ROCK	3.68	20	351707	822623	MILTON (VA.)	089
0344616410	MEMINGER C AT MTH NR E FLAT ROCK	1.33	20	351710	822625	MILTON (VA.)	089
0344628775	KING C AT MTH NR BARKER HEIGHTS	7.58	20	351832	822601	MILTON (VA.)	089
0344632515	DEVILS F HEADWATERS NR DANA	1.92	20	351928	822340	MILTON (VA.)	089
0344632535	DEVILS F AT SR 1006 NR DANA	4.49	20	351920	822423	MILTON (VA.)	089
0344632553	DEVILS F AT I 26 NR HENDERSONVILLE	6.66	20	351924	822536	MILTON (VA.)	089

STATION NUMBER	STATION NAME	DRAINAGE AREA (SQ MI)	SITE TYPE	LAT	LONG	QUAD NAME	COUNTY CODE
0344632755	DEVILS F AT MTH NR HENDERSONVILLE	9.31	20	351935	822707	MILTON (VA.)	089
0344632850	MUD C AT SR 1503 NR BALFOUR	48.4	20	352003	822747	MILTON (VA.)	089
0344633260	BRITTON C AT SRR AT BALFOUR	3.18	20	352006	822808	MILTON (VA.)	089
0344636300	MUD C AT BALFOUR	52.2	11	352030	822804	MILTON (VA.)	089
0344638055	MUD C AB CLEAR C AT BALFOUR	52.7	20	352100	822747	MILTON (VA.)	089
0344640815	LAUREL F AT MTH NR EDNEYVILLE	2.71	20	352547	822012	BAT CAVE	089
0344640820	CLEAR C NR EDNEYVILLE	4.92	20	352546	822013	BAT CAVE	089
0344640825	COX C AT MTH NR CLEAR CREEK	2.83	20	352505	822132	BAT CAVE	089
0344640839	PUNCHEON CAMP C AT MTH AT CLEAR CREEK	1.68	20	352439	822202	BAT CAVE	089
0344640855	CLEAR C AT CLEAR CREEK	14.0	20	352411	822221	BAT CAVE	089
0344640870	MILL C AT MTH AT FRUITLAND	1.59	20	352322	822309	MILTON (VA.)	089
0344640901	KYLES C HEADWATERS NR FRUITLAND	0.80	20	352506	822420	MILTON (VA.)	089
0344640940	LANNING MILL C AT MTH NR FRUITLAND	1.13	20	352414	822429	MILTON (VA.)	089
0344640988	KYLES C AT MTH AT FRUITLAND	4.46	20	352305	822337	MILTON (VA.)	089
0344640996	HENDERSON C AT MTH NR FRUITLAND	4.10	20	352303	822339	MILTON (VA.)	089
0344641010	CLEAR C NR FRUITLAND	32.6	20	352248	822358	MILTON (VA.)	089
0344642075	CLEAR C AT FRUITLAND RD NR FRUITLAND	34.0	20	352232	822449	MILTON (VA.)	089
0344643086	HARPER C AT MTH NR FRUITLAND	2.25	20	352233	822459	MILTON (VA.)	089
0344649995	WOLFPEN C AT US 64 NR OAK HILL	2.04	20	352122	822530	MILTON (VA.)	089
0344650000	CLEAR C NR HENDERSONVILLE	42.2	01	352113	822640	MILTON (VA.)	089
0344654550	ALLEN B AT MTH NR BALFOUR	1.22	20	352056	822710	MILTON (VA.)	089
0344656555	CLEAR C AT I 26 AT BALFOUR	43.9	20	352057	822711	MILTON (VA.)	089
0344677000	FEATHERSTONE C NR HENDERSONVILLE	1.85	20	352308	822658	MILTON (VA.)	089
0344677105	FEATHERSTONE C AT I 26 NR MOUNTAIN HOME	4.12	20	352220	822824	MILTON (VA.)	089
0344696050	BYERS C AT MTH NR HENDERSONVILLE	2.90	20	352252	822353	MILTON (VA.)	089
0344700000	MUD C AT US 25 AT NAPLES	110.	20	352314	823013	SKYLAND	089
0344700250	MUD C AT MTH NR NAPLES	113.	20	352347	823139	SKYLAND	089
0344705000	BROAD R TRIB NR HENDERSONVILLE	1.49	20	352357	823202	SKYLAND	089
0344722910	CANE C HEADWATERS NR FAIRVIEW	2.22	20	353221	822131	BLACK MOUNTAIN	021
0344722925	ROCKY C HEADWATERS NR FAIRVIEW	1.82	20	353315	822219	BLACK MOUNTAIN	021
0344722950	ROCKY F C AT MTH NR FAIRVIEW	3.45	20	353233	822302	OTEEN	021
0344722975	CANE C AB GARREN C AT FAIRVIEW	8.64	20	353207	822334	OTEEN	021
0344722985	GARREN C HEADWATERS NR FAIRVIEW	2.69	20	353125	822148	BLACK MOUNTAIN	021
0344722995	GARREN C NR FAIRVIEW	4.12	20	353203	822325	OTEEN	021
0344722998	TRANTHAM C AT MTH NR FAIRVIEW	2.22	20	353221	822424	OTEEN	021
0344723000	CANE C AB FAIRVIEW	16.8	20	353212	822436	OTEEN	021
0344725600	CANE C AT US 74 AT FAIRVIEW	18.5	02	353102	822408	OTEEN	021
0344725650	REED C AT MTH NR FAIRVIEW	1.17	20	353208	822558	OTEEN	021
0344725675	ASHWORTH C HEADWATERS NR FAIRVIEW	3.25	20	353021	822228	BLACK MOUNTAIN	021
0344725725	ASHWORTH C AT MTH AT FAIRVIEW	6.91	20	353049	822351	OTEEN	021
0344725850	SHOAL C AT MTH NR FAIRVIEW	1.61	20	353011	822502	OTEEN	021
0344733401	BRUSH C HEADWATERS NR FAIRVIEW	2.27	20	352857	822356	FRUITLAND	021
0344733502	BRUSH C AT MTH NR FAIRVIEW	3.73	20	352350	822521	MILTON (VA.)	021
0344733510	GAP C HEADWATERS NR FAIRVIEW	3.67	20	353112	822612	OTEEN	021
0344733525	WEBB C AT MTH NR FAIRVIEW	1.96	20	353105	822615	OTEEN	021
0344733535	GAP C TRIB AT MTH NR FAIRVIEW	0.94	20	353012	822545	OTEEN	021
0344733552	CANE C NR FAIRVIEW	40.6	20	352946	822531	MILTON (VA.)	021
0344734000	CANE C AT BUSH C RD NR FAIRVIEW	42.7	20	352851	822606	MILTON (VA.)	021
0344735000	GRAVELLY C AT MTH NR FAIRVIEW	1.54	20	352831	822622	MILTON (VA.)	021
0344737000	TWEED C AT MTH NR LIMESTONE	1.31	20	352808	822715	MILTON (VA.)	021
0344741100	CANE C NR LIMESTONE	47.5	20	352752	822731	MILTON (VA.)	021
0344741125	MERRILL COVE C HEADWATERS NR FAIRVIEW	1.96	20	353034	822803	OTEEN	021
0344741150	MERRILL COVE C HEADWATERS NR LIMESTONE	3.42	20	352937	822830	MILTON (VA.)	021
0344741200	MERRILL COVE C AT MTH NR LIMESTONE	5.78	20	352734	822757	MILTON (VA.)	021
0344741210	ROBINSON C NR LIMESTONE	2.96	20	352904	822334	MILTON (VA.)	021
0344741600	ROBINSON C NR FLETCHER	5.47	02	352705	822845	MILTON (VA.)	021
0344743055	BENT C HEADWATERS NR CANDLER	2.28	20	352816	823841	DUNSMORE MOUNTAIN	021
0344744050	LAUREL B AT MTH NR CANDLER	1.13	20	352830	823826	DUNSMORE MOUNTAIN	021
0344744950	BENT C AB LAKE POWHATAN NR CANDLER	5.40	20	352903	823744	DUNSMORE MOUNTAIN	021
0344748618	PINNER C NR FLETCHER	1.42	20	352654	822358	MILTON (VA.)	021
0344750000	CANE C AT FLETCHER	63.1	01	352608	822922	MILTON (VA.)	089
0344752010	HOOPERS C AT DAM NR EDNEYVILLE	2.55	20	352745	822440	MILTON (VA.)	089
0344753011	HOOPERS C TRIB AT MTH NR GOODLUCK	1.77	20	352703	822516	MILTON (VA.)	089
0344754012	HOOPERS C NR GOODLUCK	6.33	20	352659	822543	MILTON (VA.)	089
0344755013	HOOPERS C AT CONFLUENCE WITH S F HOOPERS C NR HOOP	8.02	20	352613	822627	FRUITLAND	089
0344756014	S F HOOPERS C AT MTH NR GOODLUCK	1.88	20	352613	822627	FRUITLAND	089
0344757900	DUNCAN C AT MTH NR FLETCHER	2.04	20	352548	822747	MILTON (VA.)	089
0344758000	HOOPERS C NR FLETCHER	15.5	02	352554	822833	MILTON (VA.)	089
0344760000	HOOPERS C AT MTH NR FLETCHER	16.3	20	352538	822931	MILTON (VA.)	089
0344765601	CUSHION B AT MTH NR FLETCHER	0.89	20	352519	823007	SKYLAND	089
0344766600	CANE C AT US 25 AT FLETCHER	82.1	11	352519	823015	SKYLAND	089
0344766628	CANE C TRIB AT MTH NR FLETCHER	1.00	20	352506	823103	SKYLAND	089
0344766875	KIMSEY C I 26 NR FLETCHER	2.49	20	352513	823134	SKYLAND	089
0344766901	CANE C AT MTH NR FLETCHER	87.2	20	352443	823219	SKYLAND	089
0344767750	MCDOWELL C ON NC 191 FLETCHER	3.12	20	352500	823427	SKYLAND	089
0344767804	MCDOWELL C AT MTH NR FLETCHER	4.83	20	352531	823252	SKYLAND	089
0344768700	FRENCH BROAD R NR FLETCHER	640.	11	352543	823311	SKYLAND	089
0344770875	LINE C AT MTH NR FLETCHER	1.55	20	352638	823332	SKYLAND	021
0344774000	AVERY C HEADWATERS NR WEST HAVEN	3.14	20	352714	823624	SKYLAND	021
0344775000	AVERY C AT SR 3492 NR WEST HAVEN	4.85	20	352720	823542	SKYLAND	021
0344776000	AVERY C AT NC 191 NR WEST HAVEN	7.15	20	352707	823425	SKYLAND	021
0344776600	AVERY C AT MTH NR FLETCHER	8.60	02	352705	823325	SKYLAND	021
0344776625	FRENCH BROAD R NR FLETCHER	652.	20	352711	823300	SKYLAND	021
0344776675	FRENCH BROAD R TRIB AT MTH NR FLETCHER	0.74	20	352718	823249	SKYLAND	021
0344783400	POWELL C NR SKYLAND	4.96	02	352826	823311	SKYLAND	021

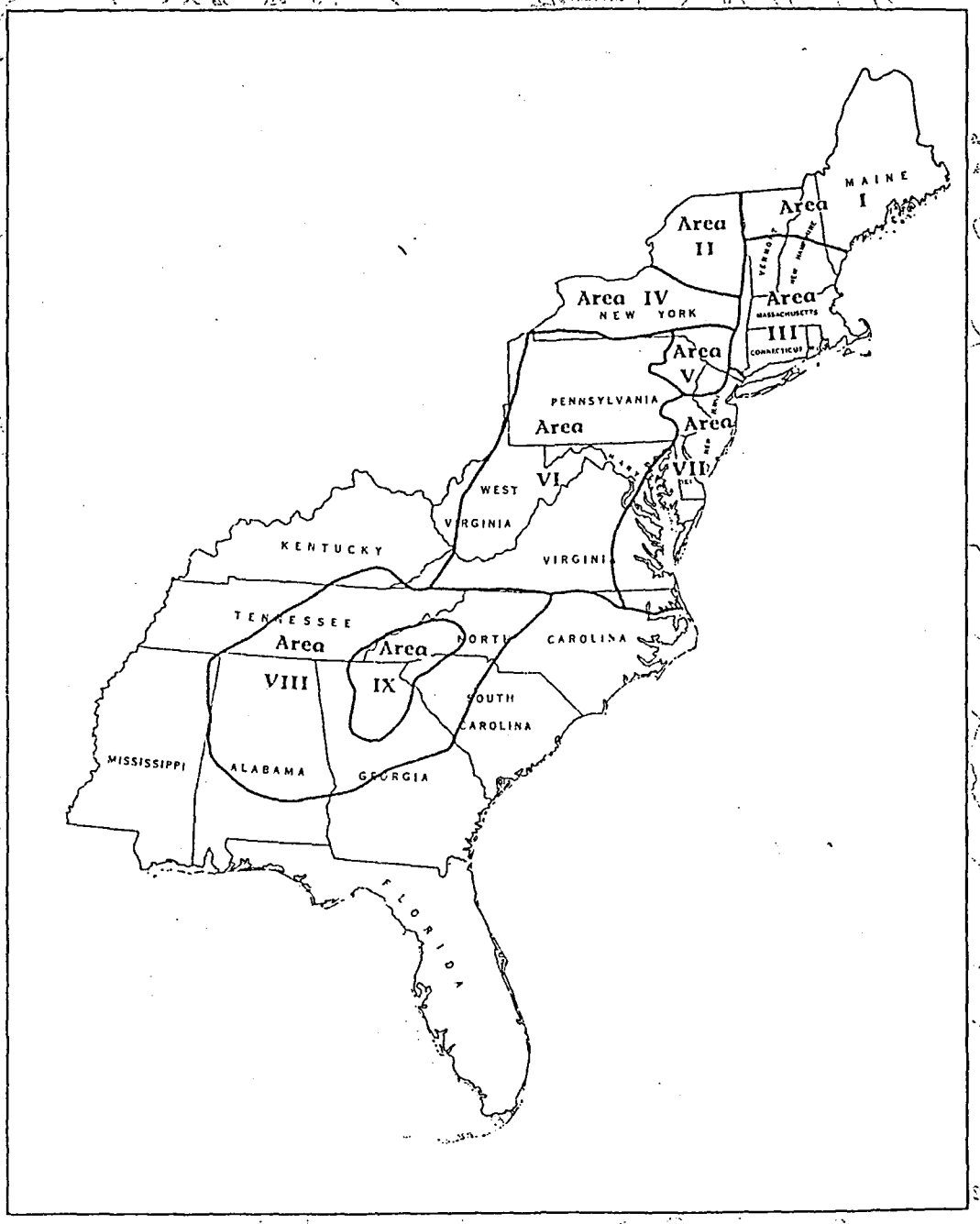
STATION NUMBER	STATION NAME	DRAINAGE AREA (SQ MI)	SITE TYPE	LAT	LONG	QUAD NAME	COUNTY CODE
0344784000	FRENCH BROAD R AT NC 280 NR SKYLAND	660.	20	352853	823328	SKYLAND	021
0344784500	DOCKER C AT MTH NR SKYLAND	0.96	20	352856	823330	SKYLAND	021
0344787000	CLAYTON C AT MTH NR WEST HAVEN	1.15	20	352923	823437	SKYLAND	021
0344787503	ASHLEY R AT MTH NR WEST HAVEN	1.05	20	352925	823457	SKYLAND	021
0344789305	BENT C AT DAM NR WEST HAVEN	5.80	20	352858	823727	SKYLAND	021
0344789500	BENT C NR WEST HAVEN	9.25	20	352928	823611	SKYLAND	021
0344790900	WESLEY C AT MTH NR VALLEY SPRINGS	1.10	20	353003	823622	ASHEVILLE	021
0344791700	BENT C AT BENT C	10.9	02	353006	823541	ASHEVILLE	021
0344800000	FRENCH BROAD R AT BENT C	676.	01	353007	823533	ASHEVILLE	021
0344800319	BORING MILL R AT NC 191 NR VENABLE	0.98	20	353042	823604	ASHEVILLE	021
0344806850	DINGLE C NR VALLEY SPRINGS	2.68	20	353020	823230	ASHEVILLE	021
0344806875	DINGLE C AT MTH NR VALLEY SPRINGS	4.19	20	353040	823403	ASHEVILLE	021
0344806910	FRENCH BROAD R NR VALLEY SPRINGS	686.	20	353115	823339	ASHEVILLE	021
0344806944	BROWN B AT MTH NR BUENA VISTA	0.68	20	353129	823243	ASHEVILLE	021
0344806955	FOURMILE B AT DAM NR BUENA VISTA	3.31	20	353152	823317	ASHEVILLE	021
0344810500	STONY F HEADWATERS NR STONY FORK	2.95	20	352734	824412	DUNSMORE MOUNTAIN	021
0344810585	LONG VALLEY B AT MTH NR VENABLE	1.95	20	353305	823512	ASHEVILLE	021
0344810600	FRENCH BROAD R AT FERRY NR W ASHEVILLE	695.	20	353308	823515	ASHEVILLE	021
0344812892	DUTCH COVE C HEADWATERS NR CANTON	2.38	20	352956	824814	CRUSO	087
0344812909	DUTCH COVE C AT SR 1854 NR CANTON	5.16	20	353045	824821	CANTON	087
0344812969	DUTCH COVE C AT MTH AT CANTON	6.64	20	353205	824912	CANTON	087
0344813100	N HOMINY C TRIB HEADWATERS NR CANTON	3.18	20	353402	824803	CANTON	087
0344813200	N HOMINY C 1.4 MI AB I-40 NR CANTON	2.01	20	353340	824806	CANTON	087
0344813600	N HOMINY C AT NC 19 NR CANTON	7.82	02	353208	824900	CANTON	087
0344813650	HOMINY C 1.1 MI BL N HOMINY C NR CANTON	15.9	20	353209	824748	CANTON	087
0344820110	HOMINY C AT COBURN	20.9	20	353159	824501	CANTON	021
0344820323	GEORGE B AT NC 19-23 NR LUTHER	1.72	20	353225	824506	CANTON	021
0344820350	HOMINY C AT SR 1141 AT LUTHER	23.3	20	353204	824413	ENKA	021
0344820375	HOMINY C TRIB AT MTH AT LUTHER	0.84	20	353159	824407	ENKA	021
0344820425	WEBB B AT I 40 NR JUGTOWN	2.64	20	353309	824340	ENKA	021
0344820475	WEBB B AT MTH NR CANDLER	3.25	20	353213	824256	ENKA	021
0344820800	HOMINY C NR LUTHER	29.4	03	353205	824249	ENKA	021
0344821000	HOMINY C AB S HOMINY C AT CANDLER	30.2	02	353208	824140	ENKA	021
0344825050	S HOMINY C HEADWATERS NR STONY FORK	2.30	20	352740	824600	CRUSO	021
0344825100	S HOMINY C NR SOUTH HARMONY	5.44	02	352827	824516	CRUSO	021
0344826100	STONY F NR STONY FORK	4.19	11	352804	824414	DUNSMORE MOUNTAIN	021
0344826205	STONY F AT MTH NR SOUTH HOMINY	5.12	20	352918	824435	DUNSMORE MOUNTAIN	021
0344826250	WARREN C HEADWATERS NR STONY FORK	2.68	20	352933	824535	CRUSO	021
0344827059	WARREN C AT MTH AT SOUTH HOMINY	3.78	20	352925	824426	DUNSMORE MOUNTAIN	021
0344827100	GLADY F HEADWATERS NR SOUTH HOMINY	1.66	20	352838	824312	DUNSMORE MOUNTAIN	021
0344827150	BALLARD C AT MTH NR STONY F	1.10	20	352838	824317	DUNSMORE MOUNTAIN	021
0344827200	S HOMINY C AT S HOMINY	16.3	02	352923	824414	DUNSMORE MOUNTAIN	021
0344827300	CURTIS C HEADWATERS NR TURNPIKE	1.98	20	353020	824505	CANTON	021
0344827400	CURTIS C AT MTH NR CANDLER	2.76	20	353040	824350	ENKA	021
0344831050	MORGAN B AT NC 112 NR CANDLER	1.32	20	353030	824340	ENKA	021
0344832935	S HOMINY C AT SR 3446 NR CANDLER	27.4	20	353005	824219	ENKA	021
0344833065	BEAVERDAM C HEADWATERS NR CANDLER	2.62	20	352831	824102	DUNSMORE MOUNTAIN	021
0344833081	BEAVERDAM C AT BEAVERDAM	6.17	20	352951	824113	DUNSMORE MOUNTAIN	021
0344834100	BEAVERDAM C AT ENKA LK RD NR CANDLER	7.65	20	353112	824115	ENKA	021
0344834105	BEAVERDAM C NR CANDLER	8.12	20	353154	824131	ENKA	021
0344841000	S HOMINY C AT CANDLER	38.3	02	353208	824133	ENKA	021
0344842801	FLAT C HEADWATERS NR MONTREAT	1.13	20	353334	821745	MONTREAT	021
0344843801	FLAT C AT MONTREAT	3.58	20	353837	821810	MONTREAT	021
0344844302	FLAT C AT SR 2517 NR MONTREAT	5.26	20	353752	821854	MONTREAT	021
0344846250	POLE C HEADWATERS AT POLE CREEK	3.76	20	353354	824221	ENKA	021
0344846275	BRYSON B AT MTH NR NEW CANDLER	1.56	20	353308	824152	ENKA	021
0344846325	L POLE C AT I 40 NR NEW CANDLER	2.34	20	353316	824107	ENKA	021
0344846350	YOUNG B AT MTH AT NEW CANDLER	0.57	20	353246	824100	ENKA	021
0344846400	POLE C AT HOMINY	9.58	02	353240	824056	ENKA	021
0344850000	HOMINY C AT CANDLER	79.8	01	353227	824035	ENKA	021
0344854030	BILL MOORE C HEADWATERS NR ENKA	3.10	20	353102	823908	ENKA	021
0344855780	BILL MOORE C AT MTH NR ENKA	6.09	20	353226	823929	ENKA	021
0344855800	HOMINY C AB ENKA PLANT NR CANDLER	86.9	03	353228	823924	ENKA	021
0344858535	MOORE C HEADWATERS NR ENKA	1.10	20	353353	824018	ENKA	021
0344858800	MOORE C AT ENKA	2.74	02	353258	823909	ENKA	021
0344861600	HOMINY C BL ENKA PLANT NR CANDLER	91.1	11	353241	823805	ENKA	021
0344867405	POND B AT MTH NR W ASHEVILLE	1.37	20	353255	823644	ASHEVILLE	021
0344875505	RAGSDALE C HEADWATERS NR ENKA	1.63	20	353432	823921	ENKA	021
0344875566	RAGSDALE C AT US 19 23 NR ENKA	3.22	20	353330	823829	ENKA	021
0344876500	RAGSDALE C AT MTH NR W ASHEVILLE	4.33	20	353326	823645	ASHEVILLE	021
0344876565	CANIF C AT MTH NR SULPHUR SPRINGS	1.94	20	353354	823638	ASHEVILLE	021
0344877125	HOMINY C TRIB AT MTH NR W ASHEVILLE	0.70	20	353347	823552	ASHEVILLE	021
0344878125	HOMINY C AT MTH AT ASHEVILLE	104.	20	353313	823523	ASHEVILLE	021
0344878425	MOORE B AT MTH AT W ASHEVILLE	0.63	20	353356	823425	ASHEVILLE	021
0344881801	SWANNANOA R AT US 70 NR BLACK MTN	0.87	20	353709	821655	BLACK MOUNTAIN	021
0344884800	FLAT C AT US 70 AT BLACK MTN	6.01	02	353711	821854	BLACK MOUNTAIN	021
0344889019	SWANNANOA R AT NC 9 AT BLACK MTN	11.2	20	353645	821913	BLACK MOUNTAIN	021
0344889040	CAMP B AT MTH NR BLACK MTN	3.00	20	353618	821925	BLACK MOUNTAIN	021
0344889060	TOMAHAWK B AT MTH NR BLACK MTN	1.99	20	353631	822007	BLACK MOUNTAIN	021
0344889080	WOLFPIT B AT MTH NR BLACK MTN	1.74	20	353628	822030	BLACK MOUNTAIN	021
0344891000	SWANNANOA R AT US 70 AT GROVESTONE	21.2	02	353611	822155	BLACK MOUNTAIN	021
0344891035	N F SWANNANOA R AT MTH NR GROVESTONE	31.5	20	353617	822206	BLACK MOUNTAIN	021
0344892126	SWANNANOA R TRIB AT MTH NR SWANNANOA	1.21	20	353611	822308	OTEEN	021
0344894035	N F SWANNANOA R HEADWATERS NR BULLHEAD MOUNTAIN	5.12	20	354233	821951	MONTREAT	021
0344894050	LEFT F AT MTH NR BULLHEAD MOUNTAIN	1.89	20	354210	821948	MONTREAT	021

U.S. Geological Survey

Water-Resources Investigations Report 88-4094

Ref. 29

MAP OF MEAN ANNUAL RUNOFF FOR THE NORTHEASTERN, SOUTHEASTERN, AND MID-ATLANTIC UNITED STATES, WATER YEARS 1951-80



Prepared in cooperation with the
U.S. Environmental Protection Agency

MAP OF MEAN ANNUAL RUNOFF FOR THE NORTHEASTERN, SOUTHEASTERN, AND MID-ATLANTIC UNITED STATES, WATER YEARS 1951–80

By
William R. Krug, Warren A. Gebert, David J. Graczyk, U.S. Geological Survey;
Donald L. Stevens, Jr., Eastern Oregon State College;
Barry P. Rochelle, Northrop Services, Inc.;
and M. Robbins Church, U.S. Environmental Protection Agency

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 88–4094

Prepared in cooperation with the
U.S. ENVIRONMENTAL PROTECTION AGENCY

Madison, Wisconsin
1990

sions that the methods that used the area-weighted average of the drainage area or the centroid of the drainage area produced somewhat better correlations—that is, the interecept was closer to zero, the standard errors were small, and the correlation coefficients were larger. These methods have slightly greater power to predict actual runoff

Additional statistical investigation found no significant differences in reliability of the runoff estimates among the areas. No significant differences existed in the errors for stations with drainage areas of differing size.

