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JOINT HIGHWAY
RESEARCH PROJECT
JHRP 88-9

ENGINEERING SOILS MAP OF
DECATUR COUNTY, INDIANA
FINAL REPORT

Timothy H. DeWitt

PURDUE UNIVERSITY

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Final Report

ENGINEERING SOILS MAP OF DECATUR COUNTY, INDIANA

TO: H. L. Michael, Director
Joint Highway Research Project

May 10, 1988

FROM: Robert D. Miles, Research Engineer
Joint Highway Research Project

Project: C-36-51B

File: 1-5-2-81

The attached report entitled "Engineering Soils Map of Decatur County, Indiana," completes a portion of the long term project concerned with the development of county engineering soils maps of the 92 counties in the State of Indiana. This is the 81st report of the series. The report was prepared by Timothy H. DeWitt, Research Assistant, Joint Highway Research Project.

The soils mapping of Decatur County was done primarily by the analysis of landforms on stereoscopic aerial photographs. Some test data from soil borings was obtained from IDOH. Generalized soil profiles for the landforms mapped are presented on the engineering soil map. A print of the engineering soils map of Decatur County is included at the end of the report.

Respectfully submitted,

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by

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ENGINEERING SOILS MAP
OF
DECATUR COUNTY, INDIANA

INTRODUCTION

The engineering soils map of Decatur County was completed using primarily aerial photographic interpretation techniques. Stereoscopic investigations of the photographs by proven observational methods were used for delineation of landform-parent material types [1]. The aerial photographs used in this project were taken for the U.S. Department of Agriculture in August, 1939. These photos were purchased from the U.S.D.A. and were printed at a scale of 1:20,000 (3 inches = 1 mile). The engineering soils map attached was prepared at a scale ratio of 1:63,360 (1 inch = 1 mile).

The soil boundaries were cross-referenced with the Agricultural Soil Survey of Decatur County, Indiana [2]. After mapping of the photos was completed, several trips to the county were made to help verify boundary and parent material interpretation. The map includes landform-parent material associations and surface soil textural symbols. All symbols on the map are standardized symbols developed by the staff of the Airphoto Interpretation Laboratory, School of Civil Engineering, Purdue University, for mapping of engineering soils. Shallow soil profiles shown on the attached map represent the soil horizons on the different parent material types. The profiles were developed

using data collected from the Decatur County Soil Survey, field sampling, field investigations, borehole records, and agricultural soil characterization data. The text of this report contains a general description of the area, a description of the soil and parent material types, and a discussion of possible engineering problems associated with the soil and bedrock of the county.

DESCRIPTION OF THE AREA

GENERAL

Decatur County is located in southeastern Indiana, 50 miles southeast of Indianapolis. Decatur County is bounded by Rush County on the north, Franklin County on the east, Jennings and Ripley Counties on the south, and Bartholomew and Shelby Counties on the west (see Figure 1). Decatur County is very odd shaped, with corners missing on the southeast and northwest sections. The county has dimensions of 5.5 to 21 miles in the east-west direction and 13 to 22 miles in the north-south direction. The maximum east-west dimension is in the middle section of the county and the maximum north-south dimension is on the western side. Decatur County covers approximately 370 square miles or 236,800 acres. Greensburg, the largest city and county seat, is located in the northcentral portion of the county.

Decatur County was founded in 1822. The land was ceded by the 1819 Treaty of St. Marys from the Delaware Indians. The population of Decatur County in 1980 was 23,841, with a growth of

Figure 1. Location Map of Decatur County.

4.85% since 1970. Table 1 gives a population summary of Decatur County.

Table 1. Population Summary of Decatur County (3).

City	Population		Population change	
	1980 Census	1970 Census	Pop. Difference	Pct. Change
Greensburg	9,254	8,620	634	7.35%
Milford	177	187	-10	-5.35%
Millhousen	214	252	-38	-15.08%
New Point	296	381	-85	-22.31%
St. Paul & She	976	785	191	24.33%
Westport	1,450	1,170	280	23.95%
Totals				
Cities & Towns	12,367	11,395	972	8.53%
Rural Areas	11,474	11,343	131	1.15%
County Total	23,841	22,738	1103	4.85%

Farming provides the major income in Decatur County. Approximately 96 percent of the available land is used for agriculture [2]. Of this land, about 72 percent is used for cropland, with corn being the primary crop.

There are other natural resources in Decatur County besides farmland. These natural resources include mineable limestone, sand and gravel aggregate, and natural gas.

CLIMATE

The climate of Decatur County is characterized by four distinct seasons. The summers are hot with high humidity and the winters are cold. Precipitation is generally evenly distributed among the months of the year. The county experiences frequent

temperature and humidity changes due the clash of warm tropical air from the south with cold polar air from the north.

Table 2 gives temperature and precipitation statistical data for Decatur County as recorded at Greensburg, Indiana [2]. These data were recorded between 1951 and 1976 at the Greensburg weather station.

The average daily temperature in Decatur County is 52 degrees F. July is generally the warmest month of the year in the county with an average daily temperature of 73.3 degrees F. On the average, the maximum temperature will exceed 90 degrees F approximately thirty-four days out of the year. The coldest month of the year is January. During January, the daily average temperature reaches 28.6 degrees F. The temperature will not reach 32 degrees F approximately twenty-two days each year.

The average yearly precipitation in Decatur County is 39.88 inches. This precipitation comes in the form of rain, snow, and sleet throughout the year. The month of May generally receives the most precipitation with a total average of 4.62 inches for the month. February usually receives the least precipitation with only 2.60 inches. During the winter months of the year, Decatur County expects to receive on the average approximately 16.6 inches of snow accumulation.

Winds in Decatur County blow most frequently from the southwest. During one or two of the winter months, the wind blows from the northwest. Thunderstorms occur on about eight days of

the year, usually in the spring and early summer [4].

DRAINAGE FEATURES

Figure 2 is the "Drainage Map of Decatur County, Indiana" prepared in 1948 by the Joint Highway Research Project at Purdue University [5]. Decatur County is drained by portions of three drainage watersheds of Indiana. These include the Upper East Fork White River watershed, the Whitewater River watershed, and the Minor Ohio watershed.

The Upper East Fork White River watershed drains everything west of a line from approximately Clarksburg in northeastern Decatur County to Smyrna in southeastern Decatur County. This area is roughly 80 percent of the county. The major rivers and creeks of the drainage basin includes: Flatrock River, Clifty Creek, Fall Fork Clifty Creek, Sand Creek, and North Fork Muscatatuck River.

Flatrock River drains the northwest corner of the county. It is formed by the joining of Little Flatrock River with Big Flatrock River approximately three miles east of St. Paul. Flatrock River leaves the county at St. Paul. Silurian age bedrock can be seen outcropping along the river's banks.

Clifty Creek and its tributaries drain the central-northern and the central-western sections of the county. Clifty Creek is formed near Sandusky when Middle Branch Clifty Creek from Rush County joins with North Clifty Creek. South Branch Clifty Creek

Figure 2. (5)
DRAINAGE MAP
DECATUR COUNTY
INDIANA

enters Middle Branch Clifty Creek about one mile east of Sandusky. Clifty Creek flows southwesterly from Sandusky and leaves Decatur County three miles west of Burney. The western part of the county just south of Clifty Creek is drained by Fall Fork Clifty Creek. Fall Fork Clifty Creek parallels Clifty Creek and leaves the county two and one half miles south of S.R. 46. It joins Clifty Creek inside of Bartholomew County.

The central and southwestern sections of the county are drained by Sand Creek and its tributaries. Sand Creek's tributaries include: Middle Fork Sand Creek, Cobbs Fork Sand Creek, Panther Creek, Millstone Creek, Rock Creek, Turnover Creek, Poplar Creek, and Bear Creek [6].

One small section in the south-central part of the county west of Smyrna is drained by North Fork Muscatatuck River and its tributary Squaw Creek. They leave Decatur County just east of Millhousen.

The Whitewater watershed drains the northeastern and central-eastern sections of the county, east of the Upper East Fork basin and north of New Point. The area drained is approximately 15 percent of the county. Salt Creek and its tributaries drain in a southeasterly direction into Franklin County. The small southeastern corner of the county east of Smyrna and south of New Point is part of the Minor Ohio watershed. Laughrey Creek drains this section southeasterly into Ripley County. The area drained is approximately 5 percent of the area of the county.

There are several characteristic drainage patterns identified in Decatur County. Two-thirds of the county is covered by Wisconsinian till plain having a dendritic to subdendritic pattern with local mottled tones. The Illinoian till plain is characterized by a very highly dissected dendritic pattern. On stream terraces the streams are largely absent due to the highly porous nature of underlying granular materials. Another striking drainage feature is an abandoned glacial sluiceway located approximately two miles southeast of St. Paul. Moraines in the county have also influenced the drainage patterns of some streams of the county. Morainic control is seen by local watershed divides, increased drainage density, and deflection of streams occur in these areas [5]. In Decatur County, Sand and Clifty Creeks flow over these ridge moraine areas. Due to increased meltwaters during glacial retreat, some of the streams in the Wisconsinian areas are underfit to the broad valleys that they occupy.

Generally, the streams in Decatur County have narrow floodplain width of less than 170 to 240 feet. But in sections of Sand Creek, Clifty Creek, and the Flatrock River, the width is considerably wider, up to almost one-quarter of a mile. Bedrock may be found outcropping or within a couple of feet of the surface in sections of all of the first and second order streams in the county. Thus, it is no surprise that the course of the streams are bedrock controlled. Along sections of Sand Creek in the southern part of the county, subterranean drainage occurs [5]. On

the airphotos, numerous sinkholes were noted.

There are no natural lakes in Decatur County. However, scattered ponds and several artificial lakes do exist throughout the county (see engineering soils map for locations) [5].

Table 3 has drainage densities for selected streams in the county. The table includes the area drained in square miles and also the number of streams per square mile [7].

Appendix A contains statistical streamflow data for the Whitewater River (at Brookville, Franklin County); Sand Creek (near Brewersville, Jennings County); Clifty Creek (at Hartsville, Decatur County), and Flatrock River (at St. Paul, Shelby County). The information supplied includes lowest and highest mean discharge, average daily discharge, flow duration, and statistics on normal and log monthly, log annual means, and peak annual discharge [8].

Low flow characteristics for streams, which drain Decatur County, are given in Appendix B. The streams included are: Flatrock River (at St. Paul, Shelby County); Clifty Creek (at Sandusky, Decatur County); Clifty Creek (at Hartsville, Decatur County); Sand Creek (near Greensburg, Decatur County); and Sand Creek (near Brewersville, Jennings County). Selected discharge characteristics are given for all five streams. In addition, magnitude and frequency of annual and summer low flow data are presented for three of the five stream sites [9]. This type of data is useful for evaluation of water resource management.

Table 3. Drainage Densities for Selected Streams in Decatur County (7).

Stream And Location	Quad.	Sec.	Twn.	Rng.	Drainage Area (mi ²)	Drainage Density (streams/mi ²)
Clifty Creek including Pond Branch	Forest Hill	34	11N	8E	75.3	4.6
Cobbs Fork at Mouth	Westport	16	9N	9E	29.7	7.6
Little Flat Rock River at Mouth	Adams	7	11N	9E	63.3	3.6
Middle Branch Clifty Creek at Mouth	Milroy	12	11N	9E	25.6	3.2
Middle Fork of Fall Fork Clifty Creek at State Road 46	Hartsville	31	10N	8E	9.5	3.9
Penther Creek at Mouth	Westport	5	8N	9E	8.8	8.7
Sand Creek above Cobbs Fork	Westport	16	9N	9E	60.5	5.9
Turnover Creek at Mouth	Westport	15	8N	8E	4.1	6.2
South Branch Clifty Creek at Mouth	Milroy	7	11N	10E	6.2	4.9
Wyalloosing Creek at S.R. 3	Westport	1	8N	8E	10.5	4.9

PHYSIOGRAPHY

Decatur County contains two subsections of the Central Lowlands Province of North America. These two from east to west are the Dearborn Upland and the Muscatatuck Regional Slope [10]. The Dearborn Upland is a dissected low plateau consisting of Late Ordovician flat-lying limestones and shales outcropping along the crest of the Cincinnati Arch. These rocks are overlain by generally less than 50 feet of glacial and unconsolidated deposits in Decatur County. The western boundary of the Dearborn Upland is the drainage divide between the southeasterly flowing streams and the southwesterly flowing streams of the county. Generally, the Dearborn Upland includes the Whitewater watershed and the Minor Ohio watershed sections. The name usually given to this drainage divide is the Laughrey Escarpment for it provides a low dividing ridge [12].

West of the Dearborn Upland is the Muscatatuck Regional Slope. The Muscatatuck Regional Slope is interpreted to be a plain containing westwardly-dipping Devonian and Silurian Age carbonate rocks. This plain slopes westward at approximately 15 feet per mile. The carbonate rocks are covered with as much as 100 feet of Illinoian and Wisconsinian glacial drift. The region is still in a youthful stage of landform development [10]. Figure 3 is a map of the physiographic units of Indiana [10]. The generalized bedrock geology of Indiana is depicted in Figure 4 [11].

TOPOGRAPHY

The topography of Decatur County can be characterized as

Figure 3. Map of Indiana Showing Physiographic Units and Glacial Boundaries (10).

Figure 4. Generalized bedrock geology map of Indiana (after Patton, 1955, p. 12). (11)

ranging from flat to very hilly. Elevations vary from 1093 feet between Kingston and St. Maurice in the northeastern part of the county to 643 feet south of Westport in the southwestern part of the county. The maximum local relief is approximately 140 feet [6]. Figure 5 is a general topographic map for Decatur county based on 100 foot contour intervals [13].

The section of the county east of the Wisconsin-Illinoian glacial boundary is a topography characterized as nearly flat. This area is the Illinoian ground moraine. Near the streams and gullies the ground moraine has been severely eroded. Along Sand Creek, where the ground moraine is thin and the limestone is close to the surface, numerous sinkholes exist.

The section of the county west of the Wisconsin-Illinoian glacial boundary is a topography shaped mainly by Wisconsin-age glaciation. The variety of materials and structures left by the glaciation has produced a topography which is gently undulating to rolling. Most of the materials left are categorized as glacial till. This undulating plain has local elevations differences between 5 to 25 feet where it is uncut by stream dissection. Stream entrenchment into the plain has produced stream valleys which are as much as 75 feet below the ground moraine surface.

The Wisconsin ridge moraine area exhibits a rolling topography, rising 20 to 30 feet above the undulating Wisconsin ground moraine and the nearly flat Illinoian ground moraine. A

Figure 5. Topographic Map of Decatur County (13)

distinct topographic boundary is traced by the ridge moraine between the two glacial stages of the county.

The most prominent topographic features in Decatur County are the kames. The kames are glacio-fluvial deposits which rise 20-65 feet above the surrounding ground moraine. The largest of the kames is located one-half mile east of Adams. The Adams kame rises 65 feet above the plain and is between one-quarter and one-half mile in diameter. Kames are common around St. Omer and Adams.

Another interesting topographic feature of Decatur County is the Burney esker. An esker is a winding ridge of glacio-fluvial material. The Burney esker ranges between 10 to 25 feet in height and is about one mile in length. The ridge is single except in one section where it is a double set of parallel ridges. The Burney esker is not accompanied by an esker trough or a delta on its southern end, which is common with most observed eskers [6].

STRUCTURAL GEOLOGY

Structurally, Decatur County lies on the western limb of the Cincinnati Arch. The Cincinnati Arch is a large anticline of slightly dipping Pennsylvanian, Mississippian, Devonian, Silurian, and Ordovician Age rocks. Figure 6 is a map showing the structural geology of Indiana. The dip of the rock strata is in a west-southwestwardly direction of between 15-20 feet per mile. Figure 7 is a cross-section and block diagram of Decatur County

Figure 6. Structural Geology and Setting of Indiana

Figure 7. Cross Section + Block Section of Decatur Co. (12)

showing the relationship between the structural geology, the physiography, and the bedrock geology of the county [12].

BEDROCK GEOLOGY

Decatur County contains rock units from portions of three rock systems [14]. These are the Devonian, the Silurian, and the Ordovician. The bedrock units of these systems generally lie in north-south bands in the southern section of Indiana. Locally, within Decatur County, erosion of the preglacial valleys has led to an interfingering of the different rock systems. Erosion exposed the older underlying rocks.

The bedrock geology is represented in Figure 8 [15]. Table 4 is a stratigraphic column for Decatur County indicating bedrock units and glacial deposits which outcrop or cover the county [16]. The column is time dependent showing units from youngest to oldest in age. In addition, the column gives a range of anticipated thicknesses for each unit and also a description of that unit.

The Devonian system contains three units [17]. These are the North Vernon Limestone, the Jeffersonville Limestone, and the Geneva Dolomite. The units of the Devonian may be found in the preglacial valleys in the western part of the county. They outcrop in parts of the stream valleys in the same area. The youngest of the Devonian units is the North Vernon Limestone. In Decatur County, the North Vernon Limestone ranges in thickness

Figure 8. Bedrock Geology Map of Decatur County (15)

Table 4. Stratigraphic Column of Bedrock Formations in Decatur County (16)

ERATHEM	SYSTEM	SERIES OR STAGE	STRATIGRAPHIC UNIT	THICKNESS (FEET)	HYDRO- GEOLOGIC UNIT	UNIT CHARACTERISTICS
Cenozoic	Quaternary	Pleistocene	Wisconsinan deposits	0-100	Till	Unconsolidated till and minor segregation of coarse material; soils brownish-gray to reddish-brown; undulating surface, low relief.
			Illinoian deposits and older	0-141 0-67		Unconsolidated till, mostly clay; soils light-gray on flats to reddish-gray on slopes; flat uplands, deeply dissected by streams.
Paleozoic	Devonian	Erian	North Vernon Limestone ¹	0-20	Upper limestone and dolomite sequence	Limestone, dark-gray to blue-gray, fine to coarse-grained, hard and fossiliferous. Upper half, thick bedded; lower half, thin to medium bedded.
			Jeffersonville Limestone ¹	0-30		Limestone, gray to brown; greatly varying lithology from top to bottom with laminated breccia zone and coral zone; abundant calcite and pyrite recrystallization.
		Wisterian	Geneva Dolomite ¹	0-30		Dolomite, buff to chocolate-brown; fine-grained, soft, sugary texture; thin bedded at top and thick bedded at base; large recrystallized calcite common.
Paleozoic	Silurian	Kriegerian	Louisville Limestone	0-30	Upper limestone and dolomite sequence	Dolomitic limestone, tan to brown, very fine grained, argillaceous; thick bedded; fossils distorted, commonly mottled and with chert zones.
			Waldron Shale	0-0	Shale	Shale, blue-gray and clayey; thin bedded; very fossiliferous and easily eroded.
		Salemian ¹	Laurel Member	0-00	Lower limestone and dolomite sequence	Dolomitic limestone, light-gray to tan, fine-grained and argillaceous; thick bedded with abundant chert.
			Osgood Member			Dolomite or limestone, tan to tan-gray, highly argillaceous; shale content increases southward.
	Alexandrian		Brassfield Limestone	0-10		Limestone, variable white, yellow-brown to salmon-pink, medium- to coarse-texture, and fossiliferous; some dolomite and irregular shale lenses.
	Ordovician	Cincinnatian	Whitewater Formation	0-00	Increasing shale	Interbedded calcareous shale and limestone, light- to dark-gray, thin bedded; thins southward from Decatur County.
			Saluda Formation	20-50		Dolomitic limestone, gray, silty, basal coral zone; unit thins northward.
			Dillsboro Formation	~ 300		Argillaceous limestones and calcareous shales; thin, interbedded, highly fossiliferous, containing about 70 percent shale.

¹ Usage of the Indiana Geological Survey.

between 0-20 feet. The North Vernon Limestone is a fine-to coarse-grained fossiliferous limestone with bedding that varies from thick in the upper section to thin in the lower section. Below the North Vernon Limestone is the Jeffersonville Limestone. Ranging in thickness from 0-30 feet, the Jeffersonville Limestone has a lithology which varies greatly from the top to the bottom of the unit. The limestone contains laminated breccia and coral zones and has also experienced abundant calcite and pyrite recrystallization. Underneath the Jeffersonville Limestone in the stratigraphic column is the Geneva Dolomite. The Geneva Dolomite has a thickness ranging from 0-30 feet. It is characterized as a dolomite that is soft and fine-grained with a sugary texture, bedding ranges from thin at the top to thick at the bottom. Large recrystallized calcite is commonly found within the unit.

The Silurian system in Decatur County contains four units. These include the Louisville Limestone, the Waldron Shale, the Salamonie Dolomite, and the Brassfield Limestone. Units of the Silurian system underlie the north, the central, and parts of the eastern sections of the county. They outcrop in parts of the stream valleys in the same areas. The youngest of these units is the Louisville Limestone. It is found in the central and eastern sections of the county and ranges in thickness from 0-30 feet thick. The Louisville is a dolomitic limestone that is fine-grained, argillaceous, containing fossils and chert. Also it tends to be thickly bedded. The next oldest unit is the Waldron Shale. The Louisville Limestone and the Waldron Shale experi-

enced intense erosion in the middle Silurian period causing a time unconformity between the Silurian and Devonian. These two units were removed from all but 50 square miles of Decatur County [16]. The Waldron Shale is also generally found in the central and eastern sections of the county. It ranges in thickness from 0-6 feet thick and is characterized as thinly bedded, very fossiliferous, and easily eroded. The type location for the Waldron Shale is Waldron in Shelby County, Indiana. Below the Waldron Shale in the stratigraphic column is the Salamonie Dolomite with its two members the Laurel Member and the Osgood Member. The total thickness of the Salamonie Dolomite is between 0 and 90 feet. The Laurel Member is characterized as a dolomitic limestone, which is argillaceous and thick bedded with abundant chert. The Osgood Member is a dolomite or a limestone, highly argillaceous, with an increasing shale content that increases southward. The Laurel Member forms a protective cap over the older Silurian units allowing the formation of a low relief plain that extends into Kentucky [16]. The final unit of the Silurian system in Decatur County is the Brassfield Limestone. It ranges in thickness from 0-10 feet. The Brassfield is characterized as a medium to coarse-textured limestone containing fossils and lenses of dolomite and shale.

The final stratigraphic system identified as outcropping in Decatur County is the Ordovician system. The Ordovician system is composed of three units. These are the Whitewater Formation, the Saluda Formation, and the Dillsboro Formation. The Ordovician

units underlie the extreme eastern edges of the county in the preglacial valleys and also further west as erosional features. The Whitewater Formation is the youngest of the Ordovician units in the county. It ranges in thickness between 0 and 60 feet. The formation is described as an interbedded calcareous shale and limestone, which is thinly bedded and thins southward from Decatur County. The next Ordovician unit is the Saluda Formation. This formation ranges in thickness between 20-50 feet in the county. The Saluda is described as a silty dolomitic limestone containing a basal coral unit. This unit thins northward. Below the Saluda Formation is the Dillsboro Formation. The thickness of the Dillsboro is estimated to be approximately 300 feet. It is characterized as argillaceous limestones and calcareous shales, which are thinly bedded and highly fossiliferous. The formation contains approximately 70 percent shale.

