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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
RESTON, VA. 22092

A WATER-QUALITY ASSESSMENT OF THE NORTHEAST CREEK AND DESPER CREEK WATERSHEDS, SOUTH ANNA RIVER BASIN, LOUISA COUNTY, VIRGINIA

By

Stanley M. Rogers

Open-File Report 77-460

Prepared in cooperation with the
U.S. Department of Agriculture
Soil Conservation Service

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METRIC CONVERSION FACTORS

The following factors may be used to convert the English units published herein to the International System of Units (SI):

English units	Multiplied by	To obtain SI units
Inches (in)	25.4	millimeters (mm)
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
square feet (ft^2)	.0929	square meters (m^2)
square miles (mi^2)	2.590	square kilometers (km^2)
cubic feet per second (ft^3/s)	.02832	cubic meters per second (m^3/s)

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A WATER-QUALITY ASSESMENT OF THE NORTHEAST CREEK AND DESPER CREEK WATERSHEDS, SOUTH ANNA RIVER BASIN LOUISA COUNTY, VIRGINIA

Stanley M. Rogers

ABSTRACT

Analysis of samples collected during the period July-September 1976 from streams at points throughout the Northeast Creek and Desper Creek Watersheds, South Anna River basin, Louisa County, Virginia, show the streams to contain very dilute, soft, acidic, calcium magnesium-bicarbonate sulfate water having low alkalinity and low buffering capacities. The mineral quality of the water is excellent. Assessment of phytoplankton and benthic invertebrate populations in the streams indicate a natural environmental constraint in growth possibly caused by low levels of nutrients, low dissolved solids and low hydrogen ion (pH) concentrations. Phytoplankton populations in two locations indicate poor biological environments in otherwise free-flowing oxygenated streams.

INTRODUCTION

Impoundment structures are planned for the Northeast Creek and for Desper Creek Watersheds and are described in a preliminary report prepared by the U.S. Soil Conservation Service, January 1964. The impoundment of flowing streams may cause significant changes in their water quality. The nature and extent of these changes in quality may be anticipated to some extent on the basis of the quality of the streams before impoundment. Assessment of the surface water quality within the watershed will help to anticipate some of the quality problems.

PURPOSE AND SCOPE

The objective of this study is to gather basic data and assess the present quality of surface water throughout the headwaters of Northeast Creek and Desper Creek Watersheds. Desper Creek is tributary to Northeast Creek a short distance downstream of the proposed impoundment of Northeast Creek at U.S. Highway 33. Emphasis in this study is placed on water quality properties needed by the U.S. Soil Conservation Service to prepare environmental impact statements. Data and conclusions presented in this report are based on one reconnaissance and three monthly sample collection trips from July through September, 1976. This report is the first in a series to be prepared under a cooperative agreement between the U.S. Geological Survey and the U.S. Soil Conservation Services.

ENVIRONMENTAL SETTING AND CONDITIONS

Northeast Creek, a tributary entering the South Anna River 67 miles above the mouth, is 7.4 miles long and drains a 16 square mile area within the Piedmont physiographic province (Figs. 1 and 4).

With the exception of the Desper Creek basin, with a drainage area of 1.9 square miles, the study area, 9.7 square miles, is bounded by U.S. Highway 33, on the south and west, U.S. Highway 522 on the east and State Route 22 on the north. The town of Pendleton is on the eastern sector along U.S. Highway 522 and the town of Mineral is

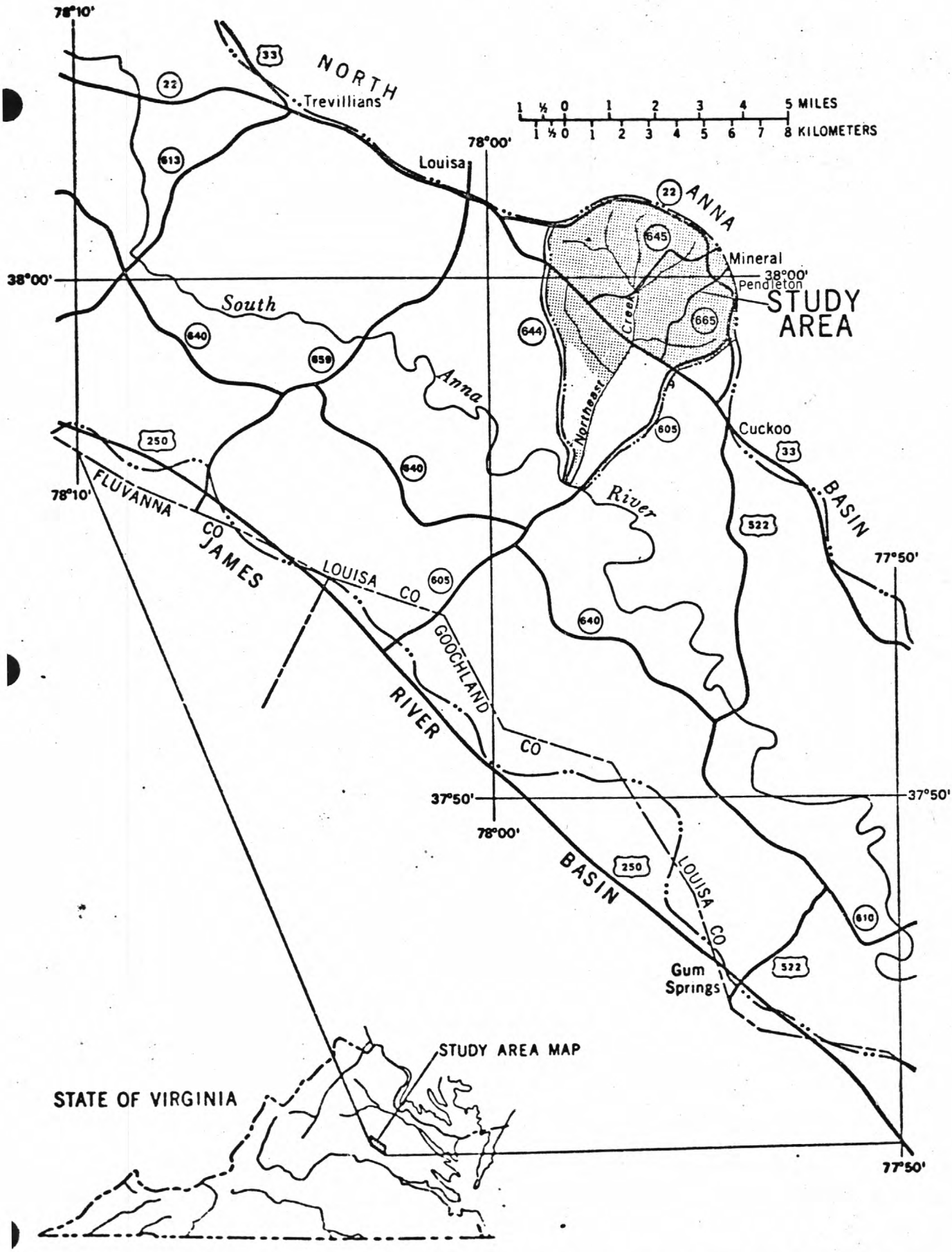

Figure 1.--Map showing location of the Northeast Creek and Desper Creek study area in the South Anna River basin.

on the northeastern sector of the perimeter along U.S. Highway 522 and State Route 22. The drainage divide between the North and South Anna River basins lies along U.S. Highway 522 and State Route 22. Sewage disposal facilities for the town of Mineral are within and discharge into the North Anna basin. However, the Louisa County High School, a large number of houses, and some industrial and commercial enterprises are on the perimeter of the Northeast Creek drainage basin along U.S. Highways 522, and 33 and State Route 22.

