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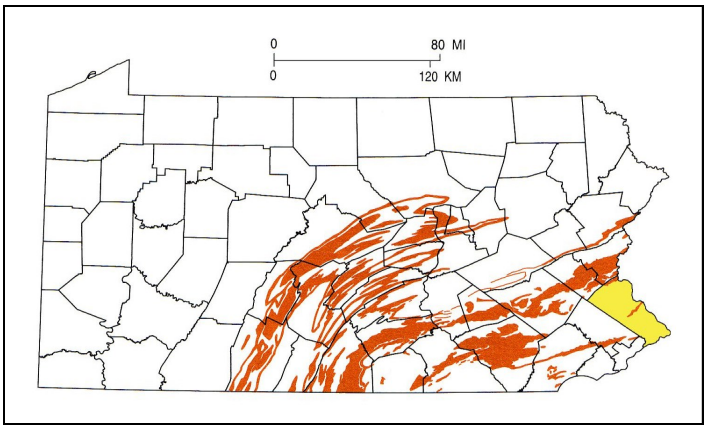
CAVE DIVING IN SOUTHEASTERN PENNSYLVANIA
An Historical, Cultural, and Speleological Perspective of Bucks County

— Danny A. Brass —

Large portions of central and southern Pennsylvania are underlain by carbonate bedrock (primarily limestone and dolomite, but with smaller amounts of marble as well). Over the course of geologic time, much of this bedrock has been exposed by gradual erosion of the overburden. In combination with the abrasive activity of water-borne sediments, the relentless action of weak acids (i.e., chemical dissolution by acidic groundwater) on soluble carbonate deposits, especially limestone, is a self-accelerating process that has led to the development of broad areas of karst topography. A variety of surface and subsurface geological features are characteristically associated with karstification; the presence of large numbers of solution caves and sinkholes is common.



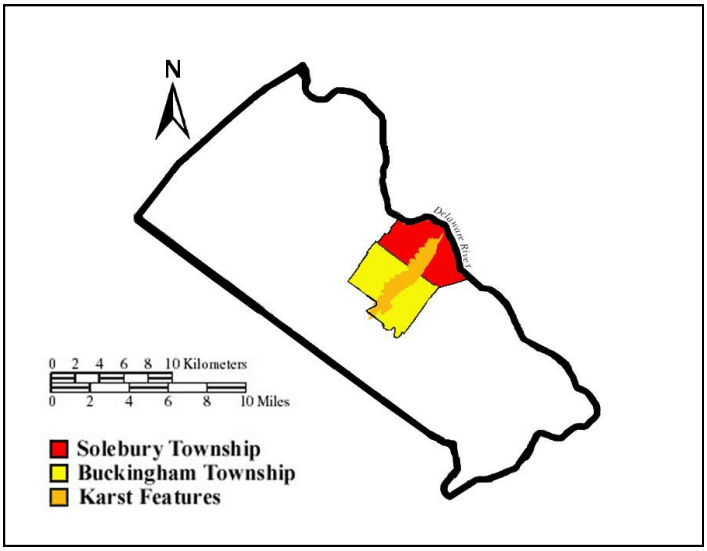
Karst topography of central and eastern Pennsylvania. Bucks County is highlighted in yellow. Modified, with permission, from Kochanov (1999).

The various features of Pennsylvania's karst landscape present cavers with challenging opportunities for underground exploration. In the southeastern corner of the state, a narrow band of karst (approximately one mile in width) stretches across Bucks County, extending through portions of both Solebury and Buckingham Townships. While several caves of historic interest can be found in Bucks County, it is not typically considered to be a dynamic area of caving activity. However, a variety of largely unexplored cave features may exist in the region.

Some General Aspects of Cave Diving

Considerably more limited in scope and number of participants than dry caving, cave diving still remains a global activity. Worldwide, a variety of cave-diving organizations can be found in areas rich in underwater caves. Major cave-diving sites include the cenotes and tidal blueholes of the Bahamas and Mexico's Yucatán Peninsula, the vast underground rivers of Australia's Nullarbor Plain and the sinkholes of its unique Mt. Gambier region, the sumps of Great Britain, and the rich concentration of springs in Florida. Diving conditions vary greatly from one region to another. This is reflected in the many differences in training procedures, required equipment, underwater protocols, and even diving philosophies, all of which have evolved in association with local diving conditions.

Although cave diving in this country includes both sump and spring diving, exploration of freshwater springs (including siphon entrances to spring systems) is the predominant activity. This is to be expected since an enormous concentration of such springs (in fact, the most in any state) can be found scattered throughout north central Florida. Indeed, with its vast number of incredibly beautiful and easily accessible springs, northern Florida represents the heart of cave-diving activity in this country.



Area of karst development in Solebury and Buckingham Townships, Bucks County, Pennsylvania.

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The two major cave-diving organizations in the United States are the Cave Diving Section of the National Speleological Society (NSS-CDS) and the National Association for Cave Diving (NACD). In general, the NACD membership has historically consisted primarily of spring divers, whereas members of the NSS-CDS have long been involved in both spring and sump diving. Keep in mind, however, that spring-like diving conditions can be found at many cave locations worldwide (e.g., tidal blueholes, inland cenotes, and many large underground rivers) and spring divers affiliated with both the NSS-CDS and the NACD are well represented at such sites.

Springs develop as water is discharged from an underground aquifer through a natural opening in the bedrock that leads to the surface. Once reaching the surface, the water may form a small- to moderate-sized pool, a large lake, or even a river. On the other hand, it may appear as little more than a puddle between some rocks. The opening in the bedrock between the aquifer and the surface may or may not be a large-enough conduit to allow passage of a diver.

Most practitioners of the art of spring diving are experienced scuba divers with advanced training in the specialized techniques needed to safely negotiate underwater cave passages. Scuba diving remains the mainstay of spring exploration, which has evolved as an extension of that basic activity. However, with the ever-growing union of spring divers to the dry-caving community, large numbers of more "cave-oriented" scuba divers have been attracted to the springs and vice versa.

In other karst regions across the country, exploration of sumps represents yet another form of cave diving. Sumps are water-filled passageways of varying size, configuration, depth, and visibility found within caves that are predominantly air-filled. They may be a permanent or seasonal feature of a given cave. Heavy rains and subsequent flooding of caves may also cause an otherwise air-filled passageway to temporarily sump. In this regard, dry cavers should always take note of the type and location of surface debris observed in caves, since this provides valuable information on the extent of seasonal passage flooding. In the absence of even a minimal air space, scuba gear is generally required to safely negotiate a sump; breath-hold dives through duck-unders may be needlessly dangerous. In passing through a sumped region, a caver typically hopes to find more airfilled passage on the far side and recognizes the sump as an obstacle blocking the path of continued exploration.

In general, these perspectives reflect a fundamental historical difference between the spring diver—who has traditionally been considered primarily as a scuba diver, exploring water-filled caves for the sheer delight in the experience—and the sump diver—who has traditionally been considered primarily as a caver, utilizing scuba gear as a required tool to further his or her capabilities of exploration in an otherwise air-filled cave. These historical differences are somewhat less sharply demarcated today and most experienced cave divers pursue a common avenue of cave-diver training before branching off to gain more specialized experience in one venue or the other.

Although sump and spring diving are certainly closely related to one another, they remain very different activities. Underwater features and diving conditions of springs and sumps are often quite different; although, some caves present more of a blend of characteristics. Indeed, the markedly adverse conditions often found within sumps—including colder water, significantly reduced visibility, and small passage size—may exert a more intense psychological strain on the explorer than the relatively benign and constant conditions found within most springs. This may be accentuated by the environment of the airfilled cave itself, should the diver not be a particularly experienced dry caver. In fact, conditions within most sumps and dry caves may even be psychological deterrents to some. Paradoxically, some cave divers who feel quite at home in submerged passageways deep within springs are ill-at-ease in dry-caving conditions, where more primal and deep-rooted fears may become manifest. In a related vein, many sump divers are uncomfortable with the greater depths and excessive penetration distances—including a frequent need for staged decompression—that often characterize spring diving.