The bedrock topography of Decatur County is represented in Figure 9 [18]. The bedrock surface ranges from less than 700 feet to more than 1000 feet above sea level with the highest elevation in the eastern part of the county.

GLACIAL GEOLOGY

Glacial activity has had the greatest affect upon the soil formation in Decatur County. Glacial deposits cover in excess of 90 percent of the surface area in the county [12]. The county has been affected by three of the four recognized glacial stages of North America. These are the Kansan, the Illinoian, and the

Figure 9. Bedrock Topography of Decatur County (18)

Wisconsinan glacial stages. Each stage deposited varying amount of materials in the county. An unconsolidated deposits map of Decatur County is illustrated in Figure 10 [15].

Kansan ice came from the northeast approximately 350,000 to 400,000 years ago and covered the entire county. The till deposited by the Kansan advance is part of the Jessup Formation of Indiana [19]. Kansan deposition thickness was generally less than fifteen feet. Also there was probably at least one retreat and readvance during Kansan time [19]. The final retreat of the Kansan ice was about 200,000 years ago, giving way to the Yarmouth interglacial period. A paleosol, a weathered soil profile, may be identified at some boring locations. Much of the deposited Kansan drift was weathered and eroded away during the Yarmouth and later glacial advances. Drillers logs from Decatur County have indicated the presense of pre-Illinoian deposits at a few locations [16]. These deposits may be found in deeply buried preglacial bedrock valleys. However, the amount of Kansan drift is, today, very sparse and of little importance.

At the end of the Yarmouth interglacial period about 125,000 years ago, another advance of glacial ice from the northeast took place. This advance is known as the Illinoian glacial advance. The Illinoian, like the Kansan, covered the entire county with ground moraine. This ground moraine, along with the action of the ice, smoothed out the landscape and filled bedrock valleys. The Illinoian glacial ice experienced at least two fluctuations as it covered Indiana. The till deposited during the stay of the

Figure 10. Unconsolidated Deposit Map of Decatur County (15)

ice is the upper part of the Jessup Formation of Indiana [19]. Thin layers of paleosol may be seen within the formation indicating the fluctuations of the ice. The Illinoian ice finally retreated about 100,000 years ago leading to the Sangamon interglacial period. The interglacial period was a time of erosion and formation of outwash of the deposited Illinoian materials [20]. A paleosol during this interglacial period may be identified in some borings in the county. This paleosol has been found to be approximately two feet thick [6]. Illinoian ground moraine can be seen at the surface in Decatur County in the eastern one-third of the county. Illinoian age deposits are found, generally, in the entire county, but are covered by younger materials and Wisconsinan glacial deposits in the western two-thirds. Today, the total thickness of Illinoian and pre-Illinoian deposits in Decatur County is on the average less than 25 feet [16]. Figure 11 is a drift thickness map of Decatur County [21]. Over two thirds of the county has a drift thickness less than 50 feet and most of the eastern part of the county exhibits a drift thickness of 25 feet or less.

The final glacial stage to affect Decatur County was the Wisconsinan glacial stage approximately 65,000 years ago. Wisconsinan ice sheets, which covered Decatur County came from the northeast and covered the western two-thirds of the county. Figure 12 is the relationship of the Wisconsinan ice lobes in Indiana [22]. The Wisconsinan ice sheets advanced and retreated twice into Decatur County. Deposits laid down by the ice are

Figure 11. Drift Thickness Map of Decatur County (21)

Figure 12. Relationship of Wisconsinan Ice Lobes of Indiana (22)

generally less than thirty feet thick. In one boring in the Wisconsin area total thickness of glacially deposited material was found to be 141 feet [16]. Refer to Figure 11 for thickness of drift in Decatur County. The first advance and the farthest advance into the county is marked by the Shelby Moraine at the Wisconsin-Illinoian boundary. As the ice melted back the first time, this ridge moraine was left along with the ground moraine and other glacio-fluvial materials. The second advance was to a position approximately two miles east of St. Paul in Shelbyville County. As this ice retreated about 12,000 years ago, the Crawfordville Moraine, along with a boulder belt close to Germantown, was laid down [23]. Only slight topographic evidence can be seen in the field to call this particular area a ridge moraine. Thus it was mapped as a Wisconsin ground moraine area in agreement with certain other authors [15].

The farthest extent of the first advance of Wisconsin glaciation in the county is marked by the Shelbyville Moraine. This point was reached approximately 21,000 years ago and is seen as a ridge moraine in Decatur County. The moraine defines the boundary between the Wisconsin - Illinoian surface deposits in the northern two-thirds of the county down to Gaynorsville. Some authors have mapped the Shelbyville Moraine all the way down to the southern border of Decatur County. However, the evidence is not there for mapping the Shelbyville Moraine any further south than Gaynorsville [15].

Behind the ridge moraine, the ice deposited glacial and glacial-fluvial materials. The Wisconsin glacial till is part of the Trafalgar Formation of Indiana [22,23]. The most widespread of the glacial materials deposited is the Wisconsin ground moraine. Topographically high conical hills of deposited fluvial materials on top of the glacier known as kames were laid down as the glacier melted. These are found close to St. Omer and Adams in Decatur County. Also deposited by the ice was an esker. Eskers form by the accumulation of coarse textured material in a fluvial channel within a glacier. When the glacier later melts away, the esker remains as a winding ridge. The Burney esker in Decatur County is located about one mile northwest of Burney. Kames and eskers are characteristic of stagnant and slowly melting glaciers. Figure 13 is a map of glacial deposits of central Indiana [22].

As the Wisconsin ice retreated, large amounts of water and materials scoured the stream channels. Terraces were built by the reworking of the till. In one location, an abandoned glacial sluiceway which once carried glacial meltwaters was found surrounded by glacio-fluvial terraces [24]. Today, the stream channels affected by glacial meltwaters are in most cases underfit. Strong winds picked up silt-sized particles and deposited loess upon the surface of the county. The depth of this loess is, however, generally less than two and one-half feet thick.

LANDFORMS AND ENGINEERING SOIL AREAS

EOLIAN LANDFORMS

No major landforms of eolian drift, such as sand dunes, exist in Decatur County but a blanket of loess of varying thickness occurs throughout the county.

Loess Plain

Loess covers most of Decatur County except for steep eroded slopes and recent alluvial deposits. The loess is, however, not thick enough to be mapped as a distinct parent material type. Total thickness in the county is less than 2.5 feet. Wisconsinan age drift has less than two feet of loess. The Illinoian ground moraine has as much as 2.5 feet of loess. Table 5 contains the names of soil series which form partially over loess and the underlying parent material type [2].

Table 5. Agricultural Soil Series Formed Partially in Loess and the Underlying Parent Material in Decatur County [2].

Illinoian Ground Moraine	Wisconsinan Ground Moraine
Avonburg (20-50")	Crosby (5-18")
Cincinnati (18-40")	Cyclone (40-60")
Clermont (24-60")	Fincastle (20-40")
Grayford (6-24")	Miami (5-18")
Hickory (<18")	Russell (22-36")
Rossmoyne (18-35")	Williamstown (4-19")
Ryker (24-40")	Xenia (22-36")

Loess soils are generally silt loam or silty clay loams. Due to the non-cohesive nature of the loess soils, highway subgrade and fill problems are common. These problems include collapse upon wetting, piping, frost heave, and pumping. Since the loess

is in combination with underlying glacial materials, these problems may be less severe.

GLACIAL LANDFORMS

Glacial landforms make up in excess of 90 percent of the parent material accumulations in Decatur County. The types of glacial parent materials mapped are Wisconsinan ground moraine, Wisconsinan ridge moraine, Illinoian ground moraine, thin Illinoian ground moraine over limestone, and thin Illinoian ground moraine over limestone and shale.

Wisconsinan Ground Moraine

Wisconsinan-age ground moraine occupies approximately 60 percent of the surface area of the county. The ground moraine is characterized by a gently undulating surface forming an extensive plain. Local relief is generally less than 10 feet but exceeds 15-20 feet in a few of the dissected stream valleys. On the aerial photography, the ground moraine showed typical light-dark mottled patterns [25]. Most of the gullies in the area are of the broad saucer shape with low gradient indicating silty clays and silty loams common with thin loess cover. The loess thickness ranges from 0-5 feet, but generally is less than two feet [2]. Generalized soil profiles for the Wisconsinan ground moraine and the other parent material types may be found on the left hand side of the engineering soils map of Decatur County. These profiles were produced using available agricultural and borehole information. The soil profiles show expected variations in the

material to a depth of 12 feet.

The soil profiles for the Wisconsin ground were divided into two categories. The categories are high and low ground moraine. These represent generalized subsoil conditions in the rises and in the basins of the Wisconsin till plain. In Wisconsin ground moraine areas, the surface soil is a silty loam down to a depth of 8-15 inches. The low ground moraine usually contains less than 8 percent organic matter [2]. The silty loam is underlain by silty clay loam and clay loam down to 42 inches in the high ground moraine and down to 52 inches in the low ground moraine. These soils are underlain by loamy soils with trace amounts of sand and gravel throughout. The low ground moraine generally contains a higher clay content in its subsurface soils verses the high ground moraine.

The agricultural soil series in Decatur County that form in Wisconsin ground moraine are: Crosby, Cyclone, Fincastle, Hennepin, Miami, Russell, Williamstown, and Xenia. Appendix C-1 contains a table of engineering soil properties for the soils of Decatur County. No locations for the sampling of the different soils are given [2]. Appendix C-2 contains a Table of physical and chemical properties of Decatur County soil [2]. Appendix D contains soil boring at various locations in Decatur County as indicated on the engineering soils map. Borehole numbers 1,3,8,17 and 18 are in Wisconsin ground moraine areas.

Wisconsin Ridge Moraine

Ridge moraine of Wisconsin age was mapped along the boun-

dary between Wisconsinan and Illinoian glacial drift. The moraine starts in the northeast corner of the county and stretches towards the southwest in a generally continuous band approximately one-half to two miles wide. The terminus of the moraine is close to Gaynorsville, in south-central Decatur County. Other sources have mapped the ridge moraine as far south as Sardinia. The ridge moraine rises as much as 30-40 feet above the surrounding flatter areas. Its rolling topography forms the distinct boundary between the Wisconsinan and Illinoian drift sheets.

On aerial photography, the ridge moraine showed a highly mottled tone. The drainage was dendritic with saucer-shaped gullies. The soil profile in the ridge moraine is similar to the ground moraine. Silty loam (A-4 to A-6) is the surface soil down to 6-8 inches. Underlying this is subsoils of silty clay loam or clay loam (A-6) down to 30 inches. Finally, loam with sand, gravel, and cobble seams may be encountered at depth. Agricultural soil series mapped as ridge moraine include Crosby, Cyclone, Fincastle, Miami, Russell, Williamstown, and Xenia.

Illinoian Ground Moraine

Illinoian-age ground moraine occupies approximately 20 percent of the surface area of the county. The ground moraine is buried beneath the Wisconsinan glacial drift of the western two-thirds of the county. The Illinoian ground moraine is characterized by a nearly flat to highly dissected, rolling topography.

Bedrock fairly close to the surface and gully erosion produces the rolling landscape. The Illinoian ground moraine is cut by numerous deep gullies and cracks. This contrasts with the very limited dissection on the Wisconsinan ground moraine. Weathering of the ground moraine is as deep as 15 feet or more over the flat areas.

On the aerial photography, the Illinoian ground moraine appears as a flat area with dark photo tones. The gullies are dark-centered and have a characteristic white fringe about them [25]. Gullies are generally of the deep saucer type.

Most of the Illinoian ground moraine has a cover of weathered loess of 2 to 4 feet thick. This loess tends to be of medium stiffness. Two sets of engineering test data are given in table 6a and 6b. Table 6a is from a flat area of Illinoian ground moraine in nearby Bartholomew County [26]. Table 6b is from a dissected area of Illinoian ground moraine in nearby Jennings County [27]. The Bartholomew County sample is weathered down to 143 inches. Below this depth, the sand content increases and the silt content decreases. The Jennings County sample is, as would be expected by its topographic location, weathered to a shallower depth than the other sample. The sample is unweathered below 85 inches. Both of these soils contain a clay rich horizon below approximately two feet, which is common with some Illinoian ground moaines.

The surface soils of the Illinoian ground moraine are a

Table 6a. Engineering Test Data from a broad, flat area of Illinoian Ground Moraine (NW, SW, sec.14, T.8N., R.5E., Bartholomew County) (2).

Clermont silt loam										
depth inches	Grav %	Sand %	Silt %	Clay %	LL %	PI %	AASHTO	UNIFIED	Wopt %	Max yd pcf
0-7	1	17	77	5	25	1	A-4(10)	ML	15	108
7-16	4	13	69	14	25	4	A-4(2)	ML	15	113
16-24	-	7	63	30	34	14	A-6(16)	CL	16	107
24-35	-	12	64	24	39	17	A-6(14)	CL	18	106
35-70	1	14	63	22	31	12	A-6(9)	CL	15	111
70-110	2	15	64	19	27	13	A-6(8)	CL	16	112
110-143	2	29	56	13	32	15	A-6(8)	CL	17	111
143-200	9	39	44	8	19	4	A-6(0)	ML	17	124

Table 6b. Engineering Test Data from a dissected area of Illinoian Ground Moraine (NW1/4, NW1/4, sec.10, T.6N. R.8E. Jennings County) (2)

Rossmoyne silt loam										
depth inches	Grav %	Sand %	Silt %	Clay %	LL %	PI %	AASHTO	UNIFIED	Wopt %	Max yd pcf
3-9	2	13	58	27	30	7	A-4(8)	ML	15	108
27-43	10	16	44	30	26	9	A-4(8)	CL	16	112
85-129	5	28	30	37	32	13	A-4(8)	CL	18	109

weathered loess (A-4) down 2 to 4 feet. This is shown as a silty loam on the engineering soil profile. Subsurface soils consist of silt loams (A-4) grading into unweathered loams (A-6), silt loams, and clay silt loams (A-4 to A-6). Agricultural soil series which form on Illinoian ground moraine include Avonburg, Cincinnati, Clermont, Hickory, and Rossmoyne.

Thin Illinoian Drift over Limestone

In some of the severely eroded stream valleys of the Illinoian drift section of the county, the Illinoian ground moraine is very thin. Where this thin ground moraine lies over the Silurian-age limestones, a distinct photo pattern exists. The underlying limestone exhibits a rounded, blocky form with sinkholes. As with the Illinoian ground moraine, white fringes occur along the gullies. However, these are not as well developed as in the regular ground moraine areas. Along sections of Sand Creek large concentrations of sinkholes exist.

The surface soils of this landform type are usually silty loams (A-4). Up to two feet of loess may be found on these slopes. Underlying soils include silt loams (A-4), clay loams (A-6), and loams down to 4.5 to 10 feet. Beneath these are Silurian-age limestones. The upper few inches of the limestone is generally weathered. Soil series which form on thin Illinoian ground moraine over limestone includes Avonburg, Cincinnati, Clermont, Grayford, Hickory, Rossmoyne, and Ryker. Borehole numbers 13 and 16 are on thin Illinoian ground moraine over lime-

Thin Illinoian Ground Moraine over Limestones and Shales

The areas mapped as thin Illinoian ground moraine over limestone and shale occur on the eastern side of Decatur County. This thin ground moraine covers Silurian-age limestones and Ordovician-age limestones and shales in the severely eroded stream valleys. These valleys are generally quite expansive. The largest quarry in Decatur County quarries Silurian-age limestones covered by thin ground moraine just north of New Point. Also, the largest lake in Decatur County, Lake Santee is found in this landform type.

Surface soils in this thin ground moraine are silty loams (A-4) and loams up to 1.5 feet thick. Most of these are due to loess cover ranging from 0-2 feet thick. Underlying soils include clay loams (A-6), silty clay loams (A-4 to A-6), and silty loams (A-4) down to as much as 12 feet. Interbedded limestones and shales are encountered at depths ranging from 3 to 12 feet below the surface. The agricultural soil series which form on thin Illinoian ground moraine over limestones and shales include Avonburg, Cincinnati, Clermont, Grayford, Hickory, and Rossmoyne.

RESIDUAL LANDFORMS

Limestone Bench

Soils which form on limestone benches are characterized as

residual soils. They are located in the northwestern section of the county. The benches line a major portion of Clifty Creek downstream from Adams. Also benches are found on Flatrock River close to St. Paul and Fall Fork Clifty Creek on the county line northwest of Waynesburg.

The residual soils on limestones benches are poorly developed. The soils are in some cases covered by Wisconsinan ground moraine or in steeper valleys, by slopewash. In other areas, soil development may be almost lacking due to frequent flooding and erosion.

The surface soils on the limestone benches are generally 7 to 14 inches of silty loam (A-4) or silty clay loam (A-6). Underlying soils are usually clay loams (A-7) with traces of limestone fragments down as deep as four feet. Limestone bedrock is generally encountered from 1 to 4 feet below the surface. However, where there is intense erosion, limestone may outcrop. The agricultural soil series which form over limestone benches include Corydon, Millsdale, and Milton.

GLACIO-FLUVIAL LANDFORMS

Kames

A total of eight kames were found in Decatur County. Kames form the most prominent topographic features in the county. The largest of these kames is the Adams kames rising 65 feet above

the surrounding plain. Kames are of glacio- fluvial origin providing limited sources of sand and gravel. Two of the kames near St. Omer have been utilized as a sand and gravel source. The kame near Adams has not been utilized as an aggregate source and may contain a large portion of finer materials.

The first one to four feet of the surface material of the kame is generally mixed. These soils are generally silts, sandy silts, sandy clay silts, or sandy silt loams with trace amounts of gravel. Underlying these surface soils are stratified layers of sandy silts, sands, and gravelly sands. Kames do not provide a major aggregate source but may provide small supplies. Care must be taken with the excessive amounts of silt found in some kames. The agricultural soil series which form on kames include Fox, Martinsville, and Ockley.

Eskers

Eskers are glacio-fluvial materials deposited in the internal streams and rivers within a glacier. They generally contain stratified sands, silts, and gravels. The only esker found in Decatur County is located 1.5 miles northeast of Burney. The soil profile will be much like the kames except surface soil development will be shallower. There was evidence in the field that the Burney esker may have been used as an aggregate supply at one time. The agricultural soil series which form on eskers include Fox, Martinsville, and Ockley.

Terraces

Areas mapped as terraces are found in the Wisconsin drift

areas. The terraces were built primarily as large quantities of meltwaters flowed through the streams and abandoned waterways of the county. Large terraces are found along Flatrock River, Clifty Creek, Fall Fork Clifty Creek, Sand Creek, and along the abandoned glacial sluiceway. Terraces contain coarse-grained materials. Thus, they have very high permeability and no surface drainage. Current scars were observed on these extremely flat landforms. These airphoto pattern elements, along with their 5 to 15 feet height above the flood plains, were used to identify the terraces on the aerial photographs.

Surface soils include silt loams (A-4), silty clay loams (A-4 to A-6), and loams down to about four feet. Underlying soils include gravelly loam, gravelly sand loam, or sand loam. Agricultural soil series which form upon terraces include Fox, Martinsville, and Ockley. Engineering test data taken from nearby Shelby County for Fox and Ockley soils are given in tables 7a and 7b [28].

Glacial Sluiceway

An abandoned glacial sluiceway was mapped in the northwest corner of Decatur County. During the retreat of the Wisconsin glacialiation, the sluiceway served as a drainageway for the heavy volume of meltwater. The sluiceway appears to have connected Flatrock River to Clifty Creek but is now at a much higher topographic position than these streams. In sections, the sluiceway

Table 7a. Engineering Test Data from a Terrace (SW, SW,
sec.35, T.5N., R.5E., Shelby County) (2)

Ockley loam										
depth inches	Grav %	Sand %	Silt %	Clay %	LL %	PI %	AASHTO	UNIFIED	Wopt %	Max yd pcf
0-7	1	39	47	13	26	9	A-4(5)	SM-SC	14	116
27-35	18	37	15	30	60	42	A-7-6(9)	SC	14	112
46-60	56	36	4	4	NA	NA	A-1-a(0)	SW-SM	10	126
At another location (SW, NE, sec 14, T.13N., R.5E., Shelby County)										
depth inches	Grav %	Sand %	Silt %	Clay %	LL %	PI %	AASHTO	UNIFIED	Wopt %	Max yd pcf
0-8	6	40	52	2	32	9	A-4(4)	ML-CL	16	109
16-29	23	39	16	22	47	27	A-7-6(5)	SC	16	110
46-56	17	68	7	8	NA	NA	A-1-b(0)	SM	12	117

Table 7b. Engineering Test Data from a Terrace (NE, sec.1,
T.9N., R.5E., Bartholomew County) (2).

Fox loam										
depth inches	Grav %	Sand %	Silt %	Clay %	LL %	PI %	AASHTO	UNIFIED	Wopt %	Max yd pcf
0-7	3	47	46	4	24	5	A-4(0)	ML	15	112
7-13	6	52	29	13	29	10	A-2-6-(1)	CL	13	116
13-26	13	55	14	18	34	12	A-4(8)	CL	18	110
26-33	11	71	11	7	NA	NA	A-3	SM	12	119
35-60	34	62	4	--	NA	NA	A-3	SW	10	112

is greater than one-quarter of a mile in width. Large outwash terraces were built along its sides. Some of these contain sand and gravel pits.

On the aerial photography, the sluiceway appears very flat with a dark tone and a silty texture. A single drainage ditch flows through the center of the abandoned drainageway. At one time, parts of the sluiceway were in a swampy condition. Thus surface soils may contain up to eight percent organic matter [2]. Surface soils of the sluiceway are loam, silty loam (A-4), and sandy clay loam down to about 30 to 36 inches. These are underlain by clay loam (A-6) and sandy clay loam with a trace of gravel to 42 inches. Under this is sand with seams of gravel. Agricultural soil series which form over the glacial sluiceway include Montgomery soils.

FLUVIAL LANDFORMS

Flood Plains

Areas mapped as flood plain in Decatur County vary in width from a few hundred feet in small tributaries to approximately one mile. Soils in flood plains can be locally, very variable, making characterization difficult. But there are some differences in the flood plains in Wisconsinan drift areas verses Illinoian drift areas making them worthy of separate characterization. Thus, the soil profile of flood plains were divided into these two areas.

