National Park Service
U.S. Department of the Interior

Great Basin National Park

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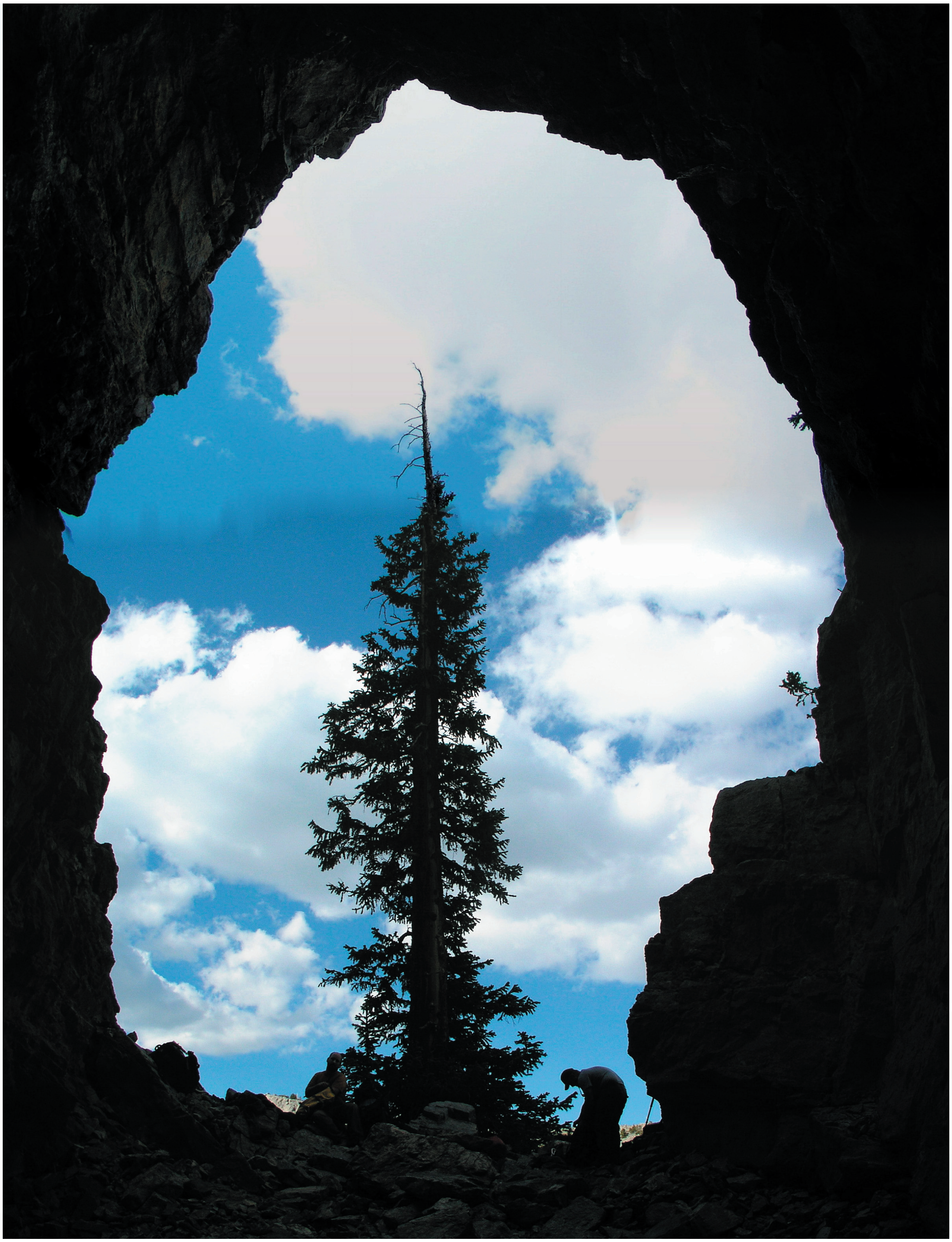
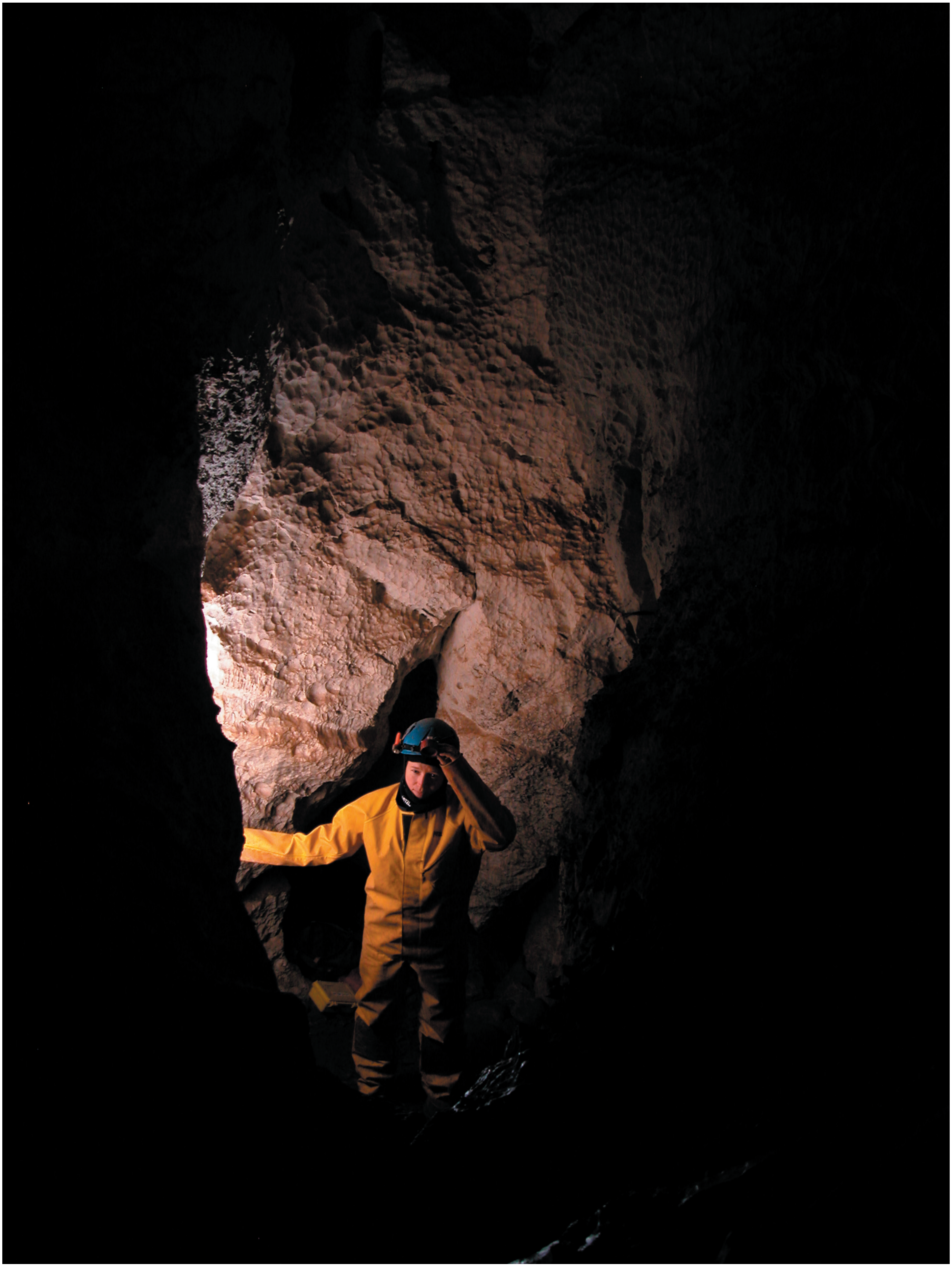
Cave Resource Condition Report





Great Basin National Park
Cave Resource Condition Report

Great Basin National Park
Baker, Nevada

Produced by Physical Sciences, Division of Resource Management
Great Basin National Park
National Park Service

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Cover: The entrance to Deep Fall Cave.

Left: A caver in the Baker Creek Cave System

Contents

Water cascades into the Baker Creek Cave System during spring runoff, 2005.

Introduction

Great Basin National Park encompasses 77,180 acres (31,233 hectares) in the South Snake Range, alongside the Nevada-Utah border. The park became the 49th National Park on 27 October, 1986, as an expansion to the 640 acre (259 hectare) Lehman Caves National Monument. The Park was established to preserve a representative sample of the Great Basin and is dominated by the 13,063-foot (3981 meter) Wheeler Peak. Significant resources preserved in the park include a wide variety of Great Basin ecosystems, from sage-steppe to alpine, as well as ancient Bristlecone forests. There are 47 known caves in the park including Lehman Caves, the longest cave in Nevada at 9,354 ft, High Pit, the highest elevation cave in Nevada at 11,200 ft, and Long Cold Cave, the deepest cave in Nevada at 436 ft vertical depth.

The park has roughly 20,000 acres (8094 hectares) of exposed carbonates that exhibit a high degree of karstification. The park contains solution caves, fracture systems, ice caves, and tectonic caves in diverse vegetation zones ranging from roughly 5,200 feet (1585 meters) to 11,658 feet (3553 meters) in elevation. The park also contains 23 known rock shelters and many dissolutional karst features. There is a high probability of undocumented cave resources in the park as a large portion of the exposed carbonates have not been systematically searched for cave and karst development.

Many of the caves in the park are known to support diverse ecosystems, including populations of sensitive bat species that use the caves for hibernacula, maternity colonies, and transitional roosts. Twelve species of bats have been documented in park caves, including four NPS-Sensitive species. Park caves have a high potential for unique species due to geographic isolation, diverse vegetative cover, and in several caves, active hydrological systems. Several troglobitic invertebrates including pseudoscorpions, harvestmen, mites, springtails, and millipedes have also been documented in park caves.

A caver exits Snake Creek Cave, one of the caves available for public use through the cave permit system.

Purpose and Scope

This document is intended to provide a synthesis of past and current cave data to determine baseline cave resource conditions in Great Basin National Park. Cave resources are identified in groups based upon surface watershed delineation, with an understanding that the surface watershed may or may not have bearing on cave-specific conditions such as subsurface drainage patterns, geologic unit, cave extent, or cave biota.

This document is a product of an NRPP-funded project; Wild Cave Inventory and Management In Great Basin National Park (PMIS 71407). At the onset of the project, Great Basin National Park (GRBA) contained thirty-two known wild caves. The park's cave resources were becoming increasingly well known and visitation was on the rise. A permit system had been initiated in 1997 in an attempt to manage visitation and eight bat compatible gates had been installed in 1998 and 1999 to reduce unauthorized entry into the most visited caves. Little information was available about cave biota and most caves were either unmapped or poorly mapped. A full inventory of the physical and biological resources of GRBA's wild caves was needed to know how to best protect, preserve, and restore these irreplaceable natural resources.

Project objectives were to:

1. Inventory caves for bats and macrobiota and establish a monitoring program for each,

2. Conduct cartographic surveys of all caves within a +/- 2% error of closure,

3. Develop a cave management database and create GIS layers, ·

4. Produce detailed maps and Limits of Acceptable Change monitoring program for each cave, ·

5. Develop alternatives for how to manage the park caves, including general procedures and customized prescriptions to ensure protection of each caves unique resources.

All project objectives were met for the 32 caves known when the project was submitted. Additionally, park staff have discovered 15 new caves over the past four years and are in the process of bringing all caves to the same level of knowledge. The park is currently in the process of formalizing management recommendations for all 47 known caves with a Cave Management Plan.

Project objectives

1. Inventory caves for bats and macrobiota and establish a monitoring program for each,
During the detailed cartographic survey of all caves, initial inventories for bat use and macroinvertebrate use were conducted. Bat population monitoring has been ongoing at GRBA since 1995. Monitoring consists of two different approaches, internal cave surveys and external mist-netting and out-flight counts. Internal surveys of both maternal and hibernacula colonies in caves were conducted to determine presence and/or absence of colonies, as well as an estimate of population size. Mist-netting and out-flight counts took place at roosts to census populations as well as at water sources away from roost locations. The eight caves permitted for public use already had initial inventories and occasional monitoring using both approaches. All other caves were initially inventoried using internal surveys. Due to the sensitive nature of most bat species, monitoring is recommended only every 2-3 years to reduce impacts to both maternity colonies and hibernacula. Detailed protocols used are presented in Appendix C. Cave specific monitoring programs for each are detailed in the individual cave reports. Macroinvertabrate inventories had been conducted sporadically in some park caves prior to this project. Detailed macrobiological inventories were conducted in the eight caves permitted for public use by Jean Krecja and Steve Taylor in 2003. Details of this inventory, including cave-specific species lists, are presented in appendix B. Macrobiological inventories were conducted in the other caves during the cartographic surveys. Due to the extremely low densities and total population size of most cave macroinvertabrate species, monitoring is recommended only every 3 years to reduce impacts to populations. Cave specific monitoring programs for each are detailed in the individual cave reports.

2. Conduct cartographic surveys of all caves within a +/- 2% error of closure, produce detailed maps for each cave,
Twenty-five caves were surveyed and mapped as a result of this project over the three year period 2002-2004. Seven caves were determined to have complete surveys to modern standards. The surveys were conducted using standard cave survey techniques (see Dasher, 1994). Directional (azimuth) data was collected with Suunto-style surveying compasses, read to the nearest one-half degree. Inclination data was collected with Suunto-style surveying clinometers, read to the nearest one-half degree. Azimuth and inclination were read and recorded as both fore and

Top: A caver enjoys the view of Snake Creek Canyon from the entrance of Snake Creek Cave, one of the caves available for public visitation through the cave permit system.

Left: A wooden staircase in disrepair near the Natural Entrance to Lehman Caves. This staircase was removed during a cave restoration project in 2005.

Right: Dr. Megan Porter collects soil samples as part of an ongoing microbiological study in the Baker Creek Cave System.

backsights, with a two-degree margin of error. Distances were measured with either a fiberglass tape, read to the nearest five hundredths of a foot or the nearest centimeter (e.g. 10.25 ft or 10.25 m), or using a Disto Laser Rangefinder, read to the nearest hundredth of a foot or nearest centimeter. Passage dimensions were either estimated or measured with the Disto Laser Rangefinder at each station. A detailed sketch of cave passages was recorded in both plan and profile views.

3. Develop a cave management database and create GIS layers,

A custom-designed cave inventory database was built in MS Access for GRBA caves. The database is a comprehensive reference source for all cave related information at GRBA. It includes cave location information, mapping and inventory status, research performed and historical information. Information from the database is easily exported for use in GIS applications. In addition to the main cave database, a separate database has been created for the cave permit system. This database will simplify the tracking of cave use over time.

4. Produce detailed maps and Limits of Acceptable Change monitoring program for each cave,

After collection of cave survey data, a cave survey software package, COMPASS, was used to reduce data and produce lineplots. Detailed cave maps were created from COMPASS lineplots and field survey notes, using Adobe Illustrator. Cave maps are presented in Appendix YYYY. Limits of Acceptable Change (LAC) maintains desired future resource & social conditions through monitoring & management actions targeted at specific problems. LAC for GRBA caves falls into two categories, caves available for public visitation and caves unavailable for public visitation. In the eight wild caves available for public visitation, physical resource condition is measured using a system of fixed photopoints established at selected sites within each cave. Each site is surveyed and descriptive information about camera placement is recorded. These photos provide comparative qualitative and quantitative data for any visible resource change. Monitoring stations for each cave, (Crevasse – 2; Hallidays Deep – 2; Wheelers Deep – 2; Systems Key – 2; Upper Pictograph – 2; Snake Creek – 5; Modal -2, and Little Muddy – 3) and an initial set of photographs was completed for each point in FY 2003. Photomonitoring in these caves will be repeated again in FY2006, and every three years thereafter. This time period allows for gradual change to become apparent, while also allowing prompt management efforts if necessary. Social conditions are managed through the wild cave permit system and limit access to each cave to one trip per week. In caves unavailable for public visitation, the physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee. Social conditions are managed through the wild cave permit system and similarly limit access to each cave to one trip per week.

5. Develop alternatives for how to manage the park's caves, including general procedures and customized prescriptions to ensure protection of each cave's unique resources.

With the completion of this project, and evaluation of the cave resources within GRBA, each cave has been assigned a customized management prescription based on a modified version of the NPS-77 cave classification system (Appendix D). With the exception of Lehman Caves, and the eight caves available to public visitation by permit, it is recommended that the remaining caves be considered closed with the exception of research and management uses. Newly discovered caves should be considered closed to all use pending an initial cartographic survey and biological inventory. Nine caves are open to public visitation in GRBA, each requiring a permit for public entry, in accordance with the NPS Management Policies (2001). This includes the developed Lehman Caves, which is only open to ranger-guided tours. Permits for Lehman are in the form of a cave tour ticket, which is purchased at the Lehman Caves Visitor Center. The remaining eight caves are undeveloped, "wild caves". These caves range from small, single-room caves to deep, cold cave systems requiring specialized equipment and technical skill. Many of the permitted caves have seasonal closures for protection of bat colonies, as well as adverse environmental conditions. Closure dates and permit conditions are outlined in the cave-specific section of this document. The cave permit system is managed by the Physical Science Branch of the Resource Management Division at GRBA. Visitors interested in wild cave activities receive a package, including a general information sheet, a cave information contact sheet, a cave permit application, and a copy of the GRBA caving restrictions and guidelines. Only one permit per week may be issued for each cave. Visitors are required to return a trip report upon completion of the trip. Data on cave permits is recorded in a custom Access database, including date of trip, participants, and trip leaders, as well as whether or not a trip report was filed. In addition to public use of caves, cave permits are issued for management use of caves as well, in an attempt to better track overall cave use.

Baker Creek Watershed

Description

The Baker Creek Watershed is located on the east side of GRBA and encompasses 10,394 acres (4206 hectares). The watershed contains a picnic area and two campgrounds. The majority of the Baker Creek watershed is underlain by insoluble rocks, predominantly the Prospect Mountain Quartzite, along with Tertiary granites. The karstic unit is the Pole Canyon Limestone at 1760 acres (712 hectares). The watershed is a forested watershed, with only 30% of the area shrub or no vegetation.

Karst

The only carbonate unit in the Baker Creek watershed is the Middle Cambrian Pole Canyon Limestone. There is extensive surficial karst development along Baker Creek, consisting of numerous epikarstic features, along with solution pits. The Baker Creek watershed contains some of the most highly developed karst drainage networks in the park, and likely in the State of Nevada.

Caves

The Baker Creek Cave System (BCCS) is the most important cave resource in the watershed, however there are many small karst features, as well as shelter caves located in the confines of the Baker Creek Watershed. Other significant caves located along Baker Creek are not physically connected to the BCCS, however are likely hydrologically connected. The majority of the park's permitted caves are a part of this network.

Baker Creek Cave System

The Baker Creek Cave System consists of four connected caves in the Baker Creek Narrows; Ice Cave, Crevasse Cave, Halliday's Deep Cave, and Wheeler's Deep Cave. This system is the second-longest cave in the State at 4315 ft.

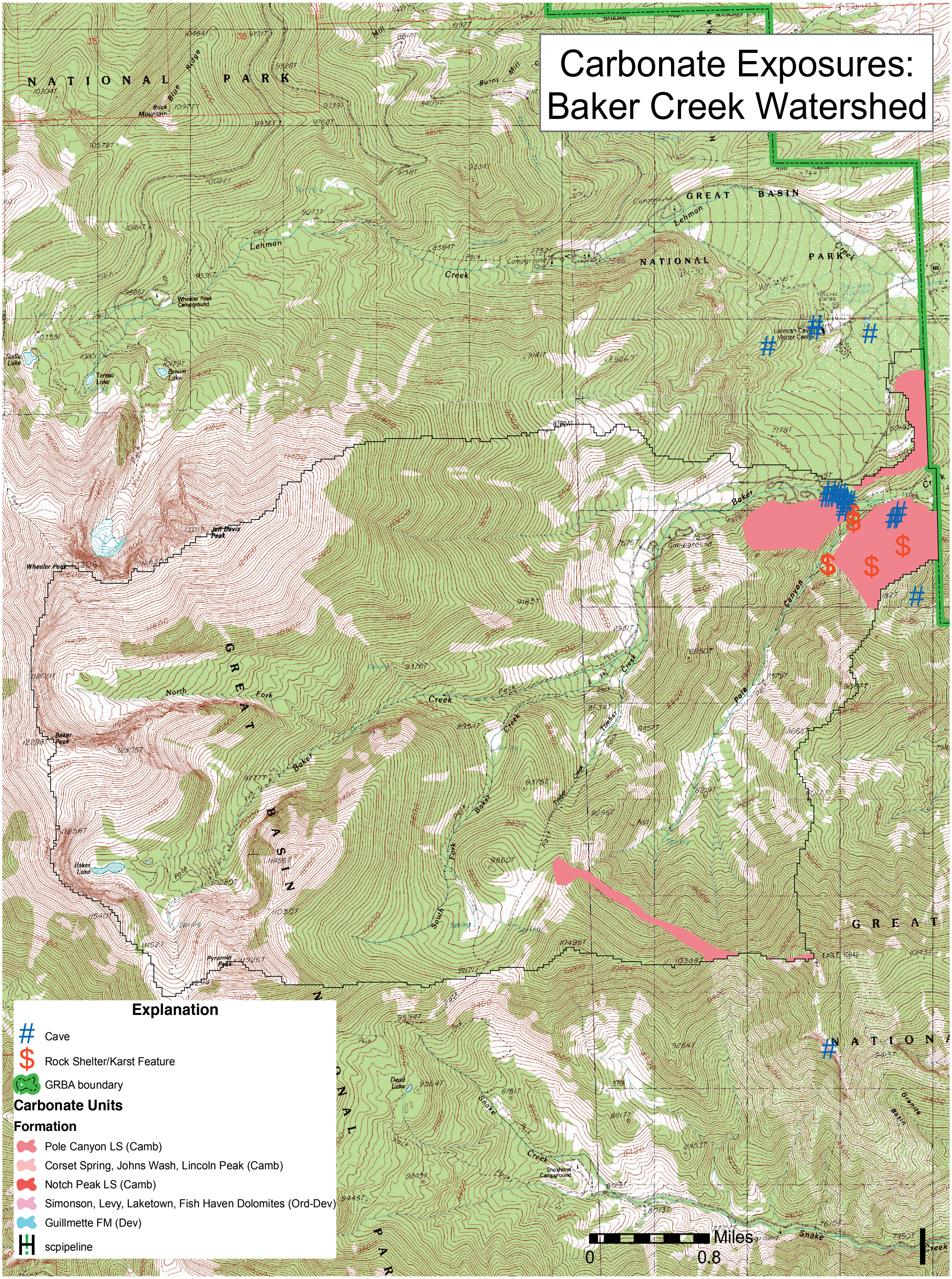
In 1958, Arthur Lange investigated the caves of the Baker Creek for the Western Speleological Institute and concluded that there was once only one system that was cut through by the Baker Creek (Bridgemon 1964). Ice, Crevasse, Hallidays Deep and Wheelers Deep Caves have been physically connected through cave exploration, and are simplified as the Baker Creek Cave System. Model Cave, Systems Key Cave, and Dynamite Cave have been shown to be connected to the Baker Creek system hydrologically.

Hydrologic studies of the caves of the Baker Creek Cave System started in August 1952. By diverting water into Dynamite Cave, the water level in Model Cave rose 15 feet. In January 1954, when no water was entering Dynamite Cave, the entire length of Model Cave could be traveled without reaching sumped passages. In March 1955, an attempt was made to find where the water in Model Cave resurfaced. To do this, two pounds of fluorescein dye was injected into the stream in Model Cave, while no water was flowing into Dynamite Cave. No dye was recovered. A month later, dye was injected into Pole Canyon Creek during the snow melt. The streams in Model Cave and spring beneath Model Cave were checked. No dye was recovered. In the middle of April, water was routed to Dynamite Cave and dye was added. On the following morning, the caves were checked. The waters of the perennial streams were unchanged, but a previously dry stream near the base of the entrance of Wheelers Deep Cave was found flowing green with fluorescein dye. Model Cave was entered the following day allowing time for the water to rise. Green color of the fluorescein dye was not seen, but the water level increased 3 to 4 times normal. A hydrologic connection between Dynamite Cave, Wheelers Deep Cave, and Model Cave was reported. (Bridgemon 1979, Lange 1958). Following the near-record snowfall of the 2004-2005 winter, a secondary channel of Baker Creek formed, and water was naturally diverted into Ice Cave. The entrance crawl to Model Cave was sumped, and water was flowing out of the entrance during a site visit in May 2005.

Management Issues and key Data Gaps

The four caves making up the BCCS make up the majority of the Park's permitted recreational caves. As such, these caves receive a larger amount of impact and potential for destructive impacts is much higher. The caves have many challenging climbs, confusing passages, tight crawls, and areas where technical ropework is necessary to negotiate cave passage. This combination of hazards creates a high potential for incidents requiring search and rescue, requiring Park staff to be familiar with the cave system. The Crevasse and Wheelers Deep entrances provide important habitat for bat colonies, as both maternity and hibernacula roosts.

The hydrology of the BCCS, and other caves in


Carbonate Exposures:
Baker Creek Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.8
NATIONAL PARK
GREAT BASIN
Baker
Creek
Lehman
Wheeler Peak
Jeff Davis Peak
Baker Peak
Baker Lake
Pyramid Peak
Snake
Creek

the Baker Creek area (Model, Systems Key) is very poorly understood, and is the key data gap for this area. A hydrologic study of this area is currently in development (PMIS 117486). Continued macroinvertebrate monitoring based on the protocols of the Krejca and Taylor study of 2003 should be implemented to determine trends.

Wheelers Deep Cave Entrance

BC-05
Proposed Management Class: 3-C-IV
Length: 4315.5 ft (Wheelers-Hallidays-Crevasse-Ice)
Vertical Relief: 237.5 ft (Wheelers-Hallidays-Crevasse-Ice)
Map page 115
Survey and Physical Inventory: May-August 2003
Biological Inventory: May 2003

Physical Description

Wheelers Deep Cave is the heart of the Baker Creek Cave System. The northeastern end of Crevasse Cave connects with Wheelers Deep. Hydrologic studies show that water diverted into Dynamite Cave flows into Wheelers Deep Cave and then is passed on to Model Cave (Lange 1958). These creeks only flow during high waters when the Baker Creek overflows into the Dynamite Cave. The sources of Wheelers Deep Cave's perennial streams are unknown. Talus slope leading to 50 ft drop creates high rockfall danger; many tight squeezes; hypothermia due to contact with cold, wet, tight passages; mazy passages at connection to Hallidays Section.

Geology, Hydrology and Speleogenesis

The Wheeler's Deep section of the BCCS is a large solution cave, consisting of a mazy phreatic section and a large joint-controlled section further to the south, which parallels Grey Cliffs.

Hydrologic studies show that water diverted into Dynamite Cave flows into Wheeler's Deep Cave and then is passed on to Model Cave (Lange 1958). These creeks only flow during high waters when the Baker Creek overflows into the Dynamite Cave. More work is necessary to confirm these earlier studies.

History and Cultural Resources

Sidney Wheeler first noted Wheelers Deep Cave in 1939 while performing a scientific excavation of Pictograph Cave (NSS Convention Guidebook 1975). The cave was rediscovered by the Salt Lake City Grotto in 1964 (Bridgemon 1979).

Biological Resources

A Macroinvertebrate study was conducted in 2003 by Krejca and Taylor (see attached species list). Wheelers Deep Cave is also an important Townsend's Big Eared-Bat (Cornynorhinus townsendii) summer roost. The colony consists of about 30 to 40 bats. The bats roost in the entrance from spring to mid-summer as a prenursery site (Appendix 2. Bat Data Summary).

Management Issues

Two impact monitoring points have been established in Wheelers Deep. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Wheelers Deep is open to public use via the cave permit system. The cave is closed to use from April 1st to July 1st for the protection of bat populations that use the cave during this time period.

Hallidays Deep Entrance

BC-07
Proposed Managment Class: 3-C-III
Length: 4315.5 ft (Wheelers-Hallidays-Crevasse-Ice)
Vertical Relief: 237.5 ft (Wheelers-Hallidays-Crevasse-Ice)
Map page 115
Survey and Physical Inventory: May-August 2003
Biological Inventory: May 2003

Physical Description

Hallidays Deep consists of several small crawls connecting Crevasse Cave to Wheeler's Deep.

Geology, Hydrology and Speleogenesis

The Hallidays Deep section of the BCCS is mostly phreatic stream passage with large quartzite cobble fill, and numerous formations.

History and Cultural Resources

Unknown.

Biological Resources

A macroinvertebrate study was conducted in 2003 by Krejca and Taylor. Microbial studies are ongoing in Halliday's by Porter and Engel (2005)

Management Issues

Two impact monitoring points have been established in Hallidays Deep. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Hallidays Deep is open to public use via the cave permit system. The cave is closed to use from April 1st to July 1st for the protection of bat populations that use the cave during this time period.

Ice Cave Entrance

BC-06
Proposed Management Class: 3-B-III
Length: 677.2 ft
Vertical Relief: 41.4 ft
Map Page 115
Survey and Physical Inventory: May-August 2003
Biological Inventory: May 2003

Physical Description

Ice Cave's entrance is located at the base of a north-facing cliff. The entrance rarely ever gets direct sunlight and receives cold sinking air from Crevasse Cave located just above it. Because of these conditions Ice Cave maintains a 0 C to 5 C temperature year around.

Geology, Hydrology and Speleogenesis

Ice Cave, along with Dynamite Cave and Systems Key, are paleo-insurgences where water was diverted into the cave system. The entrance floor is filled with Pleistocene rocks showing that the cave used to route water from large floods. The cave is heavily scalloped and follows the typical structural trends seen in Systems Key Cave and Wheelers Deep Cave.

For a number of months in spring/summer 2005, a side channel of Baker Creek was flowing into the Ice Cave entrance, completely sumping the gate at times.

History and Cultural Resources

Ice Cave is a cold cave connected with Crevasse Cave (Figure 17). The first account of making the connection between these two caves is by J. R. Wahrenburg on July 10, 1964 (Bridgemon 1964).

Biological Resources

The low temperatures between Ice and Crevasse Cave make favorable conditions for Townsend's Big-Eared Bats. Solitary bats have been noted in the cave year around (Appendix 2. Bat Data Summary). A macroinvertebrate study was conducted in the cave in 2003 by Krejca and Taylor.

Management Issues

Three impact monitoring points have been established in Ice. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Ice Cave is open to public use via the cave permit system. The cave is closed to use from October 15th to September 10th for the protection of bat populations that use the cave during this time period.

Crevasse Cave Entrance

BC-07
Proposed Management Class: 3-C-III
Length: 252.1 ft
Vertical Relief: 126.4 ft
Map page 115
Survey and Physical Inventory: May-August 2003
Biological Inventory: May 2003

Physical Description

Crevasse Cave is an impressive 200-ft long entrance that extends down to a depth of about 150 ft. The cave is constrained within a large joint plane. The northeastern part of the cave connects with Hallidays Deep Cave, and the southwestern part connects to Ice Cave. All of Crevasse Cave consists of vertical passages. The horizontal portions are considered parts of Hallidays Deep Cave and Ice Cave.

Geology, Hydrology and Speleogenesis

Crevasse Cave is a large tectonic fracture cave in the Baker Creek Narrows. The cave connects at depth with Hallidays Deep cave, a classic solution cave. The cave was likely formed as a bank margin failure after the downcutting of the Narrows.

History and Cultural Resources

The earliest reports of Crevasse Cave are associated with the 1958 geologic study by Arthur Lange. No cultural resources are noted in the cave.

Biological Resources

Crevasse contains the park's most important winter and summer roosts for Townsend's Big-Eared Bats, with an average winter colony of about 80 bats. This colony is the only known winter colony where the bats appear clustered together. In the summer, about 100 to 200 bats have been estimated roosting just beneath the top of the entrance (Appendix 2. Bat Data Summary).

Management Issues

Three impact monitoring points have been established in Crevasse. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Crevasse is open to public use via the cave permit system. The cave is closed to use from October 15th to September 10th for the protection of bat populations that use the cave during this time period.

Model Cave

BC-08
Proposed Management Class: 4-C-III
Length: 1969.1 ft
Relief: 146.8 ft
Map page 103
Survey and Physical Inventory: March-April 2003
Biological Inventory: May 2003

Physical Description

The Model Cave survey is currently at approximately 2000 feet, however the cave extends to at least twice that length before reaching an impassable sump. Model Cave has the largest surface footprint of any cave in the park: from the cave's entrance to the back of the cave is about 2000 ft (Figure 18). The cave entrance appears as a drainage from the base of a large cliff. The entrance is a paleo-resurgence of the Baker Creek Cave System. The cave also has familiar features such as clean scalloped walls, long muddy crawls, and active streams, making it a model cave.

Geology, Hydrology and Speleogenesis

Model Cave is a large solution cave along Baker Creek. It is a classic stream cave, with many visible flow features, incised canyon passage, and multiple streams.

Because of the cave's water fluctuations, it has been the focus of hydrologic studies such as Lange (1958) and Bridgemon (1979). January and February seem to be the only months where the back of the cave to the last sump is accessible. During the summer, water flows in the main stream bed a few hundred feet beyond the entrance of the cave. In May of 2003, water levels were observed not only rising from the back of the cave, but also from the back of the small canyon passage near station M13L.

During January 2004, the back of Model Cave was accessed. Three separate water sources were found. In section A, the furthermost point on the 1955 Western Speleological Institute Map of Model Cave, an isolated pool blocks the passage. A stream (Stream 1) begins in section C and continues to section E, where it flows into a deep pool. This pool did not have a visible outlet, nor was the bottom visible with the available light sources. In section H, two water sources flowed into the cave. Stream 1 reappeared, muddy from our upstream travels, and only 2 m away Stream 2 poured out of the cave wall, joining Stream 1. Stream 2 had clear water that was noticeably colder than Stream 1. The combined stream flowed for approximately 100 m to section I, where it continued down a bedrock passage that was too small for humans to enter (Schenk, Patel, Roberts 2004).

Water samples taken on the trip showed that Stream 1 had the highest alkalinity and hardness. These values indicate that Model Cave Stream 1 water has been in contact with the surrounding limestone for the most amount of time, and that it most likely does not come directly from Baker Creek. However, Stream 2 and Baker Creek had fairly similar water chemistry, which suggests that the water leaving Baker Creek enters Model Cave fairly quickly (Schenk, Patel, Roberts 2004). Two reports of a fish found in Model Cave (Heath 1997, NOLS 2000) also support this hypothesis.

Due to the proximity of Baker Creek to Model Cave, it was conjectured that Baker Creek could be the source of water for these streams. A large amount of water leaves Baker Creek and enters the cliff face at Sink Cave, where it could possibly then enter Model Cave. To test these hypotheses, water samples were collected for analysis and a dye trace was conducted. The dye trace revealed no information as to the source of the water supply, which still remains unknown. Water from Sink Cave may eventually run into Model Cave, but in order to test this dye-traps should be placed in Model Cave at Streams 1 and 2. Additional dye tracing over a longer period of time may reveal more definitive answers.

In spring 2005, the cave entrance crawl was sumped, and water was flowing from the entrance, as well as a large amount of flow at the spring resurgence just below the entrance.

History and Cultural Resources

Model Cave was discovered in 1952 on the Stanford Grotto's three-month expedition funded by O. H. Truman, Californian Geophysicist (Lange 1952).

Biological Resources

Model Cave is one of the most biologically significant caves in the park. It has the highest known species diversity of cave invertebrates and excellent habitat potential due to high nutrient input and hydrological activity. Solitary Townsend's Big Eared-Bats and Western Small-Footed Bats have also been observed to be roosting in Model throughout the year (Appendix A. Bat Data Summary). In the summer of 1966, a sighting of the Spotted Bat (Euderma maculatum) was made in Model Cave (Soulages 1966).

Management Issues and key Data Gaps
Model Cave is gated but open to public use via the cave permit system. The cave has great potential for high CO_2 levels, due to the large amount of organic input. The cave survey is not complete, as the far reaches of the cave have been sumped during recent survey attempts. Two distinct water inputs exist in the cave, and it is an important part of the karst hydrologic system of the Baker Creek area. Inclusion of Model Cave in the hydrologic characterization of the Baker Creek Cave System is highly important to understand subsurface drainage in this area of the park.

Two impact monitoring points have been established in Model Cave. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Systems Key

BC-12
Proposed Management Class: 3-C-III
Length: 1038.8 ft
Vertical Relief: 93.9 ft
Map page 114
Survey and Physical Inventory: July-August 2002
Biological Inventory: May 2003

Physical Description
The cave is about 1500 ft long, but a connection to the rest of the Baker Creek system was never found. The cave passage morphology lines up with the passages in Crevasse Cave and Pictograph Cave.

