THE TEAYS PREGLACIAL DRAINAGE SYSTEM

OF

PLEASANT TOWNSHIP, MADISON COUNTY, OHIO

A Senior Thesis

Prepared

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ABSTRACT

Before the glacial invasion of Pleistocene time, the streams of the present Ohio Basin flowed generally northwestward and were carried by the Teays River and its tributaries. The Teays River rose in the Piedmont Plateau of Virginia and North Carolina and flowed northwestward across West Virginia, Ohio, Indiana, and Illinois to the ancestral Mississippi River. This system of drainage was brought to a close by the advance of Pleistocene glaciers, which filled the valleys and formed new drainage patterns.

The buried valleys of Pleasant Township, Madison County, Ohio, have been mapped for this report from well records. The bedrock of Madison County consists mainly of limestone and dolomite strata of Silurian and Devonian ages. These are generally dependable sources of water supply for community use, farms and suburban homes. Sand and gravel beds which underlie or are interbedded in the glacial till are also sources of water, along with sand and gravel beds associated with the Darby Creek and Deer Creek valleys.

INTRODUCTION

The consolidated rocks in Madison County were deeply trenched by the Teays River and its tributaries. The Teays River drainage system was ended by the advance of the glaciers in the Pleistocene epoch. These ancient valleys are buried under a deep layer of till, clay, silt, sand, and gravel. The sand and gravel beds are good sources of ground water along with the limestone and dolomite strata of Silurian and Devonian age. Ground water is also available from the outwash sand and gravel beds in the Deer Creek valley.

The geology, geography, and ground water hydrology of Pleasant Township will be discussed along with a discussion of the Teays River drainage system and the drainage modifications of the Teays River due to the advance of the Pleistocene glaciers. Because of the importance of the deposits in the buried valleys with respect to water supplies, the principal objective of this investigation was to map the buried valleys in Pleasant Township.

Research was the primary source of information for the manuscript while information from well logs contributed to the construction of the map of the buried valleys in Pleasant Township Well logs from Pleasant Township were contributed by the Ohio Division of Water.

THE GEOGRAPHY OF PLEASANT TOWNSHIP

LOCATION AND SIZE OF THE AREA

Madison County is in central Ohio just west of Columbus, the capital, and encompasses 463 square miles, or about 296,320 acres. The city of London, near the center of the county, is the county seat and lies about midway between Columbus and Springfield. It is bounded by Union County on the north, Franklin and Pickaway Counties on the east, Fayette County on the south and Greene, Clark, and Champaign Counties on the west. Figure 1 shows the location of Madison County, Ohio.

Pleasant Township is located in the southeast corner of Madison County. It is bordered by Fairfield Township to the north, Oak Run Township to the northwest and Range Township to the west as can be seen in Figure 2. Pickaway County lies to the east and Fayette County lies to the south. Mount Sterling is the major city of the township.

SETTLEMENT OF THE MADISON COUNTY AREA

The Delaware, Mingo, Shawnee, and Wyandot were the Indian tribes living in the area and used Madison County for hunting. In the early 1800's, when settlers began to arrive, the Indians ceased hunting the area.

The first permanent settler was Jonathan Alder, who was captured and raised by the Indians. In 1795, after the Treaty of Greenville, more settlers began to arrive. By 1820, the population of the Madison County area was about 4,800. By 1850,

FIGURE 1. MAP OF OHIO, SHOWING COUNTIES AND STREAMS

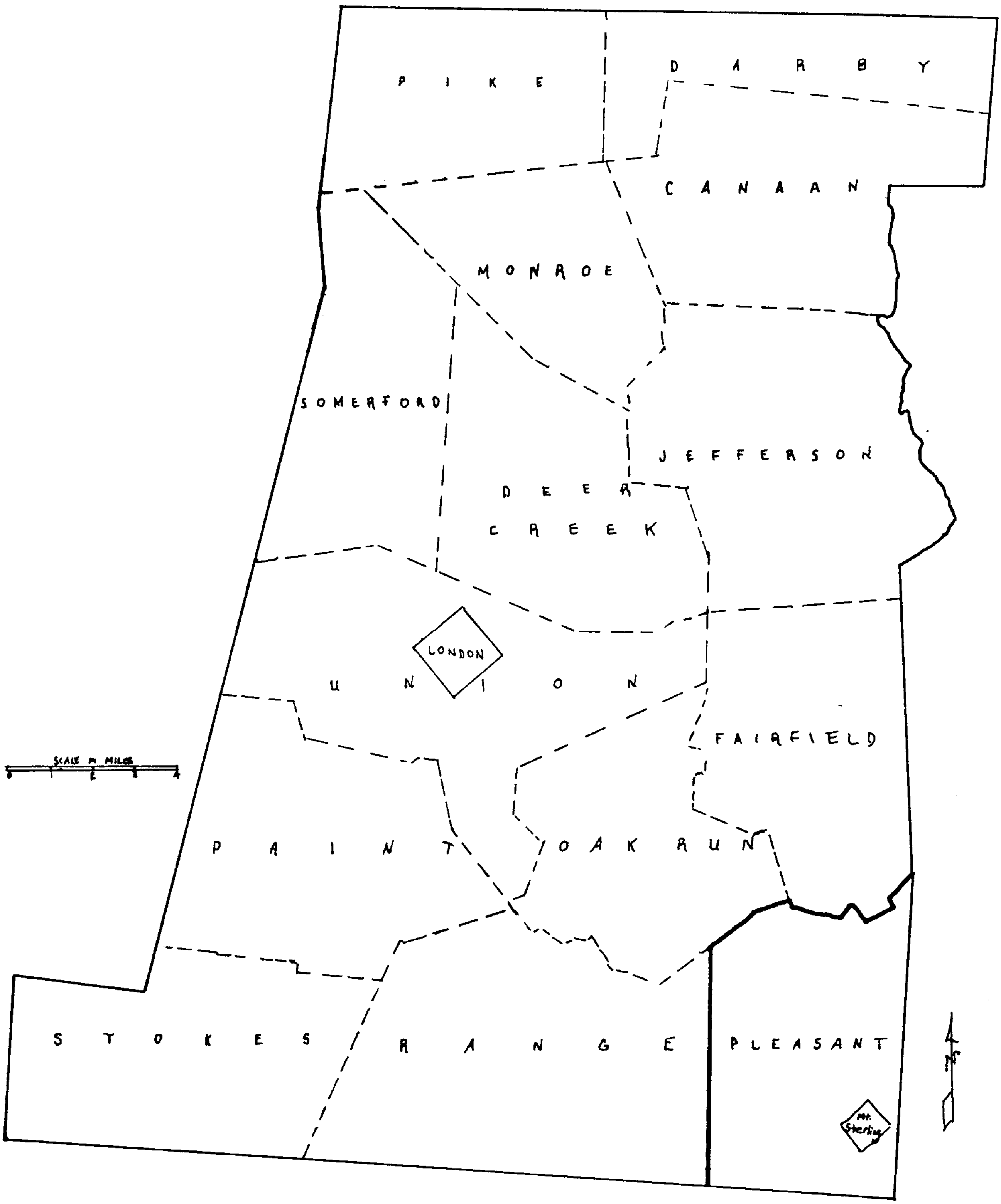


FIGURE 2. MAP OF MADISON COUNTY AND ITS TOWNSHIPS

the population was 10,015 and by 1880, it was 20,130.

All of Madison County was in the Virginia Military District. People receiving land grants would designate their own boundaries, therefore tracts of land in Madison County are irregular in shape and size.

Madison County was erected in 1810 by an act of Legislature. The County was named after James Madison, who was president at that time.

In 1980, Madison County had a population of 33,004, its largest to date. Pleasant Township had a total population of 2,768 with 1,623 people living in Mount Sterling Village.

AGRICULTURE

Farming is the dominant land use in Madison County with about 96% of the total land area utilized for this purpose. There are approximately 1000 farms averaging 286 acres each. Cash grain production is the major farm enterprise with a smaller income derived from the sale of livestock and livestock products. Corn, soybeans, and wheat are the major crops grown. Swine are raised mainly in the southern third part of the county, being a chief source of farm income.

NON-FARM DEVELOPMENT

Although farming is the dominant land use in Madison County, residential, commercial, industrial and related types of non-farm land use development has been increasing in recent years. Factories in London and the surrounding towns produce a variety of products such as food and food-related items, plastics, and industrial machinery and parts. There are also several farm equipment dealers and grain elevators in the county.

MINERAL RESOURCES

Madison County has a very minor place in Ohio's large mineral industry. There are several gravel pits, clay pits, and a small limestone quarry accounting for the county's entire mineral production.

CLIMATE

The climate of Madison County is classified as continental. This is characterized by large annual, daily, and day to day ranges in temperature. Precipitation varies widely from year to year but is normally abundant and well distributed throughout the year. Fall is the driest season. Most precipitation during the winter months occurs as rain.

Overall, Madison County is cold in the winter and uncomfortably warm in the summer. Precipitation results in adequate accumulation of soil moisture, minimizing the hazard of summer drought. In winter the average temperature is 31°F with an average daily minimum temperature of 23°F. In the summer, the average temperature is 72°F and the average daily maximum temperature is 84°F. The total annual precipitation is 36.7 inches. The relative humidity in midafternoon is about 60%. The sun shines approximately 65% of the time possible in the summer and 35% in winter. The prevailing wind is from the south-southwest with an average wind speed highest in March with 11 miles per hour. Tornadoes and severe thunderstorms occur occaisionally and are usually of local extent and short duration but can cause damage in a variable pattern.

