MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph.D.
Director

BULLETIN 55

GEOLOGY AND GROUND-WATER SUPPLY AT CAMP McCAIN

By

GLEN FRANCIS BROWN, M. S.

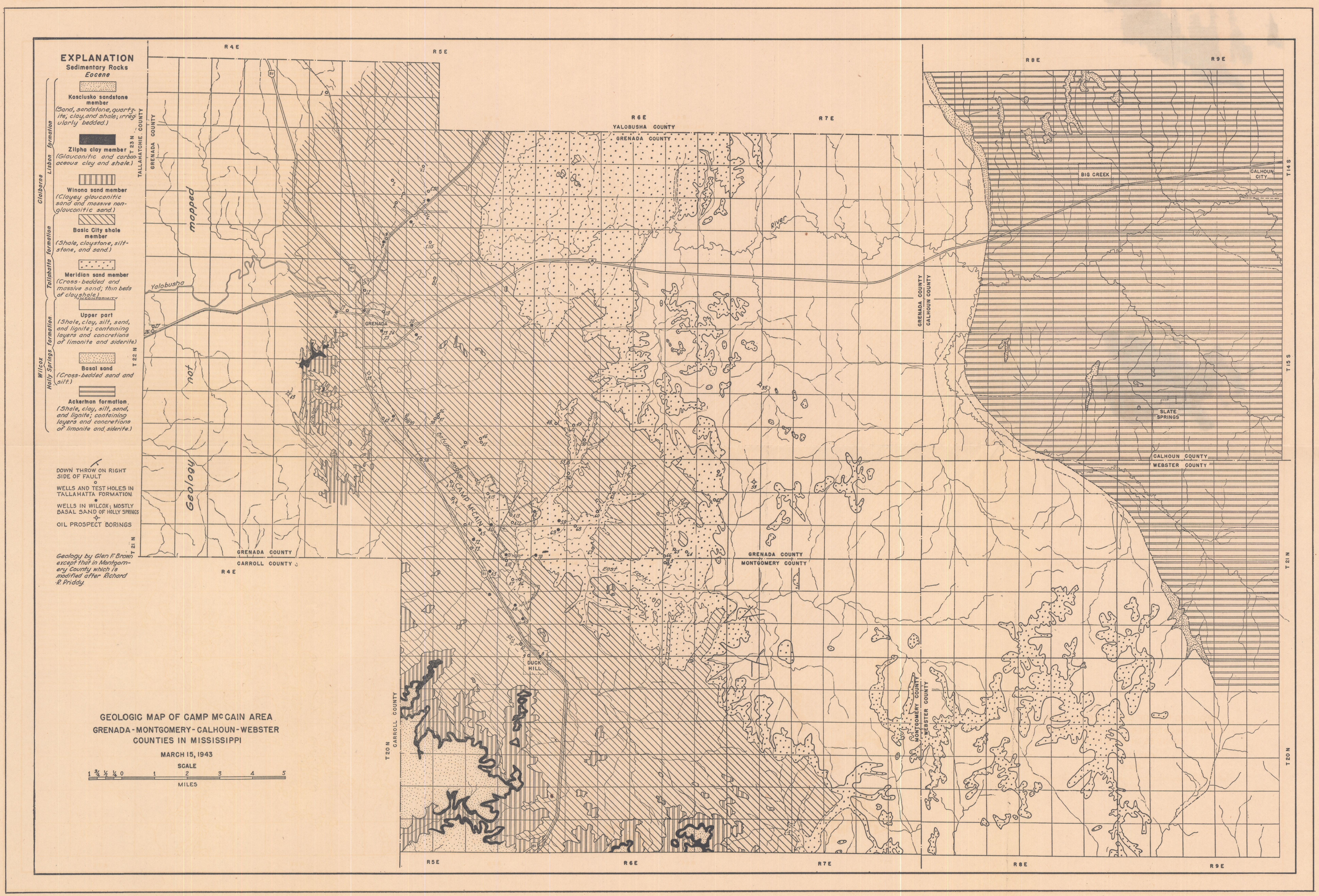
and

ROBERT WYNN ADAMS, B.S., M.B.A.

In cooperation with the
United States Geological Survey

UNIVERSITY, MISSISSIPPI

1943


EXPLANATION
Sedimentary Rocks
Eocene
Claiborne
Lisbon formation
Kosciusko sandstone member
(Sand, sandstone, quartzite; clay, and shale; irregularly bedded.)
Zilpha clay member
(Glauconitic and carbonaceous clay and shale.)
Winona sand member
(Clayey glauconitic sand and massive non-glauconitic sand.)
Tallahatta formation
Basic City shale member
(Shale, claystone, siltstone, and sand.)
Meridian sand member
(Cross-bedded and massive sand; thin beds of clayshale.)
UNCONFORMITY
Wilcox
Holly Springs formation
Upper part
(Shale, clay, silt, sand, and lignite; containing layers and concretions of limonite and siderite.)
Basal sand
(Cross-bedded sand and silt.)
Ackerman formation
(Shale, clay, silt, sand, and lignite; containing layers and concretions of limonite and siderite.)
DOWN THROW ON RIGHT SIDE OF FAULT
WELLS AND TEST HOLES IN TALLAHATTA FORMATION
WELLS IN WILCOX; MOSTLY BASAL SAND OF HOLLY SPRINGS
OIL PROSPECT BORINGS
Geology by Glen F. Brown except that in Montgomery County which is modified after Richard R. Priddy
GEOLOGIC MAP OF CAMP McCAIN AREA
GRENADA-MONTGOMERY-CALHOUN-WEBSTER COUNTIES IN MISSISSIPPI
MARCH 15, 1943
SCALE
MILES
R4E
R5E
R6E
R7E
R8E
R9E
T 23 N
T 22 N
T 21 N
T 20 N
T 14 S
T 15 S
TALLAHATCHIE COUNTY
GRENADA COUNTY
YALOBUSHA COUNTY
CARROLL COUNTY
MONTGOMERY COUNTY
CALHOUN COUNTY
WEBSTER COUNTY
Geology not mapped
Yalobusha
GRENADA
CAMP McCAIN
DUCK HILL
BIG CREEK
CALHOUN CITY
SLATE SPRINGS

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MISSISSIPPI GEOLOGICAL SURVEY

COMMISSION

STAFF

LETTER OF TRANSMITTAL

Office of the Mississippi Geological Survey
University, Mississippi
October 3, 1943

To His Excellency,
Governor Paul Burney Johnson, Chairman, and
Members of the Geological Commission

Gentlemen:

Herewith is Bulletin 55, Geology and Ground-Water Supply at Camp McCain. It is a report to the U. S. Army Engineers summarizing the results of field and laboratory investigations of a water supply for a camp of thousands of men.

The investigation is the joint work of the U. S. Geological Survey and the Mississippi State Geological Survey and was undertaken at the request of the War Department which allocated funds to supplement the joint cooperative budget of the Federal-State ground-water survey. Although the investigation is of a small area, the study, of necessity, extended far to the north and to the east, the collecting areas of the ground water beneath the Camp. And although the investigation is of a specialized area, nevertheless it constitutes a part of the cooperative ground-water investigation of the larger Mississippi Alluvial (Delta) area, which, likewise of necessity, includes a stratigraphic and areal study of the beds far to the east, the recharge area of this great "Alluvial Empire" that extends from the Tennessee line to the Bluffs at Vicksburg.

The investigation provided an adequate supply of good water for the Camp that otherwise would have had great difficulty in finding a sufficient supply. It has been largely the work of Glen Francis Brown, ably assisted by Robert Wynn Adams, Associate Professor of Civil Engineering at Mississippi State College.

It presages the solution of the ground-water problems of the greater Alluvial area and the geology of the belt to the east.

Very sincerely yours,

William Clifford Morse,
State Geologist and Director

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GEOLOGY AND GROUND-WATER SUPPLY AT CAMP McCAIN

BY GLEN FRANCIS BROWN
AND ROBERT WYNN ADAMS

SUMMARY

Camp McCain, in Grenada and Montgomery Counties, Mississippi, is built on terraces of the Batupan Bogue Valley in the north-central hills. The valley is developed on the lower part of the Basic City shale member of the Tallahatta formation, which belongs to the Claiborne series of middle Eocene age. The shale of this member grades downward into a dominantly sandy phase of the Tallahatta known as the Meridian sand member, which includes lenses and thin stringers of gray and chocolate-colored shale similar to the shale in the Basic City member. Disconformably underlying the Tallahatta formation is the Wilcox series of early Eocene age. Outliers of the Meridian sand may be seen midway within the belt of outcrop of the Wilcox series east of the Camp.

The Wilcox series is divided into the Holly Springs formation above and the Ackerman formation below. A third unit may be represented by fine sandy deposits and overlying shale beds beneath the northern part of the Camp, but the deposits are not sufficiently widespread to warrant distinct separation. Beneath the Wilcox series are the Porters Creek clay and the Clayton formation of the Midway series (Paleocene age). Below these formations of Cenozoic age are upper Cretaceous deposits and older Mesozoic and Paleozoic rocks.

The Cenozoic and Mesozoic beds lie on the east flank of the Mississippi embayment. They strike in a north-south trend and dip toward the west, the dip ranging from a few feet to about 100 feet a mile. They have been folded and faulted by earth movements, the most prominent resulting in a strike-fault of about 80 feet displacement which bisects the Camp terrain.

The principal water-bearing beds at the Camp and at the Air Base are the Meridian sand member of the Tallahatta formation, the base of the Claiborne series, and the basal sand member of the Holly Springs formation near the middle of the Wilcox series. The Meridian sand is found from the surface to depths

as much as 280 feet. The sand member of the Holly Springs formation is present at depths of about 284 to 521 feet.

The Meridian sand is a widespread aquifer. At Camp McCain its thickness is near a minimum for northwestern Mississippi. The coefficient of transmissibility, as determined by pumping tests, ranges from 13,300 to 168,000; that is, the rates at which water will be transmitted through a cross section of the sand a mile wide and under a hydraulic gradient of one foot a mile range from 13,300 to 168,000 gallons a day. The coefficient of storage ranges from 0.000073 to 0.00164. The coefficient of storage is defined as the quantity of water, in cubic feet, that is discharged from each vertical prism of the aquifer with a basal area equal to one square foot when the water level is lowered one foot. The coefficients of transmissibility increase toward the northwest, indicating that the ability of the sand to yield water increases in that direction. The coefficients of permeability, as determined by pumping tests, range from 191 to 731, whereas coefficients of permeability of specific washed drilling samples, as determined in the laboratory, range from 201 to 7,766. Each coefficient of permeability derived from a pumping test is obviously an average for the entire thickness of the aquifer. The Meridian sand is capable of yielding enough water to supply all of the Camp requirements. The water is of good chemical quality except that it contains as much as 6.5 parts per million of iron and appreciable quantities of carbon dioxide, and therefore needs treatment.

The basal sand member of the Holly Springs formation is thin and discontinuous, and the grain size is considerably smaller than the grain size in the Meridian sand. Consequently, the yields of the wells are rather small, and the draw-downs are large. The coefficients of transmissibility, as determined by pumping tests, range from 1,500 to 19,925; the coefficients of storage range from 0.00015 to 0.00080. The coefficients of transmissibility increase toward the southeast, indicating that the ability of the sand to yield water increases in that direction, although three channelways trending east-west are the loci of greatest transmissibility. The coefficients of permeability, as computed from pumping tests, range from 60 to 744, whereas coefficients of permeability of specific washed drilling samples, as determined in the laboratory, range from 5 to 1,465. The water from the Holly Springs formation is of good chemical quality. It is not as low in total dissolved solids as the water from the Meridian sand but contains very little iron, no free carbon dioxide, and does not require treatment.

The water supplies at the Camp and at the Air Base have been developed mostly in accordance with the results of this investigation. As the water from the sand at the base of the Holly Springs formation does not require treatment, it has been developed to what is considered to be the safe yield; that is, about 1,200 gallons a minute. The wells were so located in the area and the pumping schedules are so arranged as to take advantage of the southeastward increase in the capacity of the sand and also to withdraw water from both sides of the fault. The rest of the water is obtained from wells in the Meridian sand.

INTRODUCTION

LOCATION

Camp McCain is situated in north-central Mississippi, about 105 miles north of the Capital at Jackson and a similar distance south of Memphis, Tennessee. The Camp, bordered on the west by the Illinois Central Railroad and U. S. Highway 51, is located in Grenada and Montgomery Counties about 7 miles south of Grenada and about 9 miles south of the Grenada Air Base.

PHYSIOGRAPHY AND DRAINAGE

The Camp is located in the north-central hills of Mississippi, where drainage is well developed and the long-term erosion cycle is advanced. Altitudes range from more than 400 feet on monadnock-like hills, such as Duck Hill on the southern boundary, to slightly less than 200 feet along the channel of Batupan Bogue. The Camp is built on a rather broad plain composed of at least two terraces of this stream and its tributaries.

The highest of these terraces is best developed at an elevation of about 230 feet and may be seen near Elliott (or near the headquarters of the 87th Division east of Batupan Bogue) where it is 15 or 20 feet above the flood plain. The lower and somewhat more extensive surface lies about 10 feet below and appears to merge into what may be a third, narrower, surface whose altitude is about 210 feet at the northern border of the cantonment area. Possibly this third surface, which is just above the flood plain, should be considered part of the second terrace but it may represent another distinct pause in the erosion cycle. The two prominent upper surfaces increase in elevation up the tributaries and are as distinct in the headwaters as along the lower courses of the Bogue.

The drainage area of Batupan Bogue includes about 200 square miles and lies in the southern part of the Yalobusha River drainage basin. The largest tributary is the East Fork of the Bogue, which drains about 100 square miles east of the Camp site, including a considerable portion of the adjacent outcrop area of the Meridian sand member, which furnishes part of the Camp water supply.

PRECIPITATION

The monthly distribution of the precipitation (Table 1) is known as the Tennessee type; that is, a maximum precipitation in spring, generally in March and April, and a minimum precipitation during the fall. However, abnormally heavy precipitation may occur during any month. Precipitation during the fall of 1942 was subnormal, followed by excessive precipitation during December of that year, and about one-half normal during January 1943.

SUMMARY OF STRATIGRAPHY

The geologic formations which underlie Camp McCain range in age from Paleozoic and older to Pleistocene and Recent. The indurated Paleozoic formations are deeply buried and are imperfectly known in this locality. Their upper strata are irregularly beveled by a surface which in general slopes to the southwest and which determines the dip of the overlying beds. This beveled upper surface of the Paleozoic rocks is about 4,000 feet below the land surface in the vicinity of Camp McCain.

Above the Paleozoic formations are deposits of Mesozoic age,

TABLE I

PRECIPITATION AT GRENADA, GRENADA COUNTY
MONTHLY, ANNUAL, AND AVERAGE AMOUNTS IN INCHES

Year	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1909	---	---	---	---	11.36	4.85	2.84	1.86	3.78	T	1.08	3.97	--
1910	3.31	5.73	0.68	5.07	5.29	3.86	8.73	6.06	.22	3.50	.96	3.32	46.73
1911	3.62	6.08	2.26	10.35	.60	2.74	3.23	5.21	.67	2.42	3.47	14.15	54.80
1912	3.91	3.01	---	---	3.03	---	---	---	---	---	---	---	---
1913	---	---	---	---	3.75	.70	---	.70	4.70	1.80	0.40	1.10	---
1914	.70	2.10	4.90	3.40	3.00	1.10	2.92	8.14	3.64	1.79	2.62	6.32	40.63
1915	5.95	4.60	3.13	2.45	2.59	6.49	1.53	2.33	4.00	2.35	5.60	6.42	47.44
1916	6.47	---	5.44	1.44	6.30	3.35	5.98	4.83	2.26	1.81	1.22	6.36	---
1917	5.90	4.00	7.09	4.57	2.79	2.52	5.47	2.86	.76	2.11	1.84	1.00	40.91
1918	--	1.71	.64	7.00	.57	3.42	1.47	1.78	2.51	4.57	3.46	1.60	---
1919	3.35	2.92	9.51	6.68	4.31	4.89	1.55	4.95	1.96	7.77	10.85	4.23	62.97
1920	6.57	2.29	7.19	15.40	7.25	3.37	4.88	4.05	1.01	1.80	4.35	6.69	64.85
1921	1.74	5.59	6.77	11.90	.32	.73	2.88	4.36	4.52	1.01	3.59	2.03	45.44
1922	5.70	10.18	6.85	5.70	4.75	2.10	2.14	1.05	---	---	---	---	---
1923	3.57	7.25	7.82	7.45	8.77	5.71	5.34	5.57	2.58	1.55	4.35	7.07	67.03
1924	5.44	5.63	6.07	5.43	4.00	2.99	1.53	2.05	3.05	.12	.70	5.24	42.25
1925	5.71	4.19	3.80	4.33	.34	1.96	3.66	1.59	2.20	7.50	6.72	3.40	45.40
1926	4.28	1.94	5.63	1.46	5.18	1.13	3.91	3.01	1.59	3.68	3.13	18.37	53.31
1927	3.73	5.57	9.09	4.96	3.18	3.68	4.44	2.76	1.78	.70	2.58	6.27	48.74
1928	3.49	1.44	4.87	8.29	2.73	5.17	1.01	6.63	1.96	.66	1.95	2.06	40.26
1929	4.00	2.75	5.24	4.87	2.67	2.35	7.76	3.73	2.96	2.74	5.58	3.44	48.09
1930	4.73	2.69	3.00	2.45	9.87	.89	1.35	4.43	1.82	2.88	5.24	3.88	43.23
1931	3.20	3.34	5.18	2.92	3.36	1.66	5.03	2.54	0.44	1.28	4.30	12.43	45.68
1932	11.45	7.60	3.29	5.11	1.62	9.97	3.08	5.71	5.55	4.76	3.96	11.89	73.99
1933	3.07	5.86	10.43	3.88	6.73	0.24	9.10	2.53	1.38	2.13	1.00	3.15	49.50
1934	2.36	4.00	5.72	0.58	1.28	7.27	1.43	5.76	5.13	2.29	5.31	6.43	47.56
1935	4.14	3.15*	9.57	6.69	5.58	4.53	0.60	0.70	2.68*	3.35*	4.40	1.77	47.16**
1936	5.07	2.68	3.47	3.80	0.81	1.70	7.00	1.46	1.09	1.14	3.86	6.35	38.43
1937	9.30	2.86	3.95	1.96	2.93	2.04	2.61	3.81	6.02	3.01	4.57	4.71	47.77
1938	4.06	3.17	4.26	4.48	1.35	7.11	3.19	2.58	1.05	0.52*	2.64*	2.91*	37.32**
1939	8.27*	7.11*	7.33*	4.04	3.38	5.75	0.79	1.70	1.40	0.08	2.33	4.66	46.84**
1940	2.52	4.25	4.83	4.93	3.93	4.41	8.88	7.90	0.81	1.50	6.71	5.78	56.45
1941	3.25	2.62	4.21	3.05	0.40	3.35	6.69	5.23	5.04	8.74	5.76	3.25	51.59
1942	2.56	3.93	7.39	3.92	4.61	3.10	1.78	3.05	2.92	1.58	0.75	7.00	42.59
1943	2.26	1.92	6.71	1.97									
Avg.	4.49	4.13	5.82	5.02	3.78	3.49	3.84	3.66	2.55	2.54	3.60	5.54	48.46

*Interpolated **Partly interpolated T Less than 0.01 inch

Altitude: 194 feet Records from U. S. Weather Bureau

including the Tuscaloosa and Eutaw formations, the Selma chalk, and the Ripley formation, all of the Upper Cretaceous. Most, but not all, of these rocks crop out farther east in the state, but at Camp McCain they are covered by about 1,800 feet of Tertiary and younger beds.

The Tertiary formations in this locality rest unconformably on the Upper Cretaceous. They are of Paleocene and Eocene age.

GENERALIZED SECTION OF THE GEOLOGIC FORMATIONS IN THE CAMP McCAIN AREA

SYSTEM		SERIES	FORMATION	MEMBER	Thickness Feet	PHYSICAL CHARACTER	HYDROLOGIC PROPERTIES
Quaternary	Recent *		Channel and flood-plain deposits and colluvium		0-20	Loose sand, clay, vegetal debris.	Too discontinuous to yield other than small domestic supplies.
Quaternary	Pleistocene		Terrace deposits and weathered loess		0-15	Loose sand, clay, loam.	Considerable water under water table conditions in the lower part; locally shallow farm wells derive small supplies, but the thin and discontinuous deposits do not permit extensive development.
Tertiary	Eocene	Claiborne	Lisbon	Kosciusko sandstone	100+	Sand, sandstone, quartzite, clay, sandy clay	Found only on hilltops above the water table at the camp.
			Lisbon	Zilpha clay	0-50	Carbonaceous shale, glauconitic sand and clay; concretionary.	Non-water-bearing; situated above the water table in the camp area.
			Lisbon	Winona sand	25+	Greensand, limonite concretions, fossiliferous; some clay.	Yields water to wells west of the camp, but the member is above the water table in the camp area.
			Disconformity (?)				
			Tallahatta	Basic City shale	150±	Shale, clay, sand, "claystone"; numerous fucoidal markings and leaf fragments; some glauconitic clay near top.	The sand lenses yield small supplies to farm wells.
			Tallahatta	Meridian sand	8-230	Sand and grit; thin lenses of Basic City type clay shale; characterized by an abundance of coarse kyanite, staurolite, and muscovite; fossil wood in outcrop.	The most important aquifer in the area, yielding about two thirds of the camp supply, the air base supply and the supplies at Grenada and Duck Hill; the presence of iron and free carbon dioxide in the water causes the water to require treatment.
			Disconformity				
		Wilcox	Holly Springs **		220-437**	Shale, clay, sandy shale, lignite, silt, calcareous sandstone and siltstone, sand; much carbonaceous material.	Non-persistent fine sand lenses in the upper part yield water only at the McCain A-11 well.
			Holly Springs *	Basal sand	0-123	Gray sand ranging from fine to medium quartz grains; minor feldspar, pyrite, magnetite, mica, other detrital grains.	Produces about 1,200 gallons a minute at the camp and at numerous farm wells; the water does not require treatment.
			Disconformity				
			Ackerman		245-362**	Shale, sandstone, siltstone, soft brown lignite, sandy shale; thin layers of siderite and calcareous siltstone are common.	Local lenses contain fresh water but lie too deep and are not extensive enough to warrant development.
			Ackerman	Basal sand	0-38	Fine sand and silt beneath the camp.	Contains a minor quantity of water reported to be "milky."
	Paleocene	Midway	Porters Creek		720±	Marine clay and shale; numerous siderite layers; perhaps minor non-marine clay, silt, fine sand; some glauconite.	Non-water-bearing; the top of the Porters Creek clay marks the bottom of fresh water in the area.
			Clayton		20-35	Limestone, calcareous shale, sandy marl.	Minor interstitial water, probably connate.
Cretaceous	Gulf (Upper Cretaceous)		Ripley		0-30	Sand; calcareous clay	Minor interstitial water, probably connate or brackish.
			Selma chalk		880±	Dense chalk.	Minor interstitial water, probably connate.
			Eutaw		200±	Glauconitic sands and clay shale.	Contains brackish water, probably high in sodium bicarbonate.
			Tuscaloosa		500-1000+	Red and gray shale, sand, sandstone, gravel.	Contains connate water in lower part and brackish water in upper part.
	Comanche (?)				Unknown		Contains connate water.
Pennsylvanian			Pottsville (?)		Unknown	Indurated shale, quartzite, sandstone.	Contains connate water.

*Includes some remnants of undifferentiated Upper Wilcox strata.
**Total thickness of formations.

The Paleocene beds belong to the Midway series, which includes the Clayton formation and the Porters Creek clay. They do not crop out in this locality but appear at the surface farther east.

The Eocene beds include the Holly Springs and Ackerman formations of the Wilcox series, and the Tallahatta and Lisbon formations of the Claiborne series. The Tallahatta formation is divided into the Meridian sand member and an overlying member of shale, claystone, siltstone, quartzite, and sand that is called the Basic City shale member. The terraces are underlain near the surface by the Basic City shale member, and the Meridian sand member lies at the surface or near it in a belt extending beneath the eastern part of the Camp (Plate 1). The beds referred to as the Lisbon formation are exposed on the highest parts of the hills around the Camp and comprise most of the terrain for several miles to the west. The Lisbon formation is divided into the Winona sand member at the base, the Zilpha clay member, and the Kosciusko sandstone member.

The youngest beds are irregular thin deposits of sand, silt, and clay. They are remnants of stream debris formed under subaerial conditions, partly during the present erosion cycle, partly during earlier more obscure cycles. Exposures are scattered along the lower slopes, on the terraces, and in the stream beds.

METHODS OF EXPLORATION

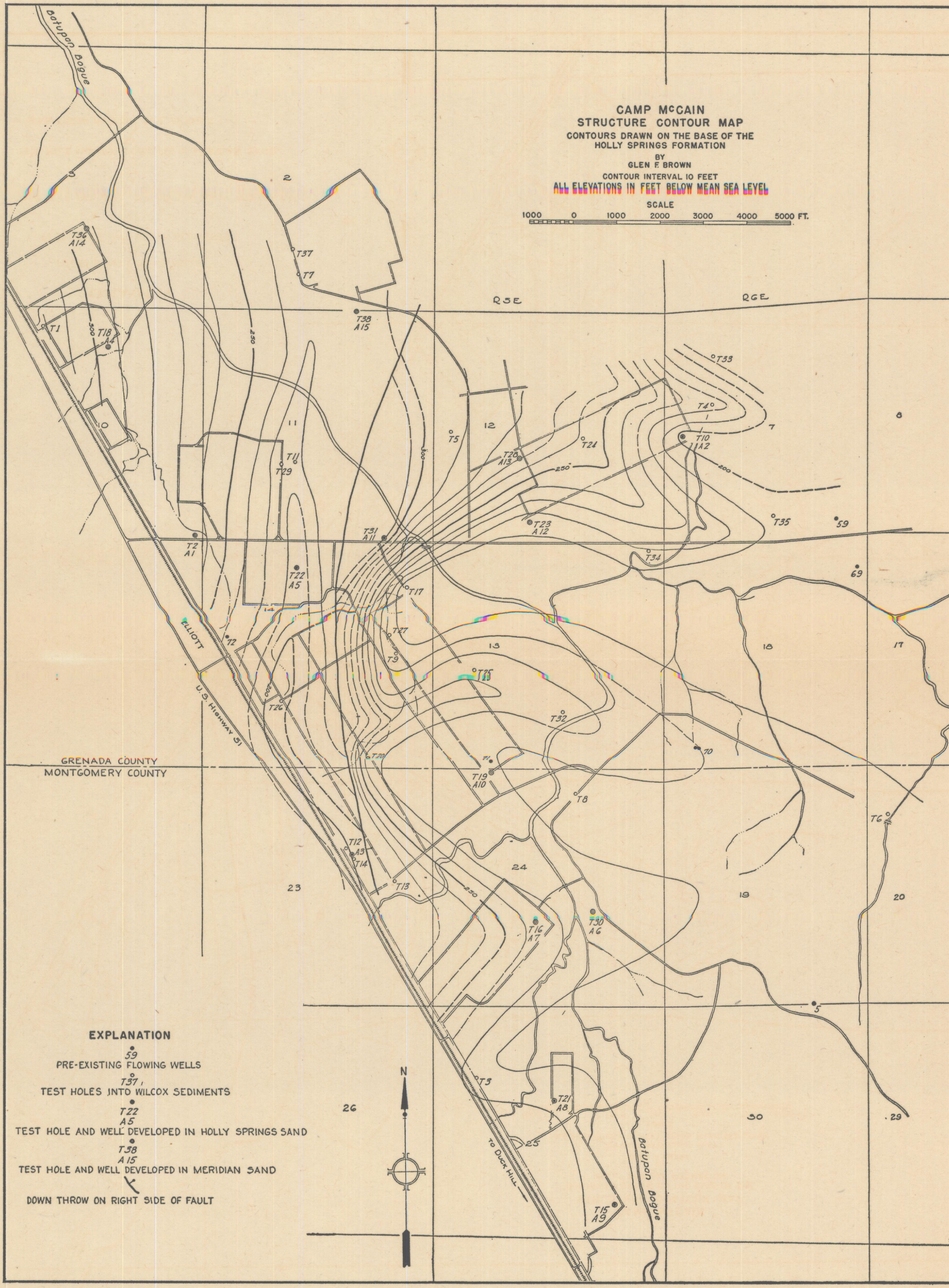
OUTLINE OF THE PROGRAM

Wells in the area were visited by the senior author in 1938 as part of a reconnaissance study of the ground-water supply of the Mississippi alluvial plain. The existing water supplies for the initial planning of the Camp were investigated by Mr. Robert Stephens of the architect-engineers' office. As a result of the information thus collected, the architect-engineers decided to explore two potential water-bearing sands, the basal sand of the Ackerman formation at a depth of about 800 to 900 feet and the sand member of the Holly Springs formation at a depth of 400 to 500 feet. The results of two test holes indicated that these horizons would probably not yield an adequate water supply where the drill penetrated them. In test hole 2 a highly permeable sand, the Meridian sand member of the Tallahatta formation, was encountered from 63 feet to 138 feet below the surface. Water from this sand contains appreciable quantities of iron and free carbon dioxide in solution and requires treatment, thus increasing the cost of operation. Test holes located on the periphery and in the center of the Camp area were drilled through the Ackerman formation, but the results were too discouraging to warrant additional exploration. Other test holes dispersed over the Camp area were put down in an effort to develop a supply from the basal sand of the Holly Springs formation, and as a result six wells were drilled in this sand, thereby substantially reducing the operating cost. The decisions made in the drilling program were based on information obtained from the laboratory studies of rotary drill cuttings, drillers' records, and electrical logs, as well as the meager information obtained from previously developed water supplies in the region.

TEST DRILLING AND SAMPLING

Test holes at 38 locations were drilled by the rotary process. An exploratory drilling rig, using a five-inch bit and mounted on a truck trailer, was used by the contractor. Samples of the cuttings were obtained from the sludge ditch following each interval of fluid circulation, which in turn followed the drilling operation for each joint of drill stem. Thus samples were obtained at an average interval of about 22 feet. The drilling fluid was circulated through a wooden trough at the key wells, and, when a sand capable of yielding water was encountered, an attempt was made to obtain quantitative samples by channeling in the trough so spaced as to be a true fraction of all the material in the ditch. The samples of cuttings were then split and a representative fraction retained for testing and examination in the laboratory. The trough and ditch were then cleaned preparatory to collecting the cuttings from the next depth interval. As rotary cuttings are always subject to contamination from the overlying sediments and the drilling fluid, all of the drilling and sampling factors must be carefully evaluated.

An experienced driller relies mainly on the behavior of the


CAMP McCAIN
STRUCTURE CONTOUR MAP
CONTOURS DRAWN ON THE BASE OF THE
HOLLY SPRINGS FORMATION
BY
GLEN F. BROWN
CONTOUR INTERVAL 10 FEET
ALL ELEVATIONS IN FEET BELOW MEAN SEA LEVEL
SCALE
1000 0 1000 2000 3000 4000 5000 FT.
EXPLANATION
59
PRE-EXISTING FLOWING WELLS
T37
TEST HOLES INTO WILCOX SEDIMENTS
T22
A5
TEST HOLE AND WELL DEVELOPED IN HOLLY SPRINGS SAND
T38
A15
TEST HOLE AND WELL DEVELOPED IN MERIDIAN SAND
DOWN THROW ON RIGHT SIDE OF FAULT
N
Batupan Bogue
R 5 E
R 6 E
GRENADA COUNTY
MONTGOMERY COUNTY
ELLIOTT
U.S. HIGHWAY 51
TO DUCK HILL
200
230
250
300

drill for information as to the material through which he is drilling. Usually when a sand is encountered the drill column rotates loosely, going forward in a series of jumps, the fluid pressure remains constant or decreases, and progress downward is rapid. If considerable clay and shale are present, the drilling is more difficult, and the fluid pressure tends to increase. If the material beneath the bit is a somewhat sticky tough clay, called "gumbo" by some drillers, the fluid pressure will tend to remain high when the bit is raised off the bottom. If the drill is cutting somewhat indurated shale, sandy shale, or silt, the fluid pressure may decline when the bit is raised. This behavior suggests "soapstone" to some drillers.