A.) Flood Plains in Wisconsinan drift areas

Soils of the flood plains in Wisconsinan drift areas are derived from the erosion of thin loess, outwash materials, Wisconsinan ground moraine, and residual bedrock. The flood plains in these areas attain widths up to one mile. These widths are generally greater than are found in Illinoian areas. In many sections of Clifty Creek, where limestone benches occur on both sides of the stream channel, the flood plain width was slightly enlarged for mapping purposes.

The first 14 to 24 inches of the flood plain soils are silty loams (A-4), organic clay loams (A-6), or organic silty clay loams (A-4 to A-6). The clay loam contains a higher organic content than the silty clay loam, up to six percent. Underlying these soils down to 32 to 72 inches is loam, which is silty and/or clayey in sections. This grades into a gravelly sand loam or a gravelly sand. In some flood plains, limestone is encountered as close as six feet below the surface. Agricultural soil series which form on flood plains in Wisconsinan drift areas include Chagrin, Chagrin Variant, Lobdell, Orrville, Sloan, and Stonelick. Borehole numbers 2,4,5,7,9,10,11,12,19 and 20 are on flood plains in Wisconsinan drift areas.

B.) Flood Plains in Illinoian drift areas

The flood plains in Illinoian drift areas contain soils which are derived from Illinoian ground moraine, thin loess, residual bedrock, and drift washed in from the Wisconsinan area. Most flood plains in the Illinoian area are a few hundred feet or

less in width. The exceptions to this are Cobbs Fork Sand Creek and sections of Sand Creek which are both approximately one-quarter of a mile in width.

The surface soils in Illinoian drift areas are silt loams (A-4) to a depth of 12 to 60 inches, silty clay loam (A-4 to A-6) to a depth of 12 inches, and clay loam (A-6) to a depth of 10 to 14 inches. In Illinoian areas mapped as ground moraine, underlying soils include loam with silt and clay seams down to 36 inches and a sandy loam with a trace of gravel. Flood plains mapped as Illinoian drift over limestone may have two possible profiles. These are silt loam lying directly over limestone at a depth of 36 to 60 inches or silt loam underlain by a gravely sandy loam at 16 inches covering limestone at a depth of 48 to 60 inches. Finally, flood plains in areas mapped as drift over limestones and shales may also have two possible profiles. Surface soils are underlain by a sandy loam at 16 inches. The sandy loam covers interbedded limestones and shales at a depth ranging from 48 to 72 inches.

Agricultural soil series which form in Illinoian drift area flood plains include Chagrin, Lobdell, Orrville, Sloan, and Stonelick. Borehole numbers 14 and 15 are on flood plains in Illinoian drift areas.

MISCELLANEOUS LANDFORMS

Gravel Pits and Quarries

Several gravel pits and one major limestone quarry are found in Decatur County. The gravel pits are found in the northwestern section of the county in the terraces and kames of the Wisconsin drift area. These pits produce an adequate supply of sand and gravel aggregate. The limestone quarry located north of New Point produces crushed stone and agricultural lime, mostly from the Silurian-age strata. Other quarries have been located along Sand Creek in the Silurian-age limestones.

ENGINEERING PROBLEMS OF DECATUR COUNTY

INTRODUCTION

This section is a discussion of possible engineering problems associated with the landform-parent material areas mapped in the county.

GROUNDWATER SUPPLY

Decatur County, like some of its neighbors, has found it difficult to develop adequate groundwater sources [16]. Larger towns like Greensburg and Westport have developed surface supplies to ensure an adequate water supply. But 70 percent of the population of the county must rely on groundwater for their needs. This has caused economic restrictions in some rural areas because water is needed for progress.

There are several rock stratigraphic units which are water yielding. These include the Devonian limestones and dolomites, the Silurian-age Louisville limestone, and the Ordovician-age Saluda Formation. Wells drilled into these aquifers will yield water at a rate ranging from 0 to 250 gpm [16]. However, in areas where the upper sequences have been eroded away, drilling the older sequences of siliceous dolomites give extremely low water yields.

Limestones and dolomites contain between 4 to 30 percent water filled voids. But they can not yield water at an adequate,

continuing rate if fracturing and dissolution of the rock is not present to allow water movement between the voids. When the water is used in that particular void, water yields drop almost to nothing. Thus, a study of fractures and lineament traces is helpful in locating drilling locations that will produce adequate yields. Figure 14 is a fracture and lineament trace map of Decatur County. The traces shown on the map are the most prominent ones in the county. Drilling near these traces or at the intersection of two or more traces gives a greater probability of adequate domestic water yields.

Several possible problems should be considered when using the fracture trace map to locate wells. First, most of the traces follow natural drainageways and may be hundreds of feet from the site needing a water supply. Thus, cost of piping should be balanced with the cost of drilling wells. This is especially true in the eastern part of the county, where many inadequate wells have been drilled. Secondly, since these lineaments are located near surface drainageways, site preparation for drilling may be costly. Next, drillers may encounter deflection of their drill bits by hard loose rocks in the fractures. Finally, the length of casing may need to be increased due to mud slumping inside the lineaments.

For drilling in fracture areas, the following techniques are helpful. First, the highest water yields are found in a 100 foot radius of the fracture. Thus, drilling directly upon fractures is not recommended. This eliminates most of the drilling problems.

Figure 14. Fracture Trace and Lineament Map of Decatur County (16).

Finally, drilling close to fracture traces generally give adequate water yields within 125 to 150 feet of the surface. Thus, the need to go much deeper when locating wells by the fracture trace method is not necessary.

FROST ACTION POTENTIAL

Several parent material types have a moderate or high probability for frost heave. These are the Wisconsinan ground moraine and ridge moraine, the Illinoian ground moraine, and the thin Illinoian moraine over bedrock. All of these may contain substantial amounts of clays and especially silts. They are generally poorly drained and thus are susceptible to frost action. Frost heave during freezing and induced low shear strength during thawing can damage rigid structures, such as pavements. Care should be taken to provide either adequate drainage and/or increased insulating materials to frost susceptible soils.

CONSTRUCTION MATERIALS

Decatur County contains several gravel pits and one major limestone quarry supplying an adequate aggregate supply. However, these pits and quarries are not centrally located. Thus, transportation of the aggregate to all areas is costly.

Crushed limestone from the quarry located north of New Point is a major source of aggregate and, at times, building stone. Chert is a detrimental component in some of the limestone rocks of Decatur County. The Laurel limestone is generally not a good

aggregate due to its porous chert content. Other unsatisfactory aggregate materials include the Waldron Shale due to its easily eroded nature, the Osgood dolomite due to its abundant chert, the Jeffersonville limestone if carbonaceous laminae are present, and the upper layer of the Louisville limestone due to abundant silt. Probably the best aggregate available is the Geneva limestone. Table 8 contains typical physical properties of some Devonian and Silurian strata [29].

Table 8. Typical Range of Physical Properties of Some Devonian and Silurian Strata from Eastern Indiana [29].

Unit	Specific Gravity	Abrasion Loss (%)	Soundness (%)	Absorption (%)
Jeffersonville	2.64-2.71	23.2-31.8	3.6-45.7	0.9-2.70
Geneva	2.34-2.68	33.3-35.3	7.54-12.0	2.34-4.8
Louisville	2.54-2.76	23.4-35.6	6.8-33.03	1.1-2.7
Laurel	2.69-2.80	23.5-29.1	4.0-39.8	0.5-2.74
Brassfield	2.69-2.75	28.3-29.0	6.3-8.03	1.1-1.4

Gravel pits are common in the terraces along Flatrock River and Clifty Creek. Also, several of the kames located near St. Omer have been utilized as sand and gravel sources. These pits offer good materials for roadfill and other aggregate requirements. Care should be taken when exploiting kame sources due to possible excess silts and fines.

STEEL AND CONCRETE CORROSION

Forty percent of the parent materials contain soils with a

high to moderate steel and concrete corrosion potential. These include the Illinoian ground moraine, thin Illinoian drift over bedrock, flood plains in Illinoian drift areas, and limestone benches. The pH of these soils range between 4.5 to 8.4 [2]. Acidic conditions present in these soils will reduce the lifespan of buried metal pipe from 40 to 15 years [30]. Aluminum pipe is often used to minimize the corrosion effects. This is the case in Bartholomew County [31]. It should be emphasized that site specific evaluation of potential metal corrosion should be considered.

Most severe concrete corrosion is due to a poor quality of concrete. Thus in areas where this is potentially a problem, good quality concrete helps to eliminate corrosion and structural damage.

WASTE DISPOSAL

There are many landform types in Decatur County which should be avoided when planning for a waste disposal system. First are the terraces and the eskers and kames. They are much too permeable to ensure proper confinement of waste materials. Next, floodplains and drainageways experience flooding, which would lead to seepage and contamination. Finally, areas with bedrock close to the surface such as limestone benches and thin Illinoian drift over bedrock. Cracks and fractures in the rocks increase permeability and allows for rapid movement of the contaminates away from the site. Wisconsinan and Illinoian ground moraine are

the best choices for location of waste systems. They have, generally, low permeability and offer good cover material due to their fines content.

FOUNDATIONS AND EXCAVATIONS

Almost all of the soils in Decatur County have a low probability of associated problems with foundations and excavations. Areas which generally experience moderate problems with foundations and excavations include the floodplains, the limestone benches, and possibly the thin Illinoian drift over bedrock areas.

Foundation and excavation problems are common in the flood plain areas. The flood plain soils are highly permeable and require dewatering. Excavations often experience slope failure thus there is a need for adequate bracing of the slopes. Blowouts due to water pressure are another common problem which should be anticipated. In these areas, bedrock is relatively close to the surface and foundations should rest upon bedrock.

On limestone benches, the number one problem will be sink holes. Without proper design, foundation collapse can cause great damage. Sink hole development and solutioning is a problem that only gets worse; thus, proper fill and drainage structures are needed.

In Illinoian drift areas over bedrock, two potential problems may occur. First, sink holes and solution cavities are

common in these areas, especially near Sand Creek. Second, exposure of the interbedded limestones and shales in the eastern part of the county can cause shale degradation and slope failures. Steps should be taken to protect the shale from the environment, when the possibility of degradation exists.

Other potential problems of the engineering soils of the county include perched water tables and ensuing slope stability problems in the ridge moraine. There is the need for dewatering in terrace excavation. Also, terraces should be explored for local loose sand seams or clay pockets.

Few problems are anticipated with building of structures and excavation of materials in the Wisconsin and Illinoian ground moraine areas. The heaviest buildings in Decatur County are located in Greensburg. The soils under Greensburg, for the most part are, Wisconsin ground moraine. These moraines are naturally overconsolidated, an important point for consolidation and settlement considerations. To ensure proper foundation performance, a careful site investigation should be undertaken to alleviate future problems. Glacial till can be very variable over a short distance. Soil exploration for new buildings in these areas is needed for identification of materials with low bearing capacity and high settlement potential.

SHALE EMBANKMENT AND DEGRADATION

Shales occurring in Decatur County could cause problems if used in embankments. Testing of shale materials to be used in

rock fills to check their tendency to degrade after placement are required. When these materials are placed and compacted, large voids exist. As the shale is exposed to the environment, it becomes soft and its collapsing void spaces cause large settlement and slope failure. Fortunately, a rating system has been devised to determine the shale suitability as a fill material [32]. Specific tests are performed upon the shale to rate it for comparison with correlation charts. These charts correlate the shale rating with common design practice.

The first test performed upon the shale is the slake durability test. This test evaluates durability and long term degradation due to weathering. Five ten-gram samples of shales are placed in a wire drum, submerged half-way in water, and rotated 200 revolutions. The drum is then oven dried before repeating the rotation. After the second set of rotations, the pieces of shale remaining are weighed. The shale durability index, $Id(2)$, is then computed as follows:

$$Id(2) = \frac{\text{Weight after second cycle} \times 100}{\text{Weight after first cycle}}$$

This results in a number between 0 to 100. Shales with an $Id(2)$ less than 80 are considered soil-like and the plasticity index is determined. Shales with an $Id(2)$ greater than 80 are considered rock-like and a point load test is performed.

Franklin developed a rating chart using index of durability versus plasticity index or point load test. Figure 15 is the

Figure 15. Franklin's Shale Rating Chart (32).

Franklin rating chart and is used to determine an 'R' value [32]. Figure 16a shows minimum lift thickness and compacted density verses the 'R' value. Figure 16b shows the correlation between the drained shear strength parameters and the 'R' value. These charts can be used to predict shale performance.

The Waldron Shale is considered a soil-like shale. It is broken down during compaction and is placed as a soil-like material. Most of the Ordovician-age shales are considered rock-like shales but in the long term would break down and be soil-like. If problems are expected with using a shale as a rock-type material, precautions can be taken to lessen degradation effects. Proper drainage within the fill helps to minimize slaking. Also, the shale fill should be isolated from water infiltration and from the environment. This can be accomplished by encasing the shale with a very low permeability fill material such as clay from the Wisconsinan ground moraine. These measures will help to slow down the slaking process and increase the service life of the fill.

SUMMARY

A summary of potential engineering soil problems of Decatur County is given in Table 9. Each parent material type is represented along with probability of certain problems occurring. These ratings reflect the average character of the parent material type.

Figure 16a. Trends in Shear Strength Parameters of Compacted Shale Fills as a Function of the Shale Quality (32).

Figure 16b. Tentative Correlations Between Shale Quality, Lift Thickness, and Compacted Densities (32).

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Appendix A.

Statistical Stream Flow Data (8).

GREAT PLAINS RIVER BASIN

017650 Whitewater River at Bensenville, Ind.

LOCATION.--Lat 39°14'14", long 89°00'48", on NE¼ sec.12, T.9 N., R.2 W., Franklin County, on right bank at downstream side of Highway bridge, 0.3 mile (0.3 km) downstream from East Fork Whitewater River, and 1.1 miles (1.8 km) south of Broadville.

DRAINAGE AREA--1,116 mi² (2,879 km²).

DURATION TABLE OF DAILY DISCHARGE FOR YEAR ENDING SEPTEMBER 30

[illegible]

CLASS	CFS	TOTAL	ACCU	PERCT	CLASS	CFS	TOTAL	ACCU	PERCT	CLASS	CFS	TOTAL	ACCU	PERCT	CLASS	CFS	TOTAL	ACCU	PERCT
1	50.00	10	100.00	100.0	9	310.00	900	1000.00	60.0	18	2000.00	500	2300	10.0	27	12000	60	175	1.0
1	50.00	10	100.00	100.0	10	300.00	1025	905.00	60.1	19	2000.00	452	1800	11.5	28	15000	40	115	0.7
2	50.00	101	100.00	99.9	11	475.00	970	860.00	52.7	20	2000.00	350	1350	8.7	29	13000	33	75	0.4
3	50.00	603	100.00	99.9	12	575.00	970	760.00	47.7	21	2000.00	250	1025	6.4	30	20000	17	42	0.2
4	110.00	1800	100.00	99.9	13	700.00	900	600.00	30.0	22	2000.00	150	750	3.8	31	20000	10	25	0.1
5	140.00	1800	100.00	99.9	14	800.00	1025	575.00	25.7	23	2000.00	100	500	2.5	32	20000	7	17	0.1
6	170.00	900	100.00	99.9	15	1000.00	700	475.00	20.0	24	2000.00	50	250	1.3	33	40000	2	4	0.0
7	210.00	1020	100.00	99.9	16	1200.00	500	300.00	10.0	25	2000.00	20	100	0.5	34	50000	1	1	0.0
8	250.00	1100	100.00	99.9	17	1000.00	200	100.00	2.0	26	10000.00	50	250	1.5					

LOWEST MEAN DISCHARGE, IN CFS, AND RAINING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
1917	199.00	39	199.00	39	199.00	39	200.00	31	212.00	31	215.00	24	220.00	19	232.00	18	221.00	18	1117.00	21																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

WHITWATER RIVER AT BROOKVILLE, IND. (Continued)

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1931	88.00 6	93.70 8	95.40 8	98.10 8	101.00 7	115.00 6	136.00 7	138.00 7	141.00 3	300.00 2
1932	93.00 10	95.30 9	100.00 10	119.00 14	194.00 26	272.00 32	312.00 28	316.00 27	334.00 19	1080.00 19
1933	119.00 21	124.00 21	136.00 22	148.00 23	182.00 23	254.00 30	306.00 35	423.00 35	579.00 34	1550.00 32
1934	184.00 32	187.00 31	198.00 32	213.00 34	216.00 32	252.00 29	334.00 33	308.00 26	348.00 28	1130.00 22
1935	60.00 1	65.00 2	69.10 2	78.40 2	84.90 1	91.60 1	92.90 1	99.90 1	111.00 1	212.00 1
1936	99.00 12	101.00 12	105.00 12	111.00 12	118.00 10	202.00 21	240.00 22	292.00 24	306.00 23	861.00 13
1937	73.00 3	75.70 3	87.60 4	89.00 4	95.80 3	121.00 8	162.00 13	238.00 19	404.00 38	1670.00 34
1938	190.00 34	195.00 34	210.00 36	263.00 40	401.00 39	500.00 39	532.00 39	573.00 38	699.00 37	1440.00 27
1939	210.00 39	212.00 38	215.00 37	219.00 35	226.00 34	273.00 33	446.00 38	405.00 37	580.00 35	1470.00 28
1940	121.00 22	126.00 22	130.00 21	136.00 21	139.00 18	164.00 17	176.00 18	175.00 12	208.00 13	952.00 15
1941	78.00 4	79.70 4	84.60 3	87.10 3	89.60 2	97.90 2	108.00 2	121.00 4	162.00 6	601.00 4
1942	64.00 2	64.70 1	66.00 1	71.50 1	132.00 15	148.00 15	162.00 14	217.00 16	268.00 14	753.00 3
1943	140.00 25	142.00 25	145.00 24	149.00 24	155.00 21	186.00 20	323.00 30	369.00 31	442.00 27	1170.00 24
1944	120.00 23	141.00 23	148.00 25	150.00 25	159.00 22	175.00 18	174.00 17	195.00 14	210.00 18	851.00 12
1945	80.00 5	84.30 5	89.00 5	97.10 6	97.70 4	103.00 3	111.00 3	116.00 3	127.00 2	1000.00 20
1946	150.00 28	161.00 27	168.00 28	181.00 29	211.00 30	285.00 36	403.00 36	590.00 39	650.00 36	1500.00 30
1947	116.00 18	117.00 18	129.00 17	123.00 15	126.00 12	138.00 12	151.00 12	163.00 13	208.00 15	796.00 9
1948	200.00 38	216.00 40	224.00 40	236.00 38	259.00 37	281.00 35	301.00 37	338.00 39	577.00 32	1810.00 36
1949	110.00 15	117.00 19	120.00 18	125.00 16	124.00 16	144.00 14	164.00 15	230.00 17	364.00 21	2580.00 38
1950	178.00 31	187.00 32	204.00 34	256.00 39	282.00 38	375.00 38	406.00 37	410.00 34	538.00 31	2950.00 37
1951	290.00 41	291.00 41	313.00 41	331.00 41	406.00 40	553.00 40	776.00 42	836.00 41	978.00 39	2160.00 45
1952	132.00 24	141.00 24	144.00 23	147.00 22	150.00 20	162.00 16	173.00 16	217.00 15	234.00 15	1670.00 35
1953	112.00 16	113.00 15	117.00 15	126.00 18	136.00 17	144.00 13	149.00 11	166.00 11	239.00 12	887.00 10
1954	101.00 13	102.00 13	105.00 13	110.00 11	114.00 9	117.00 7	120.00 6	127.00 6	156.00 5	530.00 3
1955	90.00 7	92.00 6	92.00 6	93.10 5	98.50 5	130.00 10	144.00 10	151.00 9	178.00 7	781.00 8
1956	91.00 8	96.70 10	99.10 9	103.00 9	131.00 14	210.00 23	327.00 32	405.00 33	539.00 32	1230.00 25
1957	116.00 19	116.00 16	117.00 14	118.00 13	123.00 11	129.00 9	142.00 9	156.00 10	234.00 11	779.00 7
1958	160.00 29	162.00 28	164.00 26	171.00 26	201.00 27	223.00 26	230.00 28	282.00 22	742.00 38	1510.00 31
1959	400.00 42	410.00 42	421.00 42	449.00 42	469.00 42	567.00 41	680.00 40	720.00 40	1350.00 41	2500.00 42
1960	156.00 27	159.00 26	174.00 29	178.00 28	192.00 25	217.00 25	240.00 21	254.00 20	312.00 17	887.00 11
1961	118.00 20	119.00 20	120.00 16	125.00 17	128.00 13	131.00 11	141.00 8	146.00 8	184.00 9	898.00 14
1962	211.00 40	212.00 39	217.00 38	220.00 36	239.00 36	274.00 34	322.00 29	354.00 30	479.00 29	1660.00 33
1963	200.00 36	209.00 37	218.00 39	221.00 37	229.00 35	261.00 31	261.00 25	268.00 21	294.00 16	972.00 16
1964	92.00 9	92.00 7	94.70 7	97.40 7	101.00 6	108.00 4	113.00 4	113.00 4	144.00 4	759.00 6
1965	98.00 11	99.30 11	101.00 11	103.00 10	108.00 8	112.00 5	118.00 5	126.00 5	181.00 8	1000.00 17

HIGHEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING SEPTEMBER 30

YEAR	1	3	7	15	30	60	90	120	183	ANNUAL
1916	38700.0 7	25100.0 8	14300.0 9	8490.0 9	6390.0 6	4950.0 8	3930.0 9	3490.0 8	2870.0 6	1710.0 11
1917	19400.0 29	14500.0 25	8270.0 25	5210.0 29	3980.0 27	2600.0 30	2340.0 31	2090.0 31	1890.0 25	1130.0 20
1924	20900.0 27	11800.0 29	6710.0 32	4590.0 32	4150.0 25	3030.0 27	3070.0 22	2800.0 17	2690.0 10	1640.0 12
1925	4720.0 42	3290.0 42	2970.0 40	2200.0 40	1590.0 40	1110.0 40	920.0 40	873.0 40	737.0 40	555.0 39
1926	14500.0 33	10000.0 31	8140.0 26	6020.0 23	4470.0 22	3320.0 23	2630.0 29	2260.0 28	2190.0 18	1910.0 6
1927	22900.0 23	14700.0 24	8550.0 24	5760.0 25	4920.0 17	3590.0 19	3610.0 13	3210.0 14	2600.0 13	1770.0 10
1928	26400.0 17	12100.0 28	7210.0 29	5470.0 27	3680.0 31	2530.0 32	2690.0 27	2340.0 26	2070.0 23	1440.0 16
1929	46600.0 4	21700.0 12	11100.0 16	7160.0 14	4510.0 20	3860.0 18	3530.0 14	3260.0 12	3270.0 5	1850.0 7
1930	28500.0 16	26500.0 5	20800.0 1	12600.0 3	7740.0 4	4990.0 4	4170.0 6	3450.0 10	2520.0 14	1380.0 18
1931	40800.0 41	4620.0 41	2700.0 42	2140.0 41	1480.0 41	1080.0 41	857.0 41	753.0 42	614.0 41	397.0 41
1932	21400.0 26	8680.0 34	6930.0 30	5540.0 26	3960.0 26	3120.0 26	2470.0 30	2310.0 27	1780.0 27	1140.0 26
1933	34500.0 10	22100.0 9	13400.0 10	7990.0 11	5710.0 12	5240.0 4	4390.0 3	3940.0 3	3460.0 2	2070.0 2
1934	7090.0 40	4380.0 40	2760.0 41	1710.0 42	1350.0 43	993.0 42	755.0 43	755.0 41	607.0 42	396.0 42
1935	12600.0 35	6780.0 37	5060.0 36	3530.0 37	2190.0 39	1420.0 39	1180.0 39	1010.0 39	814.0 39	465.0 40
1936	11200.0 37	9450.0 33	5680.0 34	3810.0 35	2590.0 36	2490.0 35	2050.0 36	1680.0 36	1290.0 37	785.0 37
1937	41800.0 5	25400.0 7	18500.0 2	15700.0 1	9810.0 1	6030.0 2	4370.0 4	3660.0 5	2790.0 9	1810.0 9
1938	25600.0 28	15200.0 22	9860.0 22	6320.0 20	6170.0 9	4540.0 11	3510.0 15	3170.0 15	2600.0 11	1820.0 8
1939	27300.0 19	17100.0 14	10100.0 20	6030.0 22	3900.0 28	3480.0 21	3200.0 19	2630.0 19	2110.0 20	1290.0 22
1940	25200.0 22	18000.0 15	10500.0 18	5970.0 24	3580.0 32	2280.0 36	2110.0 35	1820.0 35	1390.0 35	773.0 38
1941	2500.0 44	1710.0 44	1290.0 44	1020.0 44	871.0 44	452.0 44	381.0 44	363.0 44	372.0 44	271.0 44
1942	17800.0 31	11300.0 30	6710.0 31	4920.0 31	2970.0 34	2500.0 33	2260.0 33	1940.0 33	1550.0 32	1010.0 29
1943	30400.0 11	21800.0 11	16200.0 3	8770.0 7	4980.0 16	3170.0 25	2930.0 23	2490.0 22	2090.0 21	1310.0 20
1944	21700.0 25	18000.0 16	12000.0 12	6840.0 17	4490.0 21	3390.0 22	2680.0 28	2190.0 30	1520.0 33	840.0 34
1945	27400.0 18	16400.0 20	10200.0 19	6240.0 21	5060.0 15	4140.0 15	3220.0 17	3060.0 16	2300.0 17	1290.0 21
1946	14400.0 34	7720.0 35	5010.0 38	3380.0 38	2650.0 35	2500.0 34	2290.0 32	2010.0 32	1760.0 28	1130.0 27
1947	29900.0 13	19000.0 13	11300.0 15	7010.0 15	5600.0 13	4920.0 4	3940.0 8	3260.0 13	2650.0 12	1600.0 13
1948	26700.0 20	13600.0 26	8800.0 23	6570.0 19	5900.0 11	3950.0 17	3390.0 16	2750.0 18	2090.0 22	1190.0 23
1949	49000.0 3	31000.0 2	15700.0 6	9640.0 5	8710.0 3	5960.0 3	4980.0 2	4270.0 2	3300.0 4	1950.0 4
1950	30700.0 8	26100.0 6	15900.0 5	13800.0 2	9650.0 2	7830.0 1	6080.0 1	5300.0 1	3980.0 1	2360.0 1
1951	29400.0 14	17200.0 18	9970.0 21	7460.0 13	4800.0 18	4200.0 14	3790.0 11	3660.0 6	3310.0 3	1950.0 5
1952	40800.0 6	27300.0 4	14500.0 8	9680.0 4	5950.0 10	4350.0 13	3770.0 12	3470.0 9	2820.0 8	1560.0 14
1953	9240.0 38	6550.0 39	5020.0 37	3610.0 36	2260.0 37	1620.0 37	1700.0 37	1520.0 37	1390.0 36	827.0 35
1954	3340.0 43	2930.0 43	2020.0 43	1680.0 43	1400.0 42	993.0 43	800.0 42	709.0 43	568.0 43	354.0 43
1955	8480.0 39	6720.0 38	5320.0 35	4370.0 33	3480.0 33	2550.0 31	2130.0 34	1870.0 34	1450.0 34	879.0 33
1956	22600.0 24	14800.0 23	7950.0 27	5130.0 30	3820.0 29	3250.0 24	2790.0 24	2450.0 24	2120.0 19	1410.0 17
1957	28600.0 15	17800.0 17	11400.0 14	6810.0 18	4230.0 24	3440.0 20	3090.0 21	2590.0 20	2060.0 24	1170.0 24
1958	25900.0 21	15200.0 21	12700.0 11	7810.0 12	5100.0 14	4990.0 5	4110.0 7	3690.0 4	2840.0 3	2010.0 3
1959	55000.0 1	33400.0 1	16100.0 1	8700.0 8	7460.0 5	4970.0 5	3850.0 10	3280.0 11	2500.0 16	1480.0 15
1960	15700.0 32	7440.0 36	4900.0 39	3890.0 39	2190.0 38	1540.0 38	1370.0 38	1230.0 38	1240.0 38	805.0 36
1961	30300.0 12	18800.0 14	10700.0 17	8270.0 10	6230.0 8	4580.0 10	4200.0 5	3510.0 7	2510.0 15	1370.0 19
1962	16200.0 30	13500.0 27	7460.0 28	5340.0 28	4430.0 23	3800.0 28	2750.0 25	2340.0 25	1860.0 26	1140.0 25
1963	52800.0 2	30700.0 3	15100.0 7	9140.0 6	6340.0 7	4110.0 16	3130.0 20	2480.0 23	1760.0 29	1000.0 30
1964	35400.0 9	22000.0 10	11900.0 13	6880.0 16	4720.0 19	4420.0 12	3200.0 18	2500.0 21	1740.0 30	937.0 31
1965	12000.0 36	9850.0 32	6030.0 33	3960.0 34	3740.0 30	2850.0 29	2700.0 26	2240.0 29	1640.0 31	932.0 31

WHITFATER RIVER AT BROOKVILLE, INO. (Continued)

STATISTICS ON NORMAL MONTHLY MEAN/ALL DAYS:

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY MEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW:											
0.3880E+03	0.6659E+03	0.1040E+04	0.2220E+04	0.2007E+04	0.2373E+04	0.2209E+04	0.1434E+04	0.1192E+04	0.8994E+03	0.4266E+03	0.4334E+03
0.2137E+06	0.5760E+06	0.4092E+06	0.6337E+07	0.1740E+07	0.1760E+07	0.1487E+07	0.1091E+07	0.1104E+07	0.4459E+06	0.2899E+06	0.4241E+06
0.4623E+01	0.7595E+01	0.4535E+01	0.2514E+01	0.1319E+01	0.1330E+01	0.1219E+01	0.1044E+01	0.1051E+01	0.4877E+01	0.3196E+01	0.4512E+01
0.3683E+01	0.2137E+01	0.1221E+01	0.1449E+01	0.7471E+00	0.4197E+00	0.5270E+00	0.1941E+00	0.1473E+00	0.3134E+00	0.3861E+00	0.5004E+00
0.1191E+01	0.1141E+01	0.4144E+00	0.1134E+01	0.4571E+00	0.5602E+00	0.5530E+00	0.7264E+00	0.4817E+00	0.4728E+00	0.1218E+00	0.1562E+00
0.7574E+01	0.4417E+01	0.8499E+01	0.1472E+02	0.1332E+02	0.1574E+02	0.1462E+02	0.9534E+01	0.7908E+01	0.4553E+01	0.2830E+01	0.2875E+01

STATISTICS ON NORMAL ANNUAL MEAN/ALL DAYS:

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.1252E+04	0.2729E+04	0.5224E+03	-0.1495E+01	0.4148E+00	0.2618E+00

STATISTICS ON LOG MONTHLY MEAN/ALL DAYS:

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY MEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW:											
0.2429E+01	0.2614E+01	0.2492E+01	0.2074E+01	0.2169E+01	0.3299E+01	0.3263E+01	0.3054E+01	0.2934E+01	0.2710E+01	0.2495E+01	0.2462E+01
0.1167E+00	0.1467E+00	0.1443E+00	0.1494E+00	0.1694E+00	0.4447E+00	0.4407E+00	0.4435E+00	0.1194E+00	0.1044E+00	0.8716E+00	0.1153E+00
0.3418E+00	0.4177E+00	0.4414E+00	0.3157E+00	0.4009E+00	0.2909E+00	0.2909E+00	0.2577E+00	0.3441E+00	0.3230E+00	0.2952E+00	0.3394E+00
0.4024E+00	0.5128E+00	0.5297E+00	0.4197E+00	0.5102E+00	0.7494E+00	0.7222E+00	0.1744E+00	0.1472E+00	0.2491E+00	0.1376E+00	0.1676E+00
0.1407E+00	0.1156E+00	0.1179E+00	0.1477E+00	0.1499E+00	0.4401E+00	0.4847E+00	0.1004E+00	0.1178E+00	0.1194E+00	0.1193E+00	0.1379E+00
0.7574E+01	0.7624E+01	0.7271E+01	0.4494E+01	0.4233E+01	0.4494E+01	0.4553E+01	0.4402E+01	0.4581E+01	0.4493E+01	0.4214E+01	0.4717E+01

STATISTICS ON LOG ANNUAL MEAN/ALL DAYS:

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.1050E+01	0.5029E+01	0.7093E+00	-0.1034E+01	0.7253E+01	0.2273E+00

ANNUAL PEAKS

1918	48100	1938	23400	1957	25200
1917	28200	1939	20400	1958	28600
1916	17100	1940	38100	1959	81800
1915	35700	1941	33300	1960	29400
1914	45700	1942	25400	1961	42000
1913	29300	1943	52500	1962	28500
1912	9250	1944	28800	1963	64500
1911	21800	1945	38800	1964	46000
1910	28000	1946	21100	1965	22800
1909	28400	1947	28800	1966	12800
1908	68200	1948	37800	1967	23400
1907	38700	1949	61200	1968	57800
1906	38700	1950	45200	1969	31400
1905	11800	1951	33600	1970	27800
1904	24700	1952	61200	1971	28000
1903	38900	1953	13500	1972	17800
1902	12000	1954	48800	1973	17500
1901	18200	1955	12100		
1900	17000	1956	28800		
1907	52200				

Appendix A-1 (Cont.)

WABASH RIVER BASIN

03365000 Sand Creek near Brewersville, Ind.

LOCATION.--Lat 39°05'03", long 85°59'32", in NWNE sec.5, T.7 N., R.8 E., Jennings County, on left bank at downstream side of county highway bridge, 2.5 miles (4.0 km) west of Brewersville, 5.7 miles (9.2 km) upstream from Wyalooking Creek, and 16 miles (26 km) upstream from mouth.

DRAINAGE AREA.--155 mi² (401 km²).

DURATION TABLE OF DAILY DISCHARGE FOR YEAR ENDING SEPTEMBER 30

CLASS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34		
	NUMBER OF DAYS IN CLASS																																				CFS-DAYS
1948	21							1	1	9	3	2	10	6	13	17	12	16	13	16	11	8	7	7	3	2	2	1					1	1			15468.1
1949	18									1		3	1	12	16	12	23	35	24	16	30	33	44	30	28	12	4	6	5	4	6	1	1			98133.3	
1950																	4	16	42	26	23	33	31	54	32	22	10	11	16	5	6	1	1			133034.3	
1951												1	25	14	11	15	6	25	23	12	8	23	48	51	26	21	27	9	11	7	3	1	1	1		90185.2	
1952													4	26	20	15	9	16	15	12	11	15	22	25	37	41	20	14	24	14	9	10	2	2	1	61745.9	
1953																																				39530.8	
1954	116																																			6714.3	
1955	29																																			27788.4	
1956																																				61089.4	
1957																																				65547.7	
1958																																				85707.2	
1959																																				63555.4	
1960																																				49545.1	
1961																																				62797.2	
1962																																				58293.8	
1963																																				61446.1	
1964	16																																			46329.4	
1965	40																																			39476.6	
1966																																				36150.7	
1967	6	2	1																																	57458.1	
1968																																				70778.4	
1969																																				61362.1	
1970																																				56935.4	
1971																																				36552.0	
1972																																				56573.4	
1973																																				89154.8	

CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT
0	0.00	268	9314	100.0	9	0.40	61	4961	96.2	18	19.0	731	5934	63.7	27	860	150	358	3.8
1	0.01	2	9046	97.1	10	0.60	98	4900	95.6	19	29.0	789	5203	55.9	28	1300	102	208	2.2
2	0.02	1	9044	97.1	11	1.00	151	4802	94.5	20	44.0	827	4414	47.4	29	2000	55	105	1.1
3	0.03	0	9043	97.1	12	1.50	200	8651	92.9	21	67.0	819	3587	38.5	30	3100	38	50	.5
4	0.04	4	9043	97.1	13	2.20	322	8451	90.7	22	100.0	890	2768	29.7	31	4700	12	20	.2
5	0.07	3	9039	97.0	14	3.40	505	8129	87.3	23	160.0	545	1878	20.2	32	7300	6	8	.1
6	0.10	37	9036	97.0	15	5.70	425	7624	81.9	24	240.0	457	1333	14.3	33	11000	2	2	.0
7	0.20	22	8999	96.6	16	8.00	494	7199	77.3	25	370.0	325	876	9.4	34				
8	0.30	16	8977	96.4	17	12.00	771	6705	72.0	26	560.0	193	551	5.9					

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1948	0.00 1	0.00 1	0.00 1	0.00 1	0.00 1	0.26 3	2.50 7	12.80 12	20.10 12	270.00 22
1950	2.60 21	3.30 22	3.70 23	4.60 23	9.30 22	23.60 23	60.90 23	67.50 23	78.60 22	300.00 24
1951	7.00 24	7.90 24	9.20 24	14.20 24	30.70 25	74.10 25	127.00 25	126.00 25	142.00 24	305.00 25
1952	0.51 11	0.50 11	0.54 10	0.61 10	0.76 7	1.80 7	1.90 4	7.90 9	28.10 15	216.00 18
1953	0.40 10	0.40 10	0.40 7	0.57 9	1.10 8	2.20 8	4.30 9	6.30 7	14.70 7	119.00 9
1954	0.00 2	0.00 2	0.00 2	0.00 2	0.00 2	0.00 1	0.00 1	0.45 1	2.70 2	50.90 1
1955	0.00 3	0.00 3	0.00 3	0.00 3	0.00 3	0.54 4	1.40 3	1.60 3	2.10 1	94.00 4
1956	0.00 4	0.00 4	0.00 4	0.00 4	3.00 12	9.20 17	18.40 21	26.00 19	35.10 16	116.00 7
1957	0.60 12	0.77 12	1.20 13	1.70 13	2.30 11	3.40 9	15.40 19	15.50 17	35.50 17	123.00 11
1958	0.30 7	0.37 8	0.41 4	0.56 7	2.00 10	4.40 12	5.40 11	10.10 10	92.20 23	221.00 19
1959	11.00 25	12.00 25	13.10 25	16.20 25	28.60 24	67.40 24	68.60 24	84.10 24	150.00 25	291.00 23
1960	1.10 14	1.30 14	1.70 15	2.30 15	6.20 19	11.10 20	13.10 16	14.70 14	18.40 11	89.80 3
1961	2.20 18	2.20 18	2.30 17	2.60 16	3.10 13	4.20 11	4.50 10	7.20 8	16.40 8	165.00 16
1962	1.30 15	1.30 15	1.40 14	1.80 14	6.60 21	10.60 19	13.20 18	15.40 16	17.80 10	182.00 17
1963	2.40 19	2.50 19	2.60 18	3.30 19	5.40 18	10.10 18	13.10 17	14.60 13	21.20 13	116.00 8
1964	0.30 6	0.33 7	0.44 9	0.57 8	0.68 6	1.60 6	2.30 6	2.70 4	12.50 6	120.00 10
1965	0.00 5	0.00 5	0.00 5	0.00 5	0.00 4	0.03 2	0.10 2	0.78 2	4.00 3	108.00 5
1966	1.90 16	2.00 16	2.60 19	3.20 17	6.30 20	12.20 21	12.40 15	15.00 15	17.60 9	88.60 2
1967	0.90 13	1.00 13	1.10 12	1.40 12	4.00 17	5.00 13	9.00 13	10.70 11	22.30 14	140.00 15
1968	0.00 6	0.00 6	0.01 6	0.04 6	0.15 5	0.88 5	2.20 5	3.90 5	11.60 5	139.00 14
1969	2.90 22	3.00 21	3.10 21	3.70 21	3.90 16	5.10 14	8.10 12	35.60 21	69.20 20	224.00 20
1970	2.60 20	2.70 20	3.00 20	3.30 18	3.50 14	7.90 16	9.60 14	25.00 18	40.60 18	133.00 12
1971	0.25 9	0.39 9	0.59 11	1.20 11	1.50 9	3.50 10	3.50 8	4.30 6	8.60 4	136.00 13
1972	3.10 23	3.40 23	3.60 22	4.40 22	13.40 23	23.00 22	39.80 22	43.10 22	48.50 19	111.00 6
1973	1.90 17	2.00 17	2.20 16	3.40 20	3.70 15	6.50 15	17.00 20	26.70 20	69.70 21	238.00 21

SAND CREEK NEAR BREWERSVILLE, IND. (Continued)

HIGHEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING SEPTEMBER 30

YEAR	1	3	7	15	30	60	90	120	183	ANNUAL
1949	8930.0 5	5730.0 4	2730.0 4	1490.0 4	1430.0 2	987.0 2	786.0 2	662.0 2	466.0 2	269.0 2
1950	10100.0 3	5820.0 3	3250.0 1	2340.0 1	1590.0 1	1230.0 1	948.0 1	812.0 1	600.0 1	364.0 1
1951	7350.0 7	3880.0 12	1790.0 9	1130.0 9	855.0 7	679.0 5	548.0 5	515.0 3	450.0 3	247.0 3
1952	5220.0 13	3490.0 7	1950.0 7	1310.0 7	814.0 8	655.0 7	577.0 4	510.0 4	417.0 4	223.0 6
1953	2350.0 22	1510.0 23	944.0 24	587.0 24	391.0 24	292.0 23	249.0 23	225.0 22	206.0 20	106.0 21
1954	385.0 25	241.0 25	191.0 25	109.0 25	72.0 25	65.3 25	57.0 25	49.4 25	35.4 25	16.4 25
1955	2710.0 21	1670.0 20	1220.0 17	857.0 18	641.0 16	439.0 16	327.0 20	272.0 20	194.0 22	104.0 22
1956	4660.0 14	2220.0 16	1190.0 21	630.0 22	548.0 19	417.0 19	384.0 16	342.0 14	269.0 14	167.0 12
1957	6180.0 10	3380.0 10	1870.0 8	1080.0 11	578.0 18	549.0 9	439.0 10	397.0 8	332.0 6	180.0 8
1958	3880.0 16	2620.0 14	1560.0 13	952.0 15	657.0 14	430.0 18	411.0 12	382.0 9	287.0 11	235.0 5
1959	13100.0 1	8510.0 1	2930.0 3	1540.0 3	1070.0 3	769.0 3	537.0 6	428.0 6	323.0 9	174.0 9
1960	7680.0 6	3440.0 8	1580.0 12	953.0 14	519.0 21	330.0 22	245.0 24	216.0 23	218.0 18	135.0 17
1961	6730.0 8	4650.0 6	2250.0 6	1420.0 6	981.0 5	625.0 6	639.0 3	495.0 5	332.0 7	172.0 10
1962	3570.0 17	2350.0 15	1410.0 15	878.0 17	647.0 15	433.0 17	371.0 17	310.0 17	228.0 17	138.0 16
1963	5900.0 11	3880.0 11	1860.0 11	1100.0 10	806.0 9	494.0 13	359.0 18	288.0 19	206.0 19	114.0 19
1964	9360.0 4	6410.0 2	3230.0 2	1780.0 2	1010.0 4	690.0 4	477.0 7	374.0 10	250.0 16	127.0 18
1965	2800.0 20	1720.0 19	1220.0 18	651.0 21	500.0 22	336.0 21	334.0 19	294.0 18	204.0 21	108.0 20
1966	2100.0 24	1410.0 24	1010.0 23	629.0 23	459.0 23	271.0 24	253.0 22	230.0 21	182.0 23	94.0 24
1967	3280.0 18	1970.0 18	1210.0 19	924.0 16	665.0 13	440.0 15	403.0 14	347.0 13	293.0 10	157.0 14
1968	11100.0 2	4840.0 5	2770.0 5	1460.0 5	889.0 6	547.0 10	473.0 8	373.0 11	323.0 8	193.0 7
1969	5600.0 12	3390.0 9	1770.0 10	1210.0 8	785.0 10	531.0 12	488.0 13	334.0 15	277.0 13	168.0 11
1970	6640.0 9	2690.0 13	1420.0 14	784.0 19	762.0 12	542.0 11	427.0 11	366.0 12	268.0 15	140.0 15
1971	3000.0 19	1580.0 21	1210.0 20	766.0 20	520.0 20	355.0 20	261.0 21	213.0 24	165.0 24	100.0 23
1972	4130.0 15	2020.0 17	1280.0 16	1010.0 12	618.0 17	465.0 14	385.0 15	326.0 16	282.0 12	163.0 13
1973	2310.0 23	1510.0 22	1160.0 22	975.0 13	735.0 11	571.0 8	454.0 9	398.0 7	379.0 5	244.0 4

STATISTICS ON ACPAL MONTHLY MEANSTALL DAYS

CCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY POWSMEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW											
0.1855E+02	0.7232E+02	0.1778E+03	0.3324E+03	0.2638E+03	0.3632E+03	0.2799E+03	0.2094E+03	0.1069E+03	0.8884E+02	0.3250E+02	0.2844E+02
0.8E+00E+03	0.1223E+05	0.3292E+05	0.1842E+06	0.4919E+05	0.6273E+05	0.3185E+05	0.4468E+05	0.1250E+05	0.4724E+04	0.2450E+04	0.1220E+04
0.2940E+02	0.1108E+03	0.1814E+03	0.4052E+03	0.1980E+03	0.2905E+03	0.1781E+03	0.2210E+03	0.1110E+03	0.9861E+02	0.4450E+02	0.3679E+02
0.3E+02E+01	0.2458E+01	0.9875E+01	0.2068E+01	0.1624E+01	0.7881E+01	0.6576E+01	0.1478E+01	0.1528E+01	0.1347E+01	0.2318E+01	0.2211E+01
0.1551E+01	0.1525E+01	0.1622E+01	0.1211E+01	0.8776E+00	0.8895E+00	0.6375E+00	0.1103E+00	0.1027E+00	0.1112E+00	0.1525E+00	0.1494E+00
0.9495E+00	0.2623E+01	0.8855E+01	0.1867E+02	0.1422E+02	0.1820E+02	0.1402E+02	0.1164E+02	0.5854E+01	0.4441E+01	0.1828E+01	0.1427E+01

STATISTICS ON NORMAL ANNUAL MEANSTALL DAYS

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.1855E+03	0.4498E+04	0.7069E+02	0.7434E+00	0.4258E+00	0.4810E+00

STATISTICS ON LOG MONTHLY MEANSTALL DAYS

CCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY POWSMEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW											
0.8548E+00	0.1418E+01	0.1518E+01	0.2259E+01	0.2312E+01	0.2438E+01	0.2342E+01	0.2122E+01	0.1805E+01	0.1610E+01	0.1105E+01	0.7962E+00
0.4288E+00	0.4467E+00	0.4185E+00	0.2533E+00	0.1753E+00	0.1363E+00	0.1117E+00	0.1803E+00	0.2386E+00	0.4659E+00	0.2415E+00	0.7937E+00
0.8348E+00	0.8832E+00	0.6449E+00	0.3053E+00	0.4187E+00	0.3692E+00	0.3343E+00	0.4418E+00	0.4885E+00	0.8826E+00	0.5379E+00	0.6400E+00
0.7180E+00	0.1266E+00	0.1726E+00	0.3734E+00	0.1195E+00	0.6638E+00	0.5786E+00	0.9410E+00	0.1898E+00	0.2243E+01	0.4445E+00	0.3266E+00
0.7816E+00	0.4818E+00	0.3373E+00	0.2244E+00	0.1811E+00	0.1915E+00	0.1427E+00	0.2034E+00	0.2768E+00	0.4234E+00	0.4633E+00	0.1114E+01
0.4068E+01	0.4734E+01	0.5188E+01	0.1072E+02	0.1099E+02	0.1158E+02	0.1113E+02	0.1109E+02	0.4586E+01	0.7852E+01	0.5534E+01	0.3784E+01

STATISTICS ON LOG ANNUAL MEANSTALL DAYS

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.2171E+01	0.5766E+01	0.2400E+00	0.2122E+01	0.1108E+00	0.4066E+00

ANNUAL PEAKS

1948	9980	1961	8440
1949	12100	1962	8040
1950	12400	1967	9640
1951	11100	1968	14000
1952	5780	1969	3060
1953	3440	1966	4420
1954	1240	1967	4440
1955	4700	1968	18000
1956	7640	1969	7400
1957	8440	1970	6410
1958	7140	1971	4700
1959	19400	1972	4470
1960	9740	1973	4470

NABASH RIVER BASIN

03364500 Clifty Creek at Hartsville, Ind.

LOCATION.—Lat. 39°15'21", long. 85°42'10", in NW 1/4 sec. 36, T.10 N., R.7 E., Bartholomew County, at downstream side of left abutment of highway bridge, 0.2 mile (0.3 km) north of Hartsville, and 1 mile (1 km) upstream from Duck Creek.