Geology, Hydrology and Speleogenesis
Systems Key is a large multi-level solution cave. The survey actually shows dry cave passages crossing beneath Baker Creek and ending near Pictograph Cave. The cave may be hydrologically connected to the Baker Creek Cave System.

History and Cultural Resources
Systems Key was discovered in 1969 (NSS News 1969). This cave was the last of the Baker Creek Caves to be discovered. Because of its central position, many thought that it would be the key to the Baker Creek System, hence its name.

Biological Resources
Systems Key Cave also contains some hibernating Townsend's Big-Eared Bats. Having an entrance on a north-facing cliff, cold air sinks into the entrance creating favorable hibernating conditions for bats. A macroinvertebrate study was conducted in 2003 by Krejca and Taylor.

Management Issues and key Data Gaps
Systems Key is gated cave, but open to public use via the cave permit system. There is a rumored bolt at the one drop in the cave, and its placement and stability needs to be evaluated. Inclusion in a hydrologic study of the Baker Creek Cave System would improve knowledge of the cave. Continued monitoring of invertebrates based on the 2003 study is essential to understand the possible impacts from recreational caving.

Two impact monitoring points have been established in Systems Key. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Dynamite Cave

BC-09
Proposed Management Class: 6-A-V
Length: 0 ft
Vertical Relief: 0 ft

Physical Description
Dynamite Cave got its name from the excessive digging that was done to connect it to the nearby passages of Halliday's Deep Cave. Debris has since plugged the opening.

Geology, Hydrology and Speleogenesis
Dynamite Cave used to be a sinking point of Baker Creek diverting water into the Baker Creek Cave System when water levels in the creek rose sufficiently. Experiments were performed at Dynamite Cave that hydrologically link it with the rest of the System. The experiment involved diverting the entire flow of the Baker Creek into Dynamite Cave. When this was done, water in Wheelers Deep and Model Cave rose. Eventually, waterflow was induced beneath Model Cave's entrance. (Lange 1958)

History and Cultural Resources
Unknown.

Biological Resources
Unknown

Management Issues and key Data Gaps
The cave entrance is currently collapsed.

Upper Pictograph Cave

BC-02
Proposed Management Class: 3-C-I
Length: 185 ft
Vertical Relief: 21.1 ft
Map page 115
Survey and Physical Inventory: 9/20/2002
Biological Inventory: May 2003

Physical Description
Upper Pictograph Cave has a 20-ft high by 15-ft wide entrance roughly 20 ft from Grey Cliffs road. It consists of a single chamber with a sediment and breakdown floor.

Geology, Hydrology and Speleogenesis
Upper Pictograph Cave is a segment of a larger cave system that has been fragmented by the creation of the Baker Narrows. It is apparent that the entire flow of Baker Creek once entered Upper Pictograph Cave (or it's predecessor)

History and Cultural Resources
The rock art at the entrance of the cave consists of Fremont style pictographs containing panels of red and black trapezoidal Kachina-style anthropomorphs (McLane 1989). This site has had sporadic excavations since 1924. In the early 1930s, Harrington reported finding chipped stone artifacts and animal bones along with ashes, charcoal, and fire cracked rocks (Wells 1990). Steward (1938) suggests that the Baker Creek Caves may have been a part of the Shoshone village of Tunkahniva (Wells 1990).

Biological Resources
Pictograph Cave is an important maternity site for Townsend's Big Eared Bats and Myotis volans (Appendix 2. Bat Data Summary). The female bats switch between Upper Pictograph Cave and the other caves in the Baker Creek System. Mist-netting from September 2002 and 2003 yielded 100 and 67 bats respectively. A macroinvertebrate study was conducted by Krejca and Taylor in 2003.

Management Issues and key Data Gaps
Due to its proximity to the road, Upper Pictograph Cave has hundreds of unauthorized visitors each year based on numbers recorded by the counter at the entrance to the cave. An interpretive sign would greatly reduce visitation to this cave. Continued monitoring of invertebrates based on the 2003 study is necessary to understand trends.

Two impact monitoring points have been established in Upper Pictograph. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Upper Pictograph Cave is open to public use via the cave permit system. The cave is closed to use from March 25th to September 10th for the protection of bat populations that use the cave during this time period.

Lower Pictograph Cave

BC-03
Proposed Management Class: 3-C-II
Length: 162.1 ft
Vertical Relief: 16.6 ft
Map page 115
Survey and Physical Inventory: 9/20/2002
Biological Inventory: May 2003

Physical Description
Lower Pictograph Cave is located about 200 feet southeast of Pictograph Cave and is also easily spotted from the road (Figure 20). This cave consists of many small openings that pinch down after about 20 feet.

Geology, Hydrology and Speleogenesis
Lower Pictograph Cave is a solution cave that was once part of a larger system including Baker Rockshelter and Upper Pictograph cave that was dissected by the creation of the Baker Narrows.

History and Cultural Resources
The cave is reported to have 17 pictograph panels that extend away from the entrance. Archeological digs were conducted in the cave during the summer of 2000 by the Western Archeological Conservation Center.

Biological Resources
An invertebrate inventory was conducted in 2003 by Krejca and Taylor.

Management Issues and key Data Gaps
The cave is located adjacent to the Grey Cliffs road, and receives a large amount of visitation due to its ease of access. An interpretive sign is necessary to help prevent disturbance of the cultural resources in the cave. Continued monitoring of invertebrates based on the 2003 survey will assist in determining impacts.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Three Hole Cave

BC-10
Proposed Management Class: 3-A-I
Length: 77 ft
Vertical Relief: 15 ft
Map page 110Survey and Physical Inventory: 5/26/1997

Physical Description

Three Hole Cave is a small cave located along Baker Creek (Figure 22). Solitary bats have been reported in Three Hole Cave. The cave is easily accessible from Baker Creek Road, but has no known hazards or sensitive resources.

Geology, Hydrology and Speleogenesis

Three Hole Cave is a small solution cave developed along a low angle fault along the Baker Creek Narrows.

History and Cultural Resources

Unknown.

Biological Resources

Rat and bat use are noted on an inventory form from the late 1990s.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Three Hole Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Fool's Hole Cave

BC-15
Proposed Management Class:3-A-II
Length: 16.3
Vertical Relief: 6.9 ft
Map page 99
Survey and Physical Inventory: 6/14/2003

Physical Description

Fools Hole is a small joint controlled cave located at the base of Grey Cliffs, approximately 40 feet from Baker Creek (Figure below). Ice was reported in the cave on June 4, 2003.

Geology, Hydrology and Speleogenesis

Fool's Hole is a small solutionally enlarged fracture along Baker Creek

History and Cultural Resources

Unknown.

Biological Resources

Rat use was noted in an inventory of the cave in the late 1990s.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Fool's Hole Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Coyote Hole Cave

BC-14
Proposed Managment Class: 3-A-I
Length: 32 ft
Vertical Relief: 10 ft
Map page 98
Survey and Physical Inventory: 6/4/2003

Physical Description

Coyote Hole is a small solutional cave located near Sawmill Rockshelter along Baker Creek

Geology, Hydrology and Speleogenesis

Coyote hole is a small solution cave.

History and Cultural Resources

Unknown.

Biological Resources

A large midden is present in the rear of the cave. No other biota are noted.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Coyote Hole Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

T Cave

BC-13
Proposed Management Class: 3-A-I
Length: 32.5 ft
Vertical Relief: 7 ft
Map page 109
Survey and Physical Inventory: 6/4/2003

Physical Description

T Cave is a small single passage, solutional cave located near Coyote Cave and Sawmill Rockshelter along Baker Creek

Geology, Hydrology and Speleogenesis
T Cave is a small solution cave, exhibiting strong structural control.

History and Cultural Resources
Unknown.

Biological Resources
Rat middens, snail shells, beetles, and a skunk were noted in the cave during survey and inventory trips in the late 1990s

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for T Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Rockfall Cave

BC-19
Proposed Management Class: 3-C-IV
Length: 57.0 ft
Vertical Relief: 41.2 ft
Map page 116
Survey and Physical Inventory: 9/12/2003

Physical Description
Rockfall cave is a small solutionally-enlarged fracture along Baker Creek. The cave ends in a small pit, with a dig lead.

Geology, Hydrology and Speleogenesis
The cave appears to be a solutionally-enlarged fracture, similar to the caves of the Baker Creek System

History and Cultural Resources
Rockfall Cave was discovered and dug open in September of 2003

Biological Resources
Roots and small mammal bones were noted during the survey of the cave

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Rockfall Cave

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Hiding Hole Cave

BC-18
Proposed Management Class: 3-A-I
Length: 60.5 ft
Vertical Relief: 16.1 ft
Map page 100
Survey and Physical Inventory: 8/29/2003

Physical Description
Hiding Hole is a small, single room cave with a large amount of unstable breakdown

Geology, Hydrology and Speleogenesis
The cave appears to be a collapse feature. No other information is noted.

History and Cultural Resources
Unknown.

Biological Resources
No biota were noted during the survey of the cave in August 2003.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Hiding Hole Cave.

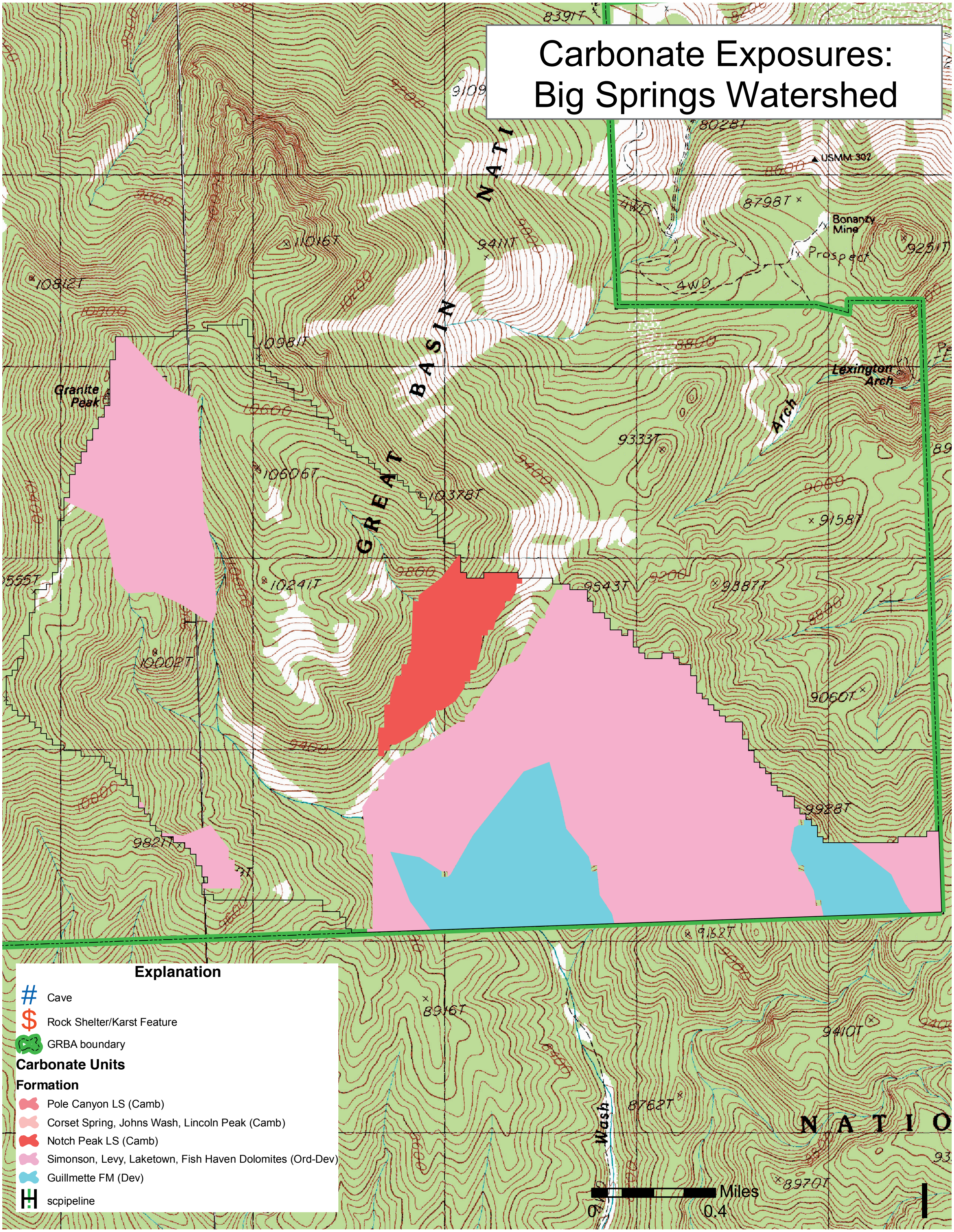
The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Big Springs Watershed

Big Springs watershed is located in the southern end of the park. It includes 1984 acres, with no known water sources or saturated wetlands within the park boundaries. However, the Big Springs Watershed outside the park encompasses Cedar Cabin Springs, one of the most reliable water sources at the southern end of the South Snake Range, and the watershed empties towards Big Springs, a huge spring complex that feeds the Burbank meadows, Lake (Big Springs) Creek, and Pruess Lake (Garrison Reservoir).

The underlying geology of Big Springs watershed is 49% Eureka Quartzite & Pogonip Group (Cambrian-Ordivian), 38% Simonson, Levy, Laketown and Fish Haven Dolomites (Ordivian-Devonian), 9% Guilmette Formation (Devonian), and 4% Notch Peak Limestone (Cambrian). The vegetative cover comprises 49% white fir, 28% subalpine, 7% Engelmann spruce, and 6% mountain mahogany.

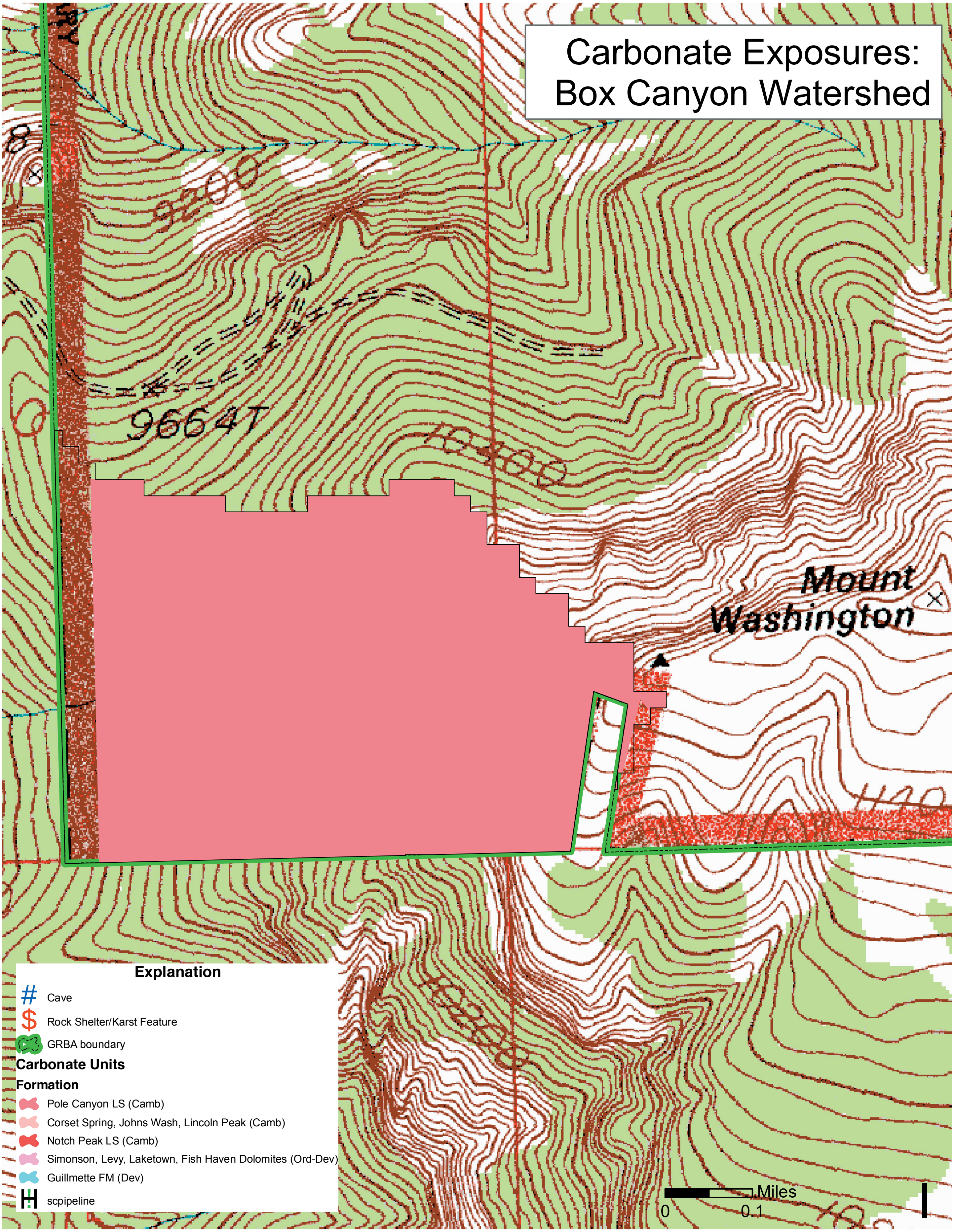
No caves or karst features are known from this watershed. A systematic inventory of the carbonate exposures in the Big Springs Watershed is necessary.


Carbonate Exposures:
Big Springs Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.4
GREAT BASIN NATI
NATIO
Granite Peak
Lexington Arch
Arch
Bonanza Mine
Prospect
USMM 302
4WD
Wash
11016T
10812T
10981T
10606T
10378T
10241T
10002T
9821T
9411T
9333T
9158T
9543T
9387T
9060T
9988T
8798T
8028T
8391T
9251T
9152T
8916T
9410T
8762T
8970T

Box Canyon Watershed

Box Canyon is located on the west side of the park just north of the road up to Mt. Washington. The watershed includes 156 acres within the park, with no water sources or wetlands known or found in the 2003 survey. The underlying geology of Box Canyon watershed is 92% Pole Canyon limestone (Cambrian) and 8% unknown. The vegetative cover is composed of 97% subalpine pine and 1% white fir, with 2% of the watershed barren.

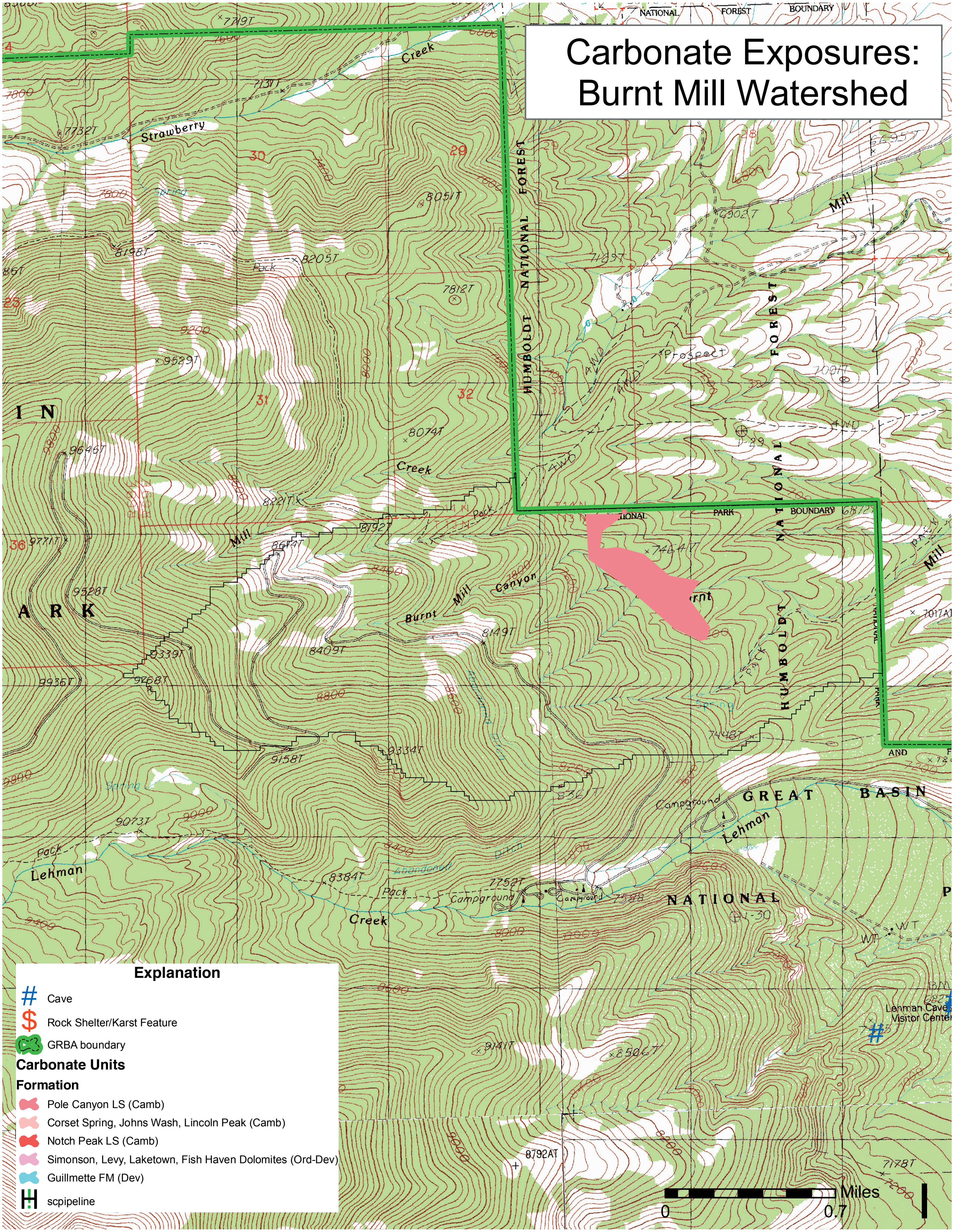
No caves or karst features are known from this watershed. A systematic inventory of the carbonate exposures in the Box Canyon Watershed is necessary.


Carbonate Exposures:
Box Canyon Watershed
9664T
Mount
Washington
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.1

Burnt Mill Watershed

The Burnt Mill watershed is located on the northeast side of the park, with part of the Wheeler Peak Scenic Drive, including a parking area for viewing the Osceola Ditch, traversing its upper slopes. The watershed consists of 1761 acres within the park. The June 2003 survey documented four springs, with one of the previously three known ones dry. The underlying geology of Burnt Mill watershed is 67% Prospect mountain quartzite (Cambrian), 27% unconsolidated sediments (Quarternary), and 6% other. The vegetative cover comprises 52% pinyon-juniper, 27% mountain mahogany, and 21% white fir.

No caves or karst features are known from this watershed. A systematic inventory of the carbonate exposures in the Burnt Mill Watershed is necessary.


Carbonate Exposures:
Burnt Mill Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
0
0.7
Miles
Burnt Mill Canyon
Strawberry Creek
Lehman Creek
HUMBOLDT NATIONAL FOREST
GREAT BASIN NATIONAL PARK
Lehman Caves Visitor Center
Campground

Can Young Watershed

Can Young watershed encompasses 2004 acres (810 hectares) on the east side of the park. It includes 19 springs, an ephemeral stream, and wetlands, all noted in the 2003 survey.

The underlying geology of Can Young watershed consists of 38% Granitic Rock (Jurassic-Tertiary), 31% Unconsolidated Sediments (Quaternary), 25% Prospect Mountain Quartzite (Cambrian), and 6% other. Vegetative cover includes 37% white fir, 24% pinyon-juniper, 21% mountain mahogany, 14% subalpine, and 4% other.

Water Trough Cave

NC-01
Proposed Management Class: 6-B-IV
Length: 144.3 ft
Relief: 11.3 ft
Map page 111
Survey and Physical Inventory: 8/8/2000

Physical Description

Water Trough cave is a small spring resurgence in Can Young Canyon.

Geology, Hydrology and Speleogenesis

Water Trough is a spring resurgence. Very little is known about the geologic setting of the cave. Notes state the cave has a six-foot rimstone dam.

History and Cultural Resources

The spring fed a water trough below the cave that was removed in 2002. Historical significance of this trough is unknown.

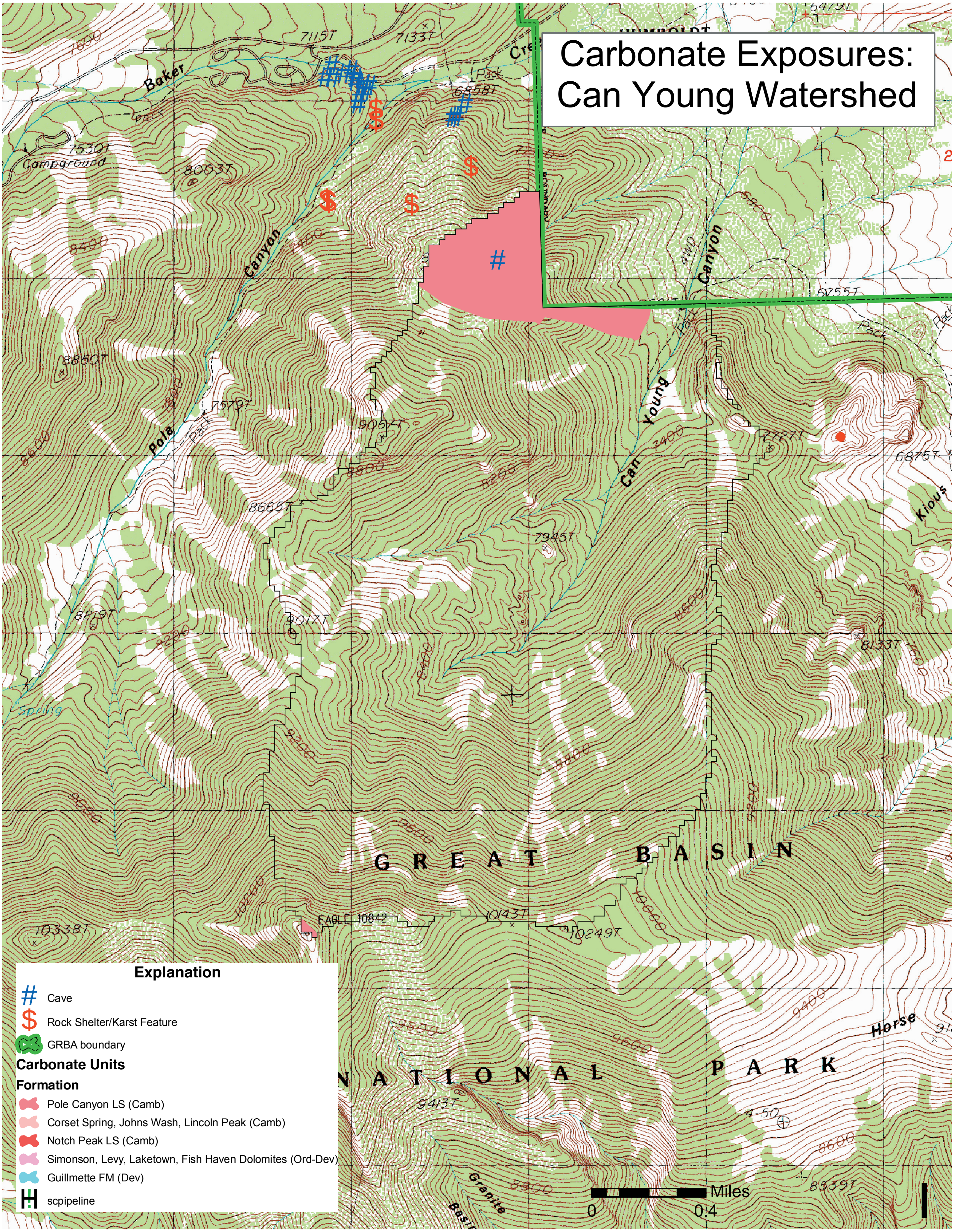
Biological Resources

Water Trough is known to be a summer roost for Townsend's Big-eared Bats (Corynorhinus townsendii). The cave was mist-netted in September 2003, and was found to be used by the following bat species: M. volans, C. townsendii, M. evotis, and M. ciliolabrum (Appendix 2. Bat Data Summary).

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Water Trough Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.


Carbonate Exposures:
Can Young Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.4
Baker
Campground
Pole Canyon
Can Young Canyon
GREAT BASIN
NATIONAL PARK
EAGLE 10842
Horse
Kious
Granite Basin

Decathon Watershed

Decathon watershed is located in the southwest part of the park. The Decathon watershed encompasses 3241 acres (1311 hectares) with one known spring, known on topographical maps as Mustang Spring. The 2003-04 survey found that the springhead of Mustang Spring dries up during the fall months, however water still drips out of a pipe. During the summer months, enough water flows from this spring to be used for sheep watering. Outside the park, Decathon Spring is a small spring that can be diverted into watering troughs. The spring is extremely small.

The underlying geology includes 84% Eureka Quartzite & Pogonip Group (Cambrian-Ordivian), 10% Notch Peak Limestone (Cambrian), and 6% other. Vegetative cover is composed of 49% subalpine, 31% white fir, 15% Engelmann spruce, and 5% other.

Deep Fall Cave

LP-03
Proposed Management Class: 4-B-IV
Length: 204 ft
Vertical Relief: 130 ft
Survey and Physical Inventory: 8/31/2004

Physical Description

The cave's entrance is a large collapse along the Highland Ridge, with a lone Bristlecone Pine in the center. A short crawl in breakdown leads to a bolted drop (~30 ft) to a permanent snow floor. A short crawl (~5 ft) leads to a large dome with an ice floor, and a second drop of ~80 ft. The cave ends in a small ice-filled room.

Geology, Hydrology and Speleogenesis

Deep Fall cave appears to be a large solution dome-pit, perhaps with some prograding collapse and cliff failure producing the entrance. The cave contains a large amount of permanent snow and ice, and the location and nature of the ice floors in the cave are known to be dynamic.

History and Cultural Resources

The cave was discovered in August 2002. No prior reports are known.

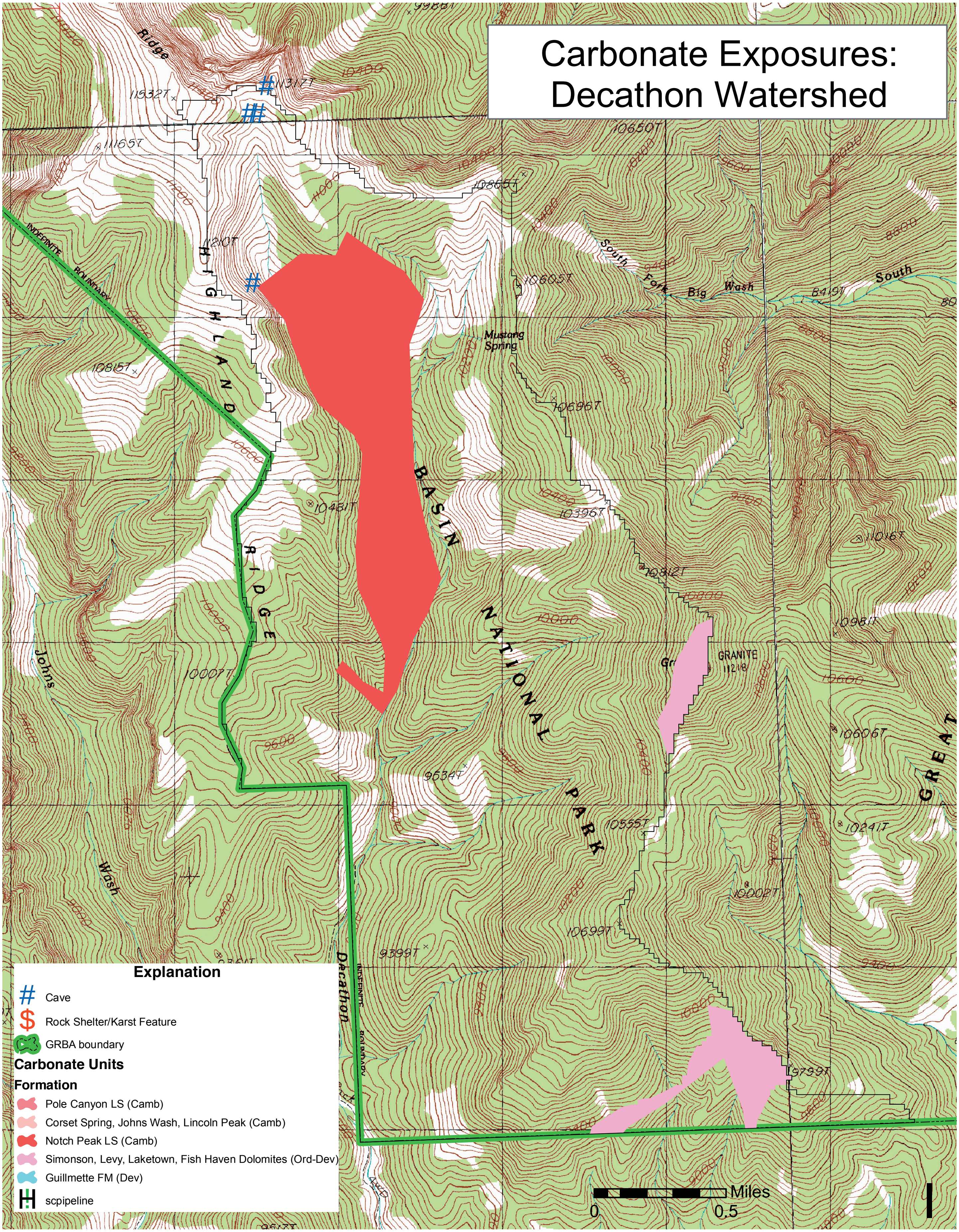
Biological Resources

No significant biota were noted on trip reports from the cave, nor were any noted on the survey trip in August 2004

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Deep Fall Cave. In addition, microclimate monitoring to determine the nature of the year-round ice in the cave may provide useful information.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.



Carbonate Exposures:
Decathon Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.5
HIGHLAND RIDGE
BASIN NATIONAL PARK
GREAT
South Fork Big Wash
Mustang Spring
GRANITE
Johns Wash
Decathon

Dry Canyon Watershed

Dry Canyon is located on the west side of the park, just south of Williams Canyon. It is comprised of steep slopes and cliffs. The watershed covers 1055 acres (427 hectares) within the park, with no water sources or wetlands known or located in the July 2003 survey. The underlying geology consists of 65% Prospect Mountain quartzite, 16% Pioche shale, 15% Pole Canyon limestone, and 4% other. Vegetative cover includes 77% subalpine pine, 13% barren, and 10% white fir.

High Pit

MW-01
Proposed Management Class: 3-B-IV
Length: 188 ft.
Vertical Relief: 72 ft.
Survey and Physical Inventory: 8/11/2004

Physical Description

High Pit is the highest solution cave found in the park and perhaps the entire state. This pit is found about 300 ft north of Mt. Washington Peak at an elevation 11,200 ft in Pole Canyon Limestone. The entrance to this pit is 10 ft by 40 ft and a depth of 64 ft. The cave contains up to 6-inch thick travertine on its walls. The bottom of High Pit is plugged with snow.

Geology, Hydrology and Speleogenesis

High Pit is a solution pit cave along the flank of Mt. Washington. There is a large amount of flowstone covering the walls of the cave, which suggests that the cave was once a closed system.