Another factor used by the driller for evaluating the water-bearing capabilities of a sand is the amount of mud fluid consumed while drilling through the sand. The consumption is measured by marking the level of the fluid in the sludge pit when the sand is encountered, then noting the decline of the fluid level in the pit as drilling progresses. Taken by itself, this measurement probably does not signify much, because penetration of the mud fluid into the sand is controlled not only by the permeability of the sand but also by the difference between the natural hydrostatic pressure of the water in the sand on one hand, and the weight of the column of mud fluid together with the pump pressure and the density of the mud fluid, on the other. Thus a highly permeable sand under a high natural hydraulic head might not consume any more drilling fluid than a less permeable sand under a lower hydrostatic head. The driller usually attempts to hold the weight of the drilling fluid between 9 and 10 pounds a gallon (1.08 to 1.20 specific gravity) by adding water as clay or shale is encountered and by adding mud or lime, if needed, after drilling through sand. The pressure maintained by a mud pump of horizontal centrifugal type is rather constant and consequently more satisfactory than the high pressures and oscillations developed by a plunger type displacement pump. A disadvantage of the centrifugal pump is that constant low pressure may not furnish sufficient force to bring to the surface the large grains of sand or fine gravel loosened by the bit. When this happens, it appears that the coarser materal remains in the lower part of the hole, and as tenacious clay or shale is encountered tne increased specific gravity of the drilling fluid and the somewhat increased pump pressure may wash out some or all of the coarser material. Consequently sand will appear frequently in the samples long after it has been cut by the bit, and its true stratigraphic position may be determined only from an analysis of the electrical log and the drilling record.

LABORATORY TESTS

The rotary samples were carefully washed by decantation in the laboratory to remove as much of the drilling fluid as possible. This washing also unavoidably removed some of the finer sand, as is shown by the greater abundance of silt and silty sand in the outcrops. The washed samples were then studied under a binocular microscope, and permeability tests of the sand samples were made.

The permeability tests were made by the use of a brass cylinder, 3.5 centimeters in diameter and 14.5 centimeters long, connected at the base to a calibrated manometer tube of glass. After the sand to be tested had been packed into the cylinder, the manometer tube was filled with water which entered the sand at the base and overflowed the rim of the cylinder. By noting the rate of percolation the ability of the sand to transmit water was approximated. This method of determining permeability is known as the variable head discharging method. The apparatus was designed by C. V. Theis, with minor modifications by V. C. Fishel and V. T. Stringfield, as shown in a report by Wenzel.[2] The results are given in coefficients of permeability, defined by Meinzer[3] as the rate of flow in gallons a day through a cross-sectional area of one square foot under a hydraulic gradient of 100 percent at a temperature of 60° F. This unit may also be defined as the number of gallons of water that would be conducted through each mile of water-bearing bed (measured at right angles to the direction of flow) for each foot of thickness of the bed for each foot per mile of hydraulic gradient, and at a temperature of 60° F.

These tests should not be considered as furnishing absolute values of permeability, because it is not possible to obtain truly representative samples. Their specific value in exploration consists in giving a comparison of the various sands. More nearly absolute values of permeability, and hence of the safe yield of an aquifer, can be made by pumping tests, which evaluate the aquifer in its natural environment.

Following the permeability test the sample was dried in an electric oven at a temperature of 150° F., and 100 grams of the dry material were separated on sieves calibrated in the Wentworth scale (Tables 2, 3, 7, 8).

Microscopic study suggested that some of the samples contained fossils. Accordingly, each fraction resulting from the mechanical analyses of the suspected sample were reexamined under the microscope, and if further study appeared desirable, some of the material was mixed in carbon tetrachloride and the floating particles were examined for foraminifera. A few samples were studied by floating light mineral grains between the grain size 0.125 and 0.0625 millimeter in bromoform (specific gravity about 2.72). The minerals heavier than 2.72 sank to the bottom and were drawn off for petrographic study. No comprehensive study of the distribution of heavy minerals was attempted.

ELECTRICAL LOGGING

The electrical log furnishes a valuable method of supplementing the sample analyses and drillers' records. At Camp McCain the Schlumberger Well Surveying Corporation made electrical surveys in 10 test holes. Promptly after a test hole was drilled, a multiple electrode was lowered to the bottom of the hole by means of a conducting cable and winch mounted on a truck. As the electrode was raised in the hole, the self-potential or natural electromotive force and the resistance of the strata to an induced current were automatically and simultaneously recorded on film exposed to the oscillations of the potentiometer and galvanometers connected to the circuits (Plates 5 to 9).

The right side of the electrical log shows the resistance of the circuit to an introduced current; oscillations reflect the differences of resistance of the material in the wall of the hole as the electrode is raised. The oscillations appear to indicate largely the differences in the amount and kind of interstitial fluid in the material which the hole penetrates, although there are other factors. Large quantities of fresh water offer high resistance, but dissolved solids in the water greatly reduce the resistance. Thus fresh-water sand offers high resistance compared to shale or clay, the interstices of which normally contain mineralized water. This difference is shown on the electrical logs by cross-hatched areas where the galvanometer used to measure resistance in clayey sediments was deflected off the film to the right as the electrode passed a sand, and another galvanometer recording greater resistance came on the film from the left. In some instances the trace of the needle on a third galvanometer of still greater resistance came on the film while the electrode was passing highly permeable sands in the Meridian sand member of the Tallahatta formation. The trace of the needle is shown on the geologic section by double cross-hatching.

The oscillations recorded by the self-potential curve on the left side of the electrical log show differences in natural potential existing between the drilling fluid and the various strata in the wall of the hole. The shape of the curve seems to be the resultant of at least two factors; namely, the difference in permeability to water of adjacent rock strata or "electrofiltration" and the electro-chemical effect resulting from differences of dissociation in the drilling mud and the water in the strata.[4]

The electro-filtration effect is influenced by the difference in head between a natural head of the water or other fluid in the aquifer opposite the electrode and the head of the column of fluid in the hole. If the head of the column of the fluid in the hole is greater than the natural head of the fluid in the sand, the movement of the fluid will be into the sand and the shift of the self-potential curve will be in a negative direction; that is, to the left. On the other hand, if the natural head is greater than the head of the drilling fluid in the hole, the movement of the fluid will be into the hole and the shift of the self-potential curve will be positive; that is, to the right. In the holes at Camp McCain the shift was always negative, opposite the water-bearing sands, and appears to have been largely the result of pressure differences.

The electro-chemical effect sometimes is known as electro-osmosis, the potential being a resultant of the differences of the electromotive forces generated in the drilling mud and the water in the sand. The shift of the self-potential curve due to this effect is said to be in the direction of the electrolyte containing the greatest total dissolved solids — that is, it will be in a negative direction if the water in the sand contains more dissociated ions than does the drilling fluid, and positive if the drilling fluid contains more dissociated ions than the water in the sand. As the drilling fluid at Camp McCain was obtained from the formations encountered by the drill and as the environment of the deposition of these formations appears to have been nearly the same for all of the stratigraphic interval involved, chemical differences would seem to be slight and, accordingly, the electro-chemical effect is considered negligible.

An important characteristic of the self-potential curve is the greatly increased width of the line on the film opposite the more highly permeable strata, apparently resulting from violent movement of the needle while the electrode was passing through these strata.

The simultaneous inspection of the resistivity and self-potential curves furnishes a method of comparing the relative water-bearing capacities of the sands beneath the Camp and sharply defines their boundaries.

PUMPING TESTS

The pumping tests at Camp McCain followed well construction and consisted of measuring accurately the water levels in the wells by means of a steel tape in the well air lines before, during, and after pumping one well at a constant known rate. The rate of discharge at the pumped well was measured by means of a pipe orifice with discharge into the atmosphere, except at well 4, where the rate was determined by measuring discharge pressure into the main and utilizing a previous calibration obtained from water discharging into the atmosphere through a pipe orifice. The rate of decline during pumping in the pumped well and in adjacent wells and the rate of recoveries in the pumped well following pumping supplied the data for calculating the storage and transmissibility coefficients of the sands.

The coefficient of storage, S, is defined by Theis[5] as the volume of water released from storage in each vertical column of the aquifer having a base one foot square when the piezometric (or pressure-indicating) surface falls one foot. The coefficient of transmissibility, T, is defined[5] as the amount of water, in gallons a day, transmitted under a unit gradient through each vertical strip of the aquifer one foot wide and having the entire height of the aquifer. This is approximately the coefficient of permeability, in Meinzer's units, multiplied by the thickness of the aquifer and adjusted for difference in viscosity of the water due to difference in temperature.

These properties, expressing the ability of a water-bearing bed to yield water to wells, may be determined from the data produced by the pumping tests described above, by utilizing formulas developed by Thiem, Theis, Wenzel, and others.[6] The Theis non-equilibrium formula was applied at Camp McCain to the draw-down or recovery of water level in observation wells located near the pumped well and to the rate of recovery in the pumped well following cessation of pumping. Only the former method allows calculation of the coefficient of storage.

The Theis formula is based on certain necessary assumptions, the more important being that the aquifer is at least as extensive as the cone of depression developed by the pumping, that the release of water from storage is instantaneous, and that the coefficient of transmissibility is constant at all times and is the same throughout that part of the aquifer under consideration. Generally, none of these conditions is completely fulfilled, and, accordingly, the results must be used with caution.

GEOLOGY AND GROUND-WATER HYDROLOGY

PRE-TERTIARY SEDIMENTS

The deeply-buried Paleozoic rocks are hard and relatively impermeable. They are composed of shale, sandstone, quartzite, and limestone. The interstitial water is salty and unfit for human use. The Cretaceous beds are more permeable. The sands and gravels of the Tuscaloosa formation and the sands of the Eutaw formation yield much water in northeastern Mississippi, but the results of drilling for oil in Grenada and Montgomery Counties indicate that here these formations lie at great depths and contain brackish or salty water. The thinner sands of the Ripley formation lie somewhat nearer the surface but they also contain brackish water. The stratigraphic relations of these beds are shown on the electrical log of the Adams Oil and Gas Co., No. 1 J. K. Avent well (Plate 2).

PALEOCENE — MIDWAY SERIES

CLAYTON FORMATION

The Clayton formation, the earliest Tertiary deposits of limestone, calcareous shale, and sandy marl, is probably not very thick beneath the Camp. The rocky character of these beds indicates that a large supply of water could not be derived from them.

PORTERS CREEK CLAY

The Porters Creek clay forms the bulk of the Paleocene deposits. Its thickness, as shown in oil exploration borings, is about 720 feet in Grenada County and in the northern part of Montgomery County. At Camp McCain the top of the formation is about 850 feet below the surface. Most of the material in the samples is dark to medium gray shale which fractures conchoidally. Thin stringers of siderite-cemented siltstone, either thin strata or concretions, were encountered 11 feet beneath the top of the Porters Creek clay in test holes 1 and 2 at the Camp and 36 feet below the top in test hole 2 at the Grenada Air Base. A bit sample from a depth of 900 feet in test hole 4 at the Camp is dark-gray clay containing much dark-green glauconite, carbonaceous fragments, and some thin layers of fine angular quartz sand. Most of the shale is generally considered of marine origin, but the carbonaceous fragments near the top, which are also somewhat sandy and silty, suggest a continental or littoral environment of deposition. The upper beds include an intensively weathered horizon which yields bauxitic clays in the outcrop belt 35 miles to the east. At the present time considerable doubt exists as to the true stratigraphic position of these upper Midway deposits. They appear transitional with the bauxite zone, possibly marking the most important time break during deposition, but the electrical logs always show a sharp change from the Midway to the Wilcox type curves. The impermeable nature of the shale of the Midway causes a uniformly low resistivity curve on the electrical log; the self-potential curve is equally straight and in a positive direction so that the top of the shale section shows up as a distinct point on the log (Plates 2, 5). This depth point agrees with the first appearance of dark shale containing glauconite in the samples from test holes 2 and 4. Similar lithologic changes in test holes 1 and 3 at the Camp and in test holes 1 and 2 at the Grenada Air Base 3 miles north of Grenada give additional evidence that the boundary is rather definite and that the changes on the electrical logs are probably mostly due to changes in the interstitial water.

The Porters Creek clay yields very little, if any, water to wells. Therefore, when the dark shales were encountered during test drilling, it was known that the bottom of all possible fresh water supplies had been reached.

EOCENE — WILCOX SERIES

ACKERMAN FORMATION

GENERAL GEOLOGY

The Ackerman formation was named for an outcrop of clay, shale, lignite, and silt, exposed in a railroad cut 1 1/4 miles northeast of the town of Ackerman in Choctaw County. The belt of outcrop extends north-northwest from Ackerman across Webster and Calhoun Counties and beyond them into the northern part of the state. The formation extends westward beneath younger sediments and is at depths of 500 to 900 feet beneath the Camp. The thickness of the Ackerman formation ranges from 245 to 362 feet in the five test wells where the boundaries can be determined with some accuracy. The samples from this formation consist of shale, sandstone, siltstone, and soft brown lignite. The shale is silty and in part sandy, calcareous, and carbonaceous. Some of it is light gray and appears kaolinitic. The sand consists mostly of fine angular quartz and mica. The sandstone and siltstone are cemented with carbonate, probably mostly siderite, and are usually slightly glauconitic. The most persistent features of the formation are some siderite-cemented siltstones near the middle (130 to 160 feet beneath the top) and a fine silty sand at the base. The lone sand probably does not warrant reference as a member on the basis of the occurence beneath the Camp but elsewhere it is more persistent. Most of the lignite lies beneath the calcareous siltstones. A sample of siltstone, mostly siderite, obtained from a drilling bit at a depth of 842 feet in test hole 2 was partly analyzed by W. W. Brannock.

	Percent
Silica (SiO_2)	11.25
Iron (Fe), mostly in ferrous state	36.55
Calcium (Ca)	1.00
Magnesium (Mg)	1.36
Manganese (Mn)	.10
Carbonate (CO_3)	40.38
Total	90.64

The Ackerman formation, as here described, is placed in the Wilcox series solely on the basis of lithology, although part of the lower sediments may be of Midway age.

The Midway surface, on which the Ackerman formation rests, strikes about N. 20° W. and dips 35 feet a mile to the southwest at the Camp. The upper surface of the Ackerman formation, on which the Holly Springs formation rests, appears to be somewhat more channeled and irregular.

HYDROLOGY OF THE BASAL SAND OF THE ACKERMAN FORMATION

The sand at the base of the Ackerman formation yields a small supply of water at the Dr. Clanton well, 0.8 mile west of Grenada (Well 16, Table 12). The water in this well rises to 210.6 feet above mean sea level, or about 15 feet above the water in wells in the basal sand of the Holly Springs formation. However, the results of six borings at the Grenada Air Base and at Camp McCain indicated that this bed is thin and discontinuous and consists of sand that is too fine and silty to yield a substantial supply. The basal part of the Ackerman formation is composed of sandy shale at the Dr. Clanton well, at test hole 4 at the Camp, and at test hole 1 at the Grenada Air Base.

At test hole 15, southernmost of the test wells at Camp McCain, the drill penetrated a bed of fine sand within the upper part of the Ackerman formation, between the depths of 570

TABLE 2

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF SANDS IN THE ACKERMAN FORMATION AT CAMP MCCAIN

Depth Feet	DIAMETER OF SCREEN OPENINGS								
	2.0 mm. gravel	1.0 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total residue	Laboratory coefficient of permeability*
Test hole 1									
843 - 868	0	0	0.00	0.24	57.42	35.04	7.31	100.01	230
868 - 890	0	0	0.00	1.21	74.13	20.55	4.03	99.92	290
Test hole 2									
777 - 797	0	0	0.37	0.60	8.16	61.03	30.57	100.73	110
Test hole 15									
574 - 596	0	0	0.34	13.98	80.01	4.90	0.80	100.03	420
596 - 617	0	0	0.29	2.08	89.61	5.25	2.79	100.02	719
617 - 639	0	0	0.29	12.65	82.50	3.13	1.40	99.97	523
639 - 661	0	0	1.67	22.00	67.24	6.08	3.06	100.05	523

*Meinzer's Units

to 642 feet, but numerous layers of calcareous sandstone and the presence of shale fragments were interpreted to mean that this bed is probably too nearly impermeable to permit the construction of a satisfactory well in it. The mechanical analysis and permeability measurements of rotary cuttings from test holes 1, 2, and 15 are given in Table 2.

HOLLY SPRINGS FORMATION

GENERAL GEOLOGY

The beds exposed in a belt west of and adjacent to the outcrop of the Ackerman formation in Choctaw, Webster, and Calhoun Counties and eastern Grenada County (Plate 1) are considered to be the equivalent of the Holly Springs formation, although they may include some slightly younger beds. Exposures extend from Big Creek, Calhoun County, to Graysport, Grenada County, a distance of 9 miles.

The Holly Springs formation dips to the west and underlies Camp McCain at depths of 100 to 500 feet. The average thickness in 37 test holes is 333 feet, but in some holes this thickness includes sand, sandy shale, and silt which may not be part of the Holly Springs formation. These beds are discussed under the title "Undifferentiated upper Wilcox sediments."

The samples obtained from the Holly Springs formation are composed of shale or clay, sandy shale, lignite, silt, calcareous sandstone or siltstone, and sand. The sand, mostly at the base of the formation where the largest grain size was found, is exposed in lenses in western Webster and Calhoun Counties. Silt is much more abundant in the outcrops than in the samples from the wells probably because the finer fractions of the samples were removed largely during drilling and sample preparation. Shale, sandy shale, and lignite are found throughout the formation, seemingly without any simple pattern of deposition. Most of the shale and sandy shale is carbonaceous and ranges in color from light gray to nearly black. The sandstone and siltstone stringers seem to be fairly persistent and have proved valuable for correlation of test holes. These rocks contain glauconite or a related mineral, but no evidence of life other than a few faecal pellets was noticed. The Holly Springs formation is dominantly non-marine and has the appearance of a deposit formed in a deltaic environment. The sandstone and siltstones probably represent minor and local marine invasions.

The basal sand of the Holly Springs formation is gray and commonly contains numerous opaque grains. Most of the grains consist of quartz (milky and clear), feldspars, magnetite, and other undetermined minerals. Pyrite, muscovite, kyanite, and staurolite are scarce. The distribution of grain size suggests that sorting during final deposition was under water, although some of the grains are frosted. Although the basal sand has been rather thoroughly explored, its distribution is somewhat puzzling. There appear to be at least three ill-defined channel-ways which in some manner are connected hydrologically and which extend in a general, although sinuous, course to the east. These channel-ways apparently terminate on the west against a reverse fault which traverses the Camp with a north-south trend. On the west which is the upthrown side of the fault, the sand is 123 feet thick at test hole 14 but thins northward into thin layers, with a maximum thickness of only 11 feet at test hole 1, about 3 miles distant.

The upper surface of the Ackerman formation, on which rests the basal sand of the Holly Springs formation, seems to be an erosional surface somewhat modified by earth movement, although the depressions east of the fault coincide only in part with the thickening of the basal sand. West of the faults the upper surface of the Ackerman formation is a relatively smooth plane tilted to the northwest 80 feet to the mile but bent into a ridge near the fault (Plate 3). The upper part of the Holly Springs formation and associated beds are beveled off beneath a nonconformity as a result of erosion prior to deposition of the Claiborne group, a stratigraphic relation well defined in the test holes beneath the Camp and in the outcrop belt in the hills to the east.

HYDROLOGY OF THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION

All the wells in the Holly Springs basal sand (Table 12, Plate 1) in the Camp McCain environs that were drilled before Camp construction are flowing wells except well 5 which is situated on a hill in Montgomery County. However, the water in the flowing wells rises only a few feet above the land surface and the artesian flow is small.

The results of mechanical analyses and permeability tests from 30 test holes are also given in tabular form (Table 3). Marked changes in grain size and permeability, both horizontally and vertically, are apparent, yet results of exploration pointed the way to construction of six wells which will yield 1,200 gallons a minute from this sand when all are pumped. Of these wells, A-3 and A-5 are west of the fault. A-6 and A-9 are in a thickening of sand southeast of the fault, and A-2 and A-11 are in the northern part of the Camp and east of the fault. The direction of the hydraulic gradients prior to pumping shows that the water was moving in a northwesterly direction (Plate 4). Thus the fault would interfere with recharge from the southeast for wells A-3 and A-5, a condition indicating that these wells will obtain their supply from storage, as further shown by pumping tests.

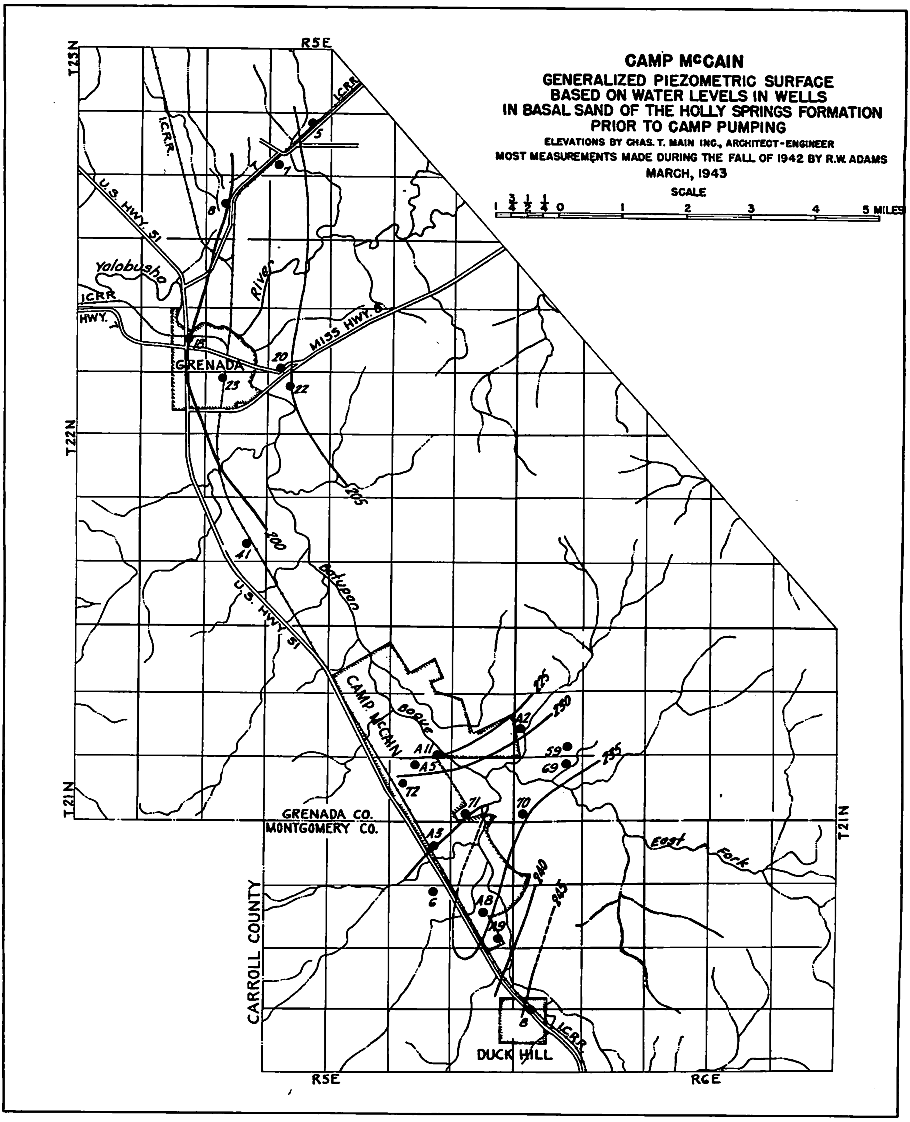

CAMP McCAIN
GENERALIZED PIEZOMETRIC SURFACE
BASED ON WATER LEVELS IN WELLS
IN BASAL SAND OF THE HOLLY SPRINGS FORMATION
PRIOR TO CAMP PUMPING
ELEVATIONS BY CHAS. T. MAIN INC., ARCHITECT-ENGINEER
MOST MEASUREMENTS MADE DURING THE FALL OF 1942 BY R.W. ADAMS
MARCH, 1943
SCALE
5 MILES
R5E
RGE
T23N
T22N
T21N
GRENADA
Yalobusha
River
U.S. HWY. 51
MISS HWY. 8
I.C.R.R.
ICRR
HWY.
Batupan
Bogue
CAMP McCAIN
GRENADA CO.
MONTGOMERY CO.
CARROLL COUNTY
East Fork
DUCK HILL
205
200
225
230
235
240
245

PLATE 4

TABLE 3

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION AT CAMP McCAIN

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total residue	Laboratory coefficient of permeability†
Test hole 1									
470 - 491	0	0	0.13	0.92	59.93	25.22	13.72	99.92	204
Test hole 2									
464 - 472	0	0	0.24	49.45	46.80	2.95	0.53	99.97	878
Test hole 3									
344 - 365	0	0.57*	0.95*	6.98	83.06	6.85	1.51	99.92	471
385 - 406	0	0.40*	0.17*	0.59	60.45	33.70	4.62	99.93	159
406 - 429	0	0.95*	0.95*	1.60	74.54	19.52	2.37	99.93	247
429 - 450	0	0.57*	0.98*	6.10	82.52	8.02	1.79	99.98	525
Test hole 4									
411 - 443	0	0.31	14.82	38.38	45.40	0.79	0.11	99.81	968
Test hole 5									
406 - 428	0	0	0.14	4.85	85.06	9.19	0.90	100.14	393
449 - 471	0	0	1.22	45.56	50.55	2.40	0.32	100.05	612
471 - 489	0	0	0.69	57.36	40.90	1.20	0	100.15	991
493 - 515	0	0	2.28	34.43	59.70	3.33	0.32	100.06	711
Test hole 6									
347 - 369	0	0	0	8.11*	80.01	10.80	1.06	99.98	325
369 - 390	0	0	0	12.01*	78.25	8.67	1.11	100.04	458
390 - 412	0	0	0	17.95*	76.13	5.23	0.59	99.90	318
412 - 434	0	0	0	48.92*	49.69	1.22	0.21	100.04	953
434 - 454	0	0	0.28*	43.21*	50.30	5.54	0.65	99.98	400
Test hole 7									
404 - 426	0	0	0.26*	2.06	80.19	13.98	3.50	99.99	421
426 - 448	0	0	0	0.92	81.96	15.25	1.97	100.10	507
Test hole 8									
277 - 298	0	0	0	12.81*	80.22	4.71	2.14	99.88	512

TABLE 3—Continued

MECHANICAL ANALYSIS AND COEFFICIENTS OF PERMEABILITY OF THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION AT CAMP MCCAIN

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total Residue	Laboratory coefficient of permeability†
298 - 320	0	0	0	5.94*	82.92	8.89	2.18	99.93	316
320 - 340	0	0	0	2.48*	82.50	13.73	1.35	100.06	251
340 - 362	0	0	0.26*	4.00*	76.86	14.63	4.24	99.99	377
362 - 384	0	0.39*	0.33*	9.79*	78.88	8.80	1.71	99.90	722
384 - 404	0	0.17*	0.68*	9.58*	64.08	23.21	2.28	100.00	321
Test hole 9									
402 - 424	0	0	2.14	39.78	56.38	1.50	0.13	99.93	793
424 - 447	0	0	0	7.01*	60.58	22.97	9.38	99.94	
Test hole 10									
370 - 393	0	0	1.64*	29.21	54.45	13.53	1.04	99.87	295
393 - 415	0	0.07*	0.09*	2.94	88.42	8.12	0.45	100.09	516
Test hole 11									
412 - 433	0	0.05*	1.24*	37.91	57.57	2.87	0.39	100.03	544
433 - 454	0	0	0.24	11.68	67.85	17.81	2.25	99.83	
Test hole 12									
343 - 364	0	0	0.04	0.94	65.72	30.55	2.58	99.83	5
364 - 386	0	0	0.89	20.48	61.99	14.83	1.88	100.07	265
386 - 408	0	0	0.30	23.52	57.87	16.44	1.98	100.11	322
408 - 428	0	0	1.38	48.42	45.72	4.09	0.48	100.09	587
Test hole 14									
345 - 367	0	0	0.62	55.21	39.77	3.91	0.48	99.99	563
367 - 388	0	0	0.45	45.63	49.53	4.03	0.35	99.99	536
388 - 407	0	0	4.21	54.12	37.43	3.65	0.49	99.90	595
407 - 429	0	0	6.87	61.98	29.38	1.59	0.08	99.90	922

Test hole 15									
279 - 301	0	0	0	43.72	54.31	1.33	0.68	100.04	686
301 - 320	0	0	3.37	63.47	32.20	0.98	0	100.02	901
320 - 340	0	0	3.94	51.95	43.43	0.69	0	100.01	723
340 - 360	0	0	1.40	47.21	49.80	1.23	0.39	100.03	809
360 - 382	0	0	0.26	30.00	65.26	3.71	0.88	100.11	601
382 - 403	0	0	1.97	50.06	46.57	1.42	0	100.02	809
403 - 423	0	0	1.51	41.64	54.48	1.92	0.47	100.02	556
423 - 445	0	0	10.36	51.63	36.90	1.12	0	100.01	710
445 - 457	0	0	3.12	75.54	19.47	1.43	0.47	100.03	1153
Test hole 17									
385 - 407	0	0	0.30*	12.31	69.09	14.62	3.54	99.86	308
Test hole 20									
408 - 430	0	0.35*	1.15	53.20	43.68	1.55	0	99.93	788
Test hole 21									
406 - 428	0	0	0	6.40	87.96	4.86	0.70	99.92	381
428 - 450	0	0	0.16*	28.44	68.83	2.58	0	100.01	454
450 - 471	0	0	0.94	47.97	46.20	3.79	1.09	99.99	486
Test hole 22									
406 - 428	0	0	2.36	51.04	45.19	1.29	0	99.88	891
Test hole 23									
428 - 450	0	0	0.31*	3.94	31.39	48.54	15.77	99.95	154
Test hole 24									
386 - 407	0	0.47*	0.99	32.24	55.27	8.72	2.24	99.93	372
Test hole 25									
406 - 427	0	0	0.25	11.76	69.78	13.44	4.58	99.81	285
Test hole 26									
452 - 473	0	0.23*	2.95*	19.46	69.71	5.66	1.93	99.94	210
473 - 494	0	0	0.27*	21.47	64.18	8.83	5.08	99.83	146
494 - 514	0	0	0.57*	20.94	75.25	2.30	1.00	100.06	292
Test hole 27									
385 - 407	0	0	0.26*	20.63	76.09	1.88	1.00	99.86	458
407 - 428	0	0	0	40.14	40.53	13.00	6.17	99.84	268
Test hole 28									
453 - 474	0	1.06*	3.28	14.63	53.89	23.71	3.33	99.90	1465

TABLE 3—Continued

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION AT CAMP MCCAIN

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total residue	Laboratory coefficient of permea-bility†
Test hole 29									
432 - 444	0	0	0.22*	51.39	38.00	7.32	3.16	100.09	414
Test hole 31									
409 - 431	0	0	0.18	21.40	61.00	12.62	4.90	100.10	300
431 - 452	0	0	0.14	46.70	48.20	4.85	0	99.89	540
452 - 473	0	0	0	38.68	56.74	4.67	0	100.09	452
473 - 494	0	0	0	44.95	51.98	2.98	0	99.91	560
494 - 514	0	0	0	54.08	43.46	2.50	0	100.04	513
514 - 536	0	0	0.35	36.15	52.72	8.61	2.11	99.94	352
Test hole 33									
372 - 388	0	0	0.35*	12.21	64.92	21.41	1.11	100.00	377
388 - 410	0	0	0.55	16.00	71.70	11.22	0.53	100.00	408
Test hole 37									
429 - 451	1.10	5.68	9.84	26.47	37.69	13.60	5.80	100.18	86
Test hole 38									
344 - 364	0	0.34	0.42	6.72	86.92	3.89	1.97	100.26	102
364 - 386	0	0.13	0.26	6.11	89.71	2.72	1.31	100.24	154
386 - 401	0.37	1.02	0.95	4.16	89.11	2.66	1.88	100.15	226
Grenada Air Base									
Test hole 2									
485 - 508	0	0.17*	1.61*	43.68	50.10	4.35	0.28	100.19	840

†Meinzer's Units *Minor shale and/or lignite contamination.

