



Photo by Capocy and Coons (KCI)

MANAGEMENT PLAN

for

**TWIN CULVERTS CAVE NATURE
PRESERVE**

**based on the INPC proposal by
A. Moorehouse, V. LaGesse, and D. Corgiat
October 1998**

**updated by
D. Coons (KCI) Summer 2005**

a cooperative project of



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CONTENTS

TITLE	1
COOPERATING ORGANIZATIONS	2
CONTENTS	3
RESOURCES	3
INTRODUCTION to cooperating organizations	4
ACKNOWLEDGEMENTS	4
HISTORY of the SITE	5
Name.....	5
Location	5
Description.....	5
Acquisition.....	6
Preservation	6
Research.....	7
DESCRIPTION of the PROPERTY.....	8
Surface Flora.....	8
UNDERGROUND RESOURCES	9
Biology	9
Vertebrates.....	9-10
Invertebrates	11
Geology.....	11-13
Paleontology	13
Mineralogy	14
Hydrology	14-16
Speleology	16-17
Archeology.....	17
MANAGEMENT PLAN	18
Dedication as Twin Culverts Cave Nature Preserve	18
Access Policies	18-19
Management Strategies.....	19-20
Surface Management	20
Cave Management	21-22
Scheduled Management Tasks	22
FUTURE OPTIONS	23
REFERENCES	23-25
ADDITIONAL REFERENCES	26

RESOURCES

INTRODUCTION to cooperating organizations

The Karst Conservancy of Illinois (KCI) is a not-for-profit corporation founded in 1998. The board of directors of the organization is composed primarily of long time members of the National Speleological Society. An Advisory Committee includes a number of professionals from related fields of study (see listings on page 2). The organization is dedicated to conserving karst resources, primarily in the state of Illinois. KCI emphasizes long-term protection and sound management of karst environments, primarily through acquisition. A primary accomplishment to date has been the purchase and dedication of the Pautler Cave Nature Preserve in Monroe Co. Illinois.

As their name implies, THE Nature Conservancy (TNC), is widely recognized as the foremost organization of its kind. They have assisted in preserving more acres of natural habitat throughout the U. S. than any other private organization. Recent strategies to preserve larger contiguous acres of habitat are focusing the efforts of the organization toward coalescing smaller isolated holdings. Their five-acre parcel at Twin Culverts Cave is an isolated preserve. It provides access and protection to a very interesting microclimate from the standpoint of speleology, but does little to establish a large surface ecosystem. Primarily for this reason, TNC has accepted an offer from the KCI to help manage the Twin Culverts Cave property in the future.

The Illinois Nature Preserves Commission (INPC) is an agency of the Illinois Department of Natural Resources (IDNR). The primary goal of this agency is intended: "...to assist private and public landowners in protecting high quality natural areas and habitat of endangered and threatened species in perpetuity through voluntary dedication or registration of such lands into the Illinois Nature Preserves System."

To date they have sanctioned more than 300 preserves located throughout the state.

ACKNOWLEDGEMENTS

As is normally the case, preservation and dedication of the Twin Culverts Nature Preserve has been a rather long and drawn out affair. Many organizations and individuals have been involved over the years. A large number of documents describing the cave and the efforts to protect it have been produced. Each is referenced in this plan. Excerpts from previous work are identified in quotation marks.

HISTORY of the site

Name

References to the cave have used various names through the years. From earliest to latest these include: Pearl Cave, Railroad Culvert Cave, Twin Culverts Cave and Twin Culvert Cave. The latter name appears most often in print, though many have pointed out that it is actually grammatically incorrect. Twin Culverts Cave seems the better choice, and will be used in this plan.

Location

The entrance to Twin Culverts Cave is located 2 miles west and 1 mile south of the town of Pearl, about 15 miles southeast of Pittsfield (population 4,000). The property is located in the SE ¼ of the NW ¼ of the SW ¼ of section 17, T. 7 S., R. 2 W. of the 4th principal meridian, latitude 39deg25min45sec, longitude 90deg40min. This township and range designation delineates Pearl Township, located in Pike County, Illinois. The area is named as a feature on both the USGS 7.5 min Pearl topographic map and the DeLorme, *Illinois Atlas & Gazetteer*, p.66. The land parcel is delineated on page 14 of the *Pike County Land Atlas & Plat Book*. Excerpts from each of these maps are presented in Appendix II.

Pearl Prairie Geological Area and Pearl Limestone Quarry [INAI sites] are located 1 mile and 2 miles northeast, respectively. Pere Marquette State Park lies 32 miles south, and Siloam Springs is located 32 miles north of Twin Culverts Cave.

Description

Twin Culverts Cave has been classified as a Grade A outstanding limestone solution cave site within the Central Tallgrass Prairie Ecoregion by the INAI. It has also been labeled as a Cave Heritage Site, located within the Big River Resource Rich Area, by the Critical Trends Assessment Project (Suloway, Joselyn, and Brown 1996). The cave lies in the Driftless Section of the Middle Mississippi Border Natural Division of Illinois, and is located in the Lincoln Hills Karst Region (Weibel and Panno 1997). The cave name is derived from the two stone railroad culverts, which were constructed on either side (north and south) of the current cave entrance. The cave serves as a migratory resting place for the state and federally endangered gray bat (*Myotis grisescens*). It also contains a spring fed subterranean lagoon with outstanding invertebrate fauna. The Nature Conservancy (TNC) owns 5 acres of property, which includes the cave entrances and surrounding land surface. The area supports an oak-hickory woodland community and a small remnant of degraded prairie