The part of the basin North of U.S. Highway 33 is traversed in a north-south direction by three all-weather roads. They are in order from east to west, State Routes 665, 645, and 644. Route 644 is a hard-surface macadam road and the others are passable in wet weather. The water quality sampling stations are on Routes 665, 645, and on jeep or logging trails that criss-cross the interior of the basin.

The basin is heavily forested with a few isolated clearings and houses. Farming and cattle industries are not extensively developed within the basin but there is an abundant wildlife population. The basin's forest has been logged extensively with resulting accumulations of sawdust piles and litter of discarded tree limbs. Recently, about 500 acres of the upper basin, lying along the northern perimeter were cleared for reforestation with pine seedlings. The resulting brush was burned and the area sprayed for the

removal of the younger secondary growth. Although the forest soil mantle appears relatively thin in road cuts on the hills, there is an abundant cover of secondary tree growth and heavy grasses cover the flood plain and low areas.

The Desper Creek basin is south and west of U.S. Highway 33 and the stream joins Northeast Creek approximately one mile downstream from U.S. Highway 33. This small basin includes several farm dwellings and the Louisa County intermediate school on U.S. Highway 33 in the upper part of the basin. There are two small impoundments in the basin, one on a branch of Desper Creek having intermittent flow below the dam. There is one sampling station in the lower reach of the creek near its mouth.

Northeast Creek and its tributaries constitute a typical dendritic drainage pattern. The headwaters of the creek are at an elevation of 490 feet above mean sea level and the mouth is at 257 feet above mean sea level. Maximum relief in the basin is about 200 feet but locally is about 100 feet. Elevation profiles for the mainstem of Northeast Creek, for two of its tributary streams and Desper Creek are shown in figure 2 and table 1. The average slope of the streambed above sampling stations 10 and 15 in the upper headwater tributary streams is about the same, 85 feet per mile; for intermediate position sampling stations 12 and 18, is 47 feet per mile, and for the lower sampling station 25, is 33 feet per mile. The slope above sampling station 30

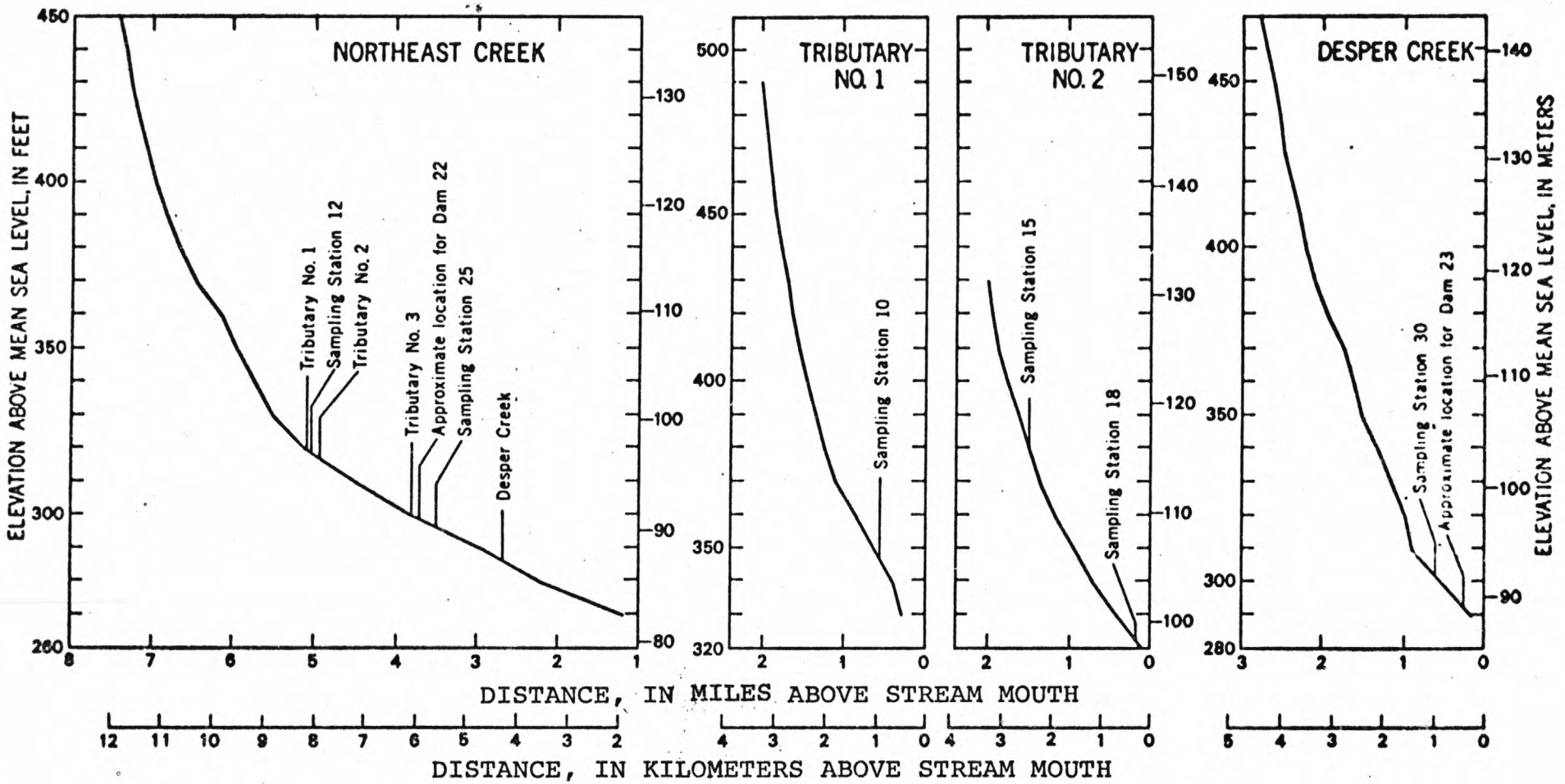

Figure 2.--Diagram showing elevation of streambeds and distance above stream mouth for sampling stations and proposed dam structures in the Northeast Creek and Desper Creek watersheds.

in the Desper Creek basin is 77 feet per mile. The flood plain is narrow in the headwaters of Northeast Creek but broadens irregularly in its downstream reaches. Meander patterns are evidence of the decreased streambed slope and average stream velocity in the lower flood plain. At low flow, riffles and shallow pools furnish a variety of aquatic habitats.