USE OF MEAN ANNUAL RUNOFF MAP

Mean annual runoff for a site can be estimated from the runoff map by several methods. The simplest method of estimating the runoff is to locate the site on the runoff map and to identify the runoff contour nearest the site. This method, however, is less accurate than other methods. The most accurate method is to draw the drainage basin on the runoff map, and use the runoff contours to divide the basin into bands of differing runoff. The area of each of the bands within the drainage basin is then determined. The areas of the separate bands are then used to compute a weighted average runoff for the basin. For example, if 50 percent of the basin is in an area of 18 in/yr (inches per year) of runoff, 30 percent in an area of 20 in/yr of runoff and 20 percent in an area of 22 in/yr of runoff the mean annual runoff would be calculated as follows:

$$0.5 \times 18 + 0.3 \times 20 + 0.2 \times 22 = 19.4$$

Runoff estimated from the map is in inches per year, averaged over the entire drainage basin. Multiply this value by the drainage area, in square miles, and divide by 13.58 to convert to mean annual discharge, in cubic feet per second. In the above example, assume the drainage area of the site is 100 mi^2. The mean annual discharge, in cubic feet per second, would be:

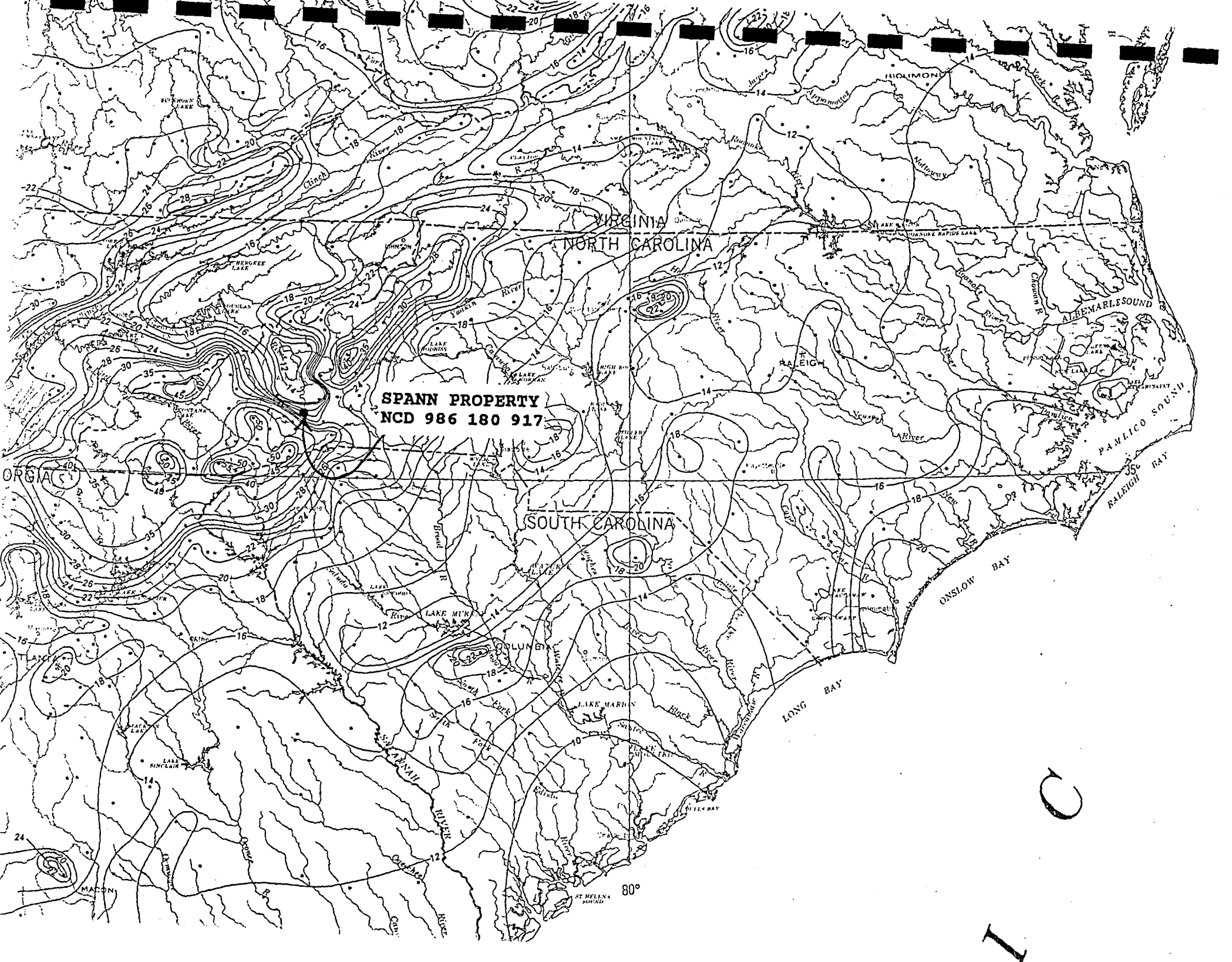
$$19.4 \times 100/13.58 = 143$$

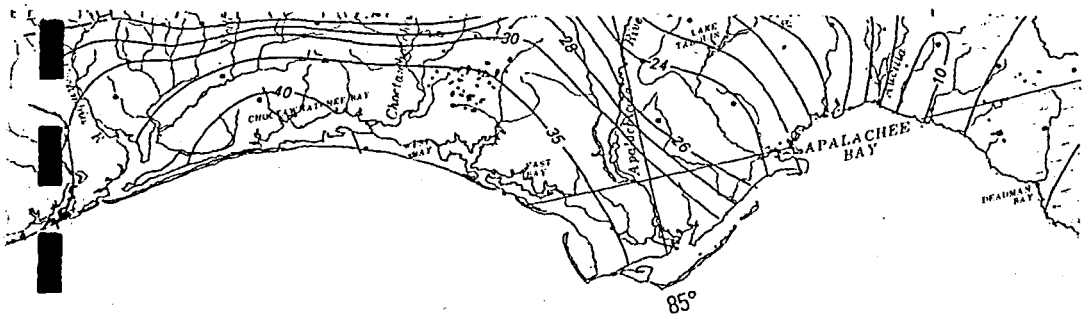
The runoff map was prepared to allow estimation of mean annual runoff at sites where no streamflow data are available. The map represents mean annual runoff for areas with natural land cover. Caution should be used in applying the map to estimate runoff for areas that are not natural land areas. The runoff map should not be used for areas, such as large urban areas, where the land cover has been altered in ways that would change the amount of runoff. The runoff map is not applicable for lakes or bays, for coastal wetlands affected by tides, for streams controlled by reservoirs large enough to influence the total annual streamflow, or for streams with substantial diversions.

Local features could cause the runoff at a particular site to differ substantially from the runoff indicated by the runoff map. The geology of the drainage basin might cause substantial amounts of water to enter or leave the basin as ground water. This could substantially increase or decrease the runoff. For example, a stream with a small drainage area that includes a large spring probably would have higher average streamflow than indicated by the runoff map.

Table 5.—Descriptive statistics of errors in estimated runoff at 93 test stations

Method	Mean absolute value	Mean	Standard error of mean	Standard deviation
		Error, in inches		
Area-weighted	2.0	-0.35	0.30	2.9
Centroid	2.2	-.71	.33	3.1
GIS	2.7	-1.74	.37	3.6
Nearest-inch	2.8	-1.77	.38	3.7
Nearest contour	2.8	-1.79	.39	3.8
		Percent error		
Area-weighted	9.0	-0.54	1.3	12.9
Centroid	9.8	-.71	1.4	13.5
GIS	12.0	-6.42	1.6	15.9
Nearest-inch	12.1	-6.20	1.6	15.6
Nearest-contour	12.2	-6.26	1.6	15.8


SPANN PROPERTY
NCD 986 180 917
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
RICHMOND
RALEIGH
COLUMBIA
ALBEMARLE SOUND
PAMLICO SOUND
RALEIGH BAY
ONSLOW BAY
LONG BAY
LAKE MARION
LAKE MC'K
SAVANNAH RIVER
80°



F MEXICO

SCALE 1:3,168,000

0 50 100 150 200

0 50 100 150 200 KILOMETERS

UNOFF FOR THE NORTHEASTE

WATER YEA

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: June 6, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Surface Water Pathway Definition

A. 15-Mile Surface Water Pathway: Using USGS data and field observations (Ref. 1; Ref. 28), SFP defined flow conditions within 15 mi. downstream of the site. The drainage area of the wetland south of the site was measured by digital planimeter. The reported drainage areas of Mud Creek at Route 25 (the site) and at the French Broad River are 110 and 113 sq mi., the mean being 111.5 sq. mi. The drainage area of the French Broad River at the mouth of Mud Creek is estimated to be 542 sq. mi. (F. B. River above Mills R. + Mills River + Mud Creek at F. B. Creek), and increases to 686 sq. mi. within 15 mi. downstream of the site (Ref. 28). The mean drainage area calculated within this interval of F. B. River is 643 sq. mi.

The mean drainage areas for both stream segments were converted to mean annual flows in the following manner:

$$\frac{(\text{DA (sq. mi.)} \times \text{MAR(inches)})}{13.58} = \text{mean annual flow (cfs).}$$

DA = Drainage Area
MAR = Mean Annual Runoff = 22 inches (Ref. 29)

Segment	Distance (mi.)	Drainage Area (sq. mi.)	Mean Flow (cfs)
Wetland/ditch	0.0-0.1	0.022	0.03 (rnd: 1)
Mud Crk.	0.1 - 1.75	111.5	180.6
French Broad River.	1.75 - 15	643	1041

(Next page)

B. Source and Wetland Areas; Probable Points of Entry: The probable point of entry (PPE) of runoff from the southern edge of the site is located in the Palustrine forested wetland area bordering the site (Ref. 35). At the time of the SI reconnaissance this wetland was saturated with water. Waste materials deposited on or buried within the steep south slope of the knoll could reach the PPE via runoff or seepage. The wetland area drains to Mud Creek via a ditch which separates the site and wetland from an adjacent farm field. The ditch, which contains standing water, joins Mud Creek at the southeast corner of the site. On the National Wetlands Inventory's Skyland, NC quadrangle the wetland perimeter measures approximately 0.8 mi., and its area, measured by digital planimeter , measures approximately 14 acres.

Most of the northern and central portion of the site slopes in a general northeast direction toward Mud Creek. The overland drainage converges to a shallow runoff channel, which empties into Mud Creek at a point 700-750 ft. downstream of the upstream ditch. The bank of Mud Creek along the entire NE site boundary is mapped as Palustrine scrub-shrub wetland (Ref. 35). The mapped perimeter and area of this on-site wetland are 0.4 mi. and 5 acres respectively.

Based on aerial photography, planimetry, and onsite observations, the area of the junkyard presently operating onsite was estimateded at approximately 5 acres. The area of suspected PCB disposal at the site is not presently known, but is assumed to be the same. The total area of the triangular parcel was calculated to be approximately 11.5 acres.

STATE OF
NORTH CAROLINA
DEPARTMENT OF
ENVIRONMENT, HEALTH,
AND NATURAL RESOURCES

Classifications and Water Quality Standards Assigned to The Waters of the French Broad River Basin

Division of Environmental Management
Raleigh, North Carolina

Reprint from North Carolina Administrative Code: 15A NCAC 2B .0304
Current through: February 1, 1993

SECTION .0300 - ASSIGNMENT OF STREAM CLASSIFICATIONS

.0301 CLASSIFICATIONS: GENERAL

(a) Schedule of Classifications. The classifications assigned to the waters of the State of North Carolina are set forth in the schedules of classifications and water quality standards assigned to the waters of the river basins of North Carolina, 15A NCAC 2B .0302 to .0317. These classifications are based upon the existing or contemplated best usage of the various streams and segments of streams in the basin, as determined through studies and evaluations and the holding of public hearings for consideration of the classifications proposed.

(b) Stream Names. The names of the streams listed in the schedules of assigned classifications were taken as far as possible from United States Geological Survey topographic maps. Where topographic maps were unavailable, U.S. Corps of Engineers maps, U.S. Department of Agriculture soil maps, and North Carolina highway maps were used for the selection of stream names.

(c) Classifications. The classifications assigned to the waters of North Carolina are denoted by the letters WS-I, WS-II, WS-III, WS-IV, WS-V, B, C, SA, SB, and SC in the column headed "class." A brief explanation of the "best usage" for which the waters in each class must be protected is given as follows:

Fresh Waters

Class WS-I:	waters protected as water supplies which are in natural and undeveloped watersheds; point source discharges of treated wastewater are permitted pursuant to Rules .0104 and .0211 of this Subchapter; local programs to control nonpoint source and stormwater discharge of pollution are required; suitable for all Class C uses;
Class WS-II:	waters protected as water supplies which are generally in predominantly undeveloped watersheds; point source discharges of treated wastewater are permitted pursuant to Rules .0104 and .0211 of this Subchapter; local programs to control nonpoint source and stormwater discharge of pollution are required; suitable for all Class C uses;
Class WS-III:	waters protected as water supplies which are generally in low to moderately developed watersheds; point source discharges of treated wastewater are permitted pursuant to Rules .0104 and .0211 of this Subchapter; local programs to control nonpoint source and stormwater discharge of pollution are required; suitable for all Class C uses;
Class WS-IV:	waters protected as water supplies which are generally in moderately to highly developed watersheds; point source discharges of treated wastewater are permitted pursuant to Rules .0104 and .0211 of this Subchapter; local programs to control nonpoint source and stormwater discharge of pollution are required; suitable for all Class C uses;
Class WS-V:	waters protected as water supplies which are generally upstream and draining to Class WS-IV waters; no categorical restrictions on watershed development or treated wastewater discharges are required, however, the Commission or its designee may apply appropriate management requirements as deemed necessary for the protection of downstream receiving waters (15A NCAC 2B .0203); suitable for all Class C uses;
Class B:	primary recreation and any other usage specified by the "C" classification;
Class C:	aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture.

Tidal Salt Waters

Class SA:	shellfishing for market purposes and any other usage specified by the "SB" and "SC" classification;
Class SB:	primary recreation and any other usage specified by the "SC" classification;
Class SC:	aquatic life propagation and survival, fishing, wildlife, and secondary recreation.

.0304 FRENCH BROAD RIVER BASIN

Name of Stream	Description	Class	Classification Date	Classification Index No.
Folly Creek	From source to Little Willow Creek	C	7/1/73	6-45-2
Big Willow Creek	From source to French Broad River	C Tr	7/1/73	6-46
South Fork Big Willow Creek	From source to Big Willow Creek	C Tr	7/1/73	6-46-1
Sentell Creek	From source to South Fork Big Willow Creek	C Tr	7/1/73	6-46-1-1
Piney Branch	From source to South Fork Big Willow Creek	C	7/1/73	6-46-1-2
North Fork Big Willow Creek	From source to Big Willow Creek	C Tr	7/1/73	6-46-2
Carter Branch	From source to North Fork Big Willow Creek	C	9/1/74	6-46-2-1
Gash Creek	From source to French Broad River	C	7/1/73	6-47
Brock Creek	From source to French Broad River	C	7/1/73	6-48
Kleine Lake	Entire lake and connecting stream to French Broad River	C	9/1/74	6-49
Shaw Creek	From source to French Broad River	C	7/1/73	6-50
Echo Lake and Briar Lake	Entire lakes and connecting stream to Shaw Creek	C	7/1/73	6-50-1
Brightwater Branch (Lake Stel)	From source to Shaw Creek	B	4/1/58	6-50-2
Battle Creek	From source to Shaw Creek	C	7/1/73	6-50-3
Mill Pond Creek	From source to French Broad River	C	7/1/73	6-51
Marston Creek	From source to Mill Pond Creek	C	7/1/73	6-51-1
FRENCH BROAD RIVER	From Mill Pond Creek to a point 0.1 mile upstream of Blue Ridge Parkway	WS-IV	8/3/92	6-(51.5)
Boylston Creek	From source to McKinney Branch	C	7/1/73	6-52-(0.5)
Sutton Creek (Sitton Creek)	From source to Boylston Creek	C	4/1/58	6-52-1
Polecat Branch	From source to Sutton Creek	C	4/1/58	6-52-1-1
Long Branch	From source to Sutton Creek	C	4/1/58	6-52-1-2
Osborne Branch	From source to Boylston Creek	C	4/1/58	6-52-2
Dog Creek	From source to Boylston Creek	C	4/1/58	6-52-3
Woody Branch	From source to Boylston Creek	C	4/1/58	6-52-4
Sam Branch	From source to Woody Branch	C	4/1/58	6-52-4-1
Goldmine Branch	From source to Boylston Creek	C	7/1/73	6-52-5
Betty Branch	From source to Boylston Creek	C	7/1/73	6-52-6
Lyday Lake	Entire lake and connecting stream to Boylston Creek	C	7/1/73	6-52-7
Murray Branch	From source to Boylston Creek	C	7/1/73	6-52-8
Crawford Branch	From source to Boylston Creek	C	7/1/73	6-52-9
McKinney Branch	From source to Boylston Creek	C	7/1/73	6-52-10
Boylston Creek	From McKinney Branch to French Broad River	WS-IV	8/3/92	6-52-(10.5)
Sweetwater Branch	From source to Boylston Creek	WS-IV	8/3/92	6-52-11
Innisfree Lake	Entire lake and connecting stream to French Broad River	WS-IV	8/3/92	6-53
Mills River	From source to a point 0.8 mile upstream of N.C. Hwy. 191	WS-II Tr	8/3/92	6-54-(1)

0304 FRENCH BROAD RIVER BASIN

Name of Stream	Description	Classification Class	Date	Index No.
Bat Fork	From source to Johnson Drainage Ditch	C	9/1/74	6-55-8-1
Dunn Creek	From source to Bat Fork	C	9/1/74	6-55-8-1-1
King Creek [McCabe Pond, Jordans Lake, Bonclarken Lake, Madonna Lake (Highlands Lake)]	From source to Madonna Lake Dam	B	4/1/58	6-55-8-1-2-(1)
King Creek	From Madonna Lake Dam to Bat Fork	C	9/1/74	6-55-8-1-2-(2)
Meninger Creek	From source to King Creek	C	9/1/74	6-55-8-1-2-3
Dye Branch	From source to King Creek	C	9/1/74	6-55-8-1-2-4
Devils Fork	From source to Johnson Drainage Ditch	C	7/1/73	6-55-8-2
Camp Branch	From source to Devils Fork	B	4/1/58	6-55-8-2-1
Britton Creek	From source to Mud Creek	C	9/1/74	6-55-9
Lugana Lake	Entire lake and connecting stream to Britton Creek	C	9/1/74	6-55-9-1
Clear Creek	From source to Lewis Creek	C Tr	7/1/73	6-55-11-(1)
Laurel Fork	From source to Clear Creek	C Tr	7/1/73	6-55-11-2
Bold Branch	From source to Laurel Fork	C Tr	7/1/73	6-55-11-2-1
Cox Creek	From source to Clear Creek	C Tr	7/1/73	6-55-11-3
Puncheon Camp Creek	From source to Clear Creek	C Tr	7/1/73	6-55-11-4
Clear Creek	From Lewis Creek to Mud Creek	C	7/1/73	6-55-11-(5)
Lewis Creek	From source to Clear Creek	C Tr	7/1/73	6-55-11-6
Big Branch	From source to Lewis Creek	C Tr	7/1/73	6-55-11-6-0.5
Byers Creek	From source to Lewis Creek	C Tr	7/1/73	6-55-11-6-1
Coon Branch	From source to Lewis Creek	C Tr	7/1/73	6-55-11-6-2
Mill Creek	From source to Clear Creek	C	7/1/73	6-55-11-7
Kyles Creek	From source to Clear Creek	C Tr	7/1/73	6-55-11-8
Lanning Mill Creek	From source to Kyles Creek	C	9/1/74	6-55-11-8-1
Henderson Creek	From source to Clear Creek	C Tr	8/1/84	6-55-11-9
Camp Judaea Lake	Entire lake and connecting stream to Henderson Creek	B Tr	8/1/84	6-55-11-9-1
Laurel Branch	From source to Clear Creek	C	7/1/73	6-55-11-10
Harper Creek	From source to Clear Creek	B Tr	7/1/73	6-55-11-11
Phillips Branch	From source to Clear Creek	C	9/1/74	6-55-11-12
Wolfpen Creek	From source to Clear Creek	C	9/1/74	6-55-11-13
Allen Branch	From source to Clear Creek	C	7/1/73	6-55-11-14
Cherry Branch (Lake David)	From source to Clear Creek	C	9/1/74	6-55-11-15
Featherstone Creek	From source to Mud Creek	C	9/1/74	6-55-12
Byers Creek	From source to Mud Creek	C	9/1/74	6-55-13
Mud Creek	From Byers Creek to French Broad River	WS-IV	8/3/92	6-55-(14)
Hollaman Lake	Entire lake and connecting stream to French Broad River	WS-IV	8/3/92	6-56
Cane Creek	From source to Ashworth Creek	WS-IV Tr	8/3/92	6-57-(1)
Spring Mountain Branch	From source to Cane Creek	WS-IV Tr	8/3/92	6-57-2
Ellison Branch	From source to Cane Creek	WS-IV Tr	8/3/92	6-57-3
Rocky Fork	From source to Cane Creek	WS-IV Tr	8/3/92	6-57-4
Licklog Branch	From source to Rocky Fork	WS-IV	8/3/92	6-57-4-1
Flat Branch	From source to Rocky Fork	WS-IV	8/3/92	6-57-4-2

