Cave Life, Bats, and Cave Protection

Bill Scheperle
and Anthony Elliott
Missouri Department of Conservation

Missouri Caves Are…

- A functional part of the natural landscape, not a separate dimension.
- Common (>7,000) in the southern ¾ of Missouri.
- Related to groundwater systems past and present.

Cambarus setosus, Bristly cave crayfish

Antrobia culveri
Tumbling Creek Cavesnail

Threats to Cave Life

- **Humans**

  Disturbance of wildlife
  Cave modification
  Vandalism
  Crime—breaching cave gates, looting, black markets

- **New Diseases**

  Amphibian Chytrid Fungus (ACF)
  White-nose Syndrome (WNS)
  ?? COVID – 19, concerns about reverse zoonosis

Vulnerable to Disturbance

Missouri Bats

- Missouri has 15 bat species, 12 are commonly here.
- Bats are popular!
- Bats consume night-flying insects and are important to our ecosystems and economy.
- Estimated $961 million value to Missouri agriculture per year. Forests also benefit. Think corn ear worms and gypsy moths!

Cave Bats


Indiana Bat - Endangered


Tri-colored Bat – Status Review


Gray Bat - Endangered


Little Brown Bat – Status Review


Big Brown Bat


Northern (Long-eared) Myotis - Threatened

White-nose Syndrome, or "WNS", is caused by the fungus *Pseudogymnoascus destructans* (Pd)

WNS is a Significant Problem

- WNS has killed millions of hibernating bats in caves and abandoned mines in North America since 2006.
- Bats are long lived and reproduce slowly.
- WNS outbreak confirmed in Missouri in March 2012.
- 7 of Missouri's bat species use caves in winter and are potentially vulnerable.
  - Gray bats appear resistant.
- Disturbance: Bats need quiet time for hibernation, raising young (gray bats in summer), or getting well, especially important because of WNS.

