

Subterranean Drainage Routes of Lost River, Orange County, Indiana

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Abstract

The upper Lost River watershed consists of a drainage net of sinking streams that are tributary to the main stream through subterranean channels and intermittent surface floodwater routes. The subterranean routes developed during early to middle Pleistocene time and beneath a topographic surface of Tertiary age. Material eroded from the Mitchell Plain during middle to late Pleistocene time alluviated the subterranean systems. Floodwater from the sinking streams overflows through higher relic surface and subterranean channels.

Fluorescein was used to trace the subterranean routes within the 163 square mile topographic drainage basin to their outlets. Subsurface water from a portion of the basin that lies on the Mitchell Plain, about 139 square miles, was traced along the trend of the westward dipping bedrock and descends 100 to 150 feet to resurge at the rise of Lost River and the Orangeville Rise. Drainage in a 14.5 square mile area in the Crawford Upland along the South Fork of Stamper Creek is diverted down dip southward beneath the topographic divide into Lick Creek which lies about 80 feet below the sinks. Drainage from Dry Branch, a 9.4 square mile karst valley in the Crawford Upland, follows the strike and descends 90 feet to the Orangeville Rise.

The Lost River drainage basin upstream from the rise one mile southwest of Orangeville covers an area of 163 square miles in Orange, Lawrence, and Washington Counties, Indiana (Figure 1). The basin lies mostly in the Mitchell Plain, a karst plateau, but is partly within the Crawford Upland, a dissected cuesta (2). The Mitchell Plain portion of the basin is characterized by surface streams flowing on Tertiary age clay deposits that range from 20 to 50 feet in thickness. During Pleistocene time many of these streams were diverted into subterranean routes and the clay has been eroded by sapping through sinkholes. The subterranean routes and their outlets were described by C. A. Malott (5) but he was unable to trace in detail some of the subterranean routes that he proposed.

The present investigation established positive subterranean drainage connections for the major sinking streams and rises in the Lost River area by use of commercial water-soluble fluorescein dye. Approximately one pound of dye was placed into each sink for each cubic foot per second flow into the swallow hole. This amount of dye was used to assure positive results and thus conserve expensive labor on the part of the authors. The resurgences were checked both visually and by the use of activated charcoal detectors. All tests were verified by the presence of fluorescein in activated charcoal placed in the particular resurgence.

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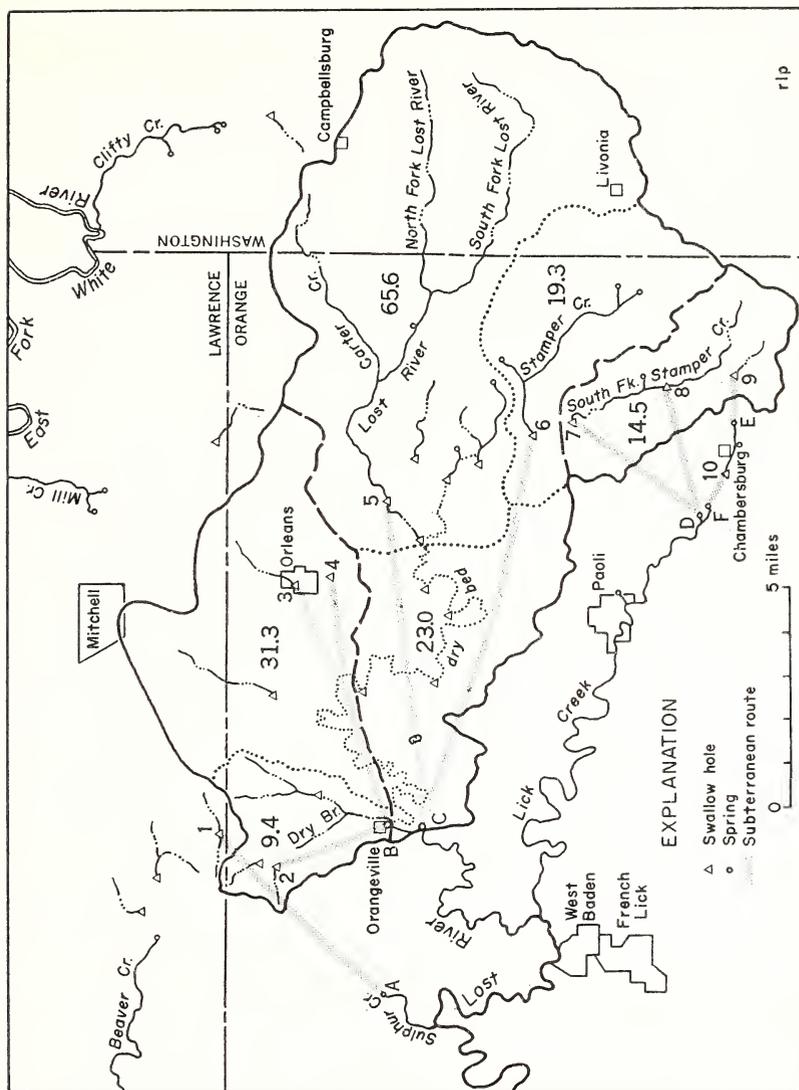


Figure 1. Map of the Lost River area showing subterranean drainage route.