.0304 FRENCH BROAD RIVER BASIN

Name of Stream	Description	Class	Classification Date	Index No.
Lake Coma	Entire lake and connecting stream to French Broad River	WS-IV	8/3/92	6-61
Powell Creek (Lake Julian)	From source to French Broad River	WS-IV	8/3/92	6-62
Ducker Creek	From source to French Broad River	WS-IV	8/3/92	6-63
Clayton Creek	From source to French Broad River	WS-IV	8/3/92	6-64
Roberts Lake	Entire lake and connecting stream to Clayton Creek	WS-IV	8/3/92	6-64-1
Ashley Branch	From source to French Broad River	WS-IV	8/3/92	6-65
Orton Branch	From source to French Broad River	WS-IV	8/3/92	6-66
FRENCH BROAD RIVER	From a point 0.1 mile upstream of Blue Ridge Parkway to a point 0.1 mile upstream of Boring Mill Branch (City of Asheville proposed water supply intake)	WS-IV CA	8/3/92	6-(66.5)
Bent Creek	From source to Powhatan Dam	WS-IV&B Tr	8/3/92	6-67-(1)
Rich Branch	From source to Bent Creek	WS-IV Tr	8/3/92	6-67-2
Rocky Branch	From source to Rich Branch	WS-IV Tr	8/3/92	6-67-2-1
Long Branch	From source to Bent Creek	WS-IV Tr	8/3/92	6-67-3
Laurel Branch	From source to Bent Creek	WS-IV Tr	8/3/92	6-67-4
Beaten Branch	From source to Bent Creek	WS-IV Tr	8/3/92	6-67-5
Boyd Branch	From source to Bent Creek	WS-IV	8/3/92	6-67-6
Bent Creek	From Powhatan Dam to a point 0.4 mile upstream of mouth	WS-IV	8/3/92	6-67-(7)
Ledford Branch	From source to Bent Creek	WS-IV	8/3/92	6-67-8
Wolf Branch	From source to Bent Creek	WS-IV	8/3/92	6-67-9
Wesley Creek (Bent Creek Ranch Lake)	From source to Bent Creek	WS-IV	8/3/92	6-67-10
Creasman Branch	From source to Wesley Creek	WS-IV	8/3/92	6-67-10-1
Bent Creek	From a point 0.4 mile upstream of mouth to French Broad River	WS-IV CA	8/3/92	6-67-(11)
FRENCH BROAD RIVER	From a point 0.1 mile upstream of Boring Mill Branch to North Carolina-Tennessee State Line	C	8/3/92	6-(67.5)
Boring Mill Branch	From source to French Broad River	C	7/1/73	6-68
Dellwood Lake	Entire lake and connecting stream to French Broad River	C	7/1/73	6-69
Austin Branch	From source to French Broad River	C	9/1/74	6-70
Dingle Creek	From source to French Broad River	C	7/1/73	6-71
Four Mile Branch (Bass Pond)	From source to French Broad River	C	7/1/73	6-72
Brown Branch	From source to Four Mile Branch	C	7/1/73	6-72-1
Raoul Branch	From source to Four Mile Branch	C	7/1/73	6-72-2
The Lagoon	Entire lake and connecting stream to French Broad River	C	7/1/73	6-73
Plateau Branch	From source to French Broad River	C	9/1/74	6-74
Long Valley Branch (White Creek) (Westerly Lake)	From source to French Broad River	C	7/1/73	6-75
Long Valley Lake	Entire lake and connecting stream to	C	7/1/73	6-75-1

DEPARTMENT OF COMMERCE
[illegible] Hodges, Secretary

WEATHER BUREAU
[illegible], Chief

TECHNICAL PAPER NO. 40

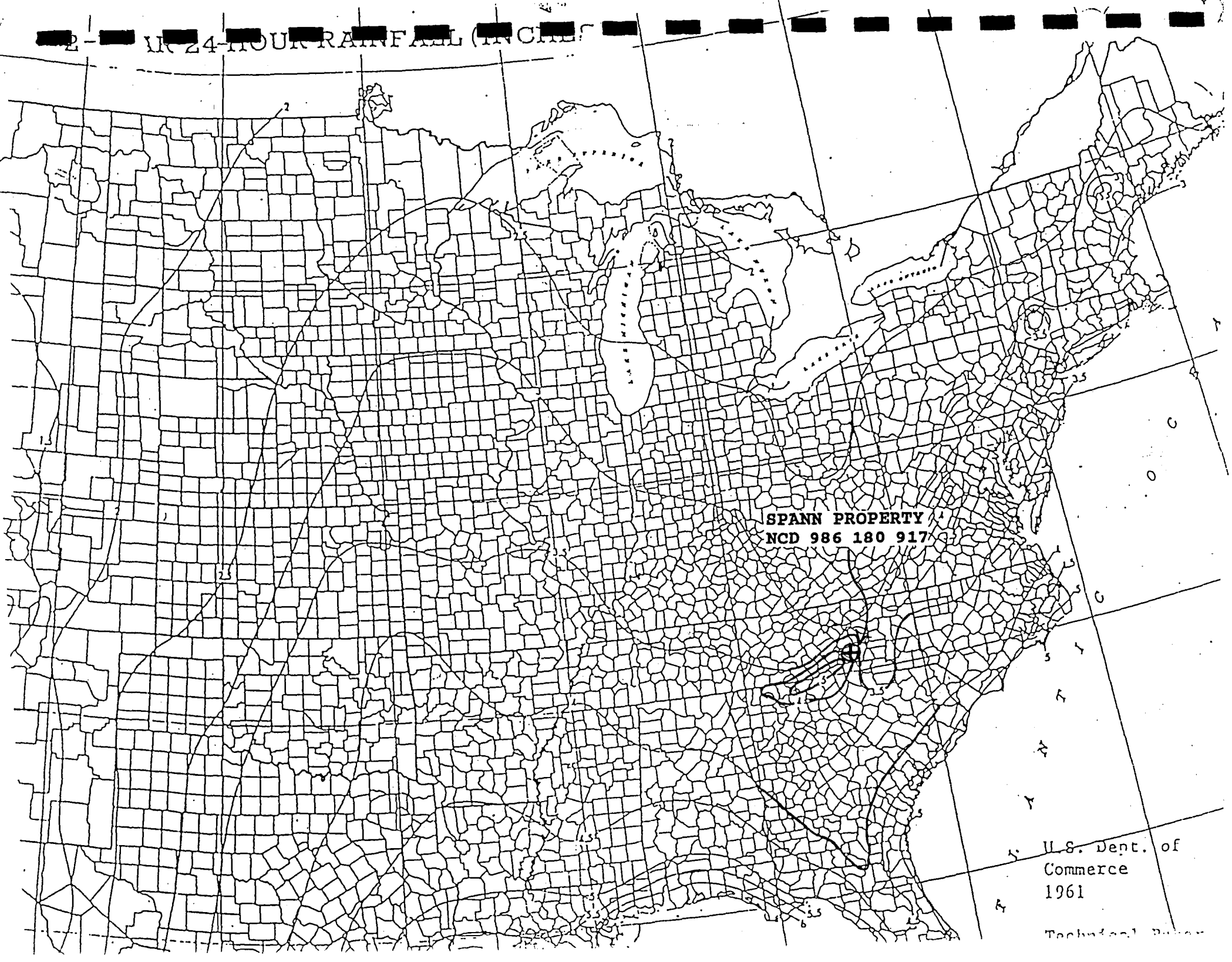
RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

PROPERTY OF EPA
FIT IV

Ref. 32


2-YR 24-HOUR RAINFALL (INCHES)
SPANN PROPERTY
NCD 986 180 917
U.S. Dept. of
Commerce
1961

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 24, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Municipal Drinking Water Supplies
within the Study Area.

SFP telephoned Mr. John Goolsby, Hendersonville Engineering Department (704-692-4228) on 2/17/94. He confirmed that no surface water intakes for public water supply are present on Mud Creek or on French Broad Creek within 15 miles downstream of the site. Their system's 3 intakes are located on the North Fork of Mills River, a tributary to French Broad River located upstream of Mud Creek (See also Ref. 23).

For confirmation/redocumentation of water line coverage for the groundwater population count, SFP visited F. R. Hayes' office in Hendersonville on 4/5/94, wherupon Hayes delineated the current service coverage on a field map.

SFP telephoned James Adams, Asst. Regional Engineer, Asheville Regional Office, NC Water Supply Division (704-669-3361) on 5/23/94. He confirmed that no surface water intakes for public water supply are present on Mud Creek or French Broad Creek within the 15-mi. surface water pathway, and that no municipal wells exist within 4 mi. of the site. He noted, however, that a proposed (but controversial) Asheville intake may be constructed on French Broad just downstream of the Blue Ridge Parkway crossing, 12 miles downstream of the site.

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 20, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Fisheries on Mud Creek and French Broad River

SFP telephoned Mickey Clemins, District Fisheries Biologist, NC Wildlife Resources Commission (704-452-0422) on 3/24/94 for information regarding fisheries on Mud Creek and the French Broad River. He confirmed that both surface water bodies are used for fishing, the river much more so than the creek. Mud Creek is used lightly for bank fishing for catfish, generally near bridges. The French Broad River is fished for trophy Muskellonge. Other species include smallmouth bass, pickerel and nongame fish such as carp, catfish, suckers, and redbreast sunfish. Boat fishing occurs, and he has seen fishing trails on banks of both water bodies.

During the SI sampling trip on 4/4/94, SFP observed 1 person fishing on Mud Creek within 100 feet downstream of the Route 25 bridge. Two lawn chairs and upright forked sticks were observed on the bank of the creek adjacent to the drainage ditch bordering the south (upstream) side of the site. These objects are evidence of regular fishing activity at that location.

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: June 30, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Wetland Targets

SFP reviewed National Wetlands Inventory maps covering both a 4-mile radius around the site and the 15-mile surface water pathway.

The probable point of entry (PPE) of runoff from the southern edge of the site is located in the Palustrine forested wetland area bordering the site. The wetland area's mapped perimeter measures approximately 0.8 mi. and its area, measured by digital planimeter, is approximately 14 acres.

The bank of Mud Creek along the entire NE site boundary is mapped as Palustrine scrub-shrub wetland, and is drained by an intermittent channel which flows into Mud Creek at a second PPE about 750 ft downstream of the southeast corner of the site. The mapped perimeter and area of this on-site wetland are 0.4 mi. and 5 acres respectively.

Wetland areas are mapped further downstream of the PPE along both Mud Creek and French Broad River. The nearest is an approximately 2500 ft. frontage located 4000 ft. downstream of the lower PPE. A total of 2.5 miles of frontage are mapped as being within wetland areas in the 15-mile surface water pathway.

SFP measured wetland acreage mapped within a 4-mile radius of the site, using the NWI draft maps of the Skyland and Horse Shoe 7-1/2 minute quadrangles, and a Planix 7 Tamaya digital planimeter. Because NWI Maps were not available for the Hendersonville and Fruitland quadrangles, the total acreages of hydric (potential wetland) soils were measured. These soils include Hatboro Loam, Kinkora Loam, and Toxaway Silt Loam (Ref. 3; Ref. 40).

The total combined acreages, by distance increment, are as follows:

Distance (mi)	Acreage
0.0-0.25	67
0.25-0.5	28
0.5-1.0	86
1.0-2.0	139
2.0-3.0	194
3.0-4.0	68
Total	582

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: May 23, 1994
Re: Site Inspection Prioritization:
Spann Property
NCD 986 180 917
Review of Natural Heritage Program Maps
and File Information

SFP reviewed NC Natural Heritage Program field location maps and rare species lists to identify rare plant and animal species within a 4-mile radius of the site and within the 15-mile surface water pathway.

The NHP has identified 8 rare animal species and 1 rare plant species within the study area. Clemmys muhlenbergii (Bog Turtle) is listed as Threatened in NC. The species, along with the plant Synosma suaveolens (Sweet Indian Plantain), the amphibian Cryptobranchus alleghaniensis (Hellbender), and the fish species Percina microcephala (Longhead Darter) are also listed nationally as Candidate C2. This listing indicates a potential candidate for endangered or threatened status which cannot presently be evaluated due to lack of data.

Species Name:	Distance from Site (Radial)	(Dnstrm)	Status NC	US	Rank NC	Global
Synosma suaveolens (Sweet Indian Plantain)	2.2	--	C	PC2	SH	G3?
Cryptobranchus alleghaniensis (Hellbender)	2.5	5.6	SC	C2	S3	G4
Necturus maculosis (Mudpuppy)	--	5.9	SC	--	S1	G5
Vireo gilvus (Warbling Vireo)	--	10.0	SR	--	S2B/SZN	G5
Percina macrocephala (Longhead Darter)	--	9.7	SC	C2	SH	G3
Clemmys muhlenbergii (Bog Turtle)	--	11.7	T	C2	S2	G3
Ambystoma talpoideum (Mole Salamander)	--	11.7	SC	--	S2	G5
Hemidactylium scutatum (Four-toed Salamander)	--	11.7	SC	--	S3	G5
Sorex hoyi winnemana (Southern Pygmy Shrew)	--	12.5	SC	3C	S2?	G5T5

(see next page)

Status Codes:

US	NC
T = Threatened	C2 = Candidate 2
SC = Special Concern	3C = Candidate 3C
SR = Significantly Rare	P = Proposed

Rank Codes:

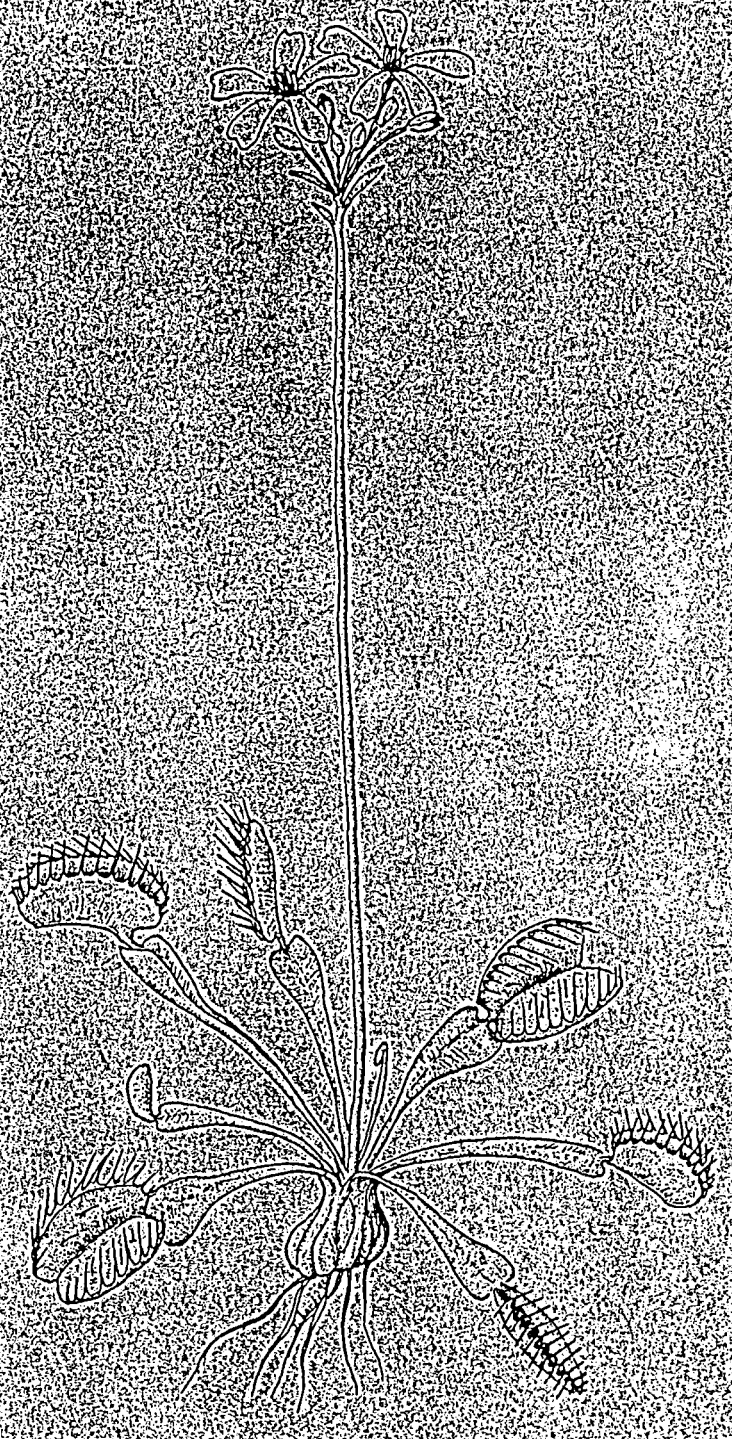
NC

S1 = Critically Imperiled in NC due to extreme rarity.
S2 = Imperiled in NC.
S3 = Rare/Uncommon in NC.
SH = Historical Occurrence in NC.
S? = Unranked or Rank Uncertain.
B = Breeding, migratory.
N = Nonbreeding, migratory.
Z = Not of significant concern.

Global

G3 = Very rare and local/restricted range.
G4 = Apparently secure globally, rare in parts of range.
G5 = Apparently secure globally, quite rare in parts of range.
T = Subspecies or Variety

NATURAL HERITAGE PROGRAM LIST OF THE RARE PLANT SPECIES OF NORTH CAROLINA



Compiled By
Alan S. Weakley,
Botanist

North Carolina Natural Heritage Program
Division of Parks and Recreation
N.C. Department of Environment, Health, and Natural Resources 1993

NATURAL HERITAGE PROGRAM LIST OF THE RARE PLANTS OF NORTH CAROLINA*
1993 Edition

compiled by Alan S. Weakley, Botanist
North Carolina Natural Heritage Program
Division of Parks and Recreation
Department of Environment, Health and Natural Resources

NATURAL HERITAGE PROGRAM LIST OF THE RARE PLANTS OF NORTH CAROLINA 1
VASCULAR PLANTS 9
MOSSES 36
LIVERWORTS 40
HORNWORTS 43
LICHENS 43

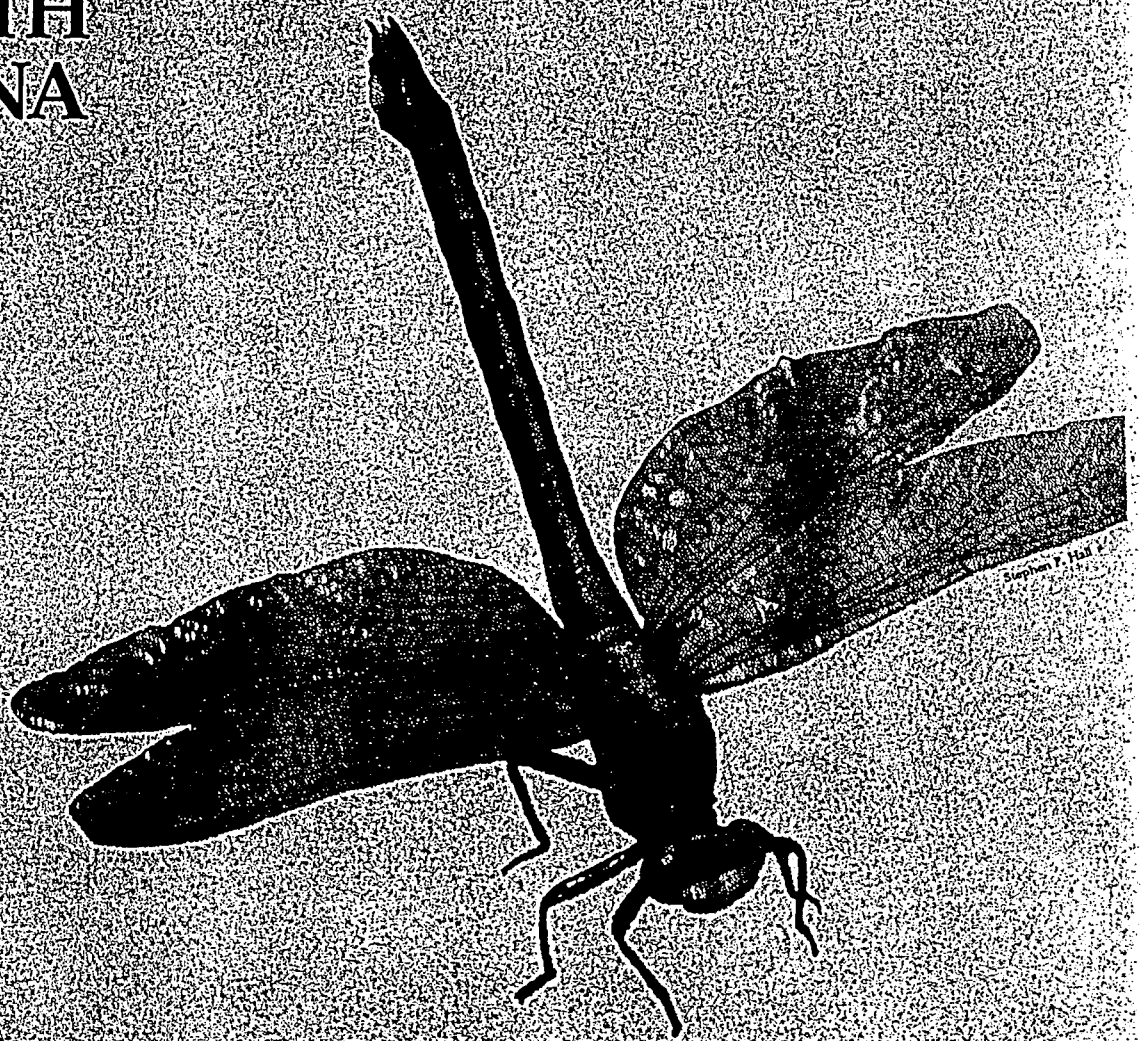
SUPPLEMENT TO THE NATURAL HERITAGE PROGRAM LIST OF THE RARE PLANTS OF NORTH CAROLINA 45
NORTH CAROLINA PLANT WATCH LIST 46
VASCULAR PLANTS 48
MOSSES 71
LIVERWORTS 71
HORNWORTS 73
LICHENS 73
REGIONALLY RARE PLANT (WITHIN-STATE DISJUNCT) LIST 74
POTENTIAL NEW TO NORTH CAROLINA PLANTS 76

---

* This list is dynamic, being revised frequently as further data become available. *If you are using a copy of this list which is more than a year old* (check the edition date at the top of the first page), *it may be out of date and you should contact the Natural Heritage Program for important updates.* Further information on these species may be obtained by contacting the North Carolina Natural Heritage Program, Division of Parks and Recreation, Department of Environment, Health, and Natural Resources, P.O. Box 27687, Raleigh, NC 27611-7687 or the North Carolina Plant Conservation Program, Department of Agriculture, P.O. Box 27647, Raleigh, NC 27611-7647.