2013 – Before WNS

photo by Shelly Colatskie

2017 – After WNS

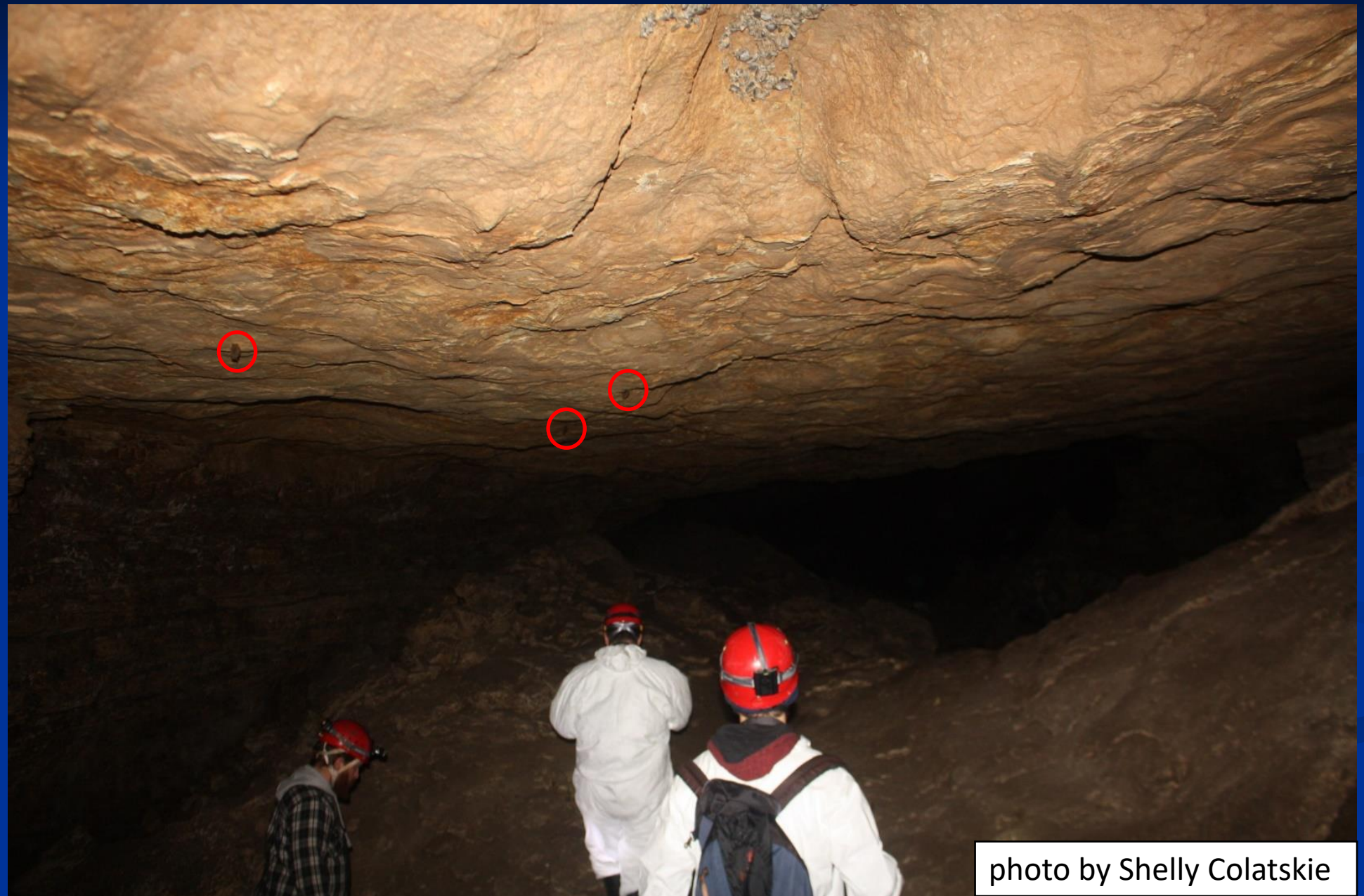
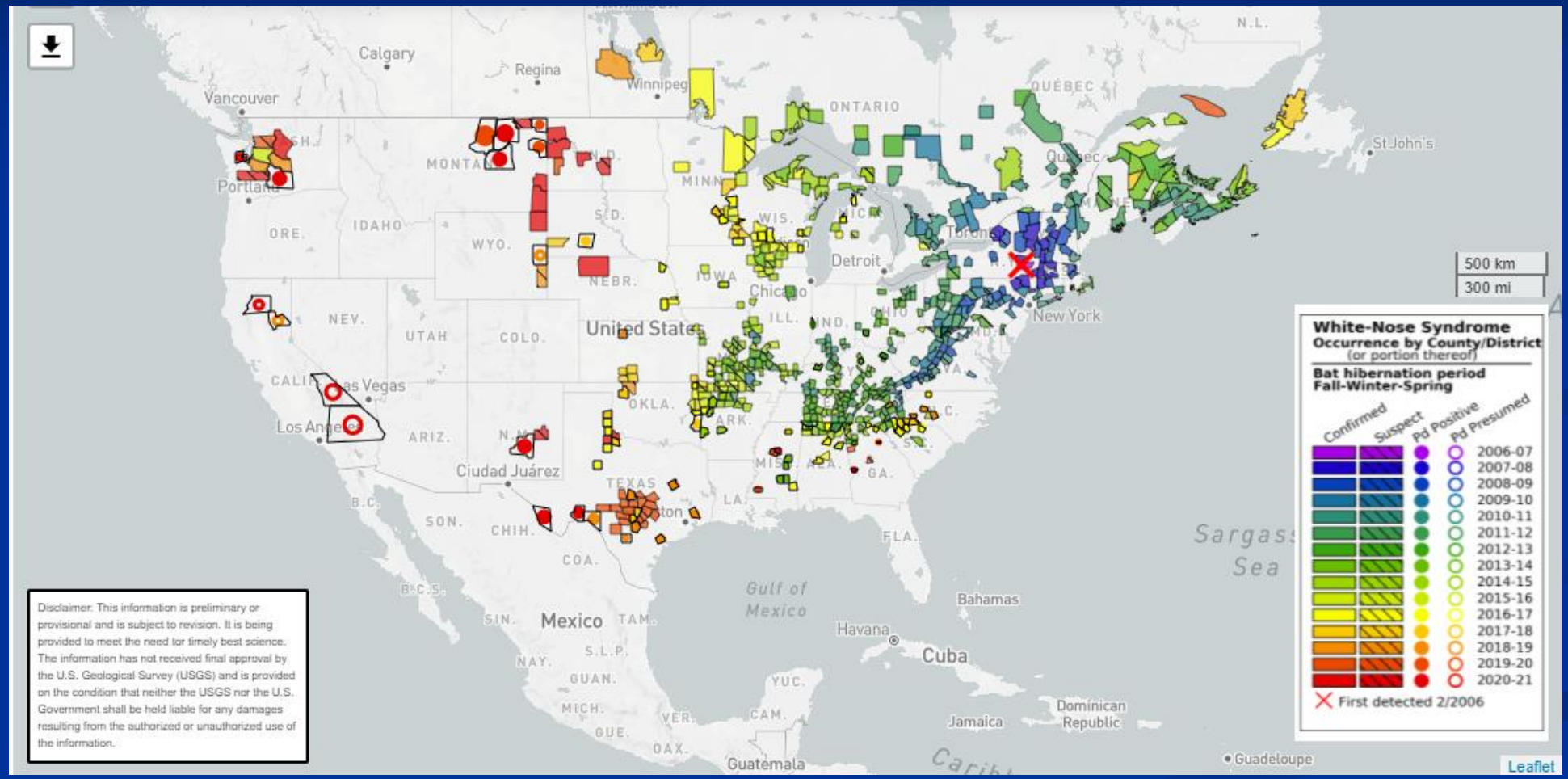