History and Cultural Resources

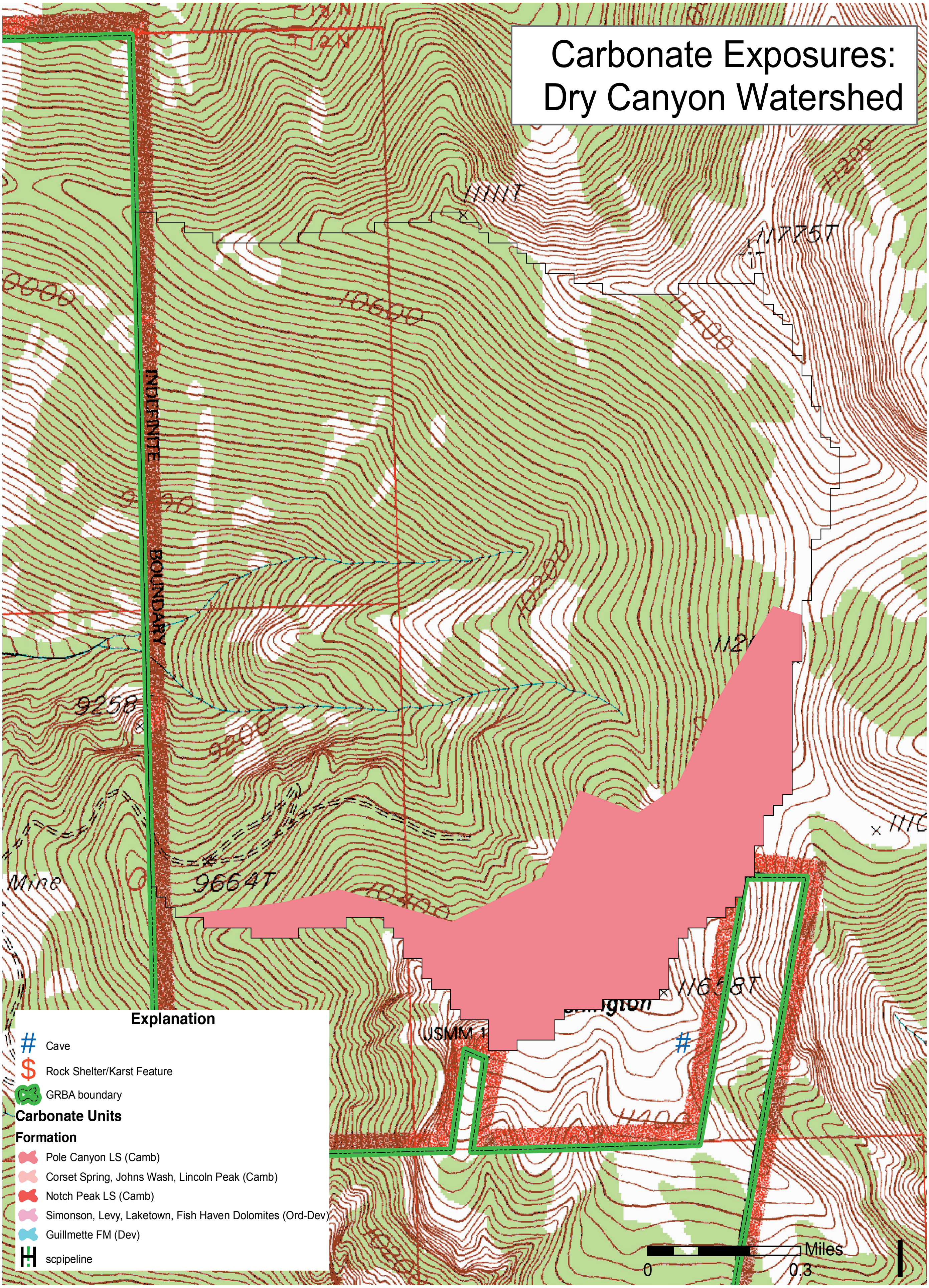
The earliest record of discovery is by Alvin McLane on October 6, 1967. No cultural resources are located in the cave.

Biological Resources

No biota has been noted on trip reports, or during the survey and inventory of the cave in August, 2004.

The location and physical layout of High Pit make it unlikely to contain many biological resources, however no detailed biological inventory has been performed in the cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.



Carbonate Exposures:
Dry Canyon Watershed
INDEFINITE BOUNDARY
11111T
11775T
10600
11400
9258
9200
9664T
Mine
11658T
USMM 1
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.3

Lehman Creek Watershed

Description
The Lehman Creek watershed is located on the east side of GRBA and encompasses 8,224 acres (3289.6 hectares). The watershed drains to the east and contains the most developed area in the park containing the visitor center, picnic area, housing and maintenance areas and three campgrounds. The majority of this watershed is underlain by non-karstic rocks, chiefly Prospect Mountain Quartzite, along with glacial and unconsolidated sediments. The karstic unit in the watershed is the Pole Canyon Limestone at 163.4 acres (66.1 hectares). The Lehman Creek watershed is primarily a forested watershed, with only 16% of the watershed with sage or no vegetation.

Karst
The only karst unit in the Lehman Creek watershed is the Middle Cambrian Pole Canyon Limestone. There is little surficial karst, as the majority of the unit is highly mantled with sediment and vegetative cover. The Lehman Creek watershed contains perhaps the most significant cave resource both in the park and the state of Nevada in Lehman Caves. Lehman Caves is the longest cave in the state with 10,263 feet of mapped passage, including the entrance and exit tunnels.

Caves
The Lehman Hill Caves include Lehman Caves, Little Muddy Cave, Lehman Annex Cave, and Root Cave. A number of small karst features are also observed within the outcrop area of the Pole Canyon Limestone in the Lehman Creek Watershed.

Lehman Caves

LH-01, 26 WP 0019; GRBA 89C-27
Proposed Management Class: 1-C-II
Length: est. 11,000 ft
Vertical Relief: est. 100 ft
Map page 116
Survey and Physical Inventory: 1997-2003

Lehman Caves is currently the main focus of visitation in the park, and has been a primary motivator for visitation since opening to tours in 1885. The first known use of Lehman Caves is by Native Americans, apparent by the discovery of several hearths and human remains in the natural entrance area. The first written account of Lehman Cave was given in the Ely Post in 1885 claiming that a local rancher, Absalom Lehman, discovered the entrance in 1879. By the end of 1885 most of the cave was fully explored.

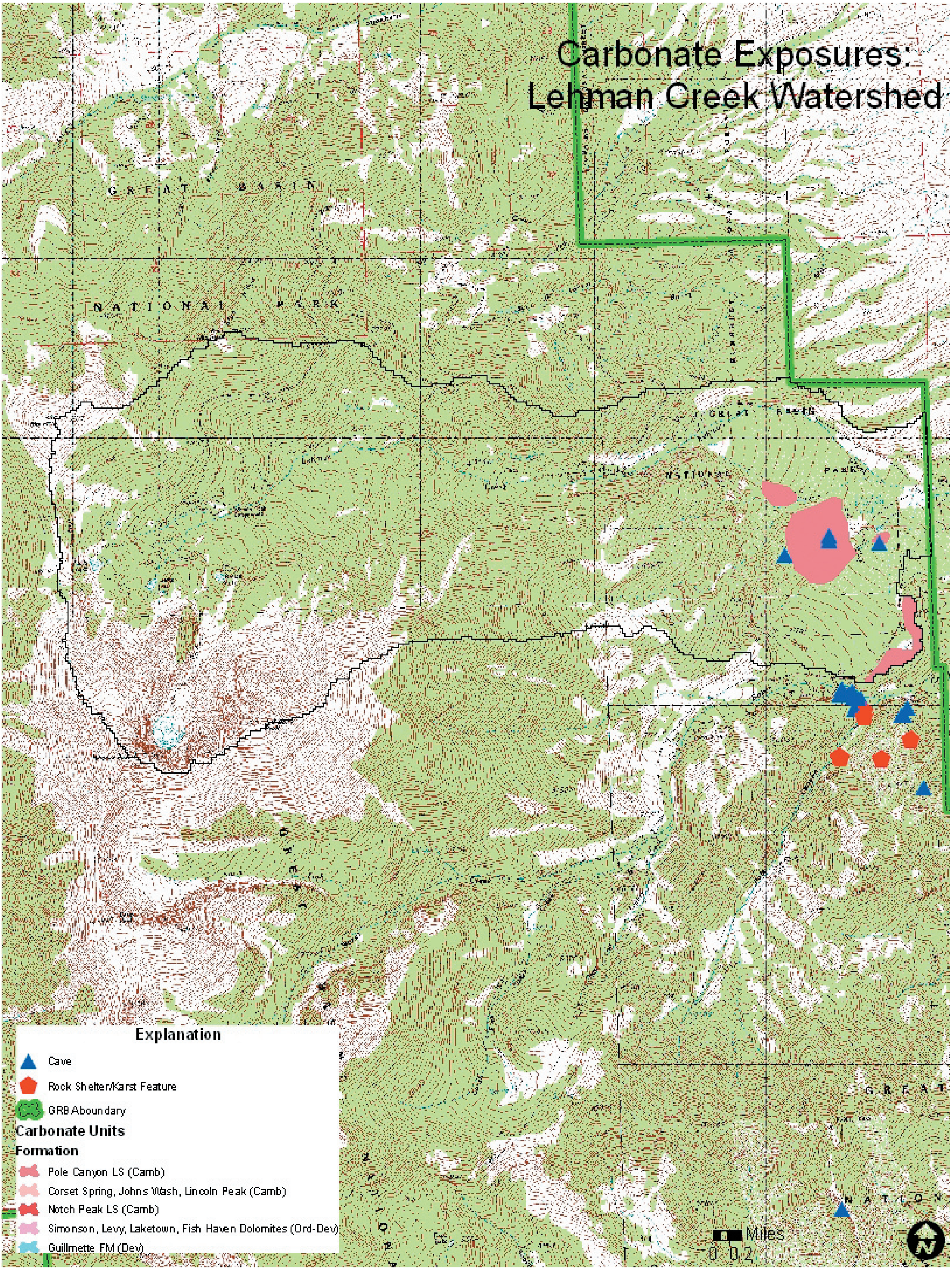
Physical Description
Lehman is developed in low-grade metamorphosed, Middle Cambrian age, Pole Canyon Limestone. Passages in Lehman consist of mostly low, wide chambers and high, narrow canyon passages, with notable exceptions in the Grand Palace, Talus Room, and Gypsum Extension.

Geology, Hydrology, and Speleogenesis
Lehman Caves is developed in thrust-fault block of low-grade metamorphosed, Middle Cambrian age, Pole Canyon Limestone (Harris and Tuttle 1975). The beds of this limestone steeply dip to the east; however, the cave is nearly horizontal in structure. This evidence suggests that the cave formed late in the history of the mountain range after the last uplift and tilting of the range approximately 5 million years ago (Harris and Tuttle 1975). Based on geologic and speleothem dating, the cave is between 5 million and 300,000 years old.

Cave passage development in Lehman follows a ramiform pattern (Palmer, 1991) indicating a hypogenic control on speleogenesis. The likely source of mixed waters in this case is rising geothermal waters, associated with broad-scale basin and range faulting. Passage development in the rear portions of the cave exhibits strong structural control. Redissolved formations occur throughout the cave, indicating there were likely multiple flood/drain events in the cave.

Water flow in Lehman Caves has been determined based upon scallop measurements in various locations, and indicates water flowed from the north through the cave toward the cave's entrance at variable rates between 0.024 m/s and 0.608 m/s. (Jasper 2000). However, this flow is thought to be a secondary action (perhaps a draining event) and not associated with the main speleogenesis for Lehman.

Airflow studies have been conducted to document baseline conditions and understand the cave's exploration potential. Airflow can affect the cave's environment by changing its temperature, relative humidity, and suspended particu-


Carbonate Exposures:
Lehman Creek Watershed
GREAT BASIN
NATIONAL PARK
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
Miles
0 0.2

lates. Airflow paths were mapped throughout the cave by Jasper (2000). The main winter airflow sinks into the Natural Entrance and flows along the tour route and disperses into the cave. Airflow also comes into the cave through the Behman Discovery passage and two small holes near the Natural Entrance. These alternative airflow routes suggest that other entrances to the system exist.

A comparison between the airflow in Lehman Caves and Lehman Annex Cave was performed. A "chimney effect" between the lower passages of Lehman Caves and the higher passages of Lehman Annex Cave is believed to create the airflow that exists in the caves. If true, then the volume of the airflow should be equal between the two caves. The Natural Entrance had an airflow volume of 0.543 m3/s sinking into it and Lehman Annex's entrance had an airflow volume of 0.047 m3/s flowing out of it. The airflow study also showed an additional 1.565 m3/s was coming into Lehman Caves through three other sources (Jasper 2000). Additional entrances may account for the lost airflow.

History and Cultural Resources

Lehman Caves contains a rich record of cultural history. Native American remains were found in 1937, while constructing the entrance tunnel under the Natural Entrance. Scientific excavations were made in 1938 and 1963. The results of the excavations showed hearths, artifacts, and scattered human bones thought to be from Shoshone Indians. The presence of hearths without evidence of food scraps suggests that the Native Americans may have used this site as a shelter. The scattered nature of the bones suggests that the bones may have been thrown in the entrance, similar to the use of Indian Burial Cave by the Goshute Indians. The bones showed no evidence of the burial site being disturbed by predators (Rozaire 1964, Wheeler 1938).

The earliest written account of Lehman Caves was given in the Ely Post in 1885. This article gives local rancher, Absalom Lehman, credit for discovering the cave. The article claims Ab Lehman discovered the entrance in 1879, but did not enter and explore the cave until 1885. By the end of 1885, almost the entire cave was explored and cave tours had begun. The history of the cave's early exploration can be traced through the inscriptions seen throughout the cave. The exploration of the cave and development of the cave tours involved mining through hundreds of cave formations (Trexler 1966). In the 1930's, the Civilian Conservation Corps did a large amount of trail construction and infrastructure development including stairs and handrails, as well as construction of the Panama Canal, and general trail improvement.

Only two discoveries have been made in Lehman Caves since its original exploration in 1885: the Gypsum Annex Passage and the Lost River Passage. Tom Simms and John Fielding discovered the Lost River Passage in 1947. The Gypsum Annex Passage, along with Model Cave, was found by the Stanford Grotto during a three month expedition funded by O. H. Truman, a California geophysicist. The passage was discovered on October 8th, 1952 by Ray de Saussure by removing a small boulder that was blocking the entrance.

Biological Resources

Apart from minor microbiological studies in the early 2000s, no significant biologic collection or research has been undertaken in Lehman since the early 1970's.

Management Issues and key Data Gaps

Lehman Caves has all of the standard management issues associated with commercial caves. A lint removal project was begun in the mid 1990s and continued briefly through the late 1990s but has not been reinstated due to macroinvertebrate concerns. The current lighting system is of poor design and creates serious lampenflora issues in numerous locations throughout the cave. Abandoned tourist trails and lighting infrastructure is degrading without current maintenance and creating unnecessary impacts on the cave environment.

Cave visitation in Lehman Caves over the years 1999-2004 averaged at 34,202 visitors per year, with a maximum of 38,858 in 1999, and a minimum of 29,020 in 2004. In general over these six years, visitation to Lehman Caves has been on the decline. Peak visitation is during the months May-September, with the peak days being Friday and Saturday. The highest cave visitation occurs on holiday weekends (Memorial Day, Independence Day, and Labor Day), in addition Pioneer Day and UEA weekends (Utah State holidays) also have high visitation. Average visitation on a Holiday weekend day over the period 2002-2005 was 361 visits, with a maximum of 592 (May 2002) and a minimum of 219 (May 2003)

Recent (2005) vandalism on ranger-led cave tours has created a concern for re-evaluation of tour size limits. A non-scientific survey of cave tour visitors and interpreters in 2003 was conducted to evaluate tour sizes. Comments from interpretive rangers nearly unanimously requested smaller tour sizes, or adding a trailing ranger to each cave tour.

Lint, for the purposes of cave management, consists of detrital material deposited along cave tour trails by visitors. This detrital material consists of spores, bacteria, skin particles, hair, and clothing fibers. While the lint is unsightly, it is also provides a detrimental impact to the cave environment. Not only does the lint provide an unnatural food source for cave biota, it has been shown that the lint can trap moisture against speleothems, causing active erosion. In some instances the lint can actually be calcified into the formations. Some work has been done to show that eccentric speleothems (such as helectites) may originate as a result of aerosol deposition and lint deposits in caves may impede the deposition of these formations.

Lampenflora, commonly referred to as algae, actually consist of a number of different algaes, mosses and other plants, and are ever-present in electrically-lit caves. In addition to the aesthetic concerns of the lampenflora, they are known to corrode and degrade speleothems and wall rock as a growth mechanism (extracting salts from the rock), producing deleterious effects upon the cave environment. A number of different techniques exist for the removal of lampenflora including UV radiation, chemical treatments and steam cleaning. The most effective treatment is the periodic use of a dilute chemical solution. A well-designed lighting system can also help to prevent proliferation of lampenflora.

Lehman Caves has been open to public tours since the late 1800s. The first electrical lights were installed in the 1940s and that system has been upgraded and modified numerous times since. The most recent system was installed in the 1970s with major upgrades to that system performed in the 1980s. The current lighting system at Lehman Caves, consisting of 331 lighting fixtures, the associated lighting control system and secondary electrical wiring, is severely impacting cave resources. No accurate detailed electrical schematics exist of the current lighting system. Large amounts of electrical cables snake through passageways away from the paved tour trail. Light fixtures are located in delicate, difficult to reach areas. Power transformers are located in delicate areas, and produce large amounts of heat and noise, which creates changes in cave microclimate. This may impact cave biota as well as visitor experience. Many areas of the cave are inundated with lampenflora as a result of direct, high intensity lighting. Impacts to macro and microbiotic populations are currently unknown. Over one quarter of the cave contains parts of old lighting systems no longer used that are adversely impacting cave resources. The park received a grant in 1999 from the National Park Foundation to correct trail lighting deficiencies and the Physical Science Branch is attempting to gain CCSP funds in addition to this grant in order to conduct a cave lighting inventory and design of a new cave lighting system (PMIS 6327).

Since discovery of Lehman Cave in the late 1800s, many infrastructure developments have been made which are adversely effecting the cave environment. Foreign material has been continuously introduced into the cave environment since the first wooden ladder was used to descend into the entrance room. Although the lighting and electrical systems have been upgraded many times, the old systems were left in place. For the last 150 years, wood, iron, steel, copper, tin, lead, asphalt and other materials have been used extensively within Lehman Cave. In the damp, biologically active environment, all of these materials have begun to deteriorate. These elements are highly reactive in both organic and inorganic chemical systems.

To improve visitor access to the cave, the Panama Canal was blasted out in the late 1950s through a cave wall leaving tons of materials adjacent to the tour route covering a large area of cave formations. Trails have been constructed to form the tourist route and have been surfaced and resurfaced with numerous materials such as asphalt, cement, and rubber mats. A portion of the cave trail system through the Talus Room and the West Room were permanently closed in the early 1980s due to safety concerns. Knowledge of human induced impacts to cave ecosystems has grown considerably in recent years. It is now recognized that the introduction of foreign materials has a profound and lasting negative impact on fragile cave ecosystems.

The park has proposed to remove a permanently closed section of trail in the Talus Room, its unused electrical system components, and debris from construction of the Panama Canal trail section (PMIS 110197). The degradation and decomposition of foreign materials along abandoned sections of the trail is a significant threat to the cave that disrupts natural cave processes and biological functions of the ecosystem, adversely impacts water quality, and creates a safety hazard to park visitors. This action will restore over 45,000 square feet of cave floor, uncover numerous buried cave formations, reduce human caused impacts to park cave resources and protect park visitors and staff. The interpretive component will assure that visitors understand the need and status of the project.

The key data gaps for Lehman Caves include a detailed macroinvertebrate study, which is planned to begin in FY06 (PMIS 100209), as well as a continued microbiological study, especially in regards to the microbial communities located in the Inscription room. Numerous speleothem dating and paleoclimatological studies have been conducted, and need follow-up to glean useful data and information. A detailed geological and mineralogical inventory are necessary for further understanding of the geologic conditions involved in speleogenesis.

References
A large amount of historical information and data exists in the Cave Management files, as well as Lehman Caves: Its Human Story (Trexler, 1965), and A History of Great Basin National Park (Unrau, 1980)

Lehman Annex Cave
LH-03
Proposed Management Class: 5-C-II
Length: 991.6 ft
Vertical Relief: 55.6 ft
Map page 111
Survey and Physical Inventory: 6/1997-7/2003

Physical Description
Lehman Annex Cave's entrance crawl plunges at about a 25 angle. The cave levels out at the first room. This room is small 10-ft diameter room with passages continuing in four different directions. All of the passages leading out of this room eventually trend north to south. All of the passages eventually follow another 25 plunge. A semi-circle fault line seems to be responsible for this plunge. The cave's lowest point ends into a dried cave pool containing mammillaries and rounded aragonite formations. A formation-lined wall indicated the pool's old water level.

Geology, Hydrology, and Speleogenesis
Lehman Annex Cave is the only other known cave entrance with blowing air near Lehman Caves, which has produced speculation that the two caves were connected. It is possible that a small airflow route, responsible for Lehman Caves' airflow, may continue down the fault line at the end of Lehman Annex Cave. The passages in Lehman Annex Cave are similar to those of Lehman Caves in that they are mostly horizontal and trend to the north (Figure 9). Lehman Annex Cave is also the only other known cave in the park, besides Lehman Caves, that contains gypsum formations. However, due to the tight passageways in Lehman Annex and the distance of the cave from Lehman Caves (approximately 1800 ft to the west and 350 ft higher in elevation), it is unlikely that a physical connection between the two caves will ever be made.

History and Cultural Resources
Lehman Annex Cave was discovered by Leona Kauffman on November 30, 1958. The 4-inch opening was stated as having "an air current strong enough to make a handkerchief stand on end" (Bridgemon 19??). Members of the Salt Lake City Grotto enlarged the opening on February 1959, and started surveying the cave in 1961. Several other trips into the cave were made, until 1964 when interest in the cave was lost. After roughly 20 years of inactivity, the cave entrance silted up leaving a 4 to 5-inch opening. In October 1998, the cave entrance was dug open again and gated. No other cultural resources are known from Lehman Annex.

Biological Resources
No known biological resources.

Management Issues and key Data Gaps
Lehman Annex is a pristine cave with little damage to cave resources. The cave is very susceptible to impact by continued visitation, and is currently gated. No other management issues are known. The current gate may not allow for natural airflow, and may need to be reevaluated.

The key data gaps for Lehman Annex include a macroinvertebrate study, as well as a microbiological study.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Little Muddy Cave
LH-04; Woods Hole Cave
Proposed Management Class: 4-C-II
Length: 1014.5 ft
Vertical Relief: 25.4 ft
Map page 112
Survey and Physical Inventory: Jan. 1997-Feb 1998

Physical Description
Little Muddy Cave consists of mazy crawlways following along joint planes. The cave has a smooth mud floor with scalloped walls showing that the cave was sculpted by swiftly flowing streams. The high amount of organic matter and known species richness of the cave make Little Muddy a biologically significant cave

Geology, Hydrology, and Speleogenesis
Cave passage development in Little Muddy exhibits a modified network maze pattern (Palmer, 1991) showing strong structural control. Considering other cave development in the area (Lehman Caves) it is likely that Little Muddy might be

a cave of transitional origin between a hypogenic cave and a more traditional stream cave. The cave is known to hold high CO2 concentrations in summer months, due to decaying organic matter, suggesting a semi-constant input of organic nutrients into the cave system.

History and Cultural Resources

In 1978, the Chief of Interpretation and Resource Management at GRBA, Edward Wood Jr, noticed a spring-like drainage coming from a small outcrop of Pole Canyon Limestone while completing the installation of the park's sewage lagoon. Shortly after, he and several others, dug open the entrance to Little Muddy Cave (Rumm 1987). Little Muddy Cave was used as a "spelunking" tour for many years which ended due to the discovery of high CO2 concentrations during the summer months.

Biological Resources

A macroinvertebrate study was conducted in Little Muddy in 2003 by Krejca and Taylor.

Management Issues and key Data Gaps

Little Muddy Cave is a permitted wild cave open to public visitation from October through April. The cave is closed during the spring and summer months due to high CO_2 concentrations. The cave has received considerable impact from being used for public wild cave tours in the 1980s. It is currently gated and receives very limited visitation under the cave permit system. An evaluation of impacts and consideration for restoration may be an option for future management.

Key data gaps for Little Muddy are limited, but include a detailed geologic and mineralogic inventory, as well as follow-up monitoring based on the baseline invertebrate inventory by Krejca and Taylor.

Three impact monitoring points have been established in Little Muddy. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Root Cave

LH-02
Proposed Management Class: 4-C-III
Length: 182.7 ft
Vertical Relief: 30.5 ft
map page 113
Survey: 12/03/1997
Physical Inventory: 3/11/2003

Physical Description

The cave's entrance is a round crawlway that leads down to a tight 7 foot drop into the main part of the cave. Root Cave consists of mostly small passages, with a large amount of roots, and a wide variety of delicate calcite formations. The cave is named for the abundance of roots in the main passage of the cave. Roots are a high nutrient source in the dark zone of a cave and are known to support unique species of troglobites. Cave communities in Root Cave also receive very little impact from human use which adds to the importance of biological surveys in this cave.

Geology, Hydrology and Speleogenesis

Root Cave is a small "z" shaped cave, which is strongly structurally controlled. No detailed geologic or mineralogic studies or inventories have been completed. It is believed that the development Root Cave may be associated with Lehman Caves, due to proximity.

History and Cultural Resources

Although details of the discovery of Root Cave were never recorded, the entrance to this cave was most likely dug open in the hopes that it would connect to Lehman Caves. The entrance to Lehman Annex lies roughly 36ft horizontally from the Lost River passage in Lehman Caves, and approximately 25 feet above it. Since the bottom of Root Cave is choked with fill, it is unlikely that a physical connection will ever be made between the two caves.

Biological Resources

Root Cave contains abundant roots, as its name implies. No detailed biological studies have been completed in the cave.

Management Issues and key Data Gaps

The current gate to Root Cave has been compromised, and is not functional. This gate needs to be repaired in order to provide protection for the cave, and protection for park visitors.

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Root Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Lincoln Canyon Watershed

The Lincoln watershed is located on the west side of the park in alpine areas. It consists of 1723 acres (697 hectares) within the park, with no previously known water sources or wetlands. During the 2003 survey, two springs were located, which was especially exciting due to the preponderance of bighorn sheep in this watershed. Further research revealed a reference that a small stream emerges from the south fork of Lincoln Canyon at 2972 m (9750 ft) (Waite 1974), which would put it in the park. Further study is needed in 2004.

The geology underlying Lincoln watershed is comprised of 44% Pole canyon limestone, 30% Corset spring, Johns Wash and Lincoln Peak formations, 11% landslide debris, 11% Eureka quartzite and Pogonip group, and 4% other. Vegetative cover consists of 68% subalpine, 19% white fir, 10% barren, and 3% pinyon.

Drumming Cave

LC-01
Proposed Management Class: 5-C-III
Length: 50 feet
Vertical Relief: 20 feet
Map Page 119
Survey and Physical Inventory: 10/18/1998

Physical Description
Small, decorated fissure in the Lincoln Mine. Access is through the Lincoln Mine drift.

Geology, Hydrology and Speleogenesis
Unknown

History and Cultural Resources
Unknown

Biological Resources
Unknown

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Drumming Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Miner's Massacre

LC-02
Proposed Management Class: 5-C-III
Length: 30+ feet
Vertical Relief: 15 ft
Map Page 120
Survey and Physical Inventory: 7/20/2003

Physical Description
Small decorated cave with massive flowstone and a waterfall. Access is through the Lincoln Mine drift

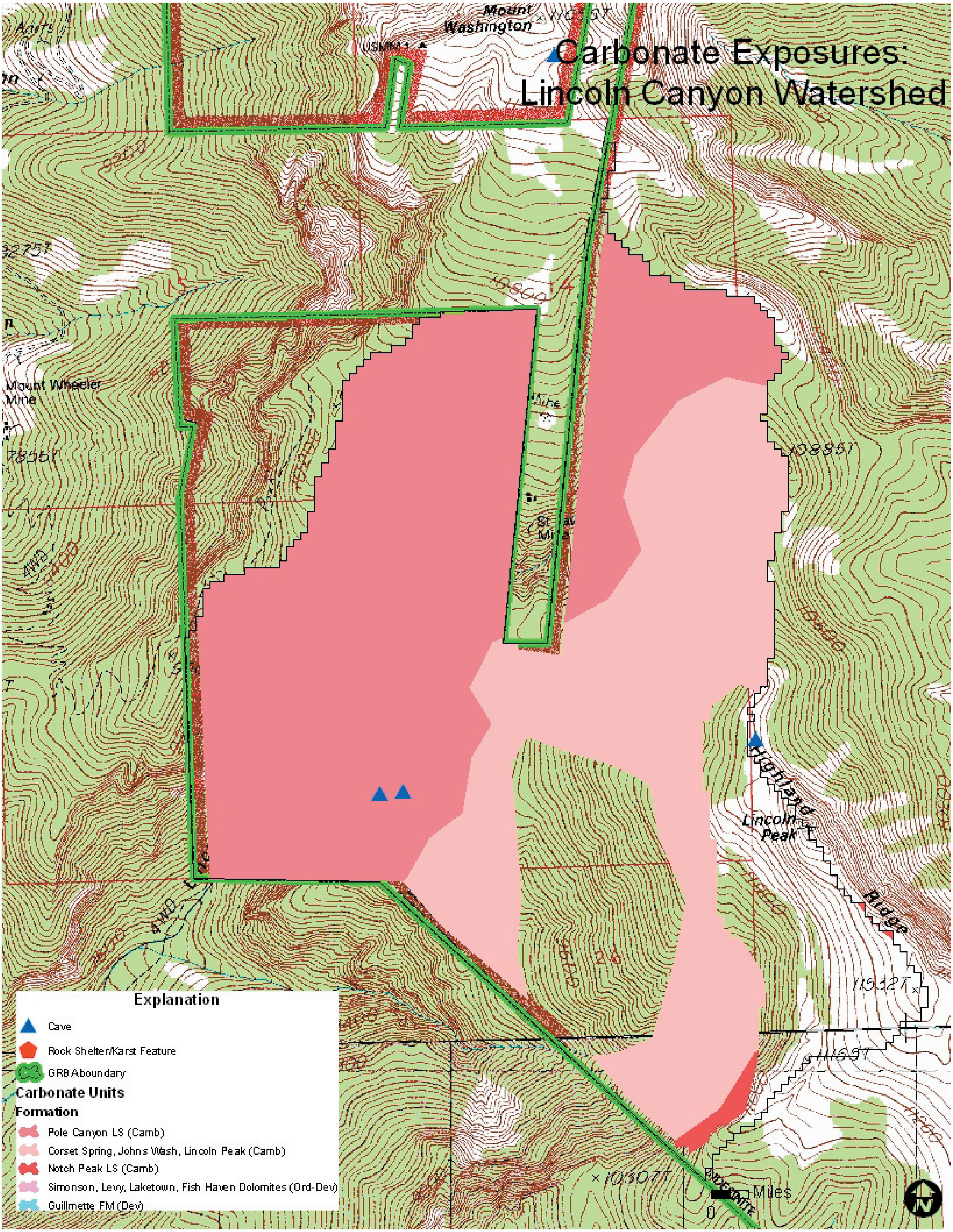
Geology, Hydrology and Speleogenesis
Cave contains a waterfall. Geology unknown.

History and Cultural Resources
Unknown.

Biological Resources
Unknown.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Miner's Massacre.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.


Carbonate Exposures:
Lincoln Canyon Watershed
Mount Washington
Mount Wheeler Mine
Highland
Lincoln Peak
Ridge
4WD
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
0
Miles

North Fork Big Wash Watershed

Overview

North Fork Big Wash consists of 8310 acres (3362 hectares), and spans the width of GRBA, containing the "Chinese Wall" and Lincoln Peak. The underlying geology is mostly carbonates (78%), with a small amount of quartzites and shales making up the difference. NFBW is a forested watershed, with only 18% shrub or no vegetation.

Karst

With the majority of the watershed underlain by carbonates, NFBW has a large amount of karst, with all of the carbonate groups represented.

Caves

The known caves in the NFBW watershed are primarily high-elevation alpine caves, and they include the deepest cave in the state (Long Cold, -436), as well as caves containing year-round ice deposits.

Highland Cave

LP-01
Proposed Management Class: 6-B-V
Length: 120 ft
Vertical Relief: unknown

Physical Description

Highland Cave is located just off the southeastern side of Lincoln Peak. Alvin McLane first spotted Highland Cave in 1969, but did not return September 25, 1971. McLane's group had to scramble down about 300 ft and then rappel about 100 ft to reach the entrance. The entrance was a 25-ft diameter hole along a low-angle fault of badly broken rock at an elevation of about 11,120 ft. The cave extends south for about 40 ft and comes to a T-junction where it goes east for about 30 ft and west for about 50 ft. The T-Junction Room has a ceiling height of about 30-ft. The cave was noted to have a mat of green algae growing in the T-Junction and amberat in the western-most portions. (McLane 1971)

Geology, Hydrology and Speleogenesis

Highland Cave is located in the Lincoln Cirque. Based on observations in other caves of the cirque, the cave is likely of hypogenic origin.

History and Cultural Resources

The cave has been entered once, in 1971.

Biological Resources

The cave contains algae, and there is evidence of rat use.

Management Issues and key Data Gaps

Highland Cave is located in the Lincoln Cirque, and is nearly impossible to enter. The cave has only been visted once, in the early 1970's, and as such, no detailed map exists.

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Highland Cave.

Dome-Ice Cave

LP-02
Proposed Management Class: 6-B-V
Length: 120 ft
Vertical Relief: unknown

Physical Description

Dome-Ice Cave is located about 200 ft away from Highland Cave at an elevation of about 11,120-ft. This cave is 120-ft long formed along a vertical fault. There is an abundance of ice accumulating on the floor of broken rocks. In the small room beneath the broken rocks is red ice thought to have been created from the mixing of animal feces and urine. In the back of the cave is a natural arch and a high 60-ft dome. About 50 ft into the cave green algae like that in Highland Cave was found. Seeing that these algae can tolerate low light and cold temperature, it may prove to be of importance (McLane 1971).

Geology, Hydrology and Speleogenesis

Dome-Ice Cave is developed along a vertical fracture. Based on observations in other caves in the Lincoln Peak Cirque, it is likely of hypogenic origin. The cave apparently contains permanent ice formations.

History and Cultural Resources

The cave has been entered once, in 1971.

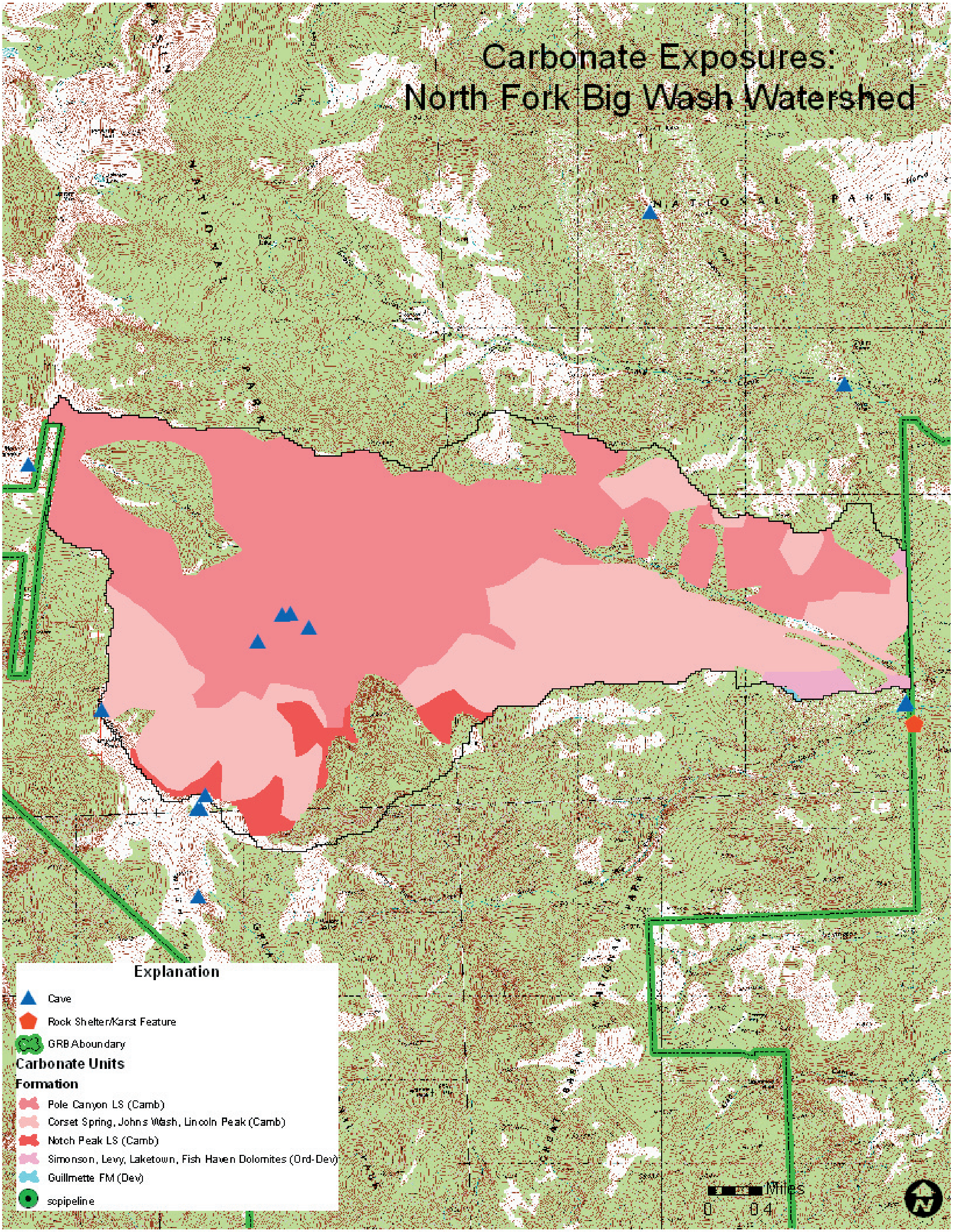
Biological Resources

Algae and possible rat use.