DRAINAGE AREA.—61.4 mi² (236.7 km²).

DURATION TABLE OF DAILY DISCHARGE FOR YEAR ENDING SEPTEMBER 30

CLASS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	CFS-DAYS	
YEAR	NUMBER OF DAYS IN CLASS																																				
1948	28					7	1	5	5	2	5	3	9	13	13	7	6	12	3	14	11	10														9246.5	
1949	1					4	6	4	1			7	14	19	23	9	17	9	17	21	20	25	25	31	31	24	14	12	7	6	7	6	1	3	1	68537.8	
1950												1	4	7	12	16	17	37	25	18	34	27	29	42	22	24	12	9	13	2	4	4	1	1		71459.1	
1951	12					2	6	5	9	4	4	2	4	4	4	7	15	31	21	23	26	30	28	37	21	26	21	8	7	3	2	3				54589.3	
1952	27					10	3	8	8	6	6	14	10	11	8	8	6	10	18	17	18	18	36	36	24	22	19	10	3	5	1			2		44910.6	
1953	46					5	14	10	8	4	8	10	7	19	7	8	6	14	20	15	42	32	18	27	14	10	12	4	2							23454.2	
1954	181					1	1	2			1	2	22	2	4	14	20	17	28	23	15	11	3	1												3284.3	
1955	110											1	4	3	1	2	1	5	13	15	24	22	33	34	30	28	12	9	10	5	1	1				23746.5	
1956	3					2	3	1	5	4	1	4	4	10	8	7	9	24	34	36	47	30	27	38	35	15	6	2	4	2	2	3				41919.9	
1957	5					5	4	5	3	10	16	19	18	14	12	5	4	6	29	29	33	43	31	32	12	11	6	7	1	1	1	2	1			25130.4	
1958						3	5	5		4	7	8	1	11		1	3	5	25	48	48	37	33	45	29	15	17	3	4	5	1					44444.0	
1959	5					1	3	1	5	2	16	13	7	12	10	10	14	27	30	25	42	36	25	35	22	4	2	2			2	1	1		1	32036.6	
1960																																					23580.2
1961	3					2	2	1	14	3	6	28	17	24	39	26	29	14	11	22	16	18	35	12	15	16	11	10	4	2	1	1	1	1			36844.4
1962																																					29117.2
1963	8					2	1	1	1	8	7	9	10	15	23	38	26	32	44	33	24	19	17	19	10	6	4	3	2	1			1	1		24530.4	
1964	88					7	2	2	5	4	16	18	19	21	17	15	32	14	17	8	5	9	14	10	8	4	5	2	2	1			1	1		27114.8	
1965	65																																				27942.6
1966	13					6	3	1	2	3	3	6	4	16	10	24	37	33	21	45	43	32	14	16	14	10	1	2	2							17956.5	
1967	49	1				1	2	2																												32757.1	
1968	32																																				44837.8
1969																																					36428.2
1970						1	6	6	2	4	7	11	13	4	23	17	27	9	17	19	17	27	38	25	25	17	11	3	2	3	1	1			1	27768.0	
1971						3	8	1	2	4	2	6	4	9	13	34	36	21	33	50	34	28	21	12	14	10	4	3	3	3						18564.1	
1972	42					2	2	2	2	1	6	4	6	3	2	23	24	31	26	34	16	31	33	20	11	11	3	3							1		24475.1
1973											1	7	19	14	9	6	6	12	4	15	45	44	33	39	41	26	15	6	6	1	1					43597.4	

CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT	CLASS	CFS	TOTAL	ACCUM	PERCT
0	0.00	718	4314	100.0	9	0.40	41	8299	89.1	18	16.0	644	9533	99.4	27	---	118	322	3.4
1	0.02	1	4596	92.3	10	0.40	155	8214	88.2	19	24.0	687	4488	92.5	28	660	45	206	2.2
2	0.04	0	4595	92.3	11	1.20	275	4863	86.6	20	34.0	817	4202	45.1	29	900	51	121	1.2
3	0.06	5	4595	92.3	12	1.40	241	7788	83.6	21	44.0	796	3385	36.3	30	1400	10	70	.7
4	0.09	0	4590	92.2	13	2.50	342	7547	81.0	22	72.0	588	2429	28.2	31	2000	24	40	.4
5	0.10	74	4580	92.2	14	3.70	353	7205	77.4	23	100.0	683	2041	21.4	32	2400	11	16	.1
6	0.20	68	4516	91.4	15	5.30	387	6452	73.6	24	150.0	441	1344	14.5	33	4300	5	5	.1
7	0.30	60	4447	90.7	16	7.70	389	4405	69.4	25	225.0	316	857	9.2	34	6200			
8	0.40	88	4387	90.0	17	11.00	543	6076	65.2	26	325.0	219	541	5.8					

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1948	0.00 1	0.00 1	0.00 1	0.00 1	0.01 7	0.77 4	1.40 10	15.60 19	17.20 14	182.00 24
1950	0.00 20	0.07 20	1.20 20	1.00 20	5.00 24	13.60 24	27.80 24	36.40 22	57.10 23	182.00 25
1951	1.40 24	1.40 23	2.20 23	3.00 24	5.30 23	11.10 22	24.50 22	42.50 24	55.20 22	164.00 23
1952	0.00 7	0.00 2	0.00 7	0.04 10	0.10 4	0.70 4	0.80 5	6.40 14	26.30 18	144.00 21
1953	0.00 3	0.00 3	0.00 3	0.09 11	0.19 10	0.72 8	1.10 7	1.20 5	7.80 8	65.90 8
1954	0.00 4	0.00 4	0.00 4	0.00 2	0.00 1	0.00 1	0.00 1	0.00 1	1.50 2	26.80 1
1955	0.00 5	0.00 5	0.00 5	0.00 3	0.00 2	0.00 2	0.00 2	0.00 2	0.04 1	44.80 2
1956	0.00 6	0.00 6	0.00 4	0.00 4	0.03 4	0.60 21	32.90 25	66.40 25	51.70 21	92.40 16
1957	0.00 7	0.00 7	0.13 14	0.27 15	0.55 11	1.30 11	2.10 12	2.80 8	15.00 12	74.30 10
1958	0.00 8	0.00 6	0.06 13	0.24 12	0.77 12	1.00 10	1.30 9	5.60 13	45.60 20	114.00 14
1959	7.70 25	9.20 25	11.40 24	13.10 25	15.10 25	21.60 25	26.90 23	39.00 23	66.70 24	150.00 22
1960	0.00 4	0.00 4	0.04 17	0.24 13	2.91 14	2.80 14	4.70 16	5.10 11	6.70 4	45.70 3
1961	0.01 14	0.50 14	0.90 17	0.64 17	1.10 15	1.60 12	2.00 11	2.80 9	6.50 7	82.70 15
1962	0.00 13	0.03 15	0.14 16	0.27 14	1.10 16	2.00 13	2.90 13	5.10 12	11.40 10	111.00 18
1963	1.20 23	2.10 24	2.60 24	2.90 23	4.10 22	6.20 19	8.00 19	9.10 16	14.50 11	65.30 7
1964	0.00 11	0.00 10	0.00 7	0.00 5	0.00 3	0.17 5	0.60 5	0.90 4	5.10 4	60.40 5
1965	0.00 12	0.00 11	0.00 4	0.00 5	0.00 4	0.00 3	0.00 3	0.00 3	1.60 3	73.90 6
1966	0.40 18	0.40 14	0.66 14	1.30 14	3.10 20	12.00 23	12.60 21	14.90 18	17.60 15	64.00 4
1967	0.00 13	0.00 12	0.00 9	0.01 9	2.20 17	3.10 16	3.40 14	6.90 15	16.10 13	77.50 12
1968	0.00 14	0.00 13	0.00 10	0.00 7	0.00 5	0.00 4	0.03 4	1.30 6	6.10 6	78.70 13
1969	1.00 21	1.00 21	1.70 22	1.90 21	2.20 18	5.40 17	6.90 18	28.20 21	78.40 25	142.00 20
1970	1.20 22	1.20 22	1.60 21	2.40 22	3.70 21	5.40 18	5.90 17	17.20 20	26.30 14	79.70 14
1971	0.00 16	0.07 16	0.04 14	0.28 16	0.80 13	2.90 15	4.00 15	4.10 10	5.60 5	75.40 11
1972	0.14 17	0.26 17	0.60 14	0.73 14	2.20 14	4.50 20	9.90 20	14.60 17	20.40 16	53.00 4
1973	0.00 15	0.00 14	0.00 11	3.00 8	5.00 8	0.32 7	1.10 8	2.60 7	25.80 17	185.00 17

CLIFFY CREEK AT HARTSVILLE, IND. (Continued)

HIGHEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING SEPTEMBER 30

	1	3	7	15	30	60	90	120	183	ANNUAL
48	6180.0 2	3540.0 1	1630.0 2	971.0 2	902.0 1	591.0 2	519.0 2	419.0 2	320.0 2	188.0 2
49	5620.0 3	3040.0 2	1410.0 1	1370.0 1	885.0 2	728.0 1	535.0 1	473.0 1	344.0 1	197.0 1
50										
151	2710.0 11	1290.0 14	954.0 10	586.0 10	470.0 9	354.0 7	302.0 5	299.0 4	267.0 3	158.0 3
152	3510.0 9	2480.0 6	1290.0 6	819.0 4	528.0 4	432.0 3	349.0 4	327.0 3	249.0 4	136.0 4
153	915.0 23	639.0 24	460.0 23	330.0 23	221.0 23	180.0 22	156.0 20	129.0 21	122.0 20	64.3 22
154	138.0 25	93.3 25	54.9 25	50.2 25	41.1 25	31.1 25	26.8 25	23.6 25	17.9 25	9.0 25
155	1070.0 22	675.0 22	531.0 22	382.0 21	277.0 21	255.0 20	156.0 21	132.0 20	112.0 21	65.0 20
156										
157	2360.0 15	1370.0 12	885.0 18	382.0 22	301.0 18	234.0 17	217.0 14	198.0 13	186.0 10	115.0 8
158	3370.0 10	1720.0 9	995.0 9	544.0 11	320.0 15	292.0 10	230.0 11	213.0 9	178.0 7	96.2 11
159	2410.0 13	1350.0 13	862.0 11	504.0 13	344.0 14	271.0 12	232.0 10	211.0 10	185.0 11	122.0 6
160	6180.0 1	2910.0 4	1340.0 4	703.0 8	559.0 3	365.0 5	274.0 8	223.0 7	169.0 9	90.5 12
161	2030.0 17	1250.0 16	600.0 21	404.0 19	228.0 22	140.0 23	104.0 23	100.0 24	99.0 22	64.4 21
162										
163	4290.0 7	2320.0 8	1190.0 7	731.0 6	524.0 5	363.0 6	363.0 3	286.0 5	196.0 5	101.0 9
164	1830.0 20	1240.0 17	680.0 19	450.0 16	377.0 11	280.0 15	229.0 12	192.0 15	139.0 16	79.8 14
165	4290.0 6	2570.0 5	1180.0 8	705.0 7	494.0 7	300.0 9	217.0 15	173.0 18	124.0 19	67.2 19
166	4760.0 4	2970.0 3	1480.0 3	636.0 3	524.0 6	418.0 4	288.0 6	220.0 8	147.0 14	74.1 18
167	2360.0 14	1260.0 15	728.0 16	403.0 20	316.0 16	245.0 16	244.0 9	201.0 11	139.0 17	75.6 17
168										
169	882.0 24	657.0 23	414.0 24	254.0 24	171.0 24	116.0 24	103.0 24	101.0 23	86.6 24	49.2 24
170	1920.0 19	1140.0 18	735.0 15	459.0 15	298.0 19	219.0 18	206.0 18	179.0 16	165.0 12	89.7 13
171	4450.0 5	2350.0 7	1320.0 5	744.0 5	471.0 8	302.0 8	285.0 7	231.0 6	187.0 6	126.0 5
172	2490.0 12	1510.0 11	793.0 12	403.0 9	300.0 10	242.0 14	217.0 16	173.0 17	157.0 13	100.0 10
173	3670.0 8	1520.0 10	773.0 13	422.0 18	358.0 13	286.0 13	217.0 17	193.0 14	144.0 15	76.1 16
174										
175	1970.0 18	947.0 21	745.0 14	443.0 17	304.0 17	198.0 21	145.0 22	117.0 22	89.6 23	50.9 23
176	2170.0 16	1110.0 19	638.0 20	440.0 14	248.0 20	213.0 19	170.0 19	152.0 19	137.0 18	77.7 15
177	1620.0 21	1100.0 20	714.0 17	521.0 12	370.0 12	289.0 11	226.0 13	198.0 12	174.0 8	119.0 7

STATISTICS ON NORMAL MONTHLY MEANSTALL DAYS

DEC	NOV	OCT	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY PCO-SUMMEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW											
0.1033E+02	0.1285E+02	0.1060E+02	0.1090E+02	0.1170E+02	0.1888E+02	0.1526E+02	0.1154E+02	0.8723E+02	0.8010E+02	0.1725E+02	0.1257E+02
0.2815E+03	0.4000E+03	0.1160E+03	0.3381E+03	0.1935E+03	0.1670E+03	0.1143E+03	0.1357E+03	0.3448E+03	0.3642E+03	0.1180E+03	0.5568E+03
0.1678E+02	0.2015E+02	0.1030E+02	0.1244E+02	0.1129E+02	0.1049E+02	0.1161E+02	0.5872E+02	0.8035E+02	0.3436E+02	0.1467E+02	0.1467E+02
0.1402E+01	0.1713E+01	0.1735E+01	0.1100E+01	0.1111E+01	0.9476E+01	0.8578E+01	0.1282E+01	0.9650E+01	0.7798E+01	0.3098E+01	0.1364E+01
0.1847E+01	0.1574E+01	0.1482E+01	0.1223E+01	0.1733E+01	0.1089E+01	0.7007E+01	0.4752E+01	0.4734E+01	0.1004E+01	0.1992E+01	0.1947E+01
0.0985E+00	0.1404E+00	0.1762E+00	0.1044E+00	0.1482E+00	0.1643E+00	0.1128E+00	0.1037E+00	0.3850E+00	0.5230E+00	0.1901E+00	0.1094E+00

STATISTICS ON NORMAL ANNUAL MEANSTALL DAYS

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.1545E+02	0.1806E+04	0.1345E+02	0.8853E+00	0.4453E+00	0.0203E+00

STATISTICS ON LOG MONTHLY MEANSTALL DAYS

DEC	NOV	OCT	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY LOG-SUMMEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW											
0.5474E+00	0.1204E+01	0.1830E+01	0.0004E+01	0.2010E+01	0.2161E+01	0.2088E+01	0.1900E+01	0.1824E+01	0.1453E+01	0.7608E+00	0.5497E+00
0.4843E+00	0.3730E+00	0.6757E+00	0.4555E+00	0.1911E+00	0.1422E+00	0.1160E+00	0.1893E+00	0.2278E+00	0.3937E+00	0.4303E+00	0.5148E+00
0.6815E+00	0.7570E+00	0.4240E+00	0.5058E+00	0.4470E+00	0.3510E+00	0.3407E+00	0.4155E+00	0.4772E+00	0.6275E+00	0.6560E+00	0.7203E+00
0.6277E+00	0.6711E+00	0.1121E+01	0.7816E+00	0.1912E+01	0.6263E+00	0.1891E+00	0.2145E+00	0.4598E+00	0.4003E+00	0.3645E+00	0.2414E+00
0.1445E+01	0.1824E+01	0.3055E+01	0.1221E+01	0.1004E+01	0.1843E+01	0.1844E+01	0.2286E+01	0.2939E+01	0.4319E+01	0.6822E+01	0.1224E+01
0.3045E+01	0.1454E+01	0.1688E+01	0.1110E+01	0.1180E+01	0.1242E+01	0.1150E+01	0.1637E+01	0.9033E+01	0.8082E+01	0.4232E+01	0.3236E+01

STATISTICS ON LOG ANNUAL MEANSTALL DAYS

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.1920E+01	0.4066E+01	0.4574E+00	-0.2163E+01	0.1335E+01	0.3340E+00

ANNUAL PEAKS

1948	3710	1941	4120
1949	4510	1947	3040
1950	4520	1943	7340
1951	3410	1946	4620
1952	4240	1948	3140
1953	1270	1944	1640
1954	4140	1947	7140
1955	1740	1948	8840
1956	5400	1949	3070
1957	4770	1970	6640
1958	2770	1971	2010
1959	1120	1972	3640
1960	3430	1973	2370

NABASH RIVER BASIN

03363500 Flatrock River at St. Paul, Ind.

LOCATION.--Lat 39°25'03", long 85°38'03", in SENNEB sec. 9, T.11 N., R. 8 E., Shelby County, on right bank 100 ft (152 m) downstream from highway bridge, 0.8 mile (1.3 km) southwest of St. Paul, and 1.5 miles (2.4 km) downstream from Mill Creek.

DRAINAGE AREA.--303 mi² (785 km²).

REMARKS.--Slight diversion occasionally by quarry above gage.