PUMPING TESTS OF WELLS IN THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION

The basal sand of the Holly Springs formation was tested by pumping successively wells A-2, A-3, A-5, and A-11 and measuring the water levels in the pumped well and in the nearby idle wells during each of the four pumping periods.

There was no change in water level in well A-11 as a result of pumping well A-5, and vice versa, although the distance between them is only 2,100 feet. The pumping of well A-5 caused a decline of the water levels in the Thomas well at Elliott (Well 72, in Table 13) at a distance of 2,300 feet from well A-5, and in well A-3 at a distance of 6,700 feet. The pumping of well A-3 caused a small decline of the water levels in wells 72 and A-5, but did not affect wells A-11, A-8, and A-9. The pumping of well A-2 caused a decline in wells A-11, 59, 69, and 70, but did not affect wells A-5, 72, or A-3. This information corroborates the presence of the fault barrier previously determined from a study of the geology. The specific capacities of the wells and the coefficients of transmissibility and storage of the basal sand, as determined from the pumping tests, are given in tabular form (Table 4).

TABLE 4

COEFFICIENTS OF TRANSMISSIBILITY AND STORAGE OF THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION (ALSO SPECIFIC CAPACITIES OF TESTED WELLS) AT CAMP McCAIN.

Coefficients of transmissibility as computed from recovery of water levels after pumping.

Well	Period of test	Length of pumping time (hours)	Period after termination of pumping used in computations (hours)	Coefficient of transmissibility (T)	Thickness of aquifer (feet)	Coefficient of permeability (60°F.)
A-2	Jan. 2-11, 1943	76.5	0-4	2,260	35	60
A-2	Jan. 2-11, 1943	76.5	4-84	4,320	35	112
A-3	Dec. 19-24, 1942	55.3	1-3½	10,600	123	744
A-3	Dec. 19-24, 1942	55.3	19-112	4,030	123	299
A-5	Dec. 29-Jan. 3, 1943	24.4	0-5	2,520	45	510
A-5	Dec. 29-Jan. 3, 1943	24.4	5-100	1,500	45	303
A-8	Dec. 22-24, 1942	24.0	0-23	19,925	93	195
A-11	Jan. 12-15, 1943	24.6	½-16	7,300	99	67
A-11	Jan. 12-15, 1943	24.6	16-70	4,140	99	381
A-11	Nov. 26, 1942	7.2	½-15	2,120	99	195

Coefficients of transmissibility and storage as computed from interference tests during pumping.

Pumped well	Period of pumping	Well turned on or off at beginning of period	Observation well	Coefficient of transmissibility (T)	Coefficient of storage (S)
A-2	Jan. 2-5, 1943	On	Gislen	13,780	0.00080
A-2	Jan. 2-5, 1943	On	Thomas	17,880	0.00058
A-2	Jan. 2-5, 1943	On	11	8,570	0.00018
A-2	Jan. 5-10, 1943	Off	11	5,300	0.00015
A-5	Dec. 28-29, 1942	On	Thomas	7,810	0.00033
A-8	Dec. 22-23, 1942	On	9	14,007	0.00021

Specific capacities of tested wells (gallons per foot of draw-down after 12 hours of pumping)

Well	Specific capacity
A-2	1.8
A-3	6.7
A-5	0.8
A-8	8.4
A-9	9.7
A-11	5.4

The coefficient of transmissibility ranges from 1,500 to 19,925, and differences are not only found in different wells but in the same well at different times (Table 4). The coefficient of storage ranges from 0.00015 to 0.00080. The wide range of coefficients seems to be due to the heterogeneity of the sand and the effects of boundaries, such as the fault, and marked changes in thickness along the flanks of the channel-ways.

Despite the heterogeneity of the sand, it may be said that, in general, the water-yielding ability increases toward the southeast.

By choosing the coefficients that seem most applicable, some estimate of the future draw-downs in the wells east of the fault can be made (Table 5). In all cases it is assumed that well A-2 is pumped at 133 gallons a minute and the other three wells at 200 gallons a minute.

TABLE 5

PREDICTION OF WATER LEVELS IN WELLS IN THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION

Probable draw-down of water level in well A-2

	Drawn-down at end of period of continuous pumping (feet) 6 mos.	1 yr.	2 yrs.	3 yrs.
Pumping A-2 (T = 2,260, S = 0.00043)	162	167	172	177
Interference from A-11, pumped 200 gallons per minute (T = 6,935, S = 0.000165)	12	15	17	19
Interference from A-8, pumped 200 gallons per minute (T = 11,000, S = 0.0004)	4	5	7	8
Interference from A-9, pumped 200 gallons per minute (T = 8,650, S = 0.0004)	3	6	7	9
Total draw-down in A-2 if all four wells are pumped	181	193	203	213
Probable draw-down of water level in well A-11				
Pumping A-11 (T = 4,140, S = 0.00017)	140	144	148	152
Interference from A-8, pumped 200 gallons per minute (T = 12,030, S = 0.00019)	5	7	8	10
Interference from A-9, pumped 200 gallons per minute (T = 9,100, S = 0.00019)	6	8	9	11
Interference from A-2, pumped 133 gallons per minute (T = 6,900, S = 0.00017)	8	9	11	12
Influence of fault (T = 4,140, S = 0.00017)	32	36	39	43
Total draw-down in A-11 if all four wells are pumped	191	204	215	228
Probable draw-down of water level in well A-8				
Pumping A-8 (T = 17,000, S = 0.00021)	37	38	39	40
Interference from A-9, pumped 200 gallons per minute (T = 14,000, S = 0.00021)	10	11	12	13
Interference from A-11, pumped 200 gallons per minute (T = 12,030, S = 0.00019)	5	7	8	10
Interference from A-2, pumped 133 gallons per minute	(not appreciable)			
Influence of fault (estimated)	8	9	10	11
Total draw-down in A-8 if all four wells are pumped	60	65	69	74

The probable decline of water level in well A-9 is comparable to that in A-8.

The estimates are based on the assumption that the cones of depression developed around the wells will not reach the outcrop area of the basal sand within 3 years. As the nearest outcrops are 15 to 20 miles east of the Camp, it appears that considerable time will lapse, possibly a year, before any important effect of the influence of the outcrop will be apparent. The exact time cannot be predicted because of the sinuous nature of the channel-ways of sand and other unknown geologic factors. If the hydrologic connection with surface water is good in the outcrop area, the water levels either will no longer decline or will decline at a reduced rate. If the hydrologic connection is poor, the water levels will decline at an increased rate after the cone of depression reaches the outcrop area.

Predictions of draw-down in wells A-3 and A-5 are exceedingly hazardous because the volume of sand and the hydrologic continuity behind the fault are unknown.

In one sense the effect of the fault is beneficial to the Camp water supply because wells A-3 and A-5 may be pumped without causing drawdown in the other pumped wells. For example, wells A-5 and A-11 may be pumped at the same time without interference between them.

The data given above furnish a rough idea of the operating conditions, although they are based on short-time pumping tests. Because of the well environment, wide deviation from the uniform condition assumed by the application of the Theis equation may result during the life of the Camp. In order to predict more accurately the draw-down and the effect of changes in pumping rates it is necessary that records be kept of the pumpage from each well, that the water levels be measured in the pumped wells prior to starting or stopping pumps, and that a program of observation-well measurements be maintained. The fluctuations obtained from such measurements, together with the pumping rates, will increase the accuracy of predictions in direct proportion to the length of record. Thus the necessity and proper time for lowering pump bowls may be known long in advance, even though heterogeneity and boundaries of the aquifer prevent accurate predictions of water-level decline from the short-time pumping tests that have been made.

QUALITY OF WATER

The general character of water from the sands of the Holly Springs formation is shown in tabular form.

TABLE 6

ANALYSES OF WATER FROM THE BASAL SAND MEMBER OF THE HOLLY SPRINGS FORMATION AT CAMP McCAIN

Analyzed by U. S. Geological Survey, except as indicated. Parts per million (except pH).

Well Number	A-2[a]	A-2	A-3[a]	A-5	A-8	A-9	A-11
Date of collection 1942	May 4	Sept. 7	March 21	Sept. 7	Sept. 7	Sept. 7	Sept. 7
Depth of sand below the surface (feet)	390-414	390-414	308-431	396-441	366-459	284-457	422-521
Silica (SiO_2)	14	--	15.2	--	--	18	19
Iron (Fe)	.2	--	0	--	--	.07	.04
Calcium (Ca)	3.7	--	0	--	--	3.4	4.4
Magnesium (Mg)	1.4	--	1.7	--	--	1.3	1.5
Sodium and Potassium (Na + K)	195	--	118	--	--	85	177
Bicarbonate (HCO_3)	224	284	289	272	338	224	364
Sulfate (SO_4)	.3	1[b]	--	1[b]	1[b]	3.4	2.1
Chloride (Cl)	32	32	--	22	44	7.2	70
Fluoride (F)	--	--	--	--	--	.2	.5
Nitrate (NO_3)	--	--	--	--	--	0	.1
Total dissolved solids	423	326	321	294	386	225	436
Total hardness as $CaCO_3$	15	27	7	24	21	14	17
pH[c]	8.3	8.4	8.6	8.5	8.5	8.6	8.6

[a] Analyzed by Mississippi State Board of Health, except pH.
[b] By turbidity.
[c] Determined at the wells by the architect-engineer, who found no free carbon dioxide in any of the wells developed in the Holly Springs sand.

UNDIFFERENTIATED UPPER WILCOX SEDIMENTS

The presence of sand above the typical shale of the Holly Springs formation and of carbonaceous shale and clay below the Meridian sand member of the Tallahatta formation in 12 of the test holes suggests that fragments of another formation of the Wilcox series are found in western Grenada County. The upper clayey beds are gray and carbonaceous, resembling clayey beds above the basal sand of the Holly Springs formation; the sandy lower part is fine grained and contains enough opaque and translucent grains so that the sand has a dark appearance. The mechanical analyses and results of permeability tests on rotary cuttings are given in tabular form (Table 7). As these samples were obtained shortly after drilling through the highly permeable Meridian sand, they undoubtedly include grains from the Meridian sand and, accordingly, the laboratory work is of questionable value.

These beds may be the stratigraphic equivalent of the Hatchetigbee formation of southeastern Mississippi. Mellen[7] assigns 175 feet of lignite, clays, sand, and sandstone to the Hatchetigbee in Winston County, but Vestal[8] was unable to find sufficient evidence for such an assignment in Choctaw County. Indeed, non-persistence of such a unit beneath the Camp suggests that the deposits could well be placed in the Holly Springs formation. However, the rugged erosion surface at the top of the Wilcox appears, in the opinion of the writers, to help explain the discontinuities and to justify a tentative separation.

No wells were constructed in the upper Wilcox sand, as the electrical logs, samples, and drilling records indicated that they would not yield an adequate supply.

TABLE 7

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE UPPER WILCOX SANDS AT CAMP McCAIN

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total residue	Laboratory coefficient of permea-bility (†)
Test hole 1									
260 - 297	0	0.31	0.26	1.23	44.98	48.00	5.14	99.92	345
297 - 351	0	0	0.47	2.72	76.78	18.80	1.31	100.08	345
Test hole 2									
169 - 191	0	1.22	3.74	8.27	42.46	38.84	5.40	99.93	359
191 - 212	0	0.73	1.40	5.16	52.38	36.67	3.58	99.92	179
Test hole 5									
148 - 168	0	0	0.16	2.77	42.00	51.74	3.45	100.12	298
168 - 189	0	0	33.30	19.28	35.49	11.44	0.60	100.11	922
Test hole 7									
235 - 257	0	0	0	70.05*	29.03	0.90	0.05	100.03	774
257 - 278	0	0	0	75.34*	23.89	0.83	0	100.06	974
341 - 360	0	0	1.32*	6.33	65.55	25.23	1.52	99.95	
Test hole 11									
260 - 282	0	0	0.39	37.85	59.32	2.07	0.18	99.81	488
282 - 303	0	0.04*	0.47*	57.44	40.64	1.05	0.19	99.83	5
303 - 324	0	0.07*	2.38*	78.11	18.55	0.73	0.22	100.06	788
Test hole 16									
151 - 173	0	0	11.74	55.41	31.73	1.07	0	99.95	656
Test hole 19									
280 - 302	0	0.27*	0.45*	33.75	58.98	6.56	0	100.01	422
302 - 322	0	0	0.32*	22.02	75.75	1.90	0	99.99	492
322 - 343	0	0	0	10.02	86.06	3.85	0	99.93	444
343 - 364	0	0	0.30*	18.33	77.56	3.75	0	99.94	444

TABLE 7—Continued

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE UPPER WILCOX SANDS AT CAMP MCCAIN

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total residue	Laboratory coefficient of permea-bility (†)
Test hole 20									
171 - 193	0	0.22*	2.58	62.50	30.42	4.16	0	99.88	564
193 - 215	0	0.29*	4.66	49.71	43.07	2.12	0	99.85	588
Test hole 22									
146 - 168	0	0	1.94	30.24	58.22	9.56	0	99.96	486
Test hole 26									
148 - 169	0	0	0.23	42.84	50.78	3.34	2.60	99.79	470
234 - 256	0	0	0	34.31	60.81	3.23	1.47	99.82	178
Test hole 29									
278 - 300	0	0	0.14*	27.80	67.86	2.82	1.21	99.83	89
Test hole 35									
277 - 299	0	0	10.35	37.75	38.55	11.95	1.25	99.85	257
299 - 321	0	0	10.84*	67.95	18.88	2.15	0.10	99.92	695

† Meinzer's Units. *Minor shale and/or lignite contamination.

EOCENE—CLAIBORNE SERIES

TALLAHATTA FORMATION—GENERAL

The Tallahatta formation is divided into two members, the Meridian sand at the base and the Basic City shale at the top.

The term Meridian was first used in 1933 by Lowe[9] as the "Meridian sand member" for exposures near Meridian that he included in the base of the Claiborne group without assigning the member to a definite formation. Grim[10] and Mellen[11] used the name in the same manner, but referred the member to the basal part of the Tallahatta formation. Foster[12] raised the Meridian sand to formational rank in keeping with his observations of disconformities above and below the sand in Lauderdale County. In northern Mississippi there is much evidence for considering the Meridian sand as conformable with the overlying (Basic) shale formation. Accordingly, the sand is here considered the basal member of the Tallahatta formation.

The term Basic* was first used in 1919 by Lowe[13] as a member of the Tallahatta formation for the exceedingly light-weight material, typically exposed in cuts on the Gulf, Mobile, & Ohio Railroad in the vicinity of Basic Station in Clarke County, which he described as claystone or diatomaceous earth. Grim,[14] McGlothlin,[15] Priddy,[16] and others indicate that the indurated deposits at Basic are contemporary with the Tallahatta shales, and interfinger them in northern Mississippi. As the strike of this member is followed northwest from Basic, the beds become more fissile and laminated although locally thin lenses retain the structural characteristics of claystone or siltstone, by which terms they have so long been designated. Although much of the Basic member consists of sand in northern Mississippi, the identifying characteristic over larger areas is the light-weight shale. Accordingly, it seems desirable to retain the term Basic for this member and, to prevent the confusion from mispronunciation, to designate it the Basic City shale.

Most of the Tallahatta formation is non-marine where exposed at the surface, but deep within the Mississippi embayment the Basic City shale is marine and the separation of the members is more distinct. The distribution of sand and shale in the outcrops and in the test holes beneath the Camp shows that

*Pronounced like classic

the boundary between the members is somewhat arbitrary; that is, lenses of sand similar to typical Meridian sand may be seen above shale similar to typical thin-bedded Basic City shale, and shale similar to the typical Basic City shale may be observed in lenses below most of the Meridian sand.

TALLAHATTA FORMATION—MERIDIAN SAND MEMBER

GENERAL GEOLOGY

The Meridian sand member is exposed in the northeastern corner of Montgomery County, in a belt about 5 miles wide across Grenada County, and in the extension of this belt northward into Yalobusha County. Beyond Yalobusha County, the belt of outcrop in north Mississippi appears to trend northeast until it merges into the sand deposits that have been referred either to the Holly Springs formation or to the "Lafayette" formation.[17] Numerous outliers on hilltops east of the belt attest the strong overlap of this member on the Wilcox series. Entrenchment of Batupan Bogue Valley is sufficient to extend the outcrop area under part of the Camp, some distance west of the general outcrop belt; and the upthrown west side of the fault beneath the Camp exposes the upper part of Meridian sand still farther west (Plate 1). The Meridian sand dips about 50 feet a mile to the west into the Mississippi embayment, where it is covered by younger deposits. In 22 test holes at the Camp it ranges in thickness from 8 to 147 feet and averages 77 feet, but its thickness increases northward until in three test holes at the Grenada Air Base it averages 215 feet. This thickening is also apparent within the outcrop belt (Plate 1) and is reflected in the increased yield of wells from south to north. The Meridian sand was deposited on the eroded surface of the Wilcox series (Plate 10) and conformably underlies the Basic City shale member.

The Meridian sand member is characterized by an abundance of kyanite, staurolite, and muscovite. The kyanite is usually colorless, only a few thick fragments being sky-blue; the parting is well developed on most grains so that fragments appear cubic. The staurolite is honey-colored to amber-colored and contains numerous inclusions, some of which are oriented in a parallel manner; the grains are irregular or subrounded and many show conchoidal surfaces, although one cleavage direction is apparent on some grains. The white mica is especially abundant in the fine sand at the base of the Meridian sand. These minerals were found in such abundance, even in the coarser fractions, as to facilitate identification of the sand with the hand lens. Secondary pyrite is evident in samples from test holes where some is a cement between sand grains, but its distribution is probably a function of depth rather than of the sand member. The middle part of the sand member generally contains the coarsest grains of sand, although locally in test holes and in outcrops a grit containing cobbles may be near the base. The coarse zones are the most permeable and are well shown on the electrical logs.

The Meridian sand appears to have been deposited on the beaches of an advancing Claiborne sea, and is considered nonmarine. The presence of grains and the grain-size distribution (Table 8) suggests that the wind aided in transporting the sand to its present position. The only fossils found were some faecal pellets at the Air Base and fragments of petrified wood, some of which are 1½ feet in diameter and several feet long, in a road-metal pit 6 miles east of Grenada and 0.4 mile south of State Highway 8 (NE. 1/4, Sec. 6, T. 22 N., R. 6 E.).

HYDROLOGY

The water levels in the wells in use before Camp construction (Tables 12, 13) were generally between 20 and 30 feet beneath the surface of the land, except in the lowland of the Yalobusha River Valley where the wells flow. Thus water in the Meridian sand is confined or semi-confined except in the outcrop areas, but even there thin shale beds probably confine some of it.

At Camp McCain nine wells have been developed in the Meridian sand for a total planned capacity of 3,200 gallons per minute. The sand is the source of water for the towns of Duck Hill and Grenada and for two wells at the Grenada Air Base. It is the most productive aquifer in this area and would be capable of furnishing entire supply for the Camp. The results of mechanical analyses and permeability tests of samples from 29 test holes are listed in tabular form (Table 8).

TABLE 8

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE MERIDIAN SAND MEMBER OF THE TALLAHATTA FORMATION AT CAMP MCCAIN AND GRENADA AIR BASE

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total Residue	Laboratory coefficient of permeability†
	DIAMETER OF SCREEN OPENINGS								
Test hole 1									
18 - 40	0	0.32	13.73	69.41	15.46	1.17	0	100.09	2071
40 - 61	0	0.41	8.45	71.28	17.95	1.91	0	100.00	1480
61 - 82	0	0.03	10.07	32.00	54.61	3.03	0.31	100.05	661
82 - 90	0	0.30	5.14	45.96	45.70	2.55	0.35	100.00	769
107 - 127	0	0	3.06	38.37	44.20	13.04	1.23	99.90	545
127 - 148	0	0.21	4.84	47.21	34.16	12.23	1.28	99.93	450
148 - 168	0	0.11	0.68	47.44	48.72	1.72	1.10	99.77	643
168 - 181	0	0.06	1.76	34.70	59.25	3.12	1.13	100.02	725
Test hole 2									
61 - 83	1.01*	1.22*	5.00	53.26	34.52	3.77	1.19	99.97	428
83 - 104	0	0.21*	2.01	65.41	31.28	1.04	0	99.95	1302
104 - 126	0	2.59	40.52	52.92	3.36	0.61	0	100.00	3116
126 - 169	0	0	12.66	77.28	9.71	0.31	0	99.96	7766
Test hole 3									
22 - 43	0	0.56	20.94	66.21	11.69	0.53	0.06	99.99	1535
43 - 64	0	0.73*	8.84	55.59	28.72	5.33	0.81	100.02	891
64 - 86	0	0.40*	21.19	74.38	3.59	0.38	0.15	100.09	3353
108 - 130	0	2.06*	28.77	32.20	26.91	8.99	1.09	100.02	471
Test hole 4									
22 - 34	0	0.21	17.91	70.14	11.43	0.21	0	99.90	1395
34 - 43	0	0.62	29.06	66.07	3.94	0.20	0	99.89	1953
43 - 65	0.20	6.23	53.96	36.68	2.68	0.16	0	99.91	2446
65 - 77	0	10.76	52.64	30.52	5.72	0.39	0	100.03	3115
77 - 89	0	8.08	5.93	18.17	65.54	2.07	0.15	99.94	802
89 - 111	0	1.36	0.63	17.03	78.84	2.13	0	99.99	904

Test hole 5									
21- 40	0	0	12.00	71.58	16.22	0.30	0	100.10	1798
40 - 62	0	0	4.70	79.96	15.10	0.31	0	100.07	1605
62 - 83	0	0	38.52	58.32	2.85	0.40	0	100.09	2682
Test hole 6									
23 - 45	0	0	12.70	80.64	6.55	0.16	0	100.05	2012
45 - 66	0	0	29.26	60.64	9.90	0.15	0	99.95	1653
66 - 80	0	0	13.34	67.75	18.69	0.20	0	99.98	1397
Test hole 7									
20 - 41	0	1.06	16.13	66.99	15.25	0.48	0	99.91	1588
41 - 63	0	0.27	20.97	63.00	15.48	0.32	0	100.04	1821
63 - 85	0	0.18	9.97	54.89	32.72	2.03	0.19	99.98	1257
Test hole 8									
20 - 41	0	0.83	12.82	66.96	16.90	2.30	0.19	100.00	1156
41 - 63	0	4.12	18.60	67.72	8.47	1.06	0	99.97	1752
63 - 85	0	0	0.14	1.34	44.98	50.45	3.03	99.94	316
Test hole 9									
82 - 103	0	1.12	9.14	39.06	45.15	4.85	0.63	99.95	997
103 - 125	0	0.19	7.63	59.24	31.10	1.70	0	99.86	1155
Test hole 10									
46 - 67	0	2.15	59.59	36.33	1.82	0.06	0	99.95	2454
88 - 110	0	0.17	1.09	12.27	82.18	3.73	0.41	99.85	507
Test hole 11									
41 - 65	0	2.21	28.46*	63.81*	5.27	0.16	0.02	99.93	1937
65 - 89	0	0.36	5.32	39.05	53.37	1.95	0.10	100.15	680
Test hole 12									
40 - 62	0	0.30	3.10	69.64	26.40	0.65	0.13	100.22	988
62 - 84	0	0.82	2.40	86.04	10.57	0.32	0.06	100.21	1586
Test hole 13									
39 - 61	0	0	0.64	27.56	66.22	5.25	0.48	100.15	599
61 - 83	0	0.42	25.19	57.12	16.19	1.20	0	100.12	1567
83 - 104	0	8.18	53.31	30.91	6.61	1.00	0	100.01	1129

TABLE 8—Continued

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE MERIDIAN SAND MEMBER OF THE TALLAHATTA FORMATION AT CAMP MCCAIN AND GRENADA AIR BASE

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total Residue	Laboratory coefficient of permea-bility†
Test hole 13									
104 - 124	0	1.50	10.46	42.56	37.49	7.26	0.72	99.99	
168 - 190	0	0	5.83	90.98	2.68	0.50	0	99.99	1337
Test hole 14									
63 - 85	0	0.03	19.02	79.30	1.53	0.11	0	99.99	1830
85 - 106	0	0.06	28.28	64.41	6.56	0.66	0	99.97	1508
Test hole 16									
64 - 86	0	0.40	7.08	49.20	42.40	0.90	0	99.98	656
86 - 108	0	0.46	8.18	61.75	28.97	0.58	0	99.94	770
108 - 129	0	0	10.82	70.88	17.40	0.81	0	99.91	1012
Test hole 17									
84 - 104	0	1.61	10.82	60.10	19.39	7.98	0	99.90	763
104 - 126	0	0	1.59	28.04	55.99	11.91	2.41	99.94	406
Test hole 18									
19 - 40	0	0.13	14.85	49.66	31.55	3.60	0	99.79	722
40 - 62	0	5.56	29.67	54.71	9.71	0.48	0	100.13	1440
83 - 105	0	0	2.32	30.02	65.48	2.13	0	99.95	576
105 - 127	0	7.73	17.42	48.35	25.66	0.84	0	100.00	846
127 - 148	0	0	8.90	84.53	6.33	0.26	0	100.02	1612
148 - 170	0	0	7.47	78.06	13.91	0.54	0	99.98	2008
Test hole 19									
41 - 63	0	4.21	17.06	64.44	12.89	1.50	0	100.10	1085
63 - 85	0	0	17.48	78.56	3.72	0.25	0	100.01	2040
85 - 106	0	0	4.29	37.90	55.39	2.42	0	100.00	632
128 - 150	0	0.55	19.90	69.48	9.80	0.31	0	100.04	1205
150 - 172	0	0.38	20.02	74.19	5.25	0.30	0	100.14	1330

Test hole 20									
19 - 41	0	0	10.36	54.31	33.18	2.07	0	99.92	612
41 - 63	0	1.37	21.83	43.93	23.47	9.33	0	99.93	520
63 - 84	0	0	11.83	76.88	10.36	0.89	0	99.96	1000
84 - 106	0	2.38	7.60	58.77	28.83	2.35	0	99.93	612
Test hole 21									
62 - 82	0	0	3.68	46.35	47.51	2.44	0	99.98	616
104 - 126	0	0	33.04	60.30	6.35	.28	0	99.97	1700
Test hole 23									
82 - 104	0	0	1.15	74.66	23.04	1.04	0	99.89	971
104 - 126	0	0	3.87	56.55	35.49	4.04	0	99.95	796
146 - 168	0	0	11.68	67.69	18.44	2.05	0	99.86	1132
Test hole 24									
105 - 126	0	1.03	24.04	56.47	17.63	0.69	0	99.86	1360
Test hole 26									
64 - 85	0	0.58	8.29	48.30	41.03	1.63	0	99.83	672
85 - 105	0	0.32	0.53	9.81	76.75	10.55	1.89	99.85	380
Test hole 28									
42 - 63	0	0.63	16.72	51.23	30.35	1.22	0	100.15	878
63 - 84	0	0.24	10.88	71.63	16.75	0.62	0	100.12	1090
84 - 106	0	0.19	8.80	73.33	17.31	0.41	0	100.04	1170
106 - 127	0	0	3.82	67.95	26.43	1.83	0	100.03	878
127 - 149	0	0	0	4.35	91.35	3.99	0.21	99.90	425
149 - 170	0	0	8.86	77.27	12.44	0.55	0	99.12	1000
170 - 192	0	0.16	28.75	63.31	7.42	0.38	0	100.02	1465
192 - 214	0	0.35	38.51	57.35	3.59	0.27	0	100.07	1870
Test hole 30									
85 - 104	0.15	2.44	47.02	47.74	2.36	0.34	0	100.05	1875
104 - 126	0	0.32	18.06	60.99	18.98	1.63	0	99.98	936
126 - 148	0	0.63	20.25	62.47	14.74	1.94	0	100.03	936
Test hole 37									
82 - 102	0	5.68	32.23	38.26	23.17	0.51	0.15	100.00	

TABLE 8—Continued

MECHANICAL ANALYSES AND COEFFICIENTS OF PERMEABILITY OF THE MERIDIAN SAND MEMBER OF THE TALLAHATTA FORMATION AT CAMP MCCAIN AND GRENADA AIR BASE

DIAMETER OF SCREEN OPENINGS

Depth Feet	2 mm. gravel	1 mm. grit	0.5 mm. coarse sand	0.25 mm. medium sand	0.125 mm. fine sand	0.062 mm. very fine sand	0.00 mm. silt, etc.	Total Residue	Laboratory coefficient of permea-bility†
GRENADA AIR BASE									
Test hole 1									
63 - 85	0	0.14	17.11	70.42	11.28	1.29	0.05	100.29	1106
85 - 107	0	0.01	10.60	79.72	9.15	0.46	0.02	99.96	1220
107 - 129	0	0.04	6.54	69.14	23.02	1.21	0.13	100.08	830
129 - 151	0	0.47	3.58	71.91	22.10	1.85	0.12	100.03	850
151 - 172	0	0.18	0.24	6.14	90.52	2.86	0.24	100.18	201
259 - 281	0	0.05	6.45	31.84	29.85	27.52	4.36	100.07	452
Test hole 2									
105 - 113	0	0.11	6.77	49.38	39.86	3.83	0.35	100.30	968
113 - 137	0	0.65	24.91	66.48	7.39	0.54	0.17	100.14	1491
137 - 159	0	0.88	11.07	68.67	18.61	0.74	0.12	100.09	1007
159 - 180	0	0.16	0.28*	9.68*	85.31	4.18	0.45	100.06	663
191 - 202	0	0.01	0.64*	33.52	65.14	0.70	0.03	100.04	967
252 - 267*	0	0	2.30	47.34	46.17	3.24	0.99	100.04	664
267 - 288	0	0.24	14.22	73.37	10.04	1.42	0.08	99.37	1550
Test hole 3									
132 - 146	0	0.07	0.20*	6.30	89.30	4.09	0.16	100.12	600
146 - 168	0	0.10*	0.40*	53.73	45.41	0.53	0	100.17	978
212 - 233	0	0	0.81	6.23	77.18	14.69	1.17	100.08	474
233 - 253	0	0.05	3.73	32.10	57.45	6.65	0.21	100.19	585
253 - 275	0	1.21	26.61	66.28	5.90	0.25	0.03	100.28	1560

† Meinzer's Units

*Minor shale and/or lignite contamination.

PUMPING TESTS

Tests, similar to those in the basal sand of the Holly Springs formation, were made of four wells in the Meridian sand member of the Tallahatta formation. Well A-4 was pumped for four days at 350 gallons a minute. Interference on nearby idle wells was observed only in wells A-1 and A-14. The results of the tests (Table 9) includes the specific capacity after 24 hours of pumping except for well A-1, which was measured after 9 hours.

The wells tested are all in the northern part of the cantonment. The heterogeneity of the Meridian sand is reflected in the wide range of coefficients of permeability and transmissibility, but the lowest coefficient of transmissibility, found at well A-12, is about three times the average of the coefficients of the Holly Springs sand. The rates of recovery following pumping at the Air Base suggests that the sand there is equally capable of yielding large supplies. The specific capacities of the wells in the southern part of the Camp (which were not completely tested) indicate that these wells are not capable of yielding water as copiously as those farther north. It is fortunate that this condition is the reverse of that in the Holly Springs sand.