While it is not uncommon to find solo diving practiced by experienced spring or sump divers, such pursuit stems largely from a personal diving philosophy. It remains a somewhat controversial issue within the cave-diving community. Although both sump and spring divers depend largely upon self-reliance in their underwater problem solving, a diving companion in the clear water and often spacious passages of a spring is generally more likely to be in a position to offer practical assistance, if needed. For the sump diver, on the other hand, solo diving is often a matter of safety. In the limited confines of many sumps, more than one diver might severely compromise both efficiency and diver safety. In many cases, however, a backup or safety

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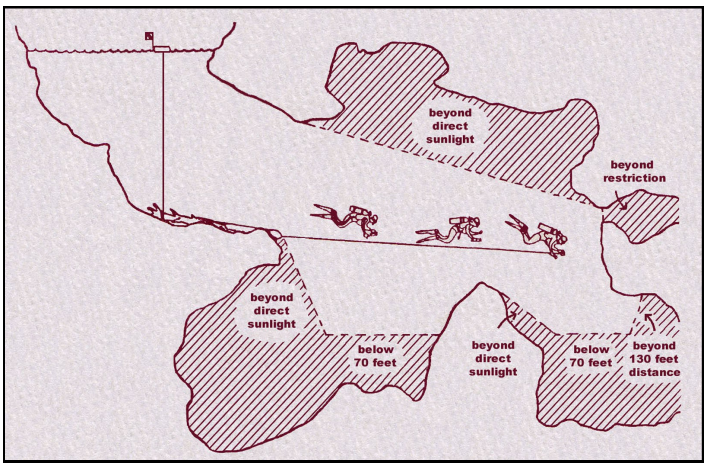
diver is geared up and ready to enter the water, if required. Thus, if the sump diver has not returned within an allotted time frame, the safety diver can attempt a rescue dive. This system is a practical compromise between absolute solo diving and a buddy team and has proven its effectiveness over the years.

It is important to appreciate the fact that sumps and springs typically place very different demands on divers, forcing them to adapt their techniques and priorities accordingly. For example, an apparent disregard by sump divers for such skills as a finely honed silt technique, which is of crucial importance to the spring diver, is not a measure of the simplicity of sump diving. Rather, it is simply a reflection of the differences in diving conditions often found between sumps and springs. As such, even an intimate familiarity with one form of cave diving does not necessarily translate into a suitable set of skills for safely pursuing the other.



Defining the limits of cavern diving. Reproduced, with permission, from Zumrick *et al*. (1988) courtesy of Wayne Mckinnon and H. V. Grey.

Readers unfamiliar with terminology used within the cave-diving community should also note that the terms cave and cavern have specific dive-related meanings, unrelated to a broader geological context. A cavern dive is defined as a daytime dive that takes place beneath a rock ceiling at a site in which visibility remains 40 feet or greater and passage size is large enough to easily accommodate two divers swimming side by side at all times. Limitations of cavern diving further require that divers never stray beyond the zone of surface light, never exceed an absolute depth of 70 feet or a combined vertical and horizontal linear distance of 130 feet from the surface (i.e., depth in open water plus penetration distance into the cave, and remain well within prescribed no-decompression limits. Appropriate air-management rules also exist for cavern diving. Remaining within these limits will help to ensure that cavern divers may still easily share air in the event of an out-of-air emergency or safely make an emergency free ascent to the surface, if necessary. By definition, divers who exceed any of these limits (or who make a comparable dive at night) are cave diving. An excellent discussion of cavern-diving limits has been presented by Zumrick *et al*. (1988).

The cave-diving community continues to play an integral role in the development of equipment and techniques that have applications in both overhead and open-water forms of diving. Moreover, cave divers remain a unique and invaluable resource in the ongoing exploration and scientific study (i.e., speleology) of caves, including such diverse disciplines as geology, hydrology, cartography, and cave-related biology.

Ingham Spring

In Pennsylvania, springs are known to develop in relation to every major type of rock; however, the largest springs are found in the central and southeastern parts of the state, principally in association with Cambrian and Ordovician limestone deposits.

Ingham Spring is an artesian spring in Bucks County, Pennsylvania. A naturally occurring artesian spring (or manmade artesian well) is the outlet of a confined underground aquifer whose water table originates at a higher elevation than the spring. This creates a hydrostatic pressure head of sufficient force to move water to a level higher than that of the downstream water table. Artificial pumping is not required to draw water from an artesian well. However, if a well were to be sunk at a site in which the hydrostatic pressure is insufficient to force water to the surface, some kind of pumping station would have to be employed.

Ingham Spring is formed in deposits of Conococheague limestone (Upper Cambrian/Paleozoic) and Brunswick shale. It is located along Lower Mountain Road in Solebury Township, just south of Route 202 between New Hope and Lahaska, at an elevation of 170 feet above sea level. Published GPS coordinates place it at latitude 40 21 12 N, longitude 74 59 38 W.

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The crystal-clear water of Ingham Spring is surrounded by an area of luxuriant growth. This picturesque setting is like a small oasis amid the clutter of local traffic Photo by George Jaegers.

As water from the underground aquifer at Ingham Spring issues through fissures in the bedrock, it forms a crystal-clear pool that has historically been recorded to be about 12 feet deep, 40 feet wide, and 75 feet long. Framed in luxuriant growth and teeming with life, the beauty of the spring and its surroundings is well known to local residents. Portions of the pool are seasonally overgrown with a thick carpet of underwater plants, which appears to reduce the size of the headpool. However, accumulations of sediment secondary to erosion along the western edge of the basin have contributed to a true reduction in the size of the pool. Thus, while the 40-foot width appears to be about the same, a current measure of the length puts it at just under 60 feet, the remaining 15 feet or so of the basin, which includes the opening into the aquifer, apparently lost to erosion.

At the eastern edge of the headpool, runoff from the spring forms a small waterfall as it cascades over a nine-foot-high retaining wall to feed the headwaters of the Aquetong Creek. The creek flows in an easterly direction to the Delaware River, located approximately two and a half miles away. In the latter part of the 19th century, the creek had been dammed to create an artificial impoundment: the Aquetong Lake.

A classification of springs is typically based on the volume of water discharged. There are no first-magnitude springs in Pennsylvania; however, at least 15 second-magnitude springs and dozens of third- and fourth-

MAGNITUDE AND DISCHARGE RATES OF SPRINGS

MAGNITUDE	FLOW (cfs, mgd, gal/min, pint/min)	FLOW (L/sec)
1st Magnitude	> 100 cfs (64.6 mgd)	>2800 L/s
2nd Magnitude	10 to 100 cfs (6.46 to 64.6 mgd)	280 to 2800 L/s
3rd Magnitude	1 to 10 cfs (0.646 to 6.46 mgd)	28 to 280 L/s
4th Magnitude	100 US gal/min to 1 cfs (448 US gal/min)	6.3 to 28 L/s
5th Magnitude	10 to 100 gal/min	0.63 to 6.3 L/s
6th Magnitude	1 to 10 gal/min	63 to 630 mL/s
7th Magnitude	1 pint to 1 gal/min	8 to 63 mL/s
8th Magnitude	< 1 pint/min	<8 mL/s
0 Magnitude	No flow (sites of past/historic flow)	

cfs = cubic feet per second, mgd = million gallons per day, L = liters, mL = milliliters

magnitude springs can be found in the state. The highest magnitude springs are found in the central and southeastern portions of the state and are associated with carbonate rock aquifers (Flippo, 1974; Geyer and Bolles, 1987). Water issues from the outlet of Ingham Spring at a measured rate of approximately 4.45 cubic feet per second (2,000 gallons per minute or almost 3,000,000 gallons per day). Of course, discharge rates may vary seasonally. According to criteria established by the U.S. Geological Survey, Ingham Spring would thus be classified as a third-magnitude spring. It is regarded as one of the most productive springs in southeastern Pennsylvania. Results of several water-quality assessments at Ingham Spring are available (Flippo, 1974).

Attention has often been called to the spring's arresting beauty and invigorating properties. It was—and still is—considered a sacred site by members of the various Native American nations that have long populated this area of southeastern Pennsylvania. Native American people have traditionally considered the blue-tinged water of the spring to have magical and curative powers. Historically,

Runoff from the spring forms a picturesque waterfall. Photo by George Jaegers.

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Waterfall and origin of Aquetong Creek. Photo courtesy of Solebury Township.

it was considered to be a site of spiritual renewal for Native people traveling along the Delaware River.

The original Indian name for the spring is Achewetong or Achewetank, from *achewe,* meaning *bush* or *bushy* and *tonk* or *tank*, meaning *at* or *place*. Loosely translated, it means *at the place in the bushes* or *at the spring among the bushes*. Early white settlers to the area referred to the spring as either the Great Spring (occasionally Great Indian Spring) or Aquetong Spring. The latter, a more easily pronounced version of the Native American name, is generally regarded as meaning *the great spring by the bushy pine trees* or *place of pine trees*; however, the name may actually refer to an extinct variety of native cedar rather than pine. Today, the spring is commonly known as Ingham Spring although Native Americans usually still refer to it as Achewetong.

