Special Area Management Plan

Wesley Chapel Special Area

Orange County, Indiana
Brownstown Ranger District
Hoosier National Forest

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Abstract: This document describes management actions to be pursued for the Wesley Chapel Special Area.

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Location

The Wesley Chapel Special Area is a 187.8-acre tract of land located on the Hoosier National Forest in western Orange County, Indiana. The area is situated approximately four and one-half miles southwest of Orleans and two miles east of Orangeville. The legal description is Township 2 North, Range1 West, Section 9, East 1/2. The area receives its name from the Wesley Chapel Church, which is located approximately one-quarter mile to the north (Appendices A and B).

Purpose of Special Area Designation

The Hoosier National Forest has designated Special Areas identified in the Land and Resource Management Plan (USDA 1991). These areas include "unique or unusual ecological, botanical, zoological, geological, scenic, historic, prehistoric, and other areas which merit special recognition and management. Management of these areas will emphasize the protection, perpetuation, or restoration of their special features and values" (USDA 1991). The Wesley Chapel area is designated as a Special Area (Management Area 8.2) (USDA 2000).

Wesley Chapel Gulf is designated as a National Natural Landmark due to its impressive geologic features. As Indiana University geologist Clyde Malott (1952) wrote "The Wesley Chapel gulf, the rise and sink of underground Lost River within it, and the network of cavernous routes of underground Lost River west of the gulf constitute the most interesting features in the Lost River region." Several karst features are represented in this unique area. They include the gulf itself, which "provides a rare glimpse of the Lost River on its subterranean path" (USDA 1994); swallow holes, sinkholes, and caves.

Historical Background

General

Wesley Chapel Gulf was designated as a National Natural Landmark on August 1, 1972. The landmark site encompasses a total of 33 acres (Appendix C). Martha Mosier of Indiana University proposed the site. Her proposal included the entire Lost River karst area, while Richard Powell of the Indiana Geological Survey specifically identified Wesley Chapel Gulf as having high natural landmark potential (USDI 1972). The National Registry of Natural Landmarks is administered by the USDI National Park Service and recognizes sites that provide significant illustrations of America's natural history (NSS 1972).

The USDA Forest Service recognized the uniqueness of Wesley Chapel area and acquired the property in 1997 through a land exchange with U.S. Gypsum Co. The area was designated as a special area (Management Area 8.2) in Forest Plan Amendment 5 on November 22, 2000.

Karst Resources

Research

The gulf has been a subject of local interest for more than two centuries. In the early days it was a source of water supply for the community and was known as Shirley Gulf. The USDI Geological Survey topographic map (Georgia and French Lick quadrangles) lists the gulf as Elrod Gulf. It was first

discussed in literature by Richard Owen (1862) as Wesley Chapel Gulf. Since that time the gulf has received a great deal of interest and study. Elrod (1876), Beede (1911), Malott (1922), and Davis (1930) prepared papers that discussed Wesley Chapel Gulf. Geologist Clyde Malott repeatedly explored the Wesley Chapel Gulf area and published a summary of his findings on the gulf and its associated cave networks as well as the adjacent Lost River system in 1932.

Since the 1930s numerous studies have been completed on the Lost River system as a whole including the Wesley Chapel area. Studies of the area have been completed by the Forest Service on vegetation types and interpretive and recreation opportunities (USDA 1994, Stafford 1994). Numerous other individuals have researched the Lost River ecosystem, including Hobbs (1973), Murdock and Powell (1968), and Powell (1987) to name a few. Other research that includes references to Wesley Chapel Gulf or its associated caves has been conducted on mud stalagmites (Malott 1933), karst systems (Malott 1945), swallow holes (Malott 1952), caves (Powell 1961), cave formations (Reeves 1967), and sedimentary formations (Conner 1994). The National Natural Landmark status of Wesley Chapel Gulf was analyzed by Ingham (1966), Powell (1970), NSS (1972), and USDI (1972). Numerous other articles have appeared in newspapers and magazines that discuss this unique area.

Biological surveys have been conducted within the caves of Wesley Chapel Gulf. The fauna in Elrod Cave was recorded by Krekeler (1958) and Barr (1960). Dr. Julian Lewis completed a subterranean fauna inventory of the Hoosier National Forest, which included the Wesley Chapel Special Area (2002), a biological survey for the Lost River cave and karst systems (1994), and an inventory of potentially endangered or threatened subterranean aquatic invertebrates for Indiana (1993). Hobbs (1973) surveyed the fauna in the Lost River system. Studies have also been completed on the northern cavefish by Packard (1888), Woods and Inger (1957), Hobbs (1973), and Keith (1988).

University of Southern Indiana Geology Department recently conducted an investigation of the alluvial sediments within Wesley Chapel Gulf. Sediment core samples were taken and analyzed to determine the thickness of the alluviated floor. The depth to bedrock was 34 feet within the gulf. The researchers also described the stratigraphy and sedimentology of the alluviated floor. The sediment cores revealed the presence of two distinct soil units. The lower unit shows evidence of frequent flood events, while the upper unit suggests short-lived depositional hiatuses, which indicates less frequent flood events. The changes in colors and particle size, and general stratigraphic architecture at similar depths within the core samples indicate probable climatic influence on sediment deposition of the lower unit and anthropogenic influences on sedimentation of the upper unit (Jones et al. 2001). The Paleo Research Institute is currently (September 2002) conducting pollen analysis on these soil cores to determine long-term changes in forests.

In August 2002 soil samples collected from within Wesley Chapel Gulf were analyzed using an insecticide screen and multi-residue screen. Soil samples were collected from between 0-24 inches and 48-72 inches. All herbicides and insecticides that the samples were screened for were below detectable levels (A and L Great Lakes Laboratories 2002).

Gulf Formation

A gulf is always associated with an underground stream, and its development has been dependent upon the collapse of the superincumbent rock over the underground stream and the solution and removal of the fallen rock. Gulfs have their beginnings in collapse sinkholes over an underground stream. When a collapse feature has its steep-walled perimeter enlarged to such an extent that it possesses a distinct alluviated floor in which an underground stream rises and sinks, then it may be called a gulf. The alluviated floor is usually marked by stream-formed channels that pass from the rise to the swallow hole or series of swallow holes where the water is returned to the underground channel system (Malott 1932).