GEOLOGY AND GROUND WATER HYDROLOGY

DRAINAGE AND TOPOGRAPHY

Madison County is part of the Till Plains Section of the Central Lowlands physiographic province. It is mostly a nearly level and gently undulating ground moraine with a few end moraines. The dominant texture of the glacial till is loam. The glacial till was laid down by two major advances of the Wisconsin glacier. Melt waters from the first advance deposited sand and gravel outwash, which was covered by the second advance. Many random pockets of sand and gravel are buried under glacial till. These pockets often provide an excellent source of water for wells.

End moraines and areas near streams form the only evident relief in the county. The highest point in Madison County, along the west-central line is about 1200 feet above sea level. The lowest point, in the southeast corner of the county in Pleasant Townshop is about 800 feet above sea level. Local relief is greatest, about 60 feet, along the main valleys where there has been dissection by short, steep tributary streams. 99% of Madison County lies mainly in the Scioto River drainage basin. The headwaters of Darby, Deer, and Paint Creeks lie within Madison County. All of the streams flow south or southeast (see Fig. 1). No natural lakes are present, but Madison Lake, about 100 acres in area, has been formed about 4 miles east of London by raising the level of Deer Creek.

Deer Creek. In Madison County, the streamflow of Deer Creek is generally from the northwest to the southeast. Deer Creek is the largest stream in the area and drains about half the land surface of the county. Its headwaters are near Summerford and it has many small tributaries. Figure 3 shows the distribution of the Deer Creek Basin and its tributaries. Its location can also be seen in Figure 1.

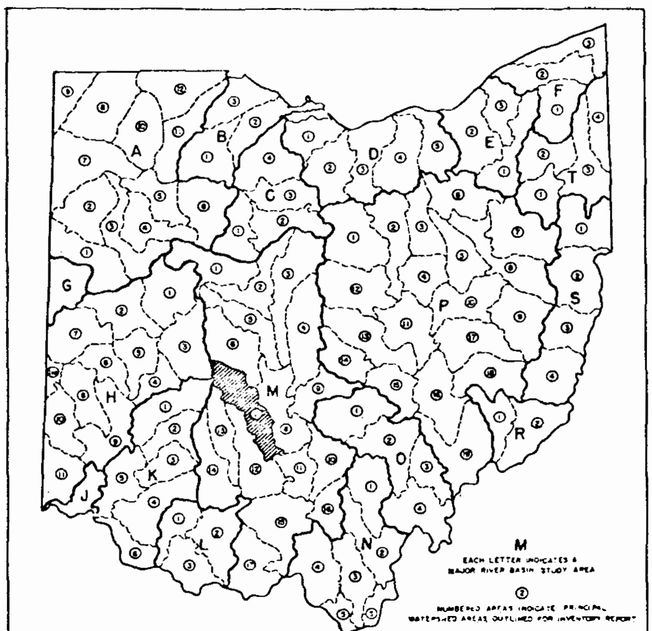
Large supplies of ground water are available in Pleasant Township from the outwash sand and gravel in the Deer Creek valley or from the underlying Bass Island dolomite.

The geologic formations in the Deer Creek Basin range from the various glacial deposits of sand, gravel, and clay to the bedrock units of limestone and shale. With the exception of the extreme lower portion of the area, the entire basin is underlain with water bearing Silurian and Devonian limestone. Table 1 shows a stratigraphic section describing the physical and water-bearing characteristics of the formations within this basin. Drainage and elevations of Deer Creek and its tributaries can be seen in Table 2.

Deer Creek Lake. Deer Creek Lake is located in Fayette and Pickaway Counties, Ohio. It lies in the Scioto River basin, 21 miles above the mouth of Deer Creek. It controls the runoff from a drainage area of 278 square miles.

The project is operated for the reduction of flood damages in the Deer Creek valley and for flood protection in the Scioto and Ohio River valleys. The cost of completing work was $19,800,000, including the development of recreational facilities.

The dam has a maximum height of 93 feet and a total crest length of 3,880 feet. A gate-controlled concrete gravity spilling section is incorporated in the earth fill structure. The full pool has an elevation of 844 feet with a surface area of 4,046 acres.



OUTLINE MAP SHOWING DISTRIBUTION OF RIVER BASIN AND WATERSHED AREAS IN OHIO FOR STUDY IN THE WATER INVENTORY PROGRAM

FIGURE 3. DISTRIBUTION OF DEER CREEK BASIN AND ITS TRIBUTARIES

Source: Ohio Water Plan Inventory, Deer Creek Basin

TABLE 1. GENERALIZED STRATIGRAPHIC SEQUENCE OF THE ROCKS IN THE DEER CREEK BASIN

SYSTEM OR SERIES		GROUP OR FORMATION	CHARACTER OF MATERIAL	WATER-BEARING CHARACTERISTICS
Quaternary	Recent		Clay, silt and sand deposited on floodplains.	Thin deposits, usually impermeable. Small yields developed from dug wells.
Quaternary	Pleistocene		Thick lenses of sand and gravel deposited in buried drainage channels.	Domestic and farm supplies available. Local municipal and industrial wells develop as much as 400 gpm.
			Clayey till interbedded with sand & gravel deposited at edge of glacier.	Potential yields of 5-25 gpm may be developed for farm & domestic use.
			Heterogenous mixture of clay, sand & gravel interbedded with sand & gravel. Deposits as much as 410 feet thick.	Few wells in glacial deposits. Adequate supplies in underlying limestone bedrock.
Devonian		Ohio	Brown-black carbonaceous shale.	Yields little or no groundwater supplies.
		Columbus	Fairly massive, pure limestone.	Municipal and industrial wells developed as much as 150 gpm in the Bass Islands [illegible] formations & upper portions of the Niagaran. Limestone is a dependable source of water for most of the basin.
Silurian		Bass Islands	Thin to massive, inpure argillaceous limestone.	
		Niagaran	Thin to massive bedded dolomite with layers of [illegible] shale in the lower portions.	
Ordovician		Richmond & Maysville	Limestone interbedded in shale.	Wells develop less than 2 gpm.

TABLE 2. DEER CREEK BASIN

Stream Name	Length (Miles)	Elev. at Source	Elev. at Mouth	Av. Fall (Ft./Mi.)	Flows Into	Mouth in County	Drains Sq. Mi.
DEER CREEK	67.1	1130	621	7.6	Scioto River	Ross	408.40
Waugh Run	5.5	741	650	16.5	Deer Creek	Ross	19.36
Hay Run	7.5	813	667	19.5	Deer Creek	Ross	30.70
Stall Run	1.7	743	694	28.8	Hay Run	Ross	4.50
Dry Run	6.0	800	730	11.7	Deer Creek	Pickaway	19.04
Buskirk Creek	5.3	840	744	18.1	Deer Creek	Pickaway	15.40
Clark Run	4.4	880	776	23.6	Deer Creek	Pickaway	10.68
Georges Run	2.5	843	785	23.2	Deer Creek	Pickaway	7.14
Long Branch	2.0	859	808	25.5	Deer Creek	Fayette	3.42
Duff's Fork	6.2	911	812	15.9	Deer Creek	Fayette	12.18
Opossum Run	2.4	864	854	45.8	Deer Creek	Pickaway	19.38
Sugar Run	4.5	936	869	14.9	Deer Creek	Madison	53.70
Mud Run	5.4	967	898	12.8	Sugar Run	Madison	7.84
Bradford Creek	12.2	1136	905	18.9	Sugar Run	Madison	40.42
Turtle Run	5.3	1040	955	16.1	Bradford Creek	Madison	12.52
Turkey Run	0.8	946	908	47.6	Deer Creek	Madison	2.36
Oak Run	13.5	1123	915	15.4	Deer Creek	Madison	42.46
Walnut Run	6.7	1085	963	18.2	Oak Run	Madison	16.64
Glade Run	6.8	979	936	6.3	Deer Creek	Madison	22.22
North Fork	4.0	1148	1059	22.2	Deer Creek	Madison	11.40

Source: Gazetteer of Ohio Streams

STRATIGRAPHY AND STRUCTURE OF THE BEDROCK

The bedrock of the Pleasant Township area consists of limestone and dolomite strata of Silurian and Devonian age as can be seen in Table 3. Several hundred feet of Ordovician age shale underlie the bedrock. The strata lie on the east flank of the Cincinnati anticline and dip northeastward toward the Appalachian basin area at about 20 feet per mile. The top of the Ordovician shale, the Richmond group, declines in elevation from 800 feet in southwestern Madison County to 300 feet in the northeastern part of the county.

The bedrock is missing in parts of the buried valleys as it has been removed by erosion. In the eastern part of Madison County, the limestone and dolomite reach a thickness of about 500 feet. The bedrock is exposed in a few isolated areas, but most of these rocks are covered by glacial and alluvial deposits.

The Brassfield limestone of Early Silurian age is deeply buried and unimportant as an aquifer. It marks the lower limit of ground water supplies. The underlying shale of the Richmond group is rarely a source of water.