Scientific Name Province: Habitat (Counties of Occurrence)	Common Name	Status NC	Status US	Rank NC	Rank Global
Stellaria alsine M: seeps (Madison)	Longstalk Starwort	SR	-	S1	G5
Stellaria corei (see Watch List)					
Stenanthium robustum (not in RAB) M: bogs and wet meadows (Alleghany*, Ashe*, Avery*, Macon)	Bog Featherbells	SR	-	S1	G?
Streptopus amplexifolius M: spruce-fir forests, northern hardwoods forests (Buncombe*, Jackson*, Macon, Mitchell, Swain, Yancey)	White Mandarin	C	-	S1	G5
Stylisma aquatica (= *Bonamia aquatica*) C: clay-based Carolina bays, moist sandy pinelands (Brunswick, Scotland*)	Water Dawnflower	SR	-	S1	G3G4
Stylisma pickeringii var. *pickeringii* (= *Bonamia p.*) SC: sandhills (Cumberland*, Harnett*, Hoke*, Moore*, New Hanover, Richmond*, Scotland*)	Pickering's Dawnflower	E	C2	S2	G4?T2
Swertia (see *Frasera*)					
Synandra hispidula M: rich cove forests (Swain)	Synandra	C	3C	SH	G3
Syngonanthus flavidulus (see Watch List)					
Synosma suaveolens (= *Cacalia suaveolens*) M: bottomlands (Buncombe, Henderson, Transylvania)	Sweet Indian-plantain	C	PC2	SH	G3?
Taxus canadensis (not in RAB) M: bogs, swamp forests under spruce (Ashe*, Watauga*)	Canada Yew	SR	-	S1	G5
Thalictrum cooleyi C: wet savannas (Brunswick*, Columbus*, New Hanover, Onslow*, Pender*)	Cooley's Meadowrue	E	E	S1	G1
Thaspium pinnatifidum M: calcareous slopes (Haywood*, Jackson, Madison*, Swain)	Mountain Thaspium	C	-	S1	G3G4
Thelypteris simulata (not in RAB) M: bogs (Alleghany*, Avery*)	Bog Fern	T	-	S1	G5
Thelypteris (also see *Phegopteris*)					
Thermopsis fraxinifolia MP: dry ridges (Buncombe, Burke*, Caldwell, Henderson, Jackson, McDowell, Polk, Stokes, Surry, Transylvania*, Yancey)	Ash-leaved Golden-banner	C	-	S2?	G3?
Thermopsis mollis PM: dry ridges and open woodlands (Buncombe, Burke*, Catawba*, Chatham, Cleveland*, Durham, Forsyth, Franklin, Gaston, Granville*, Guilford, Henderson, Iredell, Lincoln, Rutherford*, Stokes, Surry, Transylvania, Wake, Warren*)	Appalachian Golden-banner	SR	-	S2?	G3G4
Tofieldia glabra CS: savannas, sandhill seeps, moist sandhill/pocosin ecotones (Beaufort, Bladen, Brunswick*, Carteret*, Columbus*, Craven, Cumberland*, Duplin, Harnett*, Hoke*, Johnston, Martin, Moore, New Hanover*, Onslow*, Pamlico, Pender*, Richmond*, Robeson, Sampson, Scotland*, Wilson)	Carolina Asphodel	C	C2	S3	G3
Tofieldia glutinosa (= *T. racemosa* var. *glutinosa*) MP: bogs, seepages (especially over mafic rocks) (Ashe*, Caldwell, Haywood*, Henderson, Jackson*, Transylvania*)	Sticky Bog Asphodel	C	-	S1	G5
Torreyochloa pallida (= *Glyceria pallida*) CM: blackwater pools, old millponds, and small stream swamps (Avery, Columbus, Currituck*, Duplin, Gates)	Pale Mannagrass	SR	-	S1	G5?
Tradescantia virginiana P: rich woods on circumneutral soils (Caswell, Harnett*, Montgomery*, Moore*, Orange, Rockingham, Stanly)	Virginia Spiderwort	SR	-	S1	G5
Trichomanes boschianum M: spray zone of waterfalls, seeps over rock (Jackson*, Macon*, Polk)	Appalachian Filmy-fern	T	-	S1	G4

NATURAL HERITAGE PROGRAM LIST OF THE RARE ANIMAL SPECIES OF NORTH CAROLINA



Compiled By
Harry E. LeGrand, Jr., Zoologist
With Contributions by Stephen P. Hall

North Carolina Natural Heritage Program
Division of Parks and Recreation
N. C. Department of Environment, Health, and Natural Resources 1993

NATURAL HERITAGE PROGRAM LIST OF THE RARE ANIMALS OF NORTH CAROLINA*

1993 Edition

compiled by Harry E. LeGrand Jr., Zoologist
with contributions by Stephen P. Hall, Invertebrate Zoologist
North Carolina Natural Heritage Program
Division of Parks and Recreation
Department of Environment, Health, and Natural Resources

NATURAL HERITAGE PROGRAM LIST OF THE RARE ANIMALS OF NORTH CAROLINA . . . 1
- MAMMALS . . . 10
- BIRDS . . . 11
- REPTILES . . . 13
- AMPHIBIANS . . . 14
- FRESHWATER FISHES . . . 15
- MARINE AND ESTUARINE FISHES . . . 17
- MOLLUSKS . . . 18
  - FRESHWATER BIVALVES . . . 18
  - FRESHWATER GASTROPODS . . . 20
  - TERRESTRIAL GASTROPODS . . . 20
  - MARINE BIVALVES . . . 21
  - MARINE GASTROPODS . . . 21
- ARACHNIDS . . . 22
- CRUSTACEANS . . . 22
- MILLIPEDES . . . 23
- INSECTS . . . 24
  - MAYFLIES . . . 24
  - CADDISFLIES . . . 24
  - DRAGONFLIES . . . 24
  - FLIES . . . 25
  - SCORPIONFLIES . . . 25
  - MOTHS . . . 25
  - BUTTERFLIES . . . 26
  - BEETLES . . . 29
  - ANTS . . . 31
- ANNELIDS . . . 31

SUPPLEMENT TO THE NATURAL HERITAGE PROGRAM LIST OF THE RARE ANIMALS OF NORTH CAROLINA . . . 32
- NORTH CAROLINA ANIMAL WATCH LIST . . . 33
  - MAMMALS . . . 35
  - BIRDS . . . 35
  - REPTILES . . . 36
  - AMPHIBIANS . . . 37
  - FRESHWATER FISHES . . . 37
  - MOLLUSKS -- FRESHWATER BIVALVES . . . 38
  - CRUSTACEANS . . . 38
  - INSECTS -- BUTTERFLIES . . . 39
  - INSECTS -- BEETLES . . . 40
- POTENTIAL NEW TO NORTH CAROLINA ANIMALS . . . 41

---

*This list is dynamic and is revised frequently as further data become available. New species are added to the list, and others are dropped from the list for various reasons. The list will be revised periodically, generally once every year or two. If you are using a copy of this list which is more than a year old (check the edition date at the top of the first page), it might be invalid and you should request a new version. Further information on these species may be obtained by contacting the North Carolina Natural Heritage Program, Division of Parks and Recreation, Department of Environment, Health, and Natural Resources, P.O. Box 27687, Raleigh, NC 27611-7687 or the Nongame and Endangered Wildlife Program, North Carolina Wildlife Resources Commission, 512 North Salisbury Street, Raleigh, NC 27611.

LIST FORMAT

Species are grouped by major taxa. The vertebrates are arranged by class, beginning with the most advanced phylogenetically (mammals). Within a given taxa, species are listed alphabetically by scientific name. The following information is presented for each species on the list. "Status" is a word or phrase that indicates the degree of protection (if any), based on rarity, of a species; "rank" is a numerical scale of the rarity of a species, regardless of legal protection.

Scientific Name.

Common Name. For most groups, these names are not standardized.

North Carolina Status. Endangered, Threatened, and Special Concern species of Mammals, Birds, Reptiles, Amphibians, Freshwater Fishes, and Freshwater and Terrestrial Mollusks have legal protection status in North Carolina (Wildlife Resources Commission). In addition to the above categories, the Natural Heritage Program maintains computer and map files on Significantly Rare, Vulnerable, and Undetermined status species, as well as species considered Extirpated. Paper files only are maintained for some of the above species; these species are indicated by the phrase "not tracking."

STATUS CODE	STATUS	DEFINITION
E	Endangered	"Any native or once-native species of wild animal whose continued existence as a viable component of the State's fauna is determined by the Wildlife Resources Commission to be in jeopardy or any species of wild animal determined to be an 'endangered species' pursuant to the Endangered Species Act." (Article 25 of Chapter 113 of the General Statutes; 1987).
T	Threatened	"Any native or once-native species of wild animal which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, or one that is designated as a threatened species pursuant to the Endangered Species Act." (Article 25 of Chapter 113 of the General Statutes; 1987).
SC	Special Concern	"Any species of wild animal native or once-native to North Carolina which is determined by the Wildlife Resources Commission to require monitoring but which may be taken under regulations adopted under the provisions of this Article." (Article 25 of Chapter 113 of the General Statutes; 1987).

North Carolina Status. Endangered, Threatened, and Special Concern species have legally protected status in North Carolina through the Plant Conservation Program. The Natural Heritage Program maintains computer and map files on Endangered, Threatened, Candidate, and Significantly Rare species; paper files are maintained on Watch List species.

STATUS CODE	STATUS	DEFINITION
E	Endangered	"Any species or higher taxon of plant whose continued existence as a viable component of the State's flora is determined to be in jeopardy" (GS 19B 106: 202.12). (Endangered species may not be removed from the wild except when a permit is obtained for research, propagation, or rescue which will enhance the survival of the species.)
T	Threatened	"Any resident species of plant which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (GS 19B 106:202.12). (Regulations are the same as for Endangered species.)
SC	Special Concern	"Any species of plant in North Carolina which requires monitoring but which may be collected and sold under regulations adopted under the provisions of [the Plant Protection and Conservation Act]" (GS 19B 106:202.12). (Special Concern species which are not also listed as Endangered or Threatened may be collected from the wild and sold under specific regulations. Propagated material only of Special Concern species which are also listed as Endangered or Threatened may be traded or sold under specific regulations.)
C	Candidate	Species which are very rare in North Carolina, generally with 1-20 populations in the state, generally substantially reduced in numbers by habitat destruction (and sometimes also by direct exploitation or disease). These species are also either rare throughout their ranges (fewer than 100 populations total) or disjunct in North Carolina from a main range in a different part of the country or world. Also included are species which may have 20-50 populations in North Carolina, but fewer than 50 populations rangewide. These are species which have the preponderance of their distribution in North Carolina and whose fate depends largely on their conservation here. Also included are many species known to have once occurred in North Carolina but with no known extant occurrences in the state (historical or extirpated species); if these species are relocated in the state, they are likely to be listed as Endangered or Threatened. If present land use trends continue, candidate species are likely to merit listing as Endangered or Threatened.

SR	Significantly Rare	Any species which has not been listed by the N.C. Wildlife Resources Commission as an Endangered, Threatened, or Special Concern species, but which exists in the state in small numbers and has been determined by the N.C. Natural Heritage Program to need monitoring. (This is a N.C. Natural Heritage Program designation.) Significantly Rare species include "peripheral" species, whereby North Carolina lies at the periphery of the species' range (such as Purple Gallinule). The designation also includes marine and estuarine fishes identified as "Vulnerable" by the N.C. State Museum of Biological Sciences (Ross et al., 1988, Endangered, Threatened, and Rare Fauna of North Carolina. Part II. A Re-evaluation of the Marine and Estuarine Fishes). Also included in the Significantly Rare designation are species formerly listed by the Natural Heritage Program (1991) as "Undetermined". "Undetermined" species are those that are secretive or are otherwise poorly known in North Carolina, which the Natural Heritage Program believes are rare and should be monitored.
EX	Extirpated	A species which is no longer believed to occur in the state.
W	Watch List	Any other species believed to be of conservation concern in the state because of scarcity, declining populations, threats to populations, or inadequacy of information to assess its rarity (see Page 33 for a more complete discussion).
*	---	Species is a game animal, and therefore (by law) cannot be listed for State protection as E, T, or SC.
#	---	Species proposed for Endangered status, but not adopted by the Wildlife Resources Commission; species is protected from taking.
@	---	Species proposed for Special Concern status, but not adopted by the Wildlife Resources Commission; species is protected from taking.

United States Status is designated by the U.S. Fish and Wildlife Service. Federally listed Endangered and Threatened species are protected under the provisions of the Endangered Species Act of 1973, as amended through the 100th Congress. Unless otherwise noted, definitions are taken from the the Federal Register, Vol. 56, No. 225, November 21, 1991 (50 CFR Part 17).

STATUS CODE	STATUS	DEFINITION
E	Endangered	A taxon "which is in danger of extinction throughout all or a significant portion of its range" (Endangered Species Act, Section 3).
T	Threatened	A taxon "which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (Endangered Species Act, Section 3).
C1	Candidate 1	"Taxa for which the [Fish and Wildlife] Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. Proposed rules have not yet been issued because this action is precluded at present by other listing activity. [Such proposed rules] are anticipated, however, and the Service encourages other Federal agencies to give consideration to such taxa in environmental planning."
C2	Candidate 2	"Taxa for which information now in the possession of the [Fish and Wildlife] Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.... Further biological research and field study usually will be necessary to ascertain the status of taxa in this category....The Service hopes that this notice will encourage necessary research on vulnerability, taxonomy, and/or threats for these taxa."
C1*, C2*	---	Candidate taxa, but lacking known occurrences
3A	Candidate 3A	"Taxa for which the [Fish and Wildlife] Service has persuasive evidence of extinction. If rediscovered, such taxa might acquire high priority for listing."
3B	Candidate 3B	"Names that, on the basis of current taxonomic understanding..., do not represent distinct entities meeting the Act's definition of 'species'; it also includes vertebrate populations that do not meet this definition."
3C	Candidate 3C	"Taxa that have proven to be more abundant or widespread than previously believed and/or those that are not subject to any identifiable threat. If further research or changes in habitat indicate a significant decline in any of these taxa, they may be reevaluated for possible inclusion in categories 1 or 2."
P_	Proposed	Species currently proposed, as either endangered or threatened. Species formally proposed receive some protection by law.

North Carolina Rank. North Carolina ranks are based on the Natural Heritage Program Network of measuring rarity and threat status. This system is widely used by other agencies and organizations, as the best available scientific and objective assessment of a species' rarity at the state level.

RANK	NUMBER OF EXTANT POPULATIONS	DESCRIPTION
S1	1-5	Critically imperiled in North Carolina because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from North Carolina.
S2	6-20	Imperiled in North Carolina because of rarity or because of some factor(s) making it very vulnerable to extirpation from North Carolina.
S3	21-100	Rare or uncommon in North Carolina.
S4	100-1000	Apparently secure in North Carolina, with many occurrences.
S5	1000+	Demonstrably secure in North Carolina and essentially ineradicable under present conditions.
SA	1-?	Accidental or casual; one to several records for North Carolina, but the state is outside the normal range of the species.
SH	0?	Of historical occurrence in North Carolina, perhaps not having been verified in the past 20 years, and suspected to be still extant.
SR	--	Reported from North Carolina, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.
SX	0	Apparently extirpated from North Carolina.
SU	--	Possibly in peril in North Carolina but status uncertain; need more information.
S?	--	Unranked, or rank uncertain.
_B	1-?	Rank of the breeding population in the state. Used for migratory species only.
_N	1-?	Rank of the non-breeding population in the state. Used for migratory species only.
_Z_	1-?	Population is not of significant conservation concern. For example, the status "SZN" indicates that the population in the non-breeding seasons (generally in migration or in winter) is transitory, without any regular locales of occurrence whereby the species can be protected. Where a number is listed with the "B" or "N" modifier, there are definable locales of occurrence that can be identified for protection.

Global Rank. Similar to North Carolina ranks, global ranks are assigned by a consensus of scientific experts, the individual natural heritage programs, and the Natural Heritage Network. Global ranks apply to the status of a species throughout its range, and are based on data on the species' status rangewide. This system is widely used by other agencies and organizations, as the best available scientific and objective assessment of a species' rarity throughout its range.

RANK	NUMBER OF EXTANT POPULATIONS	DESCRIPTION
G1	1-5	Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction.
G2	6-20	Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3	21-100	Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single physiographic region) or because of other factors making it vulnerable to extinction throughout its range.
G4	100-1000	Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5	1000+	Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GH	0?	Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.
GX	0	Believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered.
GU	--	Possibly in peril range-wide, but status uncertain; more information is needed.
G?	--	Unranked, or rank uncertain.
G_Q	--	Questionable taxonomic assignment.
T_	--	The rank of a subspecies or variety. As an example, G4T1 would apply to a subspecies of a species with an overall rank of G4, but the subspecies warranting a rank of G1.

Physiographic Province. The provinces in which the animal is known to occur are indicated. This should not be regarded as the only province(s) of the state in which the species could occur; our knowledge of the fauna of North Carolina, especially the invertebrates, is still very imperfect. The provinces are abbreviated as follows:

M	Mountains	All parts of North Carolina west of the foot of the Blue Ridge Escarpment.
P	Piedmont	All parts of North Carolina east of the foot of the Blue Ridge Escarpment and west of the Fall Line, including outlying "foothill" ranges, such as the Brushy, Uwharrie, and Sauratown mountains.
C	Coastal Plain	All parts of North Carolina east of the Fall Line (including the Sandhills), but excluding the portions associated with tidal water (ocean, sounds, barrier islands, and mainland brackish or salt marshes).
T	Tidewater	That part of the state associated with tidal water, such as the ocean and barrier islands, sounds, estuaries, and mainland brackish or salt marshes.

Habitat. The known, or the most typical, habitats are described briefly; as with provinces, these should not be regarded as the only possible habitats of the species in the state.

Scientific Name Province: Habitat	Common Name	Status N.C.	Status U.S.	Rank N.C.	Rank Global
Crotalus adamanteus C: pine flatwoods, savannas, pine-oak sandhills	Eastern Diamondback Rattlesnake	SR#		S1	G5
Dermochelys coriacea T: oceans, rarely in sounds	Leatherback	E	E	SZN	G3
Eretmochelys imbricata T: oceans, very rarely in sounds	Hawksbill	E	E	SZN	G3
Heterodon simus C: sandy woods, particularly pine-oak sandhills	Southern Hognose Snake	SR	C2	S3	G4G5
Lampropeltis getula sticticeps T: maritime forests, thickets, and grasslands on the Outer Banks	Outer Banks Kingsnake	SC		S2	G5T2Q
Lepidochelys kempii T: ocean and sounds	Atlantic Ridley	E	E	SZN	G1
Malaclemys terrapin T: salt or brackish marshes; estuaries [not tracking]	Diamondback Terrapin	SC	C2	S3	G5
Micrurus fulvius C: pine-oak sandhills, sandy flatwoods, maritime forests	Eastern Coral Snake	SR#		S1	G5
Nerodia sipedon williamengelsi T: salt or brackish marshes	Carolina Salt Marsh Snake	SC		S2	G5T2
Opheodrys vernalis M: fields and grassy meadows	Smooth Green Snake	SC		SH	G5
Ophisaurus mimicus C: pine flatwoods, savannas, pine/oak sandhills	Mimic Glass Lizard	SC		S2	G3
Pituophis melanoleucus melanoleucus CM: dry and sandy woods, mainly in pine/oak sandhills	Northern Pine Snake	SC	C2	S3	G5T?
Sistrurus miliarius CP: pine flatwoods, pine/oak sandhills, other pine/oak forests	Pigmy Rattlesnake	SR@		S3	G5
Sternotherus minor [S. m. peltifer] M: streams and rivers in Mississippi drainage	Loggerhead Musk Turtle [Stripeneck Musk Turtle]	SC		S1	G5

AMPHIBIANS

Ambystoma talpoideum MP: breeds in fish-free semipermanent woodland ponds; forages in adjacent woodlands	Mole Salamander	SC		S2	G5
Ambystoma tigrinum C: breeds in fish-free semipermanent ponds; forages in adjacent woods, usually sandy pinewoods	Tiger Salamander	T		S2	G5
Aneides aeneus M: damp, shaded crevices of cliffs or rock outcrops in deciduous forests (southern mountains)	Green Salamander	E	C2	S1	G3G4
Cryptobranchus alleganiensis M: large and clear fast-flowing streams	Hellbender	SC	C2	S3	G4
Desmognathus santeetlah M: stream headwaters and seepage areas; southwestern mountains	Santeetlah Dusky Salamander	SR		S2S3	G3Q
Eurycea junaluska M: forests near seeps and streams in the Cheoah River system	Junaluska Salamander	SC	C2	S2	G2Q
Eurycea longicauda longicauda M: moist woods and floodplains	Longtail Salamander	SC		S2	G5T5
Eurycea quadridigitata (part) C: pocosins, bay forests, flatwoods, savannas	Dwarf Salamander (silver-bellied morph)	SC		S2	G5T?Q
Hemidactylium scutatum MPC: pools, bogs, and other wetlands in hardwood forests	Four-toed Salamander	SC		S3	G5
Hyla andersonii C: pocosins, bay forests, boggy areas	Pine Barrens Treefrog	SR	3C	S3	G4
Necturus lewisi PC: rivers and large streams in Neuse and Tar drainages (endemic to North Carolina)	Neuse River Waterdog	SC	3C	S3	G3
Necturus maculosus	Mudpuppy	SC		S1	G5

Scientific Name Province: Habitat	Common Name	Status N.C.	Status U.S.	Rank N.C.	Rank Global
Notropis rubescens M: Savannah drainage	Rosyface Chub	T		S1	G4
Noturus eleutherus M: French Broad drainage	Mountain Madtom	SC		SH	G5
Noturus flavus M: Cane River	Stonecat	E		S1	G5
Noturus furiosus	Carolina Madtom		3C	S3	G3
CP: Tar and Neuse drainages (endemic to North Carolina)	[Neuse population]	SC		S2	G3T2Q
	[Tar population]	SR		S2	G3T2Q
Noturus gilberti P: Dan drainage	Orangefin Madtom	E	C2	S1	G2
Noturus, new species C: Cape Fear, Waccamaw, and Lumber drainages	Broadtail Madtom	SC		S2	G2
Percina aurantiaca M: Tennessee drainages	Tangerine Darter	SR		S3	G3G4
Percina burtoni M: South Toe River; formerly in French Broad drainage	Blotchside Darter	E		S1	G2
Percina caprodes M: Tennessee drainages	Logperch	T		S2	G5
Percina macrocephala M: French Broad River; probably extirpated	Longhead Darter	SC	C2	SH	G3
Percina oxyrhynchus M: New drainage	Sharpnose Darter	SC		S1	G4
Percina sciera M: French Broad drainage	Dusky Darter	E		S1	G5
Percina squamata M: Tennessee drainages	Olive Darter	SC	C2	S3	G3
Phenacobius teretulus M: New drainage	Kanawha Minnow	SC	C2	S3	G3
Polyodon spathula M: French Broad River	Paddlefish	E	C2	S1	G4
Semotilus lumbee C: streams in the sandhills	Sandhills Chub	SC	3C	S3	G3
Stizostedion canadense M: French Broad and Hiwassee rivers	Sauger	SR*		S2	G5

MARINE AND ESTUARINE FISHES

Acipenser brevirostrum TC: brackish water of large rivers and estuaries; spawns in freshwater areas	Shortnose Sturgeon	E	E	S1	G3
Acipenser oxyrhynchus TC: coastal waters, estuaries, large rivers	Atlantic Sturgeon	SC		S3	G3
Eleotris pisonis T: fresh to brackish ponds, river mouths, and estuaries	Spinycheek Sleeper	SR		S2	G5
Evorthodus lyricus T: shallow tidal water, especially pools in salt marshes	Lyre Goby	SR		S2	GU
Gobionellus stigmaticus T: shallow salt or brackish water	Marked Goby	SR		S2	G?
Hypsoblennius ionthas T: shallow bays, estuaries, tidal creeks	Freckled Blenny	SR		S2	GU
Microphis brachyurus T: warm fresh to brackish water	Opossum Pipefish	SR		S1	G5
Oostethus brachyurus (see Microphis).					