The Wesley Chapel Gulf and its deeply alluviated floor of clays and silts clearly indicate the destruction and removal of approximately 720,000 cubic yards of native limestone. The width of the gulf is far greater than any known section of underground Lost River. The gulf is not merely a fallen-in cavern whose collapse rock has been dissolved away. The shape of the gulf and its present relations to the underground watercourses suggest something concerning the nature and method of its development. It probably was initiated as one or more collapse sinkholes of rounded outline over a broad and weakened portion of the underground system. The collapsed rock obstructed free passage of the waters and their energies were concentrated about the collapse rock that in time undermined the walls about the collapse depression. Further collapse increased the perimeter of the initial collapse depression. If two or three collapse areas were formed in a row, their perimeters in time were merged to form a large and elongated depression with semicircular ends, such as Wesley Chapel gulf possesses. Horns of rock would extend out in the depression for a time, but eventually they would melt away through enhanced weathering and solution. One such horn of rock, tumbled and broken, still extends into the floor of Wesley Chapel Gulf (Malott 1952).

Past Land Uses

The majority of the area has been cleared and in the recent past used for grazing both in the gulf and surrounding area. The property was managed as a typical family farm from the 1900s to 1990s. Lands were cultivated for crop production. The grazing ceased in 1996 when the Forest Service acquired the property, and there has been no active management since that time other than custodial care.

The gulf and area immediately surrounding it, as well as the area around the old farmstead, were heavily logged in the past. The vegetation removal could be described as a high-grade operation, where the highest value and quality tree species were removed.

When given permission by the previous owners, the gulf and its associated caves had been visited by select groups for recreational, scientific, and educational purposes.

Existing Conditions

General

The Wesley Chapel area contains unique karst features described herein. The property is an old farm and homestead with approximately 149 acres of abandoned cropland and pasture that are still in an open condition, approximately 30 acres of timber partially located on a ridge, and the 8-acre gulf. Low rolling hills, numerous caves and sinkholes, and a scenic knob complement the property. The old home

and outbuildings have been removed as well as interior fencing and assorted trash, however, the exterior fencing remains. The old driveway is still in good condition, and offers access and parking to visitors. The neighboring area is agricultural and very rural, with some Amish neighbors using primitive farming methods. A power line right of way crosses the property on the western boundary.

Karst Resources

The term karst implies the processes and phenomena associated with the dissolution of bedrock by water. Karst landscapes are characterized by closed depressions of various size and arrangement, disrupted surface drainage, and caves and underground drainage systems (White 1988). Karst terrain is typically pictured as an area containing sinkholes, sinking streams, and caves. The term is derived from an area in northwestern (former) Yugoslavia, called the Carso plateau, where karst features have their most extensive and complex development (Powell 1961).

Wesley Chapel Gulf - Wesley Chapel Gulf is one of the most impressive geological features along the Lost River. It is the largest gulf located within the Lost River system. A gulf is a steep-walled karst feature with a flat, alluviated floor in which an underground river rises and sinks. The Wesley Chapel Gulf is located on a direct line between the main rise (located two miles west) and sink (located 5 miles east) of the Lost River (Appendix B). As a surface feature, the gulf is entirely within the St. Genevieve limestone layer. The Lost River chert, which is near the base of the St. Genevieve, is exposed in places at or just above the level of the alluviated floor of the gulf (Malott 1932).

Wesley Chapel Gulf is an abrupt steep-sided depression, which resembles a large peanut shell. The gulf measures 1,075 feet in length and averages approximately 350 feet in width. It includes approximately 8.3 acres as measured from the rim, while the floor of the gulf is around 6.1 acres in size. The gulf walls vary in height from 25 feet on the northwest side to approximately 95 feet on the southwest side (Malott 1932)(Appendix D).

The Lost River rises from a 125-foot rise-pit called Boiling Spring located at the southern end of the gulf. The artesian waters rise from the main subterranean course of Underground Lost River. The rise pit overlies a water-filled opening about 3 feet in diameter that slopes downward to where it intersects a larger passage about 160 feet from the rise pit and about 45 feet below normal pool level. The large passage is 10 feet high, 30 feet wide, and extends northeastward at least 200 feet (Powell 1987). The waters in Boiling Spring are forced to rise 20 feet or more from the submerged passage during low-water periods, and as much as 50 feet or more during flood periods (Malott 1952). During low-water periods the Boiling Spring pool is 25-30 feet deep, azure blue in color and perfectly calm (Malott 1932). There are two primary drains for the water from the rise pool, which vary over time depending on the amount of sediment and debris blocking them. For both drains the water flows for a short distance and then either disappears through the mud-covered talus rock at the base of the south wall of the gulf or drains along the east wall.

During high-water periods the water increases in volume and becomes muddy and silt-laden as it rises turbulently from Boiling Spring. The pit fills to overflowing and the water is discharged into the floodwater channels. The channels are littered with swallow holes (over 100 have been recorded). Each of the swallow holes is successively filled to capacity. Floodwaters primarily enter the underground system immediately south of Boiling Spring through chinks in the limestone wall, through other

openings in the southern and western walls of the gulf, and through several swallow holes located at the northwest end of the gulf.

Following very heavy rains, the gulf floor may become completely inundated by up to five feet of water. At such times the waters issuing from Boiling Spring are violently turbulent and great boils of rising waters discharge from it. As much as 4,000 - 5,000 cubic feet per second issue from the underground course of Lost River (Malott 1952). The flood occurs because water enters from Boiling Spring faster than it drains out through the numerous swallow holes (Hobbs 1973). Malott (1932) suggests that the flooding occurs more on account of the limited capacity of the underground channel system west of the gulf than due to the limited capacity of the numerous swallow holes through which the waters escape from the gulf.

There is a hanging valley located on the northeast side of the gulf. Storm waters enter the gulf at this location and have caused the development of a V-shaped notch in the perimeter of the gulf (Appendix D).