Management Issues and key Data Gaps

Dome-Ice Cave is located in the Lincoln Cirque, and is nearly impossible to enter. The cave has only been visted once, in the early 1970's, and as such, no detailed map exists.

A detailed macroinvertebrate study as well as a



Carbonate Exposures:
North Fork Big Wash Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.4

microbiological study are needed to fill data gaps for Dome-Ice Cave.

Mountain View Cave

LP-04, (Second Chance Cave)
Proposed Management Class: 4-B-III
Length: 53 ft
Relief: 12 ft
Map page 104
Survey and Physical Inventory: 7/15/2000, 8/2004

Physical Description

Mountain View Cave was discovered by Jon Jasper and Kyle Voyles on July 15, 2000 while searching for a route down to Highland Cave. The cave is a nice size walking passage that contains some flowstone and small calcite crystals (Figure 26). About 40 ft west of the entrance is a small hole that has mammillary-like formations coming out of the entrance.

Geology, Hydrology and Speleogenesis

Mountain View Cave is a small solution cave on Lincoln Peak. The cave contains dogtooth spar crystals, suggesting a hypogenic origin.

History and Cultural Resources

No cultural resources are noted for Mountain View Cave.

Biological Resources

The cave contains evidence of packrat use. No other biota were noted.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Mountain View Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Broken Cave

LP-05, Alpine Kyle Cave
Proposed Management Class: 4-B-IV
Length: 108 ft
Relief: 55 ft
Map page 117
Survey and Physical Inventory: 8/10/2002

Physical Description

Broken Cave is a small solution cave

Geology, Hydrology and Speleogenesis

Broken Cave is a solution cave on the flank of Lincoln Peak.

History and Cultural Resources

Broken Cave was noted by Alvin McLane on trying to reach Highland Cave. McLane originally called both the earth crack to the north and the cave, "The Fissure." The earth crack is now referred to as "The Fissure." McLane's description of the cave lead to its name. McLane described: "I stooped through a broken hole into a broken room, passed through a broken crawl and down a broken fissure to a broken chamber..."

Biological Resources

No biota were noted on trip reports.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Broken Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Wild Goose Cave

LP-06
Proposed Management Class: 4-B-III
Length: 118 Feet
Vertical Relief: 20 Feet
Map Page 124
Survey and Physical Inventory: 8/17/2004

Physical Description

Unknown

Geology, Hydrology and Speleogenesis

Wild Goose Cave is a small solution cave on Lincoln Peak. Sub-aqueous Dogtooth Spar are present in the rear of the cave, indicating a possible hydrothermal hypogenic origin

History and Cultural Resources

Unknown

Biological Resources

Packrat scat and amberrat are present in the cave.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Wild Goose Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Birthday Cave

LP-07
Proposed Management Class: 4-B-IV
Length: 30 Feet
Vertical Relief: ~10 Feet
Survey and Physical Inventory: 8/17/2004

Physical Description
Birthday Cave is a small tectonic cave on Lincoln Peak

Geology, Hydrology and Speleogenesis
Unknown

History and Cultural Resources
The cave was discovered in fall 2004 by Robert Pleszewski and Jason Mateljak.

Biological Resources
None noted.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Birthday Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Snow Cone Cave

LP-08
Proposed Management Class: 4-B-IV
Length: 66 Feet
Vertical Relief: 15 Feet
Map Page 122
Survey and Physical Inventory: 8/16/2004

Physical Description
Unknown

Geology, Hydrology and Speleogenesis
Snow Cone Cave is a small solution cave

History and Cultural Resources
The Cave was discovered in August 2004. No known cultural resources.

Biological Resources
None noted.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Snow Cone Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Swiss Cheese Cave

LP-09
Proposed Management Class: 4-B-IV
Length: 26 Feet
Vertical Relief: 10 Feet
Map Page 123
Survey and Physical Inventory: 8/17/2004

Physical Description
Unknown

Geology, Hydrology and Speleogenesis
Swiss Cheese Cave is a small solution cave

History and Cultural Resources
The cave was discovered in September, 2004.

Biological Resources
No biota were observed during the survey of the cave

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Swiss Cheese Cave

Long Cold Cave

BW-01
Proposed Management Class: 6-B-IV
Length: 721 ft.
Vertical Relief: 436 ft.
Survey and Physical Inventory: July-August 2004

Physical Description
Long Cold Cave is the deepest cave in the State of Nevada at −436 feet. The cave is a long fracture, with permanent ice at the lower levels. It is an extremely challenging vertical cave, requiring the use of European single-rope techniques (rebelays). The cave has a large amount of unstable breakdown, and extreme care must be taken to avoid dislodging rocks when traversing the cave.

Geology, Hydrology and Speleogenesis
The cave is a deep tectonic fracture cave, similar to the other caves associated with the Chinese Wall. There are a few rooms with large speleo-

thems (flowstone, draperies) as well as a large amount of moonmilk. The lower levels of the cave have a large amount of permanent ice, as well as very interesting ice helectites.

History and Cultural Resources
The first trip to reach the bottom was July 5, 1990 by McLane's group. There are two rope segments embedded in ice at about −150 ft in the cave. These are believed to be from the McLane trips of the early 1990s.

Biological Resources
No biota were observed during the survey of the cave in August, 2004, however the cave has been reported to have bat use.

Management Issues and key Data Gaps
Long Cold Cave is an unstable alpine fracture cave. Exploration of the cave requires advanced European single-rope techniques, and the cave has been rigged with permanent stainless steel expansion bolts. The cave is quite cold with permanent ice, and requires special clothing in order to prevent hypothermia.

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Long Cold Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Pine Cone Cave

BW-02
Proposed Management Class 3-B-IV
Length: 354.3 ft
Vertical Relief: 245.6 ft
Map Page 121
Survey and Physical Inventory: August 2004

Physical Description
Pine Cone Cave is located about 500 ft to the west of Roaring Wind Cave in the same fracture as Long Cold Cave at an elevation of about 9910-ft. The cave depth is about 200 ft. The cave was named Pine Cone Cave because of the abundance of Bristlecone pine cones on the floor of the cave.

Geology, Hydrology and Speleogenesis
This cave is another in the series of tectonic fracture caves along the Chinese Wall. A large amount of moonmilk, along with some flowstone and popcorn was observed in the cave.

History and Cultural Resources
Alvin McLane first descended the cave on July 4, 1990. No cultural resources were identified in Pine Cone Cave

Biological Resources
Amberrat and numerous rat middens are located throughout the cave. A dead rabbit was observed in the cave during the survey in 2004.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Pine Cone Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Roaring Wind Cave

BW-03
Proposed Management Class: 6-B-IV
Length: 588 ft.
Vertical Relief: 129 ft.
Survey and Physical Inventory: Sep. 2004

Physical Description
Roaring Wind is the easternmost cave in a long line of fracture caves along the Chinese Wall near Mt. Washington. The entrance is a 90-ft long fracture in line with a joint system containing Pine Cone Cave and Long Cold Cave. The initial drop is about 150 ft. A small opening to a pit is present at the bottom of this drop with a strong wind. McLane climbed down this hole about 8 ft and found no way to continue. A passage at the bottom of the drop continued about 150 ft to the west until it became too narrow to continue. In the middle of the pit, a passage could be reached with a good swing. This passage continued for about 100 ft to the west with a passage lined with moonmilk. Forty feet beyond, the group reached another pit. This pit was about 110-ft deep bringing the depth of the cave to roughly 270 ft below the cave's entrance. The cave's length is about 550 ft long. (McLane 1991).

Geology, Hydrology and Speleogenesis
Roaring Wind is a tectonic cave associated with bank margin failure of the Chinese Wall. The cave contains permanent snow, and perhaps ice in the lower levels. A large amount of moonmilk is present in the upper levels of the cave.

History and Cultural Resources
William Oates found roaring Wind Cave on September 10, 1987. The first recorded descent into

the cave was lead by Alvin McLane on September 30, 1989.

Biological Resources
No biota were observed during the survey in September 2004, or were mentioned in previous trip reports.

Management Issues and key Data Gaps
The entrance to Roaring Wind Cave has loose talus on all sides, and has an extremely high rockfall potential. The cave is an incredibly complex vertical cave, and has been rigged with permanently-installed stainless steel expansion bolts. The cave survey is incomplete, due to a large rock blocking furhter progress.

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Roaring Wind Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Cave 24

BW-04
Proposed Management Class: 3-B-IV
Length: 272.4 ft
Vertical Relief: 48.4 ft.
Map page 112
Survey and Physical Inventory: 7/24/2004

Physical Description
This cave has a 60-ft diameter entrance sink (Figure 25). The cave contains about a 40-ft entrance drop, and two tall, narrow fissure passages.

Geology, Hydrology and Speleogenesis
The cave is similar to many of the caves along the Chinese Wall, formed by tectonic action as a failure of the cliff face. The cave contains a large amount of moonmilk.

History and Cultural Resources
William Oates found Cave 24 on Sept 10, 1987. No cultural resources were located in the cave.

Biological Resources
Two bats were seen in Cave 24 on October 18, 1997. They were identified as a Townsend's Big Eared Bat and a Myotis species. During the resurvey of the cave in June, one harvestman (Opillionidae) was observed in the eastern-most passage in the cave.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Cave 24.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Snake Creek Watershed

Overview
The Snake Creek watershed includes 13,021 acres (5269 hectares). The Snake Creek watershed is located on the east side of the mountain and contains the longest canyon within the park. The underlying geology of the Snake Creek Watershed is nearly evenly divided between carbonates and insoluble rocks. The watershed is predominately a forested watershed with roughly 10% shrub or no vegetation.

Karst
The Snake Creek Watershed contains 7630 (3087 hectares) acres of exposed carbonates, with each carbonate unit found in the Park represented. Each of the five rock units show some surficial karst expression, with caves found in the Cambrian Pole Canyon and Notch Peak Limestones, as well as the Ordivician/Devonian Dolomites. There is one major resurgence in the watershed (Squirrel Springs Cave), very little is understood about the nature and location of the recharge area.

Caves
Four caves are known from the Snake Creek Watershed, and numerous remnant caves, karst features, and shelter caves. The caves range from alpine solution pits to hypogenic cave systems.

Snake Creek Cave
SC-01
Proposed Management Class: 4-C-II
Length: 1682.2 ft
Vertical Relief: 57.2 ft
Map Page 107
Survey: July-Nov 1998
Physical Inventory: August 2002

Physical Description
Snake Creek Cave receives the most visitation of any wild cave in the park. The cave is known for its spectacular anthodite and frostwork formations, and high diversity of bat species (Appendix A. Bat Data Summary). The Snake Creek Cave entrance is at an elevation of 6720 ft. The cave is formed in the Cambrian age, Notch Peak Limestone.

Geology, Hydrology and Speleogenesis
Snake Creek Cave contains a wide variety of speleothems, second in the Park only to Lehman Caves. The cave exhibits many examples of passage development that suggest a hypogenic origin.

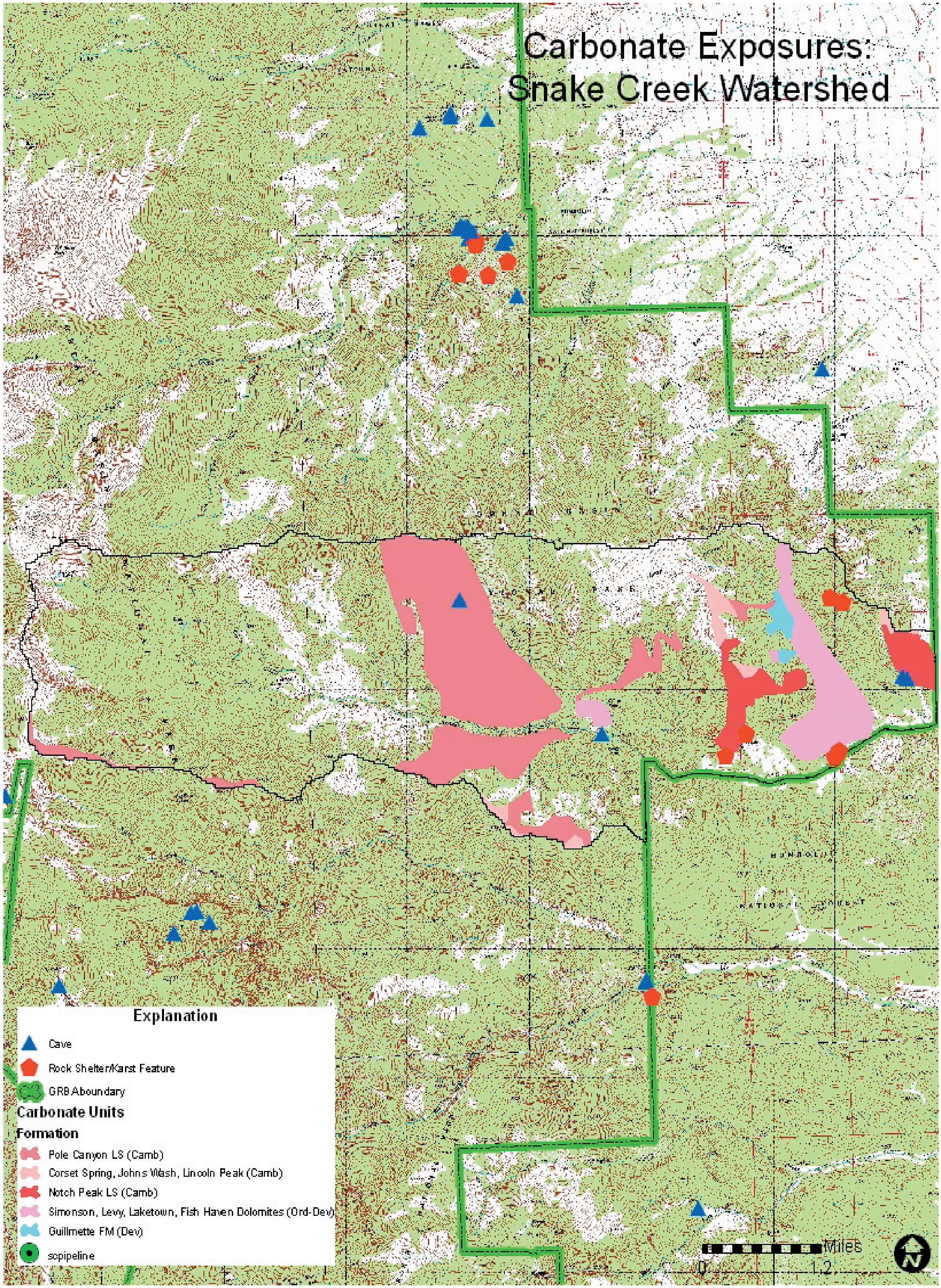
Another distinctive feature that occurs throughout the cave is floor cracks that parallel the cave's passages. After the cave passages formed, they began to fill with a silt, mud, and calcite cement mixture. The faulting that controlled the orientation of the passages was still active. The faulting slowly offset the floor throughout most of the cave between six inches and one foot. Because of the sediment floor's plastic mixture, most of the floor bent and cracked only along the ridge of the maximum amount of movement. This feature suggests that slow faulting occurred soon after the development of the cave.

One of the larger rooms in the cave contains a low-angle thrust fault. The bedding planes from the entrance to this room are dipping 50° to the southwest (Figure 23). When the fault is reached the bedding panes are not recognizable and the rock has an appearance as if it was harshly corroded. Large anthodites have formed along this fault. The cave passage continues following beneath the dip of the fault. The cave abruptly ends at a dried shelfstone pool surrounded by a solid limestone wall. The only possible input would be through the sediment-plugged floor. This cave has a similar end as nearby Indian Burial Cave.

History and Cultural Resources
Historic signatures from Morrison and Roland in 1886 show the cave's long history of visitation.

Biological Resources
During sureys of the entrance, Snake Creek Cave was shown to have a very high diversity of bat species using the cave. A macroinvertebrate study was completed in 2003 by Krejca and Taylor.

Management Issues and key Data Gaps
Snake Creek Cave is one of the wild caves permitted for public use in GRBA, and as such has some management issues associated with visitation. The entrance crawl is extremely dusty, and as such, visitors in this seciton of cave have a higher risk of conducting airborne infections such as Hanta Virus and Histoplasmosis. There are extremely delicate anthodites in the H Passage of Snake Creek Cave, and although this area of the cave is signed as being closed, compliance is voluntary.


Carbonate Exposures:
Snake Creek Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBAboundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
1.2

Key data gaps for Snake Creek are limited, but include a detailed geologic and mineralogic inventory, as well as follow-up monitoring based on the baseline invertebrate inventory by Krejca and Taylor.

Five impact monitoring points have been established in Snake Creek. Initial photographs were taken in FY 2003. Photomonitoring will be repeated again in FY2006, and every three years thereafter.

Fox Skull Cave

SC-04
Proposed Management Class: 3-B-II
Length: 102.0 ft
Relief: 10.8 ft
Map page 118
Survey and Physical Inventory: August 2003

Physical Description
Fox Skull Cave is located roughly 200 ft south of Snake Creek Cave in the same outcrop of limestone The cave has a similar geologic setting as Snake Creek Cave. It is phreatic in origin with no evidence of vadose flow (Hiscock 1979).

Geology, Hydrology and Speleogenesis
Fox Skull is likely associated with the same events that created Snake Creek Cave. It's proximity suggests a hypogenic origin.

History and Cultural Resources
Unknown.

Biological Resources
A fox skull was removed from the cave in the late 1970s. Bat and rat use has been noted in the cave.

Management Issues and key Data Gaps
A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Fox Skull Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Squirrel Springs Cave
SC-07
Proposed Management Class: 3-C-II
Length: 50.5 ft
Relief: 22.5 ft
Map page 108
Survey and Physical Inventory: 12/1/1997

Physical Description
Squirrel Springs is a small resurgence along the Snake Creek drainage. The cave ends in a sump and is the source of an important spring that flows into Snake Creek.

Geology, Hydrology and Speleogenesis
The cave is a perennial resurgence contributing to Snake Creek. There is a large potential for further cave discovery.

History and Cultural Resources
Squirrel Springs Cave was first noted by the High Desert Grotto in June of 1982 (High Desert Grotto 1982), though it may have been discovered prior to that date since the cave is a large water source. Squirrel Springs Cave was named after a skeleton of a squirrel found in the entrance in the fall of 1998.

Biological Resources
Evidence of rat use, some fungus noted during inventory.

Management Issues and key Data Gaps
Squirrel Springs is a resurgence for an unknown karst system. Dye tracing, and groundwater flow delineation for the Squirrel Springs basin, as well as a detailed macroinvertebrate study and a microbiological study are needed to fill data gaps for Squirrel Springs Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Bristlecone Cave

SC-06
Proposed Management Class: 6-B-IV
Length: 309 ft,
Vertical Relief: 184 ft
Survey and Physical Inventory: August 2004

Physical Description
The entrance is a fissure 30-ft long by 10-ft wide at an elevation of 10,390 ft. The entrance pit is a 60-ft drop with nicely fluted walls, followed by traversing across 30-ft deep Pendulum Pit, then dropping another 60-ft pit with fluted walls and a floor covered with rat droppings, and finally entering a crawl. The deepest explored point was approximately 190 ft below the entrance (Bridgemon 1968).

Geology, Hydrology and Speleogenesis
Bristlecone cave is a large solution pit, containing

classic solution pit features, such as fluted walls.

History and Cultural Resources

In August 1965, Jeff Ward, a student at the University of Iowa, discovered Bristlecone Cave while he was hiking in search of Bristlecones Pines exceeding the age of those in the Wheeler Peak cirque. On August 10, 1966 Ron Bridgemon relocated and entered the cave. The cave was surveyed in August 2004, and a cave register was located at the bottom. Apparently, this was the first entry in the cave since the Bridgemon trips of 1966.

Biological Resources

On August 11, 1966, 29 bats were seen flying from the cave (Soulages 1966). There is evidence of rat use.

Management Issues and key Data Gaps

A detailed macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Bristlecone Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

South Fork Big Wash Watershed

The South Fork of Big Wash (SFBW) watershed is located on the east side of the park, and merges with the North Fork of Big Wash watershed just outside the park boundaries to become the Big Wash watershed. The Big Wash watershed was separated in its upper reaches due to its large size. The SFBW watershed includes 4,483 acres within the park boundaries, with 17 known springs, 4 saturated wetlands and one stream.

The underlying geology consists of 43% Corset Spring, Johns Wash and Lincoln Peak Formations, 27% Eureka Quartzite and Pogonip Group, 9% landslide debris, 6% Pole Canyon limestone, 6% Notch peak limestone, 4% Simonson, Levy, Laketown and Fish Haven dolomites, 4% unconsolidated sediments, and 1% Guilmette formation. Vegetative cover includes 27% subalpine pine, 33% white fir, 18% pinyon/juniper, 16% mountain mahogany, and 6% aspen.

Castle Butte Cave

BW-06
Length:
Vertical Relief:

Physical Description
Unknown

Geology, Hydrology and Speleogenesis
Unknown

History and Cultural Resources
Unknown

Biological Resources
Unknown

Management Issues and key Data Gaps
A detailed survey, and physical inventory, as well as a macroinvertebrate study and a microbiological study are needed to fill data gaps for Castle Butte Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Cats Meow Cave

BW-07
Length:
Vertical Relief:

Physical Description
Unknown

Geology, Hydrology and Speleogenesis
Unknown

History and Cultural Resources
Unknown

Biological Resources
Unknown

Management Issues and key Data Gaps
A detailed survey and physical inventory, as well as a macroinvertebrate study and a microbiological study are needed to fill data gaps for Cats Meow Cave.

Chamber Cave

BW-09
Length: ~40 ft.
Vertical Relief:

Physical Description
Chamber Cave is located along a fracture, and consists of multiple entrances into a large single chamber (~40x20, 30 feet high). The cave contains a breakdown and sediment floor.

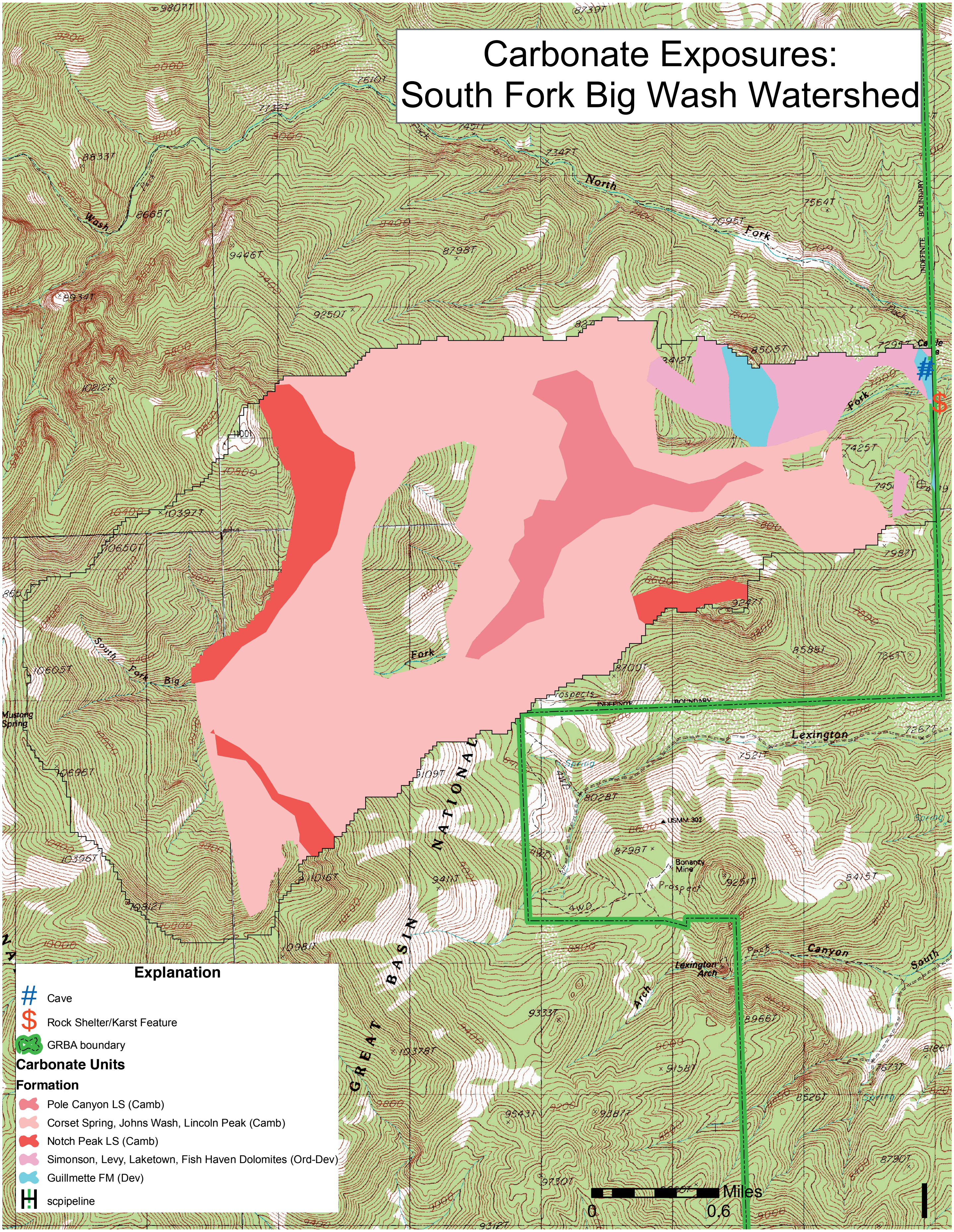
Geology, Hydrology and Speleogenesis
Chamber Cave is apparently a large phreatic chamber developed along a local fracture system.

History and Cultural Resources
None known.

Biological Resources
A dead rat was observed in the cave upon its discovery in 2003, no other biota are noted in the trip report.

Management Issues and key Data Gaps
A detailed survey and inventory, along with a macroinvertebrate and microbiological inventory are necessary to fill data gaps for Chamber Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.


Carbonate Exposures:
South Fork Big Wash Watershed
Explanation
Cave
Rock Shelter/Karst Feature
GRBA boundary
Carbonate Units
Formation
Pole Canyon LS (Camb)
Corset Spring, Johns Wash, Lincoln Peak (Camb)
Notch Peak LS (Camb)
Simonson, Levy, Laketown, Fish Haven Dolomites (Ord-Dev)
Guillmette FM (Dev)
scpipeline
Miles
0
0.6
North
Fork
South
Fork
Big
Wash
Lexington
Canyon
Lexington Arch
Bonanza Mine
GREAT BASIN NATIONAL

High Hole

BW-10
Length: ~30 ft.
Vertical Relief:

Physical Description

High Hole is a short cave located high on a cliff in the South Fork of Big Wash. No other description is given in the trip report

Geology, Hydrology and Speleogenesis

Unknown

History and Cultural Resources

Unknown

Biological Resources

Unknown

Management Issues and key Data Gaps

A detailed survey and inventory, including a macroinvertebrate study as well as a microbiological study are needed to fill data gaps for High Hole.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

Mystery Cave

BW-11
Length: 25+ feet
Vertical Relief:

Physical Description

Mystery is a small cave with a sediment floor. About 25 feet into the cave there appears to be a constructed wall, and the ceiling is blackened, perhaps from fires in the cave. The cave is a possible dig, with air.

Geology, Hydrology and Speleogenesis

Unknown

History and Cultural Resources

An apparently constructed wall exists in the cave, as well as possible evidence of fires, suggesting this may be a cultural site.

Biological Resources

None noted.

Management Issues and key Data Gaps

This cave has apparent cultural significance, and needs to be investigated by a cultural resource specialist.

A detailed survey and inventory, including a macroinvertebrate study as well as a microbiological study are needed to fill data gaps for Mystery Cave.

The physical resource condition is monitored on a per trip basis by park staff. All scientific and management trips require the presence of the cave management specialist or his/her designee.

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Summary

This document represents the current state of information on cave resources at Great Basin National Park. It is intended to be used as a baseline condition report in preparation for future cave management planning. As such, a set of key data gaps and further planning proposals are presented here.

Key Data Gaps

While cave-specific data gaps have been identified, four overarching key data gaps exist for cave and karst resources at GRBA:

Biological inventories

With the exception of the eight permitted caves surveyed in 2003 by Krecja and Taylor, no caves within the park have received a comprehensive biological inventory. What little work that has been done found several endemic species. The 2003 inventory resulted in the discovery of six new invertebrates in caves highly impacted by human use. The new species are potentially endemic as well as exclusively cave-adapted. There is great potential for similar discoveries in other caves within park boundaries.

Hydrologic studies

While the majority of the caves in the park are detached from active hydrological systems, two very important exceptions exist. The caves of the Baker Creek Cave System, as well as other caves in the Baker Creek area (Model and Systems Key) contain active hydrologic systems, and very little is known about the nature of these systems. Squirrel Springs Cave, in the Snake Creek area is an active resurgence and an important contributor to Snake Creek. The hydrology of both of these systems is very poorly understood at all scales.

Use of caves by bat populations

Several caves in the Baker Creek area are very important habitat used by a number of different bat species. The park has a limited amount of bat survey data from the mid 1990s through the present that deals with presence and absence of species only. The current dataset lacks sufficient detail to determine specific roost needs for the various species. There is no consistent microclimate data associated with bat roosts, and there is a lack of detailed information about when colonies change roosts, or move to a different location within a roost.

Undocumented cave and karst resources

There are 47 known caves within the boundaries of GRBA, as well as an additional 23 known shelters and karst features. A large portion of the exposed carbonates in the park have not been systematically inventoried for caves and karst features. A high potential exists for discovery of new significant caves and karst features within these uninventoried areas.

Cave and Karst Management Planning

The Physical Science Branch is currently in the process of revising the outdated Cave and Karst Management plan, the first step of which is the completion of this condition report. In addition to this, the following projects are currently under development:

PMIS 100209, Cave Invertebrate Inventory. (FUNDED FY06)

The key objectives of this two-year project are to conduct a systematic invertebrate inventory of the 15 highest priority caves in the park, including Lehman Caves. The outcome of this inventory will identify threats to these cave invertebrate populations, and develop management strategies based on ecological and biological information on the collected taxa. Without this vital information, the park risks irretrievably losing sensitive and endemic cave species.

PMIS 6327, Design Low Impact Trail Lighting for Lehman Caves

The key objectives of this project will consist of two components: 1) A comprehensive review of all impacts associated with the current cave lighting system at Lehman Caves, including a detailed map of lighting fixtures, wiring, and other electrical components; and 2) With the assistance of the regional office and Denver Service Center staff, contract for the design of a low impact cave lighting system. The results of this project will enable park managers to make informed decisions and prepare a technically sound proposal for the construction of a new cave lighting system. This project will be followed by a project to replace the current lighting system with the system designed as a result of the design work.

PMIS 117486, Determination of Ground-water Flowpaths and Hydrologic Relations in the Baker Creek Karst Watershed

The key objective of this project is to determine the hydrologic relations between the major caves in the Baker Creek area, and their relation to the overlying watershed. Specific objectives include: 1) Establish the relation between Model and System's Key caves, and their relation to the Baker Creek System. 2) Determine ground-water travel times between different components of the Baker Creek system and/or between areas in the watershed and the cave system. 3) Delineate the recharge area (watershed) for the cave system and identify the potential point sources where surface water can recharge the aquifer directly. 4) Determine the discharge point(s) for water from the cave system.

PMIS 110197, Restoration of Lehman Caves
The key objectives of this project are to restore sections of Lehman Cave to a pre-disturbance condition. This project will remove a permanently closed section of trail in the Talus Room, its unused electrical system components, and debris from construction of the Panama Canal trail section. The degradation and decomposition of foreign materials along abandoned sections of the trail is a significant threat to the cave that disrupts natural cave processes and biological functions of the ecosystem, adversely impacts water quality, and creates a safety hazard to park visitors. This action will restore over 45,000 square feet of cave floor, uncover numerous buried cave formations, reduce human caused impacts to park cave resources and protect park visitors and staff. The interpretive component will assure that visitors understand the need and status of the project.

In addition to these projects, Physical Science staff plan to carry out other projects during the course of normal operations, including:

Lint removal from the tour routes of Lehman Caves
Staff from the Physical Science Branch, along with volunteers will begin systematic removal of lint accumulations along the tour routes of Lehman Caves. Lint deposition has been shown to be a serious concern in commercial caves such as Lehman. Areas will be examined for macroinvertebrates prior to cleaning.

Lampenflora (algae) removal from the tour routes of Lehman Caves
The current lighting system in Lehman Caves supports the growth of lampenflora in numerous locations along the tour routes. Physical Science staff will periodically remove lampenflora with a chemical solution, as necessary.

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Appendix A: Bat Data Summary, 2002-2003

Site Name	Date	Method	Species	Juveniles	Females	Males	Total	Repro Status	
Snake Creek	6/10/2002	Mist-Netting	COTO	0	0	4	4	4TD	
			MYEV	0	1	0	1	1N	
			MYCI	0	1	0	1	1N	
Snake Creek	8/20/2002	Internal	NA	0	NA	NA	3	3 Adults (sex indeterminable)	
Snake Creek	9/12/2002	Mist-Netting	COTO	0	3	2	5	1L, 1N	6pm -10:05pm
			ANPA	0	0	3	3		
Fox Skull	4/29/2002	Internal	COTO	NA	NA	NA	1	NA	
			Unknown	NA	NA	NA	1	NA	
Fox Skull	6/10/2002	Exit Count	NA	NA	NA	NA	1	NA	7:15pm-9:00pm
Crevasse	6/11/2002	Exit Count	NA				48 out 36 in		7pm-9:30pm
Crevasse	9/13/2002	Exit Count	NA				54 total		6:30pm - 8pm
Systems Key	6/11/2002	Mist-Netting	NA	0	0	0	0		
Wheeler's Deep	6/12/2002	Mist-Netting	COTO	0	3	1	4	1P, 1TD, 1Unknown	
			MYEV	0	1	0	1	1N	
			MYVO	0	0	1	1	1TD	
		Exit Count	NA	NA	NA	NA	15 out 9 in		7:30pm-10:10pm
Wheeler's Deep	8/6/2002	Internal	Possible COTO	NA	NA	NA	1	NA	
Wheeler's Deep	9/13/2002	Mist-Netting	MYVO	1	0	1	1	1TP	
U. Pictograph	6/12/2002	Mist-Netting	MYVO	0	2	0	2	1N?,1P	
			COTO	0	3	0	3	3P	
		Exit Count	NA	NA	NA	NA	29 out 20 in		8:17pm-8:59pm
U. Pictograph	9/12/2002	Mist-Netting	MYVO	38	85	12	97		6:30pm - 11:30pm
			MYCI	0	0	1	1		
			COTO	1	0	1	2	1 N	
Lincoln Adit	6/13/2002	Mist-Netting	MYVO	0	0	22	22	22TD	
			MYEV	0	1	1	2	1TD, 1P	
		Exit Count	NA	NA	NA	NA	148 out 153 in		7:45pm-9:15
3-Hole	7/10/2002	Internal					0		
3-Hole	8/23/2002	Internal					0		
Mt Washington (bulldozer pits)	7/10/2002	Mist-Netting	MYEV	0	0	6	6	6TD	
			EPFU	0	0	1	1	1TD	
			MYVO	0	1	5	6	1L, 5TD	
			MYCA	0	0	1	1	1TD	
		Visual	NA	NA	NA	NA	8 escape holding bags/net		

Squirrel Spring	8/22/2002	Internal					0		No further surveys conducted: Entrance choked with debris.
Ice Cave	8/23/2002	Internal					0		
Ice Cave	9/13/2002	Exit Count	NA				7 total		6:45pm - 7:45pm
Model Cave	9/11/2002	Internal	NA	NA	NA	NA	2		
Site Name	Date	Method	Species	Juveniles	Females	Males	Total	Repro Status	
Model Cave	6/4/2003	Internal	COTO				1		
Snake Creek Cave	6/5/2003	Mist-Netting	COTO	0	2	3	5	2 N, 3 TD	19:10-23:50
			ANPA	0	0	1	1	1 TD	
			MYVO	0	0	2	2	2 TD	
			MY??	NA	NA	NA	2	escaped from net	
	6/5/2003	Exit Count	NA	NA	NA	NA	6 out 5 in	not including captures & released	
Snake Creek - Old Road Crossing	9/3/2003	Mist-Netting					0	10-15 free-flying	
Snake Creek Cave	9/3/2003	Mist-Netting	COTO	1	0	2	2		
			ANPA	0	2	1	3		
			MYVO	1	0	0	1		
		Exit Count					10 out 3 in		
Fox Skull	9/3/2003	Internal					2		
Wheeler's Deep	6/11/2003	Internal	COTO	present	present	NA	entrance area 1st cluster - 15in X 10in 2nd cluster - 10in X 6in		
Wheeler's Deep	6/26/2003	Internal					0		
Wheeler's Deep	9/6/2003	Mist-Netting	COTO	0	8	5	13	7P, 5 TD	7:05-11pm
			MYEV	0	0	4	4	4 TD	
			MYVO	0	1	4	5	3 TD, 1TP, 1N	
			MY				1	escaped	
Crevasse/Halliday's	9/6/2003	Exit Count					32 out 12 in	40 avg seen	7:19pm-8:12pm
Lincoln Canyon Adit	6/19/2003	Mist-Netting	MYVO	2	0	10	12	1 TP, 11 TD	

			MYEV		0	2	5		7	5 TD, 2 N
			EPFU		0	0	1		1	1 TD
			COTO		0	1	0		1	1 N
			??	NA	NA	NA			1	escaped possible MYVO
	6/19/2003	Exit Count	NA	NA	NA	NA		3 out		
								20 in		
Halliday's Deep	6/27/2003	Internal						entrance ceiling		
								One cluster - 15in x 12in		
Halliday's Deep	7/9/2003	Internal							0	
H2O Trough	9/4/2003	Mist-Netting	MYEV		1	2	0		3	
			COTO		0	1	2		3	
			MYVO		0	7	0		7	
			MYCI		0	0	1		1	
Upper Pictograph	6/25/2003	Internal							0	
Upper Pictograph	7/27/2003	Exit Count						3 in		
								6 out		
Upper Pictograph	9/5/2003	Mist-Netting	MYVO		4	58	9		63	
			COTO		0	2	1		3	
			EPFU		0	1	0		1	
Lower Pictograph	7/27/2003	Exit Count						3 in		
								1 out		
Crevasse/Halliday's	8/29/2003	Internal	COTO					3 clusters-		
								11x11 each		
								6 solitary		
Hiding Hole	8/29/2003	Internal							1	
Srawberry Creek - last campground	9/4/2003	Mist-netting							0	3 sighted
T-Cave	6/4/2003	Internal							0	
Coyote Hole	6/4/2003	Internal							0	
Fool's Hole	6/4/2003	Internal							0	

Appendix B: Cave-Specific Species Lists

Snake Creek Cave Species List (Krejca and Taylor 2003)

Phylum Mandibulata
- Class Diplpoda
  - Order Polydesmida
    - *Speodesmus* n. sp.?
- Class Insecta
  - Order Collembola (springtails)
    - Family Entomobryidae
    - Family Arrhopalitidae
      - *Arrhopalites* n. sp.?
  - Order Pscopotera (book and bark lice)
  - Order Coleoptera (beetles)
    - Family Anthicidae
      - Undetermined
  - Order Diptera (flies)
    - Family Sciaridae
    - Family Tipulidae (crane flies)
  - Order Hymenoptera
    - Family Formicidae
      - *Aphaenogaster* sp.