Acquisition

Interpreted from Picken, Bowles, Nelson and McFall, (1980) Natural Land Institute: “Twin Culverts Cave was originally owned by the Gulf, Mobile & Ohio Railway Company. Dr. John Warnock, a professor in the Department of Biological Sciences at Western Illinois University, initiated steps toward formal preservation of this area by contacting Dr. Lewis Stannard at the Illinois Natural History Survey on January 4, 1967. Warnock and Stannard then contacted Dr. W. D. Klimstra of the Illinois Chapter of The Nature Conservancy to suggest a project of preserving the area. He also contacted representatives of the Railroad Company, principally Mr. Brock and R. E. McGinn, in 1969. They discussed the possibility of leasing or purchasing five acres of land surrounding the entrance to the cave during a meeting at the site on February 3, 1971. A merger between the Gulf, Mobile, and Ohio Railroad Company and the Illinois Central Gulf Railroad in the fall of 1972 held up negotiations. The first agreement drawn up between the Illinois Central Railroad and The Nature Conservancy provided that the buyer would construct and maintain a fence on the three sides of the property abutting the railroad right-of-way and that the railroad company would retain the mineral rights. The Nature Conservancy explained that to give maximum protection to the preserve, they could not agree to give up mineral rights to the cave. An agreement on this was reached, and the deed was signed on April 21, 1975. An extensive folder containing copies of all correspondence between Dr. Warnock and the other involved organizations is on file.

The purchase price is listed as \$1,000. The fee simple deed is recorded in Drawer 1, Card 1307 at the Pike Co. Courthouse located in Pittsfield, Illinois. It is interesting to note that the fencing provision is retained in the document. Copies are on file with each of the organizations participating in this plan.

It should be noted that efforts to date have preserved only five acres of the 10-acre site originally described by the INAI. An additional 5 acres of privately owned land overlies the terminal extent of the known cave passage. Efforts to acquire this land and include it into the preserve will be a focus for participating organizations.

Preservation

Early efforts toward conservation included work by: Dr. John Warnock (WIU), George Fell (NLI), and Jerry Paulson (INPC). At its 32nd meeting on May 1, 1970, the INPC recommended preservation of the entrance to the cave either by leasing on a long-term basis to the Department of Conservation for subsequent dedication or by dedicating it as a nature preserve. At the 37th meeting of the INPC, the Commission granted “approval for dedication in principal”, resolution 184, for five acres to be purchased by as a nature preserve. At its 53rd meeting in October of 1974, the INPC gave preliminary approval for dedication of the portion of Twin Culverts Cave owned by TNC.

Research

Efforts to document and study this site were initiated by several other organizations working in parallel with efforts by The Nature Conservancy to purchase the property. Early biological study focused on bat populations that inhabited the cave. D. Skaggs (1973) and L. Kerr (1973) both completed independent masters thesis with Western Illinois University. Warnock (1971) paraphrases their work with the following statement: “At least five species of bats utilize the cave including large numbers of the relatively rare gray bat (*Myotis grisescens*) which.....should be on the list of rare and vanishing species.” An exhaustive two-year project was completed during the course of these studies to identify all individuals within the cave by species and sex. Each individual was then banded and released. Their location of capture within the cave was noted and temperature baselines were also noted.

Members of the Illinois Speleological Survey visited the cave in June of 1973 and completed a detailed underground survey of the total extent of the cave. A copy of the map produced at this time by J. White and D. Coons is included on page 6 of Appendix II to this plan.

Mr. White would later head the Illinois Natural Areas Inventory project, funded by the IDNR. His staff described the area in a five-page report and entered it into the inventory as Area #784. The same author prepared an eleven-page report entitled Nature Preserve Potential of Twin Culvert Cave in September of 1973. It provided a very comprehensive description of the site that was often quoted in later work.

Two separate management plans for the cave have been produced under the same name, *Twin Culvert Cave Master Plan*. The first was done by T. A. Walkington, Stewardship Study Coordinator for the Illinois Chapter of TNC in 1978. A second plan was compiled by the Natural Land Institute in 1980. It was authored by J. Picken, M. Bowles, N. Nelson and D. McFall. This second plan sites the “*Rules for Management of Illinois Nature Preserves*, INPC (1994)”. A third, and much more extensive, plan titled *Proposal for the Dedication of Twin Culvert Cave as an Illinois Nature Preserve* was completed in 1998 by A. Moorehouse, V. LaGesse, and D. Corgiat. Much of this current revision is based on their work. The management strategies presented in all of these documents are designed to protect, in perpetuity, both the resources of the cave environment and the overlying surface of the preserve area.

An ambitious project to construct a bat friendly gate at the entrance to the cave was undertaken in August of 1998. S. Taylor describes this effort in an extensive report. Photographs of the effort appear on pages 1&2 of Appendix III to this document.

In the summer of 1999, the INPC, in conjunction with the IDNR, presented the site to be officially dedicated as a nature preserve. This document was signed by then governor

George H. Ryan on July 29, 1999. It is recorded in Book 347 on Page 245. Copies of all these documents are on file with each of the organizations participating in this effort.

DESCRIPTION of the PROPERTY

The entrance to the cave lies midway between two parallel rights of way that were constructed by the Gulf, Mobile & Ohio Railway Company. Each of these grades excavated a 50-foot deep cut through the hillside above the cave. Material from each cut was subsequently used to construct a 30-foot high fill across a small adjacent valley. A massive arched stone culvert underlies each grade to accommodate intermittent stream flow through this valley, a small tributary to Hill Creek. A graveled county road also utilizes the culverts and streambed during periods of dry weather. Limestone for construction of the two culverts was quarried from bedrock underlying the adjacent hillside. One of these grades is now abandoned, but the second still supports the existing rail track. This unusual construction of two identical large stone culverts in such close proximity to one another accounts for the name of the area.