Waterfall at Ingham Spring. Photo by George Jaegers.

The upstream section of Aquetong Creek. Nearby Aquetong Lake is just beyond the trees. Photo by George Jaegers.

Prior to the arrival of white settlers, the area of the spring was occupied primarily by Native Americans who were members of the Lenni-Lenape (Delaware) Nation. It is said that Chief Teedyuscung himself had been born at Achewetong although this might not have actually been the case. With the coming of the white settlers, epidemics of smallpox and other diseases broke out among many Indian communities, ravaging Native American populations throughout their range. Like all Native Americans, the Lenape had no immunity against such European diseases. As a result, the area of the spring was largely abandoned by those who had survived the devastation. War, disease, and ongoing conflict with white settlers all conspired to help drive the Lenape out of the Delaware Valley. Few remain in the area today.

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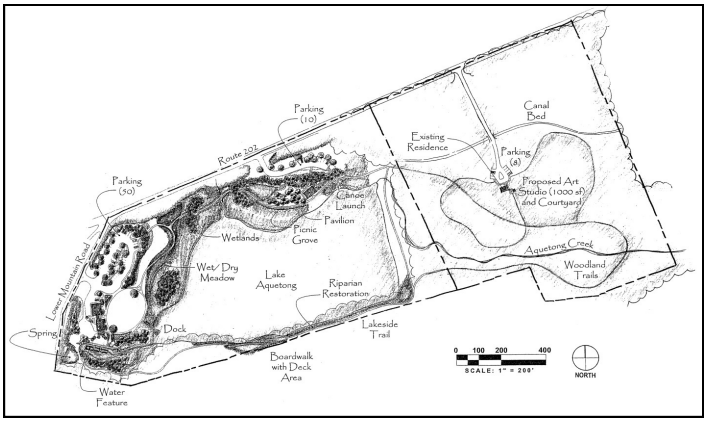
Satellite photograph of Aquetong Lake. Courtesy of Yahoo, Inc.

Native American religion is site specific in nature and proper worship requires physical access to sacred sites… places where energy and power can be felt in the land. Such worship continues to be an important part of tribal culture. The remaining members of various Indian communities that still live in the region continue to conduct sacred ceremonies at the spring. On the 21st day of the last month of every quarter of the calendar year (March, June, September, and December), which correspond to the spring and autumn equinoxes and the summer and winter solstices, tribal members of the Native American Alliance of Bucks County gather at this venerated site for ceremonial services.

Sadly, continued erosion along the banks of the spring has severely undermined the structural integrity of the basin. Much of the original wall containing the actual entrance to the aquifer appears to have collapsed. The slide has filled in most of the western edge of the basin with sediment and rubble. The Native American Alliance has been negotiating with the state to develop a plan that would help to ensure the preservation of this sacred site as well as its vital connection to Native American culture and heritage.

Member nations of the Alliance would also like to convert a portion of the old Judy home—still standing near the spring—into a Native American museum. However, in view of the extensive renovations that would be required, construction of a separate freestanding structure might be a more viable option. Solebury Township is amenable to discussing the feasibility of constructing an on-site Native American museum with members of the Alliance. The township is also pursuing ideas for construction of a welcome/educational center at the spring. Creation of a local interpretive center would provide a wonderful resource for the community.

Aquetong Lake is an impoundment formed by damming of the Aquetong Creek. Photo courtesy of Solebury Township.



Solebury Township's proposed site plan for the Aquetong Creek watershed.

Aquetong Lake

Just a few hundred feet downstream of Ingham Spring, readily visible from Route 202 and very apparent on regional satellite photographs, is Aquetong Lake. Some 12 - 15 acres in extent, this manmade lake is a very important source of water for the great diversity of wildlife and waterfowl that it helps to support. And because large por-

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The headpool of Ingham Spring, circa 1926. From Lapp (1926) courtesy of the University of Pennsylvania Library system.

tions of the spring-fed lake do not freeze in the wintertime, it is an invaluable resource for overwintering animal populations. As such, the presence of the lake makes this locale one of the most important wetland habitats of Bucks County. Often underappreciated, no part of our landscape provides so many benefits at so little cost to the public as America's wetlands.

The lake is actually an impoundment that had been established along the Aquetong Creek (also sometimes referred to as Ingham Creek). It was originally formed by construction of a massive earthen dam across the creek in 1870. This artificial dyke dammed the creek, creating a focal expansion that overflowed its banks and became the lake.

Beyond the spillway of the dam, runoff from the lake continues flowing in an easterly direction as the Aquetong Creek. Along with some smaller tributaries, the creek flows approximately two miles to the city of New Hope,

Waterfall at Ingham Spring, circa 1926. From Lapp (1926) courtesy of the University of Pennsylvania Library system.

The headpool of Ingham Spring, circa 1926. The fissure entrance to the aquifer is located beneath the walnut tree. From Lapp (1926) courtesy of the University of Pennsylvania Library system.

where it forms a picturesque waterfall adjacent to the Bucks County Playhouse[1] before spilling into the Delaware River, some 50 miles south of the Water Gap. In fact, New Hope—the oldest town in Solebury Township—was originally situated on the very site it occupies

[1]The Bucks County Playhouse was originally the site of a gristmill in the 1700s. The buildings were converted into the playhouse in 1938. Today, it is the State Theatre of Pennsylvania.

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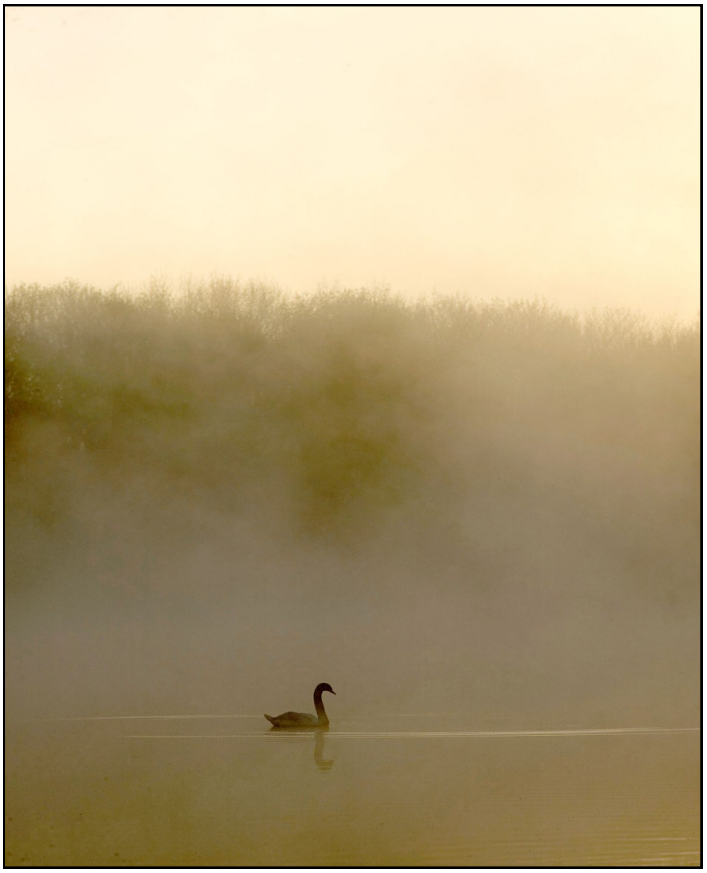

Aquetong Lake is an important source of water for area wildlife. Photo courtesy of Solebury Township.

today because of both the reliable flow of water provided by the spring and the site's suitability as a ferry crossing to the New Jersey side of the Delaware River (note: the Delaware forms the border between Pennsylvania and New Jersey).

Because of the creek's reliability as a water source, a number of mills had been established along its course during the 1700s. Indeed, once early settlers to the area realized they could harness the power of the spring, New Hope developed into a major center of industry (Gelman, 2003; Goodwin, 2005). Modern-day New Hope has largely shed its industrial heritage. Today, its streets are lined with art galleries and antique shops, and its major industry is now tourism.