The processes that have formed the gulf are still in operation and the growth of the gulf has been progressive. The gulf is a product of perimeter collapse and dissolution of the fallen rock. The enveloping underground streams are vigorous dissolving agents, which continually sap the foundation of the gulf walls. These walls are hollowed out, weak at their bases, and do not stand on solid rock. Over time, 720,000 cubic yards of rock have been undermined, tumbled in, and dissolved away, thereby creating a new level. The streaming waters surrounding the gulf are perpetually working to enlarge it into a lengthening valley expanse (Malott 1952).

In describing his Wesley Chapel Gulf explorations Dr. Clyde Malott (1932) wrote: "This miserable little stretch of the underground river route gives us but a tantalizing glimpse of a mighty cavern, whose main channel length cannot be less than eight miles. Inadequate as it is, it is a sample of a big cavern in the making... coursed by a dangerous river. It presents a forbidding, mysterious, fearful picture to the senses and it is impressive only when conceived as the underground conduit of a large stream more than eight miles in length and 60 to 150 feet beneath the upland surface which feeds water to it through... nondescript inlets."

Elrod Cave - Elrod Cave is accessed through a round, steep-sided, collapse sinkhole 90 feet in diameter. The cave is entered via an upper level passage with massive mud banks where the floodwaters of the underground Lost River drop sediment (Lewis et al. 2002). The main cavern extends southeast for 350 feet and varies in width from 40-125 feet. Malott (1932) believed the cavern also extended westward from the sinkhole, since the circular sinkhole appeared to have been formed by the collapse of a cavern roof. This has now been confirmed by recent surveys. The sinkhole forming the entrance of Elrod Cave is visible from beneath in Wesley Chapel Gulf Cave (Lewis et al. 2002). The passages of Elrod Cave are mud-covered and contain numerous shallow trenches that lead into a deep funnel-shaped pit on the north side. The pit is around 35 feet in diameter. Along the trench banks many mud stalagmites have developed. Numerous stalactites hang as pendants or in large clusters from the cavern roof. Several localized drop pools have been found which contain cave pearls. There is an opening in the north wall of the cave passage that leads down for 20 feet to a muddy cavern channel that enters from the east (Malott 1932). The lower level of the cave is an active stream passage and is one of the routes the Lost River takes around the dam formed by the collapse creating the gulf (Lewis et al. 2002). The cave map

published by Malott (1932) shows a few hundred feet of passage, a newer map that is currently unpublished significantly extends the length of this cave (Lewis et al. 2002). Due to recent survey work, this cave is now known to be hydrologically connected to the larger Lost River system and may be connected by additional survey work (Lewis et al. 2002).

Boiling Spring Cave - This is a short cave located within Wesley Chapel Gulf with the entrance over the Rise of the Lost River. The passage can be followed back and downward for about 100 feet over and through broken limestone. Water from Boiling Spring reaches this cave only during extremely high-water periods.

Wesley Chapel Gulf Cave - This cave is located within Wesley Chapel Gulf and provides direct access to the Underground Lost River. This cave is accessible through a small opening, which leads steeply downward between the wall of the gulf and the talus rock underneath. The floor of this north-south section of the subterranean Lost River lies approximately 30 feet below the level of the alluviated floor of the gulf. The water that flows through these channels enters primarily near the south end of the gulf (Hobbs 1973). This portion of the cave system parallels the western edge of the gulf and is rather simple. The route is direct and has connecting channels. The total length of the main passage and the connecting channels is 1,440 feet (Malott 1952).

The southwest section of the underground system is larger and more complex. This section parallels the gulf at first, then proceeds in a westerly direction away from the gulf, although the course is not direct. "It follows a zig-zag course, alternating chiefly northwest and southwest in conformity to two major intersecting joint systems. It is a complex channel system consisting of many minor leads which leave and return to, or branch off from, the main channels. Also, it is developed at two distinct major levels with minor connections at still other levels" (Malott 1932).

When Malott surveyed the Wesley Chapel Gulf Cave the total length of the entire system including the network of passages was determined to be 5,175 feet (Malott 1932). The length of this cave has been significantly extended by recent cave surveys. Two additional entrances have been discovered. The floor of one of these entrances was tunneled extensively by cavers and reached the underground Lost River. The cave passages that were entered via this entrance as well as another nearby artificial entrance (in the bottom of an adjacent sinkhole) were subsequently connected to Wesley Chapel Gulf Cave (Lewis et al. 2002). More than sixteen miles of cave passage have now been mapped and more is currently being explored. The passages include large river passage as well as a variety of overflow routes. This cave system is presently the third longest in Indiana and is very complex. During the recent cave survey efforts a breakdown was discovered that represents the underside of the Elrod Cave entrance sink. This cave is separated from the main Wesley Chapel Gulf Cave by only a few feet (Lewis et al. 2002).

Wesley Chapel Gulf Cave contains numerous potholes and solution ripples or facets, mud stalagmites, stalactites, scallops, flowstone, rimstone and exposures of the Lost River Chert, which make it not only aesthetically interesting but demonstrate many important facets of the geology and hydrology of the Lost River karst area (Hobbs 1973). Caution should be used in exploring this cave because of several deep pools of water and the ever-present danger of flooding by storm waters that enter the cavern system. This cave floods during all but the driest months of the year.

Swallow holes - Swallow holes are sites where the water from a sinking stream enters the ground. During low-water flow conditions water enters the bed of Lost River and is conveyed through swallow holes into the groundwater system. During higher flow conditions, the capacity of some of these swallow holes is exceeded. The excess water will flow above ground. During these high-water conditions, the flow through some swallow holes reverses and they discharge waters from the groundwater system back to the surface. The floor of Wesley Chapel Gulf is littered with swallow holes, especially within the west floodwater channel. Malott (1932) located over 100 swallow holes in the gulf floor.

Sinkholes - A sinkhole is a depression in the land's surface. Most sinkholes are characterized as points where there is direct and open water and sediment flow from the surface into the groundwater system. Numerous sinkholes are located within the special area. The majority of the sinkholes had trash including metal, wood, concrete, glass, and household items within them. They were cleaned out and restored to natural conditions in the summer of 1999.