Data for the seasonal and diurnal variation in air temperature over the Northeast and Desper Creek basins is given in table 2 and figure 3. These data were taken at the Louisa station, (National Oceanic and Atmospheric Administration, 1975). The temperature of shallow free flowing, streams from non-thermal sources and having riffles and shallow pools in its course is greatly influenced by the temperature of the overlying air mass. Although water and air temperatures may differ at times by several degrees at a given station, the effect of the water-air temperature equilibrium is to produce approximately the same temperature over a long period of time. This is not true for streams or for impoundments where the underlying water is shielded from influence of the air temperature.

Stream temperature is an important factor in (1) the solubility of atmospheric and decompositional gases such as oxygen and nitrogen in water; (2) the rate of growth of aquatic biota; (3) the number and diversity of organisms present in stream habitats; (4) the oxidation and decomposition

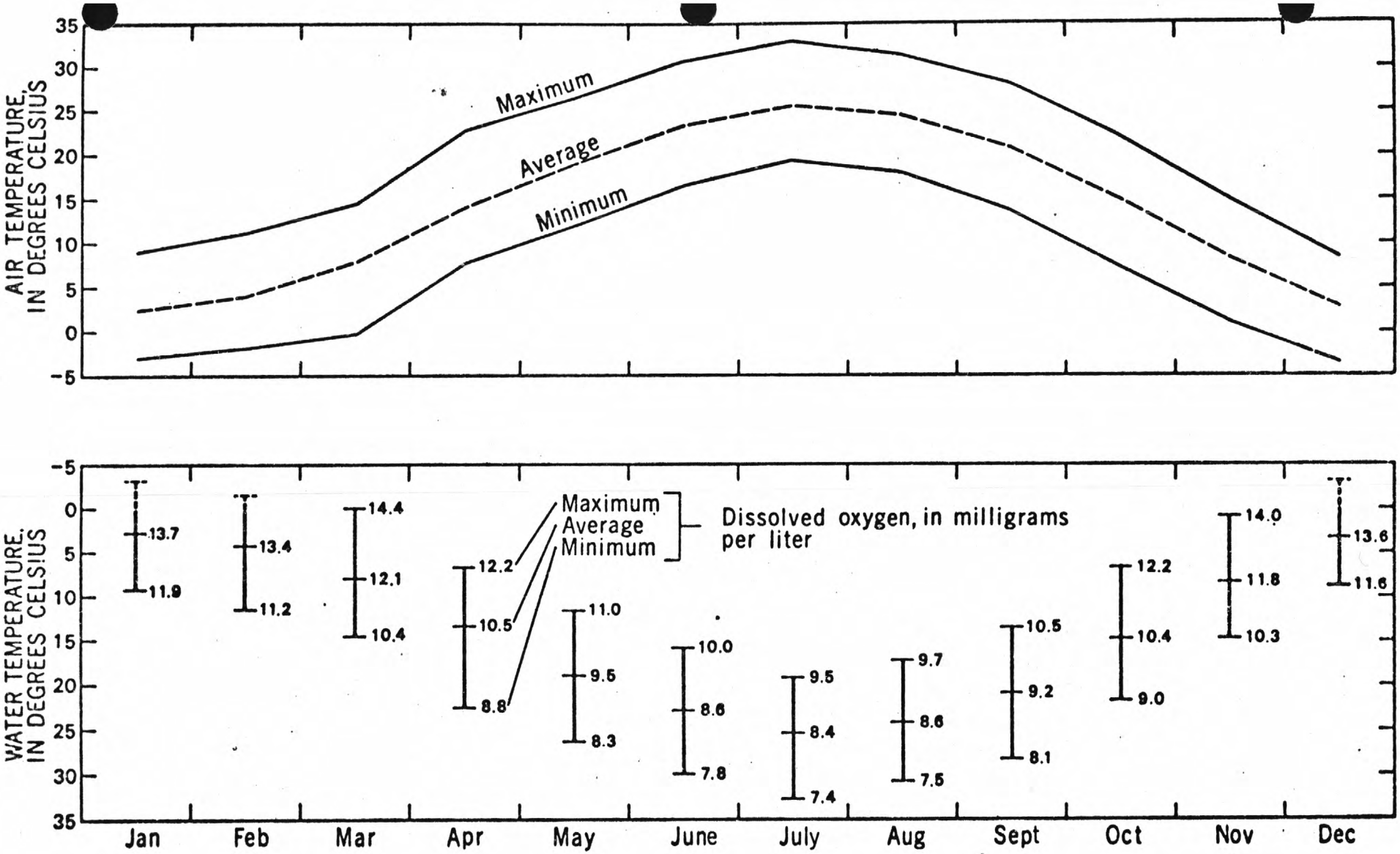

Figure 3.--Graph showing seasonal and diurnal variations in air temperature and dissolved oxygen in streams at these temperatures in the Northeast Creek and Desper Creek watersheds.

rate of organic matter in stream waters; (5) the rate of reaeration of streams having less than saturation concentrations of oxygen. The yearly temperature cycle produces the normal progression of seasons with the emergence of flora in the spring, growth and maturation in the summer and fall and return to dormancy in the winter months. However, the increased average diurnal temperatures in the spring and summer months increase growth of viable organisms, favor oxidation of organic matter and limit the oxygen capacity of streams. Demands on the oxygen reserves of streams by additional oxidizable organic matter may deplete oxygen concentrations and stress organisms depending on the stream water for their oxygen supply.

SAMPLING PROGRAM AND SITE DESCRIPTION

Samples were collected for the analysis of dissolved minerals and gases according to methods described by Brown and others, 1970. Biologic samples were collected according to Slack and others (1973).

Water quality sampling stations on Northeast Creek and its tributary streams are in downstream order 10, 12, 15, 18, 22 and 25 (fig. 4). These numbers are the last two digits of the 10 digit downstream order number used for the identification of sampling locations as shown on figure 4. Station 30 is near the confluence of Desper and Northeast Creeks downstream of Highway 33. Stations 12 and 25 are on the mainstem of Northeast Creek; 10 is on unnamed tributary number 1; 15 and 18 are on unnamed tributary number 2, and 22 is on unnamed tributary number 3.

When sampled at station 10, the water was clear and flowing through riffles and shallow pools. The banks were sloping and bottom materials consisted of fine sand and pebbles with some cobbles. Foam was observed on the surface of this stream during two sampling trips, and had been carried from some point upstream of the station to the juncture of the tributary with the mainstem of Northeast Creek.