The two parallel railway lines also delineate the boundaries of the property. The southeastern edge follows the curvature of the tracks with a 75-foot setback from the center of the active line. The northwestern edge follows the base of the slope created by the abandoned grade. A distance of roughly 200 feet separates the two lines. A legal description and map accompany the document, *Dedication of Twin Culvert Cave as an Illinois Nature Preserve* (1999). A copy of this map is presented on page 9 of Appendix II to this plan.

Once construction of the second culvert was completed, the original line was abandoned. The land area between has been left largely untouched by current day development or farming practices. The cave and overlying surface area are now managed as a biological preserve and natural area. The cave entrance provides access to a perennial underground stream, facilitating the monitoring of water quality in this area of the Lincoln Hills aquifer. Invertebrate biologic collections to establish existing populations have been done in the past. Since 1996, Joe Kath IDNR has conducted periodic monitoring of bat populations in the cave including the endangered species, *Myotis grisescens*.

Surface flora

White (1973) describes the surface flora of the area:

“The most natural vegetation is around the cave entrance. Above the cave is a prairie remnant, about 50 feet square, with species such as little bluestem, prairie dock, tall coreopsis, stiff coreopsis, yellow coneflower, feverfew, Carolina rose, and prairie willow. Oaks and hickories are invading the prairie. The slope around the entrance is wooded: the largest trees are chinquapin oak, sugar maple, American elm, and hackberry. Along the railroad rights-of-way the vegetation is mainly thickets of rough-leaved sumac, sassafras, and others. This brushy vegetation also covers the hill south of the railroad, above the main passage of the cave.”

Scientific names for each of these plants appear on page 4 of Appendix I to this plan. This document forms the basis for all subsequent published descriptions. One notable addition to this list appears in the *Twin Culvert Cave Master Plan* prepared by the Natural Land Institute (1980). They note that: “The threatened plant goldenseal (*Hydrastis canadensis*) occurs on slopes of the east railroad embankment above the cave.” This plant is listed as “endangered” by the state of Illinois, though it does not appear on the federal listing monitored by the US Fish and Wildlife Service. The american elm, listed above, has also suffered large-scale degradation throughout the midwest.

Additional inventory of flora in the preserve by Angella Moorehouse of the INPC has added many more species to this listing. Her work is also listed in Appendix I. Goldenseal and small specimens of american elm have been identified at the site as recently as 2004. Her photo of the former accompanies this report. Monitoring the continuing success of these species will be an ongoing project.

UNDERGROUND RESOURCES

Biology

Vertebrates

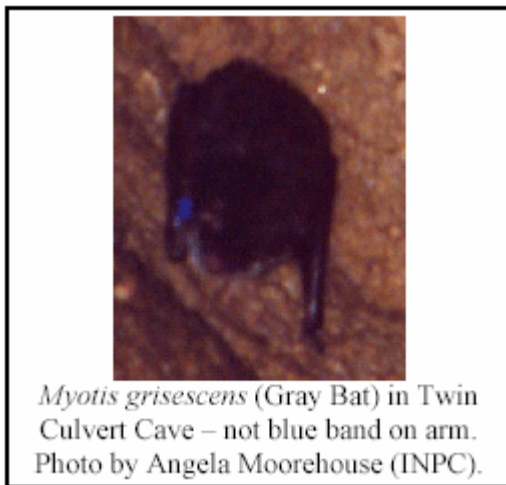
The earliest biological study documented in this review was prepared by Hall and Wilson (1966). Their report is referenced by Warnock (1971). This early work “located several maternity colonies (of *Myotis grisescens*) in the Twin Culvert area in the late 1950’s, but the bats were not present in the summers of 1963 and 1964”.

Warnock (1971) continues: “At least five species of bats utilize the cave including large numbers of the relatively rare gray bat (*Myotis grisescens*).....Gray bats use the cave mostly during September and October while migrating from summer roosts to winter roosts. Their whereabouts during the period November through August are little known although several individuals have been captured at Pearl Cave, which were banded in south central Missouri. Biologists from Western Illinois University have banded several hundred gray bats at Pearl Cave, but band returns have not yet been obtained. The gray bats are very vulnerable while in the cave because they roost in tight clusters of several hundred which often are easily reached and/or disturbed”.

Graduate student work supported by Warnock has resulted in two separate masters thesis. White (1973) paraphrases this work: “Kerr (1973) studied the bats in the cave from August 1969 to October 1970. He found the following numbers of bats: gray bat (100), little brown bat (32), eastern pipistrelle (29), big brown bat (9), and Keen’s bat (2). Skaggs (1973) also studied the bats in the cave, from September 1969 to May 1972, and found the same species as Kerr found, except he found no big brown bats.”

Very little appears in the record since this early work was finished. Joe Kath of the IDNR began systematic inventory of the bats in 1996. In a personal communication in 2005 he reports: “We have documented only small numbers of bats using this cave - *Myotis septentrionalis*, *Pipistrellus subflavu*, *Eptesicus fuscus*, *Myotis lucifugus*, and one (1) *Myotis grisescens* in September of 1997. Use is quite sporadic and we do not consider this cave a significant hibernacula.” In short, the same species of bats are recorded in both the older and the more recent studies, but the numbers have declined.

Taylor (1998) reports, “Bats have contributed up to 3 feet of guano near the entrance and within the last 30 feet of the cave. It is likely that guano was much deeper within the cave but was harvested by local residence for use as a fuel or fertilizer. The tremendous accumulation of guano and dark staining of the ceiling, especially within the later portion of the cave, indicates that the cave provided for a large maternal colony of bats perhaps as recently as 30-40 years ago.” Moorehouse and Taylor (2005) also report the sighting of one gray bat and one big brown bat during work on a gating project completed in “August of 1998. Photographs of both of these individuals accompany this report. The gray bat pictured is still wearing a blue plastic band on the forearm.