Cave Fauna - Studies of the cave fauna within the Wesley Chapel Gulf area have been occurring since the late 1800s. The Lost River Cave System, including Wesley Chapel Gulf Cave, Elrod Cave, Hudelson Cave and Tolliver Swallowhole Cave have a total of 20 species of obligate subterranean species known. With the exception of three of those species, all are accounted for in Wesley Chapel Gulf Cave and Elrod Cave. Areas containing 20 or more obligate subterranean species are considered to be "global subterranean hotspots". The Lost River System is only one of five such locations in Indiana J. Lewis, pers. comm.).

Elrod Cave – There are twelve obligate subterranean species known from this cave and nine of those are considered to be species of management concern. Seven of those are listed as Regional Forester's Sensitive Species (RFSS) for the Hoosier National Forest and the two others will be automatically added to the list when it is next revised.

The species list includes: Indiana groundwater copepod (*Rheocyclops indiana*) (G1), Packard's groundwater amphipod (*Crangonyx packardi*) (G3-RFSS), Northern cave isopod (*Caecidotea stygia*)(G5), Northern cave crayfish (*Orconectes inermis*)(G3-RFSS), Bollman's cave milliped (*Conotyla bollmani*)(G3-RFSS), Subterranean sheet-web spider (*Phanetta subterranea*)(G5), Cavericolous sheet-web spider (*Porrhomma cavernicola*) (G3-RFSS), Cave springtail (*Onychiurus* undescribed species) (G1), Marengo Cave ground beetle (*Pseudanophthalmus stricticollis) (=P. jeanneli*) (G3-RFSS), Young's cave ground beetle (*Pseudanophthalmus youngi*)(G2-RFSS), Cave dung fly (*Spelobia tenebrarum*)(G5), and Northern cavefish (*Amblyopsis spelaea*)(G3-RFSS) (Lewis 1994 and Lewis et al.2002).

This cave is the type-locality of the terrestrial isopod *Ligidium elrodi* and the cave beetle *Pseudanophthalmus jeanneli* (a synonym of *P. stricticollis* per T.C. Barr, pers. comm. with J. Lewis)

In addition to the species listed above, the following species were noted by Lewis (1994 and 1998), Lewis et al. 2002, and Hobbs (1973): cave cricket (*Ceuthophilus stygius*), collembolan (*Arrhopalites pygmaeus*), eastern pipistrelle (*Pipistrellus subflavus*), flies (*Megaselia cavernicola* and *Spelobia tenebrarum*), phoebe (*Sayornis phoebe*), spiders (*Cicurina pallida, Meta americana,* and *Phanetta subterranea*), terrestrial isopod (*Ligidium elrodi*), unidentified fungus gnats, and unidentified mites.

Wesley Chapel Gulf Cave – There are seventeen obligate subterranean species known from this cave and fourteen of those are considered to be species of management concern. Nine of those are listed as Regional Forester's Sensitive Species for the Hoosier National Forest and the five others will be added to the list when it is next revised.

The species list includes: Weingartner's cave flatworm (*Sphalloplana weingartneri*) (G2), Northern cavefish copepod (*Cauloxenus stygius*)(G1- RFSS), Packard's groundwater amphipod (*Crangonyx packardi*) (G3-RFSS), Indiana cave amphipod (*Crangonyx* undescribed species)(G3), Northern cave isopod (*Caecidotea stygia*)(G5-RFSS), Northern cave crayfish (*Orconectes inermis*)(G3-RFSS), Bollman's cave milliped (*Conotyla bollmani*)(G3-RFSS), Subterranean sheet-web spider (*Phanetta subterranea*)(G5), Cavericolous sheet-web spider (*Porrhomma cavernicolum*)(G3-RFSS), Indiana cave springtail (*Sinella alata*)(G3-RFSS), Carolyn's cave springtail (*Arrhopalites carolynae*)(G2), Cave springtail (*Onychiurus* undescribed species)(G1), Cave dipluran (*Litocampa* undescribed species)(G2), Marengo Cave ground beetle (*Pseudanophthalmus stricticollis (=P. jeanneli*))(G3-RFSS), Young's cave ground beetle (*Pseudanophthalmus youngi*)(G2-RFSS), Cave dung fly (*Spelobia tenebrarum*)(G5), and Northern cavefish (*Amblyopsis spelaea*)(G3-RFSS) (Hobbs 1973, Keith 1988, Lewis 1994, Lewis et al. 2002, and Lindberg pers. comm. 1999).

In addition to the species listed above, Lewis (1994 and 1998 and Lewis et al. 2002) also recorded the following: amphipod (*Crangonyx* sp.), cave cricket (*Ceuthophilus* sp.), collembolan (*Arrhopalites pygmaeus*), epigean harvestmen (*Leiobunum* sp.), flies (*Megaselia cavernicola* and *Spelobia tenebrarum*), isopod (*Caecidotea stygia*), millipede (*Scytonotus granulatus*), spiders (*Lepthyphantes* sp., *Meta americana*, and *Phanetta subterranea*), terrestrial isopod (*Ligidium elrodi*), unidentified centipede, and unidentified mites.

This cave system is immense and supports a community of obligate cavernicoles of global significance. Almost all of these species are associated with the underground Lost River and the associated riparian habitat. The aquatic fauna encountered in the underground Lost River is the most extensive found in any cave in Indiana (Lewis et al.2002).

Boiling Springs Cave - There are three obligate subterranean species known from this cave, Northern cave isopod (*Caecidotea stygia*)(G5), Packard's Cave amphipod (*Crangonyx packardi*(G3-RFSS)*,* and amphipod (*Crangonyx* sp.) however it is presumed that many others are present (Lewis et al. 2002).

In 1994 Lewis also completed cursory examinations of two springs located in Wesley Chapel Gulf, one spring was located on the north side and the other was located on the southeast side of the gulf. He recorded the following: amphipod (*Gammarus minus*), flatworm (*Phagocata gracilis*), and isopod (*Lirceus fontinalis*) (Lewis 1994). In 2000-2001 Lewis also sampled the spring at the Boiling Spring Rise Pool. He located one obligate subterranean species northern cave isopod (*Caecidotea stygia)*, no species of management concern, and the following two species isopod (*Lirceus frontinalis)* and the amphipod (*Crangonyx forbesi)(*Lewis et al. 2002).