A 100-foot reach of Northeast Creek was sampled for benthic invertebrates immediately upstream from station 12. This station is in full shade all day. The streambanks

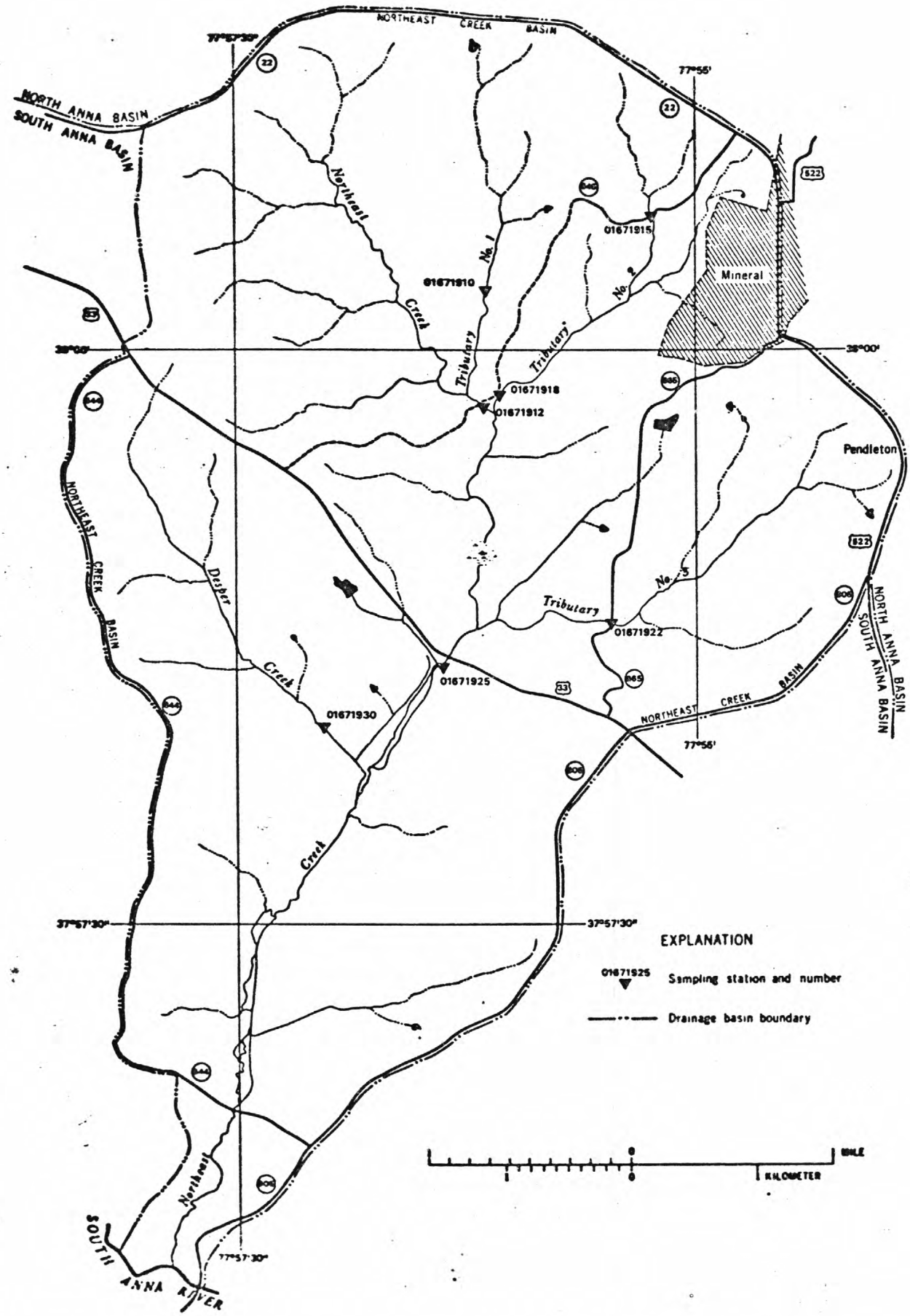

Figure 4.--Location of water quality sampling stations and headwater tributary streams of Northeast Creek, South Anna River basin.

are vertical and bottom materials are 90 percent fine sand, 5 percent cobbles, and 5 percent silt.

At station 15 the water was clear and the banks were low and relatively flat. The bottom materials are fine sand and some clay. There is scattered penetration of sunlight and the water was only a few inches deep. At station 18 on the lower end of tributary 2, the banks are sloped to vertical, the bottom materials are 90 percent coarse sand and 10 percent cobbles with abundant quartz minerals. Riffles and shallow pools are present. This station is in a forest clearing and in sunlight most of the day.

At station 22 on tributary 3 a very shallow riffle and a pool approximately 4 feet deep are present. When sampled, the riffle was in the sunlight and the pool was in the shade but the pool would be in the sunlight for about one-half of the day. The water in the pool and stream was clear. Because of the temperature, depth, and the available sunlight, this pool might well provide a suitable environment for algae growth.

A stream reach 75 feet long was sampled for benthic invertebrates upstream of station 25. The banks are sloped, bottom materials are 90 percent sand and silt and 10 percent cobbles. Quartz rocks are abundant within the stream reach. The water is clear, riffles and a pool are present. The riffles are in the sunlight for approximately one-half of the day but the pool is in the shade most of the day.

All stations are in a heavily forested area though there is local penetration of sunlight along reaches of the stream. The tributary streams have intermittent flow in their upper reaches and remain shallow in the riffles with pools of shallow depths. Rainfall immediately preceding and during the sampling season was below normal resulting in low streamflows sustained in part by springs in the area and, in part, by ground-water seepage. Some seepage areas are indicated by the appearance of red (iron) precipitate and black-oily precipitate (manganese) along several of the stream reaches near quality sampling stations.

DATA EVALUATION

Physical and chemical

The chemical quality properties, as determined in the field and laboratory, are listed in tables 3 and 4, respectively. Specific conductance, an indicator of the total dissolved minerals, ranged from 42 to 73 micromhos per centimeter at 25° Celsius. These values indicate a very low dissolved mineral content which is confirmed by the corresponding range and magnitude of dissolved solids concentrations. Dissolved solids concentrations were determined as residue on evaporation at 180° Celsius and calculated as sums of the individually determined dissolved chemical constituents. Residues on evaporation ranged from 42 to 55 mg/L (milligrams per liter) and sums from 37 to 54 mg/L. The close agreement between concentrations as residue on evaporation and as a calculated sum for a particular sample indicates all major chemical constituents are included in the analysis.

Hardness ranged from 10 to 23 mg/L in the basin streams but only tributary 2 water, at station 18, contained noncarbonate hardness. Stream waters in the basin are very soft as defined by hardness for most surface waters.

In most natural water, alkalinity is practically all produced by the dissolved bicarbonate and carbonate ion concentrations. However, in waters having pH less than 8.2, only the bicarbonate ion is reported as present. Total alkalinity, as CaCO3, (calcium carbonate), is calculated

from the concentrations of the bicarbonate ion in these waters. Bicarbonate ranged from 20 to 27 mg/L, and expressed as total alkalinity, ranged from 16 to 22 mg/L. Total alkalinity is a measure of the stream's ability to resist change in pH on the addition of acid materials. This resistance to change in pH is the natural "buffering" capacity. Streams in the study area have a low buffering capacity and, therefore, the water quality is sensitive to the addition of alkali or acid material.

Dissolved iron was 240 micrograms per liter at station 18 but at the lower station (25) was 450 micrograms per liter. The concentration at the lower station is in excess of the 300 micrograms per liter that is the recommended upper level for laundry or textile operations specified by the U.S. Environmental Protection Agency (1973a). Dissolved manganese was 10 micrograms per liter at station 12, and 20 at stations 18, and 25. These concentrations are below problem causing levels.

Concentrations of the dissolved chemical constituents for water samples expressed as milliequivalents per liter (me/L) are used in a Stiff diagram to show the chemical character of the water at several stations. Diagrams for samples collected at stations 12, 18, and 25 on Northeast Creek and Station 30 on Desper Creek are given in figure 5.