Phylum Craniata
- Class Aves
  - Order Passeriformes
    - Family Troglodytidae
      - *Catherpes mexicanus* (Swainson, 1829)
- Class Mammalia
  - Order Chiroptera
    - Family Vespertilionidae
      - *Antrozous pallidus*
      - *Corynorhinus townsendii*
      - *Myotis ciliolabrum*
      - *Myotis evotis*
      - *Myotis volans*

Lower Pictograph Cave Species List (Krejca and Taylor 2003)

Phylum Mandibulata
- Class Insecta (insects)
  - Order Collembola (springtails)
    - Family Entomobryidae
      - *Tomocerus* sp.

Phylum Craniata
- Class Mammalia
  - Order Chiroptera
    - Family Vespertilionidae
      - *Corynorhinus townsendii*

Pictograph Cave Species List (Krejca and Taylor 2003)

Phylum Chelicerata
- Class Arachnida
  - Order Acari (mites)
  - Order Araneae (spiders)
  - Order Opiliones (harvestmen)
    - Family Triaenonychidae
      - *Cryptobunus* (probably *ungulatus ungulatus* Briggs 1971, the Model Cave Harvestman, but this is a new locality)
  - Order Pseudoscorpiones
    - Family Neobisiidae
      - *Microcreagris* (probably *grandis* Muchmore 1962) *Microcreagris grandis* was also reported in "Pictograph Cave," by Bridgemon (1967), presumeably this is the same site as Upper Pictograph Cave.

Phylum Mandibulata
- Class Insecta (insects)
  - Order Collembola (springtails)
    - Family Entomobryidae
      - Undetermined
      - *Tomocerus* sp.
  - Order Coleoptera (beetles)

Phylum Craniata
- Class Mammalia
  - Order Rodentia
    - (Rodent skull)
    - Family Cricetidae
      - *Peromyscus* sp. (mouse)
  - Order Chiroptera
    - Family Vespertilionidae (bats)
      - *Corynorhinus townsendii*
      - *Corynorhinus townsendii pallescens* (Big-eared bats)
      - *Myotis ciliolabrum*
      - *Myotis evotis*
      - *Myotis volans*

Systems Key Species List (Krejca and Taylor 2003)

Phylum Platyhelminthes
- Class Tricladida (flatworms)

Phylum Annelida
- Class Oligochaeta (earthworms and aquatic worms)

Phylum Crustacea
- Class Copepoda
- Class Ostracoda

Phylum Chelicerata
- Class Arachnida
  - Order Acari (mites)
    - Family Rhagidiidae
    - undetermined
  - Order Araneae (spiders)
  - Order Opiliones (harvestmen)
    - Family Triaenonychidae
      - *Cryptobunus* (probably *ungulatus ungulatus* Briggs 1971, the Model Cave Harvestman, but this is a new locality)

Phylum Mandibulata
- Class Chilopoda (centipedes)
- Class Diplpoda (millipeds)
- Class Insecta
  - Order Plecoptera (stoneflies)
  - Order DIptera (flies)
    - Family Chironomidae
    - Family Heleomyzidae
      - undetermined

Phylum Mollusca
- Class Gastropoda (snails)

Phylum Craniata (Patel 2004)
- Class Mammalia
  - Order Chiroptera
    - Family Vespertilionidae
      - *Corynorhinus townsendii*

Model Cave Species List (Krejca and Taylor 2003)

Phylum Annelida
- Class Oligochaeta (earthworms and aquatic worms)

Phylum Crustacea
- Class Copepoda
- Class Ostracoda

Phylum Chelicerata
- Class Arachnida
  - Order Acari (mites)
    - Family Rhagidiidae?
    - undetermined
  - Order Opiliones (harvestmen)
    - Family Triaenonychidae
      - *Cryptobunus ungulatus ungulatus* Briggs 1971 (Model Cave Harvestman)

Phylum Mandibulata
- Class Diplpoda (millipeds)
  - Order Polydesmida
    - *Speodesmus* n. sp.?
    - Undetermined
- Class Insecta
  - Order Collembolda
    - Family Entomobryidae
    - *Tomocerus* sp.
    - Undetermined
    - Family Onychiuridae
    - Family Arrhopalitidae
    - *Arrhopalites* n. sp.?

Phylum Mollusca
- Class Gastropoda (snails)

Phylum Craniata (Patel 2004)
- Class Mammalia
  - Order Chiroptera
    - Family Vespertilionidae
      - *Corynorhinus townsendii*

Crevasse Cave Species List (Krejca and Taylor 2003)

Phylum Chelicerata
- Class Arachnida
  - Order Araneae (spiders)
  - Order Opiliones (harvestmen)
    - Family Triaenonychidae
      - *Cryptobunus* (probably *ungulatus ungulatus* Briggs 1971, the Model Cave Harvestman, but this is a new locality)
  - Order Pseudoscorpiones
    - Family Neobisiidae
      - *Microcreagris* (probably *grandis* Muchmore 1962, but this is a new locality)

Phylum Mandibulata
- Class Chilopoda (centipedes)
- Class Insecta (insects)
  - Order Collembola (springtails)
  - Order Coleoptera (beetles)
    - Undetermined coleopteran
    - Family Tenebrionidae (darkling beetles)
  - Order Diptera (flies)
    - Family Sciaridae
  - Order Hymenoptera (bees, wasps, ants)
    - Family Formicidae (ants)

Phylum Mollusca
- Class Gastropoda (snails)

Phylum Craniata
- Class Mammalia
  - Order Rodentia
    - (Rodent skull)
  - Order Chiroptera (Patel 2004)
    - Family Vespertilionidae
      - *Corynorhinus townsendii*

Ice Cave Species List (Krejca and Taylor 2003)

- Phylum Chelicerata
  - Class Arachnida
    - Order Acari (mites)
    - Order Araneae (spiders)
    - Order Opiliones (harvestmen)
      - Family Triaenonychidae
        - *Cryptobunus* (probably *ungulatus ungulatus* Briggs 1971, the Model Cave Harvestman, but this is a new locality)
- Phylum Mandibulata
  - Class Chilopoda (centipedes)
  - Class Diplopoda (millipeds)
  - Class Insecta (insects)
    - Order Diptera (flies)
      - Family Heleomyzidae
- Phylum Mollusca
  - Class Gastropoda (snails)
- Phylum Craniata
  - Class Mammalia
    - Order Chiroptera
      - Family Vespertilionidae (bats) skull

Wheeler's Deep Species List (Krejca and Taylor 2003)

Phylum Chelicerata
- Class Arachnida
  - Order Acari (mites)
  - Order Araneae (spiders)
  - Order Opiliones (harvestmen)
    - Family Triaenonychidae
      - *Cryptobunus* (probably *ungulatus ungulatus* Briggs 1971, the Model Cave Harvestman, but this is a new locality)

Phylum Mandibulata
- Class Diplopoda
  - Order Polydesmida
    - *Speodesmus* n. sp.?
  - Undetermined
- Class Insecta
  - Order Coleoptera (beetles)
  - Order Diptera (flies)
    - Family Mycetophilidae (fungus gnats)

Phylum Mollusca
- Class Gastropoda (snails)

Phylum Craniata
- Class Mammalia
  - **Order Rodentia**
    - (Rodent skull)
  - Order Chiroptera
    - Family Vespertilionidae
      - *Corynorhinus townsendii*
      - *Myotis ciliolabrum*
      - *Myotis evotis*
      - *Myotis volans*

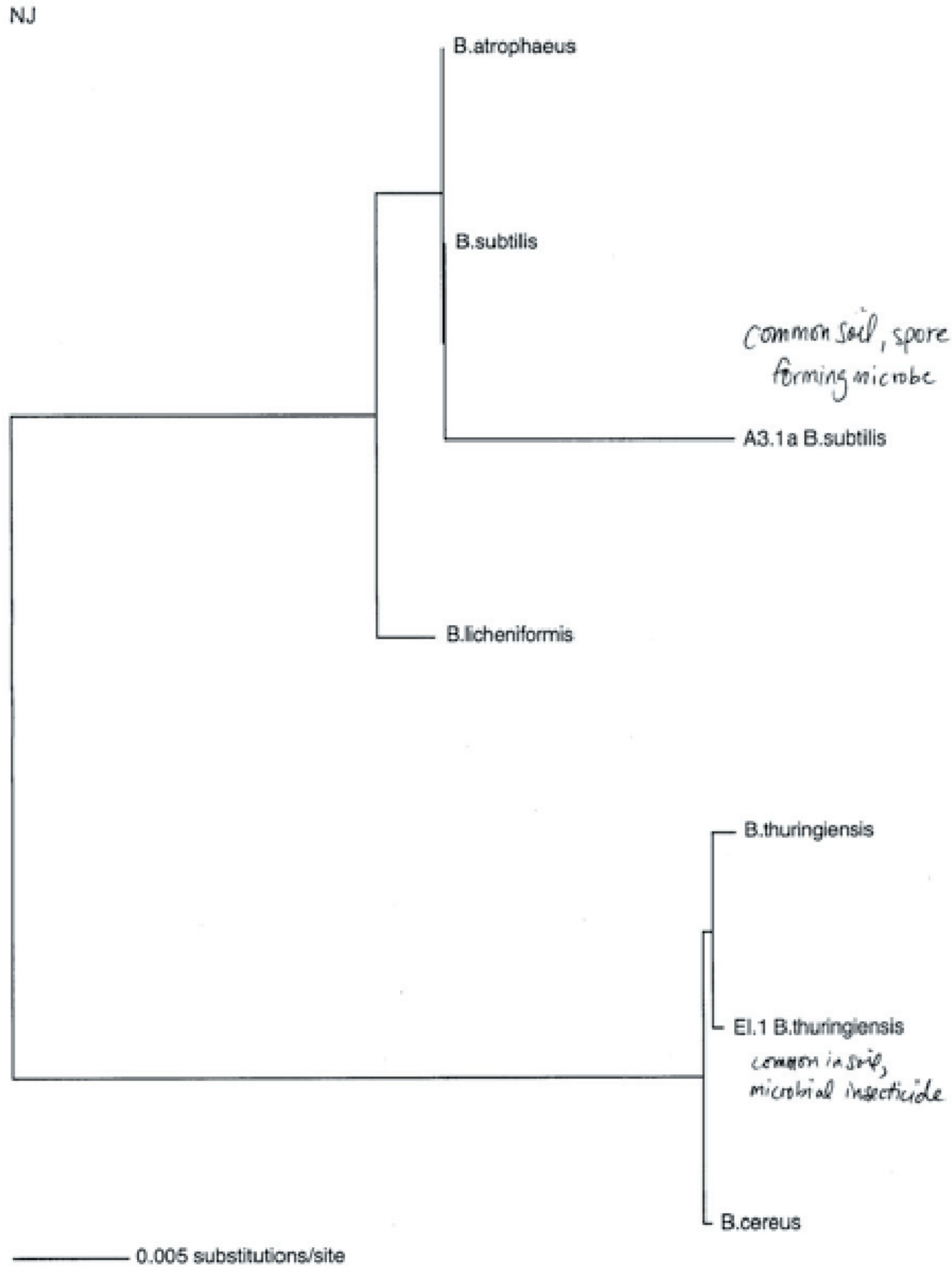
<u>Halliday's Deep Section Species List</u> (Krejca and Taylor 2003)

Phylum Chelicerata
- Class Arachnida
  - Order Acari (mites)
  - Order Araneae (spiders)
    - Family Lycosidae (wolf spiders)
  - Order Opiliones (harvestmen)
    - Family Triaenonychidae
      - *Cryptobunus* (probably *ungulatus ungulatus* Briggs 1971, the Model Cave Harvestman, but this is a new locality)

Phylum Mandibulata
- Class Insecta (insects)
  - Order Coleoptera (beetles)
    - Family Tenebrionidae (darkling beetles)
  - Order Diptera (flies)
    - Family Heleomyzidae
  - Order Hymenoptera (bees, wasps, ants)
    - Family Ichneumonidae
  - Order Lepidoptera

Phylum Craniata (Patel 2004)
- Class Mammalia
  - Order Chiroptera
    - Family Vespertilionidae
      - *Corynorhinus townsendii*

A1
A2
B4
B9
UAU87517
UAU87518
44a-A1-12
A3
lake sediment, Lake WI
AF201365
AF201366
AF201367
estuarine sediments
33-P98A00
UAR294873
UAR294881
AF201359
AF201360
SAGMA-9
AF119136
AF119127
AF119125
UAR294879
pHAuB-30
marine sediments
33-FL19A00
AF052946
AF121988
AF121998
AF122001
AF121992
UHU46680
AF121993
AF121994
AF122000
UCU78199
UCU78199
pIVWA3
UMA347777
UHU46678
UHU46679
PAAR4
PAAR8
PAAR9
UAR294854
UAR294874
AF052948
UAR294876
UAU87519
UAR294878
pPCA4.9
marine sediments
SAGMA-A
WCA39
SAGMA-C
B1
WCA51
WCA19
B5
B6
WCA1
WCA31
Wind Cave sediment
SAGMA-10
SAGMA-D
ZmrA4
AF389433
SAGMA-X
UCR535135
gold deep mine waters
UCR535124
UCR535126
UCR535132
UCR535129
UCR535130
uranium mine waste
0.005 substitutions/site


NJ
B.atrophaeus
B.subtilis
common soil, spore forming microbe
A3.1a B.subtilis
B.licheniformis
B.thuringiensis
EI.1 B.thuringiensis
common in soil, microbial insecticide
B.cereus
0.005 substitutions/site

Little Muddy Species List (Krejca and Taylor 2003)

Phylum Chelicerata
- Class Arachnida
  - Order Acari (mites)
  - Order Araneae (spiders)
  - Order Pseudoscorpiones
    - Family Neobisiidae
      - *Microcreagris* (probably *grandis* Muchmore 1962) *Microcreagris grandis* was also reported in Little Muddy Cave by Schmitz (1986).

Phylum Mandibulata
- Class Diplopoda
  - Order Polydesmida
    - *Speodesmus* n. sp.?
- Class Insecta (insects)
  - Order Collembola (springtails)
  - Order Heteroptera (true bugs)
    - Undetermined
  - Order Siphonaptera (fleas)
  - Order Diptera (flies)
    - Family Cecidomyiidae
    - Family Muscidae
    - Family Sciaridae

Lehman Caves Species List (Krejca and Taylor 2003)
All of the observations and collections in the following list are from past studies that have been compiled into one list by Krejca and Taylor (2003). All citations for taxa are listed in their paper referenced at the end of this report.

Eubacteria (true bacteria):
Cyanobacteria
Class Myxophyceae (blue-green algae)
Anacystis montana (Lightfoot) Drouet and Daily (Stark 1969)
Schizothrix calcicola (C. Agardh) Komont (Stark 1969)
Oscillatoria Vaucher sp. (Stark 1969)
Anabaena Bory sp. (Stark 1969)
Coccochloris Springel sp. (Stark 1969)
Eubacteria (true bacteria):
Bacteria:

In one culture made from a stalactite, an unidentified bacterial colony developed along with a fungus. (Went, undated)

"Bacteria were common in pools which dry during winter" according to Stark (1969)

Slime bacterium *Dictyostelium* sp. occurs on walls (Desert Research Institute 1968 and Stark 1969)

Slime mold *Stemonites* sp. is common on wood (is this a fungus or bacteria?) (Desert Research Institute 1968, Stark 1969)

Bacteria *Zoogloea ramigera* tentative identification by Stark found (Desert Research Institute 1968)

Chemotrophic bacteria *Leptothrix* sp. (iron bacteria) are producers (Desert Research Institute 1968).

Eukaryotes (organisms with nucleated cells):
Green Plants:

Embryophytes (land plants):
Bryophyta (mosses)
Class Bryopsida
Order Hypnales
Family Amblystegiaceae
Campylium chrysophyllum (Bird) J. Lang identified by
Sheps (1972)
Order Funariales
Family Funariaceae
Physcomitrium sp. identified by Sheps (1972)
Class Bryopsida: *Bruchia* sp. identified by Sheps (1972)

Embryophytes (land plants):
Marchantiomorpha (liverworts)
Phylum Hepatophyta
Class Jungermanniopsida
Order Jungermanniales
Family Metzgeriales
Closely resemble *Metzgeria* sp. but they are small. Identified by the Desert Research Institute (1968) and mentioned by Stark (1969) as "one species of Liverwort" from Lehman Cave
Embryophytes (land plants):
Filicopsida (ferns)
Order Filicales
Family Dryopteridaceae
Cystopteris fragilis (L.) Bernh were identified by Stark (1969)
Family Aspleniaceae
Asplenium sp. were identified by Stark (1969)
Green Plants:
Algae:
Division Chlorophyta
Class Chlorophyceae (green algae)
Mugeotiopsis calospora Palla (Stark 1969)
Chlorococcum humicola (Nageli) Rabenhorst (Stark 1969)
Protococcum viridis Agardh (Stark 1969)
Nannochloris Naumann sp. (Stark 1969)
Roya anglica G.S. West (Stark 1969)
Cosmarium corda sp. (tentative identification)(Stark 1969)
Chlorella vulgaris Beijerinck (tentative identification)(Stark 1969)
Coccomyxa dispar Schmidle (tentative identification)(Stark 1969)
Palmella miniata Liebl. (tentative identification)(Stark 1969)
Also, an unidentified species of alga was transplanted by Sheps (1972)

Eukaryotes (organisms with nucleated cells):

Animalia (Metazoa):
Phylum Annelida
Class Oligochaeta reported by Desert Research Institute (1968)
Phylum Chelicerata
Class Arachnida
Order Oribatida
Family Oribatidae reported by Desert Research Institute

(1968), Stark (1969)
Order Araneae four undetermined species of spider from Lehman Cave (Desert Research Institute 1968, Stark 1969)
Order Pseudoscorpiones
Family Neobisiidae
Microcreagris grandis Muchmore 1969, type material
(Muchmore 1969); and recorded by other authors (Desert Research Institute 1968, Stark 1969, Schmitz 1986)
Phylum Mandibulata
Class Insecta
Order Collembola
Family Entomobryidae
Entomobrya marginata Tullberg reported by Stark (1969)
Family Sminthuridae reported by Desert Research Institute (1968) – likely the same as our Arrhopalitidae
Family Poduridae reported by Desert Research Institute (1968)
Order Diptera
Family Sciaridae
Bradysia sp. (det. By R.J. Gagne, USNM) (Desert Research Institute 1968, Stark 1969)
Family Phoridae
Megaselia sp. (det. By W.W. Wirth USNM) (Desert Research Institute 1968, Stark 1969)
Family Psychodidae
Psychoda sp. (Desert Research Institute 1968, Stark 1969)
Family Ceratopogonidae
Culicoides sp. (det. W.W. Wirth USNM) (Desert Research Institute 1968, Stark 1969)
Family Streblidae (Desert Research Institute 1968, Stark
1969)
Family Heleomyzidae
Pseudoleria sp. (det. A. Steyskal, USNM) (Desert Research Institute 1968)
Order Lepidoptera
Family Tineidae
probably *Amydria* sp. (det. D.R. Davis, USNM), reported as fairly abundant (Desert Research Institute 1968, Stark 1969)
Order Coleoptera: referring to pack rat guano at Lehman Cave:

Stark (1969) says "beetle galleries and frass are common under old dung and another type burrows into pellets, but no beetles are known to be active in the dung of the caves today"

Family Psyllipsocidae

Psyllipisocus ramburii Selys-Longchamps (det. E.L. Mockford, Ill.) (Desert Research Institute 1968, Stark 1969)

Family Cryptophagidae (Desert Research Institute 1968)

Phylum Craniata

Class Aves

Order Galliformes

Family Phasianidae "Grouse? (recent)" tentatively identified from skeletal remains by Orr (1952)

Class Mammalia

Order Carnivora

Family Canidae

Canis latrans Say, 1823 "Coyote (fossil?)" tentatively identified from skeletal remains by Orr (1952)

"Fox (fossil?)" tentatively identified from skeletal remains by Orr (1952)

Order Rodentia

Family Erethizontidae

Cf. *Erethizon* tentative identification of skeletal remains from Lost River Passage, "cf" indicates the identification is based solely upon visual inspection, judged probably Holocene (10,000 years or younger)(Mead 1980).

Family Sciuridae

Tamias sp. tentative identification of skeletal remains from Lost River Passage, "cf" indicates the identification is based solely upon visual inspection, judged probably Holocene (10,000 years or younger)(Mead 1980).

Tamias dorsalis (Baird, 1855) (Desert Research Institute 1968, Stark 1969)

Marmota cf. *flaviventris* (Audubon and Bachman, 1841) tentative identification of skeletal remains fromLost River Passage, "cf" indicates the identification is based solely upon visual inspection, judged probably Holocene (10,000 years or younger)(Mead 1980); also "Marmot (fossil?)" tentatively identified from skeletal remains by Orr (1952)

Family Muridae

Peromyscus maniculatus (Wagner, 1845) (Desert Research Institute 1968, Stark 1969)

Probably *Neotoma* sp. based on guano, (Desert Research Institute 1968, Stark 1969)

Reithrodontomys sp. tentative identification of skeletal remains from Lost River Passage, "cf" indicates the identification is based solely upon visual inspection, judged probably Holocene (10,000 years or younger)(Mead 1980).

Order Lagomorpha
Family Leporidae
Cf. *Sylvilagus* sp. (probably *S. nuttalli*) tentative identification of skeletal remains from Lost River Passage, "cf" indicates the identification is based solely upon visual inspection, judged probably Holocene (10,000 years or younger)(Mead 1980).
"Jack rabbit (recent)" tentatively identified from skeletal remains by Orr (1952)
Order Primates
Family Hominidae
Homo sapiens "Human (recent)" tentatively identified
from skeletal remains by Orr (1952)
Phylum Rotifera
Trichocera sp. identified by Drs. Wheeler (Desert Research Institute 1968)
Lepadella sp. identified by Drs. Wheeler (Desert Research Institute 1968)
Eukaryotes (organisms with nucleated cells):
Stramenopiles:
Class Bacillariophyceae (diatoms)
Navicula (6 species of naviculoid diatoms)(Stark 1969)
Coscinodiscus Her. Sp. (Stark 1969)
Stramenopiles:
Phylum Sarcodina (protozoans)
Superclass Rhizopoda (amoebae):
Cucurbitella sp. Penard, tentative identification (Desert Research Institute 1968)
Actinophyidae
Actinosphaerium sp. (Desert Research Institute 1968)
Amoebidae
Vahlkampfia sp. (Desert Research Institute 1968)
Amoeba sp. (Desert Research Institute 1968)
Eukaryotes (organisms with nucleated cells):
Alveolotes:
Phylum Ciliophora
Class Ciliata
Lagenophrys nassa Stein, tentative identification by Stark (Desert Research Institute 1968)
Strombidium viride Stein, tentative identification by Stark (Desert Research Institute 1968)
Mesodinium acarus Stein, tentative identification by Stark (Desert Research Institute 1968)
Paramecium sp. Hill (water) tentative identification by
Stark (Desert Research Institute 1968)
Rhopalophrya sp. identified by Drs. Wheeler (Desert Research Institute 1968)

Oxytricha sp. identified by Drs. Wheeler (Desert Research Institute 1968)
Euplotes sp. identified by Drs. Wheeler (Desert Research Institute 1968)
Urostyla sp. identified by Drs. Wheeler (Desert Research Institute 1968)
Chilodonella sp. identified by Drs. Wheeler (Desert Research Institute 1968)
Vorticella sp. identified by Drs. Wheeler (Desert Research Institute 1968)

Eukaryotes (organisms with nucleated cells):
Fungi:

A single unidentified species of fungus was observed in situ and cultured from inactive and active stalactites. The fungus is described as slow-growing with very fine white mycelium. (Went, undated)

An unidentified fungus was found growing beneath an experimental light placed by Sheps (1972)

"Large numbers" of fungi were reported throughout the cave on moist walls, dead organic matter, dead flies and on stalactites by Stark (1969).

Chytrids live on dead algae and pollen (Desert Research Institute 1968, Stark 1969)

Marasmius fruiting body found on wood (Desert Research Institute 1968)

Phylum Mastigophora?
Anisonemidae
Peranema sp. (eat dead organic debris) (Desert Research Institute 1968)

Appendix C: Bat Survey Protocol

Bat Survey Protocol

Great Basin National Park

Bat inventories will be conducted at Great Basin National Park to identify species composition within the park, to locate important roost sites for the purposes of effective protection and management, and to determine species diversity and relative abundance for use in species monitoring.

The inventories will be conducted through internal investigation of potential roosts (internal survey), and by monitoring entrances for potential bat activity (external survey). The data gained from these surveys will be used to initiate a bat monitoring program in the park.

Internal Survey

Time of Application

1. An inventory of each cave will be performed in the summer (between June and August) and in the winter (December to January).

2. Each site will be visited on two different dates within a season (at least two weeks apart).

3. If bats are found at any time, no return visit is necessary during that season.

Summer Survey

Procedure

1. Stop at the cave entrance. Look and listen for bats. Remember that a single bat in flight is not necessarily an indication of the presence of a colony. Many of the caves harbor solitary bats that may become active and take flight in the presence of humans. Listen for vocalizations which indicate the presence of more than one bat.

2. Enter the cave slowly, stopping to look and listen for bats. Be aware that colonies appear more active later in the maternity season, especially after the young have been born. At the beginning of summer, it is possible that vocalizations from a colony may not be heard prior to approaching it. For this reason, it is critical to move slowly and look carefully for bats.

3. The entire ceiling area and walls should be examined first, then the floor inspected for guano. Look for solitary bats and bats in crevices as well as the more conspicuous Corynorhinus colonies.

4. If a colony is seen, avoid passing by or under it. Do not try to count the bats in the cluster. Leave immediately. No return visit is necessary for that season.

5. If no bats are seen, return in approximately two weeks for another internal survey.

6. If guano is found, but no bats, return at night for a night roost survey between one-half hour after sunset and midnight. (See “External Surveys: Summer” for procedure.)

7. If bats are seen during the night survey, no second year night roost survey is necessary.

It should be noted that internal surveys may not detect small maternity colonies of crevice roosting species.

If a cave cannot be entered, or if the entire floor and/or ceiling of the cave cannot be investigated, an external survey should be conducted in place of an internal search.

Equipment Needed

3 sources of light; at least one with a detachable red filter

Batteries and spare bulbs

Caving helmet with headlamp (counts as one source of light)

Knee pads

Natural fiber clothing

Camera and film

Digital thermometer, hygrometer, and Raytek MiniTemp

Maps (USGS, cave)

Compass

Inventory forms (one for each cave to be inventoried)

Pens/pencils

Data Collection

A separate Bat Survey Form must be completed for each bat inventory (Appendix 5). All hard copies of the completed Bat Survey Forms will be filed at the Resource Management office. Field data will be organized and entered into a Microsoft Access database after each survey.

External Survey: Summer

Procedure

1. A complete external survey will consist of a sundown and night roost "stakeout," that will be conducted between 30 minutes prior to sunset and midnight (until 10 p.m. for sundown stakeout only).

2. Sundown and night roost stakeouts, if possible, should be conducted during an acceptable lunar phase: new moon to three-fourths full. Bat flights may be depressed during the full moon period.

3. If weather conditions are poor for bat flight (e.g., raining, strong winds), the stakeout should be postponed until the next suitable night. Bat flights may be reduced during poor weather conditions.

4. If a cave has several entrances, or an entrance that is too large to view with or without the night vision scope, they can be blocked or partially blocked using tarpaulins. Reserve the use of tarps for small entrances, or to partially cover larger entrances. At least one main entrance should be left unaltered.

5. Night vision scopes with small infrared illuminators, can be used with strong auxiliary lights covered with a Kodak Wratten No. 88A gelatin filter to enhance viewing at larger entrances. This will transmit almost no visible light. The auxiliary lights should be placed on both sides of the cave entrance and directed at the opposite wall.

6. All persons participating in the stakeout should wear dark, natural fiber clothing that does not make ultrasonic sounds when brushed.

7. Personnel will be in place prior to 30 minutes before sunset (or 30 minutes after sunset for a night roost stakeout only).

8. Personnel will be positioned so that they offer a low visual and sonar profile. If there are more entrances to cover than night vision scopes, observers without scopes should be positioned to view the bats skylighted or moonlit as they exit.

9. Anabat will be used during the survey to gather species-specific data. Earphones will be used so as not to advertise the observer's presence to the bats.

10. If bats are detected, observers at each entrance should make note of whether bats are leaving or entering the cave. Hand tallies should be used to track the number of bats leaving and/or entering the cave.

11. Continue monitoring until 10 p.m. for a sundown stakeout and until midnight for a night roost stakeout.

12. If bats are detected, no summer season return visit is necessary (except, possibly, for monitoring purposes).

13. If no bats are detected, the external survey will be repeated in two weeks.

AnaBat will be used in conjunction with visual techniques during the external surveys to gather species-specific information. The software is specifically designed to analyze echolocation calls for free-flying bats that cannot be identified during standard external surveys. An IBM laptop computer will be used in the field to analyze echolocation calls recorded through a bat-detector device. Species will be identified acoustically by comparing calls with a standardized library of vocalizations. Bat echolocation calls will be processed and analyzed following procedures outlined in the Anabat System Manual: Techniques for the Effective Use of Anabat in Identifying Free-Flying Bat Species (Corben and O'Farrell, 1999).

Equipment Needed

Natural fiber clothing, dark in color

Night vision scopes with infrared illuminator

Auxiliary lights with Kodak Wratten 88A filter

Ultrasound (bat) detector with earphones

Mini-Mag light with red filter (for recording data while night vision is in use)

Hand tallies

Digital thermometer-hygrometer

Survey Form and Population Trends Monitoring Form

Tarpaulins (optional)

AnaBat equipment (detector, computer, etc.)

Data Collection:

All field data must be recorded on the Bat Survey Form

Internal Survey: Winter

Procedure:

1. Inventory personnel should wear clothing that minimizes ultrasound, e.g., cotton, wool and polypropylene are preferable to nylon and other slick fabrics.

2. The number of people entering a site should be kept to a minimum. However, for safety reasons there should be a minimum of two people in simple caves and three people in caves requiring rope work.

3. If bats are discovered, obtain a general estimate of the population (e.g., >10, <50, etc.).

4. Red filtered lights will be used in the presence of bats.

5. If no bats are seen, return no sooner than two weeks for another internal survey.

If a cave cannot be entered, or the entire cave cannot be investigated, an external survey should be conducted toward the end of the hibernation period in late March or early April.

Equipment Needed:

3 sources of light, at least one with red filter

Batteries and spare bulbs

Caving helmet with headlamp

Knee pads

Warm, natural fiber clothing

Camera and film

Digital thermometer-hygrometer

Hand tallies

Maps (USGS, cave)

Compass

Survey forms (one for each cave to be surveyed)

Pens/pencils

Night vision scopes with infrared illuminator (optional)

Data Collection:

A Bat Survey Form should be completed for each internal survey

External Survey: Winter

Follow the protocol for conducting a summer external survey (sundown stakeout only), but until one hour after sunset.

Bat Monitoring Protocol

Capture and release techniques will be used to gain specific information on bat species in the park that is unobtainable by internal roost surveys alone. Mist netting will be used for the purposes of species identification, species diversity, reproductive status, size, age, and relative abundance. The following protocols have been developed to minimize impacts on the bat species captured, and to ensure scientific consistency in data collection.

Procedure for Mist Netting

1. 6 m or 2.6 m mist nets should be used.

2. All mist nets should be placed before sunset on moonless nights, due to the fact that bats possess good eyesight and are capable of seeing a moonlit net. To minimize the capture of any birds, nets should be kept closed until just before dark.

3. Nets should be set up by two people. One person can hold the pole and net while the other places the panel end loops over the pole and anchors the pole with cord. The cord may be tied to any nearby object stout enough to hold both the pole and net, or tied to stakes driven into the ground for that purpose.

4. When anchoring the poles that hold the net, the top three panel end loops should be placed above the anchor cord, and the bottom two loops below the anchor cord. Occasionally, the terrain may warrant more net area below the anchor cord (such as across a small ravine, where the poles are on slopes). Under these conditions, three panel end loops are placed below the anchor cord.

5. The net should be spread taunt enough so that a 2.5 cm (1-in) bag droop occurs in each of the panels. The net itself should be stretched tight. As the evening progresses, the rise in humidity will cause the net to droop, so periodic adjustments should be made to keep the net taut.

6. Nets should not be placed more than 30.5 m (100 ft) apart. Distances greater than this will cause time to be wasted in traveling between nets. Nets will also have to be checked less frequently if they are too far apart.

7. The nets should be checked every 5 min. Bats are capable of swiftly chewing holes in nets. If they are left unattended, the nets may become riddled with holes in a short time.

8. Nets should be maintained until midnight, at which time they should be closed. Much of the bat activity at water sources occurs in the first half of the night. Maintaining nets until midnight provides an adequate representation of bat use.

9. To close a net, push all the panel end loops together at the anchor cord on the pole. Take a 30.5 cm (12-in) piece of plastic flagging and tie the end loops together, using a single knot. (Do not include the anchor cord.) Do this at both ends of the net. (This keeps the loops from getting tangled in the net.) One end of the net can then be taken off the pole and folded toward the other end. When the net is completely folded, place the tied end loops together and stuff the net into a bag for safekeeping.