Probably a Big Brown Bat
(*Eptesicus fuscus*)
Photo by Angella Moorehouse (INPC)

The question becomes obvious: What happened to the gray bats in Twin Culverts Cave? The U. S. Fish and Wildlife Service now list this troglodene species as endangered. Warnock, Skaggs, and Kerr report 100’s in the early seventies. Since then only two lone individuals have been recorded. This remains as the biggest puzzle to solve in regards to management decisions for the cave. It is hoped that time and additional research will answer some of the questions surrounding this mystery.

Invertebrates

Oliver and Graham (1988), representatives of the Illinois State Museum, are believed to be the first biologists to have made an invertebrate collection from Twin Culverts Cave, but no cave-specific data are available.

Webb, Taylor, and Krejca (1994) describe collections of cave dwelling arthropods made at other sites within Pike Co. during their study. No collection from Twin Culverts Cave was reported at this time.

Taylor (2005), Center for Biodiversity, Illinois Natural History Survey prepared a report in support of this management plan. In it he extracts a list of Twin Culverts Cave invertebrate taxa from an earlier work by Peck and Lewis (1977). Taxonomic changes since 1977 generally were not corrected here due to time constraints. Individual species mentioned in this report are listed on pages 2&3 of Appendix I to this plan.

Dr. Taylor concludes: “Our knowledge of the biology of this cave is pretty good, especially compared to many other caves in the Lincoln Hills area. Several of the taxa are clearly cave-adapted, and both terrestrial and aquatic forms are represented. Nonetheless, it is almost certain that this list could be greatly increased with further study.”

A map illustrating Biodiversity *Levels of Karst Landforms in the United States* by David Culver is included on page 5 of Appendix II to this plan. Since the Lincoln Hills area was highly influenced by glaciation in the past, it is defined as a less diverse area than unglaciated areas located further to the south. A reasonable comparison can be made to the Pautler Cave Nature preserve in Monroe Co. This cave is owned by KCI and dedicated by the INPC. Twin Culvert currently lists a total of 6 cave-adapted invertebrates. Pautler provides habitat for 18 spelean species of invertebrate (*Pautler Cave Management Plan*, 2001).

Geology

Twin Culverts Cave is developed in the Lincoln Hills Karst, which in turn is part of the larger Southwest Illinois Karst. See map on page 1 of Appendix II to this plan. The rocks exposed in the area are Mississippian in age. Pautler Cave is formed in the St. Louis Limestone as mapped by Weller and Weller (1939). Twin Culverts Cave is developed in a member of limestone that occurs lower (and therefore older) in this series. An excerpt from the poster map, *Geologic Road Map of Illinois* by Grimley, Stiff and Andrew (2001), illustrates the geologic stratum of the area.

White (1973) also describes the geology of the area:

“The cave is located on the point of a spur along the north edge of the upland called Old Pearl Prairie. The bedrock is Lower Mississippian, probably the Burlington Limestone. The limits of Pleistocene glaciation in the vicinity of the cave are subject to conjecture:

Twin Culverts Cave may be at the very limit of the area covered by the Illinoian glacier, or the cave may be about 1 mile to the west. The limit of the Kansan glacier is less than 10 miles west of the cave. Regardless of the exact position of the glacial boundaries, there is glacial outwash on the upland south of Twin Culverts Cave, and there are eroded loess deposits in the area.”

Skaggs (1973) assigns a different unit to the rock formation: “Rock within the cave is fossiliferous and cherty consisting of Valmeyeran Mississippian limestone.”

It is clear that the region narrowly missed glaciation during both the Kansan advance (~750,000 – 450,000 years BP) and again during the Illinoian advance (200,000 – 125,000 years BP). The boundaries of both these events are delineated by Grimley, Stiff and Andrew (2001). An excerpt from this map is included on page 11 of Appendix II to this plan. The line of terminal moraines from each event passes through Pike County. Large amounts of till and heavier outwash was deposited directly onto the karst surface during these events. The flanking Illinois and Mississippi River Valleys flowed at much larger volume and carried huge volumes of outwash. Wide mudflats filled the valley adjacent to either river. Following the retreat of the ice, a mantle of loess was blown onto the karst from the surface of these mudflats. More loess was blown in during the Wisconsin stage of ice advance (25,000 – 10,000 years BP). Loess deposits overlying the limestone of the area have eroded to reveal bedrock at many of the higher elevations. Valley bottoms and hillsides are still mantled with soils of the Fayette-Rozetta-Seaton group that were formed from these wind blown sediments. Streambeds in the area are floored primarily with a gravelly chert substrate.

Bretz and Harris (1961) described Twin Culvert Cave in *Caves of Illinois* as: “A network of two sets of joint-controlled vertical slots that cross at approximately right angles.” This report goes on to state: “The cave system has no genetic relation to the present valley and apparently would be a sealed cavity were it not for roof failure. Had this breakdown developed earlier in the tributary valley’s deepening, the pre-existing cave would now be completely filled with chert gravel. Had an opening to the surface existed when the Old Pearl Prairie glacial sand was deposited, the cave would now contain a complete fill from that deposit.”

White and Coons subsequently delineated the full extent of cave passage in a mapping project completed in 1973. There is little doubt that the cave narrowly missed being obliterated by fill from each of the successive glacial events. The most plausible explanation to this escape lies in a better understanding of the current day entrance to the cave. If this entrance had existed during the glacial events, there would have been much more fill introduced to the interior of the cave. If the entrance did not exist at that time, the fill event would be greatly reduced.