DURATION TABLE OF DAILY DISCHARGE FOR YEAR ENDING SEPTEMBER 30

CLASS	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
YEAR	NUMBER OF DAYS IN CLASS																																		CFS-DAYS					
1931		3	1	2	2	3	5	5	2	10	12	10	45	60	55	40	24	25	19	11	10	6	4	7	1	2									27212.0					
1932									5	4	9	10	16	36	28	29	15	24	21	36	28	19	29	16	15	11	6	4	3	2					102072.3					
1933											3	11	10	9	20	22	13	8	9	8	23	36	45	31	41	32	15	9	7	5	3	3	2		187943.1					
1934		2	5	7	9	14	14	14	9	8	16	6	17	49	64	23	18	23	26	15	5	6	3	5	2	2	3							39320.4						
1935									4	10	15	35	21	71	24	24	27	34	15	24	15	15	10	7	5	4	2	3							47859.7					
1936			3	4	6	8	7	13	13	9	16	11	25	16	18	11	25	14	35	29	27	26	24	6	8	2	6	1	3					91605.6						
1937													14	11	27	12	17	28	18	57	40	30	30	26	11	8	8	5	6	3	2	1	3		208148.0					
1938												2	10	14	13	6	13	32	41	36	27	21	28	38	28	16	8	13	3	9	4	3		210590.0						
1939										1	10	7	5	29	20	13	18	25	28	17	21	27	39	33	22	12	16	9	7	3	1	1	1		130567.1					
1940			1	2	2	2	9	19	20	22	15	39	48	16	9	18	17	25	25	15	15	12	12	7	6	4	3	1	1	1	1	1	1		71142.5					
1941		2	5	7	9	7	29	10	14	8	11	21	27	39	71	67	8	12	6	4	2	2	1	1	2										14405.2					
1942			1	1	1							2	8	13	25	21	31	46	47	44	27	31	17	13	10	9	5	8	4	1					104511.6					
1943												1	12	39	27	10	10	13	21	32	47	46	28	23	19	13	7	2	3	2	1	1	1	1		118194.0				
1944												8	24	22	36	51	55	39	5	9	7	6	13	15	19	21	14	8	5	1	3	2	1	2		75401.5				
1945												12	19	11	49	48	9	16	13	10	18	9	14	22	24	18	20	14	9	8	4	10	1	3		122800.5				
1946													8	17	6	9	7	10	10	35	36	41	36	34	26	33	23	12	8	4	1				113735.2					
1947													15	2	3	23	19	7	11	14	44	21	35	21	25	31	28	24	17	5	5	9	2	2	2	160618.8				
1948													2	19	10	13	21	34	53	35	43	8	16	20	21	15	17	11	6	5	9	4	2	2		105678.2				
1949													9	9	5	25	22	16	25	18	31	13	16	21	39	22	30	26	14	7	6	4	4	2	1	1	188745.6			
1950														5	12	38	30	31	16	20	35	40	30	37	17	14	7	11	6	5	5	2	2	2		234456.0				
1951													13	22	10	4	6	10	21	28	14	16	48	41	21	30	22	19	16	8	9	3	3	1		187283.0				
1952													2	6	13	34	20	22	19	12	14	12	19	18	13	16	31	20	37	20	13	13	4	1	3	2	1	1	148880.6	
1953													15	4	3	16	20	17	17	8	19	15	17	20	17	19	26	46	26	19	19	9	6	4	3	72542.4				
1954													3	18	24	8	15	35	23	46	20	16	24	9	30	32	10	10	14	11	8	6	1	1	1	27658.2				
1955													1	6	14	8	3	3	19	25	23	21	12	6	12	38	19	27	27	33	26	16	11	9	3	71576.3				
1956													12	9	11	10	12	6	5	19	50	39	40	19	31	30	24	18	12	8	3	4	2	1	1	132906.6				
1957													1	3	3	12	17	14	25	21	9	28	17	19	37	36	28	19	27	15	8	6	3	5	3	1	105648.8			
1958														9	6	1	9	11	10	15	29	59	43	42	30	31	19	17	11	12	5	4	1	1	1	175404.0				
1959													1	6	7	15	16	14	9	15	12	45	18	38	30	40	32	34	14	8	2	2	3	2	1	1	126302.3			
1960														1	15	12	17	24	23	44	51	36	41	31	12	14	11	4	3	3	1	1	1	1		81218.0				
1961														13	18	20	48	39	29	28	24	13	17	14	16	19	11	11	12	16	7	4	4	1	2	1	139291.0			
1962															4	31	31	28	32	25	28	18	26	40	28	28	16	10	3	7	8	1	1		93748.0					
1963															1	5	4	4	5	1	10	2	18	62	82	29	17	11	13	21	20	14	14	11	7	2	6	2	1	78827.1
1964																																					90903.8			
1965																																					89310.3			
1966																																					51769.1			
1967																																					125705.1			
1968																																					146485.6			
1969																																					155088.0			
1970																																					91574.0			
1971																																					88554.0			
1972																																					89267.2			
1973																																					178389.0			

CLASS	CFS	TOTAL	ACCU	PERCT	CLASS	CFS	TOTAL	ACCU	PERCT	CLASS	CFS	TOTAL	ACCU	PERCT	CLASS	CFS	TOTAL	ACCU	PERCT
0	0.00	0	15706	100.0	9	6.80	330	15147	96.4	18	110.0	896	7956	50.7	27	1600	215	509	3.2
1	0.50	5	15706	100.0	10	9.30	459	14817	94.3	19	140.0	1180	7040	45.0	28	2200	119	294	1.8
2	0.80	20	15701	100.0	11	13.00	592	14358	91.4	20	190.0	1213	5880	37.4	29	3000	78	175	1.1
3	1.10	28	15681	99.8	12	17.00	828	13766	87.6	21	260.0	1123	4467	29.7	30	4100	50	97	.6
4	1.50	43	15653	99.7	13	23.00	1019	12438	82.4	22	360.0	935	3544	22.6	31	5500	24	47	.2
5	2.00	79	15610	99.4	14	31.00	1004	11919	75.9	23	480.0	858	2689	16.6	32	7500	13	23	.1
6	2.70	101	15531	98.9	15	42.00	910	10915	69.5	24	660.0	574	1751	11.1	33	10000	9	10	
7	3.70	93	15430	98.2	16	58.00	846	10005	63.7	25	890.0	383	1177	7.5	34	14000	1	1	
8	5.00	190	15337	97.7	17	78.00	1203	9159	58.3	26	1200.0	285	794	5.1					

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNU
 

FLATROCK RIVER AT ST. PAUL, IND. (Continued)

LOWEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MARCH 31

YEAR	1	3	7	14	30	60	90	120	183	ANNUAL
1951	23.00 39	23.30 37	27.70 39	34.30 40	41.40 40	65.40 39	132.00 41	140.00 39	194.00 38	538.00 38
1952	11.00 25	11.00 24	11.40 24	12.00 23	12.60 19	13.90 16	16.90 15	28.90 18	104.00 27	458.00 35
1953	4.60 14	5.00 14	6.40 15	7.80 15	8.20 13	10.60 12	11.30 8	12.30 8	29.60 7	187.00 9
1954	2.00 9	2.10 9	2.20 9	2.20 6	2.40 3	3.20 1	4.70 1	7.30 2	13.90 3	109.00 2
1955	1.80 8	1.80 8	2.10 7	2.40 7	2.90 4	7.10 7	7.90 5	9.80 4	14.40 4	175.00 5
1956	1.40 7	1.50 6	1.80 6	2.10 5	4.50 8	18.60 20	63.60 34	94.50 35	137.00 33	315.00 25
1957	3.50 10	3.80 10	5.60 13	6.70 14	7.70 12	9.80 11	11.50 9	15.50 9	37.20 11	184.00 8
1958	14.00 31	15.00 31	15.70 31	16.50 28	22.40 31	31.40 29	38.30 26	56.50 27	206.00 39	392.00 28
1959	87.00 42	88.30 42	76.10 42	77.40 42	96.60 42	134.00 42	176.00 42	195.00 42	323.00 42	581.00 42
1960	6.30 17	6.90 17	8.30 20	4.60 20	13.40 22	18.40 19	24.50 20	33.10 19	50.20 18	199.00 11
1961	11.00 26	11.00 25	11.30 23	12.00 24	13.00 21	15.40 18	18.60 17	21.90 14	33.80 9	275.00 21
1962	17.00 36	17.70 35	19.30 34	20.60 33	26.70 33	32.20 30	37.30 25	46.70 25	80.10 23	413.00 31
1963	16.00 34	16.00 33	17.30 32	18.60 31	24.30 32	27.80 25	30.20 22	35.40 20	44.70 13	203.00 13
1964	0.80 3	0.80 3	0.80 1	0.87 1	1.30 1	3.40 2	5.90 2	6.90 1	18.80 6	154.00 4
1965	3.80 11	4.30 12	4.50 10	5.40 11	6.70 10	7.10 8	9.00 7	11.70 7	35.20 10	295.00 24
1966	12.00 27	13.30 27	15.30 29	16.20 27	16.90 26	36.50 34	40.60 27	56.90 28	67.50 21	214.00 14
1967	4.10 13	4.30 13	4.80 11	6.20 12	10.00 16	13.20 14	18.50 16	19.60 12	49.50 16	265.00 26
1968	4.00 12	4.20 11	4.80 12	5.20 10	5.60 9	7.90 9	11.80 10	17.60 10	39.10 12	274.00 19
1969	23.00 37	24.00 39	24.30 37	26.20 36	28.20 35	35.30 31	46.50 30	136.00 38	233.00 41	464.00 36
1970	47.00 41	47.70 41	49.90 41	57.60 41	71.60 41	78.20 40	92.20 39	159.00 40	168.00 37	353.00 27
1971	13.00 28	14.00 30	15.60 30	21.90 35	29.20 37	36.10 33	40.80 28	44.30 24	61.70 20	281.00 22
1972	13.00 29	13.70 28	15.10 27	17.20 29	19.80 28	28.60 27	32.40 24	35.70 21	81.60 25	182.00 6
1973	8.90 22	9.20 22	10.20 22	10.90 21	12.30 18	19.60 21	29.20 21	38.30 23	131.00 31	437.00 34

HIGHEST MEAN DISCHARGE, IN CFS, AND RANKING, FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING SEPTEMBER 30

YEAR	1	3	7	15	30	60	90	120	183	ANNUAL
1931	1160.0 42	1000.0 42	678.0 41	514.0 41	347.0 42	258.0 42	198.0 42	160.0 42	117.0 42	74.6 42
1932	3880.0 29	2230.0 32	1840.0 30	1550.0 26	1110.0 24	880.0 21	781.0 25	579.0 26	434.0 29	279.0 24
1933	9620.0 8	5350.0 16	3070.0 15	1840.0 19	1210.0 20	1110.0 12	943.0 10	865.0 9	831.0 6	515.0 5
1934	1860.0 38	1520.0 38	1020.0 40	584.0 40	407.0 41	291.0 41	223.0 41	255.0 40	193.0 40	108.0 40
1935	1770.0 39	1440.0 39	1200.0 37	950.0 37	611.0 37	409.0 38	372.0 38	308.0 38	238.0 38	131.0 39
1936	3440.0 31	2880.0 29	1860.0 28	1320.0 29	877.0 30	863.0 22	693.0 27	588.0 24	451.0 26	250.0 27
1937	13400.0 3	9470.0 2	6490.0 1	5350.0 1	3530.0 1	2120.0 1	1500.0 2	1290.0 2	973.0 2	570.0 3
1938	6540.0 19	5370.0 14	3510.0 11	2250.0 9	1940.0 4	1480.0 4	1130.0 5	1060.0 4	872.0 5	577.0 2
1939	8020.0 9	5370.0 15	3240.0 12	2550.0 12	1260.0 17	1060.0 13	952.0 9	789.0 12	621.0 13	358.0 15
1940	6900.0 17	5010.0 17	2980.0 17	1650.0 24	959.0 28	598.0 34	585.0 33	550.0 32	372.0 34	194.0 37
1941	888.0 43	537.0 43	326.0 43	200.0 43	156.0 43	103.0 43	84.3 43	74.6 43	65.4 43	40.6 43
1942	3890.0 28	3090.0 27	1860.0 29	1450.0 27	862.0 33	757.0 26	672.0 28	581.0 25	465.0 24	286.0 23
1943	7970.0 11	5550.0 11	4660.0 6	2200.0 10	1220.0 19	805.0 24	713.0 22	627.0 21	533.0 19	324.0 19
1944	7130.0 14	5510.0 12	3620.0 9	1980.0 13	1260.0 18	911.0 20	705.0 24	577.0 27	394.0 33	206.0 34
1945	5450.0 22	4470.0 20	2830.0 20	1690.0 21	1370.0 14	1120.0 10	864.0 14	808.0 11	604.0 14	326.0 18
1946	2390.0 34	1720.0 38	1400.0 33	1050.0 33	739.0 34	655.0 32	648.0 29	554.0 30	471.0 23	312.0 20
1947	6800.0 18	5490.0 13	3110.0 14	1890.0 16	1480.0 11	1330.0 6	1080.0 6	925.0 8	744.0 8	440.0 9
1948	5400.0 23	3700.0 25	2560.0 22	1870.0 17	1570.0 9	1020.0 15	849.0 15	698.0 15	521.0 21	289.0 21
1949	16500.0 1	10400.0 1	5350.0 2	3070.0 3	2590.0 3	1780.0 3	1470.0 3	1240.0 3	938.0 3	517.0 4
1950	12400.0 4	8690.0 3	5040.0 3	4460.0 2	2970.0 2	2340.0 1	1760.0 1	1510.0 1	1110.0 1	642.0 1
1951	7800.0 16	4850.0 18	2890.0 19	2140.0 11	1310.0 15	1120.0 11	1010.0 8	981.0 6	885.0 4	513.0 6
1952	12200.0 5	8100.0 4	3970.0 7	2430.0 5	1520.0 10	1320.0 7	1040.0 7	964.0 7	759.0 7	405.0 11
1953	1490.0 36	1770.0 35	1350.0 36	975.0 36	590.0 38	446.0 36	444.0 36	413.0 35	358.0 35	199.0 35
1954	1390.0 41	1020.0 41	671.0 42	495.0 42	433.0 40	293.0 40	228.0 40	191.0 41	141.0 41	75.6 41
1955	1480.0 40	1220.0 40	1040.0 39	864.0 38	700.0 35	553.0 35	459.0 35	411.0 36	340.0 37	196.0 36
1956	8000.0 10	5880.0 9	3050.0 16	1860.0 18	1120.0 23	735.0 30	623.0 30	577.0 28	539.0 18	363.0 14
1957	4950.0 25	3800.0 24	2280.0 27	1410.0 28	918.0 29	847.0 23	790.0 18	672.0 17	526.0 20	289.0 22
1958	7100.0 15	4260.0 21	2460.0 23	1670.0 22	1150.0 22	1050.0 14	934.0 11	840.0 10	648.0 11	481.0 8
1959	10500.0 7	7210.0 6	3540.0 10	1910.0 15	1710.0 6	1150.0 9	880.0 13	739.0 13	592.0 15	346.0 16
1960	4400.0 26	2680.0 31	1390.0 34	1030.0 34	653.0 36	445.0 37	373.0 37	342.0 37	344.0 36	222.0 32
1961	7850.0 12	5550.0 10	3120.0 13	2300.0 8	1720.0 5	1340.0 5	1270.0 4	1040.0 5	725.0 10	382.0 13
1962	3440.0 32	2760.0 30	1660.0 31	1170.0 32	1030.0 26	739.0 29	698.0 26	601.0 23	456.0 25	257.0 25
1963	13800.0 2	8030.0 5	4100.0 5	2340.0 7	1610.0 7	1000.0 17	738.0 21	574.0 29	401.0 32	219.0 33
1964	7520.0 13	5950.0 8	3760.0 8	2380.0 6	1580.0 8	1250.0 8	888.0 12	680.0 16	482.0 22	246.0 28
1965	4980.0 24	4040.0 23	2310.0 25	1300.0 30	974.0 27	749.0 27	766.0 19	630.0 19	446.0 27	245.0 29
1966	1900.0 37	1610.0 37	1130.0 38	724.0 39	477.0 39	372.0 39	315.0 39	269.0 39	237.0 39	142.0 38
1967	5950.0 20	4590.0 19	2970.0 18	1710.0 20	1090.0 25	742.0 28	706.0 23	628.0 20	623.0 12	344.0 17
1968	12100.0 6	7170.0 7	4410.0 4	2450.0 4	1440.0 12	950.0 18	807.0 16	664.0 18	579.0 16	400.0 12
1969	5660.0 21	4260.0 22	2650.0 21	1950.0 14	1390.0 13	929.0 19	752.0 20	615.0 22	561.0 17	425.0 10
1970	3310.0 33	2180.0 33	1600.0 32	1030.0 35	863.0 32	674.0 31	596.0 31	530.0 31	436.0 28	251.0 26
1971	3770.0 30	3060.0 28	2440.0 24	1610.0 25	1160.0 21	761.0 25	586.0 32	488.0 33	404.0 31	243.0 31
1972	2110.0 35	1790.0 34	1390.0 35	1170.0 31	866.0 31	628.0 33	547.0 34	479.0 34	421.0 30	244.0 30
1973	4200.0 27	3240.0 26	2280.0 26	1650.0 23	1260.0 16	1010.0 16	794.0 17	714.0 14	742.0 9	489.0 7

FLATROCK RIVER AT ST. PAUL, IND. (CONTINUED)

STATISTICS ON NORMAL MONTHLY MEANFALL DAYS

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY ROWS (MEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW)											
0.7792E+02	0.1932E+03	0.3078E+03	0.5383E+03	0.5121E+03	0.5956E+03	0.5670E+03	0.3948E+03	0.2700E+03	0.1748E+03	0.6953E+02	0.6054E+02
0.1721E+01	0.6418E+03	0.5879E+03	0.5648E+06	0.1438E+06	0.1595E+06	0.1365E+06	0.5644E+03	0.5831E+05	0.3593E+05	0.1276E+05	0.4958E+04
0.1312E+03	0.2630E+03	0.3143E+03	0.7515E+03	0.3794E+03	0.3994E+03	0.3695E+03	0.3105E+03	0.2415E+03	0.1896E+03	0.1129E+03	0.7042E+02
0.2911E+01	0.2047E+01	0.1093E+01	0.2629E+01	0.1151E+01	0.8340E+00	0.5740E+00	0.1361E+01	0.1408E+01	0.2058E+01	0.3863E+01	0.1705E+01
0.1883E+01	0.1341E+01	0.1021E+01	0.1396E+01	0.7433E+00	0.6705E+00	0.6517E+00	0.7867E+00	0.8945E+00	0.1084E+01	0.1624E+01	0.1163E+01
0.2073E+01	0.5139E+01	0.8188E+01	0.1432E+02	0.1357E+02	0.1584E+02	0.1508E+02	0.1050E+02	0.7181E+01	0.4450E+01	0.1849E+01	0.1610E+01

STATISTICS ON NORMAL ANNUAL MEANFALL DAYS

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.1123E+03	0.2086E+05	0.1444E+03	0.3073E+00	0.4426E+00	0.3578E+00

STATISTICS ON LOG MONTHLY MEANFALL DAYS

OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT
BY ROWS (MEAN, VARIANCE, STANDARD DEVIATION, SKEWNESS, COEFF. OF VARIATION, PERCENTAGE OF AVERAGE FLOW)											
0.1503E+01	0.1925E+01	0.2194E+01	0.2425E+01	0.2540E+01	0.2659E+01	0.2640E+01	0.2472E+01	0.2258E+01	0.2003E+01	0.1582E+01	0.1477E+01
0.3214E+00	0.3402E+00	0.3334E+00	0.2629E+00	0.2096E+00	0.1250E+00	0.1208E+00	0.1168E+00	0.1700E+00	0.2446E+00	0.1874E+00	0.3049E+00
0.5722E+00	0.5832E+00	0.5775E+00	0.5319E+00	0.5578E+00	0.3536E+00	0.3475E+00	0.3418E+00	0.4123E+00	0.4440E+00	0.4329E+00	0.5522E+00
0.3388E+00	0.2233E+00	0.1433E+00	0.2633E+01	0.1619E+01	0.7366E+00	0.6177E+00	0.1734E+00	0.1994E+00	0.2344E+00	0.7206E+00	0.3157E+01
0.3807E+00	0.3030E+00	0.1832E+00	0.1538E+00	0.1848E+00	0.1330E+00	0.1317E+00	0.1382E+00	0.1825E+00	0.2446E+00	0.2736E+00	0.3738E+00
0.5452E+01	0.7498E+01	0.8545E+01	0.9445E+01	0.9890E+01	0.1035E+02	0.1028E+02	0.9627E+01	0.8795E+01	0.7801E+01	0.4162E+01	0.5753E+01

STATISTICS ON LOG ANNUAL MEANFALL DAYS

MEAN	VARIANCE	STANDARD DEVIATION	SKEWNESS	COEFF. OF VARIATION	SERIAL CORR
0.2436E+01	0.6400E+01	0.2531E+00	-0.1238E+01	0.1039E+00	0.2652E+00

ANNUAL PEAKS

1931	1140
1932	8700
1933	10200
1934	4040
1935	7040
1936	4040
1937	18400
1938	8440
1939	9340
1940	7840
1941	2440
1942	4440
1943	10000
1944	9340
1945	7640
1946	2840
1947	9170
1948	7040
1949	18500
1950	14500
1951	8400
1952	15400
1953	2240
1954	1520
1955	3560
1956	10800
1957	6400
1958	7100
1959	14500
1960	6240
1961	11000
1962	3700
1963	17100
1964	9240
1965	8540
1966	2240
1967	4700
1968	17400
1969	6110
1970	4740
1971	4470
1972	2540
1973	4940

Appendix B.

Low Flow Drainage Characteristics (9).

03363500 Flatrock River at St. Paul, Ind.

LOCATION.--Lat 39°25'03", long 85°38'03", in NE 1/4 sec. 9, T. 11 N., R. 8 E., Shelby County, on right bank 500 ft downstream from highway bridge, 0.8 mile southwest of St. Paul, and 1.5 miles downstream from Mill Creek.

DRAINAGE AREA.--303 sq mi.

DISCHARGE DATA AVAILABLE.--October 1930 to September 1967. Prior to October 1958, published as Flatrock Creek at St. Paul.

SELECTED DISCHARGE CHARACTERISTICS.--

Average discharge: 307 cfs (37 years)
Minimum daily discharge: .6 cfs August 1931
1-day, 30-year low flow: .6 cfs

WATER INTAKES AND SEWER OUTFALLS.--Slight occasional diversion by quarry above gage.

Magnitude and frequency of annual low flow

Magnitude and frequency of summer low flow

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	6.5	2.3	1.3	0.8	0.4
3	6.8	2.5	1.4	.9	.5
7	7.9	2.9	1.7	1.0	.6
14	9.1	3.8	2.3	1.5	1.0
30	12	5.2	3.3	2.2	1.4
60	18	8.1	5.5	3.9	2.7

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	11	4.2	2.3	1.3	0.7
3	12	4.5	2.5	1.5	.8
7	14	5.4	3.0	1.9	1.0
14	17	7.2	4.6	3.2	2.2
30	27	12	8.0	6.0	4.3
60	55	26	16	11	7.0

Duration of daily flow for indicated period

Months	Period	Discharge, in cfs, which was exceeded for indicated percent of time during 1931-67 water years					
		98	95	90	80	70	50
3	Aug.-Oct.	1.7	2.6	5.0	8.9	13	22
6	May-Oct.	2.3	4.5	8.0	15	23	51
3	June-Aug.	3.4	6.7	12	20	29	55
12	Oct.-Sept.	3.7	7.9	13	24	37	105
							136
							370
							330
							690

03364400 Clifty Creek at Sandusky, Ind.

LOCATION.--Lat 39°25'27", long 85°28'48", in NE 1/4 NE 1/4 sec. 11, T. 11 N., R. 9 E., Decatur County, at bridge on State Highway 3, in Sandusky.

DRAINAGE AREA.--46.4 sq mi.

DISCHARGE DATA AVAILABLE.--Low-flow measurements, 1969-70 water years.

SELECTED DISCHARGE CHARACTERISTICS.--Minimum flow observed:

7-day, 2-year low flow: 0.2 cfs
 7-day, 10-year low flow: .2 cfs
 50% daily flow duration: 0 cfs
 90% daily flow duration: 12 cfs
 90% daily flow duration: .5 cfs

0.2 cfs October 1963

03364500 Clifty Creek at Hartsville, Ind.

LOCATION.--Lat 39°16'25", long 85°42'10", in NW 1/4 sec. 36, T. 10 N., R. 7 E., Bartholomew County, at downstream side of left abutment of highway bridge, 0.2 mile north of Hartsville, and 5 miles upstream from Duck Creek.

DRAINAGE AREA.--91.4 sq mi.

DISCHARGE DATA AVAILABLE.--February 1948 to September 1967.