Movement of water in the Meridian sand is apparently not seriously hindered by the fault which cuts across the member at the Camp, as shown by the generalized piezometric surface map (Plate 11).

Measurements of depths to the water level should be made before the pumps are started and again before they are stopped. Continued records of changes in water level, together with the pumping rates and total pumpage, will furnish the data needed for possible changes in operation or additional wells that may be required in the future.

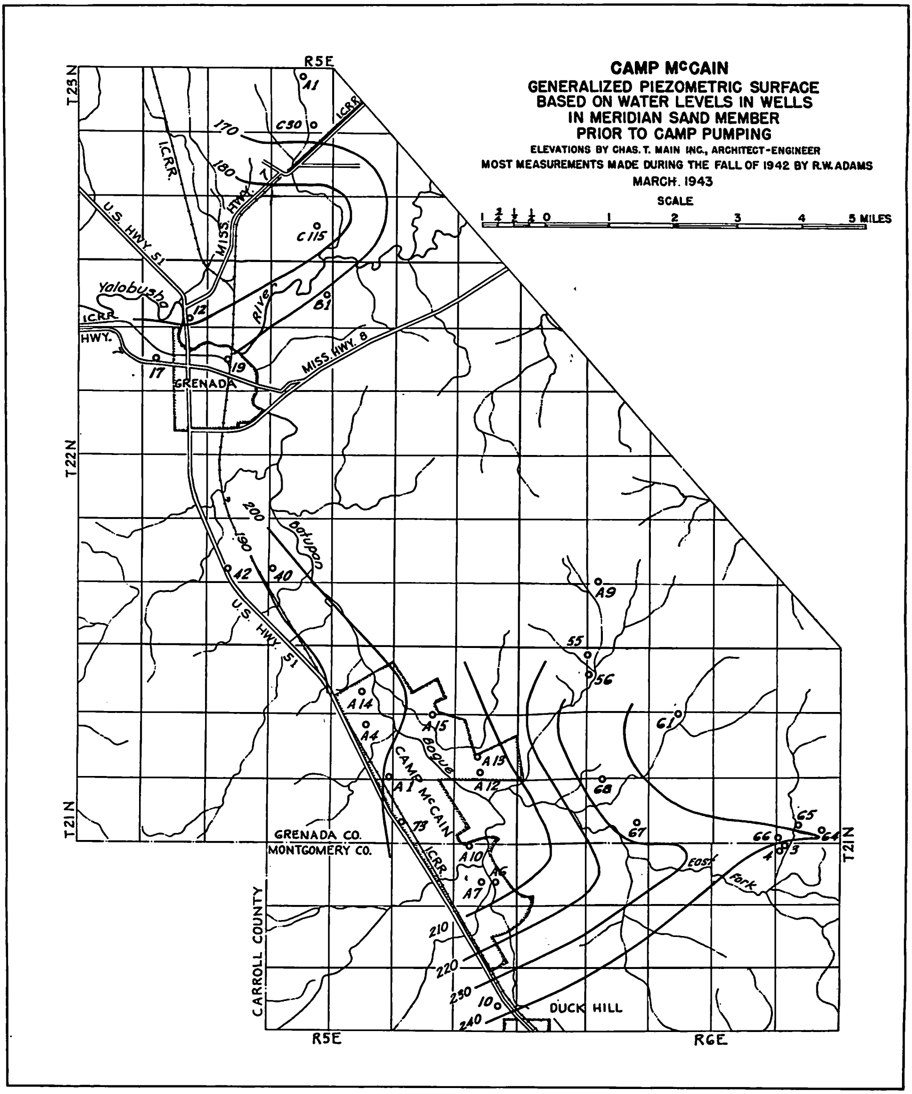

CAMP McCAIN
GENERALIZED PIEZOMETRIC SURFACE
BASED ON WATER LEVELS IN WELLS
IN MERIDIAN SAND MEMBER
PRIOR TO CAMP PUMPING
ELEVATIONS BY CHAS. T. MAIN INC., ARCHITECT-ENGINEER
MOST MEASUREMENTS MADE DURING THE FALL OF 1942 BY R.W. ADAMS
MARCH. 1943
SCALE
5 MILES
R5E
R6E
T23N
T22N
T21N
GRENADA
Yalobusha River
U.S. HWY. 51
MISS. HWY. 7
MISS. HWY. 8
I.C.R.R.
Batupan Bogue
CAMP McCAIN
GRENADA CO.
MONTGOMERY CO.
CARROLL COUNTY
East Fork
DUCK HILL

PLATE 11

TABLE 9

COEFFICIENTS OF TRANSMISSIBILITY AND STORAGE OF THE MERIDIAN SAND MEMBER OF THE TALLAHATTA FORMATION (ALSO SPECIFIC CAPACITIES OF TESTED WELLS) AT CAMP MCCAIN

Coefficients of transmissibility as computed from recovery of water levels after pumping

Well	Period of test	Length of pumping time (hours)	Period after termination of pumping used in computations (hours)	Coefficient of transmissibility (T)	Thickness of aquifer at well (feet)	Coefficient of permeability (60° F.)
A-12	Dec. 30-Jan. 4, 1943	24.7	0.5-73.3	13,300	116	108
A-13	Jan. 15-Jan. 17, 1943	35.7	0.2-1.75	37,000	182	191
A-14	Feb. 18-Feb. 20, 1943	24.6	1.4-16.2	56,000	78	675
A-15	Feb. 18-Feb. 20, 1943	24.5	1.5-26.8	70,000	90	731

Coefficients of transmissibility and storage as computed from interference tests during pumping

Pumped well	Period of pumping (1943)	Well turned on or off at beginning of period	Observation well	Coefficient of transmissibility (T)	Cofficient of storage (S)
A-4	Feb. 2-6	On	A-1	168,000	0.00164
A-4	Feb. 2-6	On	A-14	136,000	0.000073
A-13	Jan. 14-18	On	A-12	19,950	0.00090
A-13	Jan. 14-18	Off	A-12	22,780	0.0011

Specific capacities of tested wells (gallons per foot of draw-down after 24 hours of pumping)

Well number	Specific capacity
1	23.3*
4	30.7
6	18.7
7	8.9
10	17.9
12	19.0
13	25.7
14	41.7
15	35.0

*After nine hours pumping.

QUALITY OF WATER

The quality and treatment of water from the Meridian sand have been the subject of considerable investigation at the Camp by the architect-engineers. Some of the results of preliminary analyses are given in tabular form.

TABLE 10

ANALYSES OF SAMPLES OF WATER FROM THE MERIDIAN SAND MEMBER OF THE TALLAHATTA FORMATION AT CAMP MCCAIN

Parts per million (except pH)

Well number	A-1[a]	A-12[b]	4[b] (Air Base No. 3)
Date of collection	Sept. 7, 1942	Jan.1, 1943	Jan. 6, 1943
Depth of sand below the surface (feet)	63-138	8-124	212-277
Silica (SiO_2)	33	--	--
Iron (Fe)	.11[c]	1.0	2.4
Calcium (Ca)	10	--	--
Magnesium (Mg)	5.0	--	--
Sodium and Potassium (Na + K)	12	--	--
Bicarbonate (HCO_3)	61	32	88
Sulfate (SO_4)	15	--	--
Chloride (Cl)	4.2	7	7
Fluoride (F)	.0	--	--
Nitrate (NO_3)	.0	--	--
Total dissolved solids	109	92	114
Total hardness as $CaCo_3$	46	50	35
pH	6[d]	--	6.2

[a] Analyzed by E. W. Lohr, U. S. Geological Survey, except pH.
[b] Analyzed by Dr. W. F. Hand, State Chemist.
[c] Average of 7 determinations by State Board of Health, May 29 through June 1, 1942, 1.8 parts per million.
[d] Average of 7 determinations by State Board of Health, May 29 through June 1, 1942.

The distribution of iron in the Meridian water as determined by the architect-engineers is of interest. The relations of average free carbon dioxide, iron, and pH to depth of well and structural position were determined (Table 11).

TABLE 11

CARBON DIOXIDE, IRON, AND pH IN RELATION TO WELL DEPTH AND STRUCTURAL POSITION

Well	Free CO_2 (parts per million)	Iron (Fe) (parts per million)	pH	Depth to base of screen (feet)	Altitude of base of screen (feet above mean sea level)
A-6	72	6.5 (app.)	5.7	130	93
A-7	60	5.9 (app.)	6.2	152	71
A-4	52	5.8	6.3	155	63
A-14	53	5.2	5.8	140	70
A-10	42	3.2	6.8	175	50
A-1	56	3.0	6.5	138	78
A-12	60	1.2	6.1	120	110*
A-13	63	.9	6.2	211	6
4 (Air Base No. 3)	....	2.4	6.2	272	-74

*Base of sand 64.5 feet.

It might be said that in general the iron content decreases as depth increases, the outstanding exceptions being wells A-12 and 4 (Air Base). At well A-12 the lower part of the Meridian sand is separated by a bed of sandy shale, above which the well screen was placed, so that there is an interval of 23 feet of deeper sand whose contained water may be comparable to the water derived from nearby well A-13. The Air Base is 11 miles north of the Camp, and the associated shales contained more carbonaceous debris. Where the iron content is high, the sand contains considerable secondary pyrite (FeS_2), frequently seen in samples as cement between sand grains. Thus it appears that the distribution of organic debris and possibly of magnetite during deposition helps to explain the erratic distribution of iron-bearing water.

TALLAHATTA FORMATION—BASIC CITY SHALE MEMBER

The upper part of the Tallahatta formation, as exposed in Montgomery, Grenada, and Yalobusha Counties, is composed of shale, siliceous claystone, siltstone, sand, and quartzite. This upper part is considered to be the stratigraphic equivalent of the much described deposits immediately above the Meridian sand near Meridian, the Basic City shale member of the Tallahatta formation. Its outcrop in these counties has an irregular width, in part because of rough terrain, but probably averages about 7 miles, including the terraces on which the Camp is built. The outcrop belt trends about N. 45° W. in Montgomery County; it extends across Grenada County in a more nearly northern direction, and still farther north it probably swings somewhat to the east. Like the underlying Meridian sand, on which it rests conformably, the Basic City shale member dips to the west about 25 feet a mile and is deeply buried in the Mississippi embayment west of the Camp.

The thickness of the Basic City shale member is irregular because of the nature of its lower contact. At the top of Aqua Hill, at the northeast corner of the cantonment area, there is glauconitic sand at an altitude of 357 feet. This sand is either the upper part of the Basic City shale member or a part of the overlying Winona sand member of the Lisbon formation. Holes at the foot of the hill indicate that the Meridian sand there is encountered just beneath the surficial deposits, at an altitude of about 190 feet; the lowest exposure of Basic City shale is about 30 feet above the bottom of the hill. Therefore, if the material at the top of the hill belongs to the Basic City shale, this member of the Tallahatta formation is between 137 and 167 feet thick at Aqua Hill.

A good section of the lower part of the Basic City shale member was exposed along a ditch excavated on Gunby Hill, Montgomery County, at the southeast corner of the cantonment.

GEOLOGICAL SECTION ON GUNBY HILL
(NW. 1/4, SE. 1/4, Sec. 24, T. 21 N., R. 5 E.)

	Feet	Feet
Tallahatta formation		
Basic City shale member		78.4
Shale, light-gray; a few leaf and twig fragments and a few thin (0.3 foot) layers of fine yellow sand	8.4	
Sand, gray and yellow clayey; a few fucoid-like markings and a little dark glauconite	6.6	
Shale, gray and yellow; numerous root tubes or worm borings that are full of sand similar to the sand above and below	1.0	
Sand, gray and yellow clayey; contains numerous fucoid-like markings near the top	5.0	
Shale and claystone, gray and brown; micaceous. Contains thin strata (0.1 to 0.8 foot) and pockets of yellow micaceous sand. Some leaf and twig fragments on the bedding planes of the shale	37.4	
Covered by detritus	15.0	
Shale, thin-bedded; light gray when dry	5.0	
Meridian sand member (?)		5.0
Sand, fine yellow; cross-bedded and micaceous	5.0	

Altitude of road at the base of the section, 228.4 feet.

Locally and down dip much of the Basic City shale member is of marine origin. In Grenada County it is composed of marine and non-marine beds with a preponderance of the non-marine. The shale, claystone, and siltstone are light gray and are of low specific gravity when dry, and the fragments ring when struck with a hammer.

The beds of sand yield water to many farm wells but are not capable of supplying large quantities of water.

LISBON FORMATION

Many of the hills around the Camp are capped by the basal Winona sand member of the Lisbon formation. This sand is about 25 feet thick, and, as a result of its high glauconitic content, it weathers dark red resulting in concretionary layers of hydrated iron oxide.

Above the Winona sand member, and apparently conformable on it, is the Zilpha clay or shale, which ranges up to about 50 feet or more in thickness. Typical Zilpha exposures of carbonaceous shale, pockets and layers of glauconitic sand, and concretions are to be found in the hills west of the Camp.

A higher member of the Lisbon formation consists of sand, sandstone, quartzite, and clay or shale. It caps the ridges west of the Camp and at a higher elevation. These beds are named the Kosciusko sandstone.

None of the water supply for the Camp is derived from the Lisbon formation.

PLEISTOCENE AND RECENT

TERRACE DEPOSITS

Where streams have cut into the terraces in the drainage area of Batupan Bogue, brown silt loam is exposed in banks 8 to 15 feet high. Excavation of sewer ditches on the terraces exposed a cross-bedded sand beneath the loam. The contact of the sand and the loam shows as much as 3 feet of relief.

SECTION EXPOSED IN A DITCH ON THE WEST BANK BATUPAN BOGUE

	Feet
Loam, brown and silty; weathering brown and yellow and containing small lenses of reworked sand at the base	6
Terrace deposits (?)	
Sand, medium to fine, and silt, light-gray, nearly white; containing thin strata of gray carbonaceous shale or clay. Cross-bedded in deltaic type	8
Tallahatta formation	
Shale, gray carbonaceous and leaf-bearing	2

The loam has been derived in large part from loess, probably blown on the terrace by the wind. The sand may have been deposited by the stream during the pre-loessal time when the terrace was a flood plain or it may be a bed in the Tallahatta formation. The sand is saturated with water, necessitating the use of driven well-points to lower the water level during the construction of the sewer and water main.

FLOOD-PLAIN DEPOSITS

Heterogeneous deposits of sand, silt, clay, vegetal debris, and fragments of shale from older formations may be seen along the stream channels. These recent deposits may extend beneath the silt-loam away from the channels, but numerous exposures strongly suggest that most, if not all, of these deposits are limited to the present narrow flood plain and change form after every flood.

From a hydrologic viewpoint they are of interest because of bank storage and possible interference with recharge into the underlying Meridian sand on the East Fork of the Bogue, where they are largely composed of silt or clay.

ACKNOWLEDGMENTS

The investigation of the geology and ground-water supply at Camp McCain was made through the office of the Area Engineer, acting under the direction of the Vicksburg and Mobile offices of the United States Engineers, and through the office of Chas. T. Main, Inc., architect-engineers for the Camp. The author wishes to express his gratitude for the cooperation of the Area Engineer, Lt. Col. John C. Wade, and of the architect-engineers, especially Messrs. Robert S. Stephens, Jr., Willis Williams, T. H. Safford, and F. M. Gunby. Altitudes of well and test hole collars, locations of borings, and maps of the area were made available through the architect-engineers, who also made most of the water-level measurements. The water-level measurement program is being continued by the Post Engineer.

This study has been under the general supervision of V. T. Stringfield of the United States Geological Survey in cooperation with the Mississippi Geological Survey. W. C. Morse, State Geologist, and F. E. Vestal of the State Geological Survey spent several days in the field examining the stratigraphy with the author. The geologic map of northern Montgomery County is revised in part from a map by Richard R. Priddy.[1] W. F. Guyton and H. D. Padgett, Jr. of the Federal Survey assisted with some of the field work and the analyses of pumping tests, and DeWitt P. Fleming prepared the illustrations. O. E. Meinzer, Geologist in Charge of the Division of Ground Water, and W. C. Morse kindly edited and criticized the manuscript.

The electrical log of the J. K. Avent No. 1 (Plate 2) was released by the Adams Oil and Gas Company; the divisions on the log below the Tertiary are based on a report from the Dixie Geological Service and on the author's interpretation. George M. Yoder of the Schlumberger Well Surveying Corporation kindly interpreted the maximum resistivity fluctuations shown on the electrical log in the depth interval containing fresh water.

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GEOLOGIC LOGS OF BORINGS IN CAMP McCAIN AREA

Test hole 1

At army well 1 (Grenada County 3) Grenada Air Base

Altitude: 205 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Sandy clay, soil, and *subsoil;* much limonite	9	9
Basic City shale member, Tallahatta formation		
Sand, fine, and thin strata of light-gray clay	37	46
Shale, dark-gray brown carbonaceous and micaceous; and thin strata of argillaceous cemented medium sand containing numerous grains of glauconite	15	61
Sandy clay; sand is coarse Meridian type	14	75
Meridian sand member, Tallahatta formation		
Sand, coarse to fine, mostly medium; angular to subrounded clear and translucent quartz; minor dark-gray chert; pyrite (secondary), magnetite, and other opaque minerals; staurolite and kyanite. A few flakes of lignite are present in the uppermost part of the sand	64	139
Shale, gray and micaceous	2	141
Sand; medium to fine at base; several striated clay fragments with appearance of faecal pellets 125 mm. to 5 mm. in size; much secondary pyrite; a little lignite	31	172
Sandy shale, fine and micaceous, somewhat carbonaceous	35	207
Sand; medium to fine (?), and numerous strata of gray shale and sandy shale	44	251
Sand, medium to very fine; angular clear and translucent quartz; minor pyrite and other opaque grains	30	281
Undifferentiated Wilcox series		
Shale and *sandy shale,* brown, gray, and carbonaceous; much lignite and pyrite; non-calcareous	93	374
Sandstone and *siltstone,* brown calcareous slightly glauconitic	1	375
Sandy shale and *shale,* gray and brown. The sandy shale is blue-green and gray. The shale is brown and carbonaceous; some is glauconitic and slightly calcareous; much mica	101	476
Rock, calcareous cement	3	479
Shale and *sandy shale;* much calcareous cement; some biotite	68	547
Sandstone, calcareous-cemented	2	549
Sandy shale and soft shale	78	627
Sandy shale and thin strata of calcareous cement; some glauconite or a similar mineral	128	755
Sandy shale and *shale,* fine-grained gray	42	797
Sandy shale and soft shale as above; much lignite. Some calcareous cement and glauconite are present	24	821
Sandy shale, dark-gray carbonaceous; also somewhat calcareous	21	842

	Thick. feet	Depth feet
Porters Creek clay, Midway series		
Shale, dark-gray carbonaceous; some dark botryoidal glauconite; minor, nearly white micaceous clay, possibly kaolinitic; very minor biotite	50	892

TEST HOLE 2

Grenada Air Base
Altitude: 212 feet

Driller: Layne Central Company

	Thick. feet	Depth feet
Basic City shale member, Tallahatta formation		
Sandy clay, gray and yellow; medium to coarse angular and subrounded quartz	42	42
Shale, dark-gray carbonaceous and micaceous; and thin strata of typical Meridian sand	16	58
Meridian sand member, Tallahatta formation		
Sand, medium to coarse; typical Meridian; secondary pyrite	8	66
Sand, medium, and thin strata of light-gray clay and darker gray carbonaceous shale. The quartz sand contains considerable white mica and secondary pyrite	39	105
Sand, coarse to fine mostly medium; and lignite which is typical Meridian except that the usual abundant kyanite and staurolite are present in very minor quantities; zircon and opaque minerals are more plentiful; numerous grains of angular to subrounded gray chert	76	181
Sand, medium angular; minor pyrite	10	191
Sand, fine; thin strata of clay and micaceous lignite; some pyrite	11	202
Clay, gray carbonaceous; much lignite and secondary pyrite	50	252
Sand, medium to very fine; angular to subrounded quartz, clear and translucent; minor feldspar (?), very minor pyrite, brown tourmaline, staurolite, and kyanite	36	288
Holly Springs formation, Wilcox series		
Clay	1	289
Clay and thin strata of calcareous-cemented sandstone	22	311
Clay, *shale*, or *sandy shale*	83	394
Sand	4	398
Sandy clay	70	468
Basal sand member, Holly Springs formation		
Sand, hard packed	12	480
Clay	5	485
Sand, medium to fine; well rounded to exceedingly angular quartz; minor magnetite; a little glauconite, probably from the overlying shale	23	508
Ackerman formation, Wilcox series		
Clay	21	529
Sand	7	536

Gumbo	26	562
Sandstone, calcareous-cemented glauconitic	3	565
Shale, brown and gray; carbonaceous	29	594
Shale and thin strata of calcareous-cemented sandstone and siltstone. The shale is gray and brown and carbonaceous; much dark mica	43	637
Shale, sandy shale, and thin strata of *sand*	24	661
Shale, waxy light-gray to nearly black, carbonaceous; thin strata of calcareous-cemented sandstone, glauconitic	34	695
Sandy shale, gray; less carbonaceous than above; some shale and light-gray waxy clay; sand washes out light-gray and fine	70	765
Basal sand member, Ackerman formation		
Sand, fine light-gray; thin strata of gray sandy shale and lignite	35	800
Porters Creek clay, Midway series		
Sandy shale, gray carbonaceous	36	836
Rock, probably siderite-cemented sandstone or siltstone	2	838
Shale, black	7	845

Test hole 3

At army well 3 (Grenada County 4) Grenada Air Base
Altitude: 199 feet Driller: Lane Central Company

	Thick. feet	Depth feet
Basic City shale member, Tallahatta formation		
Clay	38	38
Sandy clay	29	67
Meridian sand member, Tallahatta formation		
Sand, fine gray; typical Meridian; minor secondary pyrite, white mica	14	81
Sand, coarse; contains more kyanite, white mica, and pyrite than the above	10	91
Clay, gray probably micaceous	7	98
Sand, coarse; typical Meridian	18	116
Clay, some fragments of lignite	6	122
Sandy clay	10	132
Sand, fine to medium, at base; all grains are angular quartz. Several faecal pellets, minor kyanite, staurolite, white mica, magnetite, and much secondary pyrite	36	168
Sand, medium coarse; probably as above	2	170
Clay, seemingly containing numerous faecal pellets	20	190
Sand, fine muddy; thin strata of "boulder"; some lignite	22	212
Sand; fine at the top to medium and coarse at the base. The largest grains are subrounded, the rest angular. Minor secondary pyrite, kyanite, staurolite, and dark minerals	44	277

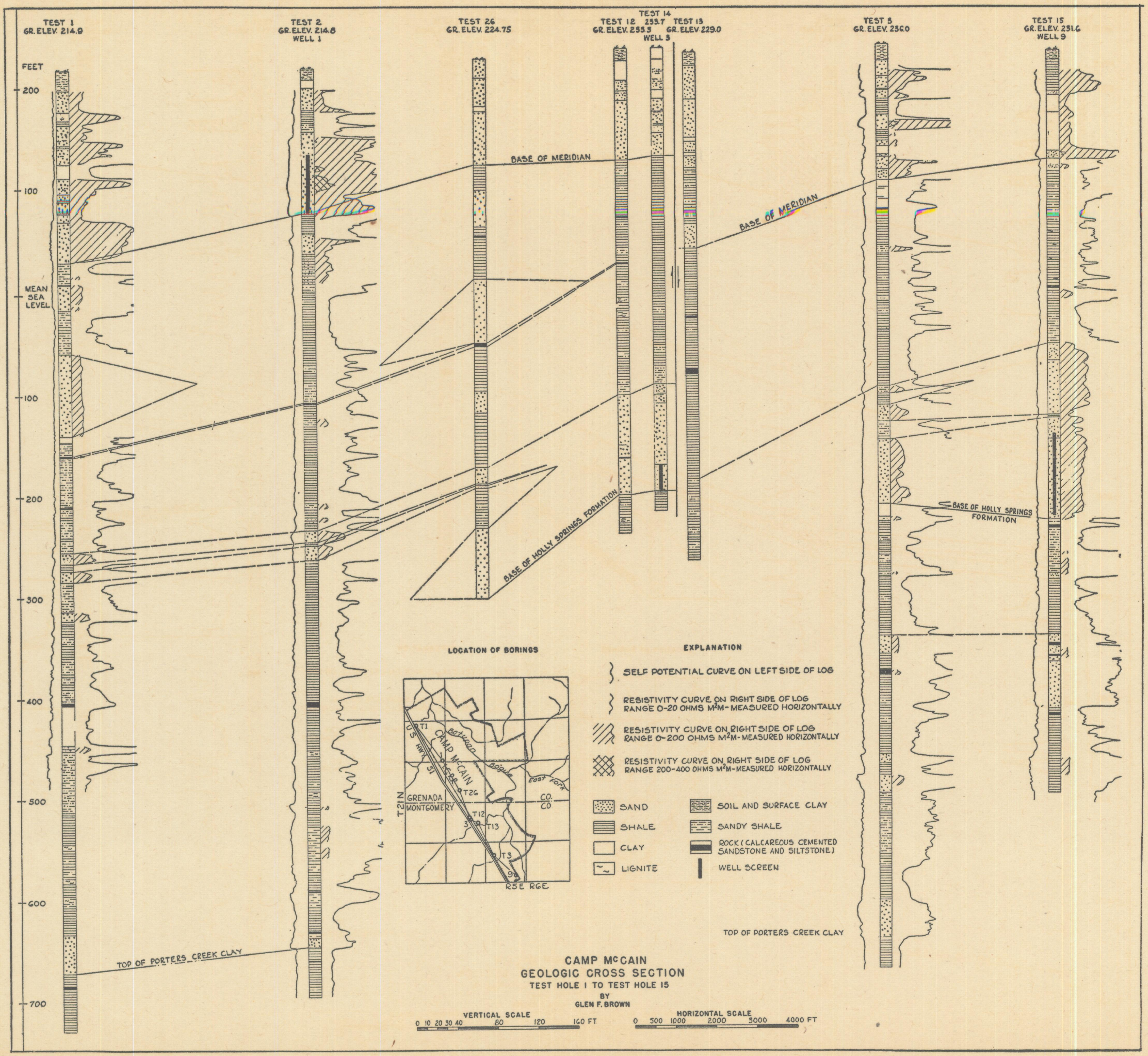
Undifferentiated Wilcox series		
Clay and *lignite*	21	298
Clay and *sandy shale*, gray and brown; much lignite and dark mica	42	340
Clay and *shale;* as above. Little calcareous-cemented sandstone	22	362
Shale and *sandy shale*	21	383
Shale	86	449
Sandy shale, dark-gray; considerable dark mica	65	514
Sandy shale; much gray and brown silt; some lignite; slightly calcareous	42	556
Rock, probably calcareous-cemented sandstone	1	557
Shale	21	578.5
Rock	1.5	580
Shale	22	602

WOMBLE AND WILLIAMS CONNECTICUT LIFE INSURANCE COMPANY NO. 1 WELL
Grenada County 6

Altitude: 201 feet Driller: S. Corley

	Thick. feet	Depth feet
Sandy clay	10	10
Gummy clay	22	32
Sandy clay	8	40
Sand	20	60
Gravel	4	64
Tallahatta formation, Claiborne series		
Sand	11	75
Shale, gumbo clay	18	93
Gumbo	15	108
Sandy shale	21	129
Sand	6	135
Sandy shale	45	180
Shale and sand	10	190
Shale	22	212
Sandy shale	8	220
Shale	12	232
Sandy shale	10	242
Sand	18	260
Undifferentiated upper Wilcox series		
Shale	22	282
Sandy shale	20	302
Hard sand	46	348
Blue gumbo	9	357
Hard rock	8	365
Hard sand shells	11	376
Hard sand	2	378

Sand rock	6	384
Gummy shale	40	424
Hard sand	6	430
Sandy shale	38	468
Broken sand and shale	12	480
Gummy shale	24	504
Basal sand member, Holly Springs formation		
Sand	12	516
Ackerman formation, Wilcox series		
Sandy shale	28	544
Sand rock	4	548
Sandy shale	12	560
Soft sand	6	566
Sand	18	584
Gummy shale	4	588
Sandy shale	7	595
Gumbo	15	610
Sand	18	628
Hard shale	32	660
Shale and sand	15	675
Sticky shale	50	725
Hard sandy shale	20	745
Sand	11	756
Gumbo and sandy shale	24	780
Hard sand rock	1	781
Hard sandy shale	5	786
Shaly gumbo	10	796
Hard sand and shale	19	815
Sand rock	2	817
Porters Creek clay, Midway series		
Hard sandy black shale	18	835
Sticky shale and gumbo	20	855
Hard sandy shale	8	863
Gumbo	12	875
Sticky shale gumbo	15	890
Packed sand	15	905
Gumbo	8	913
Sandy shale	19	932
Tuff gumbo	8	940
Sandy shale	8	948
Hard sand rock	2	950
Sand and shale	10	960
Blue gumbo	20	980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TEST 26
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TEST 12
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TEST 14
233.7
WELL 3
TEST 13
GR. ELEV. 229.0
TEST 3
GR. ELEV. 236.0
TEST 15
GR. ELEV. 231.6
WELL 9
FEET
200
100
MEAN SEA LEVEL
100
200
300
400
500
600
700
BASE OF MERIDIAN
BASE OF MERIDIAN
BASE OF HOLLY SPRINGS FORMATION
BASE OF HOLLY SPRINGS FORMATION
TOP OF PORTERS CREEK CLAY
TOP OF PORTERS CREEK CLAY
LOCATION OF BORINGS
CAMP McCAIN
U S HWY 51
GRENADA
MONTGOMERY
CO.
CO
T21N
R5E RGE
EAST FORK
T1
T26
T12
T13
T3
EXPLANATION
SELF POTENTIAL CURVE ON LEFT SIDE OF LOG
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-20 OHMS M²M-MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-200 OHMS M²M-MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 200-400 OHMS M²M-MEASURED HORIZONTALLY
SAND
SHALE
CLAY
LIGNITE
SOIL AND SURFACE CLAY
SANDY SHALE
ROCK (CALCAREOUS CEMENTED SANDSTONE AND SILTSTONE)
WELL SCREEN
CAMP McCAIN
GEOLOGIC CROSS SECTION
TEST HOLE 1 TO TEST HOLE 15
BY
GLEN F. BROWN
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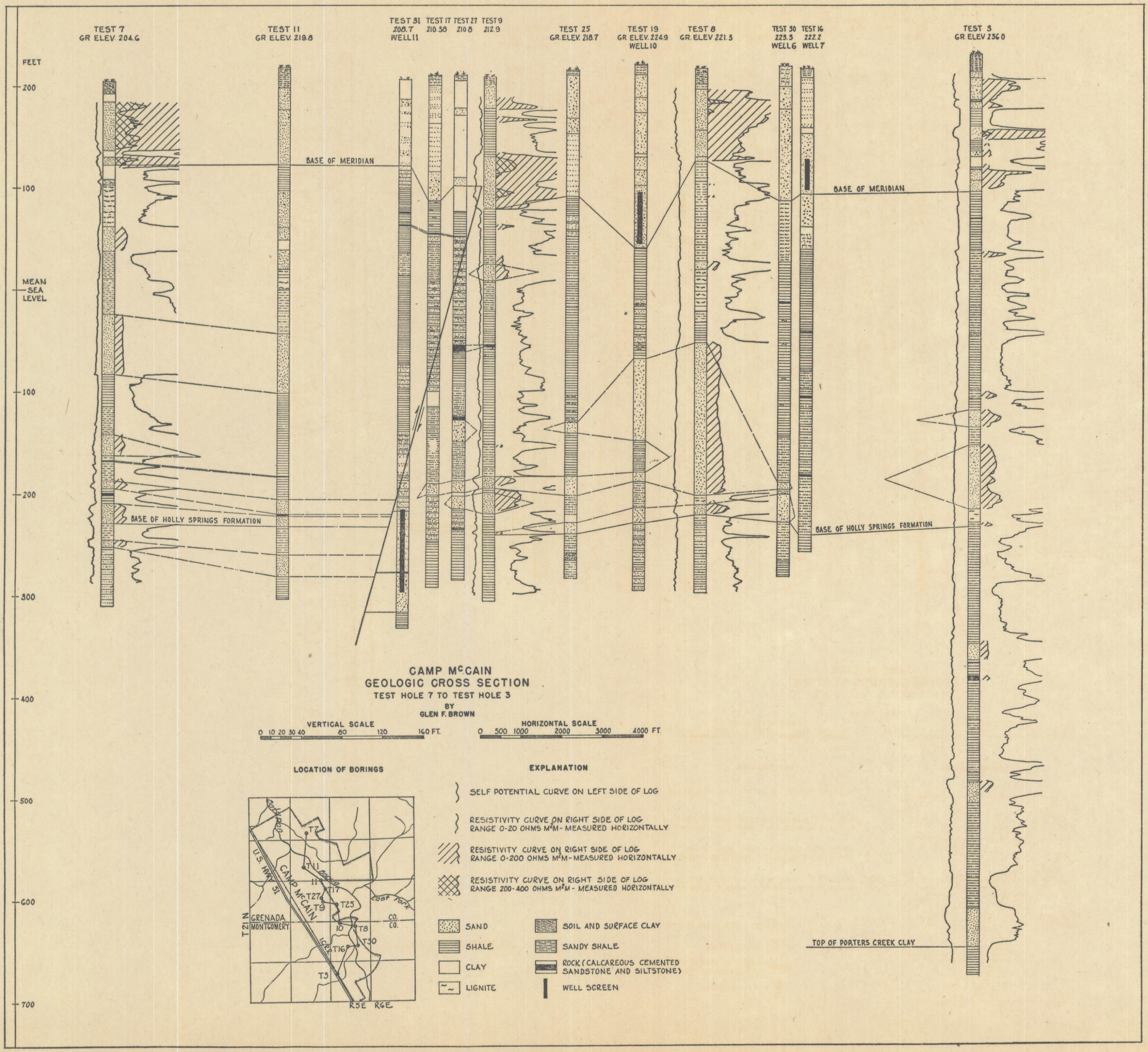
0 10 20 30 40 80 120 160 FT.
HORIZONTAL SCALE
0 500 1000 2000 3000 4000 FT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TEST 11
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TEST 31
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WELL 11
TEST 17
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TEST 27
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TEST 9
212.9
TEST 25
GR ELEV. 218.7
TEST 19
GR ELEV. 224.9
WELL 10
TEST 8
GR ELEV 221.5
TEST 30
225.5
WELL 6
TEST 16
222.2
WELL 7
TEST 3
GR ELEV 236.0
FEET
200
100
MEAN SEA LEVEL
100
200
300
400
500
600
700
BASE OF MERIDIAN
BASE OF MERIDIAN
BASE OF HOLLY SPRINGS FORMATION
BASE OF HOLLY SPRINGS FORMATION
TOP OF PORTERS CREEK CLAY
CAMP McCAIN
GEOLOGIC CROSS SECTION
TEST HOLE 7 TO TEST HOLE 3
BY
GLEN F. BROWN
VERTICAL SCALE
0 10 20 30 40 80 120 160 FT.
HORIZONTAL SCALE
0 500 1000 2000 3000 4000 FT.
LOCATION OF BORINGS
U.S. HWY. 51
CAMP McCAIN
GRENADA
MONTGOMERY
CO.
CO.
T21N
R5E R6E
EXPLANATION
SELF POTENTIAL CURVE ON LEFT SIDE OF LOG
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-20 OHMS M²M- MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-200 OHMS M²M-MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 200-400 OHMS M²M - MEASURED HORIZONTALLY
SAND
SHALE
CLAY
LIGNITE
SOIL AND SURFACE CLAY
SANDY SHALE
ROCK (CALCAREOUS CEMENTED SANDSTONE AND SILTSTONE)
WELL SCREEN