Capturing and Handling Bats

The actual capture and handling of the bats is an effort that requires full concentration and attention. Bats can chew holes in the net if left unattended for any length of time, and can become easily entangled in them. In the intervals between checking the nets, bat extraction, and data collection, flashlights should be off, and talking kept to a minimum. This helps both to maintain concentration and to avoid scaring off the bats.

When a bat is caught in the net, quickly move to extract it before it can escape or become further entangled. Determine from which side of the net the bat entered. Immobilize the bat with a gloved hand (or give the bat a gloved finger to chew on for distraction) and carefully remove the net strands from head, body, and wings. Be especially careful with the fragile wing membrane and bones.

If the bat cannot be processed right away, place it in a cloth bag along with a slip of paper noting the time of capture, the net in which it was captured, and the side of the net it was captured on (e.g. cave side, outside, downstream, etc.). Hang the cloth bag from a branch in a sheltered spot. Do not leave the bags unattended since predators can take advantage of the easy meal. Lactating females, or any females caught during the maternity season, should be processed as quickly as possible and released without delay.

Bats captured during mist-netting will be released in conjunction with AnaBat to build a local library of echolocation calls. Captured bats will be released individually and followed to obtain as many confirmed vocalizations as possible. Calls verified by capture will be cataloged and compared visually with known catalog calls.

Data Collection

All field data must be recorded on the Bat Monitoring data sheet to ensure data consistency. The data from the sheets must be entered into a Microsoft Access database after completion of monitoring. Bat species will be vouchered through morphometric data, photographs, and digital Anabat sonograms. All voucher photographs will be stored in a designated binder. An entry for the binder will be made in the Dataset catalog. Photographic negatives of voucher specimens will be organized and provided to designated park repositories. Data for all vouchers collected will be entered in both the NPS NPSpecies database and the NPS ANCS+ database that is administered by the NPS National Catalog.

List of Materials

The following materials are required for mist netting of bats:

Mist nets 2.6m x 6m and 2.6m x 2.6m; 38mm mesh, 50 denier/2 ply nylon

Poles Two 1.5 m (5 ft) segments joined by a sleeve are needed at each end of the net.

Anchor cord for poles Strong string or cord.

Stakes The type used for tents.

Millimeter ruler Flexible plastic, 150 mm (6 in) is sufficient. Cutting the end off so it is even with the "0" mark makes for easier use.

Scales (2) 100 gm (3.5 oz) (Pesola recommended).

Zip lock storage bags For containing bats while weighing. Safe for the short time the bats will spend in them. Quart capacity will suffice for most bats.

Cloth bags For holding bats after removing from net. Should have string or cloth ties.

Headlamp This frees both hands for handling bats.

Leather gloves Light-weight. Deerskin gloves are very good, with the exception of handling large Eumops spp.

Watch To note the time of capture.

Clipboard For holding data forms.

Data forms See Appendix 4.

Pencils To complete data forms.

Insect repellant Use as needed.

Paint: light-colored, If marking bats is a consideration Washable, Non-toxic

Camera, film, and flash	For voucher pictures.
Thermohygrometer	Portable
AnaBat Equipment	Bat Echolocation

Appendix D: Cave Classification System

This Cave Classification System provides the organizational structure for cave management in the park. The classification system described in this plan has been adapted to the park from the NPS-77 Cave Classification System. The system consists of a three-element code rating consisting of the following: a numeral indicating the management class, a letter indicating the resources present in the cave, and a Roman numeral indicating the hazard rating. For example, a cave coded “2-D-II” describes an undeveloped cave that could be visited with an NPS trip leader (Management Class 2), contains speleothems of unusual quality (Resource Class D), and has moderate hazards with primarily horizontal passages (Hazard Class II). The management of a cave takes into consideration the cave’s management, resource, and hazard classes.

Different classification ratings may be assigned to caves based on seasonal variations, in order to minimize interference with, or safety hazards resulting from, natural processes and populations. Sections of a caves may be managed under separate management classes.

I. Management Classes

Class 1 Caves

Class 1 caves are developed caves with two sub-categories: highly developed and minimally developed.

Highly developed caves are managed to provide a visitor maximum convenience (e.g., hard-surfaced trails, handrails, electric lights, etc.), and interpretive media (e.g. ranger-led tours, interpretive signs, etc). Highly developed caves provide an opportunity for most visitors to tour the cave without special clothing, equipment, knowledge, or skills. It fulfills the expectations of most visitors and enables large numbers of people to tour the cave.

Minimally developed caves are managed to provide ease of access to the cave with minimal modification to cave resources. Development generally consists of a designated trail following a non-technical route. This allows visitors to gain a more natural cave experience without requiring special skills or equipment.

The management objective for Class 1 caves is to provide educational opportunities for visitors to gain knowledge and appreciation of natural resources in the park while minimizing overall impact to the cave, and protecting, maintaining, and conserving natural and cultural cave resources.

Class 2 Caves

Class 2 caves are undeveloped caves that may be visited when accompanied by a designated NPS trip leader. NPS trip leaders are responsible for ensuring that each group takes precautions to leave the cave unimpaired for future visitors. The resources within these caves can sustain minimal damage if groups are conscientious and conservation-minded. Human use impacts to cave resources will be assessed before assigning caves a Class 2 designation.

The management objective for Class 2 caves is to preserve and protect cave resources while providing an opportunity for a small number of park visitors to experience the undeveloped cave environment with the guidance and knowledge of park staff.

Class 3 Caves

Class 3 caves are undeveloped caves that may be visited by permit without being accompanied by NPS staff. Class 3 caves vary from relatively easy to very difficult caves that require extensive crawling and/or vertical work. Permits are issued only to those visitors who have experience and knowledge of caving techniques, the necessary equipment, and strong cave conservation ethics. The management objective for Class 3 caves is to protect and preserve cave resources while allowing technically experienced and cave conservation-minded visitors to experience wild caves in the park.

Class 4 Caves

Class 4 caves are closed to general use pending further evaluation for designation in another management category. Caves are designated as Class 4 because they are either newly discovered and require further exploration, or they are known caves that require baseline inventories and resource impact studies.

Class 5 Caves

Class 5 caves are closed to general use because they contain physical, biological, paleontological, archeological, or other resources of scientific value that are easily impacted. Only approved research or management use is allowed.

The management goal of Class 5 caves is to protect and preserve sensitive physical and biological cave resources, while providing opportunities for scientific studies that apply directly to the management and conservation of park caves.

Class 6 Caves

Class 6 caves or sections of cave are closed to all use except the minimum entry required for administrative purposes. These caves are closed because they have a Class V hazard rating, are difficult to enter without causing irreparable damage to fragile cave resources, or contain threatened species that could be severely impacted by visitor use.

Management Class 6 caves will be managed exclusively for the purposes of protecting, preserving, and perpetuating natural and cultural cave and karst resources in the park, and ensuring human safety.

II. Resource Classes

Class A Caves

Class A caves contain few features of scientific value. Resources present within the caves are of the type that are not easily impacted by human use.

Class B Caves

Class B caves contain significant physical or biological cave resources that are not easily subject to vandalism or disruption by visitor use based on their location or size.

Class C Caves

Class C caves contain speleothems that are unusually susceptible to breakage, and/or other biological or physical resources of scientific value that could be seriously disturbed or destroyed by cavers. Examples of Class C speleothems include gypsum flowers or hair, anthodites, delicate frostwork, and helictites.

Class D Caves

Class D caves contain resources of scientific value that would be damaged by any use of the cave (e.g. biological species that have a sensitive habitat or are otherwise threatened, pristine, formation-lined passages, etc.).

III. Hazard Classes

A cave's hazard rating reflects not only what the caver encounters within the cave, but also what is encountered in reaching the cave.

Class I Caves

Class I caves offer the least hazard to the caver with the following general characteristics:

1.single, well-defined main passageway with no lateral passages

2.no passageways less than 60 centimeters (24 inches) in diameter

3.no step-type drops over one meter (three feet

4.no known loose ceiling rocks and few loose rocks on the floor.

Class II Caves

Class II caves contain moderate hazards and are mostly horizontal in structure. The following are general characteristics of Class II caves:

1.well-defined main passageways with minimal side passages

3.no step-type drops over three meters (10 feet)

4.no known loose ceiling rocks or hazardous floor material

Class III Caves

Class III caves contain structural hazards not found in Class I and II caves. Vertical equipment is not necessary for all Class III caves. Any of the following qualify a cave as Class III:

1. multiple passageways with various connections

2. vertical drops up to 15 meters (50 feet)

3. extensive crawling and tight restrictions

Class IV Caves

Class IV caves are the most hazardous from a structural standpoint. Each caver needs to have a complete set of vertical gear. The following are general characteristics of Class IV caves:

1.maze-type passageways

2. extremely difficult access

2.vertical drops over 15 meters (50 feet)

3.loose ceiling rocks on crawlways under two meters (six feet) high.

Class V Caves

Class V caves are extremely hazardous due to characteristics including, but not limited to, human health hazards, dangerous gases, flooding,, hazardous access, and unstable rock. Class V caves should only be entered by qualified cavers with special equipment, and only if the need for information is greater than the risk involved. Extra safety precautions should be taken, and special communications should be available.

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Appendix E: Cave Maps

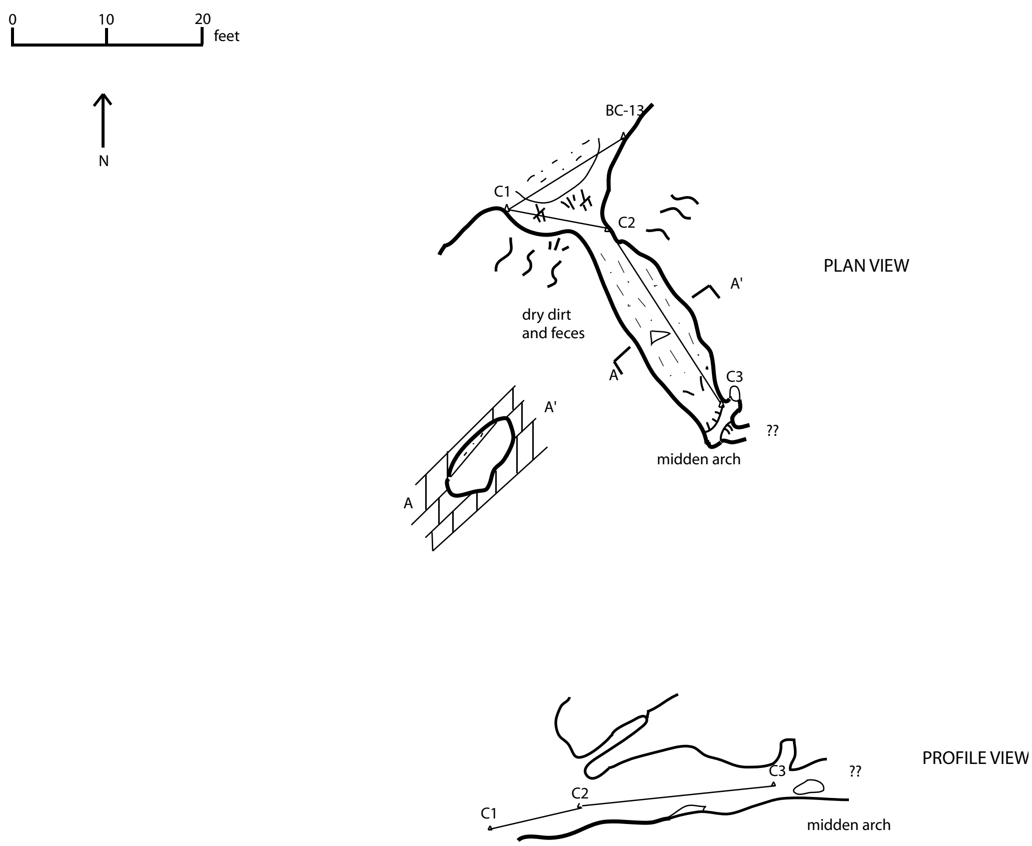
COYOTE HOLE CAVE

WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK

SUNNTO COMPASS AND TAPE SURVEY BY
LD SEALE, S JOHNSON, AND A HAMILTON

DRAFTED BY: S JOHNSON

SURVEY DATE: JUNE 4, 2003
TOTAL SURVEY TRAVERSE: 25.4ft



STANDARD NSS SYMBOLS USED

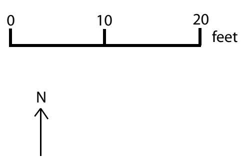
FOOL'S HOLE CAVE

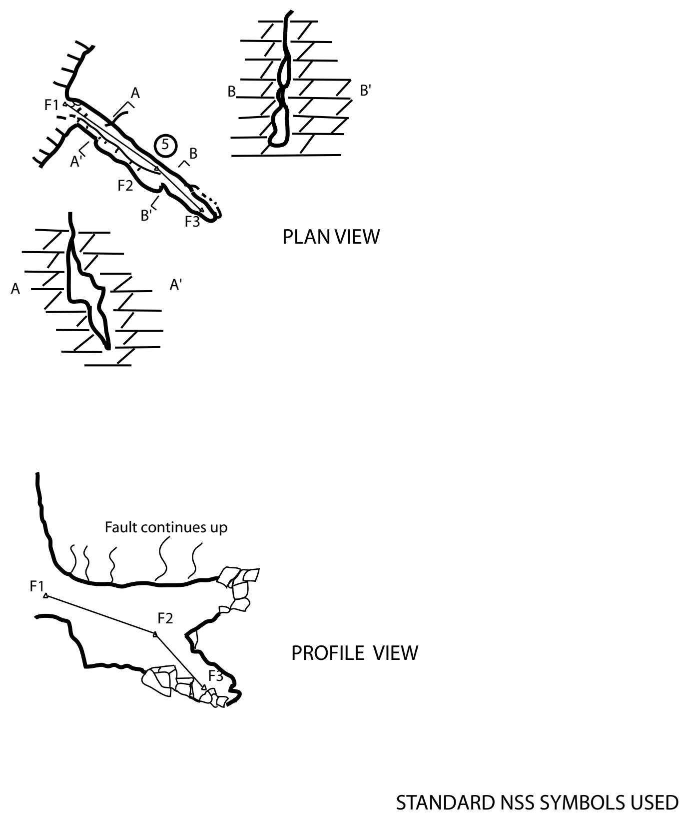
WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK

SUNNTO COMPASS AND TAPE SURVEY BY
LD SEALE, S JOHNSON, AND A HAMILTON

DRAFTED BY: S JOHNSON

SURVEY DATE: JUNE 4, 2003
TOTAL SURVEY TRAVERSE: 16.2ft





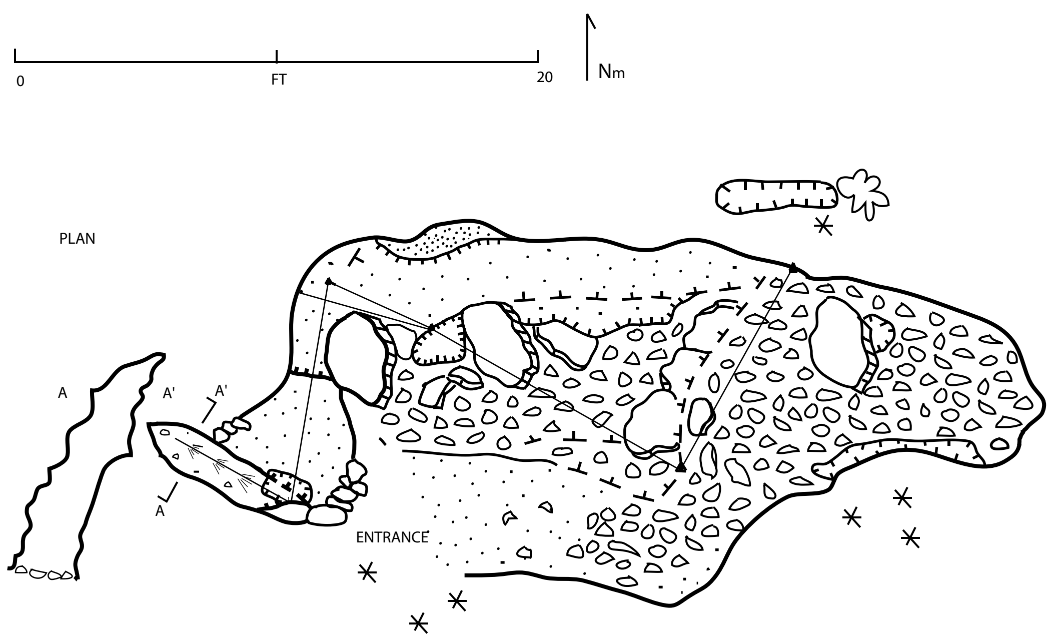
STANDARD NSS SYMBOLS USED

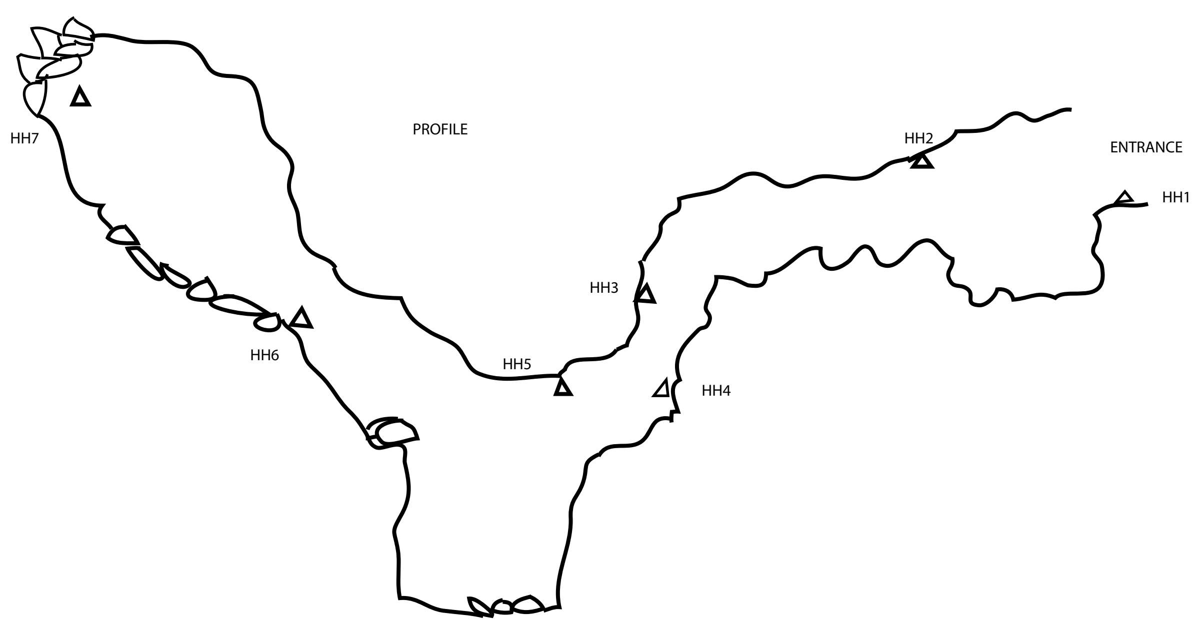
Hiding Hole

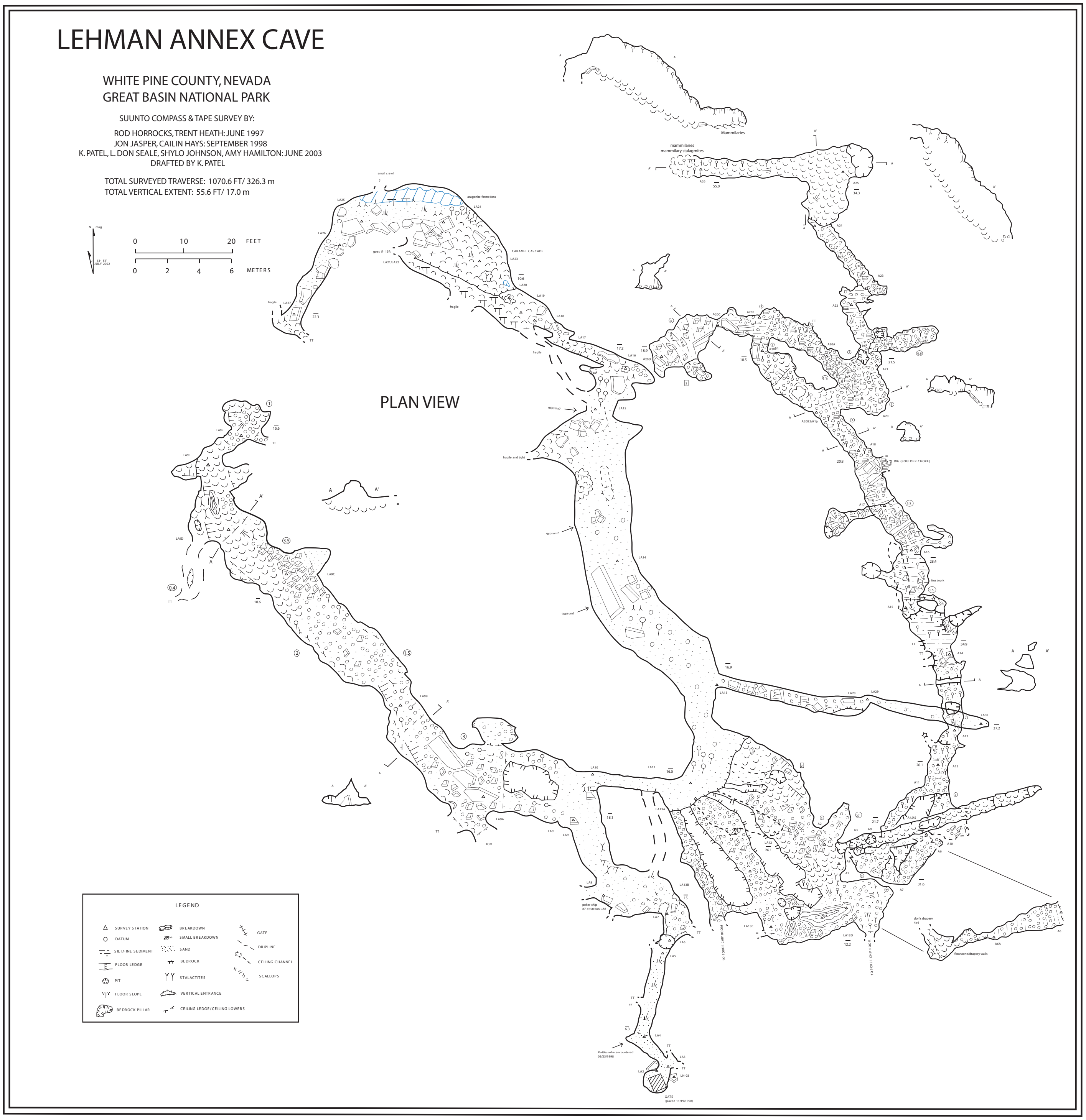
WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK

Compass & Tape Survey by
Ryan Shurtz and Shylo Johnson

Survey Date: August 29, 2003



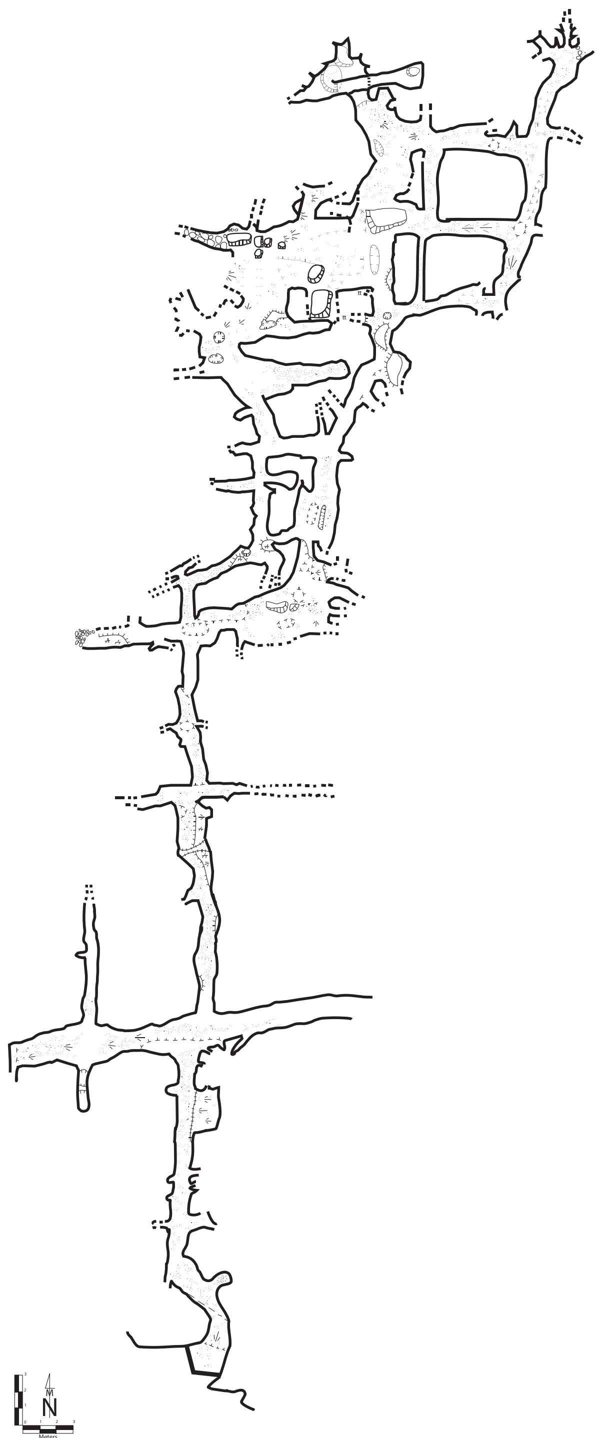


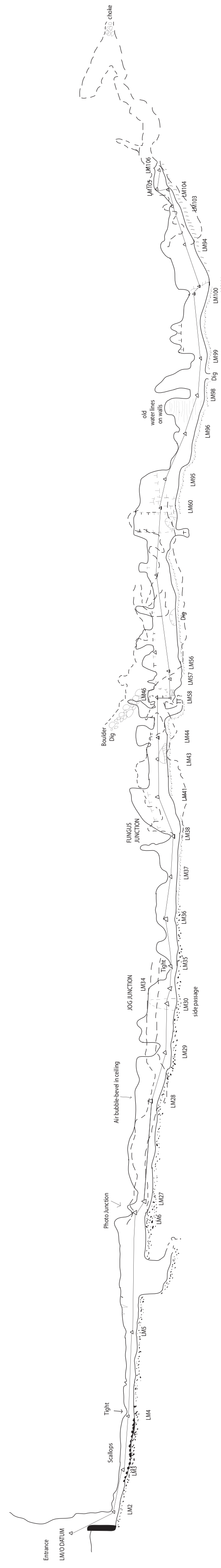

LEHMAN ANNEX CAVE
WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK
SUUNTO COMPASS & TAPE SURVEY BY:
ROD HORROCKS, TRENT HEATH: JUNE 1997
JON JASPER, CAILIN HAYS: SEPTEMBER 1998
K. PATEL, L. DON SEALE, SHYLO JOHNSON, AMY HAMILTON: JUNE 2003
DRAFTED BY K. PATEL
TOTAL SURVEYED TRAVERSE: 1070.6 FT/ 326.3 m
TOTAL VERTICAL EXTENT: 55.6 FT/ 17.0 m
0 10 20 FEET
0 2 4 6 METERS
PLAN VIEW
Mammilaries
mammilaries
mammilary stalagmites
DIG (BOULDER CHOKE)
LEGEND
SURVEY STATION
DATUM
SILT/FINE SEDIMENT
FLOOR LEDGE
PIT
FLOOR SLOPE
BEDROCK PILLAR
BREAKDOWN
SMALL BREAKDOWN
SAND
BEDROCK
STALACTITES
VERTICAL ENTRANCE
CEILING LEDGE/CEILING LOWERS
GATE
DRIPLINE
CEILING CHANNEL
SCALLOPS

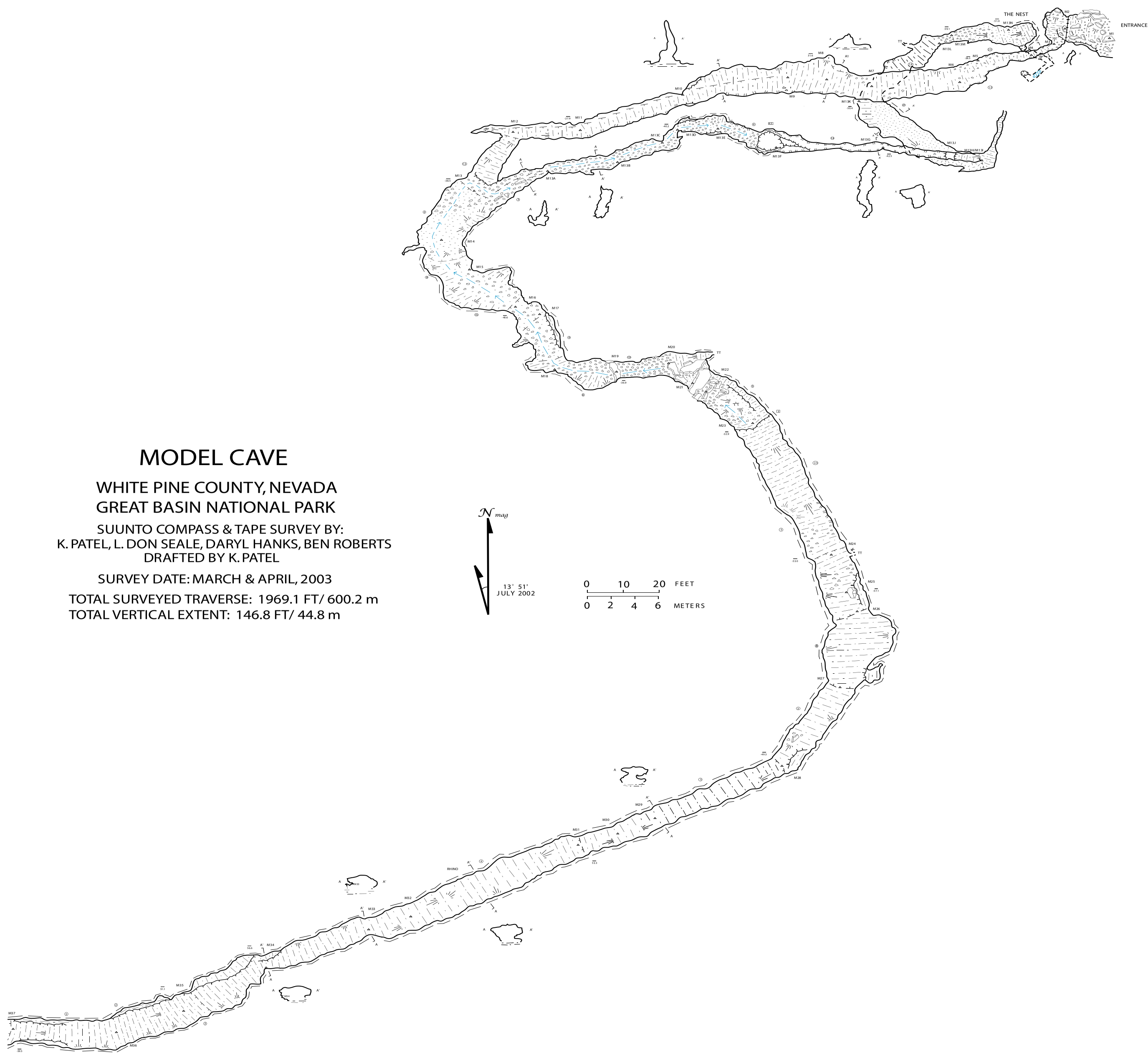
Little Muddy Cave, Great Basin National Park
White Pine County, NV
Suunto Compass and Tape Survey
January 1997 through Febuary 1998
Total Survey Length: 309 Meters

Surveyed by:
Rod D. Horrocks, Dale Green, John Woodyard, Neil Shurtleff, Rose Shurtleff, Abby Wines, Ken Watson, Lee Gray, Earl Pekrson, Mike Marion, Hal Smith, Lu Smith, Val Stratford, Dave Stratford, Rodney Mulder and David Harris

Drafted by:
L. Don Seale and
Amy Hamilton
March-May 2003





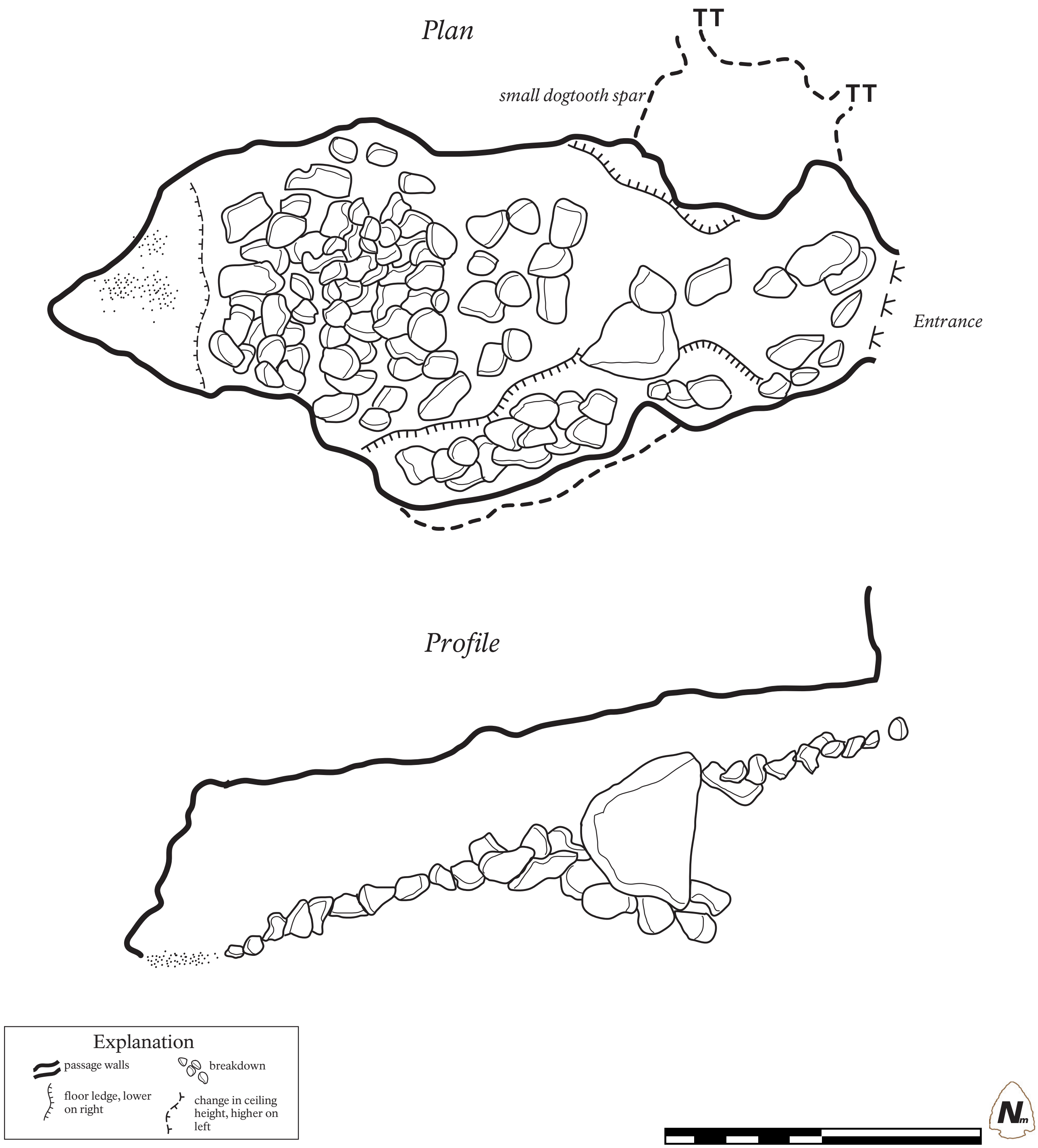

MODEL CAVE
WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK
SUUNTO COMPASS & TAPE SURVEY BY:
K. PATEL, L. DON SEALE, DARYL HANKS, BEN ROBERTS
DRAFTED BY K. PATEL
SURVEY DATE: MARCH & APRIL, 2003
TOTAL SURVEYED TRAVERSE: 1969.1 FT/ 600.2 m
TOTAL VERTICAL EXTENT: 146.8 FT/ 44.8 m
THE NEST
ENTRANCE
13° 51'
JULY 2002
0 10 20 FEET
0 2 4 6 METERS

