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MAP AND CHART 4
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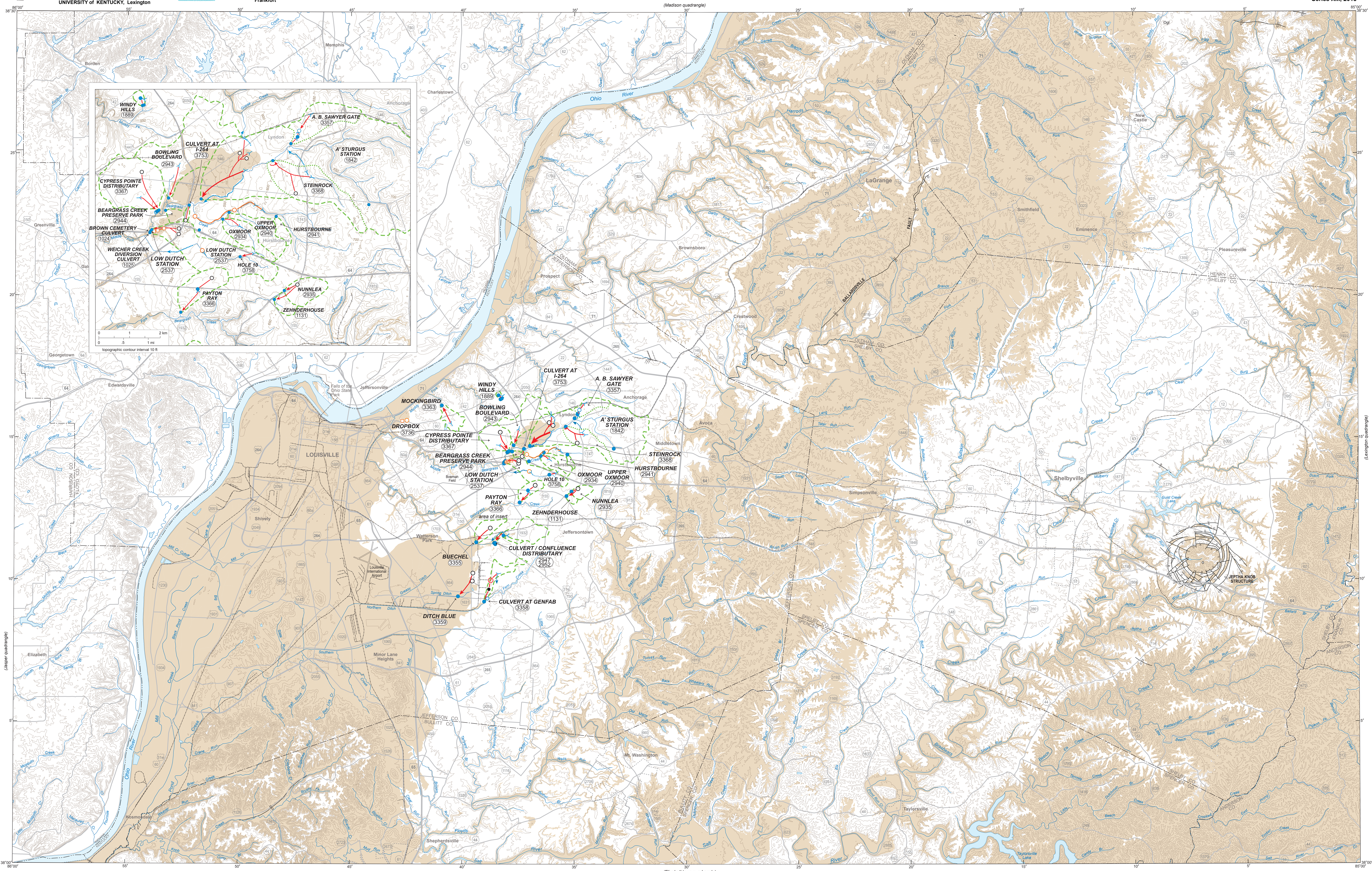

MAPPED KARST GROUNDWATER BASINS IN THE LOUISVILLE 30 x 60 MINUTE QUADRANGLE

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LEGEND

- Area of potential karst groundwater basin development
- Area of limited karst groundwater basin development
- Inferred perennial groundwater flow route
- Subsurface overflow (high-flow) route (shown on inset map only)
- Surface overflow (high-flow) route
- Artificial route; sanitary sewer or storm drain
- Groundwater basin catchment boundary
- Groundwater sub-basin catchment boundary
- Stream sink or swallet
- Underflow spring (perennial)
- Overflow spring (high flow)
- Karst window or sinking spring
- Intermittent karst window or sinking spring
- Cave stream
- Other tracer-injection point
- Sanitary-sewer dye-recovery point
- Storm-drain dye-recovery point
- (2934) Kentucky Division of Water AKGWA spring identification number
- *OXMOOR* Spring name

EXPLANATION

This map shows karst groundwater basins in the Louisville 30 x 60 minute quadrangle, determined primarily by groundwater tracer studies. It can be used to quickly identify the groundwater basins and springs to which a site may drain. Major springs and the relative size of their catchment areas can be evaluated for potential as water supplies. The map also serves as a geographic index to literature on karst groundwater in the area.