<u>Non-Karst Resources</u>

Heritage Resources- Wesley Chapel area is located in an ecotone area formed by the junction of the Crawford Upland section and the Escarpment section of the Shawnee Hill natural region (Homoya et al. 1985). The meeting of these distinct natural areas and the related flora and fauna, along with the presence of the distinctive natural environment formed by Wesley Chapel Gulf, creates a unique setting in terms of its biology and physiography. For the prehistoric inhabitants of the area, the reliable source of water provided by the gulf would have attracted wildlife, and the diverse landscape would have provided a variety of plant resources.

In the summer and fall of 1999, an archaeological literature review and reconnaissance survey was conducted on the entire 206 acre Wesley Chapel Gulf tract (Jackson 2000 and Striker 2000).

The literature review indicated four archaeological sites had been previously documented in the area. They included a farmstead (12 Or 0575), and three prehistoric open sites (12 Or 0382-0384). This farm consisted of a house, shed, tool shed, chicken coop, pig shelter, an old barn, and a new pole barn. James and Ellen Hudleson built the house in 1900. They sold to James and Effie Elrod in 1909, who made improvements to the land and operated the farm until 1952. This site was determined not eligible to the National Register of Historic Places (NRHP) and the buildings have been removed (Krieger 1997).

Wesley Chapel is located on private land just outside the north end of the area. It was built in 1858 and was part of the Orangeville Mission (Stout 1965). This church, originally known as Bruner's Chapel, and its associated cemetery have not yet been formally recorded as heritage resources.

During the 1999 survey an additional thirteen new sites were recorded (12 Or 0612-0616, and 12 Or 0624-0631). The prehistoric sites scattered around the gulf most likely represent short-term camps established for the purpose of resource extraction. From data gathered thus far, it appears that the gulf was utilized as a source of water and possibly a source for lithic raw materials. For ten thousand years this area was intensively utilized. Occupation began in the Late Paeleoindian period, extended through the Archaic and Woodland Traditions, and ended with modern 20th century European American agricultural settlement, or from circa 8000 B.C. – A.D. 1952.

Vegetation - A plant survey was completed in the area in 1994 before the Forest Service acquired the land. At the time of the survey, the area was still actively grazed. The primary herbaceous species are weedy species including smartweed (*Polygonum* sp.), wingstem crownbeard (*Verbesina alternifolia*), aster species (*Aster* sp.), beefsteak plant (*Perilla frutescens*), ironweed (*Vernonia gigantea*), raspberry (*Rubus occidentalis*), and rose (*Rosa* sp.) (Stafford 1994 and Reynolds 1999). The presence of weedy herbaceous plants is to be expected as a result of the past disturbance.

Most of the woody species are present on the floor of the gulf or immediately adjacent to the gulf perimeter. Dominant woody species include sycamore (*Platanus occidentalis*), sugar maple (*Acer saccharum*), eastern redcedar (*Juniperus virginiana*), pignut hickory (*Carya ovalis*), shagbark hickory (*Carya ovata*), white ash (*Fraxinus americana*), American elm (*Ulmus americana),* boxelder (*Acer negundo*), and hackberry (*Celtis occidentalis*). Black cherry (*Prunus serotina*), honey locust (*Gleditsia triacanthos*), pawpaw (*Asimina triloba*), hawthorn (*Crataegus* spp), Ohio buckeye (*Aesculus glabra*), and wahoo (*Euonymus atropurpurea*) are also present in limited numbers (Stafford 1994 and Reynolds 1999).

Other plants that are common within the vicinity of the gulf include wild geranium (*Geranium maculatum*), star chickweed (*Stellaria pubera*), blue phlox (*Phlox divaricata*), pale violet (*Viola striata)*, common blue violet (*Viola papilionacea*), and sessile trillium (*Trillium sessile*) (Reynolds 1999).

Since the exclusion of grazing in 1996, cedar and scattered hardwoods are beginning to invade the open fields. The open fields are dominated by fescue (*Festuca* sp.) and broom sedge (*Andropogon virginicus*). The floor of the gulf is also still in an open forb and herbaceous condition and is dominated by ironweed.

Currently, there are no known plant populations of Federally endangered, threatened, or proposed species, Regional Forester sensitive species, or Forest species of concern within the special area.

Wildlife - No formal surveys have been completed on the wildlife in the Wesley Chapel area. During a breeding bird survey in 1998 a Henslow's sparrow (*Ammodramus henslowii*), a Regional Forester's sensitive species and Indiana state endangered species, was detected in the field at the south end of the property (Castrale 1998). During informal site visits white-tailed deer (*Odocoilus virginiana*), raccoon (*Procyon lotor*), and wild turkey (*Meleagris gallopavo*) tracks and/or scat were observed in the area. Birds that were observed or heard include American crow (*Corvus brachyrhynchos*), red-tailed hawk (*Buteo jamaicensis*), blue jay (*Cyanocitta cristata*), American robin (*Turdus migratorius*), brown-headed cowbird (*Molothrus ater)*, northern flicker (*Colaptes auratus*), and fox sparrow (*Passerella iliaca*). A common garter snake (*Thamnophis sirtalis*) was also located (Reynolds 1999).

Currently, there are no known populations of Federally endangered, threatened, or proposed animal species within the special area. There is limited suitable roosting and foraging habitat available at present for the Indiana bat (Myotis sodalis) due to the small proportion of acres that are forested as well as the lack of trees with suitable bark characteristics for roosting. Aside from Henslow's sparrow and the cave species discussed earlier in the document, there are no known Regional Forester's sensitive animal species or Forest animal species of concern within the area.