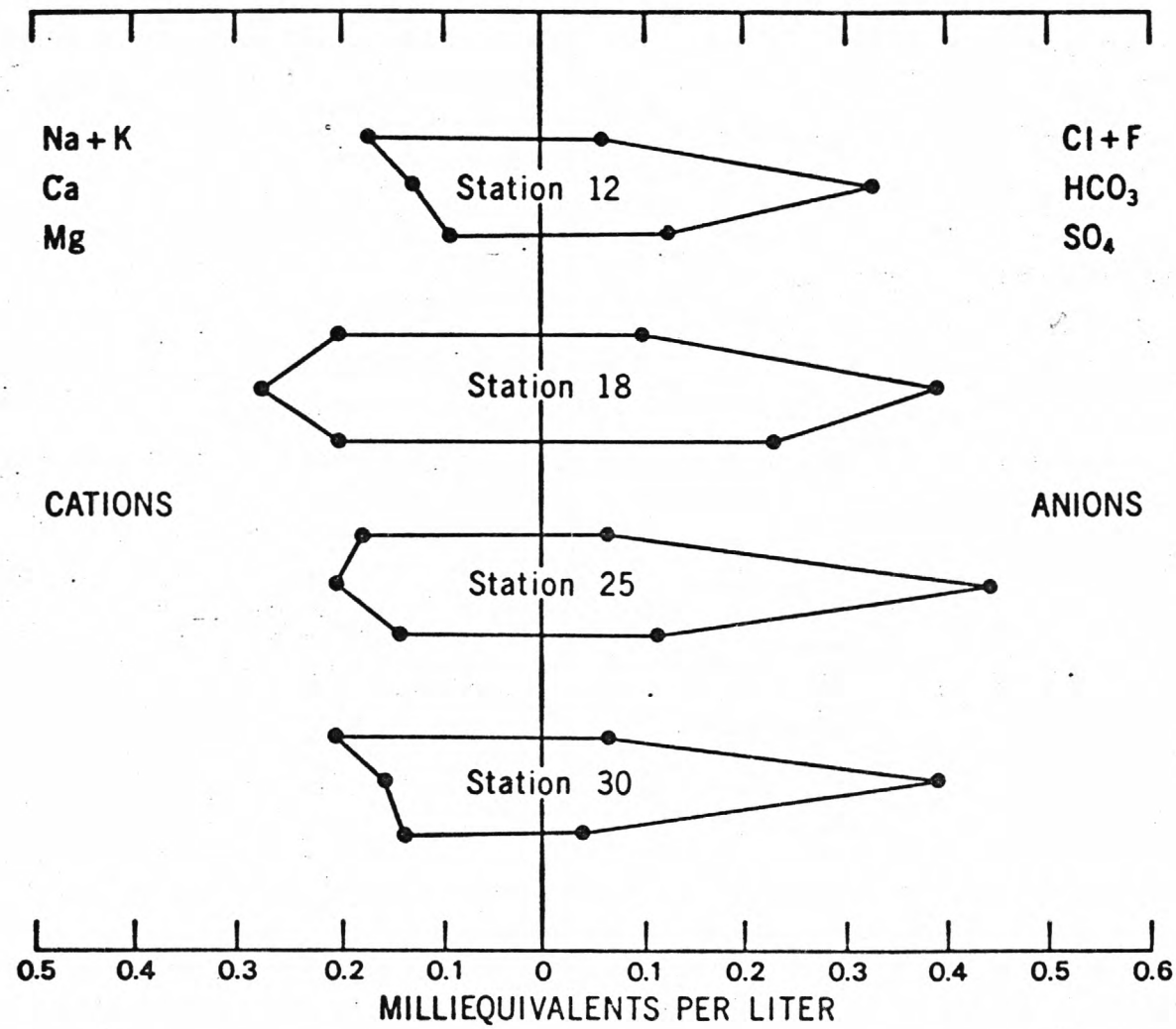

Figure 5.--Stiff diagrams showing chemical composition of water samples from Northeast Creek and Desper Creek watersheds, July 7, 8, August 5, 1976.

Water from tributary 2 is more concentrated in all constituents, except bicarbonate, than is the water in the mainstem of the creek at stations 12 and 25. The mainstem water increases in constituent concentrations (meq/L) between stations 12 and 25 on the mainstem of the creek, but the increase cannot be attributed solely to the inflow of tributary 2. There is not a proportionate increase for sulfate and chloride as for the other major ions. That the major increase is for calcium, magnesium and bicarbonate indicates that the downstream increases in concentrations result less from the inflow of tributary 2 than from ground-water seepage and (or) other tributary inflow. Calcium, magnesium, bicarbonate and sulfate are the dominate ions and the water is a calcium magnesium bicarbonate sulfate water. Tributary number 2, which drains the area of the basin nearest to the mining area at Mineral, contains a greater concentration of sulfate than Desper Creek which drains a more remote area. However, Desper Creek is a calcium magnesium-bicarbonate chloride water.

Organic and biochemical

Organic matter in stream water comes from plant and animal sources and differs widely in form and composition. Usually, organic matter considered in water quality is subdivided into nitrogenous and carbonaceous matter. Nitrogen determinations give useful information on the history of the water pollution; chemical oxygen demand gives information on amounts of oxidizable organic and reducing material present, and total organic carbon determinations indicate the amount of all carbonaceous organic matter. Biochemical oxygen demand indicates the biologically decomposable portions of the organic matter. Bacterial, phytoplankton, and benthic invertebrate determinations enumerate the number, kinds and diversities of the living part of the organic matter in the stream and in its bed materials. These biota are indicators of long term water quality in these aquatic environments.

Organic nitrogen, an important nutrient for aquatic biota, is present naturally in all surface water and results from nitrogenous products within the watershed and the normal biological life of the stream. It is sometimes but not always indicative of pollution from industrial or domestic sources. The range of total organic nitrogen in these streams, 0.09 to 0.20 mg/L, does not indicate a high level of organic enrichment. However, levels of 0.3 mg/L nitrate as (N) and 0.015 mg/L phosphate as (P) are levels above which algal blooms may occur in pools or lakes (Lackey, 1961). Nutrient concentrations

of nitrate and phosphate are below these critical levels in these streams. No algal blooms were observed within the streams or ponds.

The ranges of concentration for these quality parmeters are given for streams in Northeast Creek basin in table 5 and are compared to those for known heavily polluted waters in sewage oxidation ponds. The magnitudes of occurence of these constituents in the Northeast-Desper Creek basins have not reached polluted or other critical concentration levels. Nitrogen and phosphorous concentrations do not indicate an abundance of nutrients and levels of carbon or oxygen demand concentrations do not indicate oxidizable or total organic matter exceeding that for most natural streams (Goerlitz and Brown, 1972).

Biologic indicators of water quality

The criteria limits of total coliform (20,000/100 mL), fecal coliform (2,000/100 mL) and fecal streptococci (table 5) were not exceeded and the fecal coliform/fecal strep ratios are all less than 1 indicating animal and not human waste as sources (Environmental Protection Agency) (Geldrich, 1966).