The stream tracing experiments were conducted to determine better the size of several minor drainage basins in the upper portion of the Lost River basin. Data collected will be used by the Soil Conservation Service in planning impoundments and channel improvements. Engineering for proposed structures on Lick Creek near Paoli and Lost River near Prospect must take into account the runoff characteristics of all sections of the Lost River drainage basin. The data obtained is for low

flow to normal flow conditions, but knowledge of the subterranean routes contributes to the prediction of flood flow conditions.

Ten separate fluorescein tests were conducted to determine subterranean drainage routes within the Lost River watershed upstream from the rise of Lost River, about one mile southwest of Orangeville. All of the tested routes proved to be entirely within the Lost River drainage basin, but five were found to be tributary to Lost River below its rise. One of these five was traced to Sulphur Creek and four were traced to Lick Creek above Paoli (Figure 1). Five tests determined the major routes of Lost River drainage above the rise. Of these, three were detected at the Orangeville Rise and two were traced to the rise of Lost River. The tests and their results are here listed in geographic order from northwest to southeast (Table 1).

The fluorescein test in Wadsworth Hollow (1, Figure 1) provided valuable insight into the selection of the topographic boundary of the northwest side of the study portion of the Lost River drainage basin. Wadsworth Hollow is a karst valley that is topographically continuous with that of Beaver Creek to the northwest. Malott (5) suggested that the drainage of the dismembered portions of Beaver Creek, including areas to the northwest of Wadsworth Hollow, were tributary to the Orangeville Rise through caverns such as Beaver Creek Swallow Hole Cave and Salts Cave (7). However, the fluorescein test has proven that this area drains instead to Sulphur Creek, more or less down the dip of the local bedrock rather than along the strike. The caverns, the two mentioned above and Canto Cave, which receives the water diverted underground at the swallow hole in Wadsworth Hollow, tend to follow joints parallel to both the strike and dip of the local bedrock. The subterranean gradient from the swallow hole to the spring on Sulphur Creek is 27 feet per mile, which is about the same as the local dip of the bedrock.

Showfarm Cave (2, Figure 1) trends along strike-oriented joints southward towards the Orangeville Rise (7). The dye test showed that the drainage resurges at Orangeville. Flood waters follow surface channels of Dry Branch to Orangeville.

Malott (5) suggested that drainage in the area of Orleans was tributary to the Orangeville Rise. Topographic maps show that the surface drainage is to Orangeville, but, the divide between subterranean drainage that is tributary to the Orangeville Rise and that which is tributary to the rise of Lost River is not discernable on the surface.

Two tests were made, therefore, to trace subterranean drainage at Orleans to an outlet. Fluorescein was dumped into a sinking stream, Flood Creek, on the west side of the town of Orleans, and into the sewage plant (3 and 4, Figure 1) that discharges its wastes into a sinkhole on the south side of town. Both were detected at the Orangeville Rise, where, incidentally, the water is sometimes used for domestic supply. A direct route between the sinks and the resurgence would pass beneath the dry bed of Lost River in the vicinity of the Mathers

TABLE 1
Results of fluorescein tests.