The Middle Silurian rocks above the Osgood shale form a general homogenous stratum in which the individual formations are distinguished mainly by their bedding. These Middle Silurian rocks are almost always a dependable aquifer for farm and home use. A few areas have been thinned by erosion and are a poorer source of water. A zone of high permeability, the Newburg sand

System	Series	Group	Formation	Section	Average thickness (feet)	Character of material	Water-bearing properties
Devonian			Columbus limestone		?	Light in color, massive to thin bedded, contains chert	Adequate water supplies generally available for farm and domestic requirements, except from the Osgood-shale. Water supplies for municipal or industrial use are generally available from the Bass Islands dolomite. Wells drilled to the so-called Newburg zone, at or near the top of the undifferentiated pre-Bass Island rocks, yield 400 gpm or more in the eastern part of the county.
Silurian	Upper Silurian	Cayuga	Bass Islands dolomite (called Waterlime or lower Monroe in old reports.)		375	Variable in structure and texture; siliceous	
	Middle Silurian		Cedarville limestone, Springfield limestone, and Euphemia dolomite of Foerste, undifferentiated		75	Variable in structure and texture	
			Osgood shale		60	Calcareous; contains limestone beds	
	Lower Silurian		Brassfield limestone		35	Massive to irregularly bedded	
Ordovician	Upper Ordovician	Richmond, Mayesville, and Eden groups, undifferentiated			1150	Shale, soft, calcareous, interbedded with thin hard limestone layers; called Cincinnatian shale in old reports.	Wells generally yield less than 1 gpm. In places water is high in salt and hydrogen sulfide. Water, where present, generally occurs in top few feet of strata.
		Rocks of pre-Eden age	So-called Trenton limestone of drillers		650	Limestone or dolomite and some shale	Generally yields salt water from so-called Blue Lick horizon, which in Madison County occurs about 600 to 700 feet below the top of the formation

TABLE 3. STRATIGRAPHIC SEQUENCE OF CENTRAL OHIO

zone, lies at or near the top of the Middle Silurian and is an excellent source of water.

The most important aquifer in the carbonate rocks is the Bass Islands dolomite. It is generally known to drillers as the Monroe dolomite. The stone is thinly to massively bedded and ranges in color from brown to dark gray and is slightly siliceous.

Water-Bearing Properties. Most wells drilled into the bedrock obtain water in the top few feet of bedrock from crevices opened or enlarged by weathering that occurred when the rocks were exposed at the surface. The weathered layer forms a homogenous aquifer with overlying sand and gravel beds. Due to differential weathering, permeability and yields differ from place to place. Yields from the weathered layer are great enough for home or farm use in most areas of Madison County. Larger supplies are commonly obtained from wells penetrating crevices below the weathered surface.

Recharge to the consolidated rocks occurs from local pricipitation seeping downward. Recharge is the greatest in areas where the consolidated rocks are close to the surface or adjacent to permeable sediments.

Newburg Zone. Wells drilled below the weathered layer in the limestone and dolomite rocks usually increase little in yield until they encounter a discreet zone of high permeability. These zones commonly occur at certain stratigraphic horizons and serve as zones of circulation in the carbonate rocks. The most important zone of this type in Madison County is referred to as the Newburg zone. Im most cases in the Newburg zone, the water is under strong artesian pressure and rises considerably above the level at which it was encountered.

The Newburg zone declines in elevation in Madison County from about 900 feet above sea level in the west to about 500 feet above sea level to the east. The dip is therefore about 20 to 25 feet per mile or about the same as the regional dip. In Pleasant Township, the Newburg zone is from about 590 feet above sea level in the west to about 480 feet above sea level in the east. In the deep buried valleys, the Newburg zone has been removed by erosion.

The Newburg zone is generally an impure, porous dolomite. In some areas the dolomite gives way to thin lenses of sandstone, marking a disconformity. It is also an important source of water for large-scale industrial and municipal use in Madison County.

Permeable zones also occur in Madison County in carbonate rocks above the level of the Newburg zone. These zones probably develop as the result of solution by ground water moving laterally along a plane of weakness. According to Norris (1959), susceptibility of any particular zone to solution may stem from close spacing of joints or could be a result of a large volume of circulating water in the area. This could lead to the development of zones of continuous porosity or caverness conditions along some beds.

Information about the water-bearing properties of the rocks below the Newburg zone is scarce due to lack of records. The underlying Osgood shale may be a poor source of water. Little is known of the water-bearing properties of the Brassfield dolomite in Madison County even though it is a common source of water a few miles to the west of Madison County. The shales of the Richmond, Maysville and Eden groups are not a source of ground water. These overlie the Trenton limestone, which is a hard, light-colored limestone. The Trenton limestone is a source of oil and gas in northwestern Ohio. In Madison County it yields small amounts of brine and is called the Blue Lick water zone. No water has been reported below the Blue Lick zone.

SOILS OF PLEASANT TOWNSHIP

Nine major soils are recognized in Madison County. These soils developed from highly calcareous glacial till of Late Wisconsin age, or from its alluvium. Six types of soils can be found in Pleasant Township and can be noted in Table 4. The Brookston and Crosby soils widely cover Pleasant Township, while the Miami, Celina, Sloan, and Fox soils are mainly found in the vicinity of Deer Creek. The upland soils of this area resulted chiefly from variations in relief and its effect on soil drainage. Miami soils develop on slopes and resulted in the formation of well drained soils, having light colored surface soils and brown subsoils. Brookston soils develop on flat to depresses areas and are very poorly drained. They have dark colored surface soils and mottled gray and brown subsoils. Thus, two different

TABLE 4. SOILS OF PLEASANT TOWNSHIP, MADISON COUNTY, OHIO

Soil	Topography	Drainage	Surface	Subsoil	Substatum
Miami	Rolling	Well	Silt Loam	Silty Clay Loam	Loam
Celina	Gently Rolling	Mod. Well	Silt Loam	Silty Clay Loam	Loam
Crosby	Nearly Level	Imperfect	Silt Loam	Silty Clay Loam	Loam
Brookston	Level	Very Poor	Silt-Clay Loam	Silty Clay Loam	Loam
Fox	Level to Rolling	Well	Loam	Clay Loam	Gravel
Sloan	Nearly Level	Very Poor	Silty Loam	Silty Clay Loam	Silt, Clay & Sand

Source: Soil Areas of Madison County, Ohio soils developed because of differences in relief as it affects soil drainage.

THE TEAYS RIVER DRAINAGE SYSTEM

INTRODUCTION

The ancient river system, Teays, flowed from the Appalachian Mountains in North Carolina to the ancestral Mississippi River in central Illinois. It cuts across virtually all present stream alignments in the region. Most of the way, the stream flowed on resistant dolomites and limestones and had a gradient of 9 to 10 inches to the mile.

William George Tight (1865-1910), Professor of Geology and Botany at Denison University, Ohio, made significant contributions to the knowledge of the preglacial river that drained Ohio prior to glaciation and is commemorated in the name Lake Tight. He was the first to discuss the drainage modifications of southeastern Ohio and to trace the course of the Kanawha River through the abandoned Teays Valley in West Virginia to Chillicothe, Ohio, where it disappears beneath glacial drift.

Lake Tight is the large proglacial lake formed in south-central Ohio, West Virginia, and Kentucky, resulting from glacial ice damming the Teays River and its tributaries. While the ice stood at its maximum, rivers of glacial waters poured off the ice sheet and backed the waters in all the southern tributaries of the preglacial Tuscarawas-Muskingum. This also led to the ultimate formation of the present Ohio River.

The Teays River also provided a corridor for the migration of flora and aquatic fauna into the Teays drainage basin.

Isolation of these species was a result of the proglacial Lake Tight.

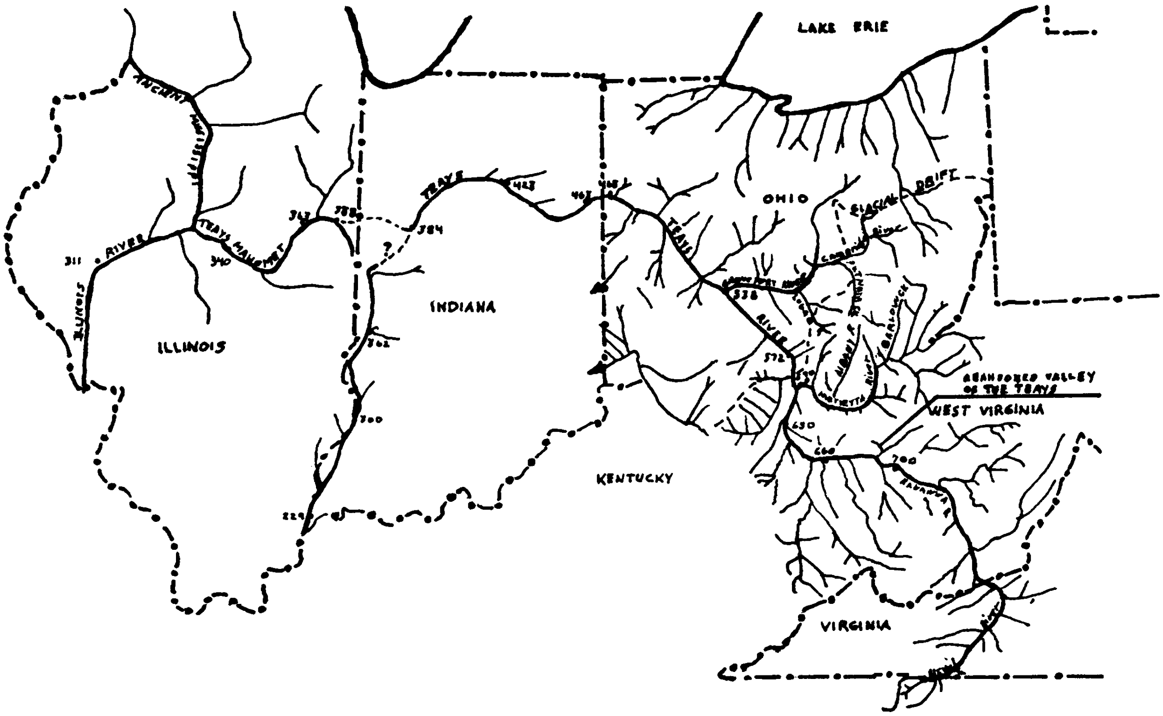
COURSE OF THE TEAYS

The term Teays is applied to the ancient river that Tight designated and also to the work of all streams contemporary with it. The immature peneplain of this era is commonly known as the Parker Strath.