In 1998, a portion of the earthen dam that secures the impoundment was deliberately breached by the Pennsylvania Fish and Boat Commission (PAFBC) in order to lower the water level and make repairs to the spillway. The breach has yet to be repaired. As a consequence, the water

Alongside the Bucks County Playhouse in downtown New Hope, the Aquetong Creek forms a broad waterfall as it plunges into the Delaware River. Photo by George Jaegers.

level in the lake has fallen dramatically. At present, the extent of the lake covers an area of only about 8 - 10 acres. According to spokespeople for the Native American Alliance, the receding water has uncovered marker stones that demarcate the presence of ancient Indian gravesites. These will again be covered over once the breach has been repaired and the water level in the lake restored.

Konkey Hole

A number of naturally occurring sinkholes can be found amid the rich limestone deposits of Bucks County. Sadly, many of these have been filled in with sediment and debris over the course of time. One such site was known to early white settlers as Konkey Hole or Conky Hole. However, the Indians called it Hollekonk (or Holy Cong) and it is from the latter term that the village of Holicong (or Hollekonk as it was originally known) derives its name.

Because of changes in word usage over the centuries, tracing etymologies may be difficult and necessarily speculative. With respect to the derivation of this name, some experts on Native American languages have suggested the following possibilities. The suffix *konk* or *cong* probably refers to *at* or *place*, while the prefix *holy*, *holi*, or *holle* may be derived from original terms related to *hukon*

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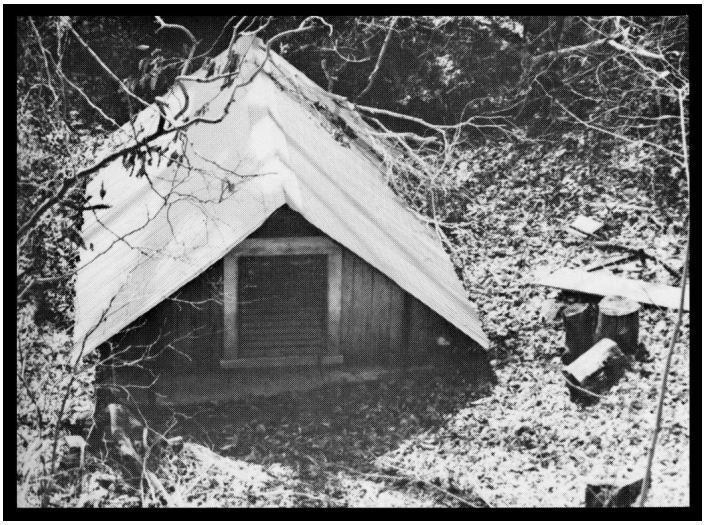

The shed at the bottom of Konkey Hole, circa 1981. Courtesy of Richard M. Kranzel.

The shed at the bottom of Konkey Hole, circa 1926. From Lapp (1926) courtesy of the University of Pennsylvania Library system.

(meaning *pot*), *hus* (meaning *bucket*), or *hos* (meaning *kettle*). Thus, such very descriptive phrases as *the place of buckets* or *the place of pots* may have simply been an eloquent means of expressing the presence of sinkholes in the area, a landform that we would nowadays refer to as karst topography.

The mysterious Konkey Hole still exists today and is located in the village of Holicong (Buckingham Township), just a few hundred feet east of Holicong Road. It is a nearly circular sinkhole about 120 feet in diameter. Historically, the water level within its funnel-shaped basin has been reported to fluctuate considerably, the surface of the water generally being about 40 - 60 feet below the rim of the sinkhole. According to historical accounts, chaff thrown into the pool would wash out at Ingham Spring, some three miles east (Davis, 1876).

Satellite photograph of Konkey Hole revealing the sinkhole and small shed within it (center of photo). Courtesy of Yahoo, Inc.

Konkey Hole figures prominently in Lenape Indian lore. According to one legend, a deer being pursued by a hunting party of young Lenape braves fell into Konkey Hole, only to emerge unscathed at Ingham Spring half an hour later. In a variation of this tale, the deer itself was never seen again; however, its blood washed out into the headpool of Ingham Spring. In yet another version, an Indian was sitting on the edge of the sinkhole skinning a deer when he and his prize suddenly toppled over into the pool. Some time later, both he and the deer washed out at Ingham Spring, apparently none the worse for wear. Finally, still another legend holds that a young Indian with a broken heart decided to take his own life by plunging into the pool at Konkey Hole. Miraculously, he did not drown, but emerged unharmed at Ingham Spring. Upon hearing what had happened, the young woman whom he loved changed her mind and agreed to become his bride.

Undoubtedly, many other tall tales and legends of Konkey Hole are known to local residents and Native Americans. A very nice painting, *The Legend of Ingham Spring*, by famed American painter Peter Hurd depicts the well-known Lenape legend of Konkey Hole and the deer.

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Lenape legends talk of a great underground river that flows from Konkey Hole to Ingham Spring. In early historical accounts of Bucks County, it was even posited that Ingham Spring might have been an outlet for a vast water-filled subterranean cavern, or perhaps even a series of interconnected caverns (MacReynolds, 1942). Such early accounts have added to the mystery surrounding the sinkhole as well as to the public's fascination with it. And, of course, such fanciful speculation is the stuff upon which cavers' dreams—and sometimes nightmares—are often built.

Because Konkey Hole is a siphon (i.e., it has a mild inflowing current), Native Americans consider that the sinkhole draws energy into the Earth. Hence, it is not a site at which sacred ceremonies are typically conducted. However, siphons *are* places of individual worship, where people may go to make personal offerings to help strengthen Mother Earth.

It should also be noted that even mild siphons impose special safety demands on cave divers. Because it is necessary to overcome an inflowing current in order to exit such a cave, diving the siphon entrance of a spring-siphon system is never something to be taken lightly.

The Changing Tides of Ownership

In 1681, King Charles II of England granted a large tract of land to William Penn as payment for a substantial debt that he owed to Penn's late father. Penn, who settled in the area that he named Bucks County—after Buckinghamshire, England where his family roots were—called the land *Sylvania*, meaning *forest*. But King Charles changed the name to Pennsylvania in honor of Penn's father. In fact, the state's name actually means *Penn's woods*.

William Penn was a member of the Society of Friends (i.e., Quakers) and one of the founding fathers of the United States. In the early 1700s, he granted some 600 acres of land in Solebury Township—named for Soulbury in England—to his secretary and supervisor of Indian affairs, James Logan. Included in this acreage of Loganian land was the site containing what was variously known as Aquetong Spring or the Great Spring. Although Logan had major plans for developing this property, business affairs elsewhere prevented him from capitalizing on these ideas. Instead, it appears that he merely leased the land out.

Jonas Ingham, an Englishman and also a member of the Society of Friends, had come to America around 1705 and settled in Bucks County with his family in 1730. Renting a portion of land from Logan, he established a textile mill in the region of the Aquetong Spring, which he operated with his son Jonathan. Jonathan took over operation of the mill when his father became ill. Jonas passed away in 1754.

In a complicated, long-term contractual arrangement, Logan then deeded 409 acres of this estate to Jonathan Ingham in 1747 (the remaining 202 acres had been deeded to Ingham's brother-in-law, Jacob Dean, under similar terms). The parcel of land that Logan deeded to Ingham, the so-called Ingham tract, included the Great Spring; it remained in the Ingham family's possession for 113 years. The spring now bears the family name in deference to the long ownership of the property by the Ingham family.[2]

The property also played an integral part in George Washington's famous crossing of the Delaware. Washington and his troops camped at the Ingham estate during their retreat from New Jersey in 1776. At that time, the estate had been owned by Dr. Jonathan Ingham, one of the elder Jonathan's sons. The estate's various buildings had been used as a makeshift hospital by Dr. Ingham during the Revolutionary War. It was during Dr. Ingham's tenure as owner of the property that the spring first became known as Ingham Spring. The estate was inherited by Dr. Ingham's son Samuel. Generally recognized as Solebury Township's most illustrious citizen, Samuel D. Ingham

[2]Under the terms of the deed, Ingham was required to pay an annual sum to James Logan for the remainder of Logan's life and then to Logan's heirs, including the Library Company of Philadelphia (trustees of the Loganian Library), in perpetuity (Dubois, 1891). At the time of his death in 1751, James Logan's extensive library of classical literature (considered one of the best in North America at the time) was donated to the people of Philadelphia in accordance with his wishes. The rent from his properties in Solebury Township was used to maintain the library. The stipulations of this deed actually remained in force until the early 1920s, when—at the request of the Library Company of Philadelphia—the rental agreement was abolished by the courts, finally liberating landowners from the burden of these annual payments (Sirmay, 1988). The library itself has had a colorful history. Today, some 2,000+ volumes of the original library still remain in Philadelphia, in residence next door to the Historical Society of Pennsylvania.