photo by Shelly Colatskie

Documented Distribution of WNS



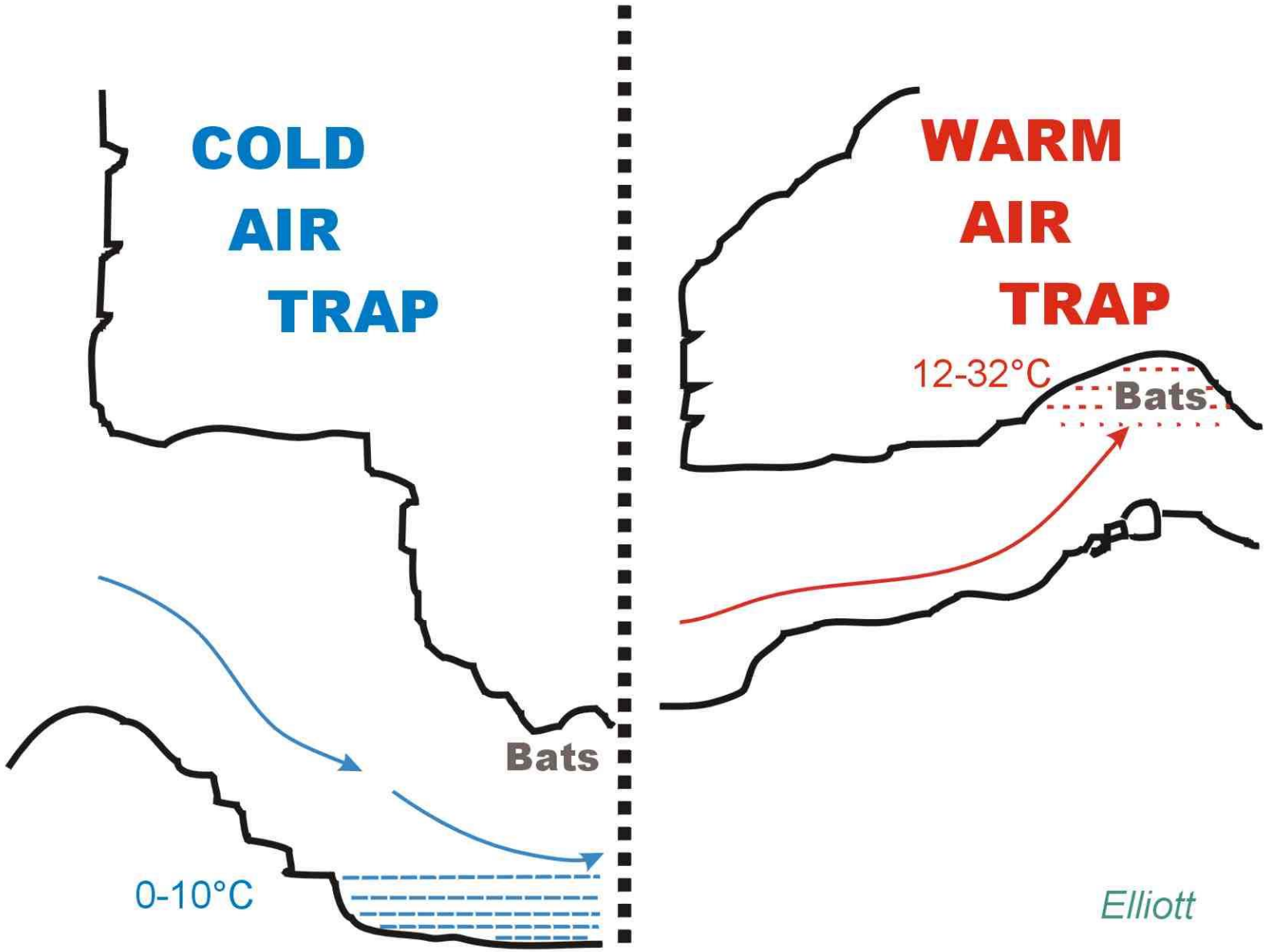
Why Close Caves & Decon?