Phytoplankton and benthic invertebrate populations are the result of long term water quality factors. These factors determine the viability of individual taxon and therefore affect the structure of the biologic communities. Generally, diversity indices less than 1 indicate severe stress on the biologic populations whereas indices of 3 or

greater are more ideal (Slack and others, 1973).

Phytoplankton and algae are identified in the American Public Health Association publication (APHA) "Standard Methods for the Examination of Water and Waste Water, twelth edition, 1965" on pages 691-744. Plates A-F on pages 739-744 identify algae and other plankton in terms of water-quality parameters such as taste, odor, filter clogging (suspended organic matter), clean water, and polluted-water algae. These parameters are used as a basis for evaluating the significance of phytoplankton populations in the Northeast-Desper Creek basins. Table 6 identifies, by genera, the plankton and algae present in the streams and lists, by station, the percent of their occurrence as identified by the APHA plate. A diversity index at the genera level is given for each sampled population. The validity of the index is relatively independent of the number of cells per milliliter or total count (Wilhn and Doris, 1968).

Table 7 identifies the APHA plate with its water-quality parameter and summarizes the percent of each phytoplankton population occurring under that plate. The compositions of the phytoplankton populations and their diversity indices are diagrammed in figure 6.

In terms of percentages of clean water algae per station population, stations 10, 15, 22 and 30 ranked lowest and were about the same, 12-15 percent. However, populations at stations 10 and 15 are dominated by non-indicator

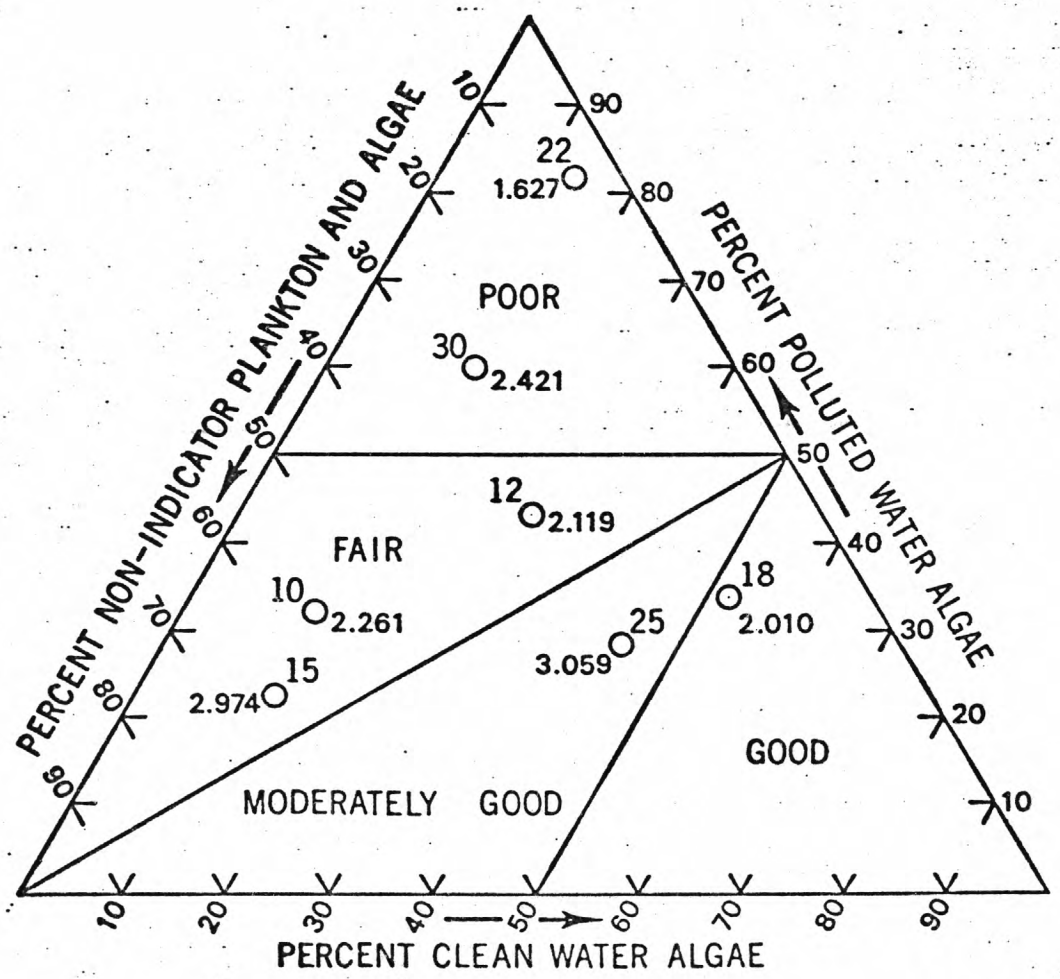

Figure 6.--Diagram showing diversity index and water quality composition of phytoplankton populations in Northeast Creek and Desper Creek watersheds.

(Fair and Geyer, 1965, p. 514-515) plankton and other surface water algae not classifiable as from polluted or clean-water environments and were classified as having fair biologic quality but populations at stations 22 and 30 are dominated by polluted-water algae and are classified as having poor biologic quality. Stations 12, 25 and 18 populations have an increasing percentage of clean-water algae. Station 12 population has less than 50 percent polluted-water algae but has a greater percent of polluted than clean-water algae and is classified as having only fair biologic quality. However, station 25 population has a greater percent of clean than polluted water algae and is classified as having moderately-good biologic quality. Only station 18 population is dominated by clean water algae and is classified as having good biologic quality. The population at station 25 represents the stream flows to be combined within the proposed impoundment. This flow from stations 10, 12, 18 and 22 produces an environment having 44 percent clean-water algae, 28 percent polluted-water algae and 28 percent plankton and other algae. The biologic quality within the proposed impoundment has been classified as moderately good.

Synoptic surveys were conducted for benthic invertebrate populations upstream from stations 12 and 25 with approximately 30-40 minutes spent on each stream reach in search for specimen. The bed materials of both reaches are predominately sand but contain some mucky silt and some cobbles. Streamflow at both stations consisted of flow

through shallow riffles and pools. The kinds and diversity of organisms collected are listed in table 8. The total count for each station, 52 for station 12, and 26 for station 25, is low. The low total count may result from rapidly changing bed material, low pH, low nutrient content, low dissolved solids and a small drainage area. The diversity indices were 2.29 at the upstream station 12 and 2.34 at the station 25 within the proposed impoundment area. On the basis of density and diversity, the two populations appear to be much alike. However, there are some differences in the composition of the benthic invertebrates on the major headwater stream above the impoundment area and that within it. The major differences between the two populations were the absence of dragonflies (Odonata) at station 12 and of caddis flies (Trichoptera) at station 25 and a greater abundance of dobson flies (Megaloptera) at station 12 than at station 25. These differences may result in part from variations in their respective life cycles, available niches, and the nature of the substrate. The majority of organisms were identified down to the class level and were organisms thriving best on sand and rock bottoms in free flowing well-aerated streams (Pennak, 1953). Aquatic earthworms, crayfish and clams were present in only one instance at each station. Snails were present in one instance at station 12 and three instances at station 25.

Though the total counts were low, diversity indices do

not indicate benthic populations under severe stress and they correspond with conditions of bed materials, flow velocity and the dissolved oxygen concentrations found within these reaches. There appears to be a natural constraint limiting the numbers of organisms.