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distinguished himself as Secretary of the Treasury in President Andrew Jackson's cabinet (Shaw, 1986).

The property containing the Ingham Spring has changed ownership several times since being owned by the Ingham family. A history of ownership has been documented by Gelman (1998) and Harrington (2005a, 2007). At the present time, both Ingham Spring and the Aquetong Lake are owned and managed by the PAFBC, which purchased the land in 1992 as a 25-acre lot (parcel # 41-22-108) from trustees of the estate of the late Kenneth Judy, MD.

After more than a decade of negotiations, a deal to sell the lake and surrounding land (a total of approximately 48 acres) for a nominal cost to Solebury Township is close to being finalized. The township would then assume responsibility for the wise stewardship of the Aquetong Creek watershed, comprising approximately 7.5 square miles of land around the creek and the impoundment.

Under terms of the agreement, a small parcel of land, slightly less than a quarter of an acre and containing the spring itself, would remain under the ownership of the PAFBC. Although the final disposition of the agreement is still pending, closing negotiations are underway and everything looks favorable for a smooth transfer of ownership. Both parties are hopeful—and optimistic—that the transfer will be completed by year's end (possibly even by mid year).

With the assistance of state and federal agencies, Solebury Township is committed to its master plan for the site, which includes repair of the damaged dam (renovating the dam and shoreline of the lake is expected to be a lengthy and expensive process), development of the property for multi-purpose recreational use, maintenance of a suitable habitat for both aquatic and non-aquatic wildlife, and construction of a downstream bypass around the lake.

The concept of a downstream bypass is an important consideration in the management of Aquetong Creek as a coldwater fish habitat. Coldwater streams capable of supporting wild trout populations are often associated with areas of karst topography, since cool groundwater issuing from underground aquifers helps to maintain a suitable water temperature. Activities that dam such streams may exert a significant thermal stress on downstream portions, converting coldwater fish habitat into habitat more suitable for warm-water species (F.X. Browne, 2004). The presence of an impoundment may also contribute to minor alterations in water chemistry, increases in suspended particulates, alterations in the makeup of invertebrate communities, and development of periodic algal blooms; the latter, paradoxically, may be associated with subsequent drops in oxygen content of the water secondary to decomposition and can lead to increased fish kills.

Because Aquetong Lake appears to exert a significant warming effect on the downstream section of Aquetong Creek—mean water temperatures downstream of the lake being about 15^{o} F warmer than those upstream—the creek is no longer a suitable habitat for supporting coldwater fishes. Based on the environmental assessment by the firm of F.X. Browne (2004), the Bucks County Chapter of Trout Unlimited (BCTU) has recommended complete removal of the dam and restoration of the stream to its original state. Others have expressed strong misgivings about this proposal, suggesting that removal of the dam would lead to formation of an unsightly bog that would only serve to encourage the breeding of mosquitoes (Harrington, 2005b). At the present time, Solebury Township remains committed to its plan to repair the dam (Granger, 2008).

A second environmental study commissioned by BCTU assessed the feasibility of constructing a downstream bypass as a practical workaround to the problem of thermal stress (F.X. Browne, 2006). The township appears to have embraced this compromise as a workable solution. The hopeful intent of the bypass is the establishment of a viable, high-quality coldwater fishery within the confines of the Aquetong Creek watershed.

Excerpts from 1981 Dive Log

According to entries in my dive log for the summer of 1981, it was on June 11 that our short-lived hunt for the longest underwater cave system in the northeast began. Eric Freedman, an NACD-certified cave diver from Long Island, had heard about a spring-fed lake from a friend of his in Pennsylvania. Recognizing the possibility, however remote, that the information might lead to discovery of a diveable cave system, we made plans to visit the site. Deep down, I had to admit that I thought the trip was likely to be little more than a wild goose chase; however, considering the rich deposits of limestone in the region, it

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certainly seemed like a worthwhile effort to investigate.

Ingham Spring is located just west of New Hope, Pennsylvania, on the property of Dr. Kenneth Judy, MD. Both he and his wife Gail are warm and friendly people. He is a general surgeon working in Manhattan, presently on the verge of retiring from practice to his Pennsylvania home. This is a sprawling estate with a 12 - 15 acre spring-fed lake on site. Dr. Judy showed us the oval-shaped headspring, which is a small basin (30 or 40 feet in length and about 10 feet deep) filled with crystal-clear water. A runoff from the spring feeds the nearby lake.

Eric and I were both very excited at the sight of this beautiful spring, which could have been plucked right out of north Florida cave-diving country. With an average water temperature of approximately 52° F, however, it was considerably colder than the 72° F characteristic of most Florida springs.

Dr. Judy told us that the cave entrance, located in the ledge along the far side of the basin, had been penetrated to a distance of 42 feet back in the 1930s; though, he could provide no additional details of the dive. Although cumbersome helmet-diving equipment had been in existence at the time, the Cousteau-Gagnan regulator, which ushered in the modern era of open-circuit scuba diving and its associated surge in underwater exploration, hadn't been developed until 1943. According to Sheck Exley (1992), the first open-circuit scuba rigs hadn't been imported into this country until 1949. Consequently, the accuracy of the 1930s time frame for this alleged dive date remains questionable. Perhaps Dr. Judy had been mistaken about the year and the dive had actually taken place in the '50s or later. Perhaps he had just misspoken or I had heard (or recorded) incorrectly. On the other hand, it might very well have been a daring breath-hold dive. There is certainly ample precedent for this. The latter could have been facilitated by exceptionally low water levels at the time, which may even have provided a minimal airspace (in which case it really wouldn't have been a *dive* at all). Then again, it may just have just been a circulating rumor that Dr. Judy had heard.[3] In any case, an effort to dive the spring even as late as the early '50s would have been a noteworthy event, marking it as one of the earliest-known cave dives ever made in the Northeast.[4]

Dr. and Mrs. Judy were both quite intrigued at the prospect of learning more about the depths of their spring and enthusiastically welcomed our little expedition. Mrs. Judy took several photographs of us suiting up for our exploratory dive.

After entering the basin, we swam across the pool to a low ledge, from which a great deal of water was issuing. Unfortunately, it took only a cursory examination for us to realize that we wouldn't gain entry into the cave system from this location. Whatever entrance into a passable conduit that had once existed here—and which, hopefully, still remains intact beyond the initial section—was now largely filled in with huge blocks of shale. Perhaps this had been the result of erosion causing a partial collapse of the cliff face in the intervening decades since allegedly first being explored. Seasonally low water levels might have also played a contributory role. The fact that the terminal portion of the underground stream passage runs directly beneath Lower Mountain Road, and perhaps even under well-traveled Route 202 as well, certainly doesn't bode well for long-term integrity of the passage. Despite the collapsed entrance, we could still feel a great volume

[3]Dr. and Mrs. Judy purchased the estate in 1974 from Dr. and Mrs. Perry Bond. The Bonds had purchased the estate in 1936. In fact, Helen Bond was Dr. Judy's sister (Gelman, 1998). As such, a young Kenneth Judy may have had ample opportunity to visit with his sister and brother-in-law during the course of their ownership of the property. It is impossible to know what stories he may have heard from his family about a dive in the spring or what events he may have actually witnessed himself during the course of such visits.

[4]The first non-breath-hold cave dive in the United States was probably that of Walter S. Chamberlin at Devil's Hole, Nevada, in 1950. However, this had been a helmet (i.e., hard hat) dive. And while open-circuit exploration of Devil's Hole followed in 1953 (see the excellent discussion by William Halliday, 1976), these latter dives had still not been the first use of open-circuit scuba gear for exploration of an underwater cave in this country. An unnamed member of the Florida Speleological Society is generally credited with having made the first cave dive in this country (at Florida's Jug Hole circa 1952) using open-circuit scuba gear. By the mid to late '50s, cave-diving activity was on the rise although the era of modern cave diving is generally considered to have begun in the '60s (Desautels, 1995). While much of this activity occurred in Florida spring-diving country, cave dives were also being made in the Northeast, including Pennsylvania. Between 1954 and 1958, John Fisher made several dives in northeast caves using a rebreather apparatus (Fisher, 1978). This included a 1956 dive (month unknown) at Schofer Cave, on the outskirts of Kutztown, Pennsylvania. In his very interesting article on cave diving in Schofer Cave (see page 4 this issue), Dean Snyder (2006) recounts Robert Kerper's dive at this sump in October 1956. The latter was the first reported cave dive in Pennsylvania using open-circuit scuba gear.

of water rushing out from between the blocks of rubble. Today, much of the ledge itself is gone, buried under a massive slide of silt. Beneath the silt, the cave passage may have completely collapsed.