The Teays gathered its headwaters in the Piedmont of North Carolina, flowed north through Virginia and northwestward across the mountains to Charleston, West Virginia (see Figure 4). From Charleston, it flowed past St. Albans, Milton and Barboursville to the Ohio River Valley at Huntington and followed the path of the present day Ohio River to Wheelersburg, Ohio. Here, the Ohio River turns abruptly toward Cincinnati, while the Teays River continues northward. The Teays River flowed through Ross County, Pickaway County, Fayette County, and Madison County, where the stream received a large tributary, the Groveport River, which drained an excessive area in central Ohio. It continued northwest through Ohio and westward to the Ohio-Indiana line in Mercer County, Ohio.

The Teays River drained a large area in northern and central Indiana. It roughly follows the present day Wabash River to its outlet. A large tributary entered the Mahomet Valley near Paxton, Illinois. From here, the Teays River runs through Illinois, where it entered the well-known bedrock valley along the Illinois River, formerly occupied by the ancient Mississippi River.

FIGURE 4. COURSE OF THE TEAYS RIVER



Source: The Teays River, The Ohio Journal of Science

MAJOR TRIBUTARIES OF THE TEAYS IN OHIO

The tributaries of the Teays River exhibit the same characteristics as shown by the Teays. In these areas the hills are considerably reduced, the tributaries have low gradients and broad valleys, and a dendritic pattern is prominent. These are all features of river maturity. The largest tributaries in Ohio are the Marietta River, Hamden Creek, the Albany River, Barlow Creek, the Portsmouth River, the Logan River, Bremen Creek, Putnam Creek, the Cambridge River, the Groveport River, Mechanicsburg Creek, and Wapakoneta Creek. These can all be seen in Figure 5.

DEPOSITS IN THE TEAYS VALLEY

Coarse Material. The coarse material found in the Teays Valley consists of sandstone boulders and highly weathered chert and quartz pebbles. These types of materials are far from abundant or are entirely absent in most parts of the Teays Valley. Where present, they lie on or near the bedrock. The chert is highly leached, discolored, and highly polished. The quartz pebbles derived from conglomerates and conglomeritic sandstones that outcropped well within the basin. The boulders are well-rounded and were gathered throughout the basin and from the Piedmont to the East.

Sands. The sand deposits lie directly on the bedrock with a few interbedded with silt deposits. They are fine-to-medium in texture, have well-rounded grains, and are stained yellow with iron oxide coatings. They contain a few percent

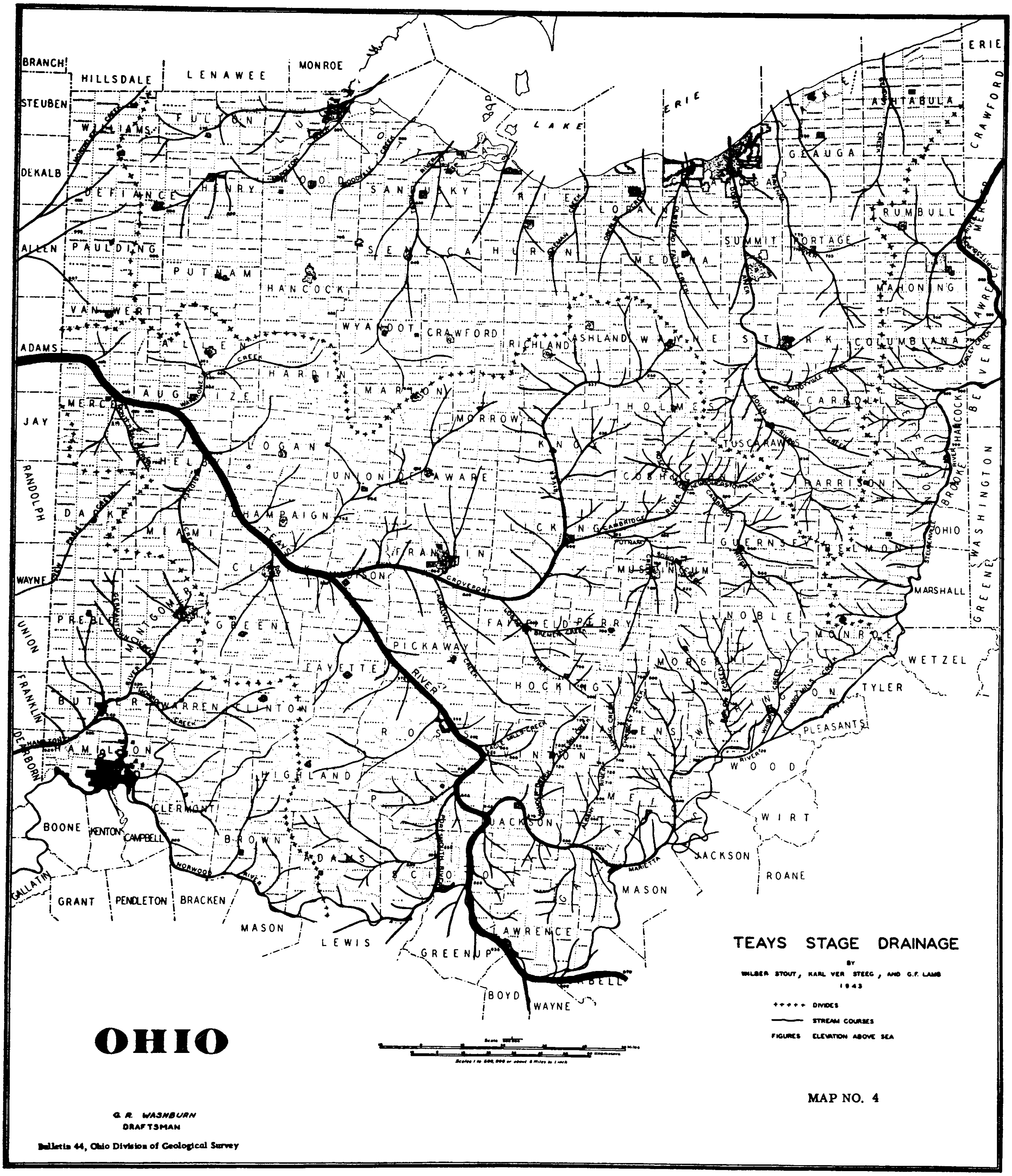


FIGURE 5. MAJOR TRIBUTARIES OF THE TEAYS IN OHIO

of mica and clay, some of which acts as bonding materials.

In some areas silts lie above the sands and appear to be the old alluvium along the preglacial streams. It is fine in texture, blue to gray, fairly plastic, and is also very siliceous.

Minford Silt. The Teays River was dammed in its lower course by an early glacier, ponding waters and producing widespread finger lakes in the Teays Valley and it tributaries. Large deposits of silt and clay in these areas are known as the Minford silt. The deposits on the old floors are best proserved in the parts of the valleys that now form divides between present streams and in the parts that were abandoned through piracy, meanders, and other adjustments. The thickness of such deposits usually range from 20 to 40 feet.

The Minford silts are always highly laminated. The material is fine-grained, has sticky plasticity, and has a smooth feel. The unoxidized color is dark bluish gray and the weathered is shades of brownish gray.

The Minford silts yield very little water to wells. This type of deposit is called "quicksand" by drillers. It is commonly forced inside the well casings by water pressure, making drilling difficult or impossible.

DRAINAGE MODIFICATIONS

The earliest ice invasion in Ohio correlates with the Kansan or pre-Kansan of the west and invaded only the northern part of the state. After this glaciation there was a long period with no surface disturbance except stream adjustments. The next two successive ice sheets were the Illinoian and the Wisconsin, which moved southward across Ohio. These two glaciers contributed great quantities of debris to the glaciated area of Ohio along with a pronounced softening of relief.

The glacial drift at the surface in Madison County was deposited during the Wisconsin glaciation around 15,000 to 20,000 years ago. The Wisconsin glacier made at least two major advances into the Ohio area, separated by a long interglacial stage. Some of the subsurface glacial deposits originated during an earlier invasion by the Wisconsin ice or by the previous two glacial stages.

<u>The Kansan or Pre-Kansan Glacier.</u> The effects of the early Kansan or pre-Kansan glacier were pronounced especially on the drainage patterns of central and southern Ohio, Pennsylvania, West Virginia, Kentucky, and Indiana as seen in Figure 6. New stream systems were inaugurated as the streams reversed or became filled with silt. Gradients of the streams were also changed due to this glaciation.