- Human disturbance stresses bats.
- Stressed WNS bats = higher death rate.
- Decontamination is a necessary precaution. Pd spores are hardy.
- Closure reduces bat stress and risk of human-borne WNS spread.
- Treatments, other preventative measures not ready for field application.

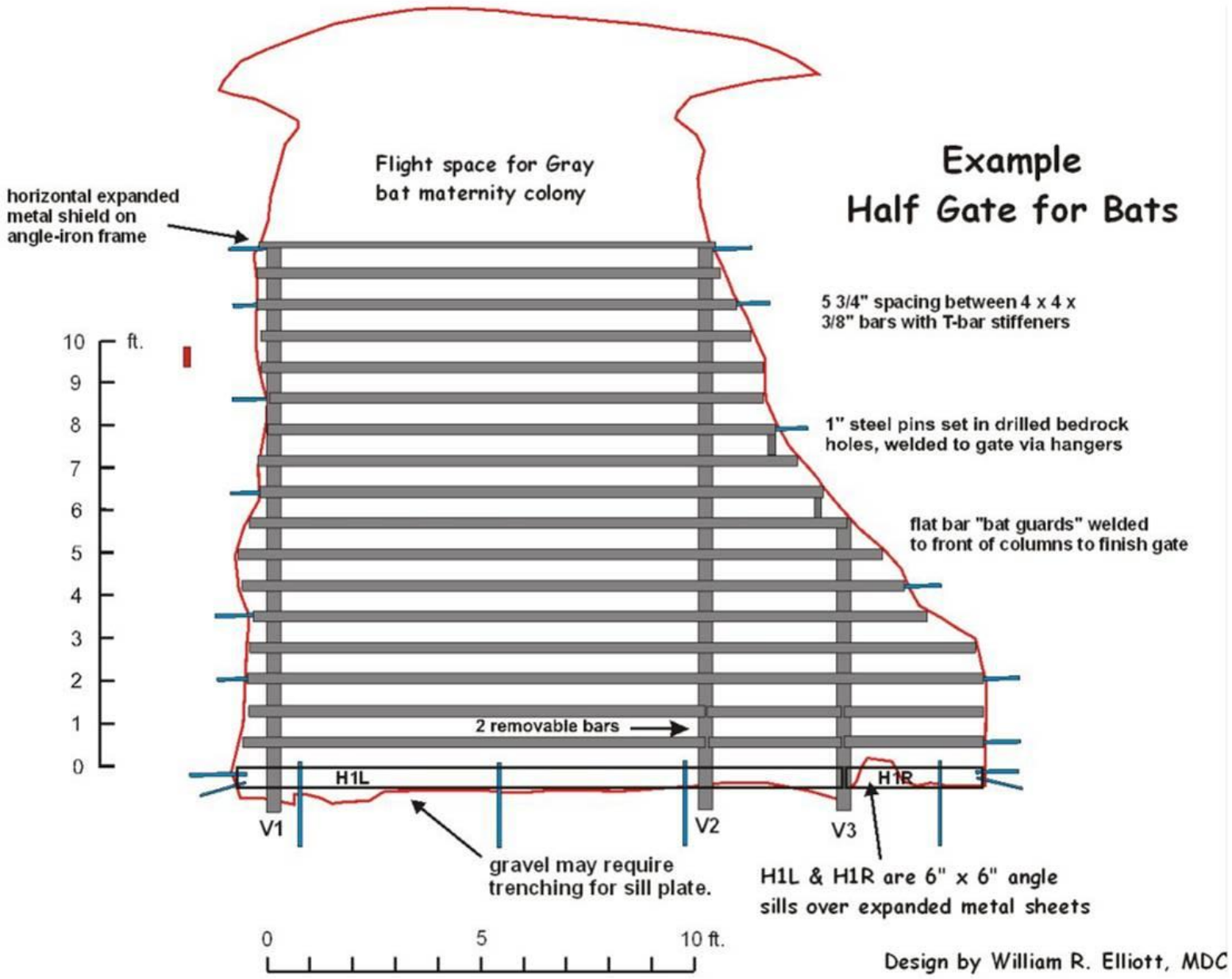
Cave Access Management

Ongoing challenge

- Closure
- Signs
- Fencing
- Gates
- Without continuous enforcement???