SELECTED DISCHARGE CHARACTERISTICS.--

Average discharge: 96.5 cfs (19 years)

Minimum daily discharge: No flow at times most years

1-day, 30-year low flow: 0 cfs

Magnitude and frequency of annual low flow

Magnitude and frequency of summer low flow

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	0	0	0	0	---
3	0	0	0	0	---
7	.1	0	0	0	---
14	.2	0	0	0	---
30	.7	0	0	0	---
60	2.0	.1	0	0	---

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	0.2	0	0	0	---
3	.3	0	0	0	---
7	.5	0	0	0	---
14	.9	0	0	0	---
30	3.9	1.0	.3	0	---
60	19	5.9	2.5	0	---

Duration of daily flow for indicated period

Months	Period	Discharge, in cfs, which was exceeded for indicated percent of time during 1949-67 water years					
		98	95	90	80	70	10
3	Aug.-Oct.	0	0	0	0	0.4	26
6	May-Oct.	0	0	0	.7	2.2	85
3	June-Aug.	0	0	.3	1.8	3.3	85
12	Oct.-Sept.	0	0	.3	2.3	6.4	212

03364800 Sand Creek near Greensburg, Ind.

LOCATION.--Lat 39°20'55", long 85°26'51", in NE 1/4 sec. 6, T. 10 N., R. 10 E., Decatur County, at county highway bridge, 1.5 miles northeast of Greensburg.

DRAINAGE AREA.--9.16 sq mi.

DISCHARGE DATA AVAILABLE.--Low-flow measurements, 1960-65, 1967 water years.

SELECTED DISCHARGE CHARACTERISTICS.--Minimum flow observed: No flow at times
 7-day, 2-year low flow: 0 cfs
 7-day, 10-year low flow: 0 cfs
 50% daily flow duration: 1.0 cfs
 90% daily flow duration: 0 cfs

03365000 Sand Creek near Breversville, Ind.

LOCATION.--Lat 39°05'03", long 85°39'32", in NW 1/4 sec. 5, T. 7 N., R. 8 E., Jennings County, on left bank at downstream side of county highway bridge, 2.5 miles west of Breversville, 5.7 miles upstream from Hyaloosing Creek, and 16 miles upstream from mouth.

DRAINAGE AREA.--155 sq mi.

DISCHARGE DATA AVAILABLE.--February 1948 to September 1967.

SELECTED DISCHARGE CHARACTERISTICS.-- Average discharge: 165 cfs (19 years)
Minimum daily discharge: No flow at times most years
1-day, 30-year low flow: 0 cfs

Magnitude and frequency of annual low flow Magnitude and frequency of summer low flow

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	0.9	0	0	0	---
3	.9	0	0	0	---
7	1.1	0	0	0	---
14	1.4	.1	0	0	---
30	3.0	.6	0	0	---
60	5.7	1.2	0	0	---

Period (Consecutive days)	Discharge, in cfs, for indicated recurrence interval, in years				
	2	5	10	20	50
1	2.0	0.4	0	0	---
3	2.1	.5	.1	0	---
7	2.7	.9	.2	0	---
14	4.4	1.0	.3	0	---
30	9.0	3.2	1.8	.7	---
60	30	8.0	3.6	1.8	---

Duration of daily flow for indicated period

Months	period	Discharge, in cfs, which was exceeded for indicated percent of time during 1949-67 water years							
		98	95	90	80	70	50	20	10
3	Aug.-Oct.	0	0	0.1	1.0	2.1	5.5	23	47
6	May-Oct.	0	.1	.8	2.9	5.3	15	65	140
3	June-Aug.	.1	1.0	2.0	4.5	7.1	15	57	132
12	Oct.-Sept.	0	.5	2.0	5.6	13	35	157	340

Appendix C.

Engineering Soil Properties of Decatur County Soils (2).

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C-1. Engineering Soil Properties of Decatur County Soils. (2).

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		#	10	40	200		
	ft				Fcl					Fcl	
AvA, AvB----- Avenburg	0-13	Silt loam-----	CL, ML, CL-ML	A-4	0	100	100	95-100	75-95	20-30	2-10
	13-27	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	75-95	30-45	10-20
	27-76	Silty clay loam, silt loam.	CL	A-6, A-7	0-3	95-100	95-100	90-100	70-95	30-45	10-20
	76-80	Clay loam, loam, silt loam.	CL	A-6, A-7	0-3	95-100	90-100	75-95	60-85	30-45	10-20
Cg----- Chapin	0-8	Loam-----	ML, CL, CL-ML	A-4	0	95-100	85-100	80-100	70-90	20-35	2-10
	8-60	Silt loam, loam, sandy loam.	ML, SM A-6	A-4, A-2, A-6	0	90-100	75-100	55-90	30-80	20-40	NP-14
Ch----- Chapin Variant	0-7	Silt loam-----	CL, CL-ML	A-4	0	95-100	90-100	80-100	60-90	20-30	5-10
	7-25	Silt loam, loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	60-90	20-30	7-12
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CkS2, CkC2----- Cincinnati	0-8	Silt loam-----	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	8-26	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	26-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	6-20
	60-80	Clay loam, loam.	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-95	25-40	5-20
CkC3----- Cincinnati	0-4	Silt loam-----	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-40	3-16
	4-16	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-100	26-40	8-15
	16-60	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-85	25-40	6-20
	60-80	Clay loam, loam	CL, ML, CL-ML	A-6, A-4	0	95-100	85-100	75-95	65-95	25-40	5-20
Cn----- Clermont	0-19	Silt loam-----	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	85-95	75-90	22-40	3-18
	19-43	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	90-100	85-95	30-45	12-25
	43-80	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	85-100	75-95	65-90	32-48	12-28
CnS4----- Corydon	0-3	Silt loam-----	CL, CL-ML	A-4, A-6	0-5	80-95	80-95	75-90	55-85	16-24	5-15
	3-15	Silt loam, loam	CL, ML-CL	A-6, A-4	0-5	80-95	80-95	75-90	55-85	16-28	5-15
	15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CrA----- Crosby	0-10	Silt loam-----	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	22-34	6-15
	10-27	Clay loam, silty clay loam.	CL, CH	A-6, A-7	0-3	92-99	89-97	78-93	64-76	37-55	17-31
	27-60	Loam, clay loam, sandy loam.	CL, ML, CL-ML	A-4, A-6	0-3	88-94	83-89	74-87	50-64	17-30	2-14
Cy----- Cyclone	0-16	Silt loam-----	CL, CL-ML	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	16-46	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	15-30
	46-60	Loam, silt loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-95	50-80	25-40	4-15
	60-65	Loam, clay loam, sandy loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	50-75	20-30	6-15

See footnote at end of table.

C-1. (continued) (2).

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		#	10	40	200		
	In				Pct					Pct	
PeA, PeB Pincastle	0-10	Silt loam	CL, ML	A-4, A-6	0	100	100	90-100	75-93	27-36	4-12
	10-27	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-95	38-54	20-32
	27-54	Clay loam, loam	CH, CL	A-7	0	95-100	90-98	85-95	75-85	45-58	30-38
	54-60	Loam, fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0-3	88-96	82-90	70-86	50-66	20-35	3-12
PeA, PeB Fox	0-10	Loam	ML, CL, CL-ML	A-4	0	95-100	85-100	75-95	55-90	20-30	3-10
	10-30	Clay loam, loam, sandy clay loam.	CL, SC	A-2, A-6, A-7	0-5	85-100	70-95	50-95	20-65	25-45	10-25
	30-60	Stratified sand to gravel.	SP, SM, GP, GM	A-1, A-2, A-3	0-10	40-100	35-100	15-95	2-20	---	NP
GrD Grayford	0-7	Silt loam	CL-ML, CL	A-4	0	100	100	90-100	70-90	18-30	4-10
	7-40	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0-5	95-100	85-100	75-100	60-95	25-40	8-15
	40-48	Clay, silty clay, clay loam.	CH	A-7	0-10	95-100	65-95	60-90	50-85	45-55	15-25
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GrC2* Grayford	0-7	Silt loam	CL-ML, CL	A-4	0	100	100	90-100	70-90	18-30	4-10
	7-36	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0-5	95-100	85-100	75-100	60-95	25-40	8-15
	36-42	Clay, silty clay, clay loam.	CH	A-7	0-10	95-100	65-95	60-90	50-85	45-55	15-25
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ryker	0-7	Silt loam	CL-ML, CL	A-4, A-6	0	100	100	90-100	80-95	25-35	5-15
	7-30	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	75-95	30-45	15-25
	30-59	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	85-98	80-98	75-95	60-85	30-45	15-25
	59-80	Loam, silty clay, clay, clay loam.	CL, CH	A-7	0	80-95	75-95	75-95	60-85	40-60	20-30
HeJ Hennepin	0-3	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-100	60-95	25-40	5-20
	3-17	Loam	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
	17-60	Loam, sandy loam	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
Hx2, Hx2, HxP Hickory	0-5	Loam	CL	A-6, A-4	0-5	95-100	90-100	90-100	85-95	20-35	8-15
	5-52	Clay loam, silt loam, silty clay loam.	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	52-60	Clay loam, loam	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
H1D3 Hickory	0-4	Clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-95	75-90	30-50	15-30
	4-48	Clay loam	CL	A-6, A-7	0-5	100	90-100	80-95	75-90	30-50	15-30
	48-60	Clay loam, loam.	CL-ML, CL	A-4, A-6	0-5	85-100	85-95	80-95	60-80	20-40	5-20
Lb Lobdell	0-8	Silt loam	ML, CL-ML, CL	A-4	0	95-100	90-100	80-100	65-90	20-30	NP-8
	8-60	Loam, silt loam, fine sandy loam.	ML	A-4	0	90-100	80-100	70-95	55-85	20-35	NP-10
MeA, MeB2 Martinsville	0-7	Loam	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-90	22-33	4-12
	7-44	Clay loam, silty clay loam, sandy clay loam, sandy loam.	CL, SC	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-20
	44-70	Sandy loam, sandy clay loam.	SM, ML	A-2-4, A-4	0	100	90-100	60-80	30-60	30-40	2-8
	70-75	Stratified sand to silt loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9

See footnote at end of table.

C-1. (continued) (2).

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		#	10	40	200		
	in				Pct					Pct	
McB2, McC2, McD2- Miami	0-7	Silt loam-----	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	7-30	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	30-60	Loam, sandy loam	CL, CL-ML, ML, SC	A-4, A-6	0-3	85-95	90-100	70-90	45-70	20-30	5-11
McC3, McD3----- Miami	0-6	Clay loam-----	CL	A-6	0	100	90-100	75-95	65-95	30-40	15-20
	6-26	Clay loam-----	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	26-60	Loam, clay loam, sandy loam.	CL, CL-ML, ML, SC	A-4, A-6	0-3	85-95	90-100	70-90	45-70	20-30	5-11
Mr----- Milford	0-14	Silty clay-----	CL, CH	A-7	0	100	95-100	90-100	80-95	40-60	20-35
	14-47	Silty clay, silty clay loam.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-40
	47-60	Stratified silty clay to loam.	CL	A-6, A-7	0	97-100	95-100	90-100	70-100	30-50	15-30
Ms----- Millsdale	0-9	Silty clay loam	CL	A-6, A-7	0	90-100	80-100	75-100	60-95	32-50	12-25
	9-36	Clay, silty clay loam, clay loam.	CH, CL	A-7	0-5	85-100	80-100	75-100	60-95	40-60	20-35
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MtA, MtB2----- Milton	0-11	Silt loam-----	ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-95	26-36	4-12
	11-24	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0	95-100	80-100	75-100	70-95	32-48	12-28
	24-34	Clay, silty clay loam, silty clay	CH, CL	A-7, A-6	0-5	95-100	80-100	70-95	50-90	32-55	14-33
	34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
My----- Montgomery	0-14	Silty clay-----	CL	A-7	0	100	100	100	85-98	40-50	20-28
	14-38	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	90-98	55-65	34-42
	38-43	Silt loam, clay loam.	CL, SC	A-6	0-5	65-100	60-90	55-80	45-70	30-40	18-28
	43-60	Gravelly sandy loam, gravelly loam.	CL, SC, SC	A-2, A-4, A-6, A-7	0-10	55-85	50-80	40-75	25-55	30-45	8-20
OcA, OcB----- Oakley	0-14	Silt loam-----	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	14-26	Silt loam, loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	75-100	65-90	50-90	35-50	15-30
	26-45	Gravelly clay loam, gravelly loam, gravelly sandy clay loam.	CL, SC, OC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	45-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
Or----- Orrville	0-10	Silt loam-----	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	22-35	4-10
	10-40	Silt loam, loam, fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0-2	95-100	75-100	70-95	45-90	20-40	2-16
	40-60	Silt loam, loam, fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0-2	95-100	75-100	70-95	45-90	20-40	2-16

See footnote at end of table.

C-1. (continued) (2).

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RoD----- Rodman	0-8	Gravelly sandy loam.	SM-SC, SM	A-1, A-2, A-4	0-2	70-85	65-85	40-60	20-40	<25	NP-5
	8-13	Gravelly loam, sandy loam, loam.	ML, CL-ML, SM-SC, SM	A-4, A-2, A-1	0-2	70-85	60-85	40-75	20-55	<25	NP-5
	13-60	Stratified sand to gravelly sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	22-55	7-20	2-10	---	NP
RsB2----- Rossmoyne	0-7	Silt loam	ML	A-4	0	90-100	90-100	90-100	85-100	30-40	4-10
	7-21	Silty clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	90-100	90-100	85-100	75-95	30-48	8-20
	21-72	Silt loam, loam, silty clay loam.	CL	A-6, A-4	0	90-100	85-95	80-90	70-85	25-40	9-19
	72-80	Clay loam, loam	CL	A-6, A-7, A-4	0	80-95	70-90	65-85	60-80	25-42	8-20
RuB----- Russell	0-12	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-90	20-35	5-15
	12-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	20-35
	30-50	Clay loam, loam	CL	A-6, A-7	0	90-100	90-95	80-90	65-75	35-50	17-31
	50-60	Loam, fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0-3	85-95	80-90	75-85	50-65	<30	2-14
So----- Sloan	0-13	Silt loam, silty clay loam.	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	13-44	Silty clay loam, clay loam, silt loam, loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	44-60	Stratified gravelly sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
Sr----- Starks	0-13	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	22-35	5-15
	13-25	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-100	35-45	15-24
	25-56	Sandy loam, loam, silty clay loam, clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0	95-100	90-100	80-95	40-80	25-40	6-17
	56-80	Stratified loamy sand to silt loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	90-100	80-95	40-90	30-60	<30	NP-15
St----- Stonelick	0-40	Fine sandy loam, loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-2	0	85-100	70-100	45-75	25-55	<24	NP-6
	40-60	Stratified loam to loamy sand.	SM, SP-SM	A-2, A-4, A-3, A-1-b	0	85-100	70-95	40-60	5-40	<15	NP
Ud*: Udorthents.											
Pits.											
WmB----- Williamstown	0-9	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	20-35	4-15
	9-33	Clay loam, silty clay loam.	CL	A-4, A-6	0	100	95-100	85-100	70-95	30-40	10-20
	33-37	Loam, clay loam	CL, CL-ML	A-6, A-4	0	100	95-100	80-95	60-80	20-35	5-15
	37-60	Loam	ML, CL-ML, CL	A-4, A-6	0-2	100	95-100	80-95	55-75	20-35	3-11
XnA, XnB----- Xenia	0-12	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-100	25-35	5-15
	12-29	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	80-95	35-50	15-30
	29-46	Clay loam	CL	A-6, A-7	0-5	92-100	90-95	75-95	65-75	35-50	15-30
	46-60	Loam	CL, ML	A-4, A-6	0-5	85-95	80-90	75-90	40-65	15-30	NP-15

* See description of the map unit for composition and behavior characteristics of the map unit.

C-2. Physical and Chemical Properties of Decatur County Soils (2).

Soil name and map symbol	Depth in	Clay %	Moist bulk density g/cm ³	Permeability in/hr	Available water capacity in/in	Soil reaction pH	Shrink-swell potential	Erosion factors		Wind erodi- bility group	Organic matter %
								K	T		
AvA, AvB----- Austburg	0-13 13-27 27-76 76-80	10-18 22-30 22-30 14-30	1.30-1.45 1.35-1.50 1.40-1.45 1.50-1.70	0.6-2.0 0.6-2.0 <0.06 <0.06	0.20-0.24 0.18-0.20 0.06-0.08 0.06-0.10	4.5-7.3 4.5-5.5 4.5-6.5 4.5-8.4	Low----- Moderate----- Moderate----- Moderate-----	0.43 0.43 0.43 0.43	4	5	.5-2
Cc----- Chagrin	0-8 8-60	10-27 18-30	1.20-1.40 1.20-1.50	0.6-2.0 0.6-2.0	0.20-0.24 0.14-0.20	5.6-7.3 5.6-7.3	Low----- Low-----	0.32 0.32	5	5	2-4
Ch----- Chagrin Variant	0-7 7-25 25	15-22 18-25 ---	1.30-1.45 1.30-1.45 ---	0.6-2.0 0.6-2.0 ---	0.20-0.22 0.17-0.19 ---	6.1-7.3 6.1-7.3 ---	Low----- Low----- ---	0.37 0.37 ---	4	5	1-4
CkS2, CkC2----- Cincinnati	0-8 8-26 26-60 60-80	15-25 22-35 24-43 24-40	1.30-1.50 1.45-1.65 1.60-1.85 1.55-1.75	0.6-2.0 0.6-2.0 0.06-0.6 0.06-0.6	0.22-0.24 0.15-0.19 0.08-0.12 0.08-0.12	4.5-7.3 4.5-5.5 4.5-6.5 4.5-6.5	Low----- Low----- Moderate----- Moderate-----	0.37 0.37 0.37 0.37	4-3	6	1-3
CkC3----- Cincinnati	0-4 4-16 16-60 60-80	15-27 22-35 24-43 24-40	1.30-1.50 1.45-1.65 1.60-1.85 1.55-1.75	0.6-2.0 0.6-2.0 0.06-0.6 0.06-0.6	0.22-0.24 0.15-0.19 0.08-0.12 0.08-0.12	4.5-7.3 4.5-5.5 4.5-6.5 4.5-6.5	Low----- Low----- Moderate----- Moderate-----	0.37 0.37 0.37 0.37	4-3	6	1-3
Cn----- Clement	0-19 19-43 43-80	13-27 25-35 27-40	1.30-1.55 1.45-1.65 1.45-1.70	0.2-0.6 <0.06 <0.06	0.22-0.24 0.18-0.22 0.10-0.18	4.5-7.3 4.5-5.5 5.1-7.3	Low----- Moderate----- Moderate-----	0.37 0.37 0.37	5	6	1-3
CnS* Corydon	0-3 3-15 15	10-18 10-23 ---	1.30-1.45 1.30-1.55 ---	0.6-2.0 0.6-2.0 ---	0.20-0.22 0.11-0.20 ---	5.6-7.8 5.6-7.8 ---	Low----- Moderate----- ---	0.32 0.32 ---	2	6	2-4
Rock outcrop.											
CrA----- Crosby	0-10 10-27 27-60	11-22 27-35 15-32	1.40-1.55 1.50-1.70 1.70-2.00	0.6-2.0 0.06-0.2 0.06-0.6	0.20-0.24 0.15-0.20 0.05-0.19	5.1-6.5 5.1-7.3 7.4-8.4	Low----- Moderate----- Low-----	0.43 0.43 0.43	3	5	1-3
Cy----- Cyclone	0-16 16-46 46-60 60-65	18-27 27-35 15-25 15-25	1.30-1.50 1.40-1.60 1.40-1.60 1.50-1.80	0.6-2.0 0.6-2.0 0.6-2.0 0.2-0.6	0.23-0.25 0.18-0.20 0.15-0.19 0.05-0.19	6.1-7.3 6.1-7.3 6.6-7.8 7.4-8.4	Low----- Moderate----- Low----- Low-----	0.28 0.43 0.43 0.43	5	6	4-6
FcA, FcB----- Fincastle	0-10 10-27 27-54 54-60	11-22 20-35 20-35 13-30	1.40-1.55 1.45-1.65 1.45-1.65 1.55-1.90	0.6-2.0 0.2-0.6 0.2-0.6 0.06-2.0	0.22-0.24 0.18-0.20 0.15-0.19 0.05-0.19	5.1-6.5 5.1-7.3 5.1-7.3 7.4-8.4	Low----- Moderate----- Moderate----- Low-----	0.37 0.37 0.37 0.37	5	5	1-3
FcA, FcB----- Fox	0-10 10-30 30-60	10-17 25-35 0-2	1.35-1.55 1.55-1.65 1.30-2.20	0.6-2.0 0.6-2.0 >6.0	0.20-0.24 0.15-0.19 0.02-0.04	5.1-7.3 5.6-8.4 7.4-8.4	Low----- Moderate----- Low-----	0.32 0.32 0.10	4	5	1-3
GrD----- Grayford	0-7 7-40 40-48 48	12-25 20-35 42-50 ---	1.25-1.40 1.40-1.60 1.40-1.60 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.20-0.24 0.16-0.20 0.09-0.11 ---	5.1-7.3 4.5-5.5 5.1-7.3 ---	Low----- Moderate----- High----- ---	0.37 0.37 0.37 ---	5-4	5	.5-2
GrC2* Grayford	0-7 7-36 36-42 42	12-25 20-35 42-50 ---	1.25-1.40 1.40-1.60 1.40-1.60 ---	0.6-2.0 0.6-2.0 0.6-2.0 ---	0.20-0.24 0.16-0.20 0.09-0.11 ---	5.1-7.3 4.5-5.5 5.1-7.3 ---	Low----- Moderate----- High----- ---	0.37 0.37 0.37 ---	5-4	5	.5-2

See footnote at end of table.

C-2. (continued) (2).