Hard black shale	40	1020
Hard packed sand rock	11	1031
Sand rock	3	1034
Sand and shale	18	1052
Gummy shale	11	1063
Sticky shale and gumbo	20	1083
Packed sand and shale	20	1103
Hard gumbo	20	1123
Sticky gumbo	15	1138
Flakey shale	20	1158
Gumbo	20	1178
Gummy shale	20	1198
Shale	38	1236
Shale and shells	20	1256
Shells	20	1276
Shale and shells	20	1296
Sandy shale	40	1336
Shale and shells	20	1356
Gummy shale	20	1376
Clayton formation, Midway series		
Chalk	35	1411
Undifferentiated Upper Cretaceous		
Sand	3	1414
Gummy chalk	3	1417
Sand	3	1420
Chalk	2	1422
Sandy shale	3	1425

Robert Williams Well

Grenada County 10

Altitude: Driller: Delta Drilling Company

	Thick. feet	Depth feet
Alluvium		
Clay	12	12
Sand, dry	23	35
Undifferentiated Wilcox series		
Rock	.3	35.3
Clay	2.7	38
Sand, dry	13	51
Soapstone	10	61
Sand, water-bearing	10	71
Gumbo	27	98
Sand, water-bearing	29	127
Gumbo	9	136
Sand, water-bearing	20.3	156.3

DR. CLANTON WELL

Grenada County 16
Altitude: 201.2 feet — Driller: R. M. Ray, Delta Drilling Company

	Thick. feet	Depth feet
Basic City shale member, Tallahatta formation		
Soil and white shale	20	20
Blue shale	20	40
Sandy blue shale	20	60
Blue shale	20	80
Blue marl	20	100
Blue shale	20	120
Hard shale	40	160
Shale	20	180
Hard gumbo	20	200
Hard sandy shale	20	220
Hard greensand	15	235
Shale	5	240
Gumbo	18	258
Rock	0.4	258.4
Shale	2	260
Sandy shale	25	285
Hard gumbo	10	295
Meridian sand member (?), Tallahatta formation		
Hard sand	5	300
Fine blue sand	25	325
Hard gumbo	15	340
Sand	12	352
Gumbo	3	355
Sand	2	357
Undifferentiated Upper Wilcox series		
Gumbo	1	358
Greensand	2	360
Hard gumbo	67	427
Rock	0.6	427.6
Hard gumbo	45.4	473
Rock	0.7	473.7
Shale	2.3	476
Rock	0.4	476.4
Sand	2.6	479
Hard gumbo	16	495
Blue shale	17	512
Sand	2	514
Shale	2	516
Sand	3	519
Holly Springs formation (?), Wilcox series		
Gumbo	10	529

Sandy shale	4	533
Gumbo	5	538
Sandy shale	3	541
Gumbo	4	545
Hard gumbo	17	562
Hard shale	17	579
Hard gumbo	16	595
Shale	16	611
Rock	0.4	611.4
Gumbo	10.6	622
Shale	10	632
Fine blue sand	50	682
Ackerman formation, Wilcox series		
Hard gumbo	10	692
Loose shale	8	700
Gumbo	12	712
Loose shale	3	715
Gummy shale	3	718
Loose shale	3	721
Gummy shale	3	724
Loose shale	3	727
Gummy shale	3	730
Loose shale	2	732
Gumbo	12	744
Sandy shale	8	752
Porters Creek clay (?), Midway series		
Hard shale	20	772
Hard shale with gummy streaks; glauconitic	19	791

GRENADA WATER WORKS WELL

Grenada County 23
Altitude: 196.7 feet

Driller:

	Thick. feet	Depth feet
Pleistocene alluvium (?)		
Surface loam	60	60
Sand	30	90
Basic City shale member, Tallahatta formation		
Soapstone (clay)	30	120
Meridian sand member, Tallahatta formation		
Sand and soft clay	40	160
Soapstone (clay) and *sand*, water-bearing	90	250
Undifferentiated Upper Wilcox series		
Blue sand	30	280
Soapstone (clay?)	30	310
Blue sandy *rock*, very fine-grained	140	450
Soft clay	10	460

Basal sand member, Holly Springs formation		
Sand, water-bearing	30	490
Ackerman formation (?), Wilcox series		
Soft blue sandstone	110	600
Rock	20	620

TOWN OF DUBARD WELL

Grenada County 27

Altitude: Driller:

	Thick. feet	Depth feet
Alluvium		
Clay	10	10
Quicksand	20	30
Basic City shale member, Tallahatta formation		
Soapstone	95	125
Meridian sand member, Tallahatta formation		
Sandstone	0.5	125.5
Sand, water-bearing	85	210.5

WELL AT BETSY ROSS INN

Grenada County 41

Altitude: 190.6 feet Driller:

	Thick. feet	Depth feet
Pleistocene alluvium		
Clay	10	10
Sand	30	40
Basic City shale member, Tallahatta formation		
Soapstone (clay)	30	70
Sand	10	80
Soapstone (clay)	10	90
Mud	20	110
Soapstone (clay)	10	120
Meridian sand member, Tallahatta formation		
Very coarse sand	95	215
Undifferentiated Wilcox series		
Hard rock	.25	215.25
Sand	10	225.25
Soapstone (clay)	335	560.25
Two thin rock layers	.75	561
Soapstone (clay)	40	601
Not reported	120	721

OSCAR GISLEN WELL

Grenada County 59

Altitude: 227.6 feet | Driller: Ed Ratliffe

	Thick. feet	Depth feet
Not described	15	15
Meridian sand member, Tallahatta formation		
Sand	6	21
Clay	9	30
Sand	5	35
Clay	7	42
Sand	18	60
Wilcox series		
Shale	140	200
Sand	13	213
Holly Springs formation, Wilcox series		
Rock	0.4	213.4
Shale	3.6	217
Rock	0.4	217.4
Shale	4.6	222
Rock	0.4	222.4
Shale	3.6	226
Rock	0.5	226.5
Shale	7.5	234.0
Rock	0.4	234.4
Shale; lignite at a depth of 310 feet	86.6	321
Sand	11	332
Rock	1.5	333.5
Shale, soft	1.5	335
Shale, hard	2	337
Greensand	5	342
Shale	55	397
Soft rock	0.5	397.5
Shale	0.5	398
Basal sand member, Holly Springs formation		
Sand, gray water-bearing	38	436

TEST HOLE 1

Altitude: 214.9 feet | Driller: Layne Central Company

	Thick. feet	Depth feet
Undifferentiated Tallahatta formation and younger strata		
Soil, sandy subsoil, and *sandy clay,* yellow and brown	18	18
Sand, coarse and medium; subrounded and subangular, clear and frosted	22	40

Sand, thin beds of gray shale and lignite. The sand is medium and coarse, angular, clear and frosted; abundant white mica; minor magnetite and pyrite..............	52	92
Clay or *shale*, dark-gray, nearly black micaceous, slightly carbonaceous	13	105
Meridian sand member, Tallahatta formation		
Sand, medium to coarse; angular and clear, subrounded and frosted; contains abundant white mica flakes up to 0.5 mm. in diameter..................................	15	120
Sand, *clay*, and *shale*. The sand is fine to coarse and is composed of quartz and white mica. The shale is dark gray, brown, and carbonaceous; some lignite	22	142
Sand, medium angular to subrounded clear and frosted quartz; minor pyrite and other opaque minerals. The 10-foot interval, 148 to 158, is highly permeable..........	41	183
Undifferentiated upper Wilcox series		
Shale and *sandy shale*, gray and brown; some lignite......	21	204
Rock, possibly calcareous-cemented sandstone or siltstone..	1	205
Sand, fine gray-green; angular, clear and frosted quartz. Numerous shale fragments; kaolinitic (?) and micaceous minerals; minor black mica and pyrite; a few grains may be glauconite	25	230
Sandy shale, dark-gray and green; abundance of shale; a few grains appear kaolinitic, some may be glauconite....	43	273
Sand, very fine to fine dark-gray and green angular quartz; numerous grains of clay minerals and glauconite (?). A few faecal pellets, light-brown and containing glauconite grains; slightly calcareous	81	354
Holly Springs formation (?), Wilcox series		
Clay; no sample because it was suspended in drilling mud	6	360
Sandstone, glauconitic, calcareous-cemented	1	361
Sandy shale, gray carbonaceous	12	373
Sandstone, calcareous-cemented, slightly glauconitic........	2	375
Sandy shale, thin-bedded fine angular quartz sand, and light-gray clay	49	424
Limestone, light-gray sandy; drilled like boulders........	2	426
Sandy shale	43	469
Basal sand member, Holly Springs formation		
Sand, fine to medium angular clear and cloudy quartz; a few fragments of gray shale; grains of black and white mica; glauconite. Part of the green mica may be chlorite	11	480
Shale or *clay*. A large portion appears to be nearly white kaolinitic clay; a few fragments of lignite.............	7	487
Sand, fine angular quartz, a lighter gray than the above sand	11	498
Shale and *sandy shale*, gray micaceous; a few fragments of lignite and glauconite	30	528
Sand, fine to medium angular quartz........................	8	536

Ackerman formation, Wilcox series		
Shale and *sandy shale*, gray and gray-brown; numerous carbonaceous fragments; a few are calcareous, slightly glauconitic, light-gray clayey sandstone	81	617
Sandstone, light-gray calcareous slightly glauconitic	3	620
Clay, gray and carbonaceous; a small amount of lignite	39	659
Sandy shale, gray and carbonaceous; some thin fragments of calcareous, slightly glauconitic sandstone; an abundance of silt and minor amount of lignite	63	722
Shale, soft; in part fine sandy shale and silt; numerous grains of lignite and carbonaceous material	83	805
Sandy shale, dark-gray; lignite	12	817
Shale, soft gray	28	845
Basal sand member, Ackerman formation		
Sand, fine angular quartz; numerous grains composed of clay minerals, mica, pyrite, and dark-green glauconite; non-calcareous, thin-bedded clay, according to the driller	38	883
Porters Creek clay, Midway series		
Shale, soft dark- gray and black; carbonaceous	11	894
Rock, calcareous siltstone, probably siderite	2	896
Shale, soft dark-green gray; drilled with difficulty	44	940

TEST HOLE 2

Camp McCain A-1

Altitude: 214.8 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Undifferentiated Tallahatta formation and younger strata		
Soil and sandy clay *subsoil*	11	11
Clay, gray and yellow sandy	8	19
Sand, coarse angular to subrounded quartz; a small part of the sample contains gray clay shale fragments	22	41
Shale, gray micaceous slightly carbonaceous; some flakes of white mica which are 1 mm. in diameter	10	51
Sandy shale, thin-bedded; coarse sand and grit. The sandy shale contains much coarse mica and fragments of lignite	12	63
Meridian sand member, Tallahatta formation		
Sand; medium to coarse (?) at the base; clear and angular quartz; very minor crystals of pyrite and kaolinite. The coarse sand at 92 to 119 feet shows extremely high resistance on the electric log. The lower 19 feet is fine grained and probably shaly at 121 to 123 feet	75	138
Undifferentiated upper Wilcox series		
Shale and *clay*, gray and dark-gray carbonaceous and micaceous	20	158
Sand, medium angular quartz; some pyrite	19	177

Shale, interbedded *sand* and *sandy shale*, dark-gray and micaceous. The sand is fine angular quartz; white mica (slightly green) and abundant pyrite	26	203
Holly Springs formation (?), Wilcox series		
Sandy shale; fine angular quartz *sand;* white mica and pyrite imbedded in dark-gray clay shale most of which thickened the drilling mud	14	217
Shale, soft dark-gray micaceous	50	267
Sandy shale and *shale;* contains abundant grains of silt, dark-gray carbonaceous and micaceous; non-calcareous; some fragments are light gray-green	55	322
Rock, apparently calcareous-cemented light-gray siltstone	1	323
Shale, gray-green and brown hard slightly silty	14	337
Sandy shale, gray slightly glauconitic and calcareous	8	345
Shale, silty mostly green and gray; some thin beds of sandy shale, according to the electrical log	74	419
Sandy shale, graygreen; somewhat indurated fine angular gray sand, mostly quartz	8	427
Shale, gray-green; some brown and carbonaceous fragments	7	434
Sandy shale; probably as above; micaceous	5	439
Shale, dark-gray carbonaceous; many fragments of lignite	8	447
Basal sand member, Holly Springs formation		
Sand, medium evenly-grained and subrounded to angular quartz	12	459
Sandy shale	2	461
Sand, very fine to medium quartz; and white mica; some white calcareous cement and a few grains of glauconite; possibly some sandy shale	16	477
Ackerman formation, Wilcox series		
Shale, thin beds of sandy shale, lignite, and brown and gray silt	136	613
Sandstone, gray calcareous; several grains of glauconite	4	617
Shale; thin beds of sandy shale, lignite, and brown, gray, and green silt; green shaly silt more common near the base	98	715
Sandy shale, gray and gray-green micaceous and glauconitic	8	723
Shale, slightly sandy gray and slightly lignitic	14	737
Sandy shale and *sand*, gray-green micaceous and slightly glauconitic	35	772
Shale and *sandy shale*, gray and gray-green	29	801
Rock, apparently calcareous siltstone	1	802
Sandy shale, gray and gray-green; minor glauconite and pyrite	15	817
Shale, gray and green; a bit sample is waxy dark-gray and contains fragments of lignite	25	842
Rock, calcareous siltstone; probably siderite (bit sample)	1	843
Clay; no sample because it was suspended in drilling mud	3	846

Basal sand member, Ackerman formation		
Sand, fine and silty. A large amount of glauconite and dark mica, but mostly angular quartz	11	857
Porters Creek clay, Midway series		
Rock, probably calcareous siltstone or sandstone	.5	857.5
Shale, soft dark-gray and green slightly calcareous; much dark glauconite	11.5	869
Rock, probably calcareous siltstone or sandstone	1	870
Shale, soft dark-gray and green slightly calcareous; much dark glauconite	35	905

TEST HOLE 3

Altitude: 236.0 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Soil, brown and sandy and sandy clay	16	16
Tallahatta formation, Claiborne series		
Sand, coarse and grit; clear and frosted quartz	6	22
Sand, medium coarse, and grit. The grains are clear and frosted quartz, rounded to subangular. Numerous grains of white mica and pyrite; much iron stain; some thin layers of gray clay shale and pyrite	22	44
Shale, gray; thin laminae; possibly some lignite	2	46
Sand, medium coarse, and grit. The grains are quartz; clear and frosted rounded to subangular; numerous grains of white mica and pyrite	7	53
Shale, dark-gray carbonaceous, possibly some lignite	17	70
Sand, medium subangular to subrounded quartz; minor pyrite; very permeable	14	84
Shale, dark-gray carbonaceous	4	88
Sand, medium subangular to subrounded quartz; minor pyrite	2	90
Shale, dark-gray carbonaceous	4	94
Sand, medium quartz subangular to subrounded	6	100
Clay; no sample because it was suspended in drilling mud	10	110
Sand	2	112
Clay or *clay shale*	1	113
Sand, medium to fine rounded to angular clear and frosted quartz; minor pyrite, white mica, and an opaque mineral	10	123
Sand, medium to coarse; thin layers of clay or shale	11	134
Undifferentiated upper Wilcox series		
Clay and *shale*, gray carbonaceous; abundant large flakes of white mica; sandy at base	26	160
Rock	.5	160.5
Shale, soft dark-gray carbonaceous; some lignite	31.5	192
Sandy shale; a few strata drilled like rock and some fragments are calcareous; a little lignite	10	202

Shale and *sandy shale* in thin alternating layers. Some calcareous material and glauconite at 237 feet and abundant brown to black lignite in the sample at 259 feet	71	273
Sandy shale; numerous grains of sand; a few grains of shale	3	276
Shale, soft to hard brown carbonaceous	55	331
Sandy shale; angular quartz and white mica imbedded in gray and brown shale; slightly carbonaceous; several small rounded grains of glauconite	9	340
Shale, gray and brown slightly carbonaceous	10	350
Basal sand member (?), Holly Springs formation		
Sand, fine and shaly; angular quartz and numerous other minerals	17	367
Sandy shale, green-gray micaceous; some lignite; gradational contact with sand at base	17	384
Sand, fine angular quartz; numerous flakes of brown and gray clay shale. Some light-gray grains appear kaolinitic; a few grains of glauconite and lignite	62	446
Ackerman formation, Wilcox series		
Clay and brown soft lignite	14	460
Sandy shale, gray and carbonaceous	4	464
Shale, thin sandy shale layers, gray, brown, and green	48	512
Sandy shale	7	519
Shale, thin sandy shale layers, slightly calcareous	57	576
Sand, fine angular quartz, micaceous and slightly glauconitic; numerous shale fragments	18	594
Shale	2	596
Boulder	.5	596.5
Shale, slightly sandy	13.5	610
Sandstone, calcareous cement, light-gray, glauconitic	3	613
Sandy shale, gray, green, and brown; some layers are calcareous and drill hard. The electrical log suggests some thin sand strata	38	651
Sandy shale, possibly some very fine angular coated quartz sand	9	660
Shale and thin layers of sandy shale, gray and green	32	692
Sand or *sandy shale*, fine angular coated quartz. Many grains are fine, almost silt. Abundant lignite	10	702
Shale, dark-gray	9	711
Sand, fine angular quartz; minor white mica and kaolin (?)	19	730
Sandy shale and *shale*, dark-gray and carbonaceous. Abundant lignite at 752 feet	74	804
Shale and *sandy shale*, dark-gray carbonaceous	30	834
Basal sand member, Ackerman formation		
Sand, fine, tight angular quartz and white mica. Several grains of light-gray clay, kaolinitic (?) and glauconitic	38	872

	Thick. feet	Depth feet
Porters Creek clay, Ackerman formation		
Clay, gray and slightly micaceous. A few grains of sand in a bit sample from 900 feet. Drills hard, Midway shale....	28	900

TEST HOLE 4

Altitude: 226.2 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and *sandy subsoil*..................................	2	2
Basic City shale member, Tallahatta formation		
Clay, gray and yellow slightly sandy.....................	15	17
Clay, sandy; angular medium to fine *sand*................	15	32
Meridian sand member, Tallahatta formation		
Sand, yellow coarse; angular to subrounded grains. Much iron stain in the quartz grains and numerous crystals of pyrite in the basal part..............................	12	44
Clay; no sample because it was suspended in the drilling mud	14	58
Sandy shale; no sample because it was suspended in the drilling mud	7	65
Grit, angular to subrounded; clear and milky quartz grains; very minor pyrite....................................	12	77
Sand, medium to fine angular quartz; minor white mica and very minor pyrite. Driller reports hard streaks........	12	89
Sand, medium to fine angular quartz grains; minor white mica and very minor pyrite...........................	23	112
Undifferentiated upper Wilcox series		
Clay, gray slightly carbonaceous and micaceous............	18	130
Shale, soft; gray carbonaceous and micaceous.............	5	135
Shale, hard dark-gray carbonaceous and micaceous........	9	144
Sandy shale or shaly sand.................................	6	150
Shale, dark-gray carbonaceous............................	24	174
Sandy shale; fine angular quartz sand imbedded in dark-gray matrix	2	176
Shale, carbonaceous dark-gray............................	2	178
Sandy shale; fine angular quartz sand imbedded in carbonaceous shale	6	184
Shale, brown and green-gray; contains abundant pyrite and numerous grains of glauconite. The green-gray material is calcareous; a few fragments of lignite.................	30	214
Sandy shale, brown and green-gray; contains abundant pyrite and numerous grains of glauconite. The green-gray material is calcareous; a few fragments of lignite......	12	226
Shale, brown and green-gray; contains abundant pyrite and numerous grains of glauconite. The green-gray material is calcareous; a few fragments of lignite.............	31	257

Sandy shale, brown and green-gray; calcareous; contains abundant pyrite and numerous grains of glauconite. Fine angular grains of quartz and glauconite are imbedded in the shale	5	262
Shale, brown and green-gray; contains abundant pyrite and numerous grains of glauconite. A little lignite	6	268
Sandy shale or shaly sand, brown and gray-green; abundant pyrite and glauconite. The gray-green fragments are calcareous; one faecal pellet	11	279
Shale, brown and gray; numerous fragments of brown and black lignite	15	294
Sandy shale, brown and gray; fine angular quartz grains	8	302
Shale and thin beds of sandy shale; brown and gray in the upper part, brown, gray, and light-green (non-calcareous) in the lower part. Some fragments are composed of thin laminae of the three colors; a few flakes of lignite	105	407
Basal sand member, Holly Springs formation		
Sand, medium clear and frosted quartz; angular to subrounded	31	438
Ackerman formation		
Clay, gray and grown; slightly carbonaceous	14	452
Shale, thin-bedded lignite, and sandy shale, green, gray, and brown non-calcareous	32	484
Sandy shale or lignite	4	488
Shale, gray and brown; and lignite, black with a brown streak; a few fragments of light-green sandy shale	32	520
Sandy shale and *shale*, carbonaceous; a few grains of a glauconitic green mineral, non-calcareous; minor white mica; numerous grains of sand at the basal part	29	549
Shale and soft *siltstone*, gray, brown, and green. Some imbedded grains of a green glauconitic mineral; minor white mica	53	602
Shale, carbonaceous mostly gray; fibrous lignite	24	626
Shale and *sandy shale*, gray and brown. Some fragments of green sandy shale are calcareous and contain a few grains of green glauconitic mineral	22	648
Shale, gray and brown, lignite; contains abundant nearly white kaolinitic (?) clay. Soft shale near the base, possibly thin beds of sandy shale	31	679
Sandy shale or shaly sand and thin beds of shale. The sand grains are fine angular quartz; minor white mica; the shale is gray and light gray and increases in purity toward the base	69	748
Shale, dark-gray; numerous light-gray kaolinitic (?) clay fragments and lignite	41	789
Sandy shale or shaly sand; fine angular quartz, black and white mica, glauconite, and a dark opaque mineral	25	814

	Thick. feet	Depth feet
Porters Creek clay, Midway series		
Clay or *shale*, dark-gray micaceous; contains numerous fragments of light-gray kaolinitic (?) clay; much dark glauconite. Lignitic fragments may be contamination; a few grains of fine angular sand	86	900
Bit sample from 822 feet is clay, waxy dark-brown and blue-green. One pocket of fine angular quartz sand is present.		
Bit sample from bottom of hole at 900 feet is clay, dark-gray carbonaceous; some thin layers of fine angular quartz sand and pyrite nodules. Much dark-green glauconite is present.		

TEST HOLE 5

Altitude: 211.4 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and clayey *subsoil*	14	14
Sandy clay; brown from oxidized iron	7	21
Meridian sand member, Tallahatta formation		
Sand; medium in upper portion grading down to coarse at the base; grit at 54 to 58 feet. Nearly pure gray angular to subrounded clear and frosted quartz; some lignite, very minor white mica, pyrite, and magnetite	56	77
Undifferentiated upper Wilcox series		
Clay and thin beds of medium sand; abundant white mica; minor pyrite	35	112
Sand, medium angular quartz, and thin beds of shale (kaolinitic?); contains white mica, a few flakes of lignite, and crystals of pyrite. The grain sizes increase slightly at the base	34	146
Sandy clay, gray and micaceous; white, blue, and black mica; abundant grains of medium angular quartz sand	22	168
Sand, heterogeneous quartz; mostly medium and fine grains; numerous clay and micaceous fragments, some lignite	20	188
Holly Springs formation (?), Wilcox series		
Clay; no sample because it was suspended in drilling mud	21	209
Lignite and *sandy shale;* light-gray and blue-green, some pyrite	21	230
Sandy shale, gray and carbonaceous	16	246
Clay; no sample because it was suspended in drilling mud	7	253
Sandy shale, gray and gray-green slightly carbonaceous	10	263
Shale, gray carbonaceous	11	274
Sandy shale, gray light-green carbonaceous; several grains of light-gray clay (kaolinite?)	10	284
Shale, soft gray-green and gray	13	297
Shale, soft; and thin beds of gray carbonaceous sandy shale, and light-green friable siltstone; some lignite	79	376

Sandy shale, gray and blue-green; slightly carbonaceous....	6	382
Shale, gray and brown; some silt	11	393
Basal sand member, Holly Springs formation		
Sand, fine angular quartz; minor mica; several clay pellets resembling kaolinite	22	415
Shale or *clay;* no sample because it was suspended in drilling mud	7	422
Sandy shale, gray-green and brown; numerous angular quartz grains	6	428
Shale, gray and green	12	440
Sand, medium to fine green-gray; many shale fragments and numerous grains of opaque minerals	30	470
Sandstone, soft shaly	1	471
Sand, fine green-gray; many shale fragments and numerous grains of opaque minerals	18	489
Sandstone, soft fine-grained slightly calcareous	2	491
Sand, fine angular quartz; numerous clay and opaque mineral fragments	14	505
Ackerman formation, Wilcox series		
Clay, gray and lignitic	53	558
Clay, gray and lignitic; some calcareous cement	22	580

TEST HOLE 6

Altitude: 231.0 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and *sandy subsoil*, brown and yellow	14	14
Meridian sand member, Tallahatta formation		
Sand, coarse, fine gravel, grit, and clear subangular quartz, slightly frosted; a few fragments of oolitic fossiliferous nearly clear quartzite. The sand grains are mostly clear and subangular, but a few grains are frosted and rounded. Rare grains of kaolinite and kyanite; very minor white mica and secondary pyrite	66	80
Undifferentiated upper Wilcox series		
Clay, gray and silty; several fragments of lignite and a few fragments of thin-bedded nearly black carbonaceous shale. Some fine-grained disseminated pyrite	24	104
Sand, coarse; similar to the overlying Meridian sand from which it cannot be distinguished in the sample	8	112
Shale and *sandy shale*, gray and brown-gray carbonaceous; much fine white mica; numerous fragments of lignite	58	170
Sandy shale and *shale*, gray and brown-gray carbonaceous and slightly calcareous. A few grains of glauconite and much white mica; thin-bedded fine angular quartz sand; numerous fragments of lignite	78	248

Shale and *sandy shale*, gray and green; non-calcareous and only slightly lignitic	32	280
Basal sand member, Holly Springs formation		
Sand, very fine evenly-grained angular quartz; mica, glauconite, and unidentified micaceous clay minerals. Rock reported at 305 feet (1 inch thick) and 315 feet (3 inches thick) is apparently calcareous-cemented sandstone	38	318
Sandy shale, green, gray, and brown; non-calcareous but glauconitic and micaceous; no lignite	34	352
Sand, fine evenly-grained quartz; minor opaque minerals and white mica; very minor glauconite and pyrite. Fragments of gray and brown sandy shale suggest that thin beds of argillaceous-cemented sand is present in this sand	42	394
Shale or *sandy shale*	3	397
Sand, medium and fine, angular and subrounded quartz; numerous coated grains, apparently smoky quartz, causing sand to have a dark appearance	45	442
Ackerman formation, Wilcox series		
Sandy shale or *shaly sand*. The sand is similar to the overlying sand, but the interstices are filled with clay minerals	8	450
Sandy and *sandy shale*, gray and brown lignitic. Part of light-gray shale seems kaolinitic	25	475