In retrospect, I can no longer say with any degree of certainty whether the blockage had been due to a geologically recent collapse of the entrance, as indicated in my log book, or if the fissures connecting with the underground aquifer had never really been large enough to admit a diver in the first place…the alleged dive mentioned by Dr. Judy notwithstanding. At the time, I remember thinking quite clearly that the blockage had obviously been secondary to a relatively recent collapse. Close to three decades later, however, my memory of the site is not exactly one of crystal clarity.

Eric and I exited the water just a bit disappointed at the unexpected find. However, we were somewhat placated by waiting tumblers of ice-cold screwdrivers—orange juice, of course—and an ample platter of cheese and crackers. Dr. Judy is a master bartender and he and his wife were extremely gracious and hospitable hosts. The Judy's hadn't been aware of the entrance collapse, but kindly gave us permission to return at our leisure and dig it out, should we be so inclined.

Just about then—perhaps in response to the odor of a delicious cheese platter wafting away on the breeze—Eric's friend Tom Hossley stopped by with his family. In an unexpected turn of events, Tom offered to show us the siphon end of the system. This was located about three miles away on the property of some friends of his. But we would have to wait for them to return home later in the evening before being able to go over. No doubt about it, this was sounding more and more intriguing by the minute.

After stowing our dive gear and devouring the last remnants of the cheese and crackers, we left the Judy homestead for a short drive to Tom's horse ranch, where we waited for his friends from nearby Holicong to return home. Although any additional diving that day was now clearly out of the question, we were certainly anxious to see the siphon entrance. Following a leisurely tour of Tom's ranch and a delightful meal, we passed the time nursing yet another round of drinks and chatting about caves and cave diving. And if it hadn't been fully obvious to us earlier that our diving was over for the day, this second round of drinks certainly left little room for doubt. To be sure, any lingering thoughts of diving a siphon entrance that evening had pretty much followed the passenger pigeon and dodo bird into extinction.

Later that night, Don and Ann Mills finally returned home from their evening out and Tom took us over to visit with his friends. The Mills are the owners of Barley Sheaf Farm. This is a large estate in rural Holicong, encompassing over 100 acres of pasture and woodland. The main attraction is a 1740s manor house that had been converted into a luxurious Bed & Breakfast.[5] It was somewhere in the middle of the Mills' pasture that the entrance to a siphon tunnel leading towards the headspring at the Judy's estate was alleged to exist. I did admit to a certain degree of incredulity, especially after Tom told us that he didn't think anyone could even get into the system from this site. But we went to have a look nonetheless.

It was close to midnight by the time we finally found ourselves hiking out into the pasture in search of a small sinkhole. After a short—and admittedly somewhat unsteady—walk across a moonlit field, Don brought us to a moderate-sized sinkhole along a wooded hedgerow on the property. Two securely locked structures, a concrete blockhouse and a wood-and-concrete shed, were located at the bottom of the sinkhole. The blockhouse contained the pumping station that supplied water for the entire farm; the shed covered and protected the water-filled throat of the sinkhole itself. When Don unlocked the door to the latter and I peered inside, I couldn't help but gasp in amazement.

Within the shed, the throat of the sinkhole was partially filled with crystal-clear water, its smooth, glass-like surface just a short distance below us. Beneath the surface, the sinkhole opened up into an obvious cave, now clearly illuminated by our lights. My first impression was that I might just as well have been staring into a smaller version of the Olson Sink entrance of Florida's extensive Peacock Springs cave system, a view that more than made up for our earlier disappointment at finding the entrance collapse at Ingham spring. From our vantage point outside the shed and the play of light and shadow in the water of the

[5]The Mills sold their interest in the Barley Sheaf Farm in 1994. The property has had two owners since that time. An interesting history of the estate during the earlier tenure of famed American playwright George S. Kaufman can be found at http://www.donswaim.com/steinbeck-kaufman.html.

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sinkhole, three distinct tunnels appeared to be leading out of sight.

Don referred to the sinkhole as the Hollekonk Well and to the submerged cave system as the Lost Arrow Cave. He told us that the local Indians used to throw barley sheaves into the sinkhole and sometime later they would wash out at Ingham Spring.[6] I guess this early barley-sheaf technique worked just about as well as fluorescein dye tracing. By that time, of course, I was simply hoping that I wouldn't inadvertently topple into the sinkhole myself, float away into the aquifer, and also wash out at Ingham Spring before anyone even noticed I was missing.

As we turned away from the shed and began hiking back across the pasture, everyone was excited about our return. The Mills, in particular, were quite interested in finding out what lay in the depths of the sinkhole. We knew we would have to rig some kind of ladder in order to conveniently access the pool. And even so, there was no doubt that getting through the small doorway of the shed was going to be problematic at best.

Of course, I had a rather dramatic vision of a major expedition in the making, with a grand design of exploring and mapping both upstream and downstream passages, photographing the system from one end to the other, naming a multitude of rooms and passageways after everyone, and, if we really got ambitious, perhaps even connecting the system to Mammoth Cave some miles to the west…well, maybe not. But, far and away, the most exciting aspect of our upcoming dive was that we would be the first ones to ever see or explore this system and there is simply no substitute for the kind of excitement that this can engender in a caver. We made tentative plans to come back the following weekend, but various circumstances kept pushing our rendezvous back.

In the interim, Eric had approached various equipment manufacturers in an attempt to secure assorted gear and corporate sponsorship for our two-man expedition. He felt confident in being able to obtain a handful of Poseidon regulators, a pair of Jetsuits, and even one or two Farallon DPVs. Personally, I didn't hold out much hope that this equipment would actually materialize (or, in the case of the DPVs, even be useful). Then again, I hadn't actually expected a cave to be there either. And yet, there it was. Hopefully, we would be able to return for a dive before too long.

As it turned out, Eric and I didn't make it back to Holicong until late in the day on July 1, 1981. We arrived at the sinkhole around 8:00 pm and lugged our gear across the Mills' pasture in a wheelbarrow that Tom had kindly donated to the enterprise. He had also provided a sturdy aluminum ladder that we could lower into the well. I secured this at the top with a length of Bluewater rope, some carabiners, and a few slings of one-inch tubular nylon webbing. Apart from our standard cave-diving gear, the ladder and wheelbarrow represented the extent of our specialized equipment. There were no Poseidon regulators, no Jetsuits, and no Diver Propulsion Vehicles anywhere in sight.

We suited up in the gathering darkness (Eric had forgotten to bring his lantern), under cover of a cloudy sky and the start of a light rain. As anticipated, getting through the door of the shed, onto, and then down the ladder while fully geared up proved to be far from an easy task. Eric climbed down first and floated on the surface while I carefully—or to be more accurate, clumsily—negotiated my own way down. Unfortunately, our combined efforts to install and secure the ladder, enter the water, and put our fins on had done a nice job of silting up the small sinkhole. Clearly, this would have been better done in stages. But time slots getting out to Pennsylvania were few.

Looking into the pool from the surface, we had been able to make out what looked like three separate tunnels. From an underwater perspective, I could now see that this had been purely illusion. The right-hand "tunnel" was merely a blind pocket in the wall that dead-ended almost immediately. The remaining two "tunnels" were really just a single passage.

Eric graciously allowed me to lead and I was delighted to be the first to see the system unfold before us. Not knowing the strength of any current in the system or even the nature of the passageway itself, we set an early turnaround point for this initial reconnoiter and adhered to a conservative plan of air management. I secured our guideline[7] to the base of the ladder and slowly reeled into the cave…into what Arthur Bye (1970) referred to as the *fathomless subterranean lake connecting Holicong and*

[6]A tale that sounds suspiciously similar to what has historically been reported to occur when material was thrown into Konkey Hole.

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Aquetong.

Visibility was down as a result of the maelstrom of silt that we had managed to stir up installing the ladder and getting into the water. This may have been compounded by minor percolation from the ceiling as our exhaust bubbles dislodged material from cracks and crevices above us. Varying degrees of ceiling percolation are not uncommon in the exploration of virgin underwater passageway. We proceeded slowly and cautiously. I noticed several large tree limbs just a short distance from the entrance shaft and I contemplated the need for making a single wrap around the thickest of these in order to help position the guideline and prevent it from "swimming" in the passage, something which would only invite entanglement had it occurred. But, quite unexpectedly, the limb simply crumbled to pieces at the slightest touch (which points out one of the significant disadvantages of line wraps to begin with). Continuing on, I swam past the withered splinters as they slowly drifted downstream with the sluggish current.