Streambed materials were sampled at stations 25 and 30 for analysis for trace metals and chlorinated organic pesticides. The trace metal analysis listed in table 9 shows no anomalies in composition or magitude of concentrations of the listed elements.

The entire suite of chlorinated organic pesticides including aldrin, dieldrin, chlordane, DDD, DDE, DDT, endrin, heptachlor, heptachlor expoxide, lindane, toxaphene, polychlorinated napthalenes and biphenyls (PCB) were sought; however, only 6.0 micrograms per kilogram of PCB was found in the sample at station 30. This is one of the more weather resistant chlorinated organics. No evidence exists for other pesticides having entered or having remained in the stream system.

SUMMARY AND CONCLUSIONS

The surface water in the Northeast Creek watershed sampled July-September 1976 is very dilute, soft, and acidic with low alkalinity and small buffering capacities. Water is of the calcium magnesium-bicarbonate sulfate type except the Desper Creek and all water has excellent mineral quality. Desper Creek is a calcium magnesium-bicarbonate chloride water.

Iron and manganese concentration levels exceed criteria limits set by some water users. Nitrogen and phosphorus concentrations indicate low nutrient levels available for stream biota. Total organic carbon and chemical oxygen demand values are indicative of levels of organic matter commonly found in unpolluted streams but the low levels of biochemical oxygen demand indicate that little of it is biodegradable.

Water temperatures were within the normal range for the sampling period and dissolved oxygen was near saturation.

The numbers of bacteria were not in excess of permissible critical levels set by the Environmental Protection Agency and derived principally from non-human sources.

The compositions and diversity indices of the phytoplankton populations indicate that there may be stream reaches with poor water environments but that the combined inflows from streams above the impoundment area furnish a water environment having moderately good biologic quality.

Benthic invertebrate populations derived from synoptic

surveys of stream reaches above and within the planned impoundment area indicate that the majority of the taxa found are associated with swift-flowing, well-aerated streams having sand and rock beds. However, total count of organisms and diversity of populations appear to be limited by natural environmental constraints.

Examination of the bed materials of the streams revealed no unusual concentration of metals and the virtual absence of chlorinated organic substances except for some PCB's in the Desper Creek basin at station 30.

Table 1.--Data for streambed profiles for Northeast Creek and Desper Creek.

Elevation in feet above mean sea level	Miles upstream from mouth			
	Northeast Creek			Desper Creek
	Mainstem	Tributary 1	Tributary 2	
270	1.15			
80	2.2			
90	2.9			0.2 mi.
300	3.8			.55
10	4.45			.9
20	5.1			1.0
30	5.5	0.3 mi.	0.4 mi.	1.15
40	5.7	.4	.7	1.3
50	5.95	.7	.95	1.5
60	6.15	.95	1.12	1.6
70	6.45	1.1	1.4	1.7
80	6.65	1.25	1.55	1.95
90	6.8	1.35	1.7	2.05
400	6.95	1.45	1.75	2.2
10	7.05	1.55	1.85	2.25
20	7.15	1.65	2.00	2.35
30	7.25	1.70	2.10	2.45
40	7.3	1.75	2.15	2.50
50	7.45	1.85	2.20	2.6
60		1.90		2.7
70		1.95		2.75
80		2.00		2.8
90		2.05		2.85

Table 2.--Climatological Data, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service

Division - Eastern Piedmont
Station - Louisa

Temperature - degrees Celsius*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
Mean daily maximum	8.2	10.5	13.5	21.7	25.6	29.2	31.8	30.5	27.1	21.1	14.4	8.8	20.2
average	2.3	3.3	7.6	13.7	18.5	22.6	24.6	23.7	20.1	14.2	8.4	2.8	13.7
Mean daily minimum	-2.9	-1.9	.4	7.1	11.5	15.8	18.3	17.7	13.6	7.4	1.5	-2.3	7.2

Precipitation - inches

Total precipitation	3.32	2.34	6.45	1.82	3.36	10.51	7.95	3.07	9.44	1.90	2.02	3.88	56.06
normal	3.00	2.95	3.90	3.09	3.26	3.32	4.66	4.79	3.11	2.99	3.10	3.50	
Departure	.32	-.61	2.55	-1.27	.10	7.19	3.29	-1.72	6.33	-1.04	-1.08	.38	14.4

*Degrees Celsius calculated from degrees Fahrenheit.

Table 3.--Northeast Creek and Desper Creek field data on water properties.

Station	Date 1976	Discharge (ft 3/s)	Water temp. (°C)	Specific conductance (micromhos) cm at 25°C	Hydrogen ion (pH)	Oxygen dissolved (mg/L)	Oxygen (percent saturation)	BOD (mg/L)	Bacteria coliform total	Bacteria coliform fecal	Bacteria strep fecal
10	07-07		19.0	42	5.9	8.6	91	--	560	139	870
	09-15	.115	17.0	42	6.0	9.0	93	--			
12	07-07		19.0	48	6.3	8.4	89	1.7	840	430	1200
	09-15	.331	16.0	70	6.0	8.2	82	--			
15	07-07		21.0	48	5.7	7.9	88	--	470	74	780
	09-15	0	17.0	43	6.0	8.2	85	--			
18	07-08		19.0	73	6.0	8.6	91	1.3	390	110	1030
	09-15	.042	17.0	73	5.8	8.9	92	--			
22			18.0	52	5.4	7.8	82	--			
	09-15	.217	19.0	52	6.1	7.3	78	--	480	180	1000
25	07-08		19.0	52	5.4	9.6	102	1.5	2200	500	2200
	09-15	.450	16.0	55	6.0	8.4	84	--			
	08-05	--	19.0	53	6.1	8.3	--	--	--	--	--
30	08-05	--	18.0	50	6.0	8.7	91	1.5	560	21	660

Table 4.--Northeast Creek and Desper Creek chemical data.

Property	Sampling stations			
	12	18	25	30
Date, 1976	07-08	07-08	07-08	08-05
Time,	1100	1040	0820	1030
Discharge, ft^3/s				
Water temp., °C	19.0	19.0	19.0	18.0
Specific conductance, micromhos/cm at 25°C	48	73	52	50
Hydrogen ion, pH units	6.3	6.0	5.4	6.0
Iron, micrograms/liter, dissolved	240	240	450	160
Manganese, micrograms/liter, dissolved	10	20	20	20
Milligrams per liter				
Silica	11	13	14	19
Calcium	2.5	5.4	4.0	3.2
Magnesium	1.0	2.4	1.7	1.7
Potassium	1.4	2.4	1.5	1.0
Sodium	2.9	3.1	3.1	4.2
Bicarbonate	20	24	27	24
Sulfate	6.0	11	5.5	1.8
Chloride	2.0	3.4	2.2	2.0
Fluoride	.1	.1	.1	.1
Dissolved solids				
residue on evap. (180°C)	42	54	53	55
sum	37	54	46	46
Alkalinity, total, as $CaCO^3$	16	20	22	20
Hardness, as $CaCO^3$				
calcium-magnesium	10	23	17	15
non-carbonate	0	4	0	0
Nitrogen, as N				
total	.24	.33	.22	.21
ammonia, total	.03	.07	.02	.00
organic, total	.18	.20	.16	.09
kjeldahl, total	.21	.27	.18	.09
nitrite, dissolved	.01	.01	.00	.00
NO^2+NO^3, dissolved	.08	.20	.06	.11
Phosphorus, as P				
total	.00	.01	.01	.01
orthosphosphate, dissolved	.00	.00	.00	.00
phosphate, dissolved	.00	.00	.00	.00
Carbon, organic, total	5.0	2.6	7.3	6.1
Oxygen demand, biochemical	1.7	1.3	1.5	
, chemical	15	7	10	
Chlorophyll, micrograms/liter				
, A	.000	.000	.000	.000
, B	.000	.000	.000	.000

Table 5.--Comparison of Northeast Creek and Desper Creek nutrient and bacterial quality parameters with those of known polluted waters.