The Teays Stage drainage suffered severe alterations due to the first period of glaciation in Ohio. The Teays Stage stream north of the Kansan or pre-Kansan boundary were eliminated or shifted to new courses. Two major modifications in the Ohio area occured. The first was the blocking and elimination of the Teays River in the St. Marys Reservoir area by a glacial sheet. This caused the floodwaters to be shifted

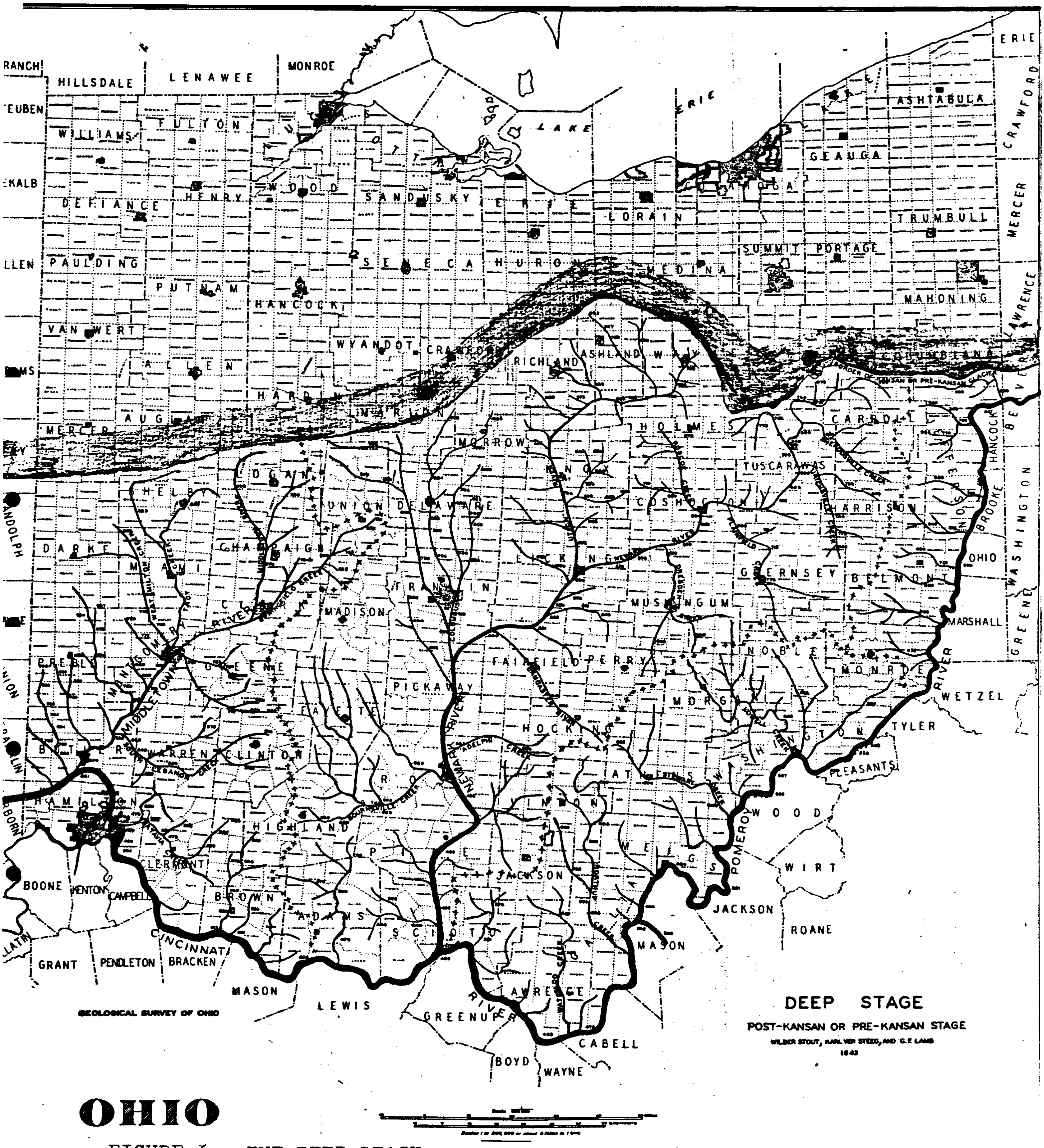


FIGURE 6. THE DEEP STAGE

G. R. WASHBURN
DRAFTSMAN

westward. The second major change in the drainage pattern in Ohio was caused by the ice sheet damming the old Pittsburgh River in the vicinity of Beaver Falls, Pennsylvania. This caused the flood waters of the upper part of the Pittsburgh River basin, now drained by the present Allegheny and Monongahela rivers, to reverse direction (Stout, 1944).

The invasion of this ice sheet across northern Ohio also shifted the main drainage lines in the central part of the state. The headwater areas of the Teays Stage remained the same, but the main streams in the lower courses pursued different directions.

Another effect during the early stages of the damming of the Teays, Dover, Pittsburgh and other rivers by the Kansan or pre-Kansan glacier was a flood period with the formation of long finger lakes in which was deposited the Minford silt.

Overall, evidence warrants that the Kansan or pre-Kansan glacier modified the rock surface and drainage patterns across northern Ohio. It brought the Teays Stage drainage system to a close and inaugurated the Deep Stage drainage system.

Stout (1938), states that soon after the new system of drainage was outlined, regional uplift took place with consequent active cutting of stream beds. Through this the stream floors were degraded much below the level of the Teays. This cycle of erosion was brought to a close by the Illinoian ice invasion and was characterized by the development of new streams, the deepening of stream channels, steep slopes of valley walls, and the general immaturity of the basins.

<u>The Illinoian Glacier.</u> The drainage pattern in Ohio was also greatly changed by the Illinoian glacier. Its farthest advance can be seen in Figure 7. In Ohio it extended only a short distance south of the bed of the Deep Stage Cincinnati River and covered about three-fifths of Ohio. The Illinoian glacier had a marked influence in leveling the surface in Ohio through the burial of drift. It was also a prominant factor in changing the drainage systems throughout the entire area. It was a thick sheet of glacial ice and had much influence in directly and indirectly shaping surface features.

The Deep Stage drainage in Ohio was completely obliterated by the Illinoian glacier. It left great quantities of glacial debris, drift, and outwash, which was worked upon by streams. This condition was much different from pre-Kansan time when the stream burden consisted only of the wash from the hills.

The mantle of the Illinoian drift in central Ohio introduced quite a few important shifts of drainage. Besides the effects it had on the Deep Stage Cincinnati River, the Deep Stage Newark River was completely blocked by the wall of ice at Hanover, Ohio. Its large northern tributary, the Utica River, was buried and elininated northward. Overall, the ice of the Illinoian glacier was an effective barrier of waters from the unglaciated portion of southeastern Ohio. These waters sought other outlets and established new lines of drainage.

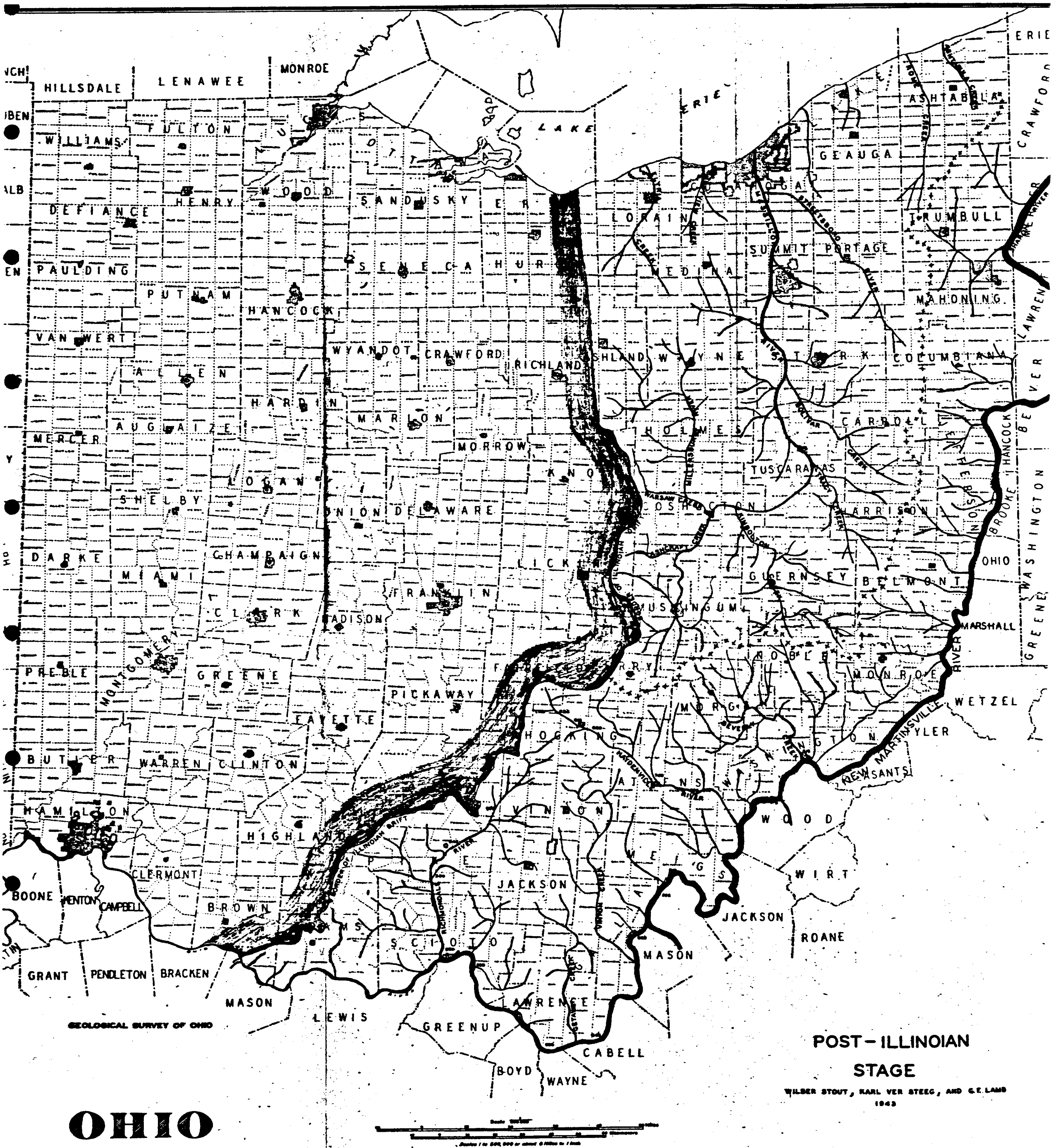


FIGURE 7. POST-ILLINOIAN STAGE

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DRAFTSMAN

The Wisconsin Glacier. The last ice sheet to invade Ohio was the Wisconsin glacier. The deposits of this glacier can be found over the northern and western parts of Ohio. It made many changes in the surface features of Ohio, leveling areas to a smooth plain and filling valleys with all sizes of outwash materials.