Current Recreation Use

Current recreation use is thought to be minimal although there have been no formal use studies of the area. Use estimates are based on visual observation by Forest Service staff, input from caving groups, and observation of impacts such as recent litter and worn paths. Most of the use appears to be related to the gulf feature and the caves. The Orange County Tourism Task Force is interested in this site, and Lost River enthusiast Bob Armstrong conducts tours several times a year. The area is well known in the scientific caving community and scientists can now visit without special permission since it is public land. There is likely only a small amount of use occurring from this group. The Indiana Karst Conservancy (IKC) reports that the caves do not get much recreational pressure, possibly due in part to folks not being aware that the area is open to the public. Another reason may be because the caves are not that attractive to the casual recreational caver. Elrod Cave is the most likely cave to be visited by recreational cavers because it is relatively easy to find and explore, and it does appear to get some use. The other caves are wet, require much crawling, are subject to dangerous flooding, and difficult to find. The Hoosier National Forest policy on recreational caving applies. The policy states that cave locations

are not publicized and use is not encouraged, but caves are open for exploration without special permission.

There appears be no other significant recreation use at this time. It is possible the area might also be used for hunting, camping, or gathering of forest products, but Forest Service employees have seen no evidence of these activities. There has been little evidence of depreciative behavior such as littering, loud parties, illegal ATV use, or arson. The Forest Service has not actively marketed the area.

Hoosier National Forest employees currently mow the driveway, parking area, and a path around the outside of the gulf. A standard Forest Service entrance sign has been erected at the driveway entrance.

Current Research

Research is currently being conducted in the following areas:
* Dr. Julian Lewis is conducting research on the cave fauna within the caves of Wesley Chapel Gulf.
* The St. Joseph Valley Grotto is continuing to map and survey Wesley Chapel Gulf Cave.
* The Paleo Research Institute is conducting pollen analysis on soil cores collected from the alluvial plain of Wesley Chapel Gulf.

Desired Future Condition

General

This area will preserve the unique karst features and, on a controlled basis, make some of them accessible to the public so they might better understand these special landforms. The area would offer a low level of development with minimal facilities. Vegetation would be managed for the betterment of particular species in areas where it is conducive to do so, while other areas will be allowed to follow natural processes.

Karst Resources

Maintain the existing karst system and prevent human-caused degradation. Promote maintenance of the natural condition of the gulf and cave recharge areas. Eliminate on-site detrimental impacts to the Lost River hydrologic system.

Vegetation management and soil disturbance within the suspected gulf and cave recharge areas is minimized to reduce detrimental impacts on the biology and hydrology of the karst system (Appendix E). The entrance to Elrod Cave is not visible due to vegetative screening.

Visitors will have an increased understanding of the karst resources within the area including the gulf, caves, karst features, Lost River system, and cave fauna.

Maintain habitat suitability for the array of fauna that use the gulf and cave systems. This includes habitat for northern cavefish, Bollman's cave milliped, Marengo Cave ground beetle, Young's cave ground beetle, Packard's Cave amphipod, and northern cave crayfish populations.

Non-Karst Resources

Heritage Resources - Known heritage resource sites are studied, protected from damage, and preserved for the future. Significant sites are listed on the National Register of Historic Places.

Partnerships are fostered to assist our efforts. Interpretation is provided through signs and tours. The public gains a better understanding and appreciation for these and other non-renewable forest resources.

Vegetation - Overall it is desirable to allow natural vegetative processes to proceed in the northern half of the special area (Appendix F). This portion of the property would primarily be maintained in a closed canopy, forested condition. An exception to this would be along the intersection of the county and parking lot access roads. Maintaining this area in a more open condition would allow good visibility for access into and off of the property.

It is also desirable to enhance the diversity of species present within the gulf itself and the surrounding area to better represent natural conditions. Due to past land clearing, several species are currently absent from the site that were present in the past.

The southern half of the property would be maintained in an open, early seral condition. This vegetative condition provides habitat for a variety of wildlife and plant species, including the RFSS Henslow's sparrow. The vegetation on the opening edges would be allowed to naturally succeed to eliminate the square opening edges and be more visually appealing. These areas would also provide cover for other wildlife species that utilize the opening.

Native vegetation will be used to buffer hydrologic features. The gulf, caves, swallow holes and sinkholes will have mature forest surrounding them in the long-term, which will filter sediment and reduce environmental impacts and fluctuations.

Wildlife - Continue to provide habitat for forested and openland wildlife species. Enhance habitat suitability for the Henslow's sparrow on the south end of the special area. Enhance forested conditions in the northern portion of the property by increasing the diversity of vegetative species and the amount of acres of forested habitat. Increase suitability of foraging and roosting habitat for the Indiana bat by increasing the white oak component.

Continue to allow consumptive use of wildlife, e.g. hunting, unless it is determined to be causing detrimental impacts to natural features or wildlife populations, or exposes other visitors to unnecessary hazards.

Recreation

The desired future recreation condition would be minimal development where visitors could see and learn about karst features. Facilities would be of simple design with low cost maintenance features. This action would be consistent with the expectation that budgets will continue to decline or stay flat in future years. Development would be limited to very basic facilities such as a small parking lot, short

trails to and around the gulf, interpretive signs, and overlook areas. Additional interpretive services might be provided through partnerships with other groups. The site would be designed for a relatively short stay of an hour or two to view the gulf. More adventurous visitors would also have the option of striking out on their own to explore the rest of the property, but would do so using their own skills.

Management Actions

Many of these management actions require National Environmental Policy Act (NEPA) analysis and documentation and a biological evaluation before they can be implemented. In addition, completion of the projects is dependent upon budget constraints and partnerships. These proposed management actions in no way constitute a commitment to implement.

Karst Management

Prepare cave management plans for Wesley Chapel Gulf Cave and Boiling Spring Cave. The management plan for Elrod Cave has currently been drafted and will be finalized following approval of this management plan.

Activities that could occur with minimal impacts to the biology and hydrology of the karst system include, but are not limited to, the following: tree planting, tree removal for safety and visual reasons, mowing and burning of upland vegetation, discing to prepare planting locations for seedlings, noxious weed removal, and sign and kiosk installation.

Prohibit alteration of the cave passages and entrances by humans and removal or destruction of cave features such as speleothems. Do not promote recreational use of the caves.

Remove any graffiti that is located in the gulf or caves to maintain a graffiti-free state. Remove trash from the gulf, caves, and sinkholes that is not historically significant.