Quality parameters		Northeast-Desper Creek	Sewage oxidation ponds 1	2	3	4
Coliform, fecal,	colonies/100 mL	74 - 500	12,000	30,000	3,600	--
Strep, fecal, MF,	colonies/100 mL	660 - 2,200	500	1,000	1,300	100
Fecal coliform/fecal strep ratio		less than 1	24	30	2.8	--
Carbon, tot organic	mg/L	2.6 - 7.3	38	44	58	36
Nitrogen, as N						
, NO_2, total	mg/L	0.00 - 0.01	0.11	0.07	0.02	0.12
, NH_4, total	mg/L	.02 - .07	8.7	4.1	5.7	0.98
, total	mg/L	.22 - .23	14	26	11	6.4
, total, org	mg/L	.16 - .20	5.3	22	5.3	4.8
, total, kjd	mg/L	.18 - .27	14	26	11	5.8
, $NO_2 + NO_3$, total	mg/L	.06 - .20	0.29	0.15	0.02	0.61
Phosphorus, as P						
, total	mg/L	.00 - .01	--	11	7.4	.56
, ortho	mg/L	.00 - .00	--	9.4	7.0	.26

Table 6.--Northeast Creek and Desper Creek phytoplankton data.

Genus	APHA Color Plate	Percentage of total count						
		Station 10 07-07	Station 12 07-08	Station 15 07-07	Station 18 07-08	Station 22 07-07	Station 25 07-08	Station 30 08-05
Achnanthes	F	--	7	--	4	4	4	--
Ankistrodesmus	D	--	7	--	--	--	4	--
Caloneis	--	--	--	--	--	--	--	5
Closterium	B	--	--	--	4	--	--	--
Cosmarium	--	--	--	--	--	--	--	5
Cruciegenia	--	--	--	10	--	--	--	--
Cyclotella	B,D	--	--	--	--	--	4	--
Cymbella	B,F	40	--	--	7	--	4	--
Diatoma	B	--	--	--	--	--	--	5
Dinobryon	A,B	--	23	--	--	--	8	--
Euglena	C,E	--	--	10	--	--	--	--
Eunota	--	--	--	5	--	--	--	--
Gomphonema	C,F	12	10	--	4	--	4	35
Lyngbya	C,F	--	--	--	--	68	--	--
Navicula	B,D	4	27	5	48	12	32	15
Nitschia	C	20	33	12	30	5	20	25
Oscillatoria	B,C	--	--	--	--	8	--	--
Peridinium	A	--	--	19	--	--	--	--
Phacotus	D	--	--	--	--	1	--	--
Phacus	C,E	--	--	--	--	1	--	--
Pinnularia	D	8	--	--	--	--	4	--
Scenedesmus	E	16	--	--	--	--	8	--
Surirella	D	--	--	--	4	--	--	--
Synedra	A,B	--	--	10	--	1	4	10
Tetraedron	C	--	--	--	--	--	4	--
Trachelomonas	B	--	--	24	--	--	--	--
Total percent		100	100	102	101	100	100	100
Total count (cells/mL)		77	160	120	84	1000	120	77
Diversity index-Genera		2.261	2.119	2.974	2.010	1.627	3.059	2.421

Table 7.--Significance of phytoplankton occurring in the Northeast Creek and Desper Creek Basins (APHA, Standard Methods, Water and Waste Water, 12th Edition, 1965).

Color Plate	
A	Taste and odor algae
B	Filter clogging algae
C	Polluted water algae
D	Clean water algae
E	Plankton and other surface water algae
F	Algae growing on reservoir walls
Other	

In instances of multiple classification (ABC or DF), percent phytoplankton were entered under C or D, respectively.

	10	12	15	18	22	25	30
Color plate							
A	0	23	29	0	01	12	10
B	40	0	24	11	0	04	5
C	32	43	22	34	82	28	60
D	12	27	12	52	13	44	15
E	16	0	0	0	0	08	--
F	0	7	0	04	04	04	--
Other	0	0	15	0	0	0	10
Total	100	100	102	101	100	100	100

Table 8.--Northeast Creek and Desper Creek benthic invertebrate data at Stations 12 and 25.

Organism	Count Sta. 12	Count Sta. 25
Annelida	--	--
Oligochaeta (aquatic earthworms)	1	1
Arthropoda	--	--
Arachnoidea	--	--
Hydracarina (water mites)	1	--
Crustacea	--	--
Decapoda (crayfish)	1	--
Insecta	--	--
Coleoptera (beetles)	--	--
Dryopidae (riffle beetles)	--	1
Elmidae	1	--
Gyrinidae (whirly gig beetles)	3	2
Diptera (midges)	--	--
Chironomidae	6	3
Ephemeroptera (mayflies)	10	8
Hemiptera (true bugs)	15	3
Megaloptera (dobsonflies)	11	1
Odonata (dragonflies)	--	--
Gomphidae	--	1
Macromiidae	--	2
Trichoptera (caddis flies)	1	--
Mollusca	--	--
Bivalvia (bivalves)	--	--
Nuculdodea	--	--
Sphaeriidae (fingernail clams)	1	1
Gastropoda (Snails)	--	--
Basommatophora	--	--
Planorbidae (orb snails)	1	3
Total Count	52	26
Diversity index	2.29	2.34
Area samples (square meters)	167	84

Table 9.--Northeast Creek and Desper Creek trace metal data, August 8, 1976.

Concentrations in bed material in micrograms per gram--dry weight.

Aluminum	Al	1600	550
Barium	Ba	30	10
Beryllium	Be	0.3	0.1
Bismuth	Bi	Less than 1	Less than .5
Boron	B	2	2
Cadmium	Cd	1	.5
Chromium	Cr	7	2
Cobalt	Co	7	2
Copper	Cu	10	1
Gallium	Ga	.4	.1
Germanium	Ge	Less than 1	Less than .5
Iron	Fe	3300	1300
Lead	Pb	10	4
Lithium	Li	1	.5
Manganese	Mn	300	130
Molybdenum	Mo	Less than .7	Less than .3
Nickel	Ni	10	3
Silver	Ag	Less than .1	Less than .05
Strontium	Sr	2	.5
Tin	Sn	Less than .7	Less than .3
Titanium	Ti	50	17
Vanadium	V	10	3
Zinc	Zn	76	8

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