Scientific Name Province: Habitat	Common Name	Status N.C.	Status U.S.	Rank N.C.	Rank Global
Phalacrocorax auritus CP: lakes with scattered trees for nesting [breeding sites only]	Double-crested Cormorant	SR		S1B,S5N	G5
Picoides borealis CP: mature open pine forests, mainly in longleaf pine [breeding evidence only]	Red-cockaded Woodpecker	E	E	S2	G2
Plegadis falcinellus T: forests or thickets on maritime islands [breeding sites only]	Glossy Ibis	SC		S2B,S1N	G5
Porphyrula martinica C: freshwater ponds with floating vegetation [breeding sites only]	Purple Gallinule	SR		S1B	G5
Regulus satrapa M: spruce-fir forests; hardwood forests mixed with spruce or hemlock [not tracking]	Golden-crowned Kinglet	SC		S3B,S5N	G5
Riparia riparia P: high, vertical banks for nesting [breeding sites only]	Bank Swallow	SR		S1B,SZN	G5
Rynchops niger T: sand flats on maritime islands [breeding sites only]	Black Skimmer	SC		S3B,S3N	G5
Sphyrapicus varius M: mature, open hardwoods with scattered dead trees [breeding season only]	Yellow-bellied Sapsucker	SR		S2B,S5N	G5
Sterna caspia T: sand flats on maritime islands [breeding sites only]	Caspian Tern	SR		S1B,S2N	G5
Sterna dougallii T: sand flats on maritime islands [breeding evidence only]	Roseate Tern	E	E	SAB,S1N	G3
Sterna nilotica T: sand flats on maritime islands [breeding sites only]	Gull-billed Tern	T		S3B,SZN	G5
Thryomanes bewickii altus M: woodland borders or openings, farmlands or brushy fields, at high elevations [breeding season only]	Appalachian Bewick's Wren	E	C2	SHB,SZN	G5T?
Vermivora bachmanii P: [not tracking; accidental visitor]	Bachman's Warbler	E	E	SA	G1
Vermivora pinus M: low elevation brushy fields and thickets [breeding season only]	Blue-winged Warbler	SR		S2B,SZN	G5
Vireo gilvus M: groves of hardwoods along rivers and streams [breeding season only]	Warbling Vireo	SR		S2B,SZN	G5

REPTILES

Alligator mississippiensis CT: fresh to slightly brackish lakes, ponds, rivers, and marshes	American Alligator	T	T(S/A)[10]	S3	G5
Apalone spinifera spinifera M: large streams in the French Broad system	Eastern Spiny Softshell	SC		S1	G5T5
Caretta caretta T: nests on beaches; forages in ocean and sounds	Loggerhead	T	T	S2B,S2N	G3
Chelonia mydas T: nests on beaches; forages in ocean and sounds	Green Turtle	T	T	S1B,SZN	G3
Clemmys muhlenbergii MP: bogs, wet pastures, wet thickets	Bog Turtle	T	C2	S2	G3

[10] T(S/A) = Threatened due to Similarity of Appearance

Scientific Name Province: Habitat	Common Name	Status N.C.	Status U.S.	Rank N.C.	Rank Global
MAMMALS					
Canis rufus CM: swamps, pocosins, extensive forests	Red Wolf	E	E	S1	G1[9]
Condylura cristata parva MC: moist meadows, bogs, swamps, bottomlands [Coastal Plain population is SC; mountain population not of concern]	Star-nosed Mole	SC	3C	S4	G5
Felis concolor couguar MPC: extensive forests, remote areas	Eastern Cougar (Panther, Mountain Lion)	E	E	SH	G4TH
Glaucomys sabrinus coloratus M: high elevation forests, mainly spruce-fir	Carolina Northern Flying Squirrel	E	E	S1	G5T1
Microsorex (see Sorex)					
Microtus chrotorrhinus carolinensis M: rocky areas at high elevations, forests or fields	Southern Rock Vole	SC	C2	S2	G5T3
Mustela nivalis M: fields and forests, mostly at high elevations	Least Weasel	SR		S2	G5
Myotis austroriparius CP: roosts in buildings, hollow trees; forages near water	Southeastern Bat	SC	C2	S2	G4
Myotis grisescens M: roosts in caves; forages mainly over open water	Gray Bat	E	E	SA	G2
Myotis leibii leibii M: roosts in hollow trees (warmer months), in caves and mines (winter)	Eastern Small-footed Bat	SC	C2	SUB,S1N	G3T?
Myotis septentrionalis (= M. keenii) MP: roosts in hollow trees and buildings (warmer months), in caves and mines (winter)	Northern Long-eared Bat	SC		SUB,S2N	G4
Myotis sodalis M: roosts in hollow trees or under loose bark (warmer months), in caves (winter)	Indiana Bat	E	E	SUB,S2N	G2
Neotoma floridana haemitoreia; Neotoma floridana magister M: rocky places in deciduous or mixed forests (haemitoreia = G5T5; magister = G5T4Q)	Eastern Woodrat (haemitoreia = Southern Appalachian Woodrat; magister = Allegheny Woodrat)	SC	C2	S2	G5
Neotoma floridana floridana [Coastal Plain race] C: forests, mainly in moist areas	Eastern Woodrat	T		S1	G5T?
Peromyscus polionotus P: sandy, fallow fields near South Carolina line	Oldfield Mouse	SR		S1	G5
Plecotus rafinesquii MC: roosts in old buildings, caves, and mines, usually near water	Rafinesque's Big-eared Bat	SC	C2	S3	G4
Plecotus townsendii virginianus M: roosts in caves (and rarely in mines), especially in limestone areas	Virginia Big-eared Bat	E	E	S1	G5T2
Sciurus niger CPM: open forests, mainly longleaf pine/scrub oak	Fox Squirrel	SR*		S3	G5
Sorex dispar M: high elevation forests with talus or rocky slopes	Long-tailed Shrew	SC	3C	S2	G5
Sorex hoyi winnemana (= Microsorex) MC: montane deciduous forests; old fields and clearcuts in northeastern Coastal Plain	Southern Pygmy Shrew	SC	3C	S2?	G5T5
Sorex longirostris fisheri C: woodlands and brushy fields, especially where damp, in Dismal Swamp vicinity	Dismal Swamp Southeastern Shrew	T	T	S2	G5T1T3
Sorex palustris punctulatus M: stream banks in montane forests	Southern Water Shrew	SC	C2	S1	G5T3
Sylvilagus aquaticus M: wet woods and floodplains in southern mountains	Swamp Rabbit	SR*		SH	G5
Sylvilagus transitionalis M: dense cover of montane woods and thickets	New England Cottontail	SR*	C2	S3	G4

[9] Re-introduction, at Alligator River NWR and Great Smoky Mountains NP, NC

MEMORANDUM

To: NC Superfund Section Staff

From: Stuart F. Parker, Jr., Stuart F. Parker
Hydrogeologist
NC Superfund Section

Date: April 14, 1994

Re: Update on Critical Habitats in NC.

SFP telephoned the Raleigh and Asheville offices of the US Fish and Wildlife Service on April 14, 1994, to determine whether any additions or deletions have occurred to the 4 critical habitats listed in NC since Pat DeRosa's inquiry on May 18, 1989.

Kate Looney (919-856-4520) and Nora Murdoch (714-665-1195), fish and wildlife biologists with the respective offices, reported that no changes had been made as of this date. The 4 species, Hudsonia montana (mountain golden heather), Hybopsis monacha (spotfin chub), Menidia extensa (waccamaw silverside), and Notropis mekistocholas (Cape Fear shiner), are listed at the same locations as in May 1989. See attached material for details.

May 18, 1989

TO: Superfund Branch Staff

FROM: Pat DeRosa PD

RE: Critical Habitats of Federally Listed Endangered Species in North Carolina

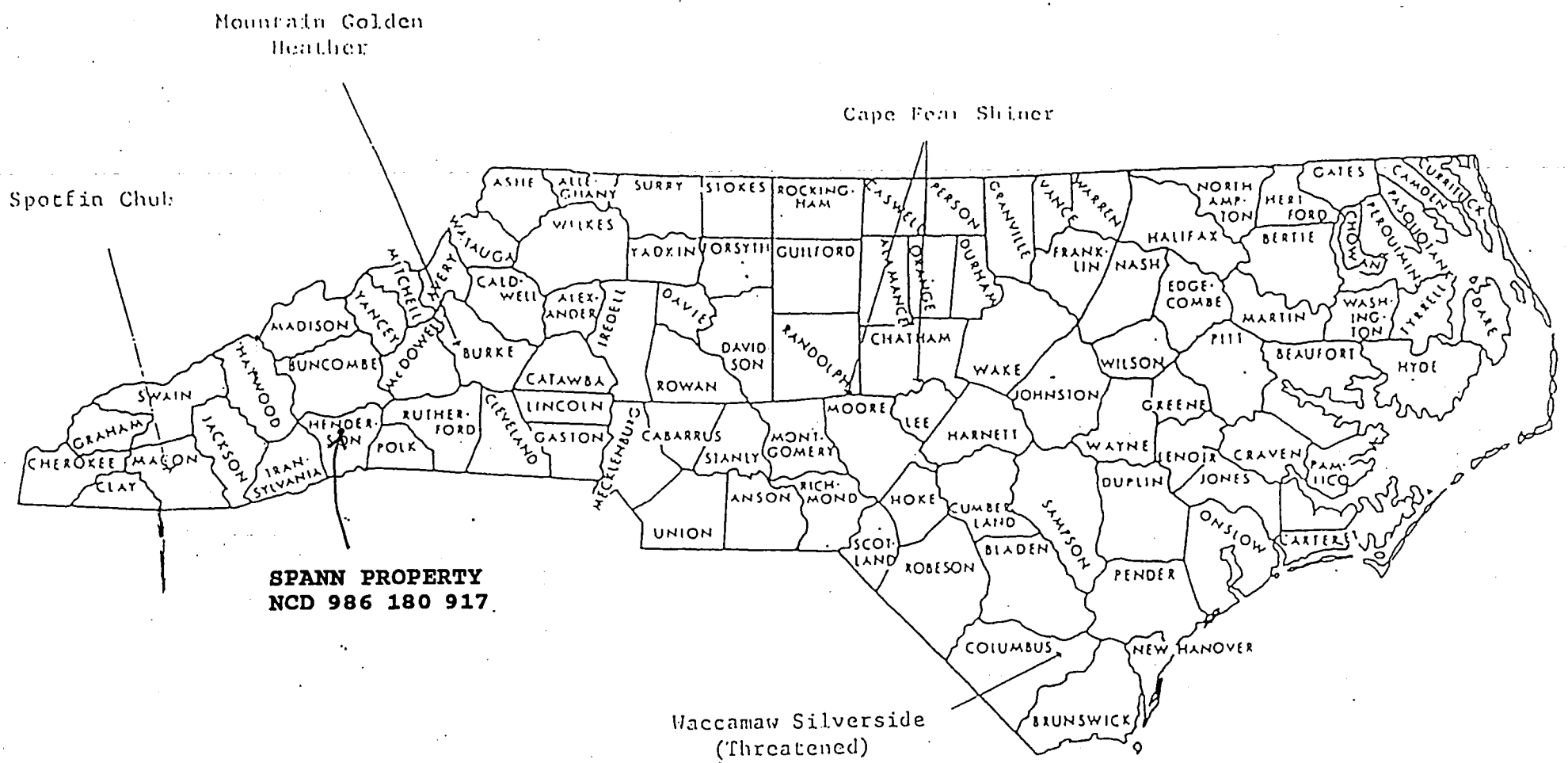
On May 18, 1989, I spoke by telephone with John Fridell, US Fish and Wildlife Service, Asheville, NC (704) 259-0321 to request an update on critical habitats in North Carolina. Mr. Fridell said the Fish and Wildlife Service has been reorganized into a western and eastern office in North Carolina. His office now handles only western North Carolina. He said there have been no changes in the designated critical habitats identified in western North Carolina.

I then spoke by telephone with Debby Mignogno, US Fish and Wildlife Service, Raleigh, NC (919) 856-4520 regarding critical habitats in eastern North Carolina. Ms. Mignogno sent the attached maps of the 2 critical habitats designated in eastern North Carolina. Please note that the Waccamaw Silverside is listed as threatened, not endangered.

PD/pb/critical.hab

CRITICAL HABITATS OF FEDERALLY LISTED

ENDANGERED SPECIES IN NC



1 inch = approx. 53 miles

Site Name: Spann Properties
Site Number: NCD 986 180 91

Site Location: Hendersonville, N.C.
Henderson County
Latitude: 35 23 06
Longitude: 82 30 10.5

Date: February 18, 1994

Calculation Results

Distance from Site Location	Population Per Ring	Population Cumulative	Number of Households Per Ring	Number of Households Cumulative
0 to 1/4 mile	35	35	15	15
>1/4 to 1/2 mile	171	206	74	89
>1/2 to 1 mile	1,015	1,221	439	528
>1 to 2 miles	4,730	5,951	2,020	2,548
>2 to 3 miles	4,563	10,514	2,002	4,550
>3 to 4 miles	9,483	19,997	4,156	8,706

Note: The populations and number of households within specified target distance rings were calculated for the NC Superfund Section by the NC State Center for Geographic Information and Analysis using the 1990 US Census data. These values were calculated by summing the population and the number of households data for each census block located within each target ring. For census blocks lying only partially within the ring, the per cent area of the block within the ring was multiplied by the population and household densities of the block.

Handout #8

SUPERFUND CHEMICAL DATA MATRIX

March 1993

Appendix B

Hazardous Substance Factor Values
(329 Substances)

Hazardous Substance Benchmarks
(329 Substances)

Hazardous Substance Benchmarks
(6 Radionuclides)

Appendix B-1

Tables for Non-radioactive Hazardous Substances

U. S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

Technical Guide
Section II-A-2
June 1991

HYDRIC SOILS
Henderson County, North Carolina

Hydric codes (HC):

1 = Hydric soils, only because of saturation for a significant period during the growing season;
2 = Hydric soils that are frequently flooded for long or very long periods during the growing season; and
3 = Hydric soils that are ponded for long or very long periods during the growing season.

Vegetation codes (VC):

1 = Hydric soils that support woody vegetation under natural conditions; and
2 = Hydric soils that do not support woody vegetation under natural conditions.

IMPORTANT NOTES: (1) Hydric soils in this county cannot be farmed under natural conditions without removing woody vegetation or hydrology manipulation. (2) Some map units and included soils listed as hydric soils in this county may not meet the definition of hydric soils and wetlands because the hydrology has been altered through drainage or other manipulations.

A. Map units that are all hydric soils or have hydric soils as a major component.

Map Unit Symbol	HC	VC	Map Unit Name
Ha	1	1	Hatboro loam
Ko	1	1	Kinkora loam
To	1	1	Toxaway silt loam

B. Map units with inclusions of hydric soils or have wet spots.

Map Unit Symbol	Map Unit Name	Hydric Inclusion	HC	VC	Normal location Inclusion
Co	Codorus loam	Toxaway	1	1	depressional areas
		Hatboro	1	1	depressional areas
DeA	Delanco loam, 0 to 2 percent slopes	Kinkora	1	1	depressional areas

Ref. 41

North Carolina Administrative Code

Title 15A
Department of Environment, Health, and Natural Resources
Division of Environmental Management

Subchapter 2L

Sections .0100, .0200, and .0300

Classifications and Water Quality Standards Applicable To The Groundwaters of North Carolina

Current Through November 8, 1993
Environmental Management Commission
Raleigh, North Carolina

SECTION .0200 - CLASSIFICATIONS AND GROUNDWATER QUALITY STANDARDS

.0201 GROUNDWATER CLASSIFICATIONS

The classifications which may be assigned to the groundwaters will be those specified in the following series of classifications:

(1) Class GA groundwaters; usage and occurrence:

(a) Best Usage. Existing or potential source of drinking water supply for humans.

(b) Conditions Related to Best Usage. This class is intended for those groundwaters in which chloride concentrations are equal to or less than 250 mg/l, and which are considered suitable for drinking in their natural state, but which may require treatment to improve quality related to natural conditions.

(c) Occurrence. In the saturated zone.

(2) Class GSA groundwaters; usage and occurrence:

(a) Best Usage. Existing or potential source of water supply for potable mineral water and conversion to fresh waters.

(b) Conditions Related to Best Usage. This class is intended for those groundwaters in which the chloride concentrations due to natural conditions is in excess of 250 mg/l, but which otherwise may be considered suitable for use as potable water after treatment to reduce concentrations of naturally occurring substances.

(c) Occurrence. In the saturated zone.

(3) Class GC groundwaters: usage and occurrence:

(a) Best Usage. The best usage of GC groundwaters is as a source of water supply for purposes other than drinking, including other domestic uses by humans.

(b) Conditions Related to Best Usage. This class includes those groundwaters that do not meet the quality criteria for GA or GSA groundwaters and for which efforts to improve groundwater quality would not be technologically feasible, or not in the best interest of the public. Continued consumption of waters of this class by humans could result in adverse health affects.

(c) Occurrence. Groundwaters of this class may be defined by the Commission pursuant to Section .0300 of this Subchapter on a case by case basis.

History Note: *Statutory Authority G.S. 143-214.1; 143B-282(2);*
Eff. June 10, 1979;
Amended Eff. October 1, 1993; August 1, 1989; September 1, 1984; December 30, 1983.

.0202 GROUNDWATER QUALITY STANDARDS

(a) The groundwater quality standards for the protection of the groundwaters of the state are those specified in this Rule. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage.

(b) The groundwater quality standards for contaminants specified in Paragraphs (g) and (h) of this Rule shall be as listed, except that:

(1) Where the standard for a substance is less than the practical quantitation limit,

the detection of that substance at or above the practical quantitation limit shall constitute a violation of the standard.

(2) Where two or more substances exist in combination, the Director shall consider the effects of chemical interactions as determined by the Division of Epidemiology and may establish maximum concentrations at values less than those established in accordance with Paragraphs (c) and (g) of this Rule. In the absence of information to the contrary, the carcinogenic risks associated with carcinogens present shall be considered additive and the toxic effects associated with non-carcinogens present shall also be considered additive.

(3) Where naturally occurring substances exceed the established standard, the standard will be the naturally occurring concentration as determined by the Director.

(c) Except for tracers used in concentrations which have been determined by the Division of Epidemiology to be protective of human health, and the use of which has been permitted by the Division, substances which are not naturally occurring and for which no standard is specified shall not be permitted in detectable concentrations in Class GA or Class GSA groundwaters. Any person may petition the Director to establish an interim maximum allowable concentration for an unspecified substance, however, the burden of demonstrating those concentrations of the substance which correspond to the levels described in Paragraph (d) of this Rule rests with the petitioner. The petitioner shall submit relevant toxicological and epidemiological data, study results, and calculations necessary to establish a standard in accordance with the procedure prescribed in Paragraph (d) of this Rule. Within three months after the establishment of an interim maximum allowable concentration for a substance by the Director, the Director shall initiate action to consider adoption of a standard for that substance.

(d) Groundwater quality standards for substances in Class GA and Class GSA groundwaters are established as the lesser of:

(1) Systemic threshold concentration calculated as follows: [Reference Dose (mg/kg/day) x 70 kg (adult body weight) x Relative Source Contribution (.10 for inorganics; .20 for organics)] / [2 liters/day (avg. water consumption)];

(2) Concentration which corresponds to an incremental lifetime cancer risk of $1x10^{-6}$;

(3) Taste threshold limit value;

(4) Odor threshold limit value;

(5) Maximum contaminant level; or

(6) National secondary drinking water standard.

(e) The following references, in order of preference, shall be used in establishing concentrations of substances which correspond to levels described in Paragraph (d) of this Rule.

(1) Integrated Risk Information System (U.S. EPA).

(2) Health Advisories (U.S. EPA Office of Drinking Water).

(3) Other health risk assessment data published by U.S. EPA.

(4) Other appropriate, published health risk assessment data, and scientifically valid peer-reviewed published toxicological data.

(f) Groundwater quality standards specified in Paragraphs (g) and (h) of this Rule and interim maximum allowable concentrations established pursuant to Paragraph (c) of this Rule shall be reviewed on a biennial basis. Appropriate modifications to established standards will be made in accordance with the procedure prescribed in Paragraph (d) of this Rule where modifications are considered appropriate based on data published subsequent

to the previous review.

(g) Class GA Standards. Where not otherwise indicated, the standard refers to the total concentration in milligrams per liter of any constituent in a dissolved, colloidal or particulate form which is mobile in groundwater. This does not apply to sediment or other particulate matter which is preserved in a groundwater sample as a result of well construction or sampling procedures.

(1) acetone: 0.7
(2) acrylamide (propenamide): 0.00001
(3) arsenic: 0.05
(4) barium: 2.0
(5) benzene: 0.001
(6) bromoform (tribromomethane): 0.00019
(7) cadmium: 0.005
(8) carbofuran: 0.036
(9) carbon tetrachloride: 0.0003
(10) chlordane: 2.7×10^{-5}
(11) chloride: 250.0
(12) chlorobenzene: 0.05
(13) chloroform (trichloromethane): 0.00019
(14) 2-chlorophenol: 0.0001
(15) chromium: 0.05
(16) cis-1,2-dichloroethene: 0.07
(17) coliform organisms (total): 1 per 100 milliliters
(18) color: 15 color units
(19) copper: 1.0
(20) cyanide: 0.154
(21) 2, 4-D (2,4-dichlorophenoxy acetic acid): 0.07
(22) 1,2-dibromo-3-chloropropane: 2.5×10^{-5})
(23) dichlorodifluoromethane (Freon-12; Halon): 1.4
(24) 1,1 dichloroethane: 0.7
(25) 1,2-dichloroethane (ethylene dichloride): 0.00038
(26) 1,1-dichloroethylene (vinylidene chloride): 0.007
(27) 1,2-dichloropropane: 0.00056
(28) di-n-butyl (or dibutyl) phthalate (DBP): 0.7
(29) diethylphthalate (DEP): 5.0
(30) di(2-ethylhexyl) phthalate (DEHP): 0.003
(31) p-dioxane (1,4-diethylene dioxide): 0.007
(32) dioxin: 2.2×10^{-10}
(33) dissolved solids (total): 500
(34) endrin: 0.002
(35) epichlorohydrin (1-chloro-2,3-epoxypropane): 0.00354
(36) ethylbenzene: 0.029
(37) ethylene dibromide (EDB; 1,2-dibromoethane): 4.0×10^{-7}
(38) ethylene glycol: 7.0
(39) fluoride: 2.0
(40) foaming agents: 0.5
(41) gross alpha (adjusted)particle activity (excluding radium-226 and uranium): 15 pCi/l

(42) heptachlor: 8.0×10^{-6}
(43) heptachlor epoxide: 4.0×10^{-6}
(44) heptane: 2.1
(45) hexachlorobenzene (perchlorobenzene): 0.00002
(46) n-hexane: 0.42
(47) iron: 0.3
(48) lead: 0.015
(49) lindane: 2.0×10^{-4}
(50) manganese: 0.05
(51) mercury: 0.0011
(52) metadichlorobenzene (1,3-dichlorobenzene): 0.62
(53) methoxychlor: 0.035
(54) methylene chloride (dichloromethane): 0.005
(55) methyl ethyl ketone (MEK; 2-butanone): 0.17
(56) methyl tert-butyl ether (MTBE): 0.2
(57) nickel: 0.1
(58) nitrate: (as N) 10.0
(59) nitrite: (as N) 1.0
(60) orthodichlorobenzene (1,2-dichlorobenzene): 0.62
(61) oxamyl: 0.175
(62) paradichlorobenzene (1,4-dichlorobenzene): 0.075
(63) pentachlorophenol: 0.0003
(64) pH: 6.5 - 8.5
(65) radium-226 and radium-228 (combined): 5 pCi/l
(66) selenium: 0.05
(67) silver: 0.018
(68) styrene (ethenylbenzene): 0.1
(69) sulfate: 250.0
(70) tetrachloroethylene (perchloroethylene; PCE): 0.0007
(71) toluene (methylbenzene): 1.0
(72) toxaphene: 3.1×10^{-5}
(73) 2, 4, 5,-TP (Silvex): 0.05
(74) trans-1,2-dichloroethene: 0.07
(75) 1,1,1-trichloroethane (methyl chloroform): 0.2
(76) trichloroethylene (TCE): 0.0028
(77) trichlorofluoromethane: 2.1
(78) vinyl chloride (chloroethylene): 1.5×10^{-5}
(79) xylenes (o-, m-, and p-): 0.53
(80) zinc: 2.1

(h) Class GSA Standards. The standards for this class shall be the same as those for Class GA except as follows:

(1) chloride: allowable increase not to exceed 100 percent of the natural quality concentration.
(2) total dissolved solids: 1000 mg/l.

(i) Class GC Waters.