Provide education materials on karst features, development of the gulf, the Lost River System, and proper caving ethics and safety considerations. Provide referrals to caving organizations for persons interested in caves and caving.

Install a NSS Contemporary Cave Use Survey register and/or other visitation monitoring devices. Inspect and replace the cave register and monitoring devices as needed.

Conduct further inventory of Wesley Chapel Gulf, Elrod, and Boiling Spring caves, including cave fauna, additional survey and mapping work, and hydrology among others. Additional in-depth cave fauna surveys should be conducted within all three caves to gather baseline data on which species are present as well as their relative abundance.

Nominate Elrod, Wesley Chapel Gulf, and Boiling Spring caves as significant caves per the guidelines established under the Federal Cave Resources Protection Act of 1988.

The locations of these caves will not be made public. Avoid human-caused alteration of the cave ecosystems and recharge area that may have detrimental impacts on cave fauna.

Coordination will occur with the power company to encourage low impact, non-chemical methods of vegetation control in the right of way in accordance with the company's existing rights.

Non-Karst Management

Heritage - Conduct an archaeological excavation of the intensive occupation surrounding the gulf. Address the prehistoric use of this distinctive landscape considering the archaeological setting as a whole, rather than focusing on individual sites. If the area or sites appear to meet the National Register of Historic Places criteria, nominate them as an archaeological district.

Continue conducting paleoenvironmental research and sediment analysis of cores taken from the gulf. Integrate that research with the archaeological work to more accurately reconstruct the past environmental conditions.

Provide public interpretation using on-site signs and brochures. Include the area in exhibits illustrating the variety of heritage resources managed by the forest.

Vegetation - Trees will be planted to accelerate the successional processes in the upland areas that will be managed in a forested condition. These tree species will also increase overall tree species diversity. Species that may be planted include white oak (*Quercus alba*) and other dry site trees. Planting is recommended in the area immediately surrounding the gulf and Elrod Cave and could continue west to County Road 350W (Thake 1999).

Site preparation will be needed to break up the fescue sod prior to planting to reduce competition for water and nutrients. This could be accomplished by discing. The silviculturist recommended that at least 900 seedlings per acre be planted (Thake 1999). The eastern redcedar would also be retained on site, even though the species would not naturally be located on this site in such abundance (Thake 1999).

Succession would be allowed to continue naturally in the remainder of the north half of the property. Planting of additional seedlings could also occur in this area if the opportunity arises, however, the areas adjacent to the gulf and Elrod Cave are the highest priorities for management.

Maintain the existing open vegetative condition in the vicinity of the intersection of the county and access roads. This area would be mowed or bushhogged on an as needed basis, most likely every 2-3 years.

No scheduled timber harvesting will occur within the area. Individual trees that pose a safety hazard may be removed. Trees may also be felled to enhance visuals around the gulf, enlarge the parking area, and for other projects designed for visitor safety and enjoyment. All trees that are cut will remain on site as down logs.

To enhance the diversity of tree species in the gulf itself portions of the gulf floor should be disced and planted with native species not currently present. Species that are present in the surrounding area, but

absent in the gulf itself, such as burr oak and black walnut, would be preferred. Approximately 900 seedlings per acre would be planted (Thake 1999).

In depth plant surveys should be completed within and around the gulf to determine which species are present. Special attention should be paid to the steep walls at the south end of the gulf.

Wildlife - Maintain the southern half of the property in an open condition to provide habitat for species dependent on early seral habitat. The opening would be maintained at least once every five years. Maintenance would include mowing with a bushhog, burning, and hand cutting. Opening maintenance would not occur between April 14 and July 1 to protect ground-nesting birds. Because of the proximity of an Indiana bat hibernaculum, any proposals to burn the area would be reviewed by the USDI Fish and Wildlife Service as per the July, 2001 Biological Opinion (USDI FWS 2001). During maintenance, woody species should be removed from the opening. Avoid fragmentation of the opening as this decreases the suitability of the habitat for Henslow's sparrows.

Allow natural succession to continue in the northern half of the property. This will provide habitat for forest-associated species in the long-term. Plant white oak and hickories in the uplands around the gulf and caves to increase the diversity of tree species present. In the long-term these species and the forested stand can provide suitable foraging and roosting habitat for the Indiana bat.

Maintain all snags on site for wildlife that do not pose a safety hazard. If trees are felled for safety, visual, or other recreation needs, they should be retained on site to provide a down log component for wildlife.

Cooperate with scientists to conduct research on various wildlife species such as Indiana bat and Henslow's sparrow.

<u>Recreation</u>

The site would utilize a low level of development of simple design to allow for low cost maintenance while accommodating the expected use (Appendix G).

The following facilities are proposed:

* *Parking lot and access road* - A gravel parking lot to accommodate approximately eight to ten cars would be located on or very near the existing access road and parking area. An environmental analysis would be conducted to determine the best location of the lot and would address underlying cave passages and other environmental considerations. If possible, the lot would be designed and located to accommodate tour and school buses. Consideration would be given to locating the lot somewhat closer to the county road to discourage garbage dumping and other depreciative behavior that sometimes occurs when parking is placed far off a road. The intersection of the access road with the county road was inspected by forest engineering staff, and found to have very good site distance. No change is anticipated regarding that intersection. The area along the access road to the parking lot would be mowed regularly to ensure that the lot is visible from the county road. There would be no public vehicle access to the area other than the parking lot.

* *Trail* – The existing mowed path would be enhanced to provide a more developed route to get visitors from the parking lot to the Gulf. An additional trail would route visitors to the floor of the Gulf. A short side trail may be constructed to route the trail by the old quarry for interpretive purposes. Brush would be cleared from a small area on the northeast side to allow a view of the hanging valley. The trail tread would be constructed using the natural surface unless heavy impact creates a need for hardening. One wooden deck overlook would be constructed on the rim to insure safety as visitors peer into the Gulf. A second viewing structure would be considered on the Gulf floor at the edge of Boiling Spring Pit. This structure would need a design to accommodate periodic flooding and a possible unstable bank.