In eastern Ohio the Wisconsin ice sheet extended about one third of the way from the lake to the Ohio River. Throughout the central part of the state, the Wisconsin lagged behind the extent of the Illinoian glacier. In western Ohio the glacier reached 15 to 40 miles north of the Ohio River. The extent of the Wisconsin glacier can be seen in Figure 8.

The Wisconsin glacier pushed out lobes along its main axes of flow. Here the ice was thicker and moved at a faster rate The location of these lobes depended upon the source of the ice while the direction of flow was determined by various surface factors such as topographical depressions. The major lobes in Ohio pushed out along the stream valleys in the Grand River, Killbuck River, Scioto River, and the Miami River.

The Wisconsin glacier caused considerable shifting and modifications of the drainage systems established in post-Illinoian time. The most important alteration was the re-establishment of the master stream along the original course and in the direction of flow of the Deep Stage Cincinnati River of post-Kansan time. This direction was westward or was in reverse with that established in post-Illinoian time.

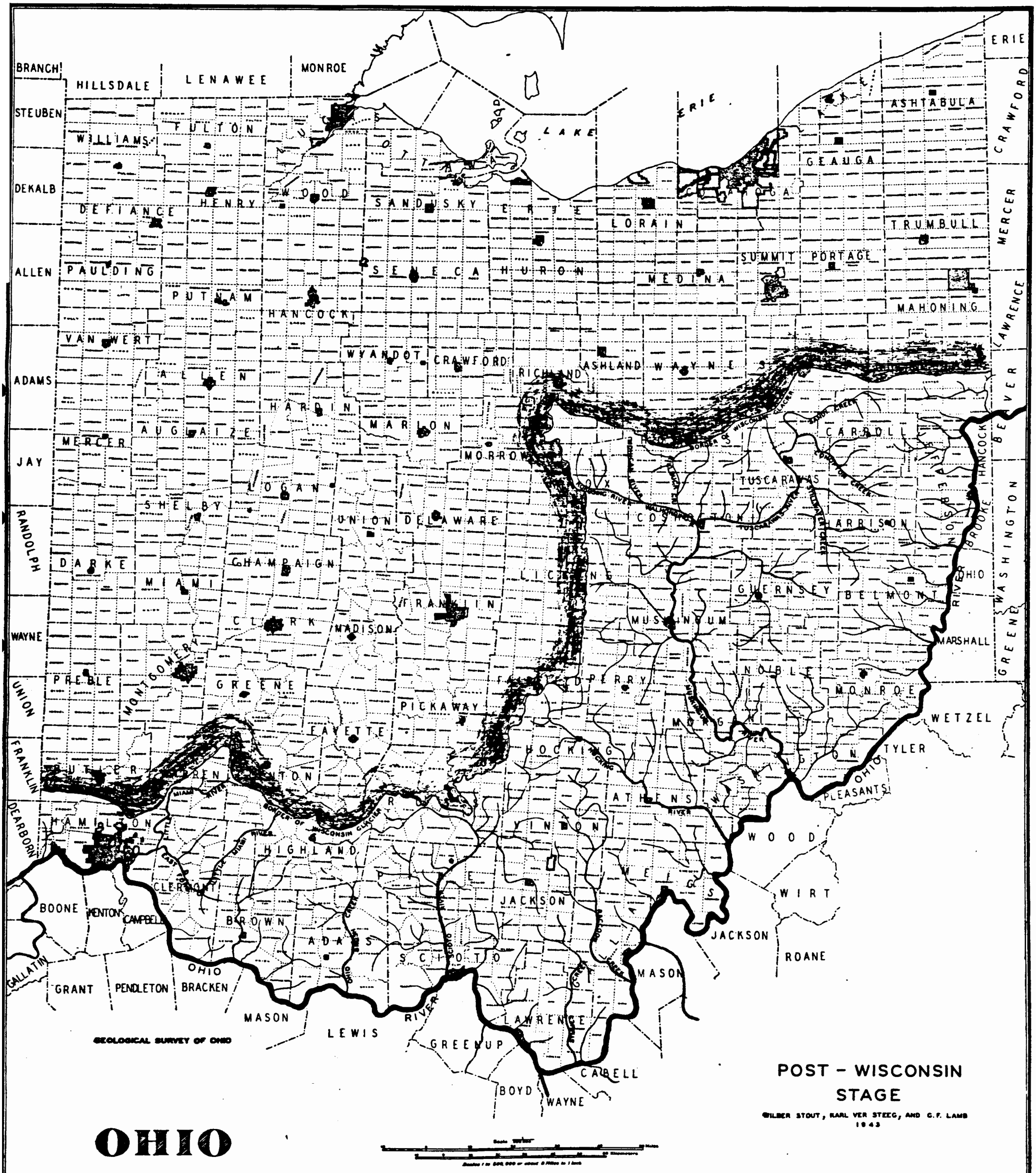

FIGURE 8. POST-WISCONSIN STAGE

G. R. WASHBURN
DRAFTSMAN

The master stream was now the Ohio River. This line of drainage was a consequence of the damming of the New Martinsville River near Homewood, Pennsylvania by a thick mass of ice and rock materials of the Wisconsin glacier.

The Wisconsin seems to have been a thicker or more massive ice sheet than the previous ones as indicated by the accumulations left behind. Its typical surface features include ground moraines, eskers, kames, outwash aprons, and beach ridges.

Summarizing, there were two major effects of the Wisconsin glacier. The first was the major change in direction of flow through the blocking of older lines of drainage and the opening of new passages. The second major effect was the choking of adjacent valleys with silt, sand, and gravel causing the new streams to flow at higher levels. Overall, the streams of Ohio are composite in make-up with the work having been done in the Teays River, Deep Stage, post-Illinoian, or post-Wisconsin time, or a combination of all of these events.

GROUND WATER CONDITIONS IN PLEASANT TOWNSHIP

Large supplies of ground water are available from the outwash sand and gravel in the Deer Creek valley in Pleasant Township or from the underlying Bass Islands dolomite. The Bass Islands dolomite is generally a good source of water with typical farm wells being drilled a few feet into the bedrock. Wells of larger yield are commonly drilled to greater depths in the bedrock and tap widespread zones of high permeability such as the Newburg zone.

Mount Sterling has the largest ground water development in Pleasant Townshop. The wells are drilled into the Bass Islands dolomite into a permeable zone similar to the Newburg zone but higher in elevation.

Plate I shows contours on the bedrock surgace in Pleasant Township based on drillers' records of wells recorded between 1954 and 1982 Madison County prior to Pleistocene glaciation was a relatively flat upland that was cut by wide, steep-sided valleys. The elevation of the bedrock surface in Pleasant Township ranges generally from 800 to 900 feet above sea level. The steep-sided valleys that cut across this area are about 600 feet above sea level. These valleys were cut by the Teays River and its tributaries.

The Teays River entered northern Pleasant Township from the east and was joined in north central Pleasant Township by a large tributary from the south. It was made up of two other smaller tributaries. Today, Deer Creek follows the path of the small tributary that flowed from the southeast, and Bradford Creek and Sugar Run follow the path of the ancient tributary that flowed from the southwest. In general, Deer Creek closely follows the drainage pattern of the ancient Teays River in Pleasant Township. The gradient of the Teays Valley in Pleasant Township is approximately 1 foot per mile. Table 5 shows the records of wells in Pleasant Township that were used in the construction of Plate I.

TABLE 5. RECORDS OF WELLS IN PLEASANT TOWNSHIP, MADISON COUNTY, OHIO

Explanation of terms and symbols:

Number................	The number of the well shown on Plate I.
Owner.................	The name of the landowner at the time of the well inventory.
Elevation of Well.....	Determined from the topographic maps of the United States Geological Survey.
Depth to Bedrock......	Depth to the surface of the consolidated rocks.
Depth of Well.........	Depth reported by driller.
Water Level...........	The depth below land surface of the water level as reported by the driller.
Date	Date of determination of the water level.
Rate	The rate, in gallons per minute, at which the well was pumped or bailed.
Drawdown	The amount of lowering of the water level in the well caused by the withdrawal of water at the rate indicated in the rate column.
Diameter of Well......	Approximate inside diameter of the well or casing.