The question becomes: When was the current day entrance opened? Extensive hillside cutting, filling, and subsequent quarrying occurred in the area during construction of the twin culverts. An older, 1:250,000 scale, topographic map of the area appends Picken,

Bowles, Nelson and McFall (1980). It clearly marks this area as a quarry site. The headwall of this abandoned quarry is still visible on the property today. A photograph of this feature is presented on page 3 of Appendix III to this plan.

A quote from *History of Pike County Illinois, 1880* by Chas. C. Chapman & Co., 1880, page 281 provides more information. “In Pearl township, on land owned by Judge Atkinson, the railroad employees of the Chicago & Alton company were blasting rock in 1871 or 1872, when they discovered a small cave in which were found lime carbonate drippings in the form of stalagmites and stalactites. Many of these are of imitative forms and can be imagined to be petrified human beings or animals. An exaggerated account of this cave was published in the Pittsfield papers at the time, which led many people to believe something wonderful was found at the place.” The article is preserved on microfiche at the Pittsfield library and is referenced in this report. A turn of the century map appears in *The Chicago and Alton Railroad* by N. W. Halsey (1905). A copy is presented on page 7 of Appendix II to this plan. It identifies the Chicago & Alton line as a predecessor of the Illinois Central Gulf Railroad Company, the corporation that eventually sold the site to TNC, and also delineates the position on the line in the same vicinity as the cave.

It is clear, then, that the quarrying process resulted in the opening of an entrance to the natural cave that underlies the property. The first line of the railway was abandoned. The second was constructed at a later date. It is not known which construction phase originally opened the existing entrance to the cave.

Twin Culverts Cave is one of the longer and larger known to exist in the Lincoln Hills Karst area of the state. An entrance gate currently limits access to the interior. Prior to that time, a steep climb down just inside the entrance acted as a natural deterrent to frequent visitation. In any event, it has only been open to human entry since the quarrying operation in the 1871. The result of this fortuitous set of circumstances is that the cave has not been heavily traveled or vandalized over the years. The *Illinois Natural Areas Inventory* describes the “Natural Quality of area #784” as “Grade A, rarely visited, very little vandalism”. It remains today as a remarkably well-preserved example of its type.

Paleontology

No significant paleontological material has been positively identified from Twin Culverts Cave. Bone deposits are known in the system, especially in a side alcove located at the base of the entrance ladder. They have not been investigated as to species and age. KCI intends to encourage qualified paleontologists to study any paleontology deposits that may be discovered either in the cave or on the surface of the nature preserve.

Mineralogy

Cave minerals, or speleothems, in the cave are described by two authors.

The Chapman account quoted in the previous section is the most intriguing: “.....they discovered a small cave in which were found lime carbonate drippings in the form of stalagmites and stalactites. Many of these are of imitative forms and can be imagined to be petrified human beings or animals.” White (1973) also describes: “In some areas, instead of dissolving limestone, the water has deposited flowstone and dripstone, as well as some unusual calcite (?) crystals.”

A second group of features found in the cave is formed by solution of the parent rock. These unusual forms are known as speleogens. A paraphrase from White (1973) describes them well: “Features that are related to the development of the horizontal passages include exceptionally well developed pendants and scallops. Another notable feature related to the genesis of the cave are thin discontinuous chert layers that stand out in relief because the surrounding limestone has been completely dissolved, and which form false ceilings in one part of the cave. These features offer outstanding clues to the formation of the cave.”

Initial documentation and continued monitoring of these features with good quality photographs will be a priority project for the KCI. Study by qualified researchers to determine the exact mineral makeup and possible age of the speleothems will be encouraged. Interpreting the clues for cave development provided by the speleogens will also be a continuing project.

Hydrology

Picken, Bowles, Nelson and McFall (1980) describe Pike Co. quite accurately. “The branching and rebranching tributaries that cut into the uplands along the main valleys of the Mississippi and Illinois Rivers have shaped much of western Illinois into a landscape of bold bluffs, deep hollows and narrow upland prairies. The region has been sculptured primarily by the erosive effect of running water during the Pleistocene era.” Topography of the site consists of rugged dissected terrain with a relief from approximately 520 to 620 feet above sea level. Precipitation usually is 36 to 38 inches annually with the largest portion occurring during the growing season. The months of heaviest average rainfall are May, June, and September.

The Lincoln Hills Karst Area includes all of Pike and Calhoun counties, large portions of Jersey, Greene and Adams, and also parts of Adams, Browne, Scott and Greene. (See the map on page 1 of Appendix II to this plan). Extensive Mississippian age limestones representing several distinct geologic units underlie this entire area. The most prominent geographic feature in this area is the long peninsula of land formed by the converging Mississippi and Illinois Rivers. A line of karst springs located along the western edge of this peninsula bears evidence to the development of an extensive subsurface hydrologic drainage network. These springs are clearly indicated on USGS topographic maps at

places like: Salt Spring Hollow near Gilead, Madison Creek Cave Spring, McNabb Hollow Cave Spring, Indian Creek Spring and The Cave In near Hastings Landing. Twin Culverts Cave may be the best known, but it is clearly not the only cave in the area.

Most surface water in karst landscapes is transmitted to the subsurface through sinkholes. The Salem Plateau Karst Area found in Monroe County, Illinois is a classic example of this type of terrain. See map on page 1 of Appendix II to this plan. Some portions of the Lincoln Hills Karst exhibit this type of extensive sinkhole development. More commonly, the transfer of meteoric waters to the subsurface in the Lincoln Hills Karst Area occurs as water is “lost” through cracks in limestone exposed beneath the floor sediments of small and intermittent surface streams.