(1) The concentrations of substances which, at the time of classification exceed the standards applicable to Class GA or GSA groundwaters shall not be caused to increase, nor shall the concentrations of other substances be caused to exceed the

MEMO

TO: Superfund Section Staff

FROM: Jeanette Stanley
Environmental Chemist
NC Superfund Section

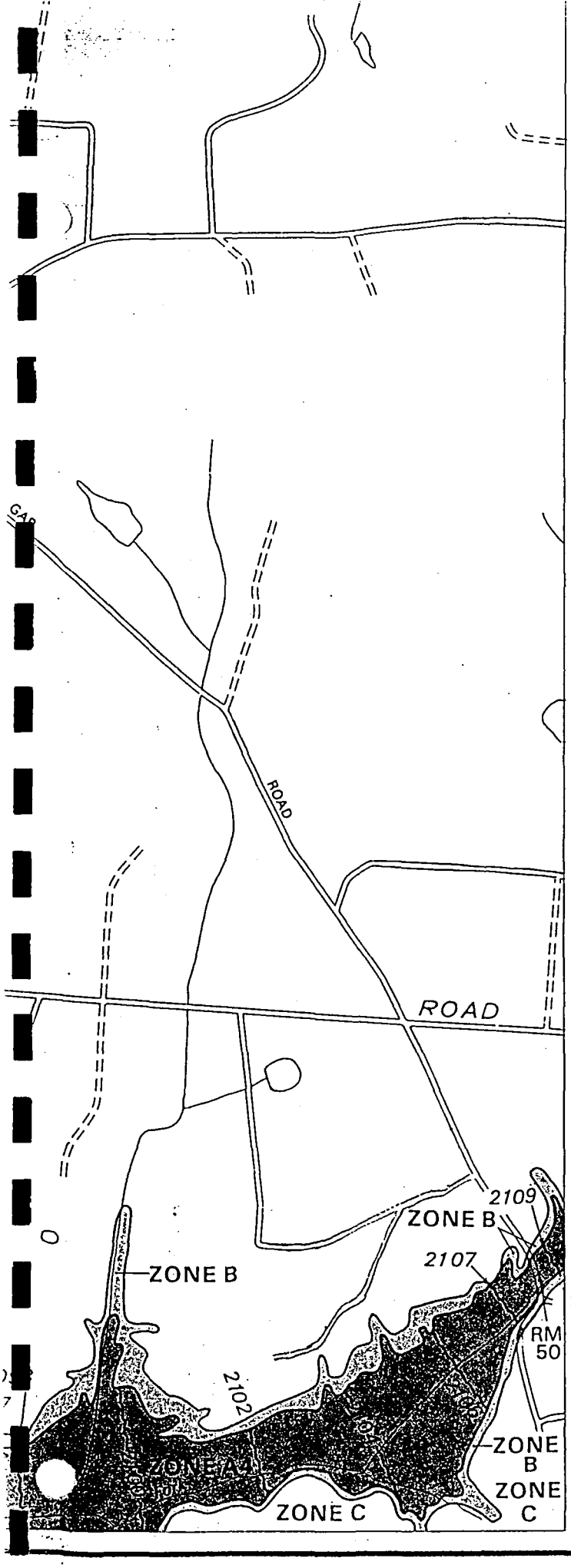
DATE: January 10, 1994

SUBJECT: Update on Status of Well Head Protection Programs in N.C.

I spoke with Carl Bailey, Groundwater Planning Branch Section Chief at (919) 733-3221. I asked him about Well Head Protection Areas (WHPAs) in North Carolina. Mr. Bailey said that Wally Venrick, Public Water Supply Section Chief, would be the most knowledgeable person on this subject.

I called Mr. Venrick at (919) 715-3232. He said that North Carolina has extended an invitation to communities to establish WHPAs, but none have been established. The cost to the community of establishing a WHPA exceeds the savings realized from waivers for certain analytical requirements. He does not anticipate that any WHPAs will be established prior to 1996.

Mr. Venrick said that there are minimum allowable distances between wells and certain structures (e.g. 100 feet between septic tanks and wells), but distances are arbitrary and vary depending on the structure.



established.

Ref. 43

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

HENDERSON COUNTY, NORTH CAROLINA

(UNINCORPORATED AREAS)

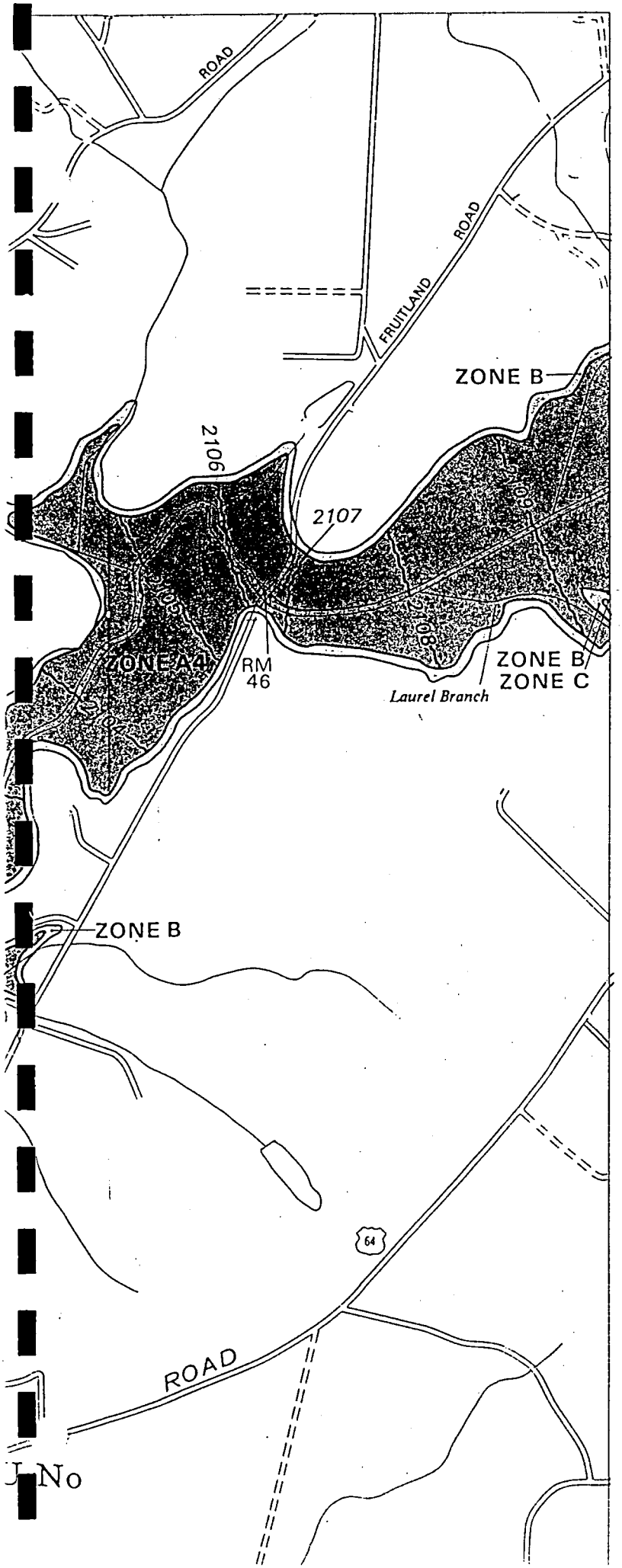
PANEL 85 OF 150

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
370125 0085 B

EFFECTIVE DATE:
MARCH 1, 1982

Federal Emergency Management Agency



KEY TO MAP

500-Year Flood Boundary	
100-Year Flood Boundary	
Zone Designations*	ZONE B / ZONE B
100-Year Flood Boundary	
500-Year Flood Boundary	
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7×
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

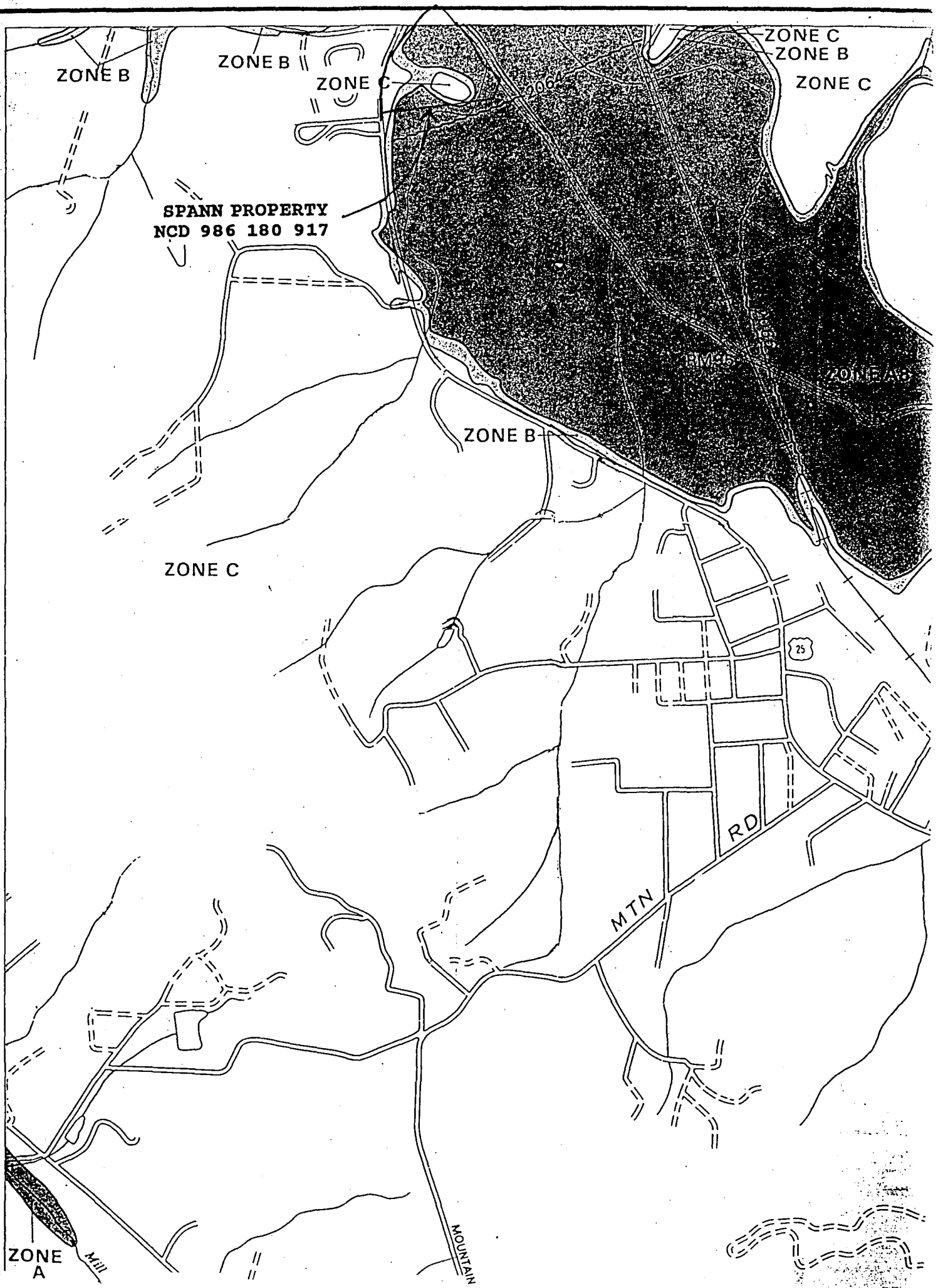
Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
JANUARY 10, 1975

FLOOD HAZARD BOUNDARY MAP REVISIONS:
JULY 29 1977


ZONE B
ZONE B
ZONE C
ZONE C
ZONE B
ZONE C
2064
SPANN PROPERTY
NCD 986 180 917
ZONE B
ZONE C
25
RD
MTN
MOUNTAIN
ZONE
A
Mill

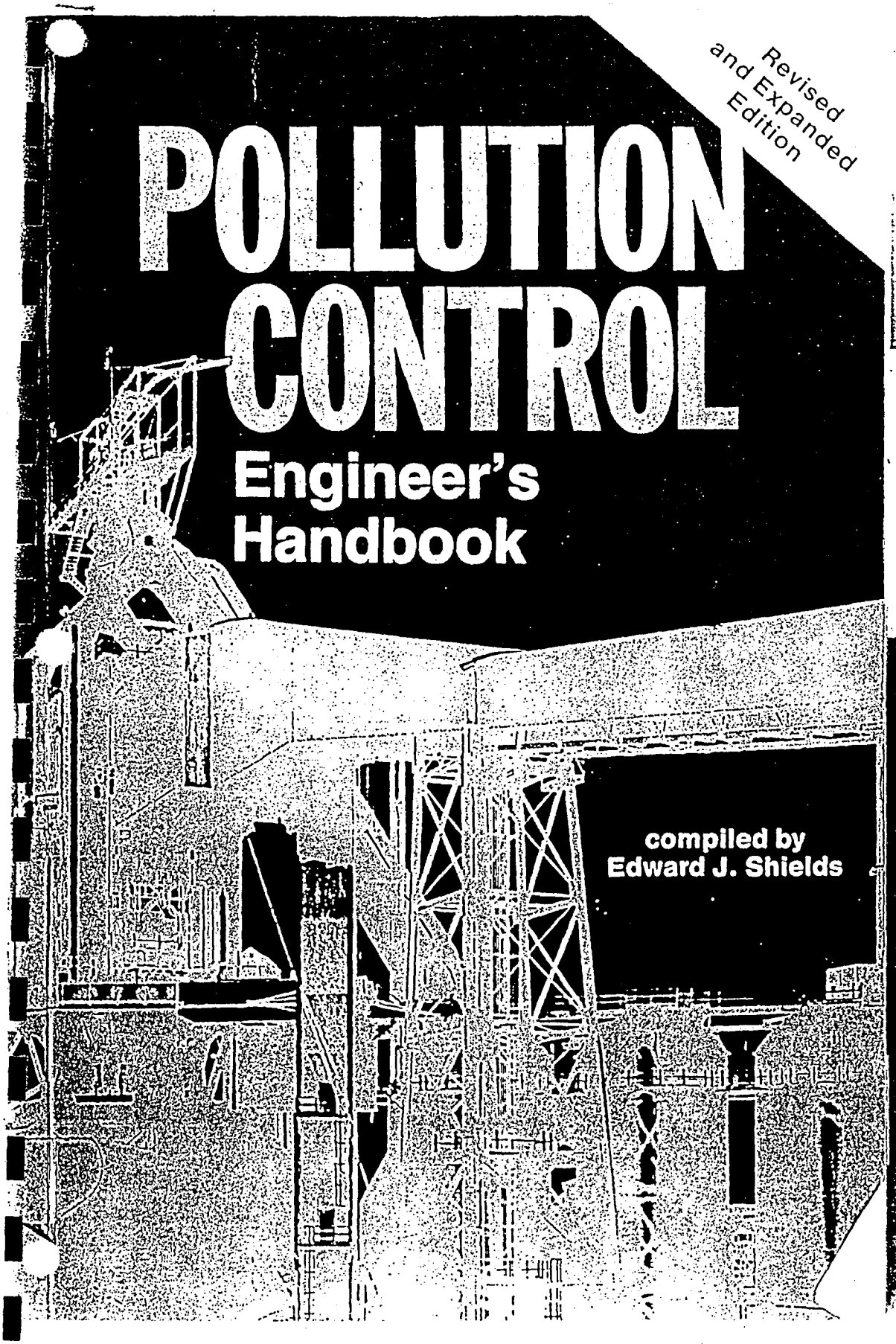
1990

Ref. 44

Revised and Expanded Edition

POLLUTION CONTROL

Engineer's Handbook



compiled by
Edward J. Shields

ELEMENT CONTENT OF NATURAL SOILS

Element	Common Range (ppm)	Average (ppm)	Element	Common Range (ppm)	Average (ppm)
Aluminum	10,000-300,000	71,000	Lead	2-200	10
Antimony	0.6-10	--	Lithium	5-200	20
Arsenic	0.1-40	5	Magnesium	600-6,000	5,000
Barium	100-3,500	430	Manganese	100-4,000	600
Beryllium	0.1-40	6	Mercury	0.01-0.8	.11
Boron	2-130	10	Molybdenum	0.2-5	2
Bromine	1-10	5	Nickel	5-1,000	40
Cadmium	0.01-7	.06	Radium	8×10^{-5}	--
Cerium	30-50	--	Rubidium	20-600	10
Cesium	0.3-25	6	Scandium	10-25	--
Chlorine	20-900	100	Selenium	0.1-2	.3
Chromium	5-3,000	100	Silver	0.01-5	.05
Cobalt	1-40	8	Strontium	50-1,000	200
Copper	2-100	30	Thorium	0.1-12	--
Fluorine	10-4,000	200	Tin	2-200	10
Gallium	0.4-300	30	Tungsten	--	1
Germanium	1-50	--	Uranium	0.9-9	1
Gold	--	1	Vanadium	20-500	100
Iodine	0.1-40	5	Yttrium	10-500	50
Lanthanum	1-5,000	30	Zinc	10-300	50
			Zirconium	60-2,000	300

REFERENCES:

- USEPA Office of Solid Waste and Emergency Response; HAZARDOUS WASTE LAND TREATMENT, SW-874 (April, 1983) Page 273, Table 6.46.
- USEPA Hazardous Waste Engineering Research Laboratory; RECLAMATION AND REDEVELOPMENT OF CONTAMINATED LAND, Volume I, EPA/600/2-86/066 (August, 1986) Pages 172 and 173, Table B-16.
- THE FATE OF HAZARDOUS MATERIAL IN SOIL; James Dragun, HAZARDOUS MATERIALS CONTROL, Vol. 1 No. 2 (March-April, 1988).

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: July 13, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Geochemical Atlas Interpretation

SFP reviewed NC Geological Survey Bulletin 93, Geochemical Atlas of North Carolina, which summarizes metals analyses for stream sediments in several counties throughout the State. Although the atlas database does not include Henderson County, it does cover adjacent Buncombe and McDowell Counties, which are geologically similar to Henderson Co.

The data indicate that the majority of samples taken in McDowall Co. and Buncombe Co. had barium concentrations in excess of 102 ppm (equivalent mg/kg). Most samples ranged from 10-12 ppm lead, but samples within the range 13-2597 ppm lead were not uncommon. The majority of sediment samples in the 2 counties contained zinc in the range 32-774 ppm. Occurrence of high barium and zinc concentrations were most common in the western Piedmont and mountain counties. These concentrations are consistant with SI sediment maxima of 70 mg/kg barium, 20 mg/kg lead, and 53 mg/kg zinc, respectively.

A GEOCHEMICAL ATLAS OF NORTH CAROLINA

NORTH CAROLINA GEOLOGICAL SURVEY

N.C. DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

LIBRARY
OCT 21 1993
N.C. DEPT OF ENVIRONMENT, HEALTH & NATURAL RESOURCES

A GEOCHEMICAL ATLAS OF NORTH CAROLINA

by

Jeffrey C. Reid

NORTH CAROLINA GEOLOGICAL SURVEY

BULLETIN 93
RALEIGH
MAY 1991
(REVISED 1993)

LIBRARY
OCT 21 1993
N.C. DEPT. OF ENVIRONMENT, HEALTH & NATURAL RESOURCES

STATE OF NORTH CAROLINA
JAMES B. HUNT, JR., GOVERNOR

DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
JONATHAN B. HOWES, SECRETARY

A GEOCHEMICAL ATLAS OF NORTH CAROLINA

by

Jeffrey C. Reid

ABSTRACT

This geochemical atlas of North Carolina presents stream sediment data and field measurements of pH and conductivity obtained by the U.S. Department of Energy's National Uranium Resource Evaluation (NURE) program. The format is similar to a companion atlas which presents NURE groundwater and stream water data for North Carolina (Reid, 1993). Samples were collected and analyzed during the period 1975-1979. Before termination of the NURE program, sampling of the entire state (48,666 square miles of land area) was completed at a reconnaissance scale. Sample density averages one sample per 7.2 square miles of land area.

The database consists of 6,744 stream sediment sampling sites, along with latitude-longitude coordinates of the sampling sites. Samples were analyzed by neutron activation analyses for: uranium (U), thorium (Th), hafnium (Hf), cerium (Ce), iron (Fe), manganese (Mn), sodium (Na), scandium (Sc), titanium (Ti), vanadium (V), aluminum (Al), dysprosium (Dy), europium (Eu), lanthanum (La), samarium (Sm), ytterbium (Yb), and lutetium (Lu) in stream sediments. Supplemental analyses by other techniques were reported for extractable U, silver (Ag), arsenic (As), barium (Ba), beryllium (Be), calcium (Ca), cobalt (Co), chromium (Cr), copper (Cu), potassium (K), lithium (Li), magnesium (Mg), molybdenum (Mo), niobium (Nb), nickel (Ni), phosphorous (P), lead (Pb), selenium (Se), tin (Sn), strontium (Sr), tungsten (W), yttrium (Y), and zinc (Zn) for 4,619 stream sediment samples. Field measurements of pH and conductivity are included. A total of 336 samples analyzed had detectable gold (Au). Reid and Carpenter (1993a,b) list analyses for all variables which exceed the 90th percentile; pH and conductivity values below the 10th percentile are also listed.

Maps showing the concentration of these elements are presented at a scale of 1:1,584,000. A geologic overlay is presented which very closely approximates this scale (25 miles = 1 inch). This overlay is taken from the scale of the Geologic Highway Map of the Mid-Atlantic States (Bennison, 1989).

The maps define regional geochemical patterns which broadly delineate areas within the state where element concentrations are, on average, higher or lower than other areas. Such information allows, for example, assessment of individual counties for baseline geochemical evaluations, environmental assessments, agricultural and epidemiological studies. The maps have limited applicability for detailed, or site-specific studies. However, concentrations of variables which equal or exceed the 90th percentile (see Reid and Carpenter, 1993a,b) can be used for more detailed compilation.

The NURE data are applicable to mineral exploration, agriculture, waste disposal siting issues, health, and environmental studies. Applications in state government include resource surveys to assist mineral exploration by identifying geochemical anomalies and areas of potential mineralization. Agriculture seeks to identify areas with favorable (or unfavorable) conditions for plant growth, disease, and crop productivity. Trace elements such as cobalt, copper, chromium, iron, manganese, zinc, and molybdenum must be present within narrow ranges in soils for optimum plant growth and productivity. Trace elements as a contributing factor to disease are of concern to health professionals. Industry can use pH and conductivity data for water samples to site facilities which require specific water quality.

PLATES

1. North Carolina counties
2. NURE stream sediment sample locations
3. Li (Lithium)
4. Na (Sodium)
5. K (Potassium)
6. Cu (Copper)
7. Ag (Silver)
8. Au (Gold)
9. Be (Beryllium)
10. Mg (Magnesium)
11. Ca (Calcium)
12. Sr (Strontium)
13. Ba (Barium)
14. Zn (Zinc)
15. Al (Aluminum)
16. Sc (Scandium)
17. Y (Yttrium)
18. La (Lanthanum)
19. Sn (Tin)
20. Pb (Lead)
21. Ti (Titanium)
22. HF (Hafnium)
23. P (Phosphorous)
24. As (Arsenic)
25. V (Vanadium)
26. Nb (Niobium)
27. Se (Selenium)
28. Cr (Chromium)
29. Mo (Molybdenum)
30. W (Tungsten)
31. Mn (Manganese)

PLATES (continued)

32. Fe (Iron)
33. Co (Cobalt)
34. Ni (Nickel)
35. Ce (Cerium)
36. Sm (Samarium)
37. Eu (Europium)
38. Dy (Dysprosium)
39. Yb (Ytterbium)
40. Lu (Lutetium)
41. Th (Thorium)
42. U (Uranium)
43. UX (extractable uranium)
44. pH
45. Conductivity

INTRODUCTION

This geochemical atlas of North Carolina presents stream sediment data obtained by the U.S. Department of Energy's National Uranium Resource Evaluation (NURE) program. The format of presentation is similar to a companion atlas which presents NURE groundwater and stream water data for North Carolina (Reid, 1993).

The database consists of 6,744 stream sediment sample sites along with their latitude-longitude coordinates. Neutron activation analyses were provided for the elements U, Th, Hf, Ce, Fe, Mn, Na, Sc, Ti, V, Al, Dy, Eu, La, Sm, Yb, and Lu in stream sediments. Supplemental analyses by other techniques including U (extractable), Ag, As, Ba, Be, Ca, Co, Cr, Cu, K, Li, Mg, Mo, Nb, Ni, P, Pb, Se, Sn, Sr, W, Y, and Zn were analyzed on 4,619 sediment samples. A total of 336 samples analyzed had reportable gold. Analyses for silver, arsenic, beryllium, and molybdenum should be used with caution because of reported data quality (refer to comments by Koch, 1988).