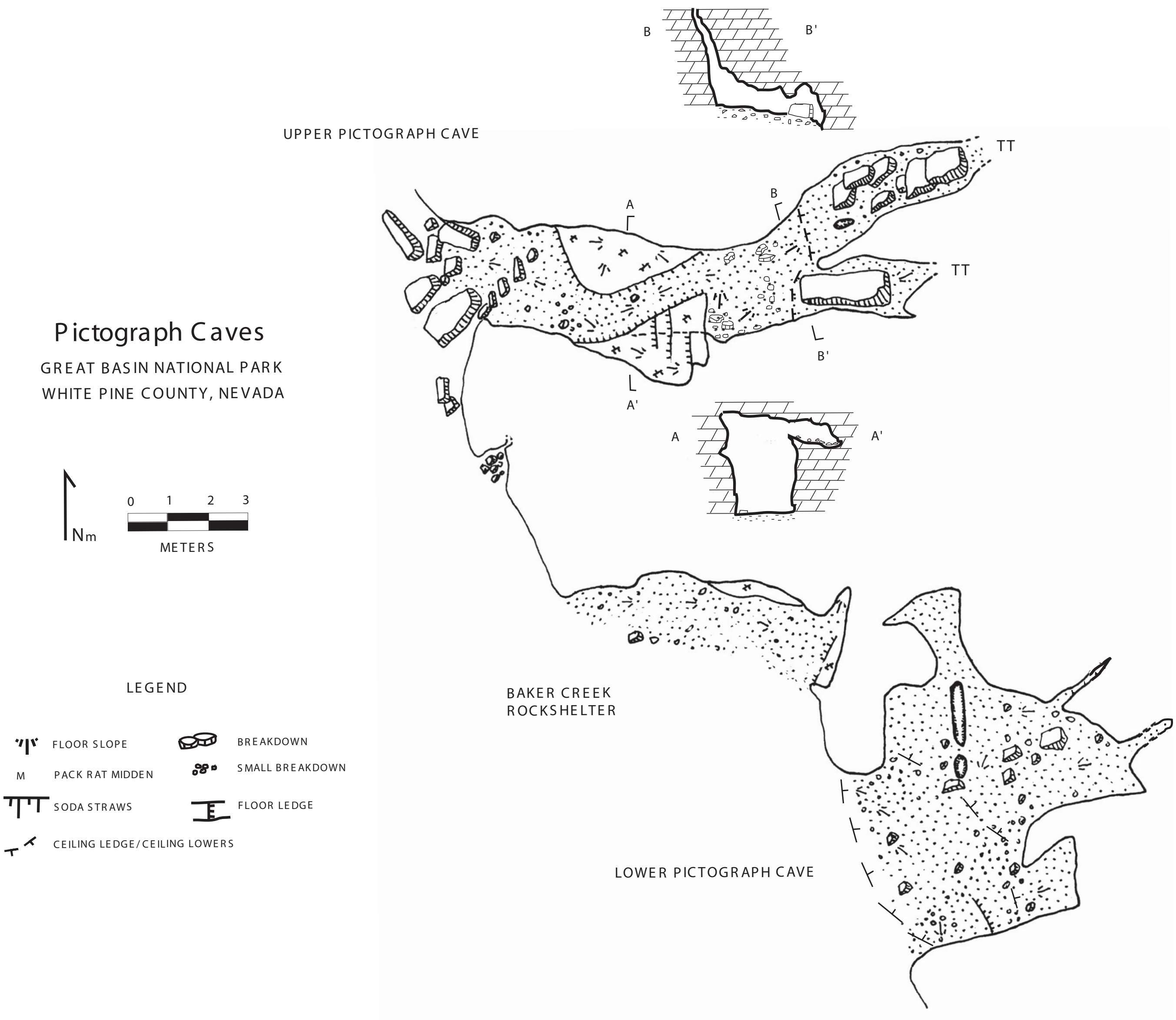
Mountain View Cave *[Second Chance Cave] (LP-04)*

Great Basin National Park, White Pine County, Nevada

Suunto compass and Disto survey, 8/17/2004

Jason Mateljak and Robert Pleszewski



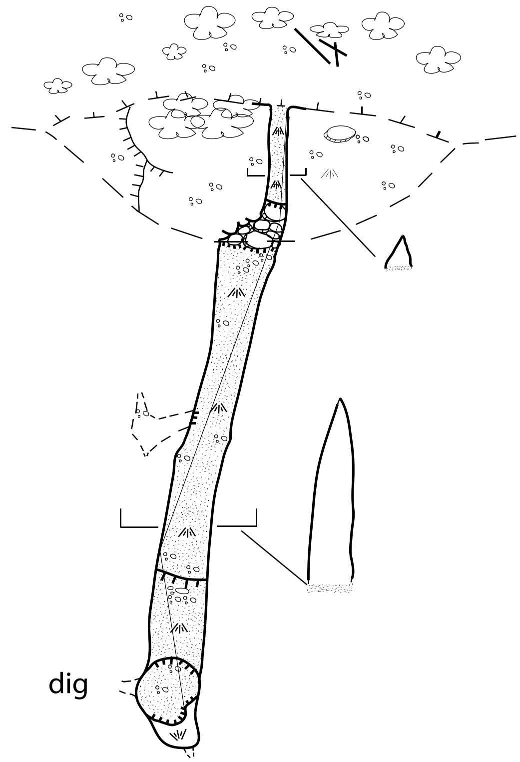

Pictograph Caves
GREAT BASIN NATIONAL PARK
WHITE PINE COUNTY, NEVADA
UPPER PICTOGRAPH CAVE
B
B'
A
A'
TT
TT
Nm
0 1 2 3
METERS
BAKER CREEK
ROCKSHELTER
LOWER PICTOGRAPH CAVE
LEGEND
FLOOR SLOPE
BREAKDOWN
M
PACK RAT MIDDEN
SMALL BREAKDOWN
SODA STRAWS
FLOOR LEDGE
CEILING LEDGE/CEILING LOWERS

ROCK FALL CAVE

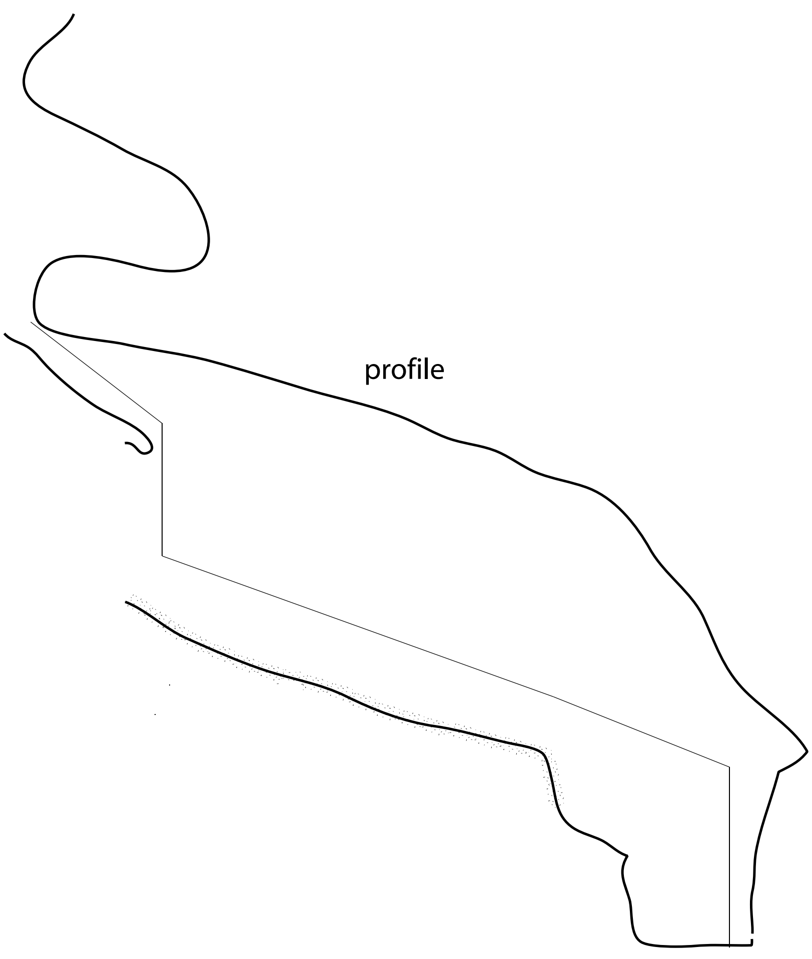
WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK

SURVEYD BY: R. SHURTZ, S. JOHNSON, K. PATEL,

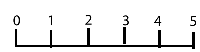
DRAFTED BY: R SHURTZ
SURVEY DATE: 09-12-03



plan view



profile



1" = 5 meters

N mag

shrub
sand/gravel
rocks/stones

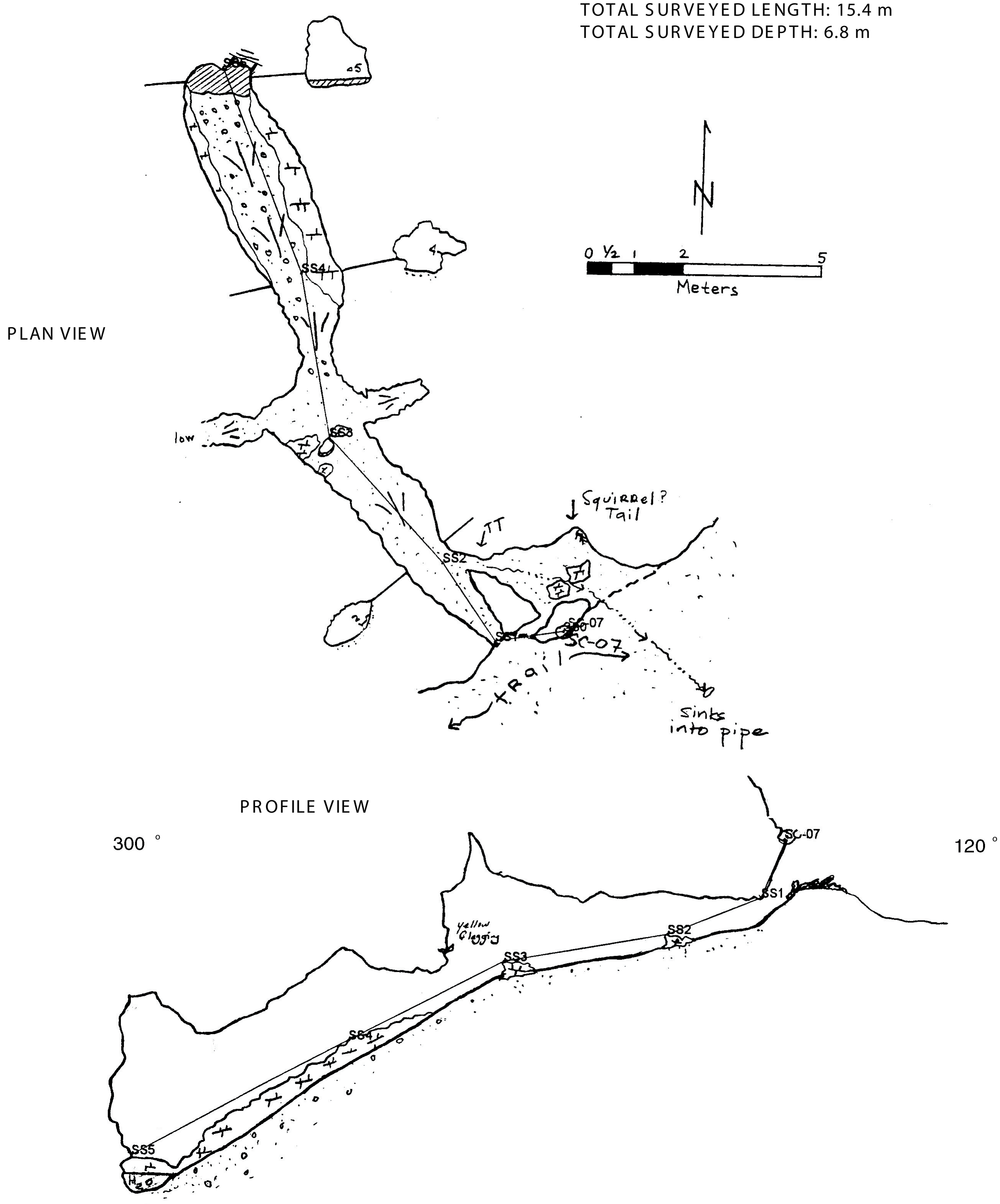
Other symbols:
STANDARD NSS SYMBOLS


SNAKE CREEK CAVE
WHITE PINE COUNTY
GREAT BASIN NATIONAL PARK,BAKER, NV
SUNTO COMPASS AND TAPE SURVEY BY
J. JASPER, A. WINES, D. STOLLEY, C. ACKLIN A. ACKLIN, B. SPREGGS
JULY - NOVEMBER, 1998
DRAFTED BY DON SEALE, 2002

SQUIRREL SPRING CAVE

SURVEYED BY JON JASPER AND KELLY MATHIS
SURVEY DATE: DECEMBER 1, 1997

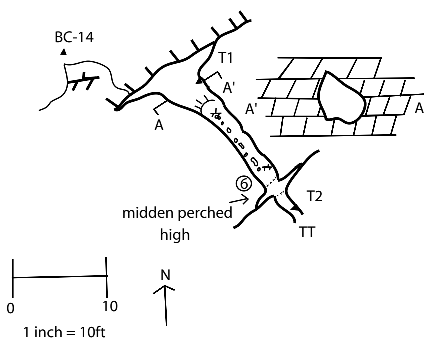
TOTAL SURVEYED LENGTH: 15.4 m
TOTAL SURVEYED DEPTH: 6.8 m

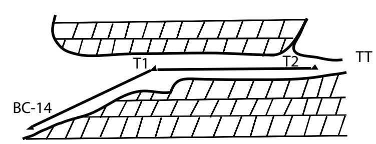


T Cave
White Pine County, Nevada
Great Basin National Park

Brunton Combo and Suunto Compass
and Tape Survey by:
L. Don Steale, Amy Hamilton, Shylo Johnson
Drafted by: Amy Hamilton

Survey Date: June 4, 2003
Total Surveyed Traverse: 31.75ft





Standard NSS Symbols

3-HOLE CAVE

GREAT BASIN NATIONAL PARK
WHITE PINE COUNTY, NEVADA

SISTECO COMPASS AND TAPE SURVEY BY:
ROD HORROCKS AND ANNA KNIPPS
SURVEY DATE: MAY 26, 1997
DRAFTED BY K. PATEL 2002

TOTAL SURVEYED TRAVERSE: 28.66m

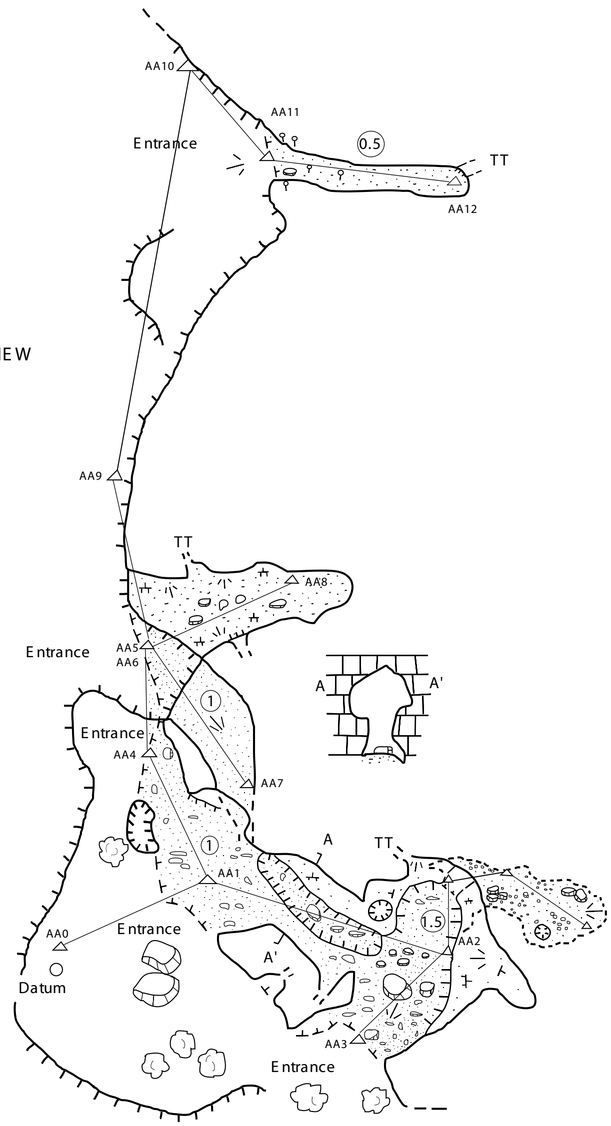
Nm

0 1 2 3
METERS

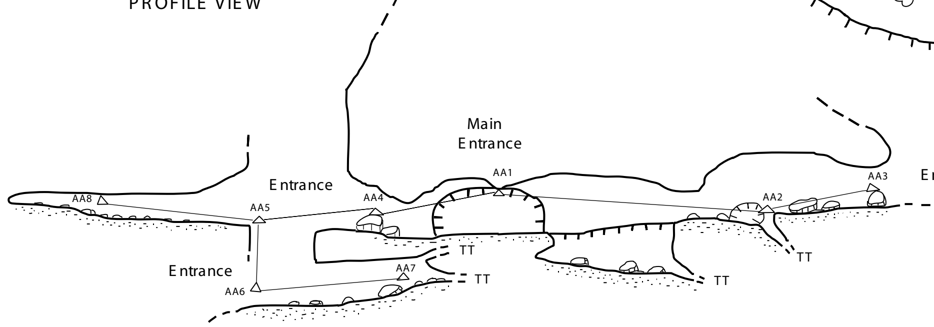
LEGEND

- SURVEY STATION
- FLOOR SLOPE
- PIT
- BEDROCK
- POPCORN
- CEILING LEDGE/CEILING LOWERS
- UNDERLYING PASSAGE
- BUSHES
- BREAKDOWN
- SMALL BREAKDOWN
- SAND

PLAN VIEW



PROFILE VIEW



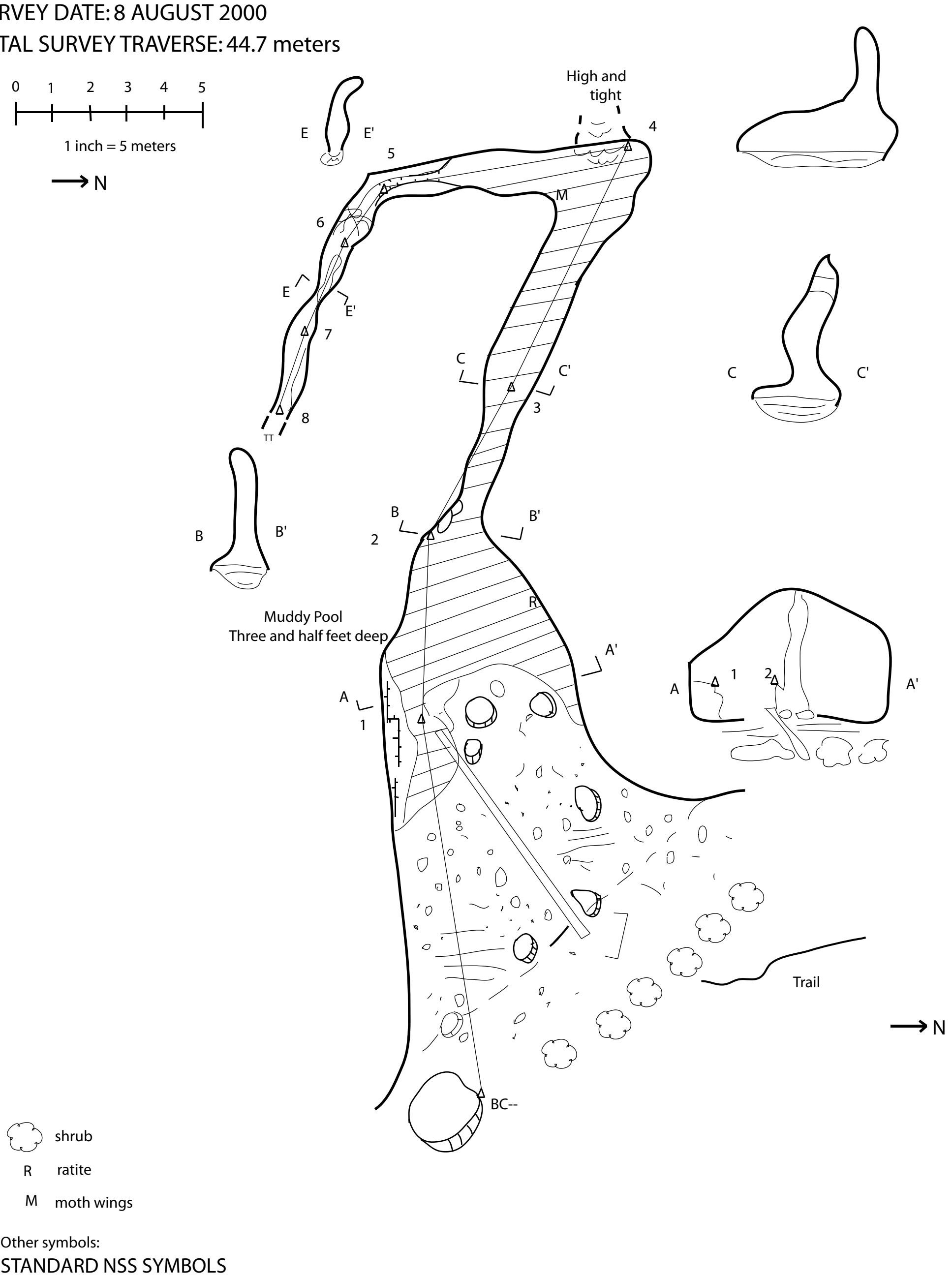
WATER TROUGH CAVE

WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK

SURVEY BY
J JASPER, B ROBERTS, A WINES, K PATEL

DRAFTED BY: S JOHNSON

SURVEY DATE: 8 AUGUST 2000
TOTAL SURVEY TRAVERSE: 44.7 meters

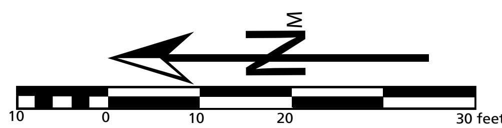


Cave 24

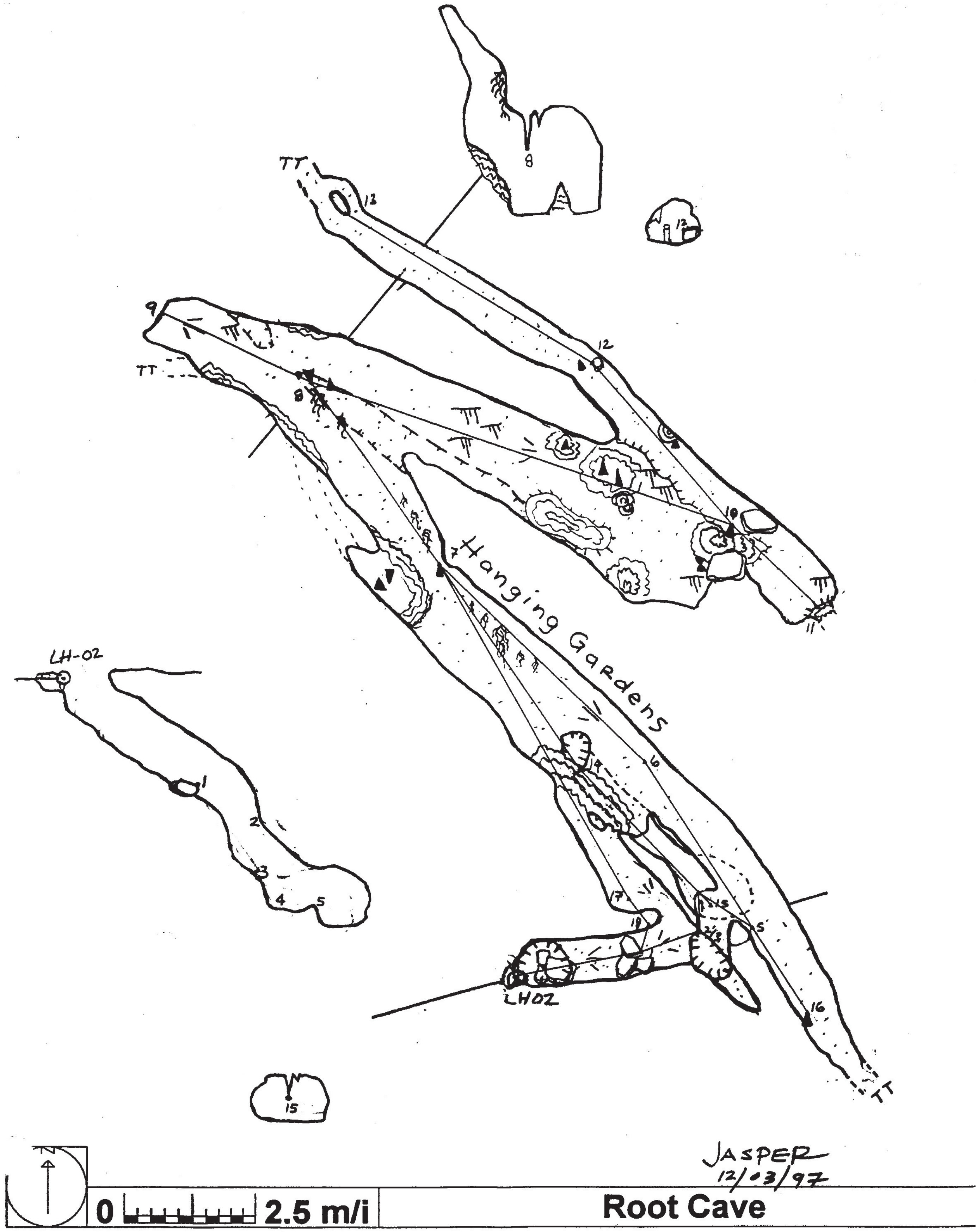
Great Basin National Park
White Pine County, Nevada

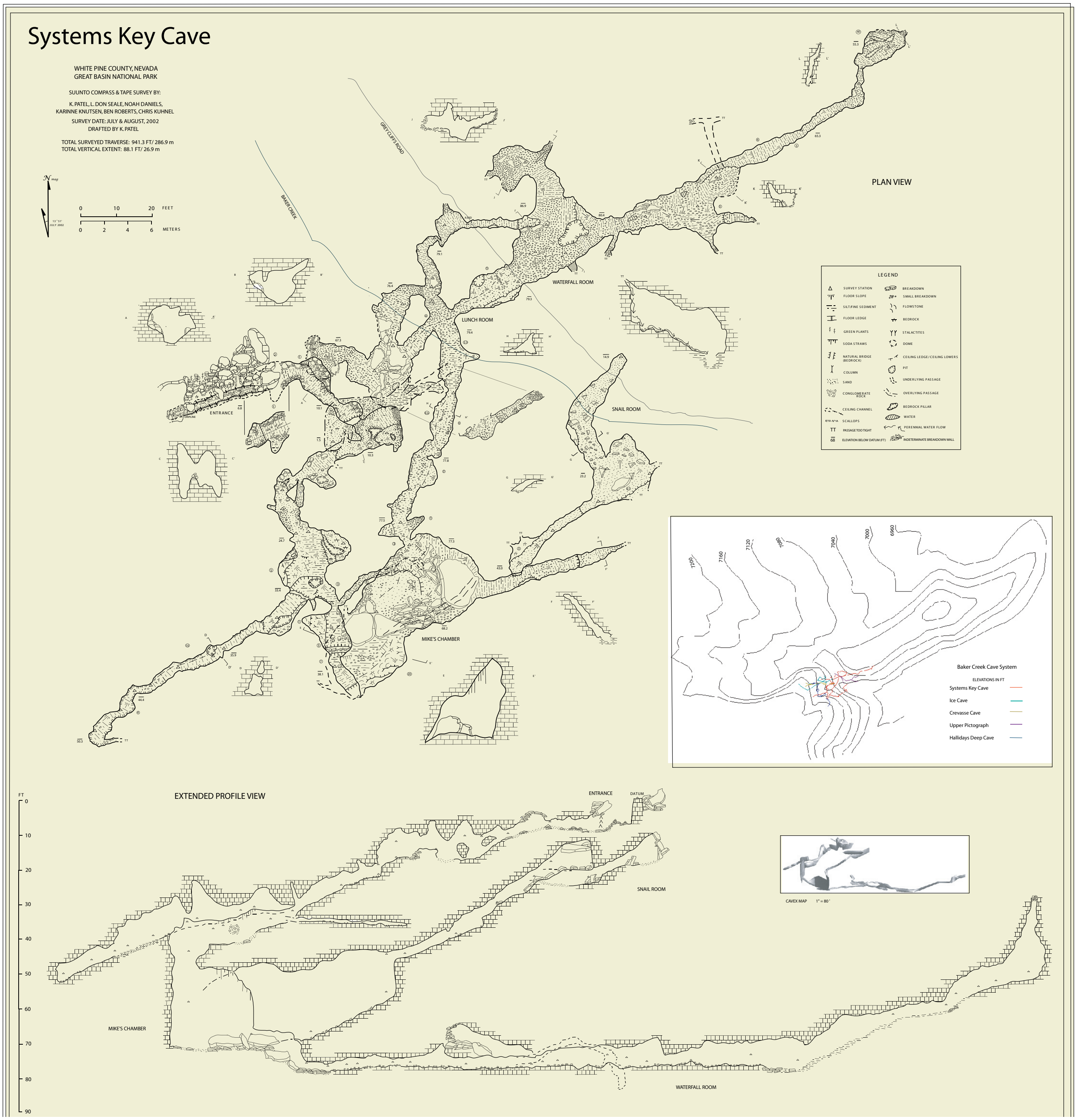
Suunto Compass and Tape Survey, 24 June 2004
by: Jason Mateljak, Robert Pleszewski, Matthew Reece

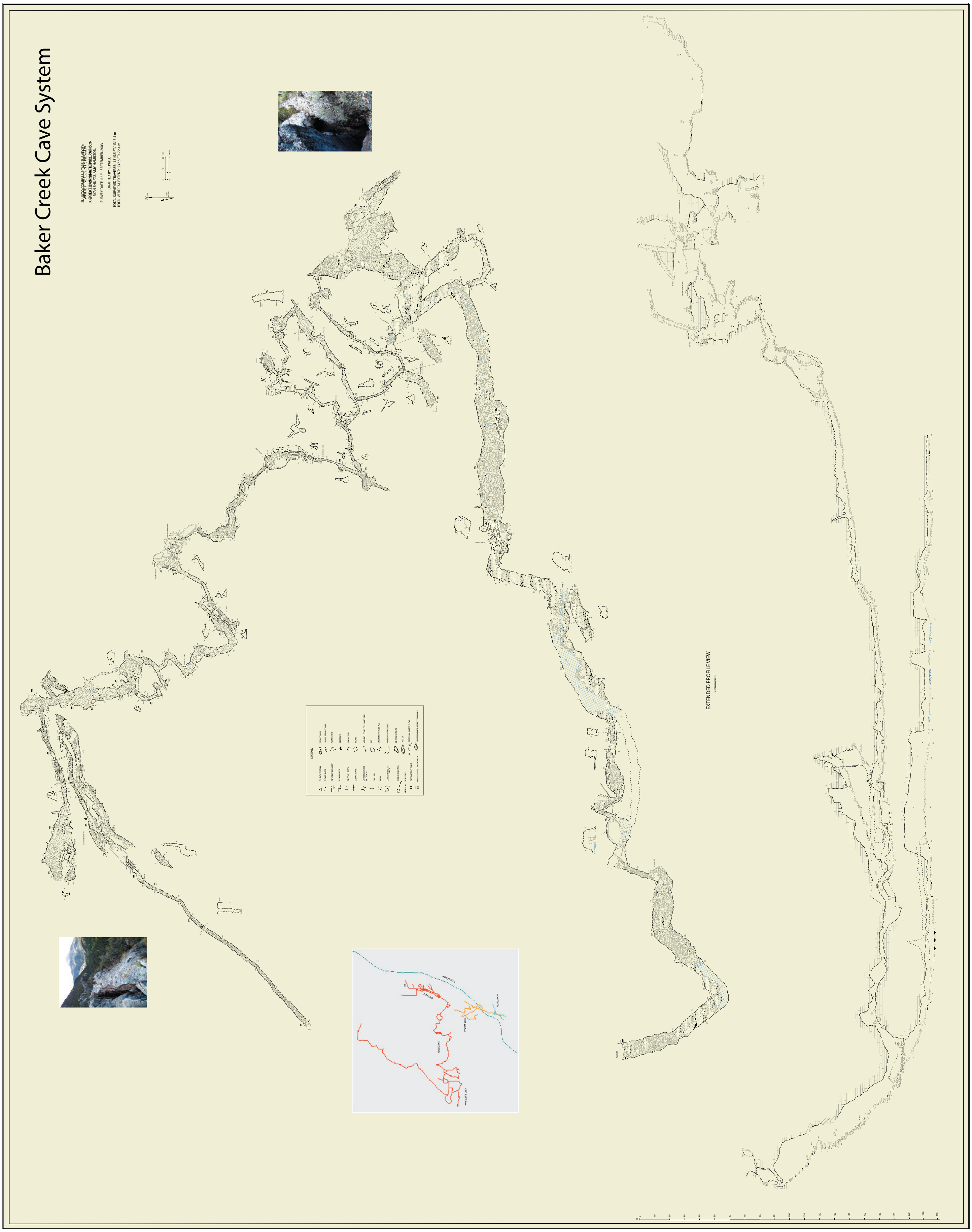
THC: 272.4 feet / 83.0 meters
TVE: 48.4 feet / 14.8 meters