Two of these small intermittent surface streams converge at the Twin Culverts Cave Nature Preserve. The presence of water within the cave is well described by White (1973): “..... the large pool near the entrance may be connected to and fluctuate with the level of the intermittent stream outside the cave. There are small pools and muddy areas deep within the cave, fed by water descending vertically from the surface. In four places where vertical seepage has intersected the cave, the water has enlarged the passage by solution of the walls. These widenings, which might be likened to ‘shower stalls’ are relatively recent and are actively enlarging, and are unrelated to the genesis of the main, linear cave passage. Features that are related to the development of the horizontal passages include rock pendants and scallops, which were formed by relatively fast-moving water. These pendants and scallops are exceptionally well developed, and along with extensive deposits of stratified sediments, they offer outstanding clues to the formation of the cave.”

Picken, Bowles, Nelson and McFall (1980) state that: “Inside the cave there is a pool near the entrance that fluctuates from a shallow pool to nearly five feet deep.”

Moorehouse, LaGessee, and Corgiat report in 1998 that the subterranean lagoon in the cave is spring fed and sometimes floods to the ceiling.

Warnock (1971) reports, “A spring flows out of the hillside, apparently from the cave, and into a nearby brook.” The rise pool to this spring is obvious today just below the ford in the roadway as one approaches the lower culvert. The spring is perennial and according to neighbors has never been known to go dry.

The vertically descending waters and fluctuating pool levels described above quite likely communicate with and ‘resurge’ cave-transported waters back to the surface through this spring. A possible explanation for these fluctuations in pool level might be back-ponding from construction debris causing breakdown blockage lodged between the collapsed entrance area and the spring. At extremely low flow conditions the pool will shrink down to not much more than a puddle. A strong active stream can then be seen flowing into the upper end of the pool. A photo of this event appears in Appendix III.

Placing non-toxic dyes at sink points in the valley above the cave would provide information for a more comprehensive understanding of the subterranean drainage of the area. The Ozark Underground Laboratory (OUL) has conducted such studies in the Pautler Cave Nature Preserve in Monroe Co. IL with funding from the U.S. Fish and Wildlife Service (Aley *et al.*, 2001). The KCI will be pursuing grant possibilities for research at Twin Culverts Cave in the future. Collecting water samples for quality analysis will also be included in this effort. Funding is now available to begin these efforts at both the cave and the spring.

Speleology

Caves of Illinois, by Bretz and Harris (1961), have long been the definitive source for information on geologic processes resulting in cave formation (speleogenesis) in Illinois. They visited Twin Culverts Cave briefly during the course of their study. Solution of limestone by percolation of slightly acidic ground water along existing rock fractures is accepted by all researchers in the field as the dominant formational process responsible for opening spaces large enough to allow entry by humans into the underground environment. In short, a combination of limestone and water will make caves.

Two primary subsets of this process are currently accepted. One is named phreatic. This term describes large volumes of slow moving water that comprise the majority of ground water resources. These zones of complete saturation occur deep below the surface of the current overlying landscape. A second process is named vadose. This process occurs much closer to the surface of the land, most commonly just at or slightly above the current ground water surface. These shallow systems form complicated dendritic systems that transport comparatively small volumes of water very quickly to karst springs, or resurgences, along the banks of deeply entrenched surface streams. An analogy of the two systems would be deep-water lakes, as opposed to shallow, fast flowing streams. Over time, both systems transport large amounts of water, but in a very different fashion. In a subterranean environment each system will form a very different type of cave structure.

Carlsbad Caverns in New Mexico and Anvil Cave in Alabama are classic examples of deep phreatic cave formational processes. Equality Cave in Illinois is also believed to have been formed by this process. Mammoth Cave in Kentucky and Meramec Caverns in Missouri are classic examples of vadose cave formation. Pautler Cave and Illinois Mammoth in Monroe Co. are also good examples of vadose cave development.

Bretz and Harris (1961) were strong advocates of phreatic style cave development. White (1973) paraphrases their work in his description of the cave, “Twin Culverts Cave developed before the present topography, and its formation had no relationship to the existing terrain. Apparently the cave was once a major conduit for water flowing near the water table.”

The cave is clearly a major stream channel. It is formed not that far below the current surface, and forms a linear subterranean conduit that runs parallel to the overlying valley on a course that culminates at a surface spring. All of these factors are recognized by current researchers to be prominent features of a vadose type cave development. Picken, Bowles, Nelson and McFall (1980) illustrate this relationship with a topographic overlay of the cave map. An updated rendition of this map appears on page 8 of Appendix II to this plan.

At the present time, just over 1,000 feet of cave passage is accessible to human entry in Twin Culverts Cave. Wall scallops noted on the map of the cave can be measured to determine the flow velocity of the water involved in forming this passage. Dye tracing can determine long distance water routes flowing beneath the currently accessible cave passage. Investigating these clues should provide much more information toward solving this interesting puzzle. Is the cave vadose or phreatic in origin?

Archaeology

Since the man made entrance has only become accessible during historic times, it seems unlikely that the cave interior was used by pre-Columbian cultures. There are, however, two surface features of the preserve that may have attracted prehistoric visitors. One is the fresh water spring located on the banks of a surface stream that often goes dry. The second is the mention of chert exposures in the ceiling of the cave. Chert, or flint, was used extensively for tool making by pre-Columbian cultures. Some archaeological material is known from the immediate area. A small (15cm diam.) flint scraper was noted during a visit in 2002 by Coons and Capocy, KCI.