Maps showing the concentrations of these elements are presented at a scale of 1:1,584,000. This very closely approximates the scale of the Geologic Highway Map of the Mid-Atlantic States (Bennison, 1989). An overlay derived from Bennison permits the reader to compare regional geology with regional geochemistry. Further geological detail is provided by the current state geologic map (North Carolina Geological Survey, 1985) and the generalized geologic map of North Carolina (North Carolina Geological Survey, 1991). Reid and Carpenter (1993a) list analyses for all variables which exceed the 90th percentile. For pH and conductivity, values below the 10th percentile are also listed. Reid and Carpenter (1993b) present similar data for NURE groundwater and limited stream water data for North Carolina. The scale of presentation, and adopted class intervals, define regional geochemical patterns which broadly delineate areas within the state where element concentrations are, on average, higher or lower than other areas. The atlas maps are believed to portray regional concentrations of chemical elements, and in the cases of pH and conductivity, to reflect shallow aquifers and stream conditions.

NATURE OF THE NURE PROGRAM IN NORTH CAROLINA

Background

Between 1973 and 1979, DOE conducted the NURE program in all of the United States except Hawaii. The purpose was to evaluate uranium resources and to locate places favorable for uranium exploration. Stream sediment, groundwater, and surface water were samples in the Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) phase of the program. About two-thirds of the United States was sampled, and all of North Carolina, before the program was terminated. Four national laboratories conducted the HSSR program. The Savannah River Laboratory at Aiken, South Carolina, conducted the North Carolina Program. Sargent and others (1982) report the North Carolina results in a publication that consists of a brief text and microfiche listing of the field and analytical data. These data are also available on magnetic tape for computer processing. The data were originally organized in 1° by 2° quadrangles of the U.S. National Map Series. Sargent and others (1982) list the quadrangle names and the original report numbers.

DATABASE

Sampling of the state's 48,688 square miles of land area was completed and stream sediments at 6,744 sample sites were analyzed before the NURE program was terminated. Sample density averages one sample per 7.2 square miles of land area. The database for the report contains about 206,000 stream-sediment analyses. Sampling was done by established geochemical exploration procedures as explained in standard texts (Rose and others, 1979), and by Sargent and others (1982). The Savannah River Laboratory prepared the samples and analyzed the original group of elements by automated neutron activation analyses. Contractors analyzed the supplemental elements by atomic absorption and other methods (Sargent and others, 1982). Samples in which gold was detected by neutron activation analysis are reported by Fay and Cook (1982).

Sargent and others (1982) explained some limitations of the data. The survey objectives dictated broad coverage of a large area and determination of a large number of variables on each sample. Although rigorous sampling and analytical procedures were employed, the scale of the project, the diverse nature of personnel and analytical procedures and the length of time over which these activities were conducted, all combine to introduce variations within the database that at times can inhibit direct comparisons. A major limitation is that large areas of the state are not included in the supplemental analyses.

Analytical procedures

Sampling and analytical procedures were described by Sargent and others (1982) and summarized here. Conductivity and pH were measured at the sampling sites. The analyses for U, Th, Hf, Ce, Fe, Mn, Na, Sc, Ti, V, Al, Dy, Eu, La, Sm, Yb, Lu, Br, Cl, and F were performed by automated neutron activation analysis (NAA). A minimum of five sediment subsamples were composited from each stream site. Approximately 400 grams of sediment passing a 420 micrometer screen (U.S. standard 40 mesh) were collected at each sampling site. Sediment samples were dried at 105°C., sieved to <149µm (100 mesh), blended, coned, and quartered. One and one-half gram aliquots of the <149µm material were packed into ultrapure polyethylene capsules for analyses. The encapsulated samples, in batches of 25, including one standard, and one blank, were loaded into the NAA pneumatic system. Transport into the irradiation assembly and counting stations and the collection and processing of data were computer-controlled (Sargent and others, 1982).

Uranium was determined by counting neutrons emitted by induced fission products of ^{235}U in the sample. Other elements were determined by computer reduction of gamma-ray spectra collected at intervals from a few seconds to about 10 days after irradiation.

Stream sediments were analyzed for supplemental analyses by a subcontractor. Methods for sample dissolution and analysis are given by Sargent and others (1982). A standard and a blank were analyzed with each group of 40 samples. Extractable uranium was determined after a 30-minute leach using hot (180°C.) 4:1 nitric and perchloric acids.

DATA PROCESSING

The atlas maps were computer-generated at the state's geographic information system (Center for Geographic Information and Analysis [CGIA]). The Division of Statistics and Information Services provided input files for CGIA using SAS software. At CGIA the data were processed on a Sun Microsystems SPARC station 1 using ESRI's (Environmental Systems Research Institute, Inc.) ARC/INFO GIS software. Camera-ready maps were plotted using a Calcomp 1077 pen plotter. CGIA and the Division of Statistics and Information Services are units of t
of Environment, He:

Some editing of
The computer files we
computer environ
variable (CSV) for
and sorting describe
Hei® personal com
program, Excel®, ve
missing data were
background was high,
of minimum detectio
period (.) indicates th
and that the detecti
Analyses denoted by
The missing data ("M
the data; data repres
next following reso
samples without coo
third sorting of the
indicates that a value
These were assigne
detection limit. Bas
frequency percent
remaining samples f

R

Organization of th
atlas follows the pe
grouped by increasin
of the periodic chart.
Conductivity and p
Four class inter
approximately to qua
are plotted on each
boundaries for refere
of sample sites. Pla
stream sediment dat
conductivity data.

Basic statistical
presented in Table 1
maximum, averag
Analytical values co
and 99th percentiles a
about acidity (pH) in
values are shown in
99th percentiles for
acidic to alkaline (.
acidic (not mapped).

Reid and Carpen
variables which exce
and conductivity, va
are also listed. In th
elements analyzed
identification num
sample. Column 3 lis
codes which consis
(see listing in Reid
three-digit site nu

acquisitions occur or routes are selected. Such data also alert planners of potential mineralization which may alter route selection.

Conductivity

Conductivity, in combination with pH, is useful in evaluation of water quality. High water conductivity appears concentrated in the northern Piedmont. Water in such regions indicates "hard water" which may require additional treatment for use. Plate 45 shows the distribution of conductivity in the State. "Holes" in the data displayed on these plates are due to the absence of sampling in the major metropolitan areas. The highest conductivity values statewide correspond to the State's most industrialized and most populated areas. Overall these data show likely man-induced pollutants to the environment through concentrated development and industrialization.

Agriculture

Heavily fertilized agricultural areas are reflected by the phosphorous and potassium atlas maps. Regional contribution to nutrient-loading to drainages may be identified. Such information may help water quality management.

Industry

Industry can use water pH and conductivity to help site plants which require specific water quality.

ACKNOWLEDGMENTS

Completion of this report results from the encouragement and support of many people and organizations: Karen Siderelis (CGIA Director), Greg Beam, Zolt Nagy, Tom Tribble, and Tim Johnson (CGIA) were important to convert numbers into maps. Greg Beam translated data files into maps and dealt with questions with exceptional patience.

Linda Little, Executive Director, Governor's Waste Management Board (GWMB), funded initial printing of the atlas. Ron Still and Sandra Washington (GWMB) handled printing contract logistics.

Delton Atkinson, Director, Division of Statistics provided technical staff and computing resources to manipulate the NURE data into a mappable format. Abas Tavakoli performed initial data and statistical manipulations and patiently handled questions. Mike J. Bowling developed tape reading procedures.

The Association of American Petroleum Geologists (AAPG) provided the base from which the geologic overlay was created. The base originally was from their 1989 revision of their Mid-Atlantic Highway Map; their generosity is appreciated.

Charles H. Gardner, Director, Division of Land Resources supported the project. John Callahan, Department of Geology, Appalachian State University encouraged publication and suggested organization options. Robert H. Carpenter urged publication of the NURE database.

Denise Smith (Department of Environment, Health and Natural Resources, Public Affairs) prepared graphics. Charles. H. Gardner, P. A. Carpenter III, and Randy Cotten reviewed early drafts and provided constructive comment.

The manuscript benefited from the constructive reviews of Robert. H. Carpenter, John Callahan, and Kenneth Sargent. John Callahan offered substantive comment leading to publication of the greater than 90th percentile data. Stephen T. Reid, editor, Division of Land Resources, reviewed drafts of the manuscript.

REFERENCES

(Note: The Department of Energy reports are available on microfiche from the Bendix Field Engineering Corporation, Box 1569, Grand Junction, Colorado 815012, where they are catalaged under their GJBX numbers.)

Bennison, A.P., (compiler), 1989, Geological map of the Mid-Atlantic region (revised): The American Association of Petroleum Geologists, Tulsa, OK.

Carpenter, Robert H. and Carpenter, Susan, F., 1991, Heavy mineral deposits of the upper Coastal Plain of North Carolina and Virginia, Economic Geology, v. 86, Num. 8, p. 1657-1671.

Fay, W. M., and Cook, J.R., 1982, Gold analyses by neutron activation from SRL NURE samples: Aiken, SC, Savannah River Laboratory, Report DPST-81-141-38, 46p. (Department of Energy report GJBX-135-82).

Grosz, A. E., San Jaun, F., and Reid, J. C., 1992, Gamma-ray aeroradiometric anomalies on Cretaceous age sediments in North Carolina: Implications for placer mineral resources, U.S. Geological Survey, Open-File report OF-92-396, 27 p.

Karfunkel, B. S., Fay, W. M., and Price, V., Jr., 1981, Analyses of monazite, zircon, and apatite from the southeastern Piedmont: E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC under contract to the U.S. Department of Energy, contract DE-AC09-76SR000001 (DPST-81-141-8; GBJX-101), 57p.

Koch, G.S., 1988, A Geochemical Atlas of Georgia, Georgia Geological Survey, Geologic Atlas 3, 2 pages plus 42 plates.

Koch, G. S., Jr., Howarth, R., J., Carpenter, R. H., and Schuenemeyer, J. H., 1979, Development of data enhancement and display techniques for stream-sediment data collected in the National Uranium Resource Evaluation program of the United States Department of Energy, contract DE-AC-13-76-GJO-1664 submitted to Bendix Field Engineering Corporation, Grand Junction, Colorado, 223p.

North Carolina Geological Survey, 1985, Geologic Map of North Carolina, scale 1:500,000, in color.

North Carolina Geological Survey, 1991, Generalized Geologic Map of North Carolina, in color.

Owens, J. P., Grosz, A. E., and Fisher, J. C., 1989, Aeroradiometric map and generalized geologic interpretation of part of the Florence and Georgetown 1° x 2° quadrangles, South Carolina: U.S. Geological Survey Miscellaneous Investigations Series Map I-1948B, scale 1:250,000, in color.

Reid, Jeffrey C., 1993, A Hydrogeochemical Atlas of North Carolina, North CarolinaGeological Survey, Bulletin 94, introductory text plus 26 plates.

Reid, Jeffrey C., and Carpenter, Robert H., 1993a, Listing of concentrations (stream sediments) of variables which equal or exceed the 90th percentile, and pH and conductivity below the 10th percentile in theNorth Carolina portion of the NURE database, North Carolina Geological Survey, Open-File Report 93-1, introductory text plus 444 pages of data.

Reid, Jeffrey C., and Carpenter, Robert H., 1993b, Listing of concentrations (groundwater and stream water) of variables which equal or exceed the 90th percentile, and pH and conductivity below the 10th percentile in theNorth Carolina portion of the NURE database, North Carolina Geological Survey, Open-File Report 93-2, introductory text plus 162 pages of data.

Rose, A. W., Hawkes, H.E., and Webb, J.S., 1979, Geochemistry in Mineral Exploration: New York, Academic Press, 657p.

Sargent, K. A., Cook, J. R., and Fay, W. M., 1982, Data Report: North and South Carolina, National Uranium Resource Evaluation Program, Hydrochemical and stream sediment reconnaissance: E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC under contract to the U.S. Department of Energy, contract DE-AC09-76SR000001 (DPST-81-146-22; GBJX-102). 45p. plus microfiche.

Note: This publication was first published in 1991. However, due to certain computer-related errors detected after publication release, this publication was retracted and was replaced by the present publication in which essential corrections were made and the text expanded to its present form. The year of publication should be cited as 1991 (revised 1993). The revised version was published in 1993.

Charles H. Gardner,
Director and State Geologist
Division of Land Resources

GEOLOGICAL SURVEY SECTION

The Geological Survey Section examines, surveys, and maps the geology, mineral resources, and topography of the state to encourage the wise conservation and use of these resources by industry, commerce, agriculture, and government agencies for the general welfare of the citizens of North Carolina.

The section conducts basic and applied research projects in environmental geology, mineral resource exploration and systematic geologic mapping. Services include identifying rock and mineral samples submitted by citizens and providing consulting services and specially prepared reports to agencies that need geological information.

The Geological Survey Section publishes Bulletins, Economic Papers, Information Circulars, Educational Series, Geologic Maps, and Special Publications. For a list of publications or more information about the section contact the Geological Survey Section, Division of Land Resources, at P.O. Box 27687, Raleigh, North Carolina 27611-7687 or call (919) 733-2423.

Jeffrey C. Reid
Chief Geologist

Table 1 - Stream sediment geochemical data for North Carolina. Table shows chemical element, atomic number, periodic chart column, number of samples represented, mean, standard deviation (Std. Dev.), and crustal abundance (Crustal Abund.).

Table 1 -- Stream-sediment geochemical data for North Carolina*.

Plot #	Variable	Atomic Number	Periodic Column	N (Raw Data)	"TOTS"	"M"	Not Plotable	Unplotable Removed	Computed N (Used Data)	X (geometric)	Fact Error	Number of Samples	Mean FINAL	Std. Dev. FINAL	Min. FINAL	Max. FINAL	50th Percentile	85th Percentile	95th Percentile	Crustal Abundance***	CUMULATIVE FREQUENCY PERCENT OF DATA PORTRAYED BY PLOTTING SYMBOL (Lowest) RANGE ONE	RANGE TWO	RANGE THREE	RANGE FOUR (Highest)
1	Li	3	IA	6677	62	0	39	39	4376	4376	0	4376	8.8	13.8	1	717	13*	20*	31*	20	26.8	44.3	71.5	100
6	Na	11	IA	6744	0	593	67	67	6084	6084	0	6084	7339	7768	100	79300	17500*	22300*	31900*	28,300	34.5	50.1	73.4	100
7	K	19	IA	6677	64	0	39	39	4376	4376	0	4376	7909	7443	500	96100	17400*	22300*	33600*	23,900	16.8	48.4	72.6	100
8	Ca	20	IIA	6677	28	0	39	39	4610	4610	0	4610	7.3	7.5	1	215	13*	19*	30*	33	10.3	48.2	71.2	100
9	Ag	47	IB	6677	38	0	39	39	4610	4610	0	4610	0.33	0.181	0.05	2.5	0.6*	0.7*	0.9*	0.07	31.78	47.33	76.03	100
10	As	79	IB	336	0	0	0	0	336	336	0	336	0.393	0.283	0.011	30.36	0.893	1.96	16.776	0.004	25.3	50	75	100
11	Be	4	IIA	6677	63	0	39	39	4573	4573	0	4573	1.1	1.5	0.2	94	N/A	2.1*	3.3*	2.8	11.2	35.6	68.8	100
12	Mg	12	IIA	6677	64	0	39	39	4574	4574	0	4574	30.89	29941	100	845600	7150	3139	11590	20,900	24.8	49.6	74.4	100
13	Cr	30	IIA	6677	1284	0	39	39	3333	3333	0	3333	330	360	30	8400	800*	800*	1400*	36,300		31.0	71.5	100
14	Sr	38	IIA	6677	3438	0	39	39	1310	1310	0	1310	82	113	33	1141	183*	270*	648	375		36	74.9	100
15	Ba	56	IIA	6677	1271	0	39	39	3361	3361	0	3361	78.4	143.3	2.5	3605	21.3*	308*	318*	425	19.3	50.1	74.4	100
16	Zn	30	IIB	6677	28	0	39	67	4610	4610	0	4610	36.4	25.8	2.5	774	49*	61*	95*	70	19.8	48.6	74.0	100
17	Al	13	IIIA	6744	0	333	67	67	6333	6333	0	6333	76400	33413	1109	329400	67800*	77900*	131300	81,300	33.3	50.1	74.9	100
18	Sc	21	IIIB	6744	0	177	67	67	6500	6500	0	6500	9	8.4	0.8	106.3	10.7*	16	42.5*	22	25	50.1	75	100
19	Y	39	IIIB	6677	40	0	39	39	4398	4398	0	4398	26.3	34.3	2.5	2015	16*	33*	34.5*	33		42.4	79.3	100
20	La	57	IIIB	6744	0	1469	67	67	5028	5028	0	5028	98	143	2	1470	31.8	335	736	30	24.4	48.7	74.8	100
21	Sm	60	IVA	6677	300	0	39	39	4369	4369	0	4369	3.7	8.71	2.5	133	1.5*	2.2*	4.1	3		63	81	100
22	Pb	82	IVA	6677	42	0	39	39	4396	4396	0	4396	11	41	3	2597	5.1*	7.7*	20*	13		36.8	68.4	100
23	Th	90	IVB	6744	0	237	67	67	6140	6140	0	6140	10000	19000	200	99600	20000*	28100*	56700*	4,600	23	49.7	74.9	100
24	Hf	72	IVB	6744	0	223	67	67	6433	6433	0	6433	53	94	1	2134	11.6*	183*	433	3	32.2	49.4	74	100
25	F	9	VA	6677	33	0	39	39	4363	4363	0	4363	995	990	10	8150	1460*	3700*	6100*	1,000	23.4	48.2	70.3	100
26	As	33	VA	6677	0	1963	32	32	2700	None	1	2700	2.1	3.1	0	40	0*	5*	17*	1.8	22.6	36.3	76.3	100
27	V	23	VB	6744	0	456	67	67	6221	6221	0	6221	78	88	10	1370	170*	230*	450*	135	17.3	42.3	71.6	100
28	Nb	41	VB	6677	39	0	39	39	4379	4379	0	4379	14.5	21.8	2	300	4.5*	33*	105*	20	35.4	37.7	76.8	100
29	Sn	50	VA	6677	0	1294	39	39	3364	3364	0	3364	1	1.21	0.05	20	3*	4*	8*	0.05		40.5	83.8	100
30	Cr	24	VIB	6677	2,317	0	39	39	4367	4367	0	4367	12.8	36.1	2.5	3010	31*	53*	90*	100	36.7	43.2	74.2	100
31	Mo	42	VIB	6677	39	0	39	39	4600	4600	0	4600	3	1.41	1	33	3*	6*	11*	1.5			83.3	100
32	W	74	VIB	6677	40	0	39	39	4398	4398	0	4398	1	41	1	230	N/A	3*	7*	1.3		84.6	96.4	100
33	Mn	25	VIIB	6744	0	467	67	67	6273	6273	0	6273	743	892	20	11630	1670*	2540*	4348	950	34.3	50.1	74.8	100
34	Fe	26	VIIB	6744	0	343	67	67	6330	6330	0	6330	30676	29073	2500	396100	42400*	79900*	130000	50,000	23.1	49.8	61.3	100
35	Co	27	VIIB	6677	36	0	39	39	4612	4612	0	4612	8.6	7.8	2.5	73	19*	26*	42*	25		49.8	66	100
36	Ni	28	VIIB	6677	29	0	39	39	4609	4609	0	4609	7.6	11	2.5	432	16*	22	39*	75		43.2	72.2	100
37	Cu	29	IAN	6744	0	336	67	67	6318	6318	0	6318	166	387	4	8266	30.1*	682*	1333	60	34.2	49.8	74.8	100
38	Zn	30	IAN	6744	0	1710	67	67	4959	4959	0	4959	22	61	1	1810	30*	83	257	8.0	13.9	47.8	74.3	100
39	Bi	83	IAN	6744	0	1091	67	67	5369	5369	0	5369	1.6	2.4	0.2	317	4.2*	5.9*	10.4*	1.3	30.3	50	75.8	100
40	Dy	66	IAN	6744	0	1583	67	67	5162	5162	0	5162	6.7	16.2	0.1	388.8	10.7*	31.9*	67	3.0	27.6	49	73.1	100
41	Yb	70	IAN	6744	0	3367	67	67	3336	3336	0	3336	7.3	7.3	0.3	103.2	14.5*	20.5*	46.9*	3.4	39.3	48.7	74.3	100
42	La	71	IAN	6744	0	1423	39	39	5302	5302	0	5302	8.8	1	0.1	13.6	1.8*	3.6*	5*	0.3	29.4	37	76.3	100
43	Th	90	ACT	6744	0	611	60	60	6273	None	2	6273	35	89	0.5	2325	10*	145*	358	5.2	34.5	51.7	76.1	100
44	U	92	ACT	6744	0	125	67	67	6519	6519	0	6519	7.4	12.4	0.1	237.8	3.3*	23.5*	37	1.8	23.6	49.3	74.3	100
45	UX	92	ACT	6677	1301	0	39	39	3333	3333	0	3333	1.4	2.6	0.05	34.2	2.6*	5.8*	13.9		34.7	47.9	70.5	100
46	pH (as given above)			6744	0	456	67	67	6221	6221	0	6221	6.8	0.9	3.9	12.3	7.1*	7.9*	8.4*		29.4	47.3	68.3	100
47	pH (Instrument reg.)*			6744	0	456	67	67	6221									3.3*	6.3*	4*				
48	Conductivity (Instrument reg.)			6744	0	391	67	67	6291	6291	0	6291	71	259	1	13300	18*	131*	232*		33.1	49.9	75.8	100
49	Conductivity (Beckman reg.)			6744	0	391	67	67	6291								17*	12*	8*					
	Total points plotted								193763															

1* Denotes upward weighting in most unique analysis. Typically this is true due 0.5 representative frequency present.

DOT = Pot back ground, *** high, and an unusual distribution of the statistical distribution bank should not be made, e.g.) indicates that the element was not detected and the detection limit was unusually high.

Not missing data.