TABLE 5. RECORDS OF WELLS IN PLEASANT TOWNSHIP
MADISON COUNTY, OHIO

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diameter of Well	Remarks
1	Earnest Redding	942	85	857	145	Rock	63	8-26-55	10	5	4½	
2	Eligha Lick	935			74	S G	35	5-12-70	15	0	4¼	clear
3	Don Morehart	932			88	G	40	1-41-64	6	0	4¼	
4	T.D. Vamcargo	925			30	S G	17	8-69	60	5	5	cloudy
5	Ira Hunter	949	143	806	147	LS	50	4-14-62	10	0	4¼	clear
6	Ira Hunter	949			104	S G	30	4-21-62	10	0	4¼	clear
7	Donny Sharrett	947	121	826	122	Rock	37	8-28-71	10	0	4¼	clear
8	Edison E. Myers	905				G	44	5-09-53	15	0	4¼	
9	James Potts	935			72	S G	38	2-28-72	20	0	4¼	clear
10	B. Dwyer	925			51	S G	33	5-22-62	8	1	4¼	cloudy
11	E.L. Oldenburg	925			90	S G	45	11-19-71	12	0	4¼	clear
12	A.E. McGafferty	905	87	818	88	Rock	32	9-09-57	8	0	4¼	
13	A.E. McGafferty	905	86	819	87	Rock	41	12-07-62	15	2	4¼	clear
14	Ivan Hughes	910			65	G	40	12-16-57	15	0	4¼	
15	Walter Eden	923			59	S G	37	2-07-63	15	2	4¼	cloudy
16	Leslie Galbreath	940			136	Sh G	34	3-19-55	10	1	4¼	
17	Jerry Smith	941	166	775	166	LS	40	5-18-65	8	5	4¼	clear
18	Dick Daily	941	166	775	178	LS	44	9-29-66	20	0	4¼	clear
19	George Balo	940			38	S G		4-10-69	20	6	4¼	clear, artesian well
20		933	133	800	133	LS	60	9-15-70	15	0	4¼	clear
21	L&K Restaurant	931	295	636		LS	33	1-14-72	50	60		clear
22	Phillips Oil Co.	928	193	735	198	LS	32	4-03-65	30	0	4¼	clear
23	Hubert Boushier	920		798		G	8	10-04-68	16	0	4¼	
24	Ed Bauman	925			120		47	2-20-54	10	0	4¼	
25	Ed Bauman	875			101	G	40	2-22-54	10	0	4	
26	Ed Bauman	925	173	752	173	Stone		11-10-59	12	0	4¼	clear

TABLE 5 CONTINUED

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diamerer of Well	Remarks
27	Mildred Junk	926	303	623	307	Rock	20	6-15-66	10	125	5 5/8	
28	H.S. Cowan	920			73	G	35	6-14-83	30	8	5	clear
29	Jerru Smith	885	172	757	172	Rock	30	7-14-83	12	3	4¼	cloudy
30	Ware Construction	900	80	810	85	LS	40	5-13-71	30	15	5	clear
31	Eugene Daniel	910	78	833	103	LS	65	6-08-72	15	8	4¼	cloudy
32	G.F. Jacobs	912	91	821	91	LS	50	8-15-68	10	20	4¼	clear
33	Tom Lindsay	912	117	795	117	LS	60	10-07-67	20	0	4¼	clear
34	Ware Construction	918	176	742	178	LS	55	4-23-69	20	10	5	cloudy
35	Green Construction	915	92	823	96	LS	60	9-09-70	16	35	5	clear
36	Jerry Smith	916	95	821	95	LS	47	9-22-66	20	0	4¼	clear
37	Dean Corn	919	93	826	93	Rock	41	9-20-63	8	2	4¼	cloudy
38	Jerry Smith	916	110	806	110	LS	80	2-21-67	12	0	4¼	clear
39	Harold Jacobs	920	90	830	90	LS	50	9-04-67	15	0	4¼	clear
40	Ohio Fuel Gas Co.	924	132	792	132	LS	45	8-05-54	90	5	10	
41	Bennett O'Day	930	135	795	137	LS	28	5-21-54	8	10	4¼	
42	James O'Day	933	96	837	97	Rock	35	8-01-57	10	60	4¼	
43	Emerick	927			87	S G	15	5-21-68	10	0	4¼	
44	Ray Butz	923	80	843	81	Rock	35	5-21-55	10	10	4¼	
45	Jerry Smith	909			120	S	50	12-01-63		0	4¼	
46	Jerry Smith	909	119	780	120	LS	50	12-05-62	6	30	4¼	
47	Chamberland	914	118	796	118	Stone	50	6-14-55	15	24	4¼	
48	James H. Crace	912			109	S	8	2-25-58	10	20	4¼	
49	Rador	904			66	S G	30	9-30-71	15	0	4¼	clear
50	Ware Construction	850	40	810	44	LS	8	10-18-71	20	30	5	clear
51	Kathy Cochran	862			58	S G	30	12-16-64	8	2	4¼	cloudy
52	Carlos Joslin	895			63	S G	15	8-24-71	15	0	5 5/8	clear
53	Nate Rapp	890			132	G	40	1-11-56	10	0	4½	
54	Henry Blair	909	95	814	95	LS	40	3-22-55	10	20	4¼	

TABLE 5 CONTINUED

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diamerer of Well	Remarks
55	Bill Oglebee	909	92	817	93	LS	40	10-07-54			4½	
56	Freewill Church	910			64	S G	50	6-11-66	10	0	4½	clear
57	Alvis Williams	912	92	820	92	LS	40	1-24-58	10	30	4½	
58	Jerry Smith	909	97	812	98	LS	42	3-07-58	10	40	4½	
59	Don Neal	913			64	S G	49	5-25-60	10	0	4½	
60	June Thompson	914			61	S G	36	5-31-61		0	4½	
61	Pearl Kemper	914	90	824	90	LS	40	5-30-58	10	30	4½	
62	Pearl Kemper	911	92	819	92	LS	40	2-28-58	10	50	4½	
63	Will Schuler	910			99	G	39				4½	
64	David Day	912	96	816	96	LS	40	5-03-58	10	10	4½	
65	Earl Chamberlain	913			75	G	35	8-20-60		0	4½	
66	Richard Lewis				83	G	50	12-17-63		0	4½	Not Locateable
67	Stanley Baisel	903	93	810	93	Rock	47	8-19-67	10	0	4½	clear
68	Williamson	905	91	814	91	Rock	50	12-04-67	10	5	4½	clear
69	Tom Whiteside				65	S G	34	2-09-70	20	0	4½	Not Locateable
70	A.K. Alkire	912	90	822	90	Rock	55	2-05-71	10	6	5 5/8	clear
71	Harold L. Rice				87	S G	4?	2-19-70	30	6	4½	Not Locateable
72	Cecil Oaten	843	145	698	150	LS	35	2-30-70	25	0	4½	clear
73	Ware Construction	845	130	715	132	LS	40	3-21-70	12	60	5	clear
74	Ralph McKinley	905	108	797	108	LS	60	2-05-70	20	0	4½	clear
75	Harold Kemper				94	S G	40	12-09-69	12	40	5	Not Locateable
76	M. FeForbge	910	77	833	77	LS	60	8-18-71	16	50	5	clear
77	James C. Chime							2-10-71				Pipe Hung up in Blue Clay
78	Kenny Stoer	895	94	801	94	LS	60	1-18-71	10	10	4½	clear
79	Jerry Smith	938	356	582		LS	80	7-27-72	20	0	4	
80	Steve Monitt	940			68	G	30	7-29-72	20	00	4	

TABLE 5 CONTINUED

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diamerer of Well	Remarks
81	Vernon Woodall	910	175	735	184	LS	60	1-20-72	30	0	4	cloudy
82	Ware Construction	939	80	859	81	LS	70		20	30	5	cloudy
83	James Maxie	928			146	G	37	11-18-72	16	0	4	clear
84	Stan Harper	941	111	830	111	Rock	20	11-10-72	10	39	4¼	clear, no odor
85	Chas B. Storr	905			105	S G	60	11-11-72	12	4	4¼	clear
86	Thompson Industries	900	129	771	131	LS	40	4-08-71	980	76	16	clear
87	Thompson Industries	905	130	775	134	LS	43	2-03-71	610	67	16	clear
88	Ware Construction	910			65	G	4	2-27-73	20	22	5	clear
89	Delbert Craft	922			65	S G	25	7-04-73	10	1	4¼	clear
90	W.W. Eden	915			58	S G	28	7-05-73	15	2	5	cloudy
91	M. Spirlsman	900	96	804	99	LS	40	7-10-73	9	65	5	cloudy
92	Joe Hempkill	920			110	S G	60	8-23-73	15	0	4	clear
93	Larry Fitapatrick	911	136	775	140	LS	60	9-03-73	10	0	4	
94	Cliff Riffe	935	375	560	380	LS	126	2-13-74	10	0	4	
95	Tim Boyd	920	95	825	98	Rock	50	2-18-74	14	5	4¼	cloudy
96	Minton Farm	875	133	742	135	LS/Sh	67	6-03-75	8	12	5	clear
97	Mack Warner	918			84	S G	42	9-15-72	20	0	5	clear
98	Charles Stank	932			90	S	51	6-02-75	20	1	6	clear, no odor
99	Jake Gross	915			93	G	44	8-20-56	20	0	4	
100	J.K.Downs	860	176	684	186	LS					5 5/8	
101	Dale Fulton	936	80	856	80	LS	16	2-21-53	10	0	4¼	
102	Gene	908			52	G	22	4-19-53		0	4¼	
103	Frank Young	865			98	S G	42	2-22-54		0	4¼	
104	Lewis Kious	930	91	839	92	LS	45	10-29-54	11	0	5 5/8	
105	R.E. Capp	897			115	G	20	9-29-56			4¼	
106	Alpha Farms	993	67	926	68	LS		3-13-54			5 5/8	
107	Clark Beale	902			34	S	16	5-03-54	6	1	4¼	
108		940			211	S		4-09-53	10	16	4¼	