TEST HOLE 7

Altitude: 204.6 feet — Driller: Layne Central Company

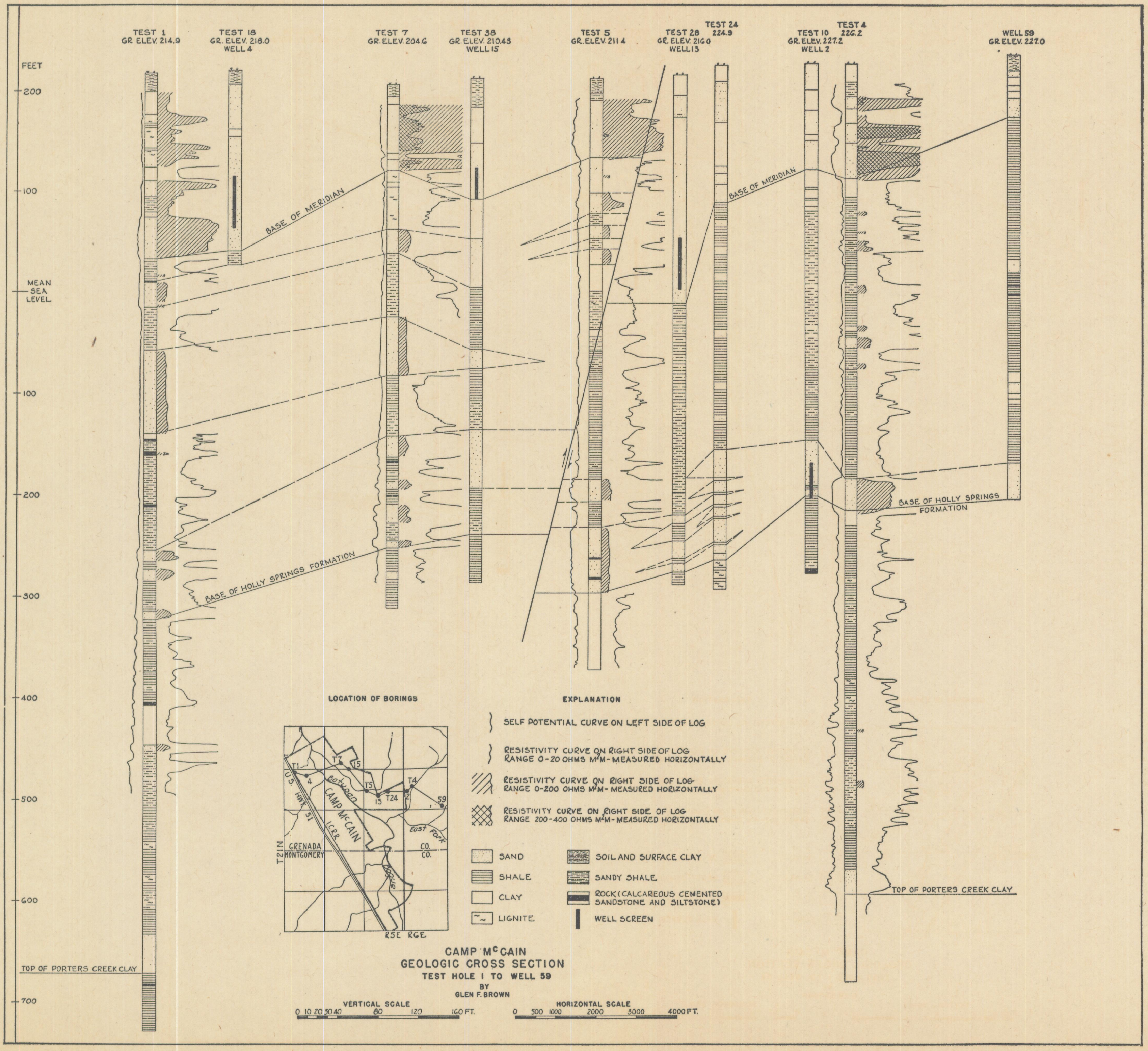
	Thick. feet	Depth feet
Soil and *sandy subsoil*, brown and yellow	12	12
Basic City shale member, Tallahatta formation		
Clay, sandy yellow and gray-green	8	20
Meridian sand member, Tallahatta formation		
Sand, poorly sorted; a few grains are fine but most are coarse; grit is also present. Many of the sand grains are exceedingly sharp and angular. This sample contains a few flakes of gray thin-bedded clay shale	48	68
Clay, gray slightly carbonaceous	6	74
Sand, poorly sorted angular quartz; minor white mica and pyrite	10	84
Undifferentiated upper Wilcox series		
Clay, gray carbonaceous; minor lignite; drilled with difficulty	12	96
Sand or *sandy shale*	5	101
Clay and *lignite;* no sample because it was suspended in the drilling mud	41	142
Sand, fine angular quartz; contains numerous grains of green and black mica, glauconite, and opaque minerals	24	166
Sandy shale, gray-green slightly calcareous and glauconitic	27	193
Sandy shale, as above, but containing more sand	35	228

Sand, fine to medium dark-colored; composed of angular quartz, glauconite, and various micaceous minerals. Many of the quartz grains are coated and stained	58	286
Shale, gray-green; some gray and brown sandy shale	32	318
Sandy shale, gray and green-gray; possibly some thin beds of sand, increasing toward the base; a little glauconite, but much lignite	27	345
Sand, fine to medium, sandy shale; angular clear and cloudy quartz, white and colored mica, and clay minerals. The middle of the section appears to be sand on the electrical log; the sandy shale above and below appears to be gradational into the sand	21	366
Sandy shale and *shale*, light-gray and dark-gray carbonaceous	4	370
Sandstone, calcareous-cemented	1	371
Sandy shale and *shale*, light-gray and dark-gray carbonaceous	19	390
Sand, medium angular quartz	7	397
Shale, brown and gray slightly carbonaceous	5	402
Limestone, sandy glauconitic	2	404
Shale, gray carbonaceous	8	412
Sand, fine gray; nearly all angular clear quartz; very minor dark mica, pyrite, and magnetite	18	430
Ackerman formation, Wilcox series		
Sand, fine angular quartz; minor white mica	25	455
Shale and *sand;* the shale is light-gray, dark-gray and brown; the sand is fine angular quartz and contains grains of clay minerals	58	513

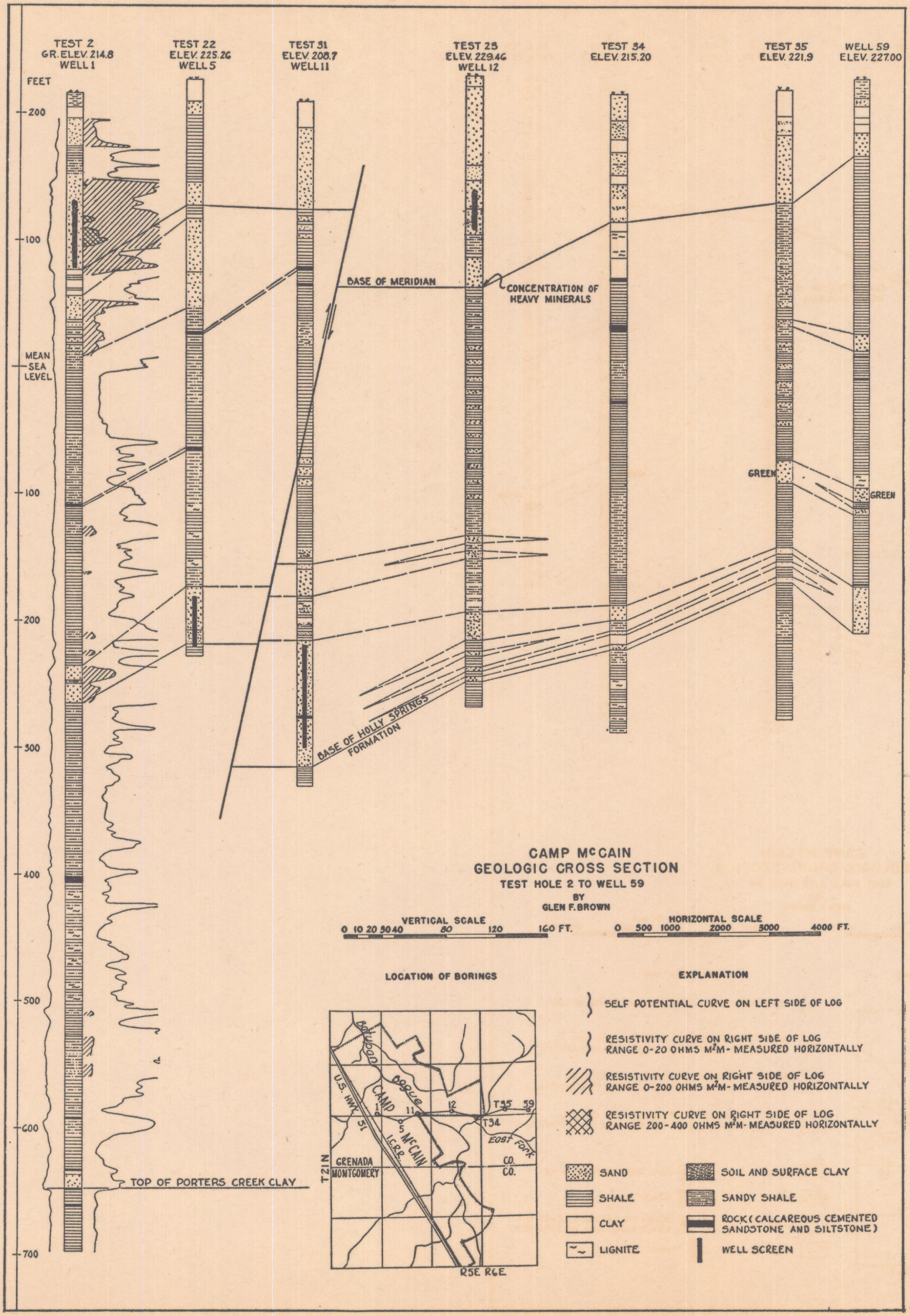
TEST HOLE 8

Altitude: 221.3 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and *sandy subsoil*, brown	15	15
Basic City shale member (?), Tallahatta formation		
Sandy clay, yellow; much iron stain	5	20
Meridian sand member, Tallahatta formation		
Sand, coarse and medium angular clear quartz; minor pyrite and magnetite near the base	40	60
Sand, fine angular clear quartz; minor white mica and opaque minerals; very minor pyrite and brown tourmaline (?); some thin beds of shale reported by the driller	26	86
Sand, coarse angular to subrounded clear and frosted quartz; minor pyrite	4	90
Undifferentiated upper Wilcox series		
Shale and *sandy shale*, dark-green and gray. Numerous hard slightly calcareous botryoidal concretions are distinctive, averaging about 1 mm. in diameter	20	110



CAMP McCAIN
GEOLOGIC CROSS SECTION
TEST HOLE 1 TO WELL 59
BY
GLEN F. BROWN


TEST 2
GR. ELEV. 214.8
WELL 1
TEST 22
ELEV. 225.26
WELL 5
TEST 31
ELEV. 208.7
WELL 11
TEST 25
ELEV. 229.46
WELL 12
TEST 34
ELEV. 215.20
TEST 35
ELEV. 221.9
WELL 59
ELEV. 227.00
FEET
200
100
MEAN SEA LEVEL
100
200
300
400
500
600
700
BASE OF MERIDIAN
CONCENTRATION OF HEAVY MINERALS
GREEN
GREEN
BASE OF HOLLY SPRINGS FORMATION
TOP OF PORTERS CREEK CLAY
CAMP McCAIN
GEOLOGIC CROSS SECTION
TEST HOLE 2 TO WELL 59
BY
GLEN F. BROWN
VERTICAL SCALE
0 10 20 30 40 80 120 160 FT.
HORIZONTAL SCALE
0 500 1000 2000 3000 4000 FT.
LOCATION OF BORINGS
U.S. HWY. 51
I.C.R.R.
CAMP McCAIN
East Fork
T21N
GRENADA
MONTGOMERY
CO.
CO.
R5E R6E
EXPLANATION
SELF POTENTIAL CURVE ON LEFT SIDE OF LOG
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-20 OHMS M²M- MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-200 OHMS M²M- MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 200-400 OHMS M²M- MEASURED HORIZONTALLY
SAND
SHALE
CLAY
LIGNITE
SOIL AND SURFACE CLAY
SANDY SHALE
ROCK (CALCAREOUS CEMENTED SANDSTONE AND SILTSTONE)
WELL SCREEN

Sandy shale, gray, brown; numerous concretions as above; lignite	24	134
Shale and *sandy shale*, light-gray, brown, and black; abundant lignitic fragments	54	188
Sand, very fine angular quartz	8	196
Shale and *lignite*. The shale is gray and brown, mostly carbonaceous; some light-green fragments contain rounded grains of dark-green glauconite	41	237
Sandy shale, light-gray slightly calcareous	11	248
Shale, gray and brown, slightly carbonaceous	20	268
Basal sand member, Holly Springs formation		
Sand, fine angular quartz; clear and coated, minor white and black mica and other minerals	149	417
Sandy shale and *lignite*. The shale is brown and gray and carbonaceous. The lignite is fibrous and black	9	426
Sand, medium and fine angular quartz; minor opaque minerals, shale fragments, and mica	10	436
Ackerman formation, Wilcox series		
Shale and *sandy shale*, gray and brown carbonaceous	20	456
Sand, medium and fine subrounded to subangular quartz; numerous opaque grains	6	462
Shale and *sandy shale*, brown, green, and gray. The sandy shale is gray-green and slightly glauconitic	50	512

TEST HOLE 9

Altitude: 212.9 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and *subsoil*, yellow, brown sandy	7	7
Basic City shale member, Tallahatta formation		
Sand; grit and coarse sand at the top; angular clear quartz; thin beds of gray shale. Numerous large rounded grains of frosted and milky quartz at the top	24	31
Shale, gray carbonaceous light-brown; few flakes of lignite and thin strata of sand similar to the overlying sand. Minor white mica and pyrite are present. The light-brown shale is evenly textured and kaolinitic	47	78
Meridian sand member, Tallahatta formation		
Sand, medium to coarse angular to subrounded quartz; minor white mica and pyrite	51	129
Undifferentiated upper Wilcox series		
Shale, gray lignitic; abundant coarse white mica in sheets	44	173
Sandy shale, green-gray; fine angular quartz; white mica and glauconite imbedded in gray soft matrix	10	183
Sand, medium to fine angular quartz; numerous grains of opaque and micaceous minerals; abundant dark-green glauconite	16	199

Sandy shale, soft gray slightly carbonaceous; containing grains of light-green glauconite; considerable clear and colored mica	2	201
Sandy shale and *lignite;* the shale is light-gray slightly glauconitic brown carbonaceous	28	229
Shale, gray and brown slightly carbonaceous; some fine light-gray sandy shale	33	262
Sandstone and *siltstone*, calcareous-cemented	2	264
Shale, brown and gray slightly carbonaceous	9	273
Shale, soft gray; some thin beds of calcareous-cemented sandstone	22	295
Shale, gray carbonaceous silty; brown-black lignite	64	359
Sandy shale, gray and green-gray; grains of quartz, white mica, and glauconite	22	381
Sandy shale and thin beds of fine angular quartz sand	9	390
Basal sand member, Holly Springs formation		
Sand, fine angular quartz; a few black opaque grains; some slightly calcareous sandy shale	12	402
Shale, soft dark-gray carbonaceous; some sandy shale and much lignite	4	406
Sand, fine to medium angular quartz; a few opaque and numerous cloudy translucent grains	21	427
Ackerman formation, Wilcox series		
Shale, gray soft carbonaceous; much lignite; some fragments are light gray, possibly kaolinitic; a little pyrite but no glauconite	85	512

TEST HOLE 10

Camp McCain A-2
Altitude: 227.2 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Sand, coarse, and grit; angular to subrounded, clear and milky quartz; minor iron stain; alluvial sand, derived mostly from the Meridian formation	26	26
Clay; no sample because it was suspended in the drilling mud	20	46
Meridian sand member, Tallahatta formation		
Sand, coarse; some grit; angular to subrounded quartz; minor pyrite and transparent mineral with rectangular cleavage; much yellow iron stain	24	70
Clay, light-gray	6	76
Sand, light-gray medium to coarse, clear and frosted quartz; minor white mica and pyrite. Some books of nearly opaque micaceous gray mineral, probably kaolinite. The lower part of the sand is finer than the upper part	28	104

Undifferentiated upper Wilcox series		
Clay and *soft shale*, gray carbonaceous; minor lignite; some light-green siltstone	36	140
Sand, fine coated quartz; numerous opaque grains	5	145
Sandy shale, green-gray non-calcareous. The grains are angular clear quartz, glauconite, dark mica, and pyrite; some flakes of lignite are present at 194 feet	71	216
Sandy shale, as above, but containing thin strata of calcareous sandy clay shale	22	238
Shaly sand, fine angular quartz; glauconite, micaceous minerals; numerous opaque grains, some lignite near the base	57	295
Sandy shale and *shale*, gray, green-gray, and brown; more sandy at the base; minor lignite	75	370
Basal sand member, Holly Springs formation		
Sand, medium to fine; light-gray angular clear and milky quartz; minor calcareous cement and opaque minerals; thin strata of gray clay shale	20	390
Sand, medium light-gray angular, sharp quartz; minor opaque grains	24	414
Shale, soft gray, brown, and green; some carbonaceous and lignitic flakes	4	418
Sand, medium light-gray; angular sharp quartz and minor opaque grains	7	425
Ackerman formation, Wilcox series		
Shale, gray and brown slightly carbonaceous; also abundant green sandy shale which is glauconitic; very minor light-gray slightly glauconitic, calcareous-cemented sandstone	71	496
Sandstone, calcareous-cemented	4	500

Test hole 11

Altitude: 219.8 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Soil, *subsoil*, and *sandy clay*, yellow, brown, and gray; medium sand at the base	20	20
Basic City shale member, Tallahatta formation		
Sand, coarse; thin strata of light-tan clay shale	21	41
Meridian sand member, Tallahatta formation		
Sand, coarse; grit, subangular to subrounded, clear and frosted quartz; medium-grained in the lower third, but coarse at the base; abundant white mica, small amounts of pyrite and magnetite. The pyrite is clearly secondary and cements quartz grains	54	95

Undifferentiated upper Wilcox series		
Shale, dark-gray silty; minor lignite	25	120
Sand, fine angular quartz; thin strata of gray clay shale	36	156
Sand, fine; mostly clear angular quartz; minor glauconite; much contamination from the overlying Meridian sand	12	168
Shale or *clay*, light-gray	10	178
Sand, gray fine; the numerous dark-gray, nearly black, grains are shale or opaque quartz, the size of the clear angular quartz; drilled hard	19	197
Shale, clay, and *lignite.* The shale is gray and brown, slightly silty, and carbonaceous	20	217
Sandy shale, light-gray and gray; slightly calcareous and carbonaceous. The driller reports boulders	21	238
Sandy shale and *sand.* The green-gray sand is composed of fine evenly-grained angular quartz, micaceous and opaque minerals, and glauconite. The sample contains many dark fragments of sandy shale	22	260
Sand, fine to medium, subangular to angular quartz; kaolinite (?), white and colored mica. A small amount of glauconite is in dark-green pellets showing irregular expansion cracks; numerous black opaque grains	58	318
Holly Springs formation (?), Wilcox series		
Shale, gray and brown; essentially non-marine; contains much lignite; a few grains of calcareous light-gray silty sand are present. A few fragments of light-gray shale are slightly calcareous	81	399
Sandstone, calcareous-cemented; no glauconite in the sample	1	400
Shale, light-gray and dark-gray and brown slightly calcareous; considerable lignite	22	422
Basal sand member, Holly Springs formation		
Sand, fine to medium, angular to subangular clear quartz. The sand is light gray and contains very minor opaque minerals	14	436
Shale, dark-gray carbonaceous	2	438
Sand, fine to medium, angular to subangular clear quartz; minor white mica	10	448
Ackerman formation, Wilcox series		
Shale and *sandy shale*, gray brown non-calcareous; much lignite	28	476
Sand, fine and very fine gray angular quartz; colored mica and other clay minerals	21	497
Shale, gray, brown, and green-gray. Some lignite; the light-gray sandy shale is slightly glauconitic	22	519

TEST HOLE 12

Altitude: 233.3 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Soil, sandy subsoil, and *clay,* yellow and brown	12	12
Tallahatta formation, Claiborne series		
Clay and *sand.* The clay is light gray, nearly hard enough to be described as a shale. The sand is coarse; contains a few grains of grit size; subrounded to subangular, white and clear quartz. The base is medium sand	40	52
Sand, medium to coarse, angular and subrounded quartz; minor white mica; some shale and lignite fragments near the base	58	110
Undifferentiated upper Wilcox series		
Shale and *sandy shale;* light-gray near the top, becoming increasingly darker and more carbonaceous downward; a little lignite	39	149
Shale, light-gray and green-gray slightly silty and sandy	11	160
Siltstone, light-gray nearly white calcareous	1	161
Shale, soft green-gray and brown; *sandy shale,* light-gray-green slightly glauconitic and hard	45	206
Limestone, sandy light-gray and tan slightly glauconitic	2	208
Shale and *sandy shale,* light-gray to medium-gray and gray-green; abundant lignite at 237-258 feet, but flakes in all the samples; calcareous, sandy shale near the base. The sample contains several compound crystals of pyrite 1 mm. in diameter	113	321
Sandy shale, gray-green; grains of angular quartz, glauconite, and light-gray clay in a dark-gray clay matrix	15	336
Basal sand member, Holly Springs formation		
Sand, fine to medium gray-green angular quartz; clear and coated; grains of light-gray clay fragments, mica and minor glauconite; a few of the grains are blue-green shale fragments and black opaque grains	50	386
Sand, fine to medium gray-green angular to subrounded quartz; numerous grains of clay minerals and a few dark opaque grains	11	397
Limestone, calcareous-cemented; similar to the sand above and below	1	398
Sand, fine to medium gray-green angular to subrounded quartz; numerous grains of clay minerals and a few dark opaque crystals; very minor dark mica	36	434
Ackerman formation, Wilcox series		
Shale, dark-gray and brown; lignitic; some sandy shale	16	450
Shale, soft carbonaceous; lignite	22	472

TEST HOLE 13

Altitude: 229.0 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Soil, subsoil, and *sandy clay,* brown and yellow	13	13
Basic City shale member, Tallahatta formation		
Sand, medium to coarse angular and milky quartz; thin beds of gray and yellow *clay;* a few grains of glauconite and white mica	34	47
Sand, coarse angular to subrounded clear and milky quartz; minor white mica; secondary pyrite	38	85
Clay; no sample because it was suspended in drilling mud	3	88
Sand, coarse; and grit; subrounded to subangular clear and milky quartz; minor secondary pyrite and white mica; very minor black tourmaline	11	99
Clay; no sample because it was suspended in drilling mud	3	102
Sand, medium to fine; similar to the overlying sand; abundant secondary pyrite	12	114
Shale and *sandy shale,* light-gray, dark-gray, and brown; some lignite; medium-gray slightly carbonaceous tough sandy shale at the base	49	163
Meridian sand member, Tallahatta formation		
Sand, medium light-gray angular to subrounded quartz; very minor magnetite and secondary pyrite; driller reports that this sand cuts satisfactorily	25	188
Undifferentiated upper Wilcox series		
Shale, soft green-gray slightly sandy; lignite	67	255
Limestone, light-gray speckled sandy	2	257
Shale, hard; brown and lignitic near the top; blue-green and slightly calcareous at the base	49	306
Sandstone, calcareous-cemented light-gray slightly glauconitic; numerous light-gray grains, possibly kaolinitic	4	310
Sandy shale, uniformly gray slightly calcareous and glauconitic, slightly carbonaceous	98	408
Basal sand member (?), Holly Springs formation		
Sandy shale; more sandy than above; gray and carbonaceous, non-calcareous; a little lignite and nearly black mica	66	474

TEST HOLE 14

Camp McCain A-3

Altitude: 233.7 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, ferrous yellow and brown	12	12
Basic City shale member, Tallahatta formation		
Sand, fine to medium clear and frosted, subrounded, angular and subangular quartz grains; also some yellow and brown clay, ferrous	29	41

Clay; small amounts of brown and yellow ferrous grains which are medium clear and frosted subrounded and angular; some lignite	9	50
Meridian sand member, Tallahatta formation		
Sand, coarse clear and frosted subrounded and angular; some lignite	35	85
Sand, coarse medium clear and frosted angular and subrounded; some lignite	23	108
Undifferentiated upper Wilcox series		
Shale, clay; green-gray; lignite and muscovite; minor fine sand, fine to very fine, subrounded and angular grains, frosted and clear; green-gray shale, white mica, and lignite	20	128
Rock; not identified	1	129
Shale, carbonaceous and micaceous; very fine greensand, subangular and rounded grains, frosted and clear	21	150
Sand and *shale.* The sand is very fine to medium subrounded and angular clear and frosted. The shale is green-gray and lignitic; minor mica. The samples are more shaly as they grade downward; the last 20 feet are almost entirely green and gray shale. Large and small sand grains are also present	87	237
Shale and *sand.* The shale is green and gray; the sand is fine with a few coarse grains, subrounded clear and frosted. Contains minor pyrite and mica. The last 40 feet include less sand and more shale	71	308
Basal sand member, Holly Springs formation		
Sand, fine, clear and frosted, angular, subangular, and subrounded; green and gray shale with minor lignite and mica	19	327
Sand, fine, clear and frosted, angular, subangular, and subrounded; green, gray, and light-green shale with minor lignite and mica	18	345
Sand, fine to medium, angular, subangular, and subrounded; green shale and minor lignite	62	407
Sand, fine, medium, and coarse, angular, subangular, and subrounded; minor shale and lignite	24	431
Ackerman formation, Wilcox series		
Shale	18	449

TEST HOLE 15

Camp McCain A-9

Altitude: 231.6 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Soil, subsoil, and *sandy clay,* gray and brown; numerous limonitic nodules	15	15

Tallahatta formation, Claiborne series		
Sand and *shale;* the sand is medium to coarse angular quartz, a few grains are rounded and frosted; the shale is dark gray slightly carbonaceous and blue gray (Tallahatta); minor pyrite and white mica..................	26	41
Sand, coarse, and grit. The sand is quartz, angular to rounded; some grains are translucent and somewhat opaline. Minor secondary pyrite, white and dark mica, and opaque minerals	4	45
Clay and a few flakes of gray-brown slightly carbonaceous *shale*	17	62
Clay and *sand.* The clay is gray slightly lignitic; the sand is medium to fine quartz; the sample contains white mica, minor pyrite, and numerous grains of kaolinitic material	38	100
Sand, medium to coarse angular quartz; much secondary pyrite	8	108
Clay: thin strata of medium sand; much secondary pyrite; a few opaque grains and numerous fragments of white mica	12	120
Undifferentiated upper Wilcox series		
Shale and *sandy shale,* gray carbonaceous; the sandy shale contains granules of light-brown shale and glauconite....	51	171
Shale and *lignite;* some sandy shale, dark-gray............	21	192
Shale, lignite, and *sandy shale,* dark-gray; small amount of light-blue gray shale..............................	37	229
Sandstone, calcareous-cemented light-brown and gray	1	230
Shale, soft light-gray; a few flakes are light-blue-gray....	27	257
Shale and *sandy shale;* possibly thin strata of fine angular quartz sand. The shale is brown and light gray, nearly white; some fragments are nearly black. The sandy shale is light gray and contains much silt..................	27	284
Basal sand member (?), Holly Springs formation		
Sand, fine angular uniform transparent to coated quartz; a salt and pepper appearance is due to numerous opaque grains	17	301
Sand, medium to fine angular translucent quartz; very minor pyrite and green mica; numerous opaque grains and several fragments of clay minerals.................	53	354
Shale, brown slightly carbonaceous.....................	3	357
Sand and thin strata of dark-gray nearly black *clay shale.* The sand is medium to fine angular quartz............	21	378
Sand; medium to coarse at base; angular to subangular clear and translucent quartz; minor pyrite and very few opaque grains at base..................................	79	457
Ackerman formation, Wilcox series		
Sandy shale, medium to light-gray.......................	6	463

Sandstone, calcareous-cemented light-gray, nearly white; angular quartz and a few opaque grains but no apparent glauconite	2	465
Sandy shale, medium to light-gray	25	490
Sand and *sandy shale*, dark. The sand is fine, mostly angular quartz, but numerous opaque micaceous and clayey grains give a dark appearance	19	509
Sand, fine angular quartz; micaceous and opaque grains	6	515
Shale, brown and gray slightly carbonaceous, slightly micaceous; some sand in samples is light-gray medium to fine quartz	37	552
Shale; as above, but lignitic	18	570
Sand, very fine to fine angular slightly coated quartz	8	578
Sandstone, calcareous-cemented	2	580
Sand, fine dark-gray; thin strata of boulders, angular quartz, and numerous opaque grains	10	590
Rock, not identified	0.5	590.5
Sand, fine; thin strata of boulders; jagged quartz, dark-gray; numerous opaque minerals	5.5	596
Sand, fine dark-gray; jagged quartz; numerous opaque grains including glauconite	46	642
Gumbo	6	648
Rock, not identified	1	649
Shale, dark-gray; thin strata of fine angular quartz sand; some lignite at 661 to 682 feet	55	704
Shale and thin strata of *sandy shale*. The shale is brown gray, blue gray, and very light gray (possibly kaolinitic); the sandy shale is the same, imbedded with a very fine angular quartz. The color is light gray compared to the overlying dark-gray sands and shale	22	726

Test hole 16

Camp McCain A-7
Altitude: 222.2 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Sand, *clay*, and some *soil*	9	9
Meridian sand member, Tallahatta formation		
Sand and thin beds of *clay*. The sand is coarse, contains numerous grains of milky quartz and a few brown grains; very little iron stain	49	58
Clay; the sample was suspended in the drilling mud	6	64
Sand, medium angular quartz and chert; a salt and pepper appearance; minor pyrite; a few grains of gypsum; slightly smaller-grained near the bottom; some secondary pyrite as cement	59	123

	Thick. feet	Depth feet
Undifferentiated upper Wilcox series		
Clay, light-gray micaceous finely interbedded; one flake of lignite	32	155
Sand and thin beds of lignite (reported by the driller)	22	177
Holly Springs formation (?), Wilcox series		
Shale and *lignite*. The shale is light gray, dark gray, and brown, non-calcareous but carbonaceous	81	258
Sandstone, calcareous-cemented	1	259
Shale; as above, except much light-gray kaolinitic clay near the base	38	297
Shale, light-gray and dark-gray carbonaceous; light-gray sandy shale	17	314
Shale, dark-gray and light-gray; also brown and carbonaceous; non-calcareous	7	321
Sandstone, calcareous-cemented light-brown slightly glauconitic	2	323
Shale or *clay*, gray very slightly carbonaceous; thin laminae of fine angular quartz sand	75	398
Sandstone, calcareous-cemented; much glauconite	2	400
Basal sand member (?), Holly Springs formation		
Sandy shale; fine angular quartz and much mica; slightly calcareous some grains resemble glauconite; numerous opaque grains	57	457
Ackerman formation, Wilcox series		
Shale, gray and light-gray slightly carbonaceous	16	473

TEST HOLE 17

Altitude: 210.38 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, sandy	10	10
Tallahatta formation, Claiborne series		
Sand and thin strata of *clay*	37	47
Clay and thin strata of *sand*	47	94
Sand, fine	28	122
Undifferentiated upper Wilcox series		
Shale, carbonaceous; minor lignite	32	154
Rock, probably calcareous-cemented sandstone, siltstone, or limestone	1	155
Shale and thin strata of *sand*	13	168
Sandy shale	32	200
Shale and thin strata of *sand;* lignite present to 278 feet	109	309
Sand, fine muddy	15	324
Shale, hard; sandy layers; some calcareous cement	38	362
Sandy shale and *shaly sand*	37	399
Basal sand member, Holly Springs formation		
Sand	11	410

Ackerman formation, Wilcox series		
Shale, soft; thin strata of fine sand; lignite	45	455
Shale, soft; minor glauconite and green mica	45	500

TEST HOLE 18

Camp McCain A-4
Altitude: 218.04 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Sandy clay	14	14
Basic City shale member, Tallahatta formation		
Sand, coarse; typical Meridian-type and thin strata of *clay*	35	49
Sand, coarse; driller reports the sample cuts well	9	58
Clay	8	66
Meridian sand member, Tallahatta formation		
Sand, fine	17	83
Sand; a small amount of muscovite and staurolite	22	105
Sand, coarse; minor muscovite and staurolite	43	148
Sand, fine	30	178
Undifferentiated upper Wilcox series		
Sandy shale and gray *clay shale*	14	192