Input Point	Altitude	Resurgence	Altitude	Head/dist.	Ft./Mile	Time/hrs.	Lbs. dye/flow
1 Wadsworth Hollow Sink* 625 NE SW 18 3N 1W	625	A Sulphur Creek NW SE 4 2N 2W	475	150/5.5	27	48—	3/2-3cfs
2 Showfarm Cave NE NW 25 3N 2W	595	B Orangeville Rise Cen. S $\frac{1}{2}$ SE 6 2N 1W	485	110/3.0	37	36	1.5/.6cfs
3 Flood Creek Sink* NW SW 30 3N 1W	615	B Same	485	130/5.5	24	36	2/.3cfs
4 Orleans Sewage Plant SE NW 31 3N 1W	625	B Same	485	140/5.5	26	36	1/.1cfs
5 Sink of Lost River Cen SW 8 2N 1E	615	C Rise of Lost River NW SE 7 2N 1W	485	130/7.0	11	116	2/1-2cfs
6 Sink of Stamper Creek Cen NE 27 2N 1E	665	C Same	485	180/10.0	18	120+	2/5-6cfs
7 Matity Sinks NW NW 35 2N 1E	675	D Spring Mill SE SE 8 IN 1E	610	65/3.7	18	24—	2/7-9cfs
8 Wolfe Sink* NE NE 11 1N 1E	695	D Same	610	85/3.2	28	154? .75	3/2-3cfs
9 Clements Sink* SE SE 14 1N 1E	715	E Dillard Cave Spring SW SW 14 1N 1E	690	25/.8	31	30	1/.2cfs
10 Sinks of Lick Creek NW SW 15 1N 1E	625	F Half Moon Spring SW NW 16 1N 1E	605	20/1.0	20	30	1/.25cfs

* Name applied here for first time.

Stormwater Rises (5), thus suggesting a possible floodwater exchange between the dry bed of Lost River and the subterranean passages.

The northern boundary of the Lost River drainage basin with the Mitchell Plain is arbitrarily drawn (Figure 1) along a low topographic divide where sinkholes are less numerous or lacking, apparently because a thick deposit of clay mantles the bedrock. Drainage to the north most probably is to the East Fork of White River through such caverns as Blue Springs Cave (6) and the Donaldson-Twin Caves which drain the sinks of Mosquito Creek (1).

Drainage of the upper part of Lost River (5, Figure 1) was traced to the rise of Lost River about one mile south of Orangeville. The dye was detected visually in the rise at Wesley Chapel Gulf, confirming the studies of Malott (3). The stream includes drainage from Carter Creek, and the North and South Forks of Lost River. On each of these tributaries a flood control structure is planned by the U. S. Soil Conservation Service. Near the sink where the dye was injected Lost River is joined by an upland dry bed or overflow route that carries overflow from the South Fork of Stamper Creek, joins Stamper Creek and several other small streams that drain westward off the thick clay covered portion of the Mitchell Plain. This overland route is scheduled to be improved by the Soil Conservation Service to decrease flooding in the downstream ends of these sinking streams.

The sinks of Stamper Creek (6, Figure 1) were traced to the rise of Lost River, contrary to the connection with Lick Creek to the southeast proposed by Malott (5). Hudelson Cavern (4) lies along the direct route between the sinks of Stamper Creek and the rise of Lost River.

The drainage of the South Fork of Stamper Creek is diverted into subterranean routes through many swallow holes along the stream bed, each successive swallow hole diverting water underground depending upon the amount of water in the stream. All of the subterranean drainage of the South Fork of Stamper Creek discharges into Lick Creek which lies down dip and topographically lower to the southwest. Three tests were conducted, in three selected sinks spaced evenly along the stream. The upstream part of the South Fork in the vicinity of Trotters Crossing (9, Figure 1) was found to be diverted westward into the headwaters area of Lick Creek. All of the downstream part of the valley of South Fork (7 and 8, Figure 1) is tributary to Spring Mill on Lick Creek. The downstream end of the South Fork was dyed during flood conditions, the only time that water flows this far downstream. Although most of the water resurged at Spring Mill, the cavernous routes were flooded to such an extent that some of the muddy water resurfaced at springs in the valley to the north about 10 to 15 feet higher than at Spring Mill.

Malott, on an unpublished map, indicated that Half Moon Spring on Lick Creek (F, Figure 1) was in part fed by the South Fork of Stamper Creek, but the only drainage traced to that spring by the fluorescein studies was that which sinks in the sinks of Lick Creek.

The Lost River topographic watershed above the rise of Lost River can be divided into three parts on the basis of tracing the normal and low flow subterranean drainage. The northwestern part includes about 40.7 square miles in the Crawford Upland and Mitchell Plain that is tributary to the Orangeville Rise. The central portion is mostly within the Mitchell Plain and covers about 107.8 square miles of drainage, including the upper part of the Lost River, that is tributary to the rise of Lost River. This portion includes the major part of the dry bed and sinkhole plain area commonly associated with Lost River. The remaining part is the karst valley of the South Fork of Stamper Creek that is tributary to Lick Creek, an area of 14.5 square miles. Flood flows within the entire drainage basin fill the subterranean conduits and overflow into surface flood channels or dry beds, ultimately to discharge at the rise of Lost River. Thus modern flood flows occupy essentially the late Tertiary or early Pleistocene surface routes that were regularly used prior to the development of karst features and caverns during early and middle Pleistocene time.

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