Not too far beyond the tree limbs, the passage started clearing up a bit, at first revealing billowy clouds of silt floating about us and finally clear water with astonishing visibility. As the water cleared and visibility improved, we found ourselves in a moderate-sized room. The walls were a mosaic of dark and light patches, but predominantly dark. The floor was covered with a layer of fine silt, the kind that remains suspended for long periods of time when disturbed. According to my log, maximum floor depth was about 45 feet and the ceiling was approximately 15 feet above us.

We explored the various nooks and crannies of the room, but only two promising leads could be seen. The right-hand tunnel—which we later named the *Mills Passage* for Don and Ann Mills, who owned the sinkhole—showed promise of heading in the direction of Ingham Spring. We pushed into this tunnel for a distance of about 100 feet beyond the far side of the room. As the roof of the passage began to drop down, tunnel diameter decreased accordingly. Should passage height remain low, I would imagine that a side-mount tank configuration might be more efficient than the back-mounted doubles that we wore.

We called the dive when the silt from our ladder placement and awkward entry—which had been slowly drifting in with the mild, inflowing current—finally began to envelop us. The silt would likely have just kept shadowing us, obscuring visibility for the duration of our dive and significantly complicating our return to the entrance. Using the guideline as a tactile reference in the diminished visibility, Eric, who was about 15 feet behind me, carefully followed it back to its point of takeoff at the ladder. Then I turned towards the exit and slowly reeled in the line behind him; conditions did not necessitate its abandonment. No permanent line was left in the system and the initial passageways were not surveyed. It should be noted here that one of the basic tenets of cave diving is that no person is ever further into the cave than the individual handling the reel. The person handling the reel is the first one into the cave and the last one to exit. In this fashion, no one is ever further into the cave than the guideline, which represents a single, continuous path to the entrance.

Future dives would certainly require considerably more care in entering the sinkhole. Of course, a permanently placed ladder would be quite helpful in this regard. Moreover, any kind of long-term expedition of the system would surely benefit from construction of some sort of diving platform that could be used as a base of operations for conveniently entering and leaving the water. Should the system be as extensive as we would like to believe, continued exploration would also ultimately require the use of multi-tank staging.

Regrettably, because of the silt that had slowly followed us in from the entrance shaft, we never made it more than a few hundred feet back into the system on this initial dive. Our bottom time had only been about half an hour and much of that had been spent orienting ourselves to the cave and exploring the first room. Moreover, we were moving very slowly since, in the reduced visibility, we didn't want to unknowingly swim into an unstable area, such as we had encountered at the Ingham Spring entrance.

My most vivid memory of the dive is of the fleeting moments before turning to leave. The water in front of me was crystal clear and my primary cave-diving light—a 55-

[7] I had carried an exploratory reel containing 500 feet of eighth-inch braided nylon line and two gap (jump) reels, each containing approximately 25 - 30 feet of line. The large reel was used for general exploration and the gap reels could be used to jump into a side tunnel or in the event of an unforeseen emergency.

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watt quartz spotlight—sliced deeply into the darkness, illuminating a huge and tantalizing path ahead of me. I could clearly see Eric's light signal along the wall and understood the message that he then signed to me: judging that diving conditions were becoming too dangerous to continue and suggesting that it might be a good time to call the dive. As I peered down the never-before-seen corridor that stretched invitingly before me, I could feel its silent pull…beckoning me to continue on. I've often wondered if any other person would ever have an opportunity to see it.

Chasing the Elusive Konkey Hole

It has only been in recent months that I've decided to reacquaint myself with the sinkhole at which we dove so long ago and to track down the exact location of the elusive Konkey Hole. Although many people living in the Holicong area have heard of Konkey Hole, relatively few have actually seen it or can pinpoint its exact location. Historical descriptions, 19th century regional boundary maps, and even various websites featuring Buckingham Township place Konkey Hole on the property of what is now the Barley Sheaf Farm. In searching for its precise whereabouts, however, I allowed myself to be thoroughly misled by the name used by Don Mills to describe the site at which we dove: Hollekonk Well. This confusion was compounded by sundry discrepancies in existing literature.

Thus, for the longest time, I considered that the Konkey Hole was situated close to the Hollekonk Well, either on or near the property of Barley Sheaf Farm. It remained a somewhat foolish presumption on my part that both the Hollekonk Well and nearby Konkey Hole were simply separate entrances into the same Lost Arrow Cave system and that either an upstream or downstream passage from one would connect with the other.

In fact, I now know that the two sites are actually one and the same. Moreover, independent corroboration of this comes from Richard Kranzel's short description of Konkey Hole in the 1983 *MAR Bulletin* (Caves of Bucks County): [*One-quarter mile east of Holicong is a sinkhole known locally as the "Konkey Hole." In the bottom of this shallow depression is a shed, which conceals a deep, water-filled opening: the Hollekonk Well. The well has long been rumored to connect with Ingham Spring, three miles to the northeast. Supposedly, if certain light objects, like wood or chaff, are immersed in the Hollekonk Well, they will ultimately appear at the spring.*]. In fact, the shed is visible on satellite imagery of the sinkhole.

The Story Continues

I moved out of the Northeast shortly after this dive and, unfortunately, never had an opportunity to renew my exploration of either Ingham Spring or Konkey Hole. To be sure, we had been very fortunate in that the respective landowners at the time had been almost as excited as us at the prospect of exploring the depths of the submerged Lost Arrow Cave system. For a long time, I wondered if a new generation of cave divers—mindful of the difficult diving conditions—might one day pick up the trail where we left off. However, this is not likely to occur in the foreseeable future. Such an undertaking could never begin—let alone succeed—in the absence of adequate landowner support and encouragement and the current landowners are neither interested in nor receptive to the idea. They wish to maintain their privacy from curious sightseers and would-be cave explorers and have made it quite clear that Konkey Hole is strictly off limits to exploration and that visitors—even photographers—are not welcome. They should be left alone.

In speaking with Eric, however, I recently learned that our initial dive had not been the end of exploration in Konkey Hole. In fact, he had returned to the sinkhole the following year and continued another 1000 feet or so beyond our first effort. Ultimately, he had been stopped by the cold. Wearing only a wetsuit, the 52° F water temperature eventually wore him down. Although it doesn't sound all that cold, long-duration dives in water of this temperature can easily sap one's energy and are best made wearing a drysuit for thermal protection. At the point where he had turned back, the cave was still going.

But the saga of Konkey Hole goes on. In the early '90s, Eric met young Chrissy Rouse. Both Chrissy and his father Chris were newly certified cave divers from Pennsylvania. Living quite a distance from the springs of northern Florida, they eventually gravitated to the high-stakes sport of deep-water wreck diving, exploring sunken shipwrecks along the Atlantic coast and quickly becoming infected with "artifact fever." Chris and Chrissy Rouse earned some degree of notoriety as the subjects of a fascinating book, *The Last Dive: A Father and Son's Fatal Descent into the Ocean's Depths*, by Bernie Chowdhury (see book

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review this issue). This book is primarily about the Rouses' headlong rush to discover the identity of a World War II German U-boat—initially dubbed the U-Who by divers exploring it—that lay in 230 feet of water, approximately 60 miles off the New York/New Jersey coastline. In October 1992, both men died in the course of a dive into the bowels of this submarine.

In 1991, however, Chris and Chrissy Rouse were continuing to make periodic trips to dive the springs of north Florida. Of course, Chrissy yearned for the discovery of a diveable underwater cave system closer to home. It was then that he met Eric, who told him about Konkey Hole. Although Konkey Hole, per se, is never mentioned by name, Chowdhury devotes several pages of his book to a discussion of the Rouses' dives at a secret site in Lahaska. Quoting Chrissy Rouse, Chowdhury writes, *You can't tell anyone about this, but we've found a cave near us! It's on private land. You start the dive in a well house on the property, and you enter the water by taking out some loose floorboards.* Recording his thoughts on hearing this description from Rouse, Chowdhury continues, *My heart leaped. This was great news. An undived local cave! It was a dream come true*. The Rouses reportedly made several dives in Konkey Hole during 1991, using a combination of back- and side-mount techniques. Although any dive logs that the Rouses may have kept are not available, Chowdhury mentions that they had found many passageways beyond the initial *Big Room* of their "newly discovered" secret cave. Of course, it was not mentioned that Eric and I had been the first to dive the cave several years earlier.