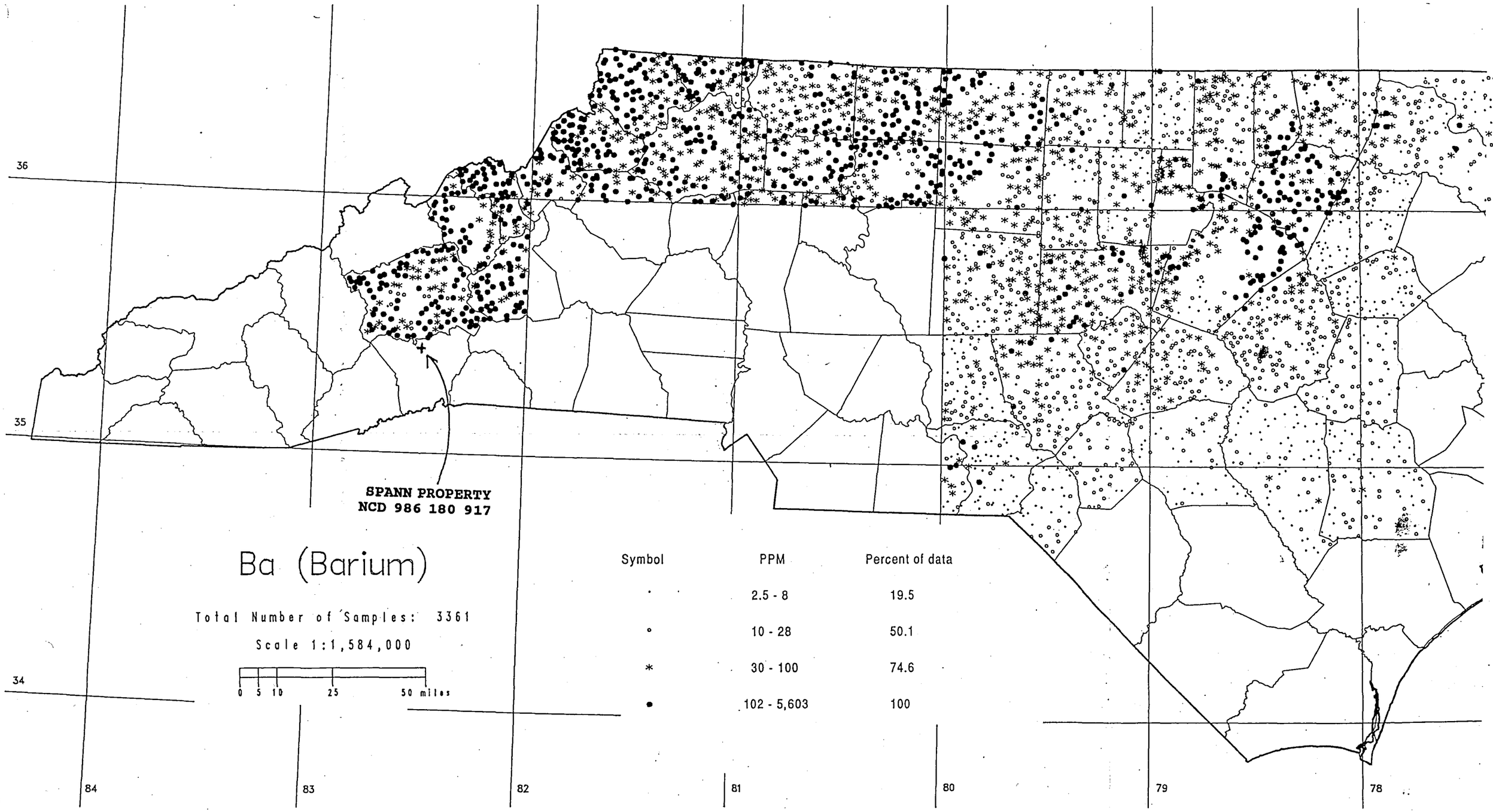
1 Acting Conductivity = Data points for which conductivity not looking in the NURE database.

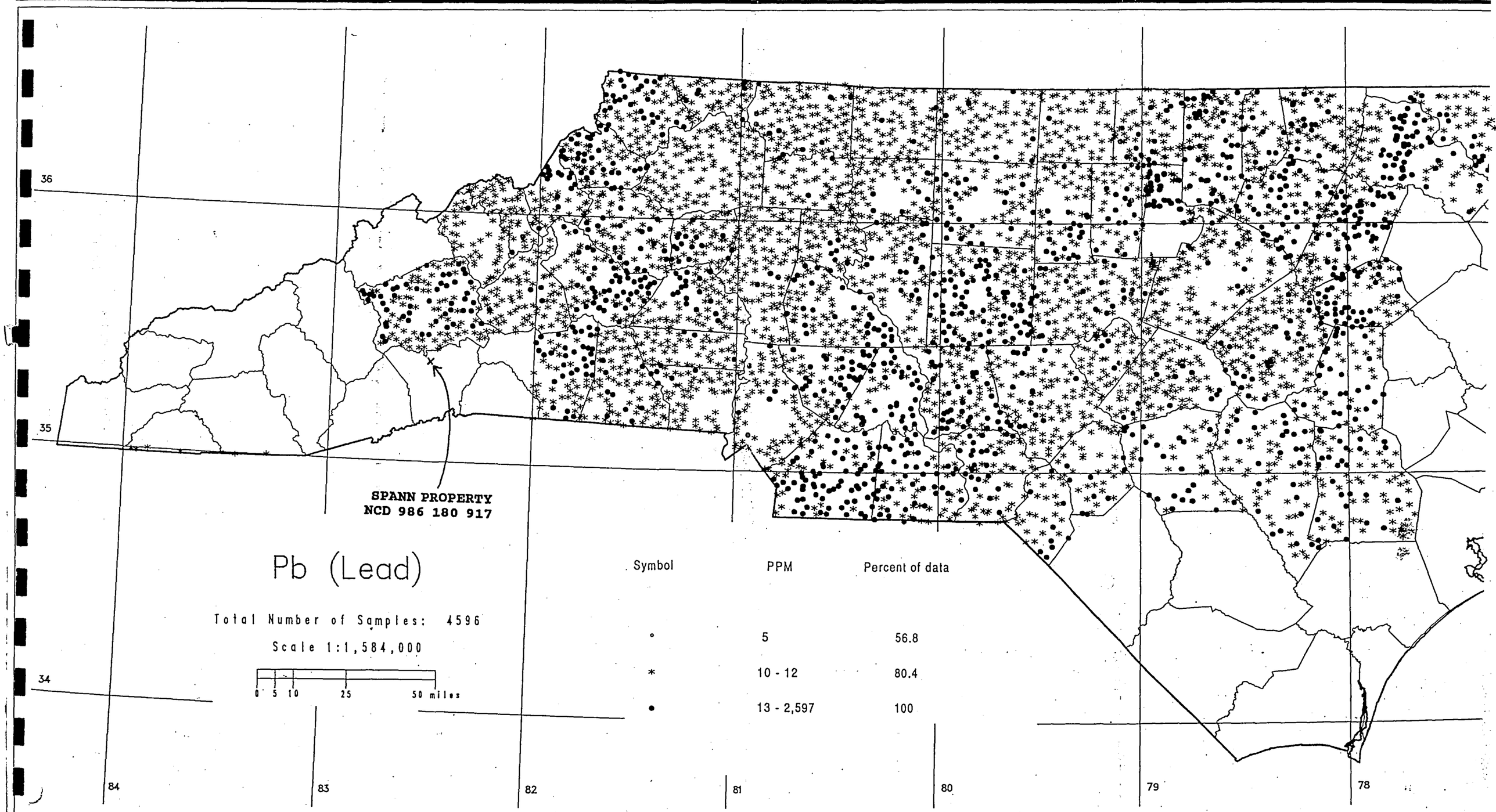
** Sorted from most least in most or like.

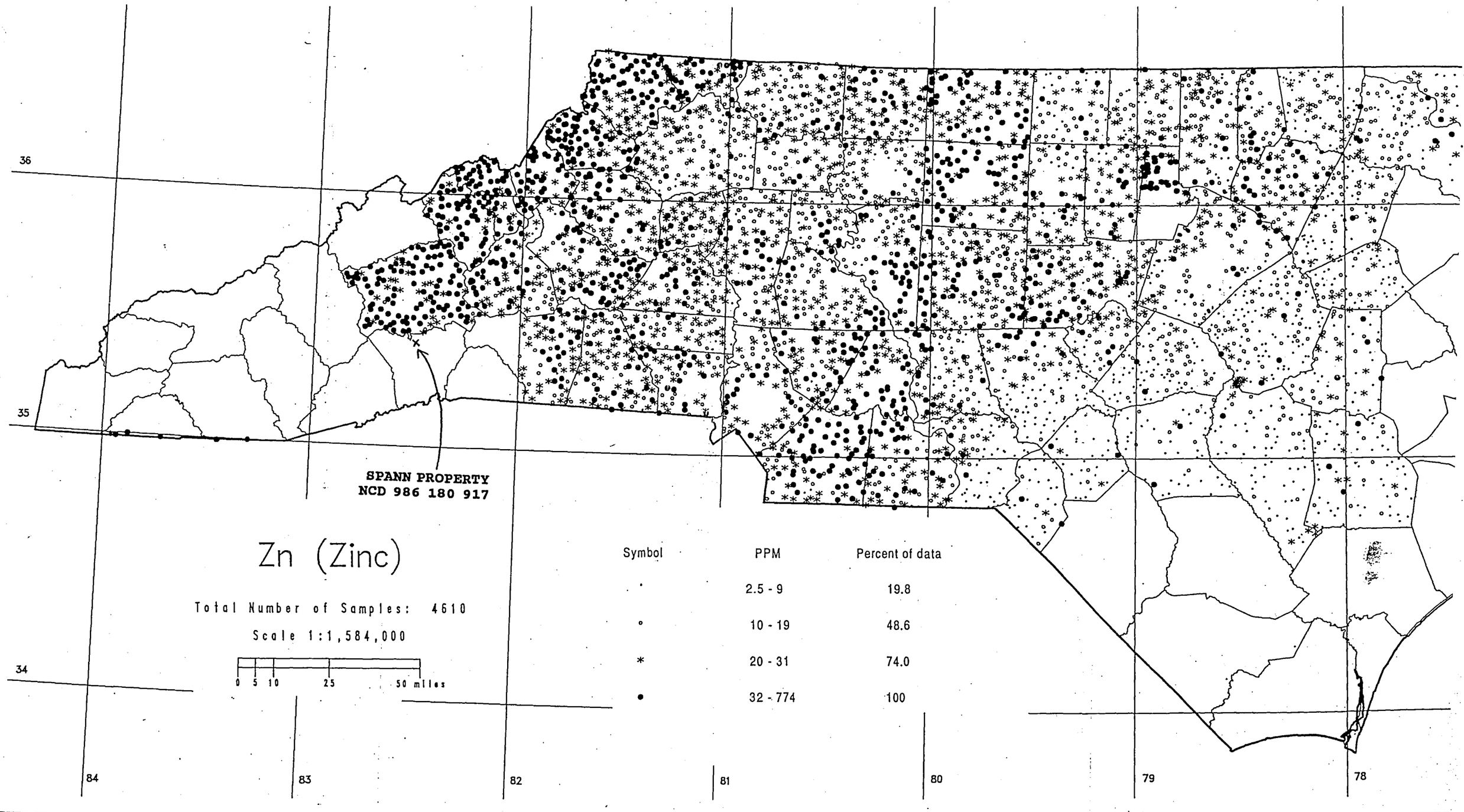
*** Photo American Geological Institute Data Sheets, 1963, Data Sheet #2.1, American Geological Institute, Falls Church, VA.

Note 1: A total of 627 sampling points with analysis expected as "X" were not plotted. These sample points are retained for Statistics included about "X" analysis.

Note 2: One point was not during data processing and cannot be located.


36
35
34
84
83
82
81
80
79
78
SPANN PROPERTY
NCD 986 180 917
Ba (Barium)
Total Number of Samples: 3361
Scale 1:1,584,000
0 5 10 25 50 miles
Symbol
PPM
Percent of data
2.5 - 8
19.5
10 - 28
50.1
30 - 100
74.6
102 - 5,603
100


36
35
34
84
83
82
81
80
79
78
SPANN PROPERTY
NCD 986 180 917
Pb (Lead)
Total Number of Samples: 4596
Scale 1:1,584,000
0 5 10 25 50 miles
Symbol
PPM
Percent of data
5
56.8
10 - 12
80.4
13 - 2,597
100


36
35
34
84
83
82
81
80
79
78
SPANN PROPERTY
NCD 986 180 917
Zn (Zinc)
Total Number of Samples: 4610
Scale 1:1,584,000
0 5 10 25 50 miles
Symbol
PPM
Percent of data
2.5 - 9
19.8
10 - 19
48.6
20 - 31
74.0
32 - 774
100

MEMORANDUM

To: File
From: Stuart F. Parker, Jr., Hydrogeologist
Date: August 18, 1994
Re: Site Inspection:
Spann Property
NCD 986 180 917
Proximity of Day Care Facilities to Site

SFP reviewed NC Division of Facility Services, Child Day Care Section's 1992 database to identify day care homes and centers located within 4 miles of the Spann Property. SFP checked listed addresses of the facilities and compared street locations to locations on topographic maps using a street map of Hendersonville and Henderson County.

Based on the available data, approximately 15 day care facilities operate within a 4-mile radius of the site. Of these, the closest 3 are located on Dolger Drive, Naples, on Park Street in Mountain Home, and on Sam Duncan Road in Fletcher. None of the 3 facilities are located within 0.25 mi. of the site.

ID/ ABBREV	OPERATION NAME/ OPERATOR NAME	MAILING ADDRESS/ LOCATION ADDRESS	CITY	ST	ZIP/ PHONE	RENEW/ POCNO
4555073 LIC A C	AARON'S SCHOOL FOR LITTLE FOLKS AARON ENTERPRISES, INC.	911 TEBEAU STREET	HENDERSONVILLE	NC	28739 704/697-0413	06/93 B4540044
4555052 LIC A C	ATKINSON ELEMENTARY PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 OLD KANUGA ROAD	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/693-4030	04/93 B4530029
4555053 LIC A C	BALFOUR ELEMENTARY PSAM/ PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 HWY. 25	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/697-4762	05/93 B4530028
4555075 LIC A L	BECKY HITT DAY CARE HITT, BECKY	34 MARION DR.	HENDERSONVILLE	NC	28733 704/693-6700	09/92
4555015 LIC A C	BLUE RIDGE COMMUNITY COLLEGE CENTER BLUE RIDGE COMM. COLLEGE	RT. 2 BOX 133 A SHEPHERD ST. - AIRPORT	FLAT ROCK FLAT ROCK	NC	28731 704/692-3572	01/93 B4540037
4555004 LIC AA C	CALVARY EPISCOPAL HEAD START WESTERN CAROLINA COMMUNITY ACTION	P.O. BOX 685 HWY. 25	HENDERSONVILLE FLETCHER	NC	28793 704/684-3646	05/93
4555054 LIC A C	DANA PSAM-PSPM HENDERSON COUNTY BOARD OF EDUCATION	125 EAST ALLEN STREET RIDGE ROAD	HENDERSONVILLE DANA	NC	28792-5029 704/685-3450	05/93 B4530030
4555055 LIC A C	EAST FLAT ROCK PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 101 EAST BLUE RIDGE ROAD	HENDERSONVILLE EAST FLAT ROCK	NC	28793 704/693-7241	04/93 B4530027
4555072 PROV C	EDNEYVILLE ELEMENTARY PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 PACE ROAD	HENDERSONVILLE HENDERSONVILLE	NC	28792 704/685-7600	04/92 B4540043
4555036	ETOWAH ELEMENTARY PSAM- PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 ETOWAH ELEMENTARY SCHOOL	HENDERSONVILLE ETOWAH SCH. ROAD	NC	28793	02/92 B4530031
4555056 LIC A C	ETOWAH PSAM-PSPM HENDERSON CO. BOARD OF EDUCATION	P.O. BOX 1700 ETOWAH SCHOOL ROAD	HENDERSONVILLE ETOWAH	NC	28793 704/692-8251	02/93 B4530031
4555057 LIC A C	FLETCHER PSAM-PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 FAIRVIEW ROAD	HENDERSONVILLE FLETCHER	NC	28793 704/684-0580	02/93 B4530032
4555080 LIC AA C	FOSTER CIRCLE HEAD START WESTERN CAROLINA COMMUNITY ACTION, INC.	P. O. BOX 685 920 FOSTER CIRCLE	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/693-6153	04/93 B4540052
4555016 LIC AA C	HELPING HAND DEVELOPMENTAL CENTER HELPING HAND DEVELOPMENTAL CENTER	P.O. BOX 1479 BRUCE DRYSDALE SCHOOL	HENDERSONVILLE HENDERSONVILLE	NC	28739 704/692-7068	12/92 B4520004
4555046 LIC A C	HERITAGE HALL SCHOOL HERITAGE HALL SCHOOL, INC.	814 OLD SPARTANBURG HWY 814 OLD SPARTANBURG HWY	HENDERSONVILLE HENDERSONVILLE	NC	28739 704/693-6845	05/93 B4540035
4555076 LIC A C	HILLANDALE PSAM HENDERSON COUNTY SCHOOLS	125 E ALLEN STREET 900 W. BLUE RIDGE AVE.	HENDERSONVILLE E. FLAT ROCK	NC	28792 704/692-4467	02/93 B4540046
4559000 GS110 C	HIS KIDS CHILD DEVELOPMENT CENTER EAST FLAT ROCK FIRST BAPTIST CHURCH	2227 SPARTANBURG HWY. 2227 SPARTANBURG HWY	EAST FLAT ROCK E. FLAT ROCK	NC	28726 704/692-4958	08/93 B4540047
4555042 LIC A C	HOME GROWN CHILDREN CANNON, SHEILA	P.O. BOX 219 DOLGER DRIVE	NAPLES FLETCHER	NC	28760 704/687-2449	12/92 B4540049
4555078 LIC A C	IMMACULATA PRESCHOOL AND DAY CARE CENTER IMMACULATA SCHOOL	711 BUNCOMBE STREET 620 OAKLAND STREET	HENDERSONVILLE HENDERSONVILLE	NC	28739 704/693-3277	06/93
4555061	IMMACULATA SCHOOL IMMACULATA SCHOOL	711 BUNCOMBE STREET	HENDERSONVILLE	NC	28739	06/92
4555071 LIC A C	JOAN'S DAY CARE CENTER BULLMAN, JOAN	RT. 9, BOX 661 PACE ROAD	HENDERSONVILLE HENDERSONVILLE	NC	28792 704/685-8387	01/93 B4540041
4555070 LIC A C	KID'S CLUB MINKEMA, CHARLES AND BETTY	1303 5TH AVENUE WEST	HENDERSONVILLE	NC	28739 704/693-9364	11/92 B4540040
4555025 LIC A C	LAPETITE ACADEMY CENCOR, INC.	1521 HAYWOOD ROAD	HENDERSONVILLE	NC	28739 704/697-2618	07/93
4555020 LIC AA C	LINCOLN CIRCLE HEAD START WESTERN CAROLINA COMMUNITY ACTION	P.O. BOX 685 1508 LINCOLN CIRCLE	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/692-7585	02/93
4555051 LIC A C	LITTLE RED SCHOOL OF HENDERSONVILLE LITTLE RED SCHOOL OF HENDERSONVILLE, INC.	P.O. BOX 1779 608 B BROOKLYN AVE.	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/693-8831	12/92 B4540036
4559003 GS110 C	LOVING HANDS CHILD CARE ETOWAH UNITED METHODIST C	PO BOX 63 BRICKYARD ROAD	ETOWAH ETOWAH	NC	28729 704/891-1620	01/93
4555058 LIC A C	MILLS RIVER PSPM HENDERSON COUNTY BOARD OF EDUCATION	P.O. BOX 1700 96 SCHOOL HOUSE ROAD	HENDERSONVILLE HORSE SHOE	NC	28793 704/891-6565	05/93 B4530026
4555043 LIC A C	NEW DAY PRESCHOOL NEW DAY PRESCHOOL, INC.	P.O. BOX 201 HWY. 64-74	BAT CAVE BAT CAVE	NC	28710 704/625-4468	05/93 B4520024
4555079 LIC AA C	PAULA KING'S DAY CARE PAULA, KING	510 STATON ROAD	FLAT ROCK	NC	28731 704/692-7117	02/93
4555049 LIC A C	SEVEN SEAS CHILD CARE CENTER GUESS, PHYLLIS	301 CANE CREEK ROAD	FLETCHER	NC	28732 704/687-1189	07/93 B4540034
4559001 GS110 C	ST JAMES SCH LITTLE FOLKS ST JAMES EPISCOPAL CHURCH	766 N MAIN ST	HENDERSONVILLE	NC	28792 704/692-9274	09/92 B4540045
4555003 LIC AA C	ST. JOHN IN THE WILDERNESS HEAD START WESTERN CAROLINA COMMUNITY ACTION	P.O. BOX 685 HWY. 25 SOUTH	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/693-1140	03/93
4555074 LIC AA C	TELAMON CORPORATION HEAD START TELAMON CORPORATION	P.O. BOX 2532 15 FRANCIS ROAD	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/697-8266	10/92
4555039 LIC AA C	TRINITY PRESBYTERIAN HEAD START WESTERN CAROLINA COMMUNITY ACTION	P.O. BOX 685 BLYTHE STREET	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/697-7884	02/93

ID/ ABBREV	OPERATION NAME/ OPERATOR NAME	MAILING ADDRESS/ LOCATION ADDRESS	CITY	ST	ZIP/ PHONE	RENEW/ POCNO
555017 IC AA C	WILLIAMS STREET HEAD START WEST CAROLINA COMM. ACTION	P.O. BOX 685 505 5TH AVE. E.	HENDERSONVILLE HENDERSONVILLE	NC	28793 704/692-2963	04/93

COUNTY: 45 HENDERSON

CHILD DAY CARE SECTION
MONTHLY ALPHABETIC LISTING AS OF 1992-09-30
HOMES

ID/ ABBREV	OPERATOR NAME/ OPERATION NAME	MAILING ADDRESS/ LOCATION ADDRESS	CITY	ST	ZIP/ PHONE	RENEW/ POCNO
4505125 REG S	ADCOCK, JEWEL JEWEL ADCOCK'S DAY CARE HOME	P.O. BOX 1026 NICHOLASON ST.	ETOWAH ETOWAH	NC	28729 704/891-8286	08/93
4505142 REG S	BATCHELDER, LESLIE LESLIE BATCHELDER DAY CARE HOME	1015 MAPLE STREET	HENDERSONVILLE	NC	28739 704/692-8073	05/93
4505111 REG S	BUIE, BEULAH BEULAH BUIE'S CHILD DAY CARE HOME	ROUTE 3, BOX 237 SAM DUNCAN ROAD	FLETCHER ~~FLETCHER~~	NC	28732 704/684-7733	03/93
4505101 REG S	CANNON, BEULA CORN BEULAH CORN CANON DAY CARE HOME	P.O.BOX 345 BROWN'S COURT	MT. HORNE MT. HORNE	NC	28758 704/692-7765	03/94
4505148 REG S	CRISP, JACKIE LITTLE LAMB DAY CARE	101 BROWNING AVE.	HENDERSONVILLE	NC	28739 704/693-7998	03/94
45000001 TEMP S	HEALY, VICKIE VICKIE HEALY'S DAY CARE HOME	218 BARNWELL ST.	HENDERSONVILLE	NC	28739 704/697-2168	11/92 B4570009
4505137 REG S	HYDE, LINDA MARIE LINDA MARIE HYDE'S CHILD DAY CARE HOME	128 SUNSET DR. 128 SUNSET DRIVE	ETOWAH ETOWAH	NC	28729 704/891-4808	12/92
4505141 REG S	JONES, TINA TINA JONES' DAY CARE HOME	211 WINDSOR COURT	HENDERSONVILLE	NC	28792 704/697-9919	03/93
4505033 REG S	MCMAHAN PRAITT, LINDA JUNE LINDA JUNE PRAITT DAY CARE HOME	417 LYNDHURST DR.	HENDERSONVILLE	NC	28739 704/692-4142	02/94
4505127 REG S	MILLER, MARGARET MARGARET C. MILLER'S DAY CARE HOME	4 SOUTHER RD.	HORSE SHOE	NC	28742 704/891-7093	09/93
4505069 REG S	NEAL, THELMA THELMA NEAL'S DAY CARE HOME	301 LINDA VISTA DR.	HENDERSONVILLE	NC	28739 704/692-9103	04/93
4505126 REG S	NELSEN, CELESTE S CELESTES DAY CARE HOME	P O BOX 1402	ETOWAH	NC	28729 704/891-3887	09/91
4505139 REG S	NORDINE, GLORIA TENDER LOVING CARE CHILD CARE	P.O. BOX 523 BIG OAK PARK	HORSESHOE HENDERSONVILLE	NC	28742 704/891-2885	12/92
4505132 REG S	SCHENIMANN, MARILYN GAYE MARILYN GAYE SCHENIMANN DAY CARE HOME	124 PLANTATION DRIVE	HENDERSON	NC	28792 704/693-6639	03/94
45000002 REG S	SMYTHE, LORI S. LORI'S DAY CARE HOME	RT 14 BOX 72A	HENDERSONVILLE	NC	28793 704/693-4010	08/94 B4570008
4505144 REG S	SWITZER, YVETTE YVETTE SWITZER'S DAY CARE HOME	P.O. BOX 251 5 PARK ST.	MOUNTAIN HOME ~~MOUNTAIN HOME~~	NC	28758 704/692-6751	08/93 B4570005
4505315 REG S	UNDERWOOD, SONJA SONJA UNDERWOOD'S DAY CARE HOME	699 HOWARD GAP RD	HENDERSONVILLE	NC	28792 704/692-4303	09/94 B4570010