The twin culverts constructed at the site certainly provide a very interesting cultural and architectural resource. The same masons built the beautifully preserved Pike Co. courthouse. Some of the adjacent area may contain historical material associated with this construction. KCI intends to provide access to qualified archaeologists to study any cultural materials (historic or prehistoric) associated with this property.

MANAGEMENT PLAN

DEDICATION as TWIN CULVERTS CAVE NATURE PRESERVE

The Nature Conservancy (TNC) has owned and maintained the property since 1975. It was dedicated as an Illinois Nature Preserve in 1998. Dedication does not change ownership. It is an irrevocable legal document that states that the property's highest and best use for all time is preservation. Enforcement of that dedication is through The Illinois Nature Preserves Commission (INPC). Currently, INPC consults with TNC on management policies. The Karst Conservancy of Illinois (KCI) is a privately formed land trust with a large committee of advisors. Each of these committee members is a professional in a given field of research. The Twin Culvert property contains resources of interest to each of these fields. In addition, the directors of the KCI are particularly well versed in the field of speleology. It is hoped that in the future, this body of additional expertise will be able to assist greatly with overall management decisions that are made in regards to the Twin Culverts Cave Nature Preserve.

ACCESS POLICIES

The surface of the property has public access via a graveled county road, which passes through the twin culverts during dry weather. No public access parking is provided, but ample room for vehicles exists on the shoulder of the county roads in the area. Off road vehicles will be allowed access only along this existing corridor. Preserves within the INPC structure are normally considered to be open to public access by foot, at least on the surface.

Access to the interior portions of Twin Culverts Cave is by permission only. Visitation must further spelean research and education. Mr. Mark Jones is the Ag instructor at the Pittsfield High School. He is currently serving as a director to the KCI and has agreed to act as caretaker for the property. He will organize and supervise cave trips for mapping, photo-documentation, biology, paleontology, groundwater studies, monitoring, education efforts and other valid research. The Illinois Nature Preserves Commission (INPC) has further agreed to inspect Twin Culverts Cave Nature Preserve at least every other year.

The entrance to the cave has been gated to control access. A 10 foot long ladder has been installed in the entrance shaft to provide for safer access to the cave. The project was accomplished as a cooperative effort that included members of The Nature Conservancy, the Illinois Nature Preserves Commission, the Illinois Department of Natural Resources, the Illinois Natural History Survey, and the Mark Twain Grotto of the National Speleological Society. The gate was installed in order to protect the cave from vandalism and provide undisturbed habitat for the endangered bat, *Myotis grisescens*, known to

frequent the interior. Photographs of the project are included on pages 1&2 of Appendix III to this plan. Visitors may be required to sign a release attesting to their relevant expertise and willingness to forgo any injury claims that they may have as a result of their access to the interior of the cave.

Management Strategies

The National Speleological Society (NSS) currently lists affiliations with more than twenty-five independent cave conservation groups. Each maintains a written management plan for all individual properties. All of these plans operate on one common assumption: When managing a cave, one cannot simply assume that a written management plan will always be effective in anticipating all contingencies. Evaluation of the desirability and practicality of various monitoring strategies should always be an option.

A quote from the NSS Example Management Plan authored by T. Engel (2004). paraphrases: “The purpose of a management plan is to describe what is on a property and how it should be managed. A plan is not a static document that once written is placed on the shelf and forgotten. It is a document that is to be used and referenced on a regular basis.”

Management strategy considerations at Twin Culverts Cave Nature Preserve have been an ongoing concern since the cave was first recognized as a significant sight by Warnock in 1971. Since then, at least four different management plans have been presented. White (1973), representing the Illinois Natural Areas Inventory, includes a Management section in his report. Walkington (1978) wrote a more extensive Master Plan on behalf of The Nature Conservancy, not long after the property was purchased for preservation. An extensive Master Plan was also prepared by Picken, Bowles, Nelson and McFall (1980). Their work is outlined under the guidelines for the *Rules for Management of Illinois Nature Preserves* and is believed to have been written in a cooperative effort with the INPC sometime after the work by Walkington. Another short, unauthored, document written in 1992 appoints Dr. John Warnock of WIU as “principal preserve custodian”. The most recent effort was prepared by Moorehouse, LaGessee and Corgiat in 1998 and forms the basis for this update.

In general, all of the existing plans are in agreement. A section of the work by Walkington is entitled *Objective for Preservation*. It offers a very good paraphrase for all of the work done to that point:

“Twin Culverts Cave has been acquired and set aside for the following purposes:

- 1) To protect and preserve unique geological and biological features of Illinois natural diversity.
- 2) To provide an outdoor laboratory for students of higher education involved in fields of ecology, biology and geology.
- 3) To provide for an opportunity to conduct advanced research into cave fauna, flora and geologic features.”

Each of the previous works hold to these basic precepts, although there are variances in the approach that each suggests in order ensuring success. Entry into the cave is one of the primary points of confusion. Some authors feel that the entrance area should be “modified to improve safety conditions”. All agree that access should be by permit only. Some feel that an entrance gate would be a desirable addition. Others feel that it would be impractical and simply attract unwanted attention and vandalism.

Completion of a solid, but friendly gate in 1998 has settled much of this debate. Surface approach to the cave is now a safe and simple walk up a path from the roadbed. Entry is only accomplished with a key. A ladder has been installed to negotiate the slippery interior entrance slope. The gate has not been either breached or vandalized since construction was completed. This improvement would seem to have solved most of the debatable management issues in a single decisive project.

This document is presented as an update to support each of the plans that have been written in the past. It is hoped that a more contemporary review of management strategies will result in a more comprehensive and multi-disciplinary approach toward managing the Twin Culverts Cave Nature Preserve.