COLD
AIR
TRAP
Bats
0-10°C
WARM
AIR
TRAP
12-32°C
Bats
Elliott


Lone Hill Onyx Cave, Meramec C.A.
7 bat species
Trained a D&D team in cave gate construction


Example
Half Gate for Bats
Flight space for Gray
bat maternity colony
horizontal expanded
metal shield on
angle-iron frame
5 3/4" spacing between 4 x 4 x
3/8" bars with T-bar stiffeners
1" steel pins set in drilled bedrock
holes, welded to gate via hangers
flat bar "bat guards" welded
to front of columns to finish gate
10 ft.
9
8
7
6
5
4
3
2
1
0
2 removable bars
H1L
H1R
V1
V2
V3
gravel may require
trenching for sill plate.
H1L & H1R are 6" x 6" angle
sills over expanded metal sheets
0
5
10 ft.
Design by William R. Elliott, MDC

Great Spirit Cave, a Natural Area

Cave gates allow wildlife, air & water to go in and out but exclude human trespassers. A hidden removable bar and padlock allows authorized personnel to enter.


DO NOT ENTER

Gating Considerations

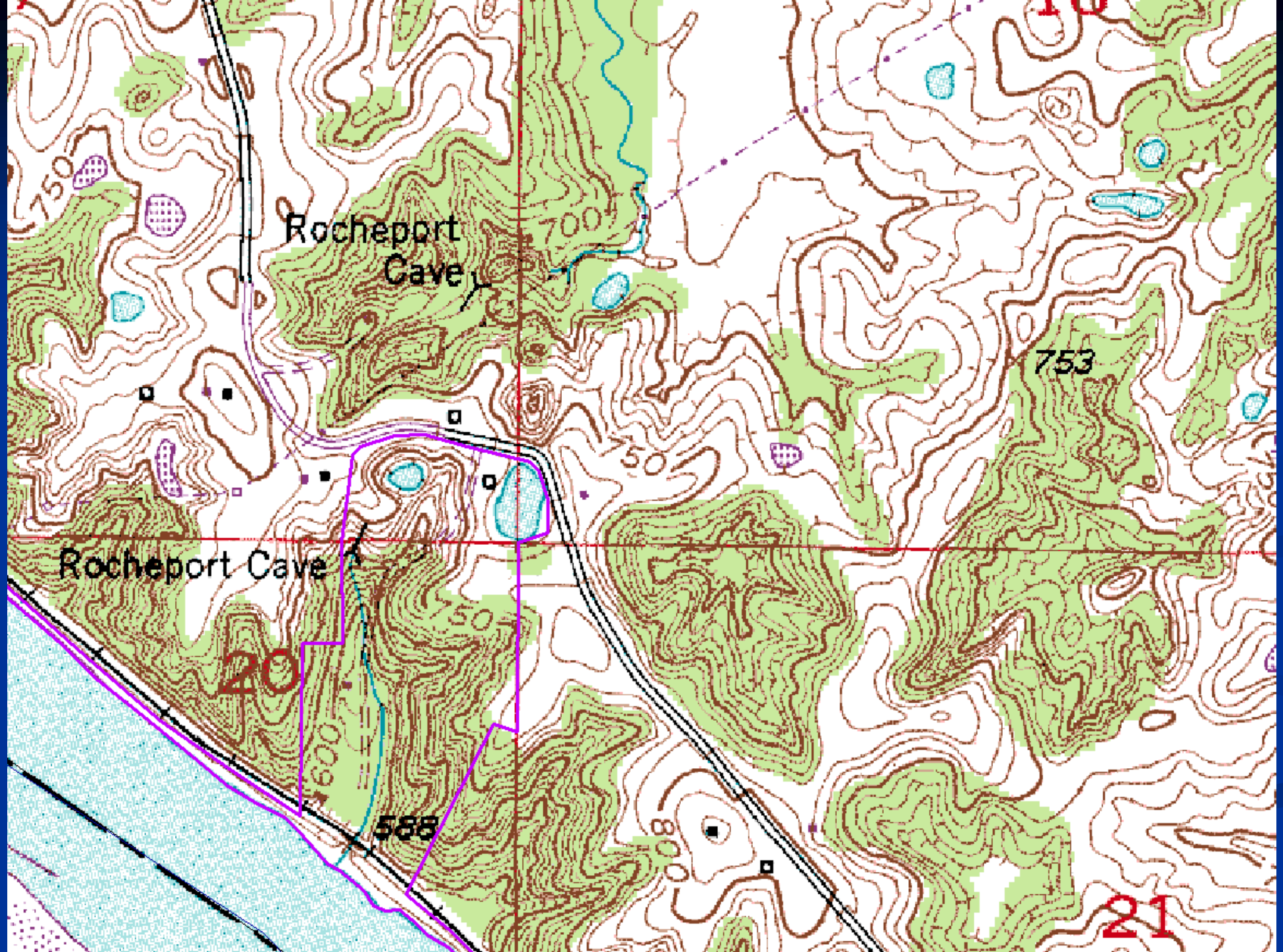
- Good reasons to gate the cave.
  - The cave is hazardous to casual visitors and no other controls (permits and signs) are adequate.
  - Endangered species inhabit the cave and can be bolstered by protection.
  - The cave is a target for vandals, looters and trespassers.
  - The cave has high value (high quality natural community, unique features).