TEST HOLE 19

Camp McCain A-10
Altitude: 224.86 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and *subsoil*, yellow and brown	10	10
Clay, yellow and gray; interbedded loose to fine quartz sand which is white; minor white mica	22	32
Meridian sand member, Tallahatta formation		
Sand; as above; minor gray *clay*, only a few grains in sample. A few yellow translucent grains may be tourmaline	15	47
Sand, coarse angular to subrounded quartz; minor mica, magnetite, pyrite; slightly smaller-grained near the base	40	87
Clay, dark-gray micaceous	3	90
Sand, fine gray quartz; abundant pyrite and magnetite	13	103
Sand, fine to very fine angular gray quartz; minor pyrite and magnetite	15	118
Sand, medium to coarse quartz; as above; grain size slightly larger at base	61	179
Undifferentiated upper Wilcox series		
Rock, unidentified	1	180
Shale, gray, green-gray, and brown; much pyrite and a green glauconitic mineral; numerous carbonaceous flakes and some lignite near depths of 237 and 280 feet; thin beds of		

fine angular quartz sand and silt; some kaolinitic clay near 259 feet	108	288
Sand, gray-green fine to very fine angular quartz; numerous grains of a micaceous green semi-translucent mineral; minor calcareous cement in dark sand containing nearly black glauconite	80	368
Holly Springs formation (?), Wilcox series		
Shale, green-gray, gray, and brown; minor sandy shale, some of which is calcareous	31	399
Sand, medium-gray to fine and very fine angular quartz; minor mica	9	408
Sandy shale, gray and green-gray; contains fine and very fine sand, angular quartz grains	26	434
Sand, fine and very fine angular light-gray quartz	12	446
Ackerman formation, Wilcox series		
Silt, *shale*, and *sand*, very fine gray and brown; a few glauconitic grains and numerous flakes of light-gray kaolinitic clays	69	515

Test hole 20

Altitude: 228.41 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, gray and sandy; thin strata of *sand*	16	16
Meridian sand member, Tallahatta formation		
Sand, fine; white; thin strata of *clay;* grit at base; secondary pyrite; light-gray shale	56	72
Sand, coarse; thin strata of *clay;* very minor lignite	22	94
Sand, coarse, and *grit;* milky quartz	14	108
Undifferentiated upper Wilcox series		
Shale, hard gray sandy, carbonaceous; some pyrite; top of Wilcox	38	146
Sand, medium to fine; thin strata of clay and boulders	25	171
Sand, medium; numerous opaque grains; thin strata of clay and boulders; a little glauconite	22	193
Sand, medium to coarse; much dark pyrite	16	209
Holly Springs formation (?), Wilcox series		
Sandy shale	20	229
Siltstone, soft non-calcareous	2	231
Sandy shale; much pyrite	9	240
Siltstone, hard calcareous	1	241
Shale and *sandy shale*, brown and gray, carbonaceous and lignitic; lower 20 feet non-calcareous and lignitic; much pyrite	116	357
Basal sand member, Holly Springs formation		
Sand, fine angular; sandy shale	11	368
Shale and *sandy shale*	44	412

Sand, fine; a little glauconite	13	425
Clay	5	430
Sand, fine; some *shale* fragments	12	442
Sandy shale and thin strata of light-gray *clay* minerals	11	453
Sand, fine angular quartz	7	460
Ackerman formation, Wilcox series		
Shale, lignitic; thin strata of *sand*	24	484
Siltstone, calcareous brown	1	485
Shale, hard lignitic; much light-gray kaolinitic clay shale	28	513

TEST HOLE 21

Camp McCain A-8
Altitude: 230.71 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, sandy	14	14
Basic City shale member, Tallahatta formation		
Sand and thin strata of *clay*	44	58
Clay	7	65
Meridian sand member, Tallahatta formation		
Sand	19	84
Clay	10	94
Sand, grit	10	104
Sand	25	129
Undifferentiated upper Wilcox series		
Shale and thin strata of calcareous boulders; a very little lignite	35	164
Rock, light-gray, unidentified	1	165
Shale, soft	8	173
Sand and thin strata of *shale*	28	201
Shale, lignitic; some glauconitic slightly calcareous sandstone	165	366
Basal sand member, Holly Springs formation		
Sand, shaly; numerous clay grains; a few glauconitic grains	22	388
Sand, fine, and thin strata of *shale*	18	406
Sand, light-gray; a few green grains	53	459
Ackerman formation, Wilcox series		
Shale, soft, and thin strata of fine *sand*	44	503
Rock, not identified		

TEST HOLE 22

Camp McCain A-5
Altitude: 225.26 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, sandy	16	16
Sand, fine	11	27

Basic City shale member, Tallahatta formation		
Shale, hard; some carbonaceous material	53	80
Meridian sand member, Tallahatta formation		
Sand, coarse micaceous; a little milky quartz and pyrite; fine at bottom	18	98
Undifferentiated upper Wilcox series		
Sandy shale; some kaolinite; a little glauconite and pyrite	10	108
Sand, shaly micaceous	42	150
Sand, fine	28	178
Holly Springs formation (?), Wilcox series		
Sandy shale, lignitic	17	195
Rock, calcareous, glauconitic	1	196
Sandy shale, gray; some pyrite	18	214
Sandy shale; numerous opaque gray-green grains	73	287
Sandstone, calcareous	2	289
Sandy shale and thin strata of gray-green boulders	42	331
Shale, brown carbonaceous; some lignite	50	381
Sandy shale	15	396
Basal sand member, Holly Springs formation		
Sand, light-gray; clear medium angular quartz	34	430
Sand, fine light-gray; numerous dark grains	11	441
Ackerman formation, Wilcox series		
Shale, gray and brown	9	450

Test hole 23

Camp McCain A-12
Altitude: 229.46 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, sandy	8	8
Meridian sand member, Tallahatta formation		
Sand; iron-stained near top; *grit* and coarse *sand;* thin strata of *clay;* medium sand at base	62	70
Sand, coarse, and thin strata of *clay*	12	82
Sand	22	104
Sand, micaceous	20	124
Sandy shale; fragments are slightly smaller at base; very micaceous	18	142
Sand, mostly clear angular quartz; an abundance of heavy minerals	23	165
Undifferentiated upper Wilcox series		
Sandy shale brown micaceous; a little lignite	39	204
Shale, brown and gray; thin strata of fine and very fine *sand;* some pyrite and dark mica	131	335
Sandy shale, green-gray	25	360
Sandy shale and thin strata of *sand*	60	420

Basal sand member, Holly Springs formation		
Sand, very fine gray and green; lignite at base; angular clear milky quartz	22	442
Ackerman formation, Wilcox series		
Shale, soft, and thin strata of very fine sand; angular quartz; green and gray mica; lignite	40	482
Shale, soft	12	494

TEST HOLE 24

Altitude: 224.91 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, light-gray and brown	16	16
Basic City shale member, Tallahatta formation		
Sand and thin strata of *clay;* angular to subrounded quartz, ill-sorted; much gypsum, pyrite, and staurolite	40	56
Clay, brown-gray	43	99
Meridian sand member, Tallahatta formation		
Sand, coarse	7	106
Clay and thin strata of *sand*	11	117
Sand, coarse light-gray; clear and smoky quartz and pyrite	15	132
Undifferentiated upper Wilcox series		
Shale and thin strata of fine *sand;* the shale is gray and brown; some lignite and a little green sandy shale	236	368
Sandy shale	9	377
Basal sand member, Holly Springs formation		
Sand, fine gray angular; clear, milky, and black grains of quartz	21	398
Sand, fine, and thin strata of gray and brown shale; a little lignite; some glauconite	64	462
Sand, fine, and thin strata of gray and brown *shale*	21	483
Ackerman formation, Wilcox series		
Shale, soft, and lignite	31	514

TEST HOLE 25

Altitude: 218.73 feet Driller: Layne Central Company

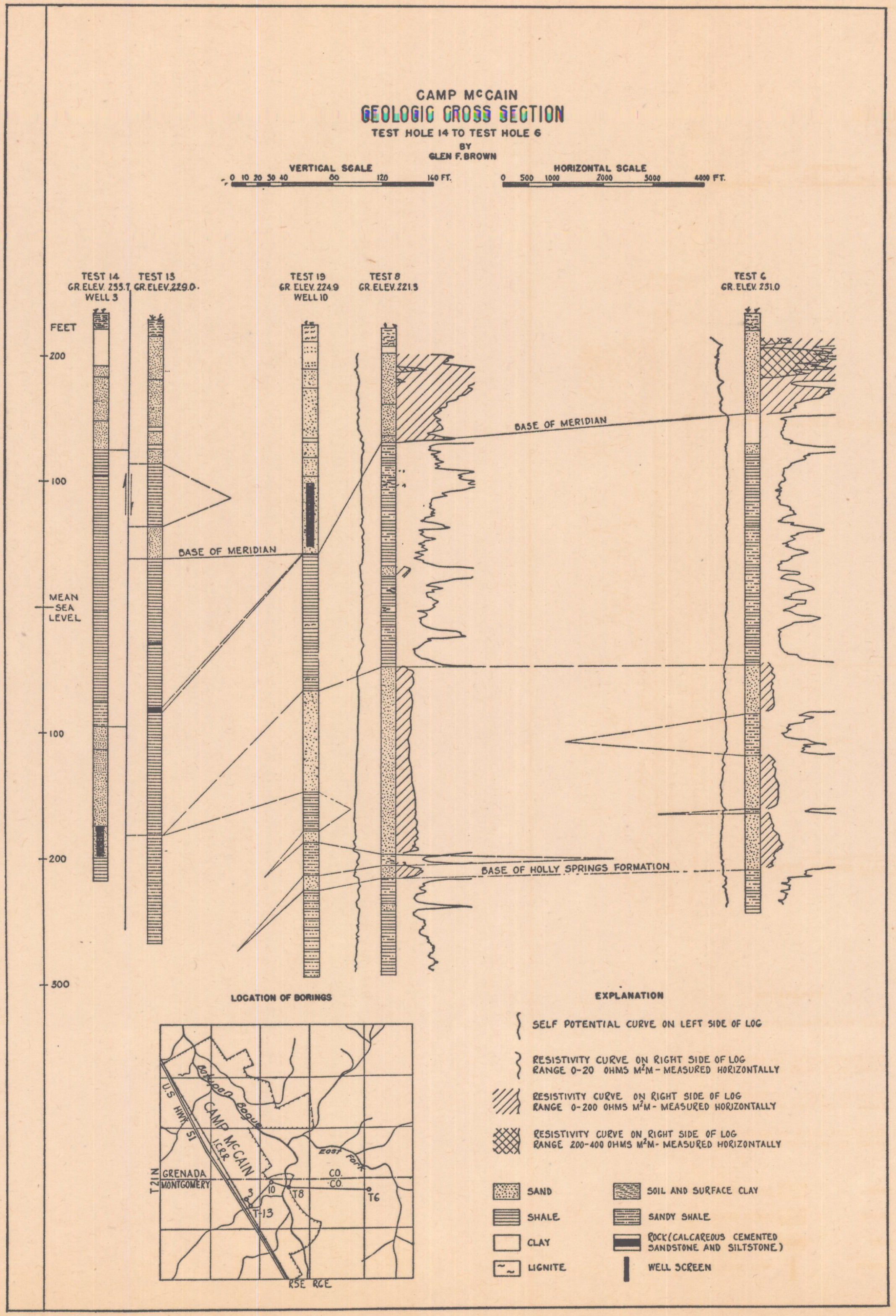
	Thick. feet	Depth feet
Clay, sandy brown; oxidized iron	8	8
Meridian sand member, Tallahatta formation		
Sand, coarse angular quartz; and thin strata of *clay*	42	50
Sand, coarse; medium at top; numerous heavy minerals at base	15	65
Clay and thin strata of *sand;* much white mica; fine sand at base	61	126

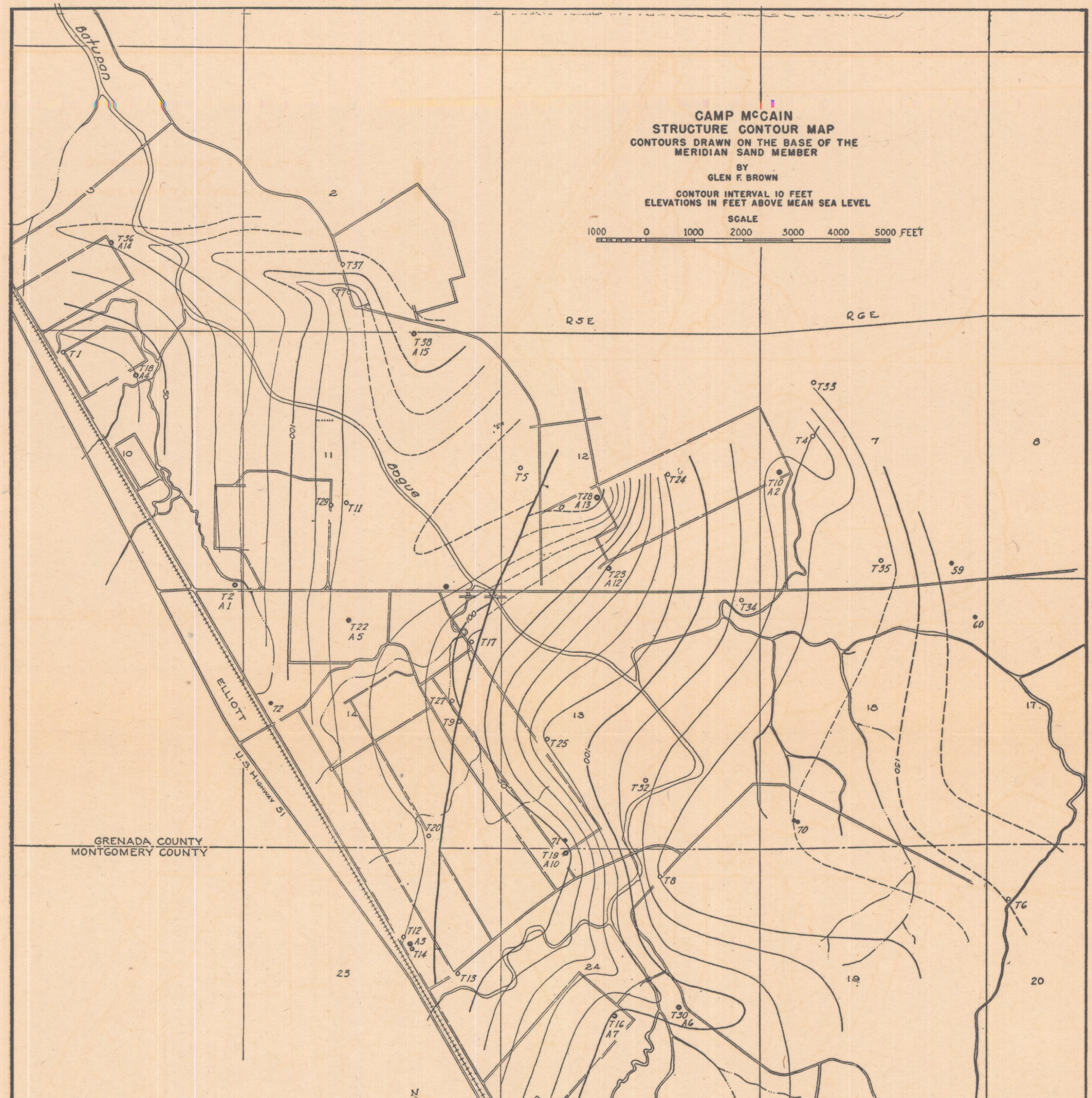
Undifferentiated upper Wilcox series		
Shale, brown carbonaceous	19	145
Sand, fine, and thin strata of *shale*, gray and brown, carbonaceous	23	168
Sandy shale, hard calcareous	67	235
Shale, green-gray non-calcareous	44	279
Shale, soft; fine angular argillaceous *sand;* abundant green shale at 319 feet; lignite and carbonaceous shale below	69	348
Basal sand member, Holly Springs formation		
Sand, very fine angular coated quartz	10	358
Shale, soft slightly calcareous; much pistachio green shale at base	42	400
Sand, fine gray angular quartz	17	417
Sandy shale	25	442
Sand, fine angular gray	11	453
Ackerman formation, Wilcox series		
Sandy shale, carbonaceous, micaceous	22	475
Sandy shale; more sand near the base	7	482
Sandy shale, fine	18	500

Test hole 26

Altitude: 224.75 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, sandy yellow	19	19
Basic City shale member, Tallahatta formation		
Sand; thin strata of gray *clay*	28	47
Clay, gray	5	52
Meridian sand member, Tallahatta formation		
Sand, coarse	33	85
Sand; fine at base	20	105
Undifferentiated upper Wilcox series		
Shale, hard brown carbonaceous	25	130
Sand, fine gray and black medium angular quartz	30	160
Shale	9	169
Sandstone, calcareous	1	170
Shale, soft gray and brown and dark-green	42	212
Sand, fine; more than half the grains are opaque	62	274
Sandstone, calcareous-cemented	3	277
Shale, soft gray	44	321
Sand, medium argillaceous; slightly glauconitic *clay*	22	343
Sandy shale, green and brown	53	396
Basal sand member, Holly Springs formation		
Sand, medium light-gray angular quartz	16	412
Clay	2	414
Sand, medium angular quartz	3	417


CAMP McCAIN
GEOLOGIC CROSS SECTION
TEST HOLE 14 TO TEST HOLE 6
BY
GLEN F. BROWN
VERTICAL SCALE
0 10 20 30 40 60 120 160 FT.
HORIZONTAL SCALE
0 500 1000 2000 3000 4000 FT.
TEST 14
GR. ELEV. 233.7
WELL 3
TEST 13
GR. ELEV. 229.0
TEST 19
GR. ELEV. 224.9
WELL 10
TEST 8
GR. ELEV. 221.3
TEST 6
GR. ELEV. 231.0
FEET
200
100
MEAN SEA LEVEL
100
200
300
BASE OF MERIDIAN
BASE OF MERIDIAN
BASE OF HOLLY SPRINGS FORMATION
LOCATION OF BORINGS
U.S. HWY 51
I.C.R.R.
CAMP McCAIN
Batupan Bogue
East Fork
GRENADA
MONTGOMERY
CO.
CO.
T21N
R5E RGE
3
10
T8
T6
T-13
EXPLANATION
SELF POTENTIAL CURVE ON LEFT SIDE OF LOG
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-20 OHMS M²M - MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 0-200 OHMS M²M - MEASURED HORIZONTALLY
RESISTIVITY CURVE ON RIGHT SIDE OF LOG RANGE 200-400 OHMS M²M - MEASURED HORIZONTALLY
SAND
SHALE
CLAY
LIGNITE
SOIL AND SURFACE CLAY
SANDY SHALE
ROCK (CALCAREOUS CEMENTED SANDSTONE AND SILTSTONE)
WELL SCREEN


CAMP McCAIN
STRUCTURE CONTOUR MAP
CONTOURS DRAWN ON THE BASE OF THE
MERIDIAN SAND MEMBER
BY
GLEN F. BROWN
CONTOUR INTERVAL 10 FEET
ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL
SCALE
1000 0 1000 2000 3000 4000 5000 FEET
R5E
R6E
Batupan
Bogue
ELLIOTT
U.S. HIGHWAY 51
GRENADA COUNTY
MONTGOMERY COUNTY
TO DUCK HILL
N
EXPLANATION
59
PRE-EXISTING FLOWING WELLS
T37
TEST HOLES INTO WILCOX SEDIMENTS
T22
A5
TEST HOLE AND WELL DEVELOPED IN HOLLY SPRINGS SAND
T35
A15
TEST HOLE AND WELL DEVELOPED IN MERIDIAN SAND
DOWN THROW ON RIGHT SIDE OF FAULT

Ackerman formation, Wilcox series		
Shale and *sandy shale*	39	456
Sand, fine dark-green and gray; numerous opaque grains; many micaceous minerals; medium to fine angular coated quartz	69	525

TEST HOLE 27

Altitude: 210.8 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, yellow and green-gray sandy	32	32
Basic City shale member, Tallahatta formation		
Sand and *clay;* some lignitic material	7	39
Clay, gray and brown; a small amount of lignitic material and sandy shale	61	100
Meridian sand member, Tallahatta formation		
Sand	8	108
Undifferentiated upper Wilcox series		
Clay, brown micaceous	25	133
Clay and boulders	1	134
Shale	23	157
Rock, not identified	1	158
Shale, gray and brown lignitic; thin strata of fine sand	106	264
Limestone, nearly white sandy	6	270
Shale, gray and brown carbonaceous	34	304
Sandy shale and *shale*, carbonaceous; thin strata of calcareous cement	30	334
Sandstone, calcareous slightly glauconitic	3	337
Basal sand member, Holly Springs formation		
Sand, fine angular quartz; numerous opaque grains; dark-green-gray sand	22	359
Shale, hard sandy calcareous	38	397
Sand, fine angular clear quartz	11	408
Clay	4	412
Sand, fine and medium angular clear quartz	12	424
Ackerman formation, Wilcox series		
Shale, carbonaceous; thin strata of medium sand	19	443
Sandstone, calcareous-cemented	2	445
Shale, soft micaceous and carbonaceous	49	494

TEST HOLE 28

Camp McCain A-13

Altitude: 216.0 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay, gray and brown sandy	20	20
Sand; thin strata of clay; typical Meridian sand and Tallahatta claystone	22	42

Meridian sand member, Tallahatta formation		
Sand, coarse; grit at base; typical Meridian sand	182	224
Undifferentiated upper Wilcox series		
Shale, brown slightly carbonaceous, and green *sandy shale;* a few grains of glauconite; some light-brown calcareous slightly glauconitic sandy shale at the base; abundantly lignitic at base	98	322
Sandy shale, gray-green, brown, and gray; minor shale and lignite; some light-brown calcareous shale between 344 and 388 feet	88	410
Sandstone, calcareous-cemented	1	411
Sandy shale, brown and gray	22	433
Basal sand member, Holly Springs formation		
Sand, medium to fine gray angular quartz	8	441
Shale or *sandy shale*	17	458
Sand, medium to fine gray angular quartz	17	475
Clay	5	480
Sand, fine argillaceous; angular quartz, and numerous opaque minerals including green mica	8	488
Ackerman formation, Wilcox series		
Shale or *sandy shale*	12	500

Test hole 29

Altitude: 220.8 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Clay and *sand*, gray; micaceous clay shale; some yellow iron stain and white quartz sand	20	20
Meridian sand member, Tallahatta formation		
Sand, medium quartz, and thin strata of gray shale	22	42
Coarse sand and *grit*	43	85
Clay and thin strata of *sand;* medium to fine but sparingly micaceous; no clay returns	22	107
Undifferentiated upper Wilcox series		
Sand and *shale*, gray and brown carbonaceous and somewhat lignitic	24	131
Limestone, gray	1	132
Shale, soft gray and fine; micaceous sandy shale; much pyrite; minor kaolinite (?) and biotite; some lignite	93	225
Siltstone, calcareous	1	226
Shale and *sandy shale*, gray and brown; calcareous at base; abundant light-gray clay minerals and green mica	47	273
Sand, medium to fine gray-green; numerous opaque and translucent grains	28	301
Holly Springs formation (?), Wilcox series		
Sand and *sandy shale*, calcareous and carbonaceous	20	321
Shale	65	386

Soft shale	47	433
Basal sand member, Holly Springs formation		
Sand, gray nearly white; medium-grained angular clear and translucent quartz; a few grains of gray chert	12	445
Ackerman formation, Wilcox series		
Soft shale	6	451
Soft shale and thin strata of *sand*	12	463
Sandstone, probably calcareous	1	464
Soft shale or *sandy shale*	37	501

TEST HOLE 30

Camp McCain A-6
Altitude: 223.3 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Sandy clay and *soil*	20	20
Meridian sand member, Tallahatta formation		
Sand and thin strata of *clay;* medium sand; a little yellow iron stain	22	42
Coarse sand and *grit;* medium at base	90	132
Undifferentiated upper Wilcox series		
Clay, gray and brown; a little lignite	60	192
Hard clay	39	231
Calcareous rock	2	233
Shale	2	235
Hard shale	26	261
Shale, gray, brown, and green; slightly calcareous; a little lignite; a few fragments of calcareous sandstone	103	364
Sandy shale, light-gray and brown; slightly calcareous	44	408
Basal sand member, Holly Springs formation		
Sand, medium to fine angular quartz; a little glauconite and calcareous cement	7	415
Sandy shale	5	420
Sand, medium to fine angular quartz; numerous opaque grains, some of which are glauconite	27	447
Ackerman formation, Wilcox series		
Sandy clay or *sandy shale*, calcareous	38	485
Shale, soft slightly calcareous	15	500

TEST HOLE 31

Camp McCain A-11
Altitude: 208.7 feet Driller: Layne Central Company

	Thick. feet	Depth feet
Clay	20	20
Meridian sand member, Tallahatta formation		
Sand; thin strata of *clay;* the sand grain size is hetero-		

geneous; a few milky subangular grains and white mica; pyrite and smaller quartz grains at the base	64	84
Undifferentiated upper Wilcox series		
Shale and thin strata of fine *sand;* a few lignitic flakes; abundant fine white mica and a little green mica	22	106
Shale, gray and brown	23	129
Rock, not identified	2	131
Shale, gray and brown	11	142
Rock, not identified	1	143
Shale	28	171
Sandy shale and *shaly sand;* numerous angular opaque grains and micaceous flakes; a little dark pyrite and lignite	21	192
Shale, hard	87	279
Sand and *shale*	22	301
Shale, green, gray, and brown; some lignite	43	344
Soft shale and thin beds of fine sand; brown-gray and green; abundant lignite	18	362
Sand, medium to fine gray; grains are angular clear quartz	4	366
Sand; thin beds of *clay;* fine angular quartz	22	388
Shale and *lignite;* thin strata of sand; gray and brown shale; some sandy shale; numerous opaque grains	22	410
Shale and thin strata of *sand*	12	422
Basal sand member, Holly Springs formation		
Sand, fine hard gray-green; numerous opaque and translucent angular grains	59	481
Sandstone or *siltstone,* calcareous	0.5	481.5
Sand, fine hard; as above; some medium sand near base	39.5	521
Ackerman formation, Wilcox series		
Soft shale; no sample because it was suspended in drilling mud	15	536

Test hole 32

Altitude: 218.8 feet — Driller: Layne Céntral Company

	Thick. feet	Depth feet
Clay, sandy brown and light-gray	22	22
Meridian sand member, Tallahatta formation		
Sand, medium to coarse	24	46
Gray clay	15	61
Sand; as above; very angular	14	75
Gray clay	8	83
Sand, medium to fine angular quartz, and thin strata of very micaceous *clay*	17	100
Undifferentiated upper Wilcox series		
Shale, carbonaceous gray and brown; a little glauconite; much pyrite	64	164
Medium sand	10	174

Shale; appearance of Meridian; probably contamination from above	82	256
Rock, gray and slightly carbonaceous; probably limestone or calcareous sandstone, brown, gray, and green; abundant lignite and pyrite	1	257
Shale, hard gray and brown lignitic and carbonaceous; some light-brown calcareous shale	137	394
Basal sand member, Holly Springs formation		
Sand, angular quartz	3	397
Sandstone, calcareous, silty	1	398
Sand, argillaceous medium to fine angular quartz; much gray clay	56	454
Ackerman formation, Wilcox series		
Sandy shale, micaceous and lignitic	46	500

TEST HOLE 33

Altitude: 228.43 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay and thin strata of *sand*, gray and tan; much iron stain	20	20
Meridian sand member, Tallahatta formation		
Sand, coarse, and thin strata of gray *sandy shale*; typical Meridian sand; grit at base	43	63
Sand, coarse, and grit; typical Meridian	22	85
Undifferentiated upper Wilcox series		
Clay and thin strata of fine angular quartz *sand*	22	107
Shale, brown carbonaceous; some white mica; thin strata of sand; small boulders	20	127
Clay; thin strata of *sand*	22	149
Sandy shale	22	171
Shale and thin strata of fine *sand*	21	192
Sandy shale, gray and green soft; minor lignite; also in-includes some light-brown glauconitic and calcareous shale	48	240
Clay and *sandy shale*, brown and green	12	252
Sandy shale, green and brown	13	265
Shale and *sandy shale*, gray, brown, and green; probably carbonaceous and lignitic	94	359
Sand	3	362
Shale	4	366
Sandy shale	6	372
Basal sand member, Holly Springs formation		
Sand, hard fine angular quartz; light-gray megascopically; several grains of milky translucent quartz; a few grains of smoky and darker quartz and other opaque minerals	42	414

	Thick. feet	Depth feet
Ackerman formation, Wilcox series		
Shale, light-brown, dark-brown, gray, and green slightly carbonaceous and calcareous; lignite	86	500

TEST HOLE 34

Altitude: 215.20 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay and *sand*	20	20
Meridian sand member, Tallahatta formation		
Sand	15	35
Clay	10	45
Sand, *clay*, and some *lignite*	18	63
Clay	7	70
Sand, micaceous coarse; some layers of *clay*	30	100
Undifferentiated upper Wilcox series		
Clay	7	107
Clay and *lignite*	21	128
Clay	16	144
Sandstone (?), calcareous-cemented	2	146
Shale (driller's term, soapstone)	35	181
Sandstone (?), calcareous-cemented	4	185
Shale (driller's term, soapstone)	20	205
Sandy shale	16	221
Shale (driller's term, gumbo)	19	240
Rock, not identified	1	241
Shale; some glauconite near base (driller's term, soapstone)	70	311
Sandy shale, brown gray carbonaceous; a little glauconite	66	377
Shale (driller's term, hard soapstone)	23	400
Basal sand member, Holly Springs formation		
Sand, fine angular quartz; numerous opaque grains	12	412
Sandy shale	8	420
Fine sand	3	423
Clay (boulders at 431 feet)	8	431
Sand, very fine angular opaque	4	435
Ackerman formation, Wilcox series		
Sandy shale; some lignite	12	447
Shale; much lignite (driller's term, gumbo)	53	500

TEST HOLE 35

Altitude: 221.9 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Clay and surface *soil*, sandy	20	20
Basic City shale member, Tallahatta formation		
Clay and thin strata of Meridian-type *sand*	15	35
Meridian sand member, Tallahatta formation		
Coarse sand and thin strata of gray *clay shale*	53	88

Undifferentiated upper Wilcox series		
Sandy shale	40	128
Sandy shale and thin strata of fine *sand;* typical Wilcox; some glauconite, dark mica, numerous opaque grains	42	170
Shale and interbedded sand and sandy shale; lignite and some glauconitic sandstone	93	263
Shale, blue and brown	27	290
Sand, light-gray medium-grained angular quartz	18	308
Shale, brown and green	50	358
Sand, argillaceous brown; numerous opaque grains	6	364
Shale, calcareous, and fine angular dirty *sand,* green and brown	22	386
Hard shale	22	408
Basal sand member (?), Holly Springs formation		
Sandy shale	20	428
Ackerman formation, Wilcox series		
Soft shale	65	493

Test hole 36

Camp McCain A-14
Altitude: 210.4 feet — Driller: Layne Central Company

	Thick. feet	Depth feet
Sandy clay	12	12
Basic City shale member, Tallahatta formation		
Sand	42	54
Shale	8	62
Meridian sand member, Tallahatta formation		
Sand	78	140
Undifferentiated upper Wilcox series		
Shale, hard	81	221
Shale, thin strata of *sand*	43	264
Hard shale	109	373
Tough clay	64	437
Fine sand	6	443
Hard clay	9	452
Basal sand member, Holly Springs formation		
Sand	12	464
Tough clay	23	487
Fine sand	14	501
Ackerman formation, Wilcox series		
Tough clay	4	505