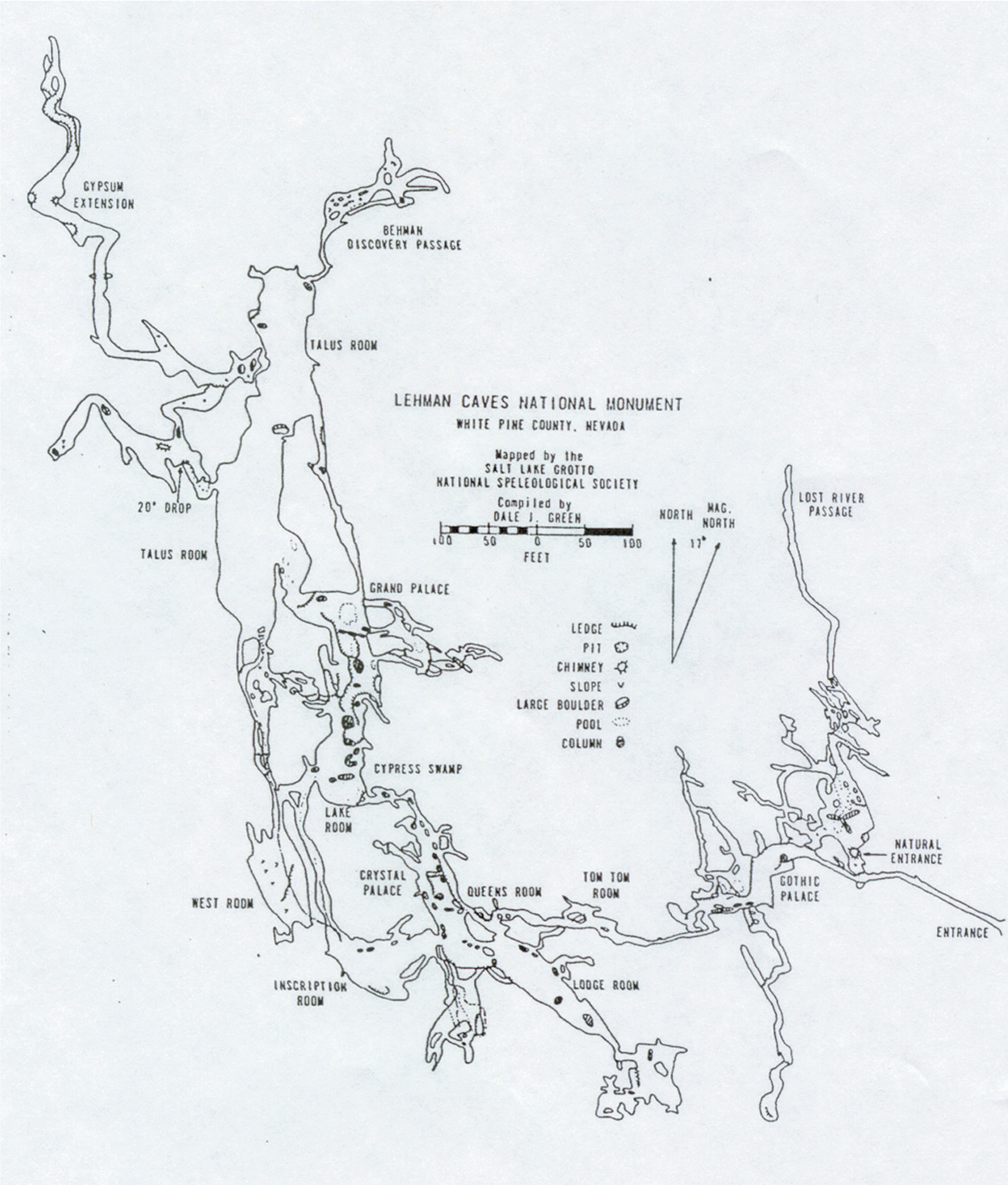


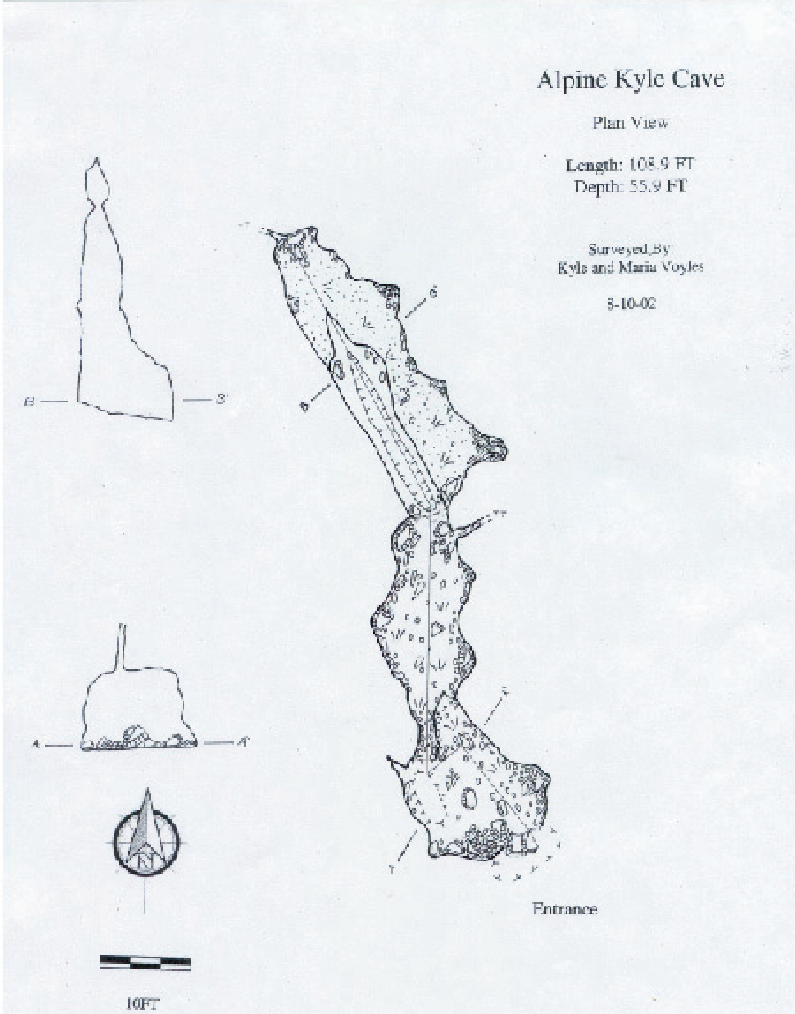
Cartography © January 2005, Matthew Reece

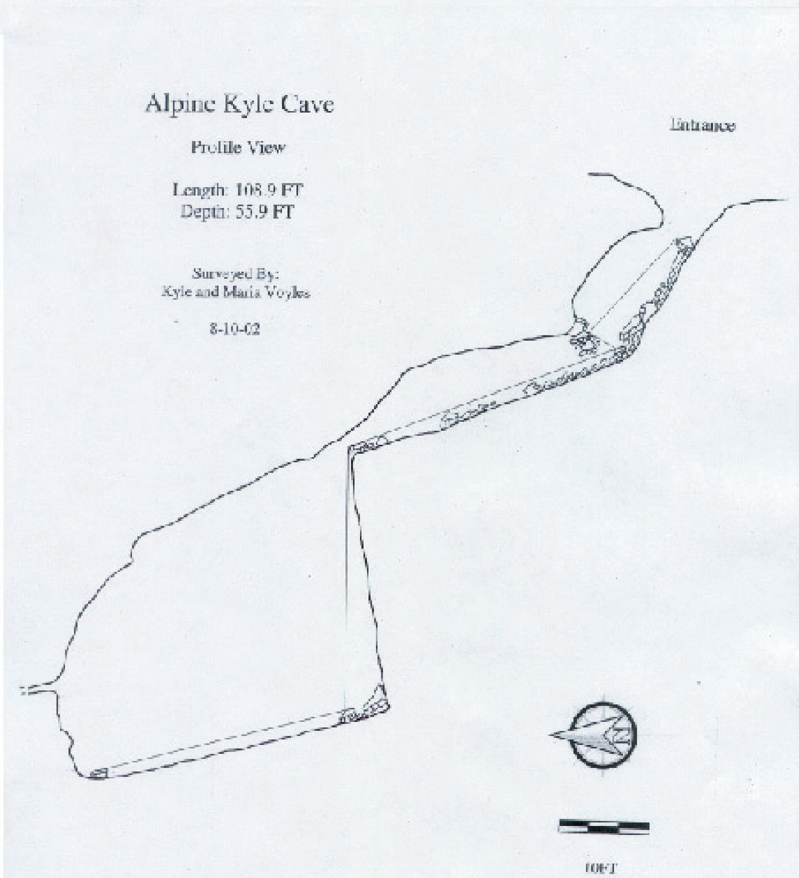

Hanging Gardens
LH-02
LH02
TT
JASPER
12/03/97
0
2.5 m/i
Root Cave

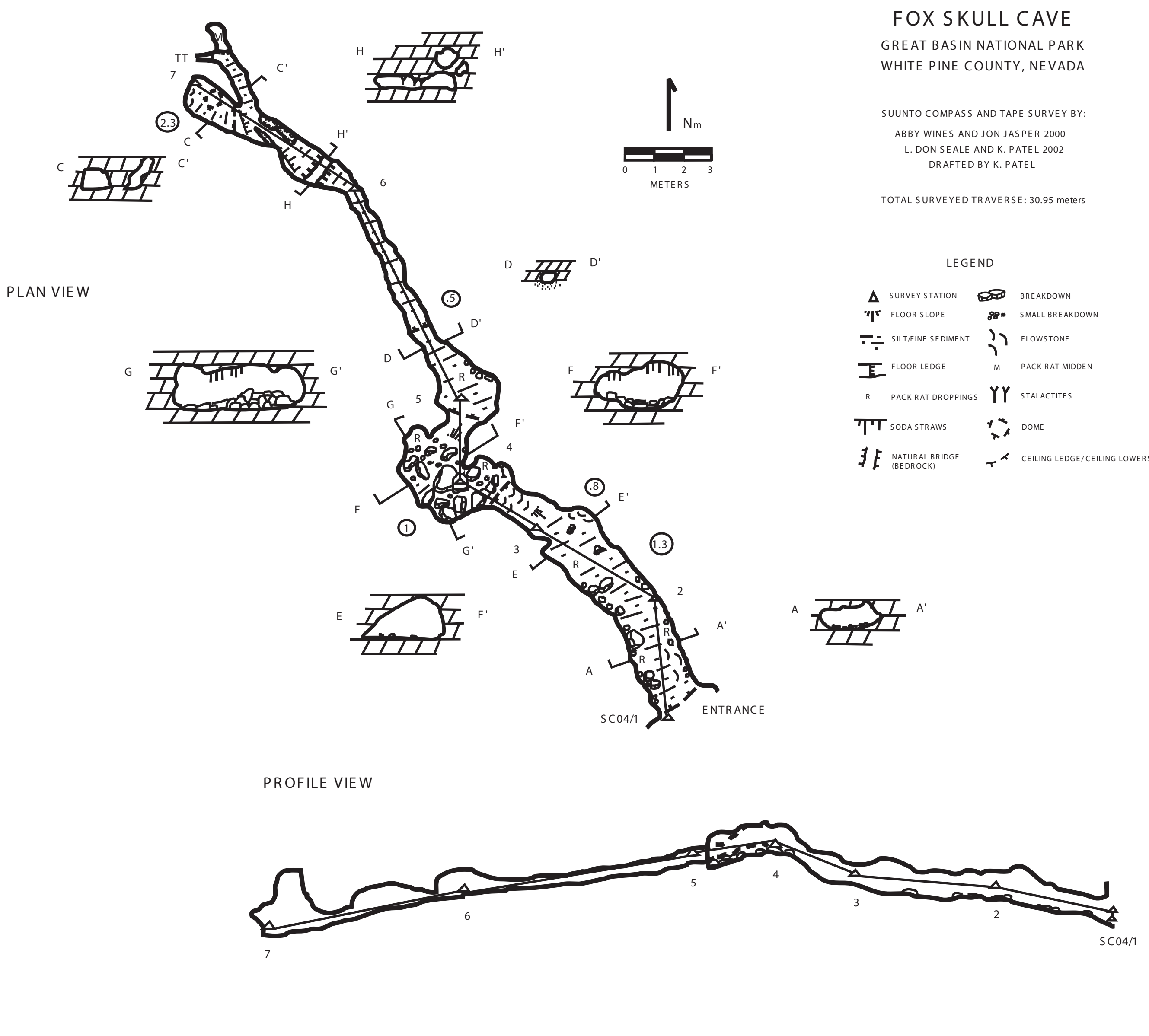

Systems Key Cave
WHITE PINE COUNTY, NEVADA
GREAT BASIN NATIONAL PARK
SUUNTO COMPASS & TAPE SURVEY BY:
K. PATEL, L. DON SEALE, NOAH DANIELS,
KARINNE KNUTSEN, BEN ROBERTS, CHRIS KUHNEL
SURVEY DATE: JULY & AUGUST, 2002
DRAFTED BY K. PATEL
TOTAL SURVEYED TRAVERSE: 941.3 FT/ 286.9 m
TOTAL VERTICAL EXTENT: 88.1 FT/ 26.9 m
N mag
13 ° 51'
JULY 2002
0 10 20 FEET
0 2 4 6 METERS
PLAN VIEW
LEGEND
SURVEY STATION
FLOOR SLOPE
SILT/FINE SEDIMENT
FLOOR LEDGE
GREEN PLANTS
SODA STRAWS
NATURAL BRIDGE (BEDROCK)
COLUMN
SAND
CONGLOMERATE ROCK
CEILING CHANNEL
SCALLOPS
PASSAGE TOO TIGHT
ELEVATION BELOW DATUM (FT)
BREAKDOWN
SMALL BREAKDOWN
FLOWSTONE
BEDROCK
STALACTITES
DOME
CEILING LEDGE/CEILING LOWERS
PIT
UNDERLYING PASSAGE
OVERLYING PASSAGE
BEDROCK PILLAR
WATER
PERENNIAL WATER FLOW
INDETERMINATE BREAKDOWN WALL
GREY CLIFFS ROAD
BAKER CREEK
WATERFALL ROOM
LUNCH ROOM
ENTRANCE
SNAIL ROOM
MIKE'S CHAMBER
7200
7160
7120
7080
7040
7000
6960
Baker Creek Cave System
ELEVATIONS IN FT
Systems Key Cave
Ice Cave
Crevasse Cave
Upper Pictograph
Hallidays Deep Cave
EXTENDED PROFILE VIEW
FT
0
10
20
30
40
50
60
70
80
90
ENTRANCE
DATUM
SNAIL ROOM
MIKE'S CHAMBER
WATERFALL ROOM
CAVEX MAP 1" = 80'


Baker Creek Cave System
EXTENDED PROFILE VIEW
LEGEND


LEHMAN CAVES NATIONAL MONUMENT
WHITE PINE COUNTY, NEVADA
Mapped by the
SALT LAKE GROTTO
NATIONAL SPELEOLOGICAL SOCIETY
Compiled by
DALE J. GREEN
100 50 0 50 100
FEET
NORTH
MAG. NORTH
17°
LEDGE
PIT
CHIMNEY
SLOPE
LARGE BOULDER
POOL
COLUMN
GYPSUM EXTENSION
BEHMAN DISCOVERY PASSAGE
TALUS ROOM
20' DROP
TALUS ROOM
GRAND PALACE
CYPRESS SWAMP
LAKE ROOM
WEST ROOM
CRYSTAL PALACE
QUEENS ROOM
TOM TOM ROOM
INSCRIPTION ROOM
LODGE ROOM
LOST RIVER PASSAGE
NATURAL ENTRANCE
GOTHIC PALACE
ENTRANCE


Alpine Kyle Cave
Plan View
Length: 108.9 FT
Depth: 55.9 FT
Surveyed By:
Kyle and Maria Voyles
8-10-02
Entrance
10FT


Alpine Kyle Cave
Profile View
Length: 108.9 FT
Depth: 55.9 FT
Surveyed By:
Kyle and Maria Voyles
8-10-02
Entrance
10FT

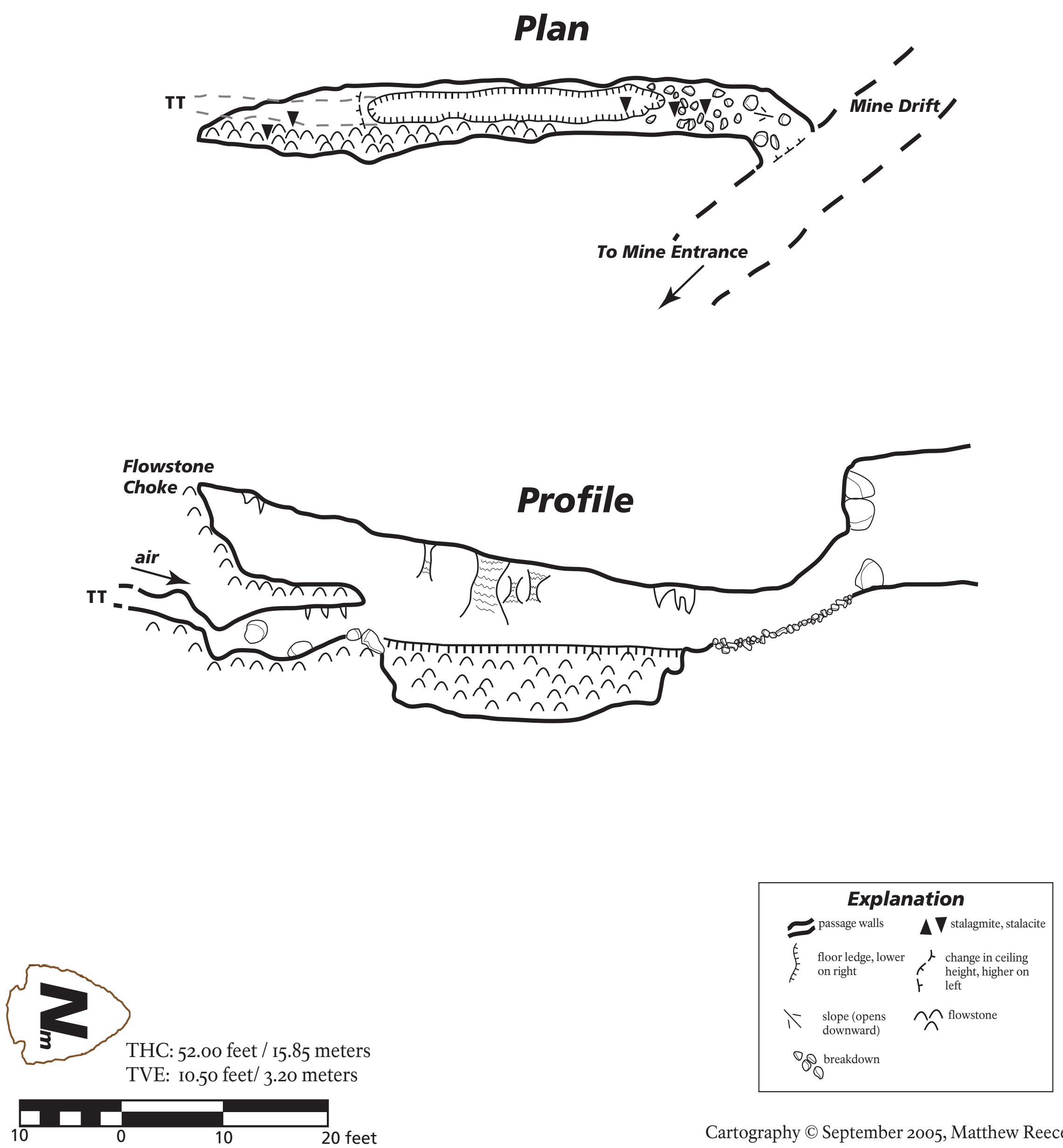

FOX SKULL CAVE
GREAT BASIN NATIONAL PARK
WHITE PINE COUNTY, NEVADA
SUUNTO COMPASS AND TAPE SURVEY BY:
ABBY WINES AND JON JASPER 2000
L. DON SEALE AND K. PATEL 2002
DRAFTED BY K. PATEL
TOTAL SURVEYED TRAVERSE: 30.95 meters
Nm
0 1 2 3
METERS
LEGEND
SURVEY STATION
BREAKDOWN
FLOOR SLOPE
SMALL BREAKDOWN
SILT/FINE SEDIMENT
FLOWSTONE
FLOOR LEDGE
PACK RAT MIDDEN
PACK RAT DROPPINGS
STALACTITES
SODA STRAWS
DOME
NATURAL BRIDGE (BEDROCK)
CEILING LEDGE/CEILING LOWERS
PLAN VIEW
ENTRANCE
SC04/1
PROFILE VIEW

Drumming Cave *(LC-01)*

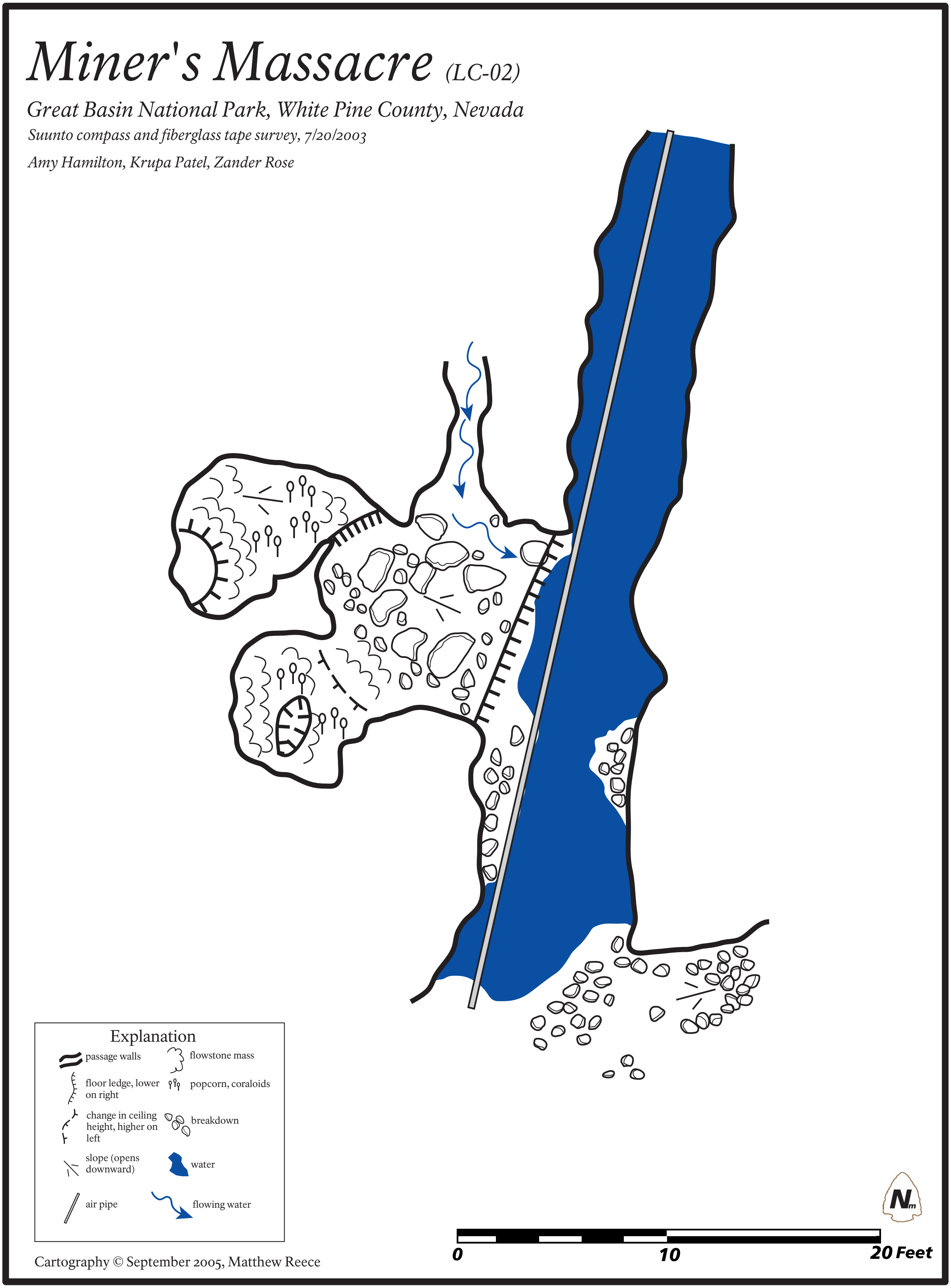
Great Basin National Park, White Pine County, Nevada

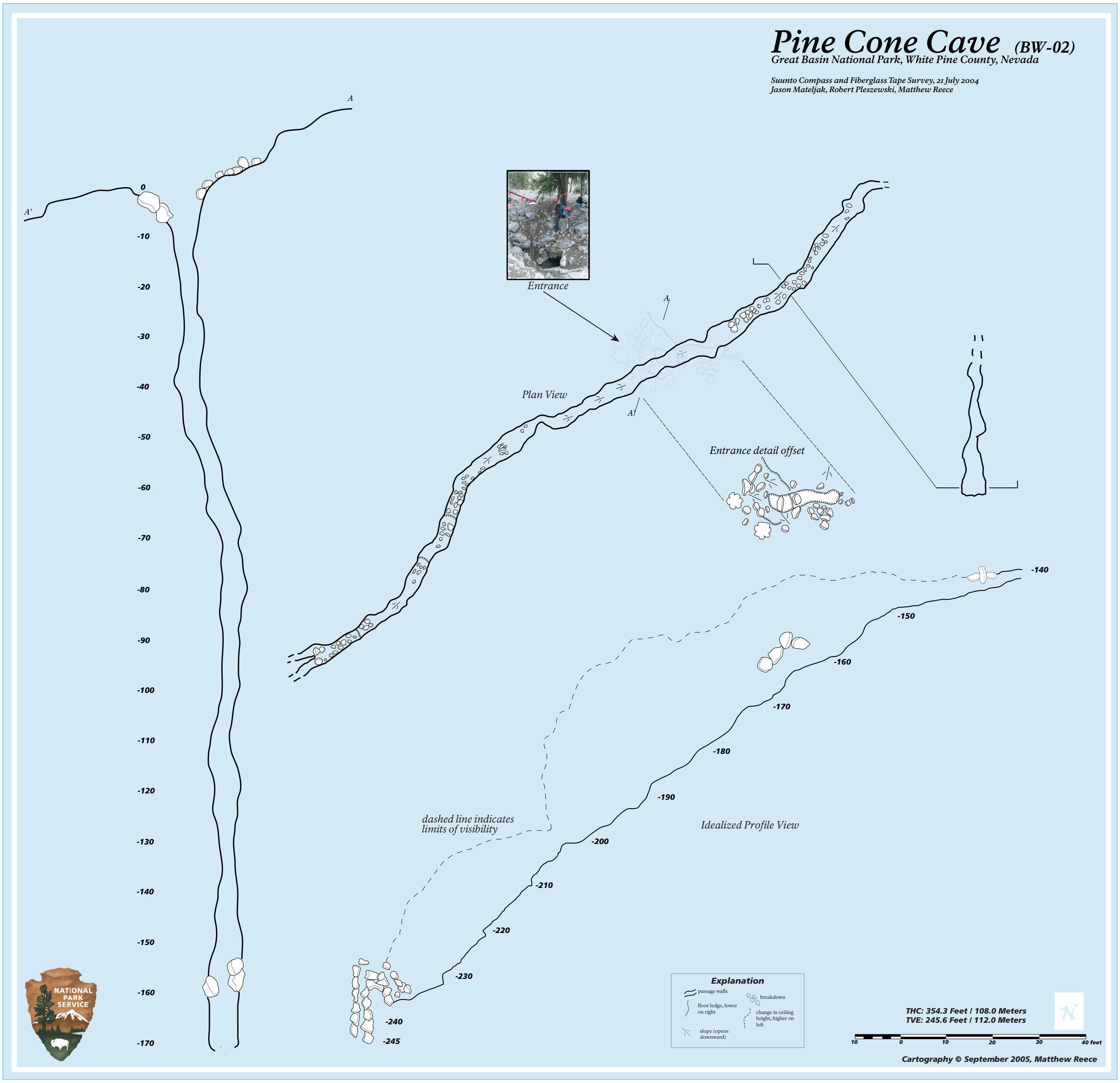
Suunto compass and fiberglass tape survey, 10/18/1998

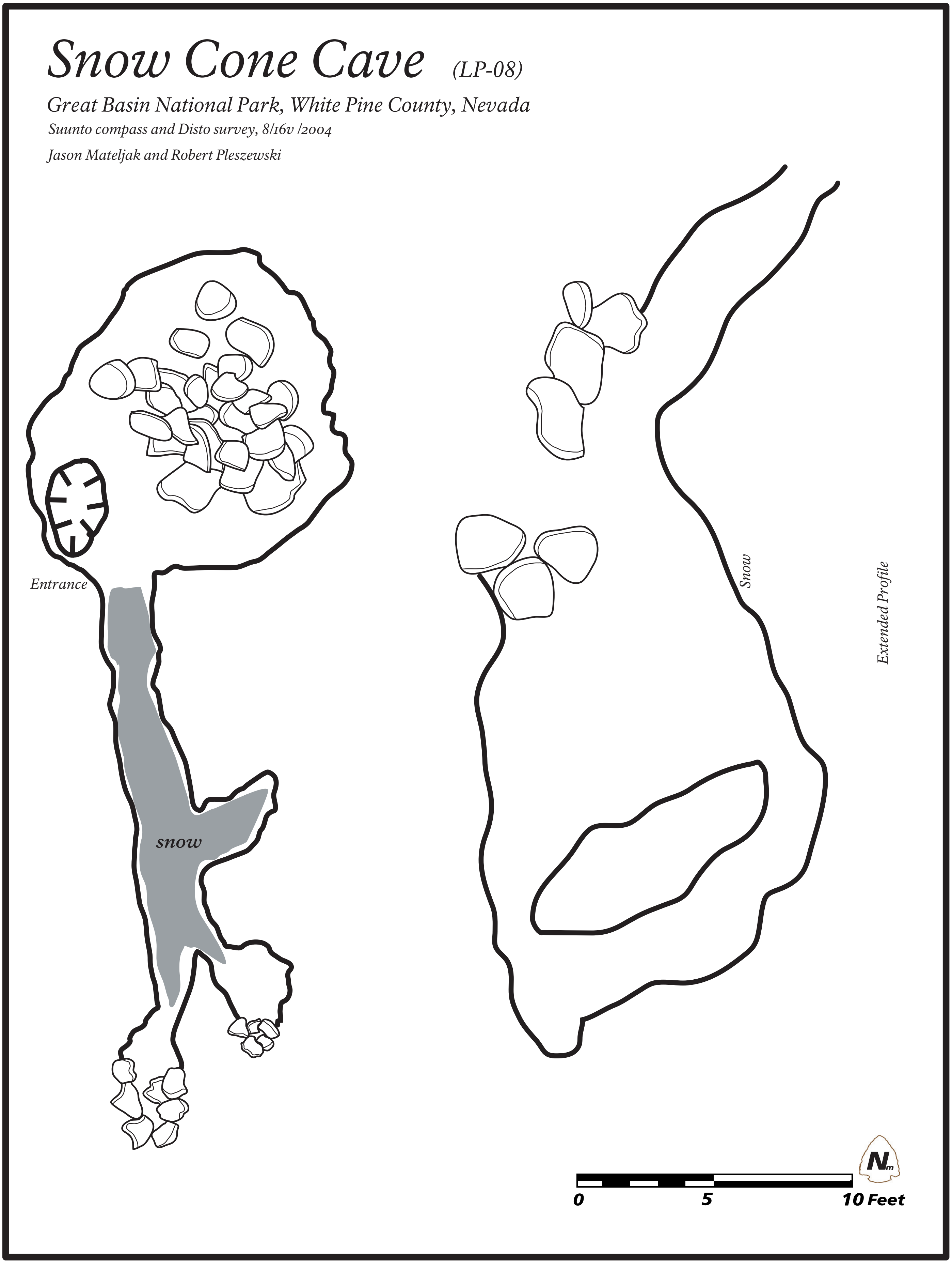
Rod Horrocks, Jon Jasper, Abby Wines, Sarina Braal, Bart Wright



Cartography © September 2005, Matthew Reece


Miner's Massacre (LC-02)
Great Basin National Park, White Pine County, Nevada
Suunto compass and fiberglass tape survey, 7/20/2003
Amy Hamilton, Krupa Patel, Zander Rose
Explanation
passage walls
flowstone mass
floor ledge, lower on right
popcorn, coraloids
change in ceiling height, higher on left
breakdown
slope (opens downward)
water
air pipe
flowing water
Cartography © September 2005, Matthew Reece
0
10
20 Feet
Nm


Pine Cone Cave (BW-02)
Great Basin National Park, White Pine County, Nevada
Suunto Compass and Fiberglass Tape Survey, 21 July 2004
Jason Mateljak, Robert Pleszewski, Matthew Reece
A
A'
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
Entrance
Plan View
Entrance detail offset
dashed line indicates
limits of visibility
Idealized Profile View
-140
-150
-160
-170
-180
-190
-200
-210
-220
-230
-240
-245
Explanation
passage walls
breakdown
floor ledge, lower on right
change in ceiling height, higher on left
slope (opens downward)
THC: 354.3 Feet / 108.0 Meters
TVE: 245.6 Feet / 112.0 Meters
10 0 10 20 30 40 feet
Cartography © September 2005, Matthew Reece
NATIONAL PARK SERVICE

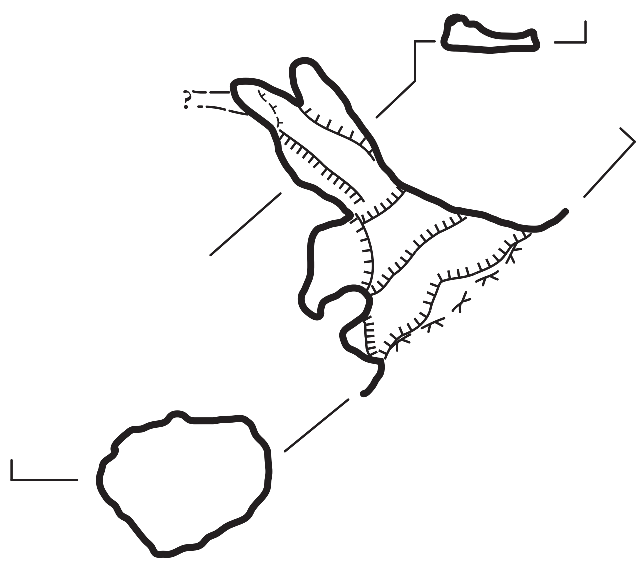

Snow Cone Cave (LP-08)
Great Basin National Park, White Pine County, Nevada
Suunto compass and Disto survey, 8/16v /2004
Jason Mateljak and Robert Pleszewski
Entrance
snow
Snow
Extended Profile
N
0
5
10 Feet

Swiss Cheese Cave *(LP-06)*

Great Basin National Park, White Pine County, Nevada

Suunto compass and Disto survey, 8/17/2004

Jason Mateljak and Robert Pleszewski



Explanation

- passage walls
- breakdown
- floor ledge, lower on right
- change in ceiling height, higher on left
- entrance dripline
- flowstone

0 10 20 Feet

N m

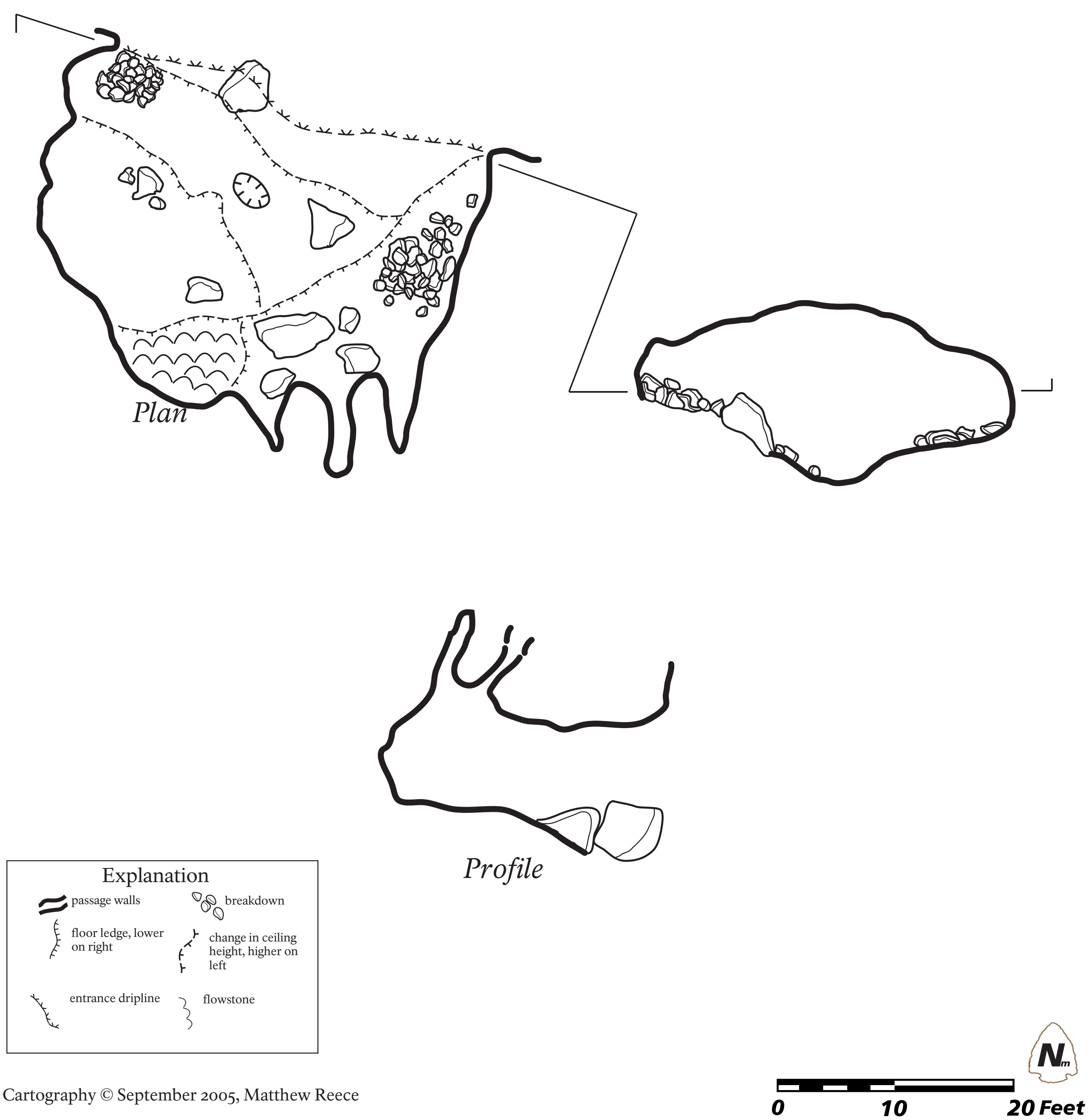
Wild Goose Cave *(LP-06)*

Great Basin National Park, White Pine County, Nevada

Suunto compass and Disto survey, 8/17/2004

Jason Mateljak and Robert Pleszewski

NATIONAL PARK SERVICE



National Park Service
U.S. Department of the Interior

Great Basin National Park
Science and Resource Managment
100 Great Basin National Park
Baker, Nevada 89311