- Poor reasons not to gate the cave.
  - Purely aesthetic objections to a gate while the cave's resources are being degraded anyway.
  - It may "start a trend" towards too much gating.
  - Because gates can be breached.

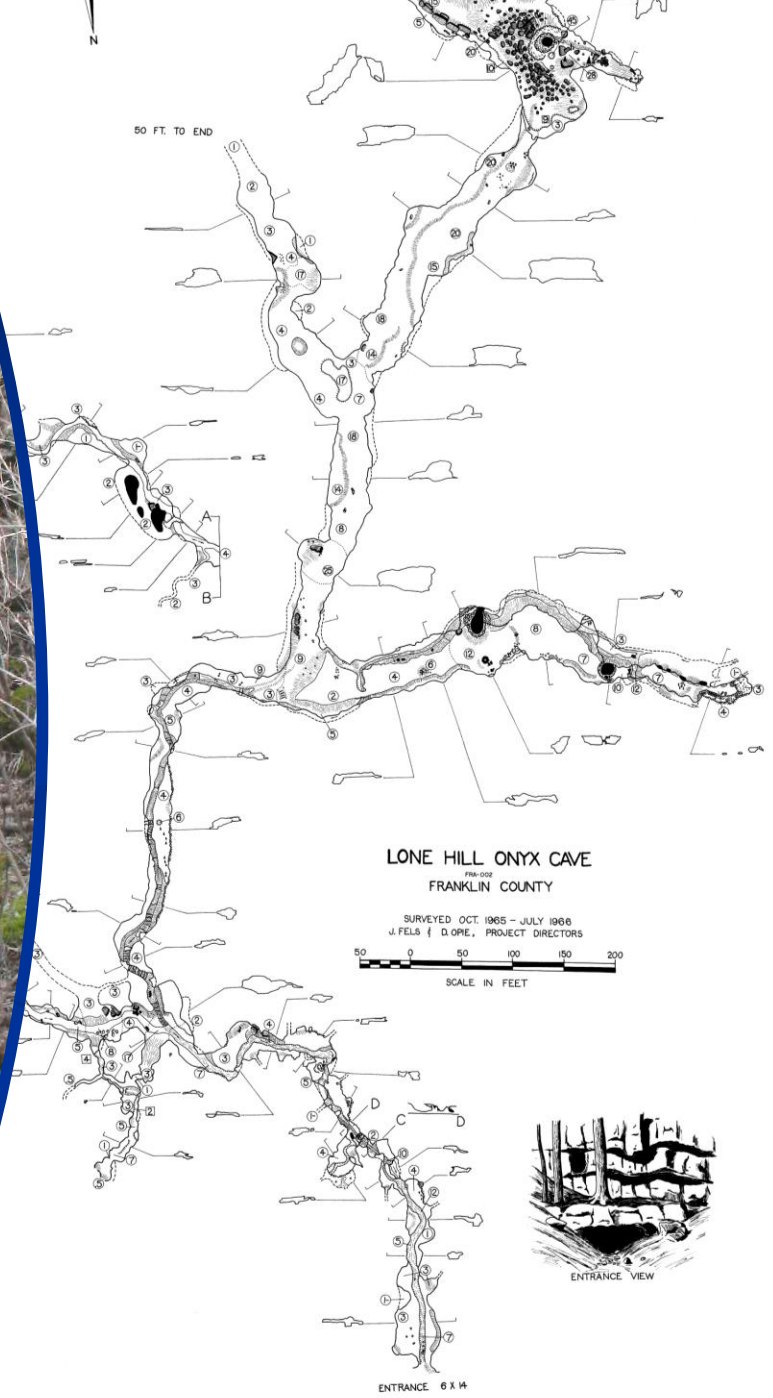
Gating Considerations

- Poor reasons for gating the cave.
  - Fear of liability, which probably is nonexistent.
  - For administrative convenience (instead of having a comprehensive conservation program).
  - To keep wild animals or competing explorers out.