* *Informational facilities* - The standard Forest Service SA 1 sign at the access road would continue to be maintained. A small kiosk or bulletin board that can accommodate printed material would be constructed. A National Natural Landmark plaque would be installed near the parking area. If partners and resources are available, outdoor interpretive signs could be installed at the overlook and other points of interest along with numbered interpretive stops along the trail. A one page leaflet known as a recreation opportunity guide (ROG) would be developed, and the trail guide could be incorporated on the reverse side of the ROG.

Other recreation considerations:

Rules and regulations would be applied in the same manner as for any other general forest area. Therefore, activities such as camping, hunting, mushroom gathering, rappelling, and caving would be allowed. One exception would be a ban on swimming or wading in Boiling Spring due to the dangerous currents that flow from the surface to underground. There would be no designated trails for horses or bikes. All recreation activities would be monitored. If unacceptable impacts occur, corrective action would be taken accordingly.

No designated trails would directly lead to any of the caves. Per Hoosier National Forest policy, visitation to caves would be allowed but not encouraged. Visitors may locate the caves on their own, but the existence of caves would not be mentioned in Hoosier National Forest published written materials such as the ROG. Other entities would be discouraged from publishing this information.

Interpretation would focus on the unique characteristics of the area. In keeping with basic interpretive concepts, information would be non-technical in nature and contain simple messages to which the visitor can relate. One or more of the following themes, or variations thereof, would be considered:

* The Wesley Chapel Gulf is a unique geologic feature that offers a rare view of how water moves in a large underground river system.

* Several examples of karst features may be found in the Wesley Chapel area.

* Water dissolving over limestone can form several types of geologic features that perform different functions.

* Humans have used the area for ten thousand years.

* Subthemes may be considered for other disciplines such as ecosystem management if there is a unique story to be told.

Safety

Safety concerns include falls from cliffs, entrapment in a flooded cave, falls from unstable banks at Boiling Spring Pit, entrapment in currents and deep water in Boiling Spring, and hazard trees at Boiling Spring Pit due to erosion around tree roots. Viewing decks and marked trails would provide safer areas. Hazard trees would be monitored and removed as needed. Visitor education would include the following safety messages at the kiosk or bulletin board, in the ROG, and where feasible, along the trail:

* Steep cliffs surround Wesley Chapel Gulf. Please stay on the trail, use the overlook to view the gulf, and keep a close watch on children.

* Do not enter the gulf floor if it is flooded due to dangerous currents.

* Do not camp on the gulf floor due the risk of rapid flooding.

* Stream banks on the gulf floor can be slippery, steep, and unstable. Do not enter the water for wading or swimming due to deep water and dangerous currents.

* Caves in this area are subject to flash flooding. Do not enter without proper training and equipment.

Maintenance

Maintenance would be handled as any other remote recreation area. As resources allow, the area would be visited regularly for mowing, trail maintenance, and litter cleanup. The trail, overlook, parking lot, signs, and interpretive facilities would be inspected annually and repaired as resources allow.

Partnerships

The USDA Forest Service would look to partners to assist in the stewardship of the Wesley Chapel area. The following are possible opportunities for partnerships:

Indiana Karst Conservancy - Maintain the existing relationship and Memorandum of Understanding with the Indiana Karst Conservancy (IKC). Encourage monitoring of the gulf, caves, and surrounding uplands by members of the group. Work with IKC to complete management plans for Wesley Chapel Gulf Cave, Boiling Spring Cave, and Elrod Cave. Enlist the group to assist in preparation of interpretive materials and in completing management projects within the special area. Coordinate volunteer projects with IKC such as cave clean ups.

Orange County Tourism Task Force - Investigate possible assistance for volunteer recruitment, publication in tourism guides, and grant writing.

In addition, Forest Service staff would investigate possible grants for financial assistance for low-level development such as interpretive materials and trail construction. The Hoosier National Forest would

also use existing volunteer programs to recruit volunteers for project work such as tree planting, trash clean up and trail maintenance.

Monitoring

Karst Management - The caves should be monitored annually to assure that visitation is not increasing to the point of damaging the cave environment and harming cave biota.

Cave Fauna - Monitor cave species including the northern cavefish, Bollman's cave milliped, Marengo Cave ground beetle, Young's cave ground beetle, Packard's Cave amphipod, and northern cave crayfish populations within the caves associated with Wesley Chapel Gulf every 2-3 years.

Vegetation - Conduct seedling survival surveys the first and third years following planting. The vegetation within the wildlife opening will be monitored through the forest openings program. Monitoring will occur every two to five years to determine if vegetation management, such as mowing, burning, and tree removal, is needed to reduce encroachment.

Wildlife - Monitor Henslow's sparrow populations through annual Breeding Bird Survey routes. Periodically monitor bat populations within the Wesley Chapel Gulf caves. If Indiana bats are detected, monitor biennially.

Recreation - The area would be monitored per the Forest Plan Monitoring and Evaluation Program. In addition, as resources allow, the area may be visually monitored for unacceptable impacts. The following may be used as indicators: trash accumulation above ground and in caves; cave graffiti; evidence of illegal ATV, bicycle, or horse use; excessive campsites and fire rings; campsites in sensitive locations; user-made trails in sensitive locations; and damage from rappelling. The number of law enforcement incidents and safety related incidents might also be used as social indicators. Management actions to mitigate impacts would be considered on a case-by-case basis. The forest would strive to find management solutions that allow as free and open use as possible, while still protecting the resources.

Cave Confidentiality

The Federal Cave Resources Protection Act of 1988 provides direction on maintaining the confidentiality of information concerning the nature and location of significant caves and caves whose significance has yet to be determined. The act states that information concerning the specific location of any significant cave may not be made available to the public. The public does have the right to visit any cave on the Hoosier National Forest without restriction (unless it becomes necessary to control access to specific caves to protect cave resources) (USDA 1991). The three caves located within the Wesley Chapel area, Elrod Cave, Boiling Spring Cave, and Wesley Chapel Gulf Cave are not currently listed as significant, but are in the process of having their significance determined. These caves, therefore, fall under the protection of the Federal Cave Resources Protection Act of 1988.

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