And, surprisingly, there is more to the story of Ingham Spring as well. In the course of 1982, Eric returned several times to Ingham Spring, taking Dr. Judy up on his offer to let him clear open the collapsed cave entrance. In fact, Eric did just this, digging open the natural underwater entrance. This eventually enabled him to gain access to the original cave passageway, still intact beyond the collapse. Of course, this confirmed the fact that our inability to gain access the year before had been due to a relatively recent collapse of the entry zone.

Because of well-founded concerns about stability, he only explored this newly opened passage for a short distance. Regrettably, the entire entrance has since completely collapsed due to continued erosion along the western edge of the basin. And while water from the underground aquifer can still find its way through the rubble—thereby continuing to feed the Aquetong Creek and Lake—almost all of the now-collapsed entrance is itself completely buried beneath a considerable quantity of silt and debris. Excavating the entrance in its current state would require a substantial effort.

Native American Legends Revisited

Upon first hearing some of the more striking Native American legends about Konkey Hole, many people, myself included, respond with a slight smile and an understandable feeling of incredulity. After all, fantastic stories of people and deer falling into the sinkhole and washing out unharmed at Ingham Spring some three miles away—in a mere half an hour no less—certainly do strain the limits of credulity. However, with confirmation of Konkey Hole as an entrance to a diveable underwater cave system, we may be able to place some of the ancient Lenape Indian legends into slightly better perspective.

Although no modern dye-tracing or hydrology studies have been conducted in the Lost Arrow Cave System (i.e., Konkey Hole → Ingham Spring)—and none are likely to be—a study was performed by Walter Lapp in 1926 as part of his M.A. thesis at the University of Pennsylvania. Accordingly, he placed 100 pounds of magnesium sulfate into the Konkey Hole siphon at 10:30 am. Water sampling from around the outflow site at Ingham Spring began ten minutes later and continued at 2 - 3 minute intervals for four hours. Samples were tested using barium chloride, which, in the presence of magnesium sulfate, will result in precipitation of insoluble barium sulfate. No such precipitates were observed. Lapp writes: *The writer does not deny that there may be some underground connection between the Conky Hole and Ingham Spring but he does not believe there is a definite underground channel connecting the two places, because four hours seems ample time for water to flow three miles, the distance between the two places*.

There is no basis upon which to speculate about the presence of additional underground tributaries that may feed into the Lost Arrow Cave system. Moreover, it is impossible for me to comment on the speed and strength of water currents beyond the section of cave that Eric and I had explored. However, I can say, without equivocation, that the current in the initial portion of the cave system was extremely sluggish…indeed, barely even noticeable.

In commenting on the strength of Lapp's conclusions, Malcolm Field—a leading authority on hydrogeology and tracer studies in karst aquifers—has suggested that the author's inconclusive results had primarily been influenced by the inappropriate methodology and poorly designed study parameters that had been employed.

While it would be nice to repeat this assessment using modern techniques, this will have to await ownership of the property by more interested landowners. However, there is no reason to doubt the veracity of historical reports claiming that material thrown into the sinkhole washes out at the spring. Moreover, the documented existence of a sizeable (and diveable) underwater cave system at Konkey Hole, a region rich in limestone, lends additional weight to such accounts.

Of course, without having thoroughly explored and mapped the system, it is impossible to say how extensive a fully diveable conduit may actually be. But, it is certainly within the realm of possibility, however unlikely, that the system is passable in its entire course to Ingham Spring. While the sections of the system that have been explored are completely underwater, it is also conceivable that portions of the cave rise above the water table now and then, providing periodic access to a breathable air supply. And even if the cave system typically does remain completely underwater throughout its extent, it is not impossible for an air space of varying volume and distance to develop during times of drought. Occurring at just the right time—coincidental with one of the Native American circumstances mentioned previously—such a condition might have been the very ingredient needed to set the stage for creation of an enduring local legend.

On the other hand, the origin of such legends may reside solely in the knowledge that small items, such as barley sheaves, thrown into the sinkhole were known to pass entirely through the system and wash out at Ingham Spring. Thus, the more colorful tales that have been handed down from one generation to the next may have only been based on an assumption that the same phenomenon would happen to a deer or a man.

Until such time as the system is more fully explored, the question remains an open one. For my own part, I certainly prefer believing in the presence of a regionally extensive underwater cave system, the existence of which provides a suitable foundation upon which the authenticity of these enchanting Native American legends might reasonably be based.

Author's Note:

Cave diving is a very specialized facet of both scuba diving and cave exploration. It is unsafe to go cave diving without ample training and appropriate equipment. Conventional open-water training and diving gear is inadequate to ensure safety in underwater caves. Indeed, no amount of open-water diving experience alone, however extensive, is sufficient to safely prepare divers for the myriad complexities inherent in cave diving.

To explore the underwater wilderness of sumps or springs is to travel through an unforgiving overhead environment, one with no direct access to the surface in the event of an emergency.[8] Any problems that develop in the course of a dive must be solved quickly and on the spot. Except when making a traverse between two separate openings into a system, exiting the cave requires re-tracing ones initial path into it. Difficulty handling an emergency at the maximal point of penetration may significantly compromise diver safety; however, life-threatening dangers may also develop only a few feet away from an entrance.

In the United States, information regarding training courses in cave and cavern diving can be obtained from either the Cave Diving Section of the National Speleological Society (NSS-CDS) or the National Association for Cave Diving (NACD). Once proficient in the fundamentals of safe cave diving, it is highly recommended that divers interested in pushing sumps attend one of the courses or mini workshops on side-mount diving offered by both the NACD and NSS-CDS. Prospective sump divers should then seek out experienced divers from whom they might learn advanced sump-diving techniques before venturing into a sump on their own. Serving as a sherpa on one or more sump-diving expeditions will also help to place important issues of logistics into proper perspective. Spring divers, who may have little previous experience in dry caves, would also do well to familiarize themselves with the rudiments of safe caving techniques before contemplating a sump dive.

[8]Somewhat similar circumstances also exist in ice diving and the deep-penetration of shipwrecks. A virtual ceiling may also be imposed by deep diving in open water, due to the associated need for an often-lengthy period of staged decompression in order to safely ascend to the surface.

Non-divers with a general interest in learning to safely experience the underground environment (i.e., exploration of dry caves) are encouraged to contact the National Speleological Society (NSS). This American-based organization is dedicated to the exploration, conservation, and scientific study of caves. Close to 200 regional member organizations, called grottos, make up the backbone of NSS structure. Present in almost every state, grottos are devoted to the training of both novice and advanced cavers, as well as to the continued development and refinement of equipment and technique for safe underground exploration. Grottos hold meetings, conduct training programs, and organize caving trips on a regular basis and welcome interested novices.

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The information presented in this article regarding historical aspects of Bucks County, Pennsylvania, were obtained from a wide range of sources, including old maps and documents, historical texts, newspaper articles, discussions with numerous people, and a variety of websites. It should be noted, however, that many of the historical details (including dates and even descriptions of important events) vary significantly from one source to another, highlighting some of the difficulties inherent in historical research—especially for someone who is not an historian to begin with. Although every effort was made to verify the accuracy of all information presented with various experts, any errors of current or historical fact that remain in the article are mine alone.

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Ingham Spring Update: Located along U.S. Route 202 and the corner of Lower Mountain Road, this 48-acre site was acquired by Solebury Township in 2009 from the Commonwealth of Pennsylvania. Solebury is in the process of developing a plan to use the site for both educational and recreational opportunities while maintaining the unique, sensitive ecosystem, which is currently a habitat for a wide variety of plant and animal life. Township administration and the Parks & Recreation Director recently met with a representative from DCNR at the Ingham Spring property to inquire about the viability of a grant to create a walking trail, picnic area, and small play area in the vicinity of the "Judy House." According to the minutes of the March 5, 2013 meeting of the township's Board of Supervisors, the Parks & Recreation Board formally endorsed a plan that included 1) ¼ mile of 8-foot-wide stone grit trail (handicap accessible), 2) a parking area for approximately 7 cars (handicap accessible), 3) a climbing rocks play area for children ages 12 and under, and 4) construction of a new picnic area and improvements to an existing picnic area overlooking the stream and spring. If the final plans are accepted and the township awarded a matching grant from the DCNR, it is believed that the proposed improvements might be completed sometime in 2014.