Soil name and map symbol	Depth in	Clay Pct	Moist bulk density g/cm ³	Permeability in/hr	Available water capacity in/in	Soil reaction pH	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter Pct
								K	T		
GrC2*: Ryker	0-7	15-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-7.3	Low-----	0.37	5	5	1-4
	7-30	20-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-7.3	Moderate-----	0.37			
	30-59	20-35	1.45-1.65	0.6-2.0	0.15-0.20	4.5-6.0	Moderate-----	0.37			
	59-80	35-50	1.45-1.65	0.6-2.0	0.09-0.20	4.5-6.0	Moderate-----	0.37			
He3: Hennepin	0-3	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low-----	0.32	4	5	1-2
	3-17	18-30	1.30-1.60	0.2-2.0	0.14-0.22	6.1-7.8	Low-----	0.32			
	17-60	13-23	1.45-1.70	0.06-0.6	0.07-0.11	6.1-8.4	Low-----	0.32			
HKD2, HKE2, HKP: Hickory	0-5	19-27	1.30-1.50	0.6-2.0	0.20-0.22	4.5-6.0	Low-----	0.37	5	6	1-2
	5-52	20-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate-----	0.37			
	52-60	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----	0.37			
HD3: Hickory	0-4	27-35	1.40-1.65	0.6-2.0	0.17-0.19	4.5-6.0	Moderate-----	0.37	4	4	.5-1
	4-48	27-35	1.45-1.65	0.6-2.0	0.15-0.19	4.5-5.5	Moderate-----	0.37			
	48-60	15-32	1.50-1.70	0.6-2.0	0.11-0.19	5.1-8.4	Low-----	0.37			
Lb: Loadell	0-8	15-27	1.20-1.40	0.6-2.0	0.20-0.24	5.1-7.3	Low-----	0.37	5	5	1-3
	8-60	18-30	1.25-1.60	0.6-2.0	0.17-0.22	5.1-7.3	Low-----	0.37			
MeA, MeB2: Martinsville	0-7	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----	0.37	5	5	1-3
	7-44	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Moderate-----	0.37			
	44-70	10-25	1.40-1.60	0.6-2.0	0.12-0.14	5.6-7.3	Low-----	0.24			
	70-75	3-23	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	Low-----	0.24			
MmB2, MmC2, MmD2: Miami	0-7	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----	0.37	5	5	.5-3
	7-30	25-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-7.3	Moderate-----	0.37			
	30-60	15-25	1.55-1.90	0.2-0.6	0.05-0.19	6.6-8.4	Moderate-----	0.37			
MoC3, MoD3: Miami	0-6	27-35	1.35-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37	4	6	.5-3
	6-26	25-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-7.3	Moderate-----	0.37			
	26-60	15-25	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Moderate-----	0.37			
Mr: Milford	0-14	35-42	1.30-1.50	0.6-2.0	0.12-0.23	5.6-7.3	High-----	0.28	5	4	5-6
	14-47	35-42	1.45-1.65	0.2-0.6	0.18-0.20	5.1-7.8	Moderate-----	0.43			
	47-60	20-30	1.50-1.70	0.2-0.6	0.20-0.22	7.4-8.4	Moderate-----	0.43			
Ms: Milldale	0-9	27-32	1.30-1.50	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	4	6	4-7
	9-36	35-45	1.40-1.70	0.2-0.6	0.12-0.16	6.1-8.4	High-----	0.32			
	36	---	---	---	---	---	---	---			
MtA, MtB2: Milton	0-11	14-27	1.30-1.50	0.6-2.0	0.18-0.23	5.1-7.3	Low-----	0.37	4	6	1-3
	11-24	35-50	1.45-1.70	0.2-2.0	0.12-0.18	4.5-7.8	Moderate-----	0.37			
	24-34	25-50	1.40-1.70	0.2-2.0	0.12-0.16	5.1-7.8	Moderate-----	0.37			
	34	---	---	---	---	---	---	---			
My: Montgomery	0-14	35-40	1.35-1.55	0.2-0.6	0.21-0.23	6.1-7.3	High-----	0.28	4	7	5-8
	14-38	40-55	1.45-1.65	0.06-0.2	0.11-0.13	6.6-7.8	High-----	0.28			
	38-43	30-40	1.50-1.70	0.2-2.0	0.09-0.15	7.4-7.8	Moderate-----	0.28			
	43-60	15-25	1.50-1.70	2.0-20	0.05-0.10	7.4-8.4	Low-----	0.28			
OcA, OcB: Ockley	0-14	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----	0.37	5	5	.5-3
	14-26	27-35	1.45-1.60	0.6-2.0	0.15-0.20	4.5-7.3	Moderate-----	0.37			
	26-45	20-35	1.40-1.55	0.6-2.0	0.12-0.14	5.6-6.5	Moderate-----	0.24			
	45-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low-----	0.10			
Or: Orrville	0-10	12-27	1.25-1.45	0.6-2.0	0.18-0.22	5.1-7.3	Low-----	0.37	5	6	2-4
	10-40	12-27	1.30-1.50	0.6-2.0	0.15-0.19	5.1-6.5	Low-----	0.37			
	40-60	12-18	1.30-1.50	0.6-2.0	0.15-0.19	5.6-7.3	Low-----	0.37			
RoG: Rodman	0-8	5-20	1.10-1.40	2.0-6.0	0.09-0.12	6.6-7.8	Low-----	0.15	3	8	---
	8-13	5-25	1.10-1.50	2.0-6.0	0.09-0.12	6.6-7.8	Low-----	0.20			
	13-60	0-10	>1.80	>20	0.02-0.04	7.4-8.4	Low-----	0.10			

See footnote at end of table.

C-2. (continued) (2).

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		Pct
RsB2----- Rossmoyne	0-7	13-27	1.35-1.50	0.6-2.0	10.20-0.24	4.5-7.3	Low-----	0.37	4	6	1-3
	7-21	22-35	1.40-1.60	0.6-2.0	10.14-0.19	4.5-5.5	Moderate-----	0.37			
	21-72	24-35	1.70-1.90	0.06-0.6	10.06-0.10	4.5-5.5	Moderate-----	0.37			
	72-80	18-45	1.60-1.75	0.06-0.6	10.06-0.10	5.6-8.4	Moderate-----	0.37			
RuR----- Russell	0-12	11-25	1.30-1.45	0.6-2.0	10.21-0.24	5.6-7.3	Low-----	0.37	5	5	.5-2
	12-30	25-33	1.40-1.60	0.6-2.0	10.18-0.20	4.5-6.5	Moderate-----	0.37			
	30-50	23-33	1.40-1.60	0.6-2.0	10.15-0.19	5.6-7.3	Moderate-----	0.37			
	50-60	14-30	1.60-1.80	0.6-2.0	10.05-0.19	7.4-8.4	Low-----	0.37			
So----- Sloan	0-13	15-27	1.20-1.40	0.6-2.0	10.20-0.24	6.1-7.8	Low-----	0.37	5	6	3-6
	13-44	15-35	1.25-1.55	0.2-2.0	10.15-0.19	6.1-8.4	Moderate-----	0.37			
	44-60	10-30	1.20-1.50	0.2-2.0	10.13-0.18	6.6-8.4	Low-----	0.37			
Sr----- Starks	0-13	15-27	1.15-1.35	0.6-2.0	10.22-0.24	5.6-7.3	Moderate-----	0.37	5	6	1-3
	13-25	22-35	1.35-1.55	0.2-2.0	10.18-0.20	5.1-6.5	Moderate-----	0.37			
	25-56	20-30	1.45-1.65	0.2-2.0	10.16-0.19	5.1-7.3	Moderate-----	0.37			
	56-80	5-20	1.55-1.75	2.0-6.0	10.08-0.18	5.6-8.4	Low-----	0.37			
St----- Stonelick	0-40	8-18	1.25-1.50	2.0-6.0	10.09-0.14	7.4-8.4	Low-----	0.24	5	3	.5-2
	40-60	5-18	1.20-1.55	2.0-6.0	10.05-0.11	7.4-8.4	Low-----	0.24			
Ud*: Udorthents.											
Pits.											
WnR----- Williamstown	0-9	14-26	1.30-1.45	0.6-2.0	10.22-0.24	5.6-7.3	Low-----	0.37	5	5	1-3
	9-33	27-35	1.35-1.50	0.6-2.0	10.15-0.21	5.6-7.3	Moderate-----	0.37			
	33-37	18-27	1.25-1.50	0.6-2.0	10.15-0.19	6.1-7.8	Low-----	0.37			
	37-60	16-26	1.45-1.70	0.2-0.6	10.05-0.19	7.4-8.4	Low-----	0.37			
XnA, XnP----- Xenia	0-12	11-22	1.40-1.55	0.6-2.0	10.22-0.24	6.6-7.3	Low-----	0.37	5	5	1-3
	12-29	25-35	1.45-1.65	0.2-0.6	10.18-0.20	5.1-6.0	Moderate-----	0.37			
	29-46	27-35	1.45-1.65	0.2-0.6	10.15-0.19	5.1-7.3	Moderate-----	0.37			
	46-60	13-27	1.55-1.90	0.2-2.0	10.05-0.19	7.3-8.4	Low-----	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

Appendix D

Borehole Data.

Appendix D-1 Borehole Data For U.S. 421 over Gas Creek in Decatur County (33)

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	Grain Size Distribution					Notes
							Texture	AASHTO		Recovery RQD	Gravel	Sand	Silt Clay	LL	
1	1	U.S. 421	99 + 55	30 L	925.8	0.0 - 14.0	Medium stiff silty loam with sand and gravel	-	10, 9, 4, 7	-	-	-	-	-	Moisture $\pm$ 9.9
1	2	"	"	"	"	14.0 - 17.3	Medium stiff sandy clay loam	-	12	-	-	-	-	-	Moisture $\pm$ 12.4
1	3	"	"	"	"	> 17.3	Medium hard grey limestone with chert	-	-	17%	-	-	-	-	B.T.H. 22.3 ft.
2	1	"	100 + 24	25 R	"	0.0 - 4.0	Loose sandy gravel	-	3.2	-	-	-	-	-	-
2	2	"	"	"	"	4.0 - 14.5	Soft moist brown loam	A-4(2)	2,2,1	-	15.7	24.4	45.1	14.8	26 18 8 Moisture $\pm$ 18.2
2	3	"	"	"	"	14.5 - 18.2	Medium dense sandy gravel with limestone fragments	-	1.4	-	-	-	-	-	-
2	4	"	"	"	"	> 18.2	Medium hard grey limestone with chert	-	-	RC-1 95 RQD 0%	-	-	-	-	Rock core Refusal at 20.5ft

B.T.H. = Boring Total Height

Appendix D-2 Borehole Data for C.R. 45 over Little Flat Rock River in Decatur County (34).

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	Recovery %	Grain Size Distribution					Notes	
							Texture	AASHTO			Gravel	Sand	Silt	Clay	LL		PL
3	1	C.R. 45	23+24	12 L	870.6	0.0- 0.6	Topsoil	-	-	-	-	-	-	-	-	-	-
3	2	"	"	"	"	0.6- 5.4	Brown moist med. stiff clay loam	A-4	7.5	-	-	-	-	-	-	-	-
3	3	"	"	"	"	>5.4	Gray and brown hard limestone	-	-	81%	-	-	-	-	-	-	B.T.H. 10.4 ft
4	1	"	23+87	7 R	864.8	0.0- 1.8	Gray very dense gravelly sand	-	1.50/.2	-	-	-	-	-	-	-	-
4	2	"	"	"	"	>1.8	Gray hard limestone	-	-	85%	-	-	-	-	-	-	B.T.H. 6.8 ft
5	1	"	24+51	12 L	869.6	0.0- 4.0	Brown moist very loose silty loam	A-4	2	-	-	-	-	-	-	-	-
5	2	"	"	"	"	4.0- 7.0	Brownish red med. dense silty loam	A-4(0)	6.4	-	0	28	54	18	23	22	1
5	3	"	"	"	"	7.0- 9.8	Blue green med. dense silty loam	A-4	7	-	-	-	-	-	-	-	-
5	4	"	"	"	"	9.8-17.3	Brown loose silty loam	A-4	5	-	-	-	-	-	-	-	-
5	5	"	"	"	"	>17.3	Gray hard calcitic limestone	-	-	80%	-	-	-	-	-	-	B.T.H. 22.3 ft
6	1	"	25+12	12 R	880.5	0.0- 0.2	Asphalt	-	-	-	-	-	-	-	-	-	-
6	2	"	"	"	"	0.2- 4.0	Brown med. dense sand & gravel	-	12	-	-	-	-	-	-	-	-
6	3	"	"	"	"	4.0- 8.5	Brown moist very stiff loam	A-4	13.9	-	-	-	-	-	-	-	-
6	4	"	"	"	"	8.5-14.9	Red moist hard clay w/rock fragments	A-7-6(21)	30/.5 40/.5	-	0	24	33	43	50	22	28
6	5	"	"	"	"	14.9-16.9	Boulder	-	-	0%	-	-	-	-	-	-	-
6	6	"	"	"	"	16.9-35.9	Red moist hard clay w/rock fragments	A-7-6	28,24,16	-	-	-	-	-	-	-	B.T.H. 35.9 ft

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description	Blow per Ft.	Recovery %	Grain Size Distribution Coarse Sand Silt Clay LL PL PI	Notes
							Tenure	AASHTO			
7	1	C.R. 45	22 + 35	CL	870.9	0.0 - 0.8	Topsoil	-	-	- - -	-
7	2	"	"	"	"	0.8 - 2.0	Brown sand and gravel	8	-	- - -	-
7	3	"	"	"	"	2.0 - 3.5	Brown moist very stiff clay loam	9	-	- - -	-
7	4	"	"	"	"	3.5 - 6.0	Brown dense gravelly sand	14	-	23 62 - 15 -	B.T.H. 6.0 ft.
8	1	"	27 + 00	30 L	905.0	0.0 - 0.4	Topsoil	-	-	- - -	-
8	2	"	"	"	"	0.4 - 6.5	Brown stiff clay loam	7.6	-	0 41 36 23 29 22 7 W X 18.7	-
8	3	"	"	"	"	6.5 - 11.0	Brown mottled gray stiff loam	7, 13	-	2 37 48 13 22 18 4 W X 12.8	-
8	4	"	"	"	"	11.0 - 12.5	Brown moist hard loam	16	-	- - -	B.T.H. 12.5 ft.

Appendix D-3 Borehole Data on S.R. 46 over Fall Park Creek in Decatur County (35)

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	Recovery RQD	Grain Size Distribution				Notes
							Texture	AASHTO			Gravel	Sand	Silt	Clay	LL PL PI
9	1	S.R. 46	932 + 89	23 R	787.3	0.0 - 5.5	Brown medium stiff clay loam with trace gravel	A-6(8)	2, 4	-	3.6	36.5	37.5	22.4	32.7 14.7/18.0 Optimum moisture content 15.0%
9	2	"	"	"	"	5.5 - 8.0	Brown soft sandy clay loam	-	2	-	-	-	-	-	-
9	3	"	"	"	"	8.0 - 12.0	Brown loose sand with trace silty clay	-	2	-	-	-	-	-	-
9	4	"	"	"	"	12.0 - 23.5	Gray medium stiff sandy gravel	-	5, 8	-	-	-	-	-	-
9	5	"	"	"	"	23.5 - 24.0	Light gray limestone dolomite with chert	-	12-55/.1	-	-	-	-	-	-
9	6	"	"	"	"	24.0 - 34.7	Gray limestone with dolomite and chert	-	-	60%, 25-30 ft 94% 30-34.7 ft	-	-	-	-	B.T.H. 34.7 ft. 98
10	1	"	933 + 36	20 R	778.3	0.0 - 4.6	Water	-	-	-	-	-	-	-	-
10	2	"	"	"	"	4.6 - 10.0	Gray medium dense fine sand with trace gravel and silt	-	4, 7	-	-	-	-	-	-
10	3	"	"	"	"	10.0 - 12.5	Gray medium dense sand with some gravel and silt	-	11	-	-	-	-	-	-
10	4	"	"	"	"	12.5 - 16.0	Brownish lt. gray clay with limestone fragments	-	8	-	-	-	-	-	-
10	5	"	"	"	"	16.0 - 21.3	Gray hard limestone with dolomite and chert	-	-	89%	-	-	-	-	-

Appendix D-3 (Cont.)

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	Grain Size Distribution					Notes		
							Texture	AASHTO		Recovery RQD	Gravel	Sand	Silt	Clay		LL	PL
11	1	S.R. 46	933+92	23R	782.5	0.0- 3.0	Brown soft sandy clay loam	-	2	-	-	-	-	-	-	-	-
11	2	"	"	"	"	3.0- 5.5	Brown loose sand with silty clay & gravel	-	4	-	-	-	-	-	-	-	-
11	3	"	"	"	"	5.5- 9.0	Gray loose sand with gravel	-	2	-	-	-	-	-	-	-	-
11	4	"	"	"	"	9.0-12.0	Gray medium dense sand with silty clay & gravel	-	8	-	-	-	-	-	-	-	-
11	5	"	"	"	"	12.0-17.0	gray & brown med. dense sand loam with gravel	-	7	-	-	-	-	-	-	-	-
11	6	"	"	"	"	17.0-24.7	gray brown lime-stone Dolomite & chert	-	-	65%, 19.5-23.1 ft., 70%, 23.1-24.7 ft.	-	-	-	-	-	B.T.H. 24.7 ft	
12	1	"	934+61	23L	788.4	0.0- 9.0	Brown med. stiff silty clay loam w/gravel	-	3,6,5	-	-	-	-	-	-	-	-
12	2	"	"	"	"	9.0-14.5	Brown loose sandy loam	-	3,4	-	-	-	-	-	-	-	-
12	3	"	"	"	"	14.5-24.9	Gray med. dense coarse sand & gravel	-	8,8	-	-	-	-	-	-	-	-
12	4	"	"	"	"	24.9-27.5	Limestone boulders	-	-	0%	-	-	-	-	-	-	-
12	5	"	"	"	"	27.5-37.0	Red stiff clay w/limestone fragments	-	8,8	-	-	-	-	-	-	-	-
12	6	"	"	"	"	37.0-40.2	Brownish gray soft clay w/gravel	-	2	-	-	-	-	-	-	-	-
12	7	"	"	"	"	40.2-50.0	Gray limestone boulders & clay	-	-	54%, 40.5-45.5 ft., 26%, 45.5-50.0 ft.	-	-	-	-	-	-	

Appendix D-4 Borehole Data on C.R. 31 over Sand Creek in Decatur County (36).

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	Recovery RQD	Grain Size Distribution					Notes	
							Texture	AASHTO			Gravel	Sand	Silt	Clay	LL		PL
13	1	C.R. 31	21+40	5.5 R	720.3	0.0- 1.0	Asphalt & gravel	-	-	-	-	-	-	-	-	-	-
13	2	"	"	"	"	1.0- 3.0	Brown med. dense sandy loam with gravel	-	6	-	-	-	-	-	-	-	fill
13	3	"	"	"	"	3.0- 5.0	Brown stiff clay loam	A-7-6(17)	7	-	10.5	10.4	49.8	24.3	43	22	21
13	4	"	"	"	"	5.0-13.0	Brown med. dense silty loam	A-4(1)	5.8	-	0.6	32.1	51.8	15.5	23	19	4
13	5	"	"	"	"	13.0-23.0	Brown med. dense sandy loam	A-2-4(0)	5.7	-	0.1	79.7	11.1	6.1	NP	NP	NP
13	6	"	"	"	"	23.0-32.0	Brown med. dense sandy loam	A-2-4(0)	6.5	-	7.9	70.0	15.2	6.9	NP	NP	NP
13	8	"	"	"	"	32.0-37.0	Gray hard lime-stone	-	-	RC-1 95 RQD 49%	-	-	-	-	-	-	-
14	1	"	22+11	12 L	692.1	0.0- 7.4	Medium dense sand and gravel	A-1-6(0)	7.8	-	44.0	46.1	-9.9	-	NP	NP	NP
14	2	"	"	"	"	7.4-12.4	Gray hard lime-stone w/calcareous shale	-	-	RC-1 98 RQD 60%	-	-	-	-	-	-	B.T.H. 12.4 ft.
15	1	"	22+92	12 R	694.1	0.0- 5.0	Concrete rubble & weathered rock	-	50/.1	-	-	-	-	-	-	-	fill
15	2	"	"	"	"	5.0-10.0	Gray hard lime-stone	-	-	RC-1 90 RQD 8%	-	-	-	-	-	-	B.T.H. 10.0 ft.
16	1	"	23+63	12 L	722.8	0.0- 0.5	Brown medium dense sandy loam	-	50/.5	-	-	-	-	-	-	-	-
16	2	"	"	"	"	0.5- 2.5	Weathered gray limestone	-	-	0%	-	-	-	-	-	-	-
16	3	"	"	"	"	2.5- 7.5	Gray hard lime-stone	-	-	RC-1 100 RQD 81%	-	-	-	-	-	-	B.T.H. 7.5 ft.

Appendix D-5 Borehole Data on S.R. 3 over Clifty Creek in Decatur County (37).

Boring No.	Sample No.	Highway Route No.	Station No.	Offset Ft.	Ground Elevation Ft.	Sample Depth Ft.	Soil Description		Blow per Ft.	Recovery RQD	Grain Size Distribution				Notes	
							Texture	AASHTO			Gravel	Sand	Silt	Clay		LL
17	1	S.R. 3	13+66	39 L	907.0	0.0- 2.0	Brown med. stiff sandy clay loam	-	4	-	-	-	-	-	-	fill
17	2	"	"	"	"	2.0-6.5	Brown med. stiff sandy clay loam	-	3.1	-	-	-	-	-	-	-
17	3	"	"	"	"	6.5-12.5	Gray med. dense sandy loam	-	9	-	-	-	-	-	-	-
17	4	"	"	"	"	12.5-22.5	Gray stiff clay	-	9.8	-	-	-	-	-	-	-
17	5	"	"	"	"	22.5-27.5	Gray stiff silty clay	-	6	-	-	-	-	-	-	-
17	6	"	"	"	"	27.5-29.0	Gray med. stiff clay	-	4	-	-	-	-	-	-	-
17	7	"	"	"	"	29.0-34.0	Gray loose sand	-	3	-	-	-	-	-	-	-
17	8	"	"	"	"	34.0-38.5	Gray limestone	-	-	26%	-	-	-	-	-	B.T.H. 38.5 ft.
18	1	"	14+60	33 R	902.0	0.0- 5.5	Brown med. stiff clay loam	-	3.3	-	-	-	-	-	-	-
18	2	"	"	"	"	5.5- 8.0	Brown med. dense sand & gravel	-	7	-	-	-	-	-	-	-
18	3	"	"	"	"	8.0-17.5	Gray stiff silty clay loam	-	6.8	-	-	-	-	-	-	-
18	4	"	"	"	"	17.5-27.5	Gray stiff sandy clay loam	-	14.10	-	-	-	-	-	-	-
18	5	"	"	"	"	27.5-32.5	Gray loose sand & gravel	-	-	-	-	-	-	-	-	-
18	6	"	"	"	"	32.5-34.5	Dense sand & gravel	-	50/.3	-	-	-	-	-	-	-
18	7	"	"	"	"	34.5-39.6	Massive limestone	-	-	63%	-	-	-	-	-	-

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TEXTURAL SYMBOLS FOR SOIL PROFILES

CHERRY CO.

JENNINGS CO.

ENGINEERING SOILS OF DECATUR COUNTY INDIANA

PREPARED BY
DR. G. A. KETTER, PHOTOGRAPHY
BY
JOHN HENRY RESEARCH PROJECT
AT
HALL, INDIANAPOLIS
1930

LEGEND

 

ENGINEERING SOILS MAP
DECATUR COUNTY
INDIANA

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