- Good reasons not to gate the cave.
  - The gate, as designed, will not comply with current ACCA and BCI standards.
  - Other controls can be used—road gates, signs, surveillance, permit system, vigilant owner or manager lives nearby.
  - The cave gate designers/installers are inexperienced or overconfident.
  - No viable plan for long term monitoring/maintenance.
  - Technical reasons (entrance is too small for proper gate, budget restrictions, etc.).


Rocheport
Cave
Rocheport Cave
753
588
20
21
700
750
600
650
800

Lone Hill Onyx Cave Gate Project



Missouri Department of Conservation 2011

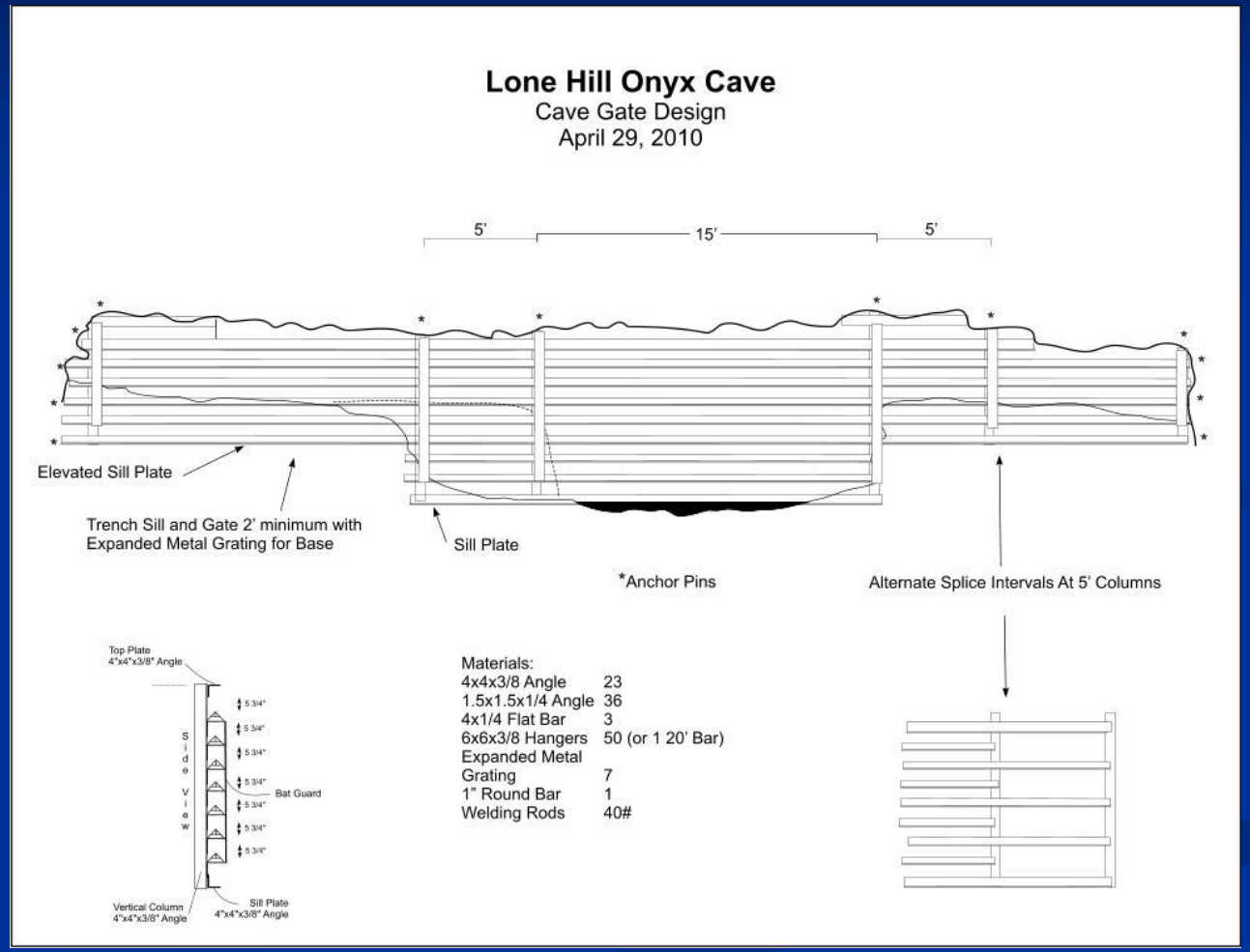
William H. Scheperle, PE

Lone Hill Onyx Cave

- Located at the Meramec Conservation Area in Franklin County MO
- Home of eight species of bats including Indiana Bat and Grey Bat
- Most popular recreational spelunking cave
- Accessible to special use permittees
- Has been gated unsuccessfully in the past
- Due to the threat of white nose syndrome and increased cave abuse the Department approved installation of a permanent cave gate.