TEST HOLE 37

Altitude: 205.6 feet | Driller: Layne Central Company

	Thick. feet	Depth feet
Soil and *subsoil*, sandy; containing limonite concretions and detrital glauconite; probably derived from upper Tallahatta and Winona greensand capping the hills to the east	17	17
Meridian sand member, Tallahatta formation		
Sand, coarse; typical Meridian; containing thin strata of gray *clay;* much secondary pyrite in the lower part....	46	63
Sand, coarse, and *grit;* much kyanite and staurolite; lignite reported by the driller..................................	51	114
Undifferentiated upper Wilcox series		
Silty shale and *sandy shale*, gray-green; containing numerous dark-green grains of a glauconitic-like mineral......	54	168
Sandy shale and *silt*, containing thin strata of clayey sand, dark-gray-green; non-calcareous; thin strata of calcareous-cemented light-gray sandy shale.......................	53	221
Sandy shale and *clayey sand*, dark-gray-green; numerous opaque minerals; distinct from above in the absence of the green glauconitic-like mineral.....................	93	314
Shale and *sandy shale;* abundant lignitic and carbonaceous material. The sandy shale is slightly calcareous; numerous light-brown calcareous fragments appear to be kaolinitic. Some fine sand was reported by the driller, but the samples contain much coarse sand, kyanite, and staurolite. This is undoubtedly contamination from the overlying Meridian sand	87	401
Shale, blue and brown-gray; thin strata of clear light-gray quartz sand	25	426
Basal sand member, Holly Springs formation		
Sand, gray fine angular clear quartz.....................	13	439
Ackerman formation, Wilcox series		
Shale, hard; *sandy shale*, gray and brown; abundant lignite	26	465
Shale and *sandy shale*, gray and brown; more lignite than the above	18	483
Rock, probably calcareous siltstone.......................	1	484

TEST HOLE 38

Camp McCain A-15

Altitude: 210.0 feet | Driller: Layne Central Company

	Thick. feet	Depth feet
Soil, *subsoil*, *clay*, and fine white micaceous *sand*..........	28	28
Meridian sand member, Tallahatta formation		
Sand, medium to fine; typical Meridian strata of *clay*......	35	63

Sand, coarse; typical Meridian; strata of carbonaceous shale and lignite; grit at base	55	118
Undifferentiated upper Wilcox series		
Clay, hard carbonaceous	39	157
Sand, clayey medium-grained gray; abundant dark mica; numerous light-gray nearly white opaque grains that may be kaolin	48	205
Shale and *sandy shale*, blue-green and brown; some grains have light-gray flakes and fresh biotite, suggesting a tuffaceous origin; a few grains are of a glauconitic-like mineral in a calcareous matrix; exceedingly abundant brown faecal pellets from 236 to 258 feet; thin strata of clayey sand	60	265
Sand, fine to medium clayey; numerous opaque grains	19	284
Sandy shale, gray-green; containing a mineral like glauconite	11	295
Shale, gray carbonaceous; some lignite at base; slightly calcareous	21	316
Silty shale, gray-green and brown; abundant lignite and slightly calcareous	28	344
Basal sand member, Holly Springs formation		
Sand, fine clayey dark-gray calcareous; remarkably uniform	57	401
Shale, carbonaceous	28	429
Sandy shale and *shale;* thin strata of light-gray fine angular sand	18	447
Ackerman formation, Wilcox series		
Shale, hard brown carbonaceous; abundant lignite; much sandy shale and silt, non-calcareous	47	494

TABLE 12

PRE-EXISTING BORINGS IN GRENADA COUNTY

No.	LOCATION	OWNER OR NAME	DRILLER	Date completed	Diameter of well (inches)	Temp. water (F.)	Depth of well (feet)	Depth to top of screen (feet)	Length of screen (ft.)	Principal water-bearing sand: Thickness (feet)	Principal water-bearing sand: Geologic horizon	Pressure head or water level: Above or below (—) measuring point (feet)	Pressure head or water level: Date of measurement	Measuring point: Above mean sea level (feet)	Measuring point: Above surface of land (feet)	Description of measuring point	Yield in g.p.m.: Pump	Yield in g.p.m.: Flow	General information
1.	At Hardy Station, SE. 1/4, SW. 1/4, Sec. 1, T. 23 N., R. 4 E.	F. C. Collins					400				Holly Springs (?)								Well 16 in Water Supply Paper 576, p. 179.
A1.	On hillside 7,200 ft. N.,1,-200 ft. E. road junction at Haserway, NW. 1/4, NE. 1/4, Sec. 23, T. 23 N., R. 5 E.	U. S. Engineers	U. S. Engineers	1942 (?)			100				Tallahatta	—54	1942(?)		279	Surface of land			Test boring for dam site.
B1.	On crest of ridge NE. 1/4, SE. 1/4, Sec. 4. T. 22 N., R. 5 E.	U. S. Engineers	U. S. Engineers	1942 (?)			111.4				Tallahatta		1942(?)	291.4	0	Surface of land			Test boring for dam site.
C30.	In small gulch 3,240 ft. N., 2,000 ft. E. road junction at Haserway, SW. 1/4, SE. 1/4, Sec. 23, T. 23 N., R. 5 E.	U. S. Engineers	U. S. Engineers	1942 (?)			85				Tallahatta	—16.5	1942(?)		202	Surface of land			Test boring for dam site.
C115.	2,280 ft. E, 5,100 ft. S. road junction at Haserway, SE. 1/4, SE. 1/4, Sec. 33, T. 23 N., R. 5 E.	U. S. Engineers	U. S. Engineers								Tallahatta	—10.7	1942(?)	176.4	0	Surface of land			Test boring for dam site.
3.	At Grenada air base army well 1, 1,930 ft. N. 50° 30′ E. well 4.	U. S. Army	Layne-Central Co.	1942	12-8	65	281.6	227	30	74	Upper Wilcox	—30.48	Oct. 28, 1942	207.47	0.4	Top of 12-inch casing on west side	200		
4.	At Grenada air base army well 3, 250 ft. N. road, SW. 1/4, NE. 1/4, Sec. 29, T. 23 N., R. 5 E.	U. S. Army	Layne-Central Co.	1942	12-8	65	276.0	222	50	66	Upper Wilcox	—22.47	Oct. 22, 1942	198.87	1.25	Top of air line	200		Depth top pump bowls, 100 ft., to lower end intake, 116 ft.
5.	A few yards NW. of Ill. Central Railroad, NW. 1/4, NE. 1/4, Sec. 28, T. 22 N., R. 5 E.	E. C. Hayward		1910	3		485				Holly Springs	5.41	Aug. 29, 1942	202	1	Top of 3-inch elbow on lead-off			
6.	200 ft. S., 150 ft. W. NE. corner NW. 1/4, Sec. 28, T. 22 N., R. 5 E.	Conn. General Life Ins. Co.	Womble and Williams	1942			3743							201		Derrick floor			Oil prospect well electrical survey made.
7.	Immediately S. of home E. of State Highway 7, SW. 1/4, SW. 1/4, Sec. 28, T. 22 N., R. 5 E.	U. S. Army		1913	3		500±				Holly Springs	3.53	Aug. 29, 1942	197.16	0.4	Reducer			Domestic supply.

8.	At S. end abandoned tenant home W. of State Highway 7, SE. 1/4, NW. 1/4, Sec. 32, T. 23 N., R. 5 E.	U. S. Army	E. P. Webb	1903			900				Holly Springs (?)	6.45	Aug. 29, 1942	193.57	3.43	Filed cross on well collar			Domestic supply.
9.	15 ft. W. of State Highway 7, SE. 1/4, NW. 1/4, Sec. 32, T. 23 N., R. 5 E.	U. S. Army		1913			500±				Holly Springs	+		197.51	0.3	Top of valve 200 feet W. of well			Domestic supply.
10.	5 miles east of Grenada	Robert Williams	Delta Drilling Co.	1939			156.3			20.3									Domestic supply.
12.	50 ft. S. of cabin on E. bank of Spring Lake, SW. 1/4, SE. 1/4, Sec. 6, T. 22 N., R. 5 E.	Joe E. Meaders	Mr. Pollard	1906	4	62	97.8				Meridian	3.0	Sept. 10, 1939	164	3.5	Top of 4-3-inch reducer		7	Found flowing.
16.	In Laundry 8 miles W. of Grenada, NE. 1/4, SE. 1/4, Sec. 12, T. 22 N., R. 4 E.	Dr. Clanton	Delta Drilling Co.	1940		70¼	794	632		50	Ackerman	9.33	April 11, 1942	201.28	0	Concrete floor at well discharge	10	5	
17.	100 ft. W. of small creek and 200 ft. N. of State Highway 7, at western edge Grenada, NW. 1/4, SW. 1/4, Sec. 7, T. 22 N., R. 5 E.	Trailer camp			3(?)						Meridian (?)	3.90	April 11, 1942	179.03	0.5	Top of casing		5	Found flowing.
18.	On NE. corner of intersection Pearl St. and U. S. Highway 51, Grenada, 700 ft. S. center of Yalobusha River bridge, SW. 1/4, NE. 1/4, Sec. 7, T. 22 N., R. 5 E.	Frank Marascalco			2	67½	517	497		20	Holly Springs (?)	6.25	Oct. 28, 1942	193.60	2.5	Top of 2-inch elbow 1.00 ft. above trough		4	Artesian head in 1919 was 15 feet above land.
19.	0.19 mile N. of Ill. Central Sta. at Grenada, 400 ft. W. of track and 200 ft. N. of spur, NE. 1/4, SW. 1/4, Sec. 8, T. 22 N., R. 5 E.	J. M. Cooley			2	64	200±				Meridian	4.76	April 11, 1942	177.36	1.64	Top of well elbow 0.7 ft. above coupling		4	Found flowing.
20.	25 ft. W. of store and 15 ft. N. of road 1/2 mile E. of old Batupan Bogue bridge in Grenada, SW. 1/4, SW. 1/4, Sec. 9, T. 22 N., R. 5 E.	D. M. Anthony	E. D. Ratliffe		1½		482				Holly Springs	9.17	Apr. 11, 1942	193.61	2.00±	Top of reducing bushing at 2 1/2 inches		8	Found flowing.
21.	Williamsville well																		
22.	In small valley in front of home 100 yards S. of State Highway 7, SE. 1/4, NW. 1/4, Sec. 16, T. 22 N., R. 5 E.	E. D. Ratliffe	E. D. Ratliffe		2		503				Holly Springs	1.30	Apr. 11, 1942	203.87	1.00±	Top of horizontal discharge pipe		4	Found flowing.
23.	1,550 ft. S. and 135 ft. W. of railroad station at Grenada. NW. 1/4 NW. 1/4, Sec. 17, T. 22 N., R. 5 E.	Town Grenada		1913	4	70	620	460	30 (?)	30	Holly Springs	2.50	Sept. 10, 1939	201.31	4.57	Top of 4 inch well tee		12	Found flowing.

TABLE 12—Continued

No.	LOCATION	OWNER OR NAME	DRILLER	Date completed	Diameter of well (inches)	Temp. water (F.)	Depth of well (feet)	Depth to top of screen (feet)	Length of screen (ft.)	Principal water-bearing sand: Thickness (feet)	Principal water-bearing sand: Geologic horizon	Pressure head or water level: Above or below (—) measuring point (feet)	Pressure head or water level: Date of measurement	Measuring point: Above mean sea level (feet)	Measuring point: Above surface of land (feet)	Description of measuring point	Yield in g.p.m.: Pump	Yield in g.p.m.: Flow	General information
24.	150 ft. N. well 23, NW. 1/4, NW. 1/4, Sec. 17, T. 22 N., R. 5 E.	Town Grenada	Gray Artisian Well Company	1925	24-12	64	172	132		30±	Meridian	—16	Sept. 10, 1939	197		Surface of land	500		Part of town supply.
25.	100 ft. W. of well 23 at Grenada water works, NW. 1/4, NW. 1/4, Sec. 17, T. 22 N., R. 5 E.	Town Grenada	Gray Artisian Well Company	1925	24-12	64	172	132	30	40	Meridian	—16	Sept. 10, 1939	197		Surface of land	500		Part of town supply.
26.	1,150 ft. S. 1,500 ft. E. of NW. corner Sec. 18, T. 22 N., R. 4 E.	Dubard No. 2	Carter Oil Co.	1931			4012							167		Surface of land			Oil exploration well (Abandoned).
27	NW. 1/4, Sec. 18, T. 22 N., R. 4 W.	Town of Dubard			2		210.5											60	From Water-Supply Paper 576.
33.	400 ft. N., 500 ft. W. of SE. corner NE. 1/4, Sec. 19, T. 22 N., R. 5 E.	W. W. Wood No.1	Wil. Stewart et al	1935			4600							212.8		Surface of land (?)			Oil exploration well (Abandoned).
34.	Gore Springs.																		
35.	278 ft. W., 99 ft. N. SE. corner NE. 1/4, SE. 1/4, Sec. 19, T. 22 N., R. 7 E.	Borden No. 1	L. B. Mawk	1924			2715							293 (barometer)					Oil exploration well (Abandoned).
36.	By negro home 1 mile E. of Tie Plant, NW. 1/4, SW. 1/4, Sec. 27, T. 22 N., R. 5 E.	W. M. Estes	Owner	1938	6		22.2				Tallahatta	—13.96	Apr. 19, 1942	219.39	2.59	Top of wooden curbing on well			Domestic well.
37.	In front of barn in valley 1 mile E. of Tie Plant, NW. 1/4, SW. 1/4, Sec. 27, T. 22 N., R. 5 E.	W. M. Estes	Owner	1930	1		16.4				Tallahatta	—11.70	Apr. 19, 1942	209.25	4.35	Top of pitcher pump base			Domestic well.
38.	200 ft. W. of well 37, NE. 1/4, SE. 1/4, Sec. 28, T. 22 N., R. 5 E.	W. M. Estes	Owner				21.5				Tallahatta	—9.28	Apr. 19, 1942		0	Top of steel cover plate			Domestic well.
39.	At Tie Plant, approximately 250 ft. SE. of well 40 NW. 1/4, NW. 1/4, Sec. 33, T. 22 N., R. 5 E.	Koppers Co.	E. D. Ratliffe	1925	8		120	100	20		Meridian			212		Surface of land	300		Industrial Supply.
40.	50 ft. N. of creosoting cylinders, Tie Plant in large pit, NW. 1/4, NW. 1/4, Sec. 33, T. 22 N., R. 5 E.	Koppers Co.		1904	6		166.5				Meridian	—22.76	Apr. 18, 1942	215.34	3.24	"x" on top of one-inch air line	400		Industrial Supply.

41.	.31 mile N. of U. S. Highway 51 and 850 ft. E. secondary road, NW. 1/4, SE. 1/4, Sec. 29, T. 22 N., R. 5 W.	Betsy Ross Inn			2		480				Holly Springs	1.78	Oct. 28, 1942	191.91	1.35	Top of concrete tank on east side		½	Found flowing.
42.	.35 mile N. of road junction U. S. Highway 51 and 150 ft. E. of highway, SE. 1/4, SW. 1/4, Sec. 29, T. 22 N., R. 5 W.	Cooper & Vance	Ratliffe and Doolittle	1942	2		110	100 (?)	10 (?)		Meridian	—21.00	July, 1942	203.82	1.27	Top of lower flange beneath pump	25 (appr.)		
43.	400 ft. S., 400 ft. W., NE. corner NW. 1/4, Sec. 26, T. 22 N., R. 4 E.	Avent No. 1	Adams Oil and Gas Company	1942			4,030							304		Derrick floor			Oil exploration well (Abandoned).
44.																			
45.	On hilltop, NE. 1/4, SE. 1/4, Sec. 34, T. 22 N., R. 5 E.	C. G. Pass	Owner	1938	6		51.0			2	(penetrated) Tallahatta	—46.93	Apr. 19, 1942		1.72	"4" on wooden curbing			Domestic well.
46.	North side secondary road, SE. 1/4, NW. 1/4, Sec. 35, T. 22 N., R. 5 E.											(beneath land) —5.5		236.10		Top of curbing on north side			Domestic well.
47.	S. side secondary road, SE. 1/4, NW. 1/4, Sec. 35, T. 22 N., R. 5 E.											(beneath land) —35		241.42		Top of curbing on north side			Domestic well.
48.	N. side secondary road, SW. 1/4, SE. 1/4, Sec. 30, T. 22 N., R. 6 E.	Hays Hankins										(beneath land) —39.5		300.59		Top of wooden curb			Domestic well.
49.	S. side secondary road, SW. 1/4, SW. 1/4, Sec. 39, T. 22 N., R. 6 E.	W. E. Boushe										(beneath land) —82.0		300.99		Top of wooden curb			Domestic well.
50.	SW. 1/4, NE. 1/4, Sec. 32, T. 22 N., R. 6 E.	Meck Mister										(beneath land) —30.0		277.93		SE. corner of wooden curb			Domestic well.
54.	On hillside at Providence Church, SE. 1/4, NE. 1/4, Sec. 1, T. 21 N., R. 6 E.	Church			24-6		18.2				Meridian	—14.46	Apr. 20, 1942		1.0	Top of 24-inch casing			
55.	North side of secondary road, NW. 1/4, NW. 1/4, Sec. 5, T. 21 N., R. 6 E.	Maud Taffey									Meridian	(surface land) —47.0		274.15		Top of well curbing			
56.	S. side of secondary road, SW. 1/4, NW. 1/4, Sec. 5, T. 21 N., R. 6 E.													252.09		Northeast corner of well curbing			
57.	W. side of road N. of confinement camp, NE. 1/4, SW. 1/4, Sec. 2, T. 21 N., R. 5 E.										Tallahatta	(surface land) —18.0		221.02		Top of north side wooden curb			Abandoned.

TABLE 12—Continued

No.	LOCATION	OWNER OR NAME	DRILLER	Date completed	Diameter of well (inches)	Temp. water (F.)	Depth of well (feet)	Depth to top of screen (feet)	Length of screen (ft.)	Principal water-bearing sand: Thickness (feet)	Principal water-bearing sand: Geologic horizon	Pressure head or water level: Above or below (—) measuring point (feet)	Pressure head or water level: Date of measurement	Measuring point: Above mean sea level (feet)	Measuring point: Above surface of land (feet)	Description of measuring point	Yield in g.p.m.: Pump	Yield in g.p.m.: Flow	General information
58.	At Glenwild barns, NW. 1/4, NE. 1/4, Sec. 4, T. 21 N., R. 5 E.	P. F. Wagner			4½		190	180	10 (?)		Meridian	—52				Surface of land			Farm supply.
59.	In small vale 100 yards N. of Prospect Road, SE. 1/4, SE. 1/4, Sec. 7, T. 22 N., R. 6 E.	Army, formerly Oscar Gislen	E. Ratliffe	1938	3	66.5	394			30	Holly Springs	+4.55	Sept. 13, 1942	228.61	1.0	Top of casing 0.80 ft. below elbow		15	Found flowing.
60.	In Valley N. secondary road, NE. 1/4, SE. 1/4, Sec. 8, T. 21 N., R. 6 E.	Hattie Beard (now Army)	Ed Pyles	1939	36 (?)		14.1				Meridian (?)	—12.23	Apr. 18, 1942		3.0	Top of wooden curving (marked)			
61.	Hillside N. secondary road, NE. 1/4, NW. 1/4, Sec. 9, T. 21 N., R. 6 E.	Army			36		23.3				Tallahatta	—10.27	Apr. 18, 1942		3.3	Top of wooden curbing (marked)			
62.	Sandy hillside E. secondary road, NW. 1/4, NE. 1/4, Sec. 12, T. 21 N., R. 6 E.	Army or J. S. Hemphill		1920			31.7				Meridian (?)	—29.66	Apr. 20, 1942			Top of wooden curbing (marked)			
63.																			
64.	Sandy valley N. county line road, SW. 1/4, SE. 1/4, Sec. 14, T. 21 N., R. 6 E.	Army or D. Wilkins					14.0				Meridian	—12.07	Apr. 18, 1942		2.5	Top of wooden curbing (marked)			
65.	At cabin on hillside, NE. 1/4, SE. 1/4, Sec. 14, T. 21 N., R. 6 E.	Army					9.3				Meridian	—8.35	Apr. 18, 1942	257.92	3.3	Top of wooden curbing (marked)			
66.	Between abandoned store and cabin, SW. 1/4, SW. 1/4, Sec. 14, T. 21 N., R. 6 E.	Army					13.7				Meridian	—8.70	Apr. 18, 1942	244.20	2.8	Top of wooden curbing (marked)			
67.	On hillside E. secondary road, NW. 1/4, SE. 1/4, Sec. 16, T. 21 N., R. 6 E.	Army					16.5				Tallahatta	—12.00	Apr. 18, 1942	244.03	3.0	Top of wooden curbing (marked)			

68.	100 feet S. Prospect road, NE. 1/4, NE. 1/4, Sec. 17, T. 21 N., R. 6 E.	Army			36		13.8				Tallahatta	—10.23	Apr. 18, 1942	243.78	3.0	Top of wooden curbing (marked)			
69.	50 ft. W. of barn, 25 feet S. oak tree, NE. 1/4, NE. 1/4, Sec. 18, T. 21 N., R. 6 E.	Army formerly J. A. Thomas	E. Ratliff		4	66	365 (?)			30±	Holly Springs	4.45	Jan. 1, 1943	226.39	3.0	Top of well elbow 2.54 ft. above 4-inch bushing		13	Found flowing.
70.	Base of hill on S. side range road, SW. 1/4, SW. 1/4, Sec. 18, T. 21 N., R. 6 E.	Army formerly A. C. Riley	E. Ratliffe		3		670			60	Holly Springs (?)	(above datum) 235.37	Apr. 11, 1942		0	Top of casing			Depth measured Jan. 1, 1943, 179 feet.
71.	In cantonment, SW. 1/4, SW. 1/4, Sec. 13, T. 21 N., R. 5 E.	Army formerly Mr. Olsen	E. Ratliffe	1917	3				none		Holly Springs	7.75	Apr. 10, 1942	228.39	1.8	Top of well bushing		3	Sealed with concrete.
72.	50 feet N. residence, 300 feet E. railroad in Elliott, SW. 1/4, NW. 1/4, Sec. 14, T. 21 N., R. 5 E.	Army formerly Lynn Thomas	E. Ratliffe	1935	2	66	447.5				Holly Springs	—2.84	Apr. 4, 1942	229.55	2	Top of 2-inch casing 0.83 foot below elbow			Recorder well.
73.	230 feet W. railroad at SW. corner Elliott, NW. 1/4, SW. 1/4, Sec. 14, T. 21 N., R. 5 E.	Army formerly Carpentier	E. Ratliffe (?)				300				Meridian								
74.		Mr. Jordan	Ratliffe & Son	1942			156	136 (?)		20	Meridian								

Table 13—Pre-existing borings in Montgomery County

No.	Location	Owner or name	Driller	Date completed	Diameter of well (inches)	Temp. water (F.)	Depth of well (feet)	Depth to top of screen (feet)	Length of screen (ft.)	Principal water-bearing sand: Thickness (feet)	Principal water-bearing sand: Geologic horizon	Pressure head or water level: Above or below (—) measuring point (feet)	Pressure head or water level: Date of measurement	Measuring point: Above mean sea level (feet)	Measuring point: Above surface of land (feet)	Description of measuring point	Yield in g.p.m.: Pump	Yield in g.p.m.: Flow	General information
1.	In valley W. of secondary road, NW. 1/4, NW. 1/4, Sec. 24, T. 21 N., R. 6 E.	E. G. Abel		1939			16.0			1±	Meridian	—8.64	Apr. 18, 1942	273.19	4.6	Top of concrete curbing			Domestic supply.
2.	S. of secondary road, NW. 1/4. NW. 1/4, Sec. 23, T. 21 N., R. 6 E.	Army, formerly Roy Dale		1935			13.8				Meridian	—5.87	Apr. 18, 1942	255.67	2.3	Top of wooden curbing (marked)			
3.	Behind abandoned cabin N. secondary road, NW. 1/4, NW. 1/4, Sec. 23, T. 21 N., R. 6 E.	Army					17.1				Meridian	—7.35	Apr. 18, 1942	252.88	3.9	Top of wooden curbing (marked)			
4.	Hilltop behind abandoned cabin S. secondary road, NW. 1/4, NW. 1/4, Sec. 23, T. 21 N., R. 6 E.	Army					36.2				Meridian	—35.68	Apr. 18, 1942	281.75	3.3	Top of wooden curbing (marked)			
5.	25 feet E. abandoned house on hilltop, SW. 1/4, SE. 1/4, Sec. 19, T. 21 N., R. 6 E.				1¼		500				Holly Springs		Jan. 1942			Top of casing			Recorder well elev. concrete at well = 304.31.
6.	.24 mile W. U. S. Highway 51 and 150 feet N. of secondary road by barn, NW. 1/4, NE. 1/4, Sec. 26, T. 21 N., R. 5 E.	Mr. Wilkins	E. Ratliffe		2		482		16		Holly Springs	—5.59	Sept. 9, 1939	244.03	1.55	Top of concrete trough at SE. corner			Farm supply.
7.																			
8.	150 feet N., 200 ft. E. intersection of U. S. Highway 51 and Duck Hill road, SE. 1/4, SW. 1/4, Sec. 31, T. 21 N., R. 6 E.	Mrs. Starks	E. Ratliffe	1934	3		488				Holly Springs	3.19	Apr. 4, 1942	242.64	1.86	Top of well tee on discharge elbow (marked)		4	Community supply.
9.	By standtank at Duck Hill, SE. 1/4, SE. 1/4, Sec. 36, T. 21 N., R. 5 W.		Carloss Well Co.	1936	4	64	127				Meridian			242 (appr.)			50		Town supply.
10.	.85 mile N. Duck Hill road-U. S. Highway 51 intersection and 250 feet E. of secondary road, NW. 1/4, SE. 1/4, Sec. 36, T. 21 N., R. 5 W.	D. D. Wilkins	E. Ratliffe	1929	2		220				Meridian	—2.65	Sept. 9, 1939	246.63	1.75	Top of well valve	5		Domestic supply.
11.	40 feet N. center Sec. 33, T. 21 N., R. 5 E.	Columbia Mutual Life Ins Co.	Henderson Oil Co.	1941			4,458							265		Top of derrick floor			Abandoned oil prospect well.

Table 14

Wells at Camp McCain

No.	WELL LOCATION	Date completed 1942	DIAMETERS (inches): Upper and outside casing	DIAMETERS (inches): Lower and inside casing	DIAMETERS (inches): Screen	DIAMETERS (inches): Gravel wall	DEPTHS (feet): Total well depth	DEPTHS (feet): To top of screen	DEPTHS (feet): To top pump bowls	DEPTHS (feet): To lower end pump intake	Length of screen (feet)	Water bearing sand: Thickness (feet)	Water bearing sand: Geologic horizon	Original pressure head or water level: Above or below (—) measuring point (feet)	Original pressure head or water level: Date of measurement 1942	Measuring point (top of air line): Above mean sea level (feet)	Measuring point (top of air line): Above surface of land (feet)	Measuring point (top of air line): Above reference bench mark (ft.)	Reference bench mark above mean sea level (feet)	Pumping rate (g. p. m.)	Temp. water (F.)
A1.	100 ft. N., 150 ft. W. SE. cor. Sec. 10, T. 21 N., R. 5 E.	April 19	18	12	10	32	142	88	80	117	50	75	Meridian	—21.80	August 28	218.87	2.9	0.60	218.27	400	64.5
A2.	2,375 ft. N., 400 ft. E. SW. cor. Sec. 7, T. 21 N., R. 6 E.	June	12	8	8	32	429	390	160	198	25	24	Holly Springs	—0.95	Sept. 19	230.31	3.1	0.60	229.71	250	66
A3.	1,950 ft. S., 1,850 ft. W. NE. cor. Sec. 23, T. 21 N., R. 5 E.	June 2	12	8	8	32	434	405	160	198	25	123	Holly Springs	—2.11	August 28	237.29	3.2	0.55	236.74	250	67
A4.	900 ft. S., 2,180 ft. W. NE. cor. Sec. 10, T. 21 N., R. 5 E.	July 2	18	12	10	32	158	105	80	106	50	112	Meridian	—21.57	August 28	222.41	4.2	0.80	221.61	350	64.5
A5.	600 ft. S., 2,160 ft. E. NW. cor. Sec. 14, T. 21 N., R. 5 E.	Sept. 14	12	8	8	32	449	405	160	198	40	45	Holly Springs	—1.60	October 8	228.54	3.2	0.65	227.89	200	67
A6.	2,050 ft. N., 1,650 ft. W. SE. cor. Sec. 24, T. 21 N., R. 5 E.	August 13	18	12	10	32	130	100	78	98	30	90	Meridian	—20.18	October 11	225.84	2.6	0.72	225.12	350	64.5
A7.	1,900 ft. N., 2,340 ft. E. SW. cor., Sec. 24, T. 21 N., R. 5 E.	June 22	18	12	10	32	122	88	80	106	30	59	Meridian	—20.56	August 28	227.35	4.2	0.72	226.63	350	64.5
A8.	2,130 ft. S., 2,740 ft. E. NW. cor. Sec. 25, T. 21 N., R. 5 E.	Sept. 1	12	8	8	32	467	438	160	198	31	93	Holly Springs	—0.80	October 8	234.32	3.0	0.97	233.35	200	67
A9.	800 ft. N., 1,200 ft. W. SE. cor. Sec. 25, T. 21 N., R. 5 E.	June 8	12	8	8	32	457	373	160	198	80	100	Holly Springs	—2.10	August 28	235.47	3.9	0.70	234.77	200	66
A10.	100 ft. S., 1,330 ft. E. NW. cor. Sec. 24, T. 21 N., R. 5 E.	August 28	18	12	10	32	179	125	80	106	50	89	Meridian	—22.77	August 28	227.18	2.3	0.72	226.46	350	64.5
A11.	100 ft. N., 1,150 ft. W. SE. cor. Sec. 11, T. 21 N., R. 5 E.	Sept. 24	12	8	8	32	504	421	160	198	81	99	Holly Springs	+9.10	Jan. 2, 1943	215.09	6.4	0.72	214.37	200	67
A12.	480 ft. N., 2,200 ft. E. SW. cor. Sec. 12, T. 21 N., R. 5 E.	June 20	18	12	10	32	124	90	80	117	30	116	Meridian	—27.53	August 28	231.88	1.6	0.72	231.16	350	64.5
A13.	1,920 ft. N., 1,950 ft. E. SW. cor. Sec. 12, T. 21 N., R. 5 E.	July 31	18	12	10	32	216	161	80	117	50	182	Meridian	—14.65	August 28	220.40	3.7	0.72	219.68	350	
A14.	1,780 ft. N., 2,600 ft. E. SW. cor. Sec. 3, T. 21 N., R. 5 E.	Nov. 12	18	12	10	32	144	90	80	117	50	78	Meridian	—20.55	Jan. 14, 1943	212.84	2.5	0.55	212.29	350	
A15.	50 ft. S., 1,800 ft. W. NE. cor. Sec. 11, T. 21 N., R. 5 E.	Dec. 3	18	12	10	32	122	88	80	117	30	90	Meridian	—12.20	Jan. 15, 1943	212.80	2.3	0.72	212.08	350	

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MISSISSIPPI STATE GEOLOGICAL SURVEY
BULLETIN 55

PLATE 2

ELECTRICAL LOG OF ADAMS OIL & GAS CO. J. K. AVENT NO. 1

400 ft. S, 400 ft. W, NE Corner NW 1/4 Sec. 26
T. 22 N., R. 4 E.
Elevation, 304 feet, (Derrick Floor)
GRENADA COUNTY, MISSISSIPPI
Surveyed by Schlumberger Well Surveying Corporation
George M. Yoder, Observer
NOV. 23, 1942

Self-Potential millivolts	Depths	Resistivity (ohms m^2m) ——— Normal Curve; - - - - Third Curve; —·— Fourth Curve

Fresh water-bearing sand