TABLE 5 CONTINUED

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diamerer of Well	Remarks
109	Fred H. Stamm	923			76	S	37	10-01-56	21	0	4¼	
110	Ernest Redding	895	53	842	56	Rock	30	3-24-54	10	0	5	
111	Eugene Hayes				139	LS		7-27-54			4¼	Not Locateable
112	Wayne Smith	915	101	814	105	LS		7-16-54			5 5/8	
113	Edward Tanner	920			123	G	6	10-03-55	10	0	4½	
114	Hugh Wendell		75		84	Rock	37	9-29-56	8	0	4¼	Not Locateable
115	John Batner	845	145	700	186	Rock	39	3-29-56			4¼	
116	Lewis Wade	920			79	G	27	10-05-56	24	6	4¼	
117	Russ Alhire	895			113	G	42	10-05-56	16	0	6	
118	Manford Deloy	905	100	805	100	LS	52	1-06-56	7	6	4¼	
119	John Meek				65	G	31	8-09-63	10	0	4¼	Not Locateable
120	John Follrod	940			63	G	25	12-01-53	8	4	4¼	
121	Clarence Gerring	950	294	656	294	Rock		2-24-56	6	0	4½	
122	Howard Graham	903			52	G	7	8-24-57	16	0	4¼	
123	Mrs. John Junk	925			130	G	30	9-03-57	27	10	5 5/8	
124	Howard Scott				196	S G	56	12-30-53		30	6 5/8	Not Locateable
125	McMullen	903			34	G	13	4-09-62		4	4¼	cloudy
126	Marforie Wittich	865			86	S G	24	11-08-72	10	10	4½	clear
127	K Mart	895			130	S G	90	9-10-72	12	0	4¼	clear
128	James H. Maxie	924			112	S G	40	9-25-71	10	0	4¼	clear
129	Ronnie Anderson	932			65	S G	50	8-01-75	10	1	5	clear
130	Myrle Olsen	904	144	760	144	Rock	42	5-06-74	10	4	4¼	clear
131	Daniel Bragg	934			92	S G	45	12-12-72	18	4	4¼	clear
132	Art Marcum	941			62	S G	42	9-01-76	12	3	5	clear
133	Mid Ohio Chemical	905	134	761	139	LS	48	2-05-76	400		8	clear
134	Mid Ohio Chemical	905	134	761	139	LS	48		350	0	8	clear
135	Ed Baird				110	S G	20	5-06-76	15	2	6	Not Locateable
136	H & D Inc.	925			90	S G	45	8-15-77	12	0	5½	clear
137	Walter Rice	926			86	S G	20	8-09-77	17	2	5 1/8	clear

TABLE 5 CONTINUED

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diamerer of Well	Remarks
138	T. Raymond	919	116	803	118	Rock	65	5-06-77	16	2	5 1/8	clear
139	Charles Bricker	940			124	S G	60	1-01-77	20	1	5	clear
140	F. Bryce		132		137	LS					5	Not Locateable
141	Tom Wittach		107		107	Rock			12	1	5 1/8	Not Locateable
142	Hallard Sevyer	916			53	S G	18	9-28-77	15	4	6	clear
143	Gary Neff	908	72	830	72	LS	60	2-18-78	15	10	5	clear
144	Phil Minic	925	122	803	125	LS	70	10-23-78	13	5	4½	clear
145	Jay Goslin	885	77	808	79	LS	40	8-06-78	14	60	5	clear
146	Clarence Bonzo	900	42	858	42	LS	25	11-18-76	20		5 5/8	clear
147	Edward Rapp	915			33	S G	18	5-14-79	16	1	4½	clear
148	Phil Minic Jr.	908			78	S G	35	5-10-79	16	1	4½	clear
149	Paul Reiser	912			62	S G	35	10-05-79	8	0	5	
150	Dwight Reed	908	104	804	106	LS		1-79			5	cloudy
151	N.C. Copas	933	82	851	85	LS	35	11-12-81	20	60	6	clear
152	Robert Lewis	923	88	835	89	Rock	3	6-03-80	15	4	5 5/8	clear
153	Harold Houser	920			81	S G	20	11-19-74	30	5	5	clear
154	Church of Christ	903	120	783	120	LS	60	2-15-80	25	0	5 5/8	clear
155	Tom Barler	917	105	783	105	LS	40	7-26-80	10	30	6	clear
156	Oscar Hite	924	74	850	74	LS	40	7-80	25	0	5 5/8	clear
157	Dean Porter	909			120	S G	58	8-26-80	15	1	4½	clear
158	James Hollar	913	97	836	97	Rock	50	12-26-80	11	8	4½	clear
159	J.B. Anderson				87		33	10-04-80	10	60	6	Not Locateable
160	Fred Trimble	920			67	S G	45	9-28-81	22	4	4½	clear
161	J.E. Reichelbeck		98		102	LS	50	9-30-81	20	30	6	Not Locateable
162	Elmer Rice	909	100	809	105	LS	40	8-12-81	25	40	6	clear
163	Robert Thomas	926	76	850	76	Rock	27	12-26-81	20	3	4½	clear
164	Carl Walters	915			145	S G	80	10-13-82	10	3	4½	clear

TABLE 5 CONTINUED

Well Number	Owner	Elevation at Well	Depth of Bedrock	Elevation of Bedrock	Depth of Well	Character of Material	Water Level Ft. Below Surface	Date	Rate (gpm)	Draw-down	Diamerer of Well	Remarks
165	Jerry Bowers	920			74	S G	40	9-82	15	0	6	clear
166	Harold Dunn	910			131	S G	60	9-82	20	0	6	clear
167	Robert Humphrey	930	109	821	109	LS	30	7-82	20	0	4¼	clear
168	Andre Crotti	942	198	742	202	LS	40				4¼	
169	Ralph Booth	922	34	888	50	LS					4¼	
170	W.E. Ewing	902	102	800	116	LS					4	
171	S.H. Anderson	922	117	805	120	LS	15				4¼	
172	Seymore Kious	924	155	769	160	LS					4¼	
173	Old Schoolhouse	921	136	785	156	LS						
174	Davis Smith	929	109	820	116	LS					4¼	
175	John Day	923	78	845	110	LS					4¼	
176	Dr. Lutz	930	87	843	132	LS					4¼	
177	Oh. Fuel/Gas	922	139	783	155	LS					8	
178	E.R. Jones	918	123	795	140	LS					4¼	
179	Harley Tracey	920	90	830	100	LS	10				4¼	
180	Charles Beal	910	102	808	200	LS	20			4¼	4¼	
181	Fred Harness	850	54	796	64	LS	8				4¼	
182	R.T. Alkire	895	96	799	104	LS	32				4¼	
183	Holtzmuller	860	69	791	75	LS	4				4¼	
184	Porter Mills	923	73	850	79	LS					4¼	
185	R.H. Graham	885	239	646	250	LS		8-52			4	
186	Earl Anderson	941	293	648	300	LS		8-53			4	
187	Harmon Boss	936	283	653	291	LS		9-53			4	
188	Dr. F.A. Lutz	918	261	657	282	LS	33	8-24-56	9		5 5/8	

SUMMARY

Pleasant Township is located in central Ohio and was first settled in the 1800's. Its population has continued to grow steadily and today it has a total population of 2,768 people. 1623 people live in Mount Sterling Village, its largest town. Agriculture is by far the prominent form of land use, making water a valuable resource.

The bedrock of the Pleasant Townshop area consists of limestone and dolomite strata of Silurian and Devonian age. Before the Pleistocene glaciation, the ancient Teays River rose in the Piedmont Plateau of Virginia and North Carolina and flowed across West Virginia, Ohio, Indiana, and Illinois to the ancestral Mississippi River. It was the major factor in shaping the land in this area until the glaciers flowed down from the north. At this time, the streams of the present day Ohio Basin flowed northwestward. The Kansan, Illinoian, and Wisconsin glaciers changed the landscape by flattening the land, filling in the valleys, blocking streams, and changing the direction of flow of most of the streams in the Ohio Basin.

The buried valleys in Pleasant Township are dependable sources of water for community use, farms and suburban houses. Sand and gravel beds which underlie or are interbedded in the glacial till are good sources of water, along with sand and gravel beds of the Darby and Deer Creek basins.

Madison County is part of the Till Plains Section of the Central Lowlands Physiographic Province. It is a nearly level undulating ground moraine with a few end moraines. Deer Creek if the largest stream in the area and drains about half of the land surface of the county. It closely follows the path of the ancient Teays River in Pleasant Township.

Wells drilled into the bedrock obtain water from the crevices in the top few feet of bedrock. This weathered layer forms a homogenous aquifer with overlying sand and gravel beds. Wells drilled below the weathered layer in the limestone and dolomite rocks increase little in yield until they encounter a discreet zone of high permeability. These zones serve as zones for circulation. The most important zone of this type in Madison County is the Newburg zone.

From Plate I it can be seen that Pleasant Township prior to Pleistocene glaciation was a relatively flat upland cut by a wide valley to the north and joined by a steep-sided tributary from the south. The elevation of the bedrock surface ranges from about 800 to 900 feet above sea level to about 600 feet above sea level in the valleys. The valleys have a gradient of about 1 foot per mile.

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