The urban development of the Louisville metropolitan area presented exceptional challenges for mapping the natural karst hydrogeology in the quadrangle. Tracer investigations revealed that some or all local groundwater is diverted into drainage pipes intended for sanitary sewers, storm sewers, or combined sewer overflows. Although an accurate number of natural springs affected by these diversions is unknown, field experience suggests a significant number. Groundwater tracers introduced into mostly natural openings could not always be recovered at the spring rise because of the intercepting drainage infrastructure. They were, however, often detected at outfalls or other pipeline access points of the manmade system. To delineate some groundwater basins, monitoring for tracers was required at several of these manmade features. Therefore, delineation of these routes required symbols unique to this map. Field work for this map was conducted primarily by Kentucky Division of Water personnel.

This map is designed for regional and preliminary hydrologic investigations. Features such as springs and swallets are much too small to precisely locate on this map with a scale small enough to show regional relationships. See the literature cited in the "References Cited" for detailed site descriptions. The data used to compile this map were obtained by numerous investigators over the last 20 years. The underflow spring draining a groundwater basin is assigned a unique identification number, referred to as the AKGWA number (Assembled Kentucky Ground WAter database). Individual basins are identified by the underflow spring name and AKGWA number. The authors of tracer data are identified by number in the "Data Source" column of the key, and are listed in "References Cited" in order of publication or research date.

Although groundwater flow routes shown here have been established by tracer studies, with the exception of mapped cave streams, the precise flow paths are unknown and are inferred or interpreted using water-level data, geologic structure, or surface features. Arrows show the direction of groundwater flow and tracer recovery locations. Conduit flow is illustrated as either thick trunk-flow lines or thinner tributary-flow lines. The locations of some groundwater basins are inferred, based on the existence of a significant spring system and the delineation of adjacent basins. The position of groundwater basin boundaries should be considered approximate because of the map's scale and because boundaries can shift during high-water conditions. Also, excess flow may exit or enter a basin via surface or subsurface overflow routes. There are probably additional overflow routes. Although most of the groundwater-tracing results shown on this map were obtained during moderate- or high-flow conditions, the groundwater basins are illustrated in base flow because base flow is the most common flow condition. The main spring draining the basin is assumed to be an underflow spring that preferentially drains base flow. Overflow springs discharge during high flow. Generally, names of groundwater basins are derived from these main springs. (Worthington, S.R.H., 1991, Karst hydrogeology of the Canadian Rocky Mountains: Hamilton, Ontario, McMaster University, Ph.D. dissertation, 380 p.) Only springs involved in tracing experiments are shown because of the small map scale.

DISCLAIMER: This map is subject to revision upon receipt of new hydrologic data. The unshaded area (show in white on the map) is karst. The shaded area (shown in light brown) is largely underlain by noncarbonate rocks and has minimal development of karst. Karst features are only shown in those areas where tracer tests have been conducted. Consult the "References Cited" for additional information.

ACKNOWLEDGMENTS: We thank the many karst investigators who have contributed data for this map. Without their cooperation, this map would not have been possible. Mr. Hugh L. Nelson Jr., Louisville office of the U.S. Geological Survey, digitized a substantial portion of the results of the groundwater tracing in the Louisville quadrangle.

1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 KILOMETERS
1 0 1 2 3 4 5 6 7 8 9 10 MILES
1000 0 5000 10 000 15 000 METERS
5000 0 10 000 20 000 30 000 40 000 50 000 FEET

N

SCALE 1:100 000
universal transverse Mercator projection, zone 16: 1927 North American datum
TOPOGRAPHIC CONTOUR INTERVAL 20 METERS

Key

AKGWA No.	*Spring Name*	*Data Source*
1024	Brown Cemetery Culvert	5 (shown on inset map only)
1025	Weicher Creek Diversion	5 (shown on inset map only)
1131	Zehnderhouse	5
1842	A' Sturgus Station	1, 2, 3, 5
1889	Windy Hills	5
2537	Low Dutch Station	5
2934	Oxmoor	5
2935	Nunnlea	5
2940	Upper Oxmoor	5
2941	Hurstbourne	5
2943	Bowling Boulevard	5
2944	Beargrass Creek State Nature Preserves	5
2947, 2952	Culvert/Confluence Distributary	5
3355	Buechel	5
3357	A.B. Sawyer Gate	5
3358	Culvert at Genfab	4, 5
3359	Ditch Blue	4, 5
3363	Mockingbird	5
3366	Payton Ray	5
3367	Cypress Pointe Distributary	5
3368	Steinrock	5
3736	Dropbox	5
3753	Culvert at I-264	5
3758	Hole 10	5

REFERENCES CITED

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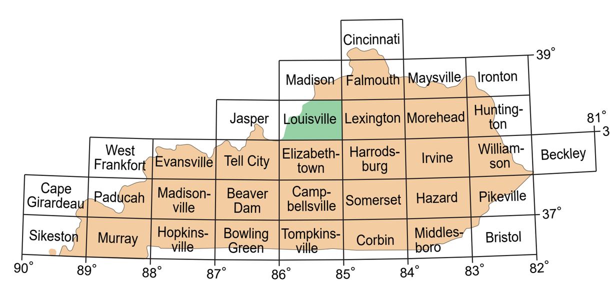
(4) Brown and Caldwell Environmental Engineering and Consulting, 2001, Phase I tracer test, General Electric Appliances, Appliance Park: Louisville, Ky., Nashville, Tenn.

(5) Blair, R.J., and Ray, J.A., 2012, Groundwater assessment for nonpoint source pollution impacts and spring basin delineations within sub-watersheds of the Salt River Basin: Beargrass Creek and Sinking Creek: Frankfort, Ky., Kentucky Division of Water, 77 p.



Locations of the 30 x 60 minute quadrangles covering Kentucky. This quadrangle, the Louisville quadrangle, is highlighted in green.

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Cartography by Terry Hounshell and Emily Morris

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