Surface Management

The surface of the preserve is currently administered under the existing INPC *Rules for Management of Illinois Nature Preserves* (1994). It is a well-crafted document that extensively defines the intent to preserve the area for perpetuity. Tenants of this plan include, the restoration of grassy areas to native vegetation and elimination of invasive species. Access will be open to the public. Camping is prohibited within the boundaries of the preserve. Firearms, including paintball, are prohibited within the preserve. Explosives, including fireworks, are prohibited within the preserve.

Local volunteers have recently organized to restore the northern culvert, owned by The Nature Conservancy, to repair missing stones. In cooperation with TNC, volunteers have also developed a small picnic area with a single picnic table placed under an oak tree at the base of the hill to the northeast of the culvert. This small area, about 20 X 20 feet in size, will continue to be maintained by local volunteers for use as a picnic area.

The natural communities surrounding the cave entrance will be managed in a manner which resembles presettlement conditions. Exotic weeds will be controlled as necessary. Prescribed fire will be used to maintain the native vegetation of the prairie and open woodlands. Visitor use will be monitored to ensure that it does not have a negative impact on the cave or the surrounding areas.

Cave Management

Large bat populations were observed at Twin Culverts Cave by researchers in the early seventies. This was the initial impetus toward establishing protection for the area. The occurrence of the endangered gray bat, *Myotis grisescens*, was a prime consideration in this effort. Although sightings of this species are in great decline, there have been occurrences in recent years. All efforts should be made to provide a safe haven for this resident in future. The species is reported in the literature as a migrant through the area. Warnock (1971) states: "Gray bats use the cave mostly during September and October while migrating from summer roosts to winter roosts. Their whereabouts during the period November through August are little known."

From more recent monitoring efforts at the sight, Mr. Joe Kath (IDNR biologist) concludes: "Actually, gray bats are doing very well - the FWS may even consider a list change because population recovery goals have been met. We have documented only small numbers of bats using this cave. Use is quite sporadic and we do not consider this cave a significant hibernacula or nursery colony for any of the species listed, the cave was always an outlier. My guess is that if there were indeed hundreds in Twin Culvert at some point in time.....with frequent visitation/disturbance/trespass, the animals simply moved to more suitable hibernacula. In that light, I would have no problem with a spring (as well as winter and summer) visit as long as the number of individuals was limited/experienced."

Standard cave management strategies recognized by the NSS include photo-monitoring, water quality monitoring, and periodic census taking of indicator species. In order for degradation to be noted, it is important to first establish a baseline condition. Currently there is no known water quality data from Twin Culverts Cave. Research to increase knowledge of each of the resources described in this document will be encouraged.

Educational trips under the supervision of a skilled and qualified trip leader will also be initiated. A pool of dedicated and experienced cavers is available within the structure of the National Speleological Society. KCI supports the implementation of a leadership program to be organized by a cooperative effort with NSS grottos in the area.

Based on these considerations, the following calendar will be suggested for entry into Twin Culverts Cave:

January 1 - March 15, limited entry for research, education and monitoring purposes.
March 15 - May 15, limited entry for bat census, monitoring and additional research.
May 15 - August 15, entry for research, restoration, monitoring and education.
August 15 - October 30, limited entry for bat census taking purposes ONLY.
October 30 - December 31, limited entry for research, restoration and monitoring.

Another major concern at the preserve is the question of what to do in case of an underground accident to a visitor entering the cave. Fortunately a well-tested system for cave rescue is already in place. Many of the NSS organized cavers in the area are graduates of the National Cave Rescue Commission. These highly qualified individuals provide a pool of the most experienced cave rescue personnel to be found in the nation. In the event of an in-cave accident, this group should be contacted FIRST at the following phone #: 812-388-6917

Scheduled Management Tasks

KCI intends to implement the following management tasks at Twin Culverts Cave. The organization will seek out volunteers to implement the following projects. Mr. Mark Jones, site caretaker, will oversee the day-to-day management of the property.

- 1) Most of the graffiti interior to the cave has been removed. Removal of a huge volume of creosote impregnated lumber and RR ties has also been accomplished. Future trash removal from the property, both interior and exterior to the cave, will also be scheduled on a regular basis.
- 2) The gate will be inspected for vandalism on a regular basis.
- 3) The lock on the cave gate will be replaced periodically, to ensure access control.
- 4) Census taking of bat species was initiated by the IDNR in 1996. Mr. Joe Kath and associates continue with this valuable ongoing project. In addition, the invertebrate populations of the cave should be more extensively inventoried and monitored
- 5) A photo-monitoring program will be instituted to assess both human impact and natural changes within the interior of the cave.
- 6) Water quality monitoring of the subterranean stream will begin as soon as possible. Parameters will include total coliform, turbidity, pH, specific conductivity, temperature, triazines, optical brighteners, dissolved oxygen, and total petroleum hydrocarbons.
- 7) The property lines and corner pins will be located and INPC signs maintained.
- 8) Exotic flora will be removed as needed. Recommendations for prairie and/or forest restoration will be considered.
- 9) Limited numbers of educational trips lead by qualified individuals will be implemented.

The documentation included with this report is intended to provide preliminary support for each of these projects. KCI will seek out qualified individuals to continue with each of these efforts.

FUTURE OPTIONS

TNC has expressed intent to transfer its ownership of the Twin Culverts Cave Nature Preserve to the KCI. Designation by the Illinois Nature Preserves Commission will remain in effect in perpetuity. It is intended that a cooperative effort amongst a larger group of qualified individuals and volunteers will establish a more comprehensive understanding and appreciation for this most unusual of natural resources. In the unforeseen event that KCI should ever dissolve, they would seek out one of the like-minded cave conservation organizations affiliated with the National Speleological Society to accept ownership of the property.

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