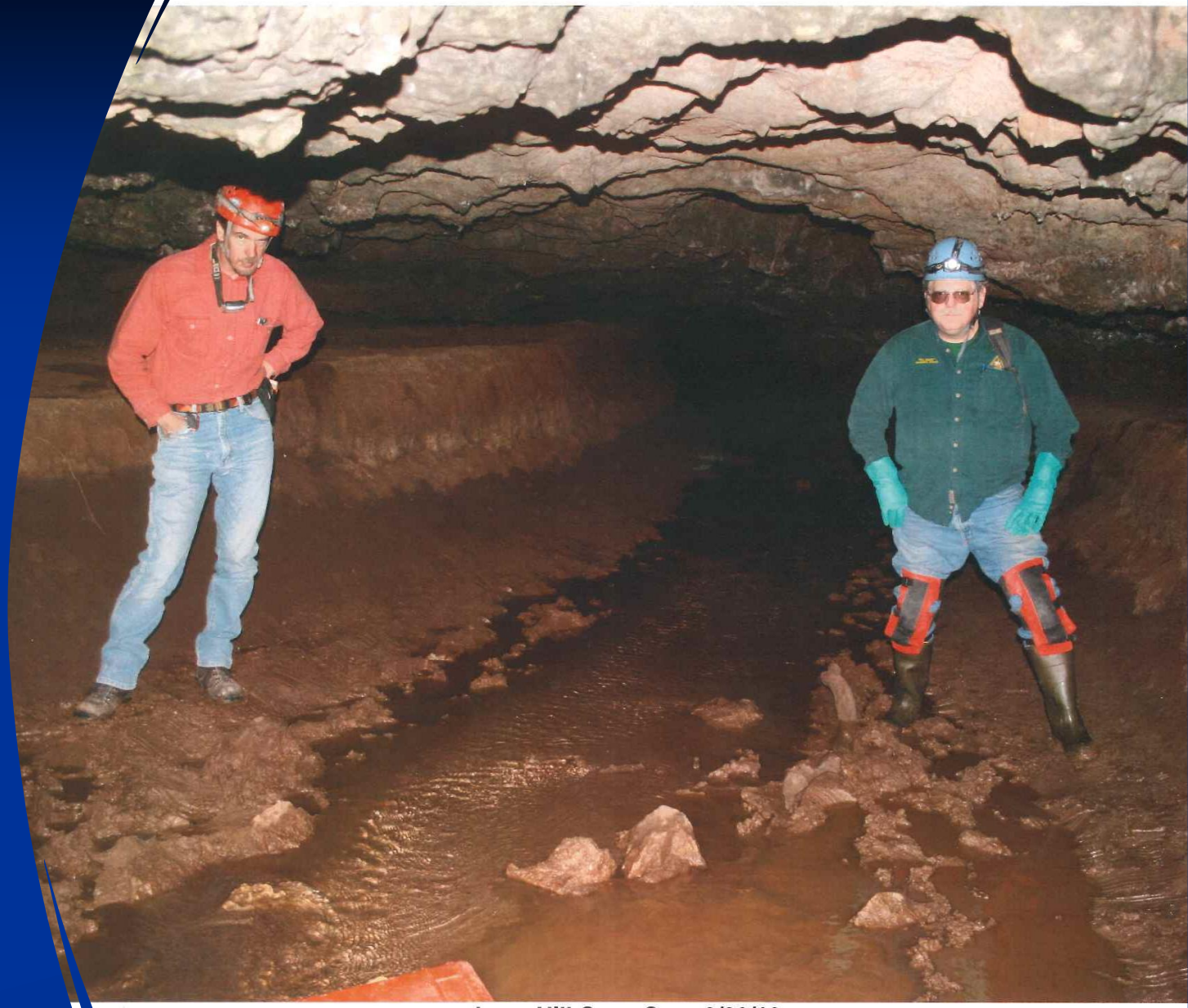
Project Design Concept

- Design and construct permanent cave gate structure that allows air flow cave habitat movement while restricting unwanted access.
- Design based American Cave Conservation Association and Bat Conservation International Guidance.
- Engineering Best Practices and Fundamentals.



The Geometry of The Cave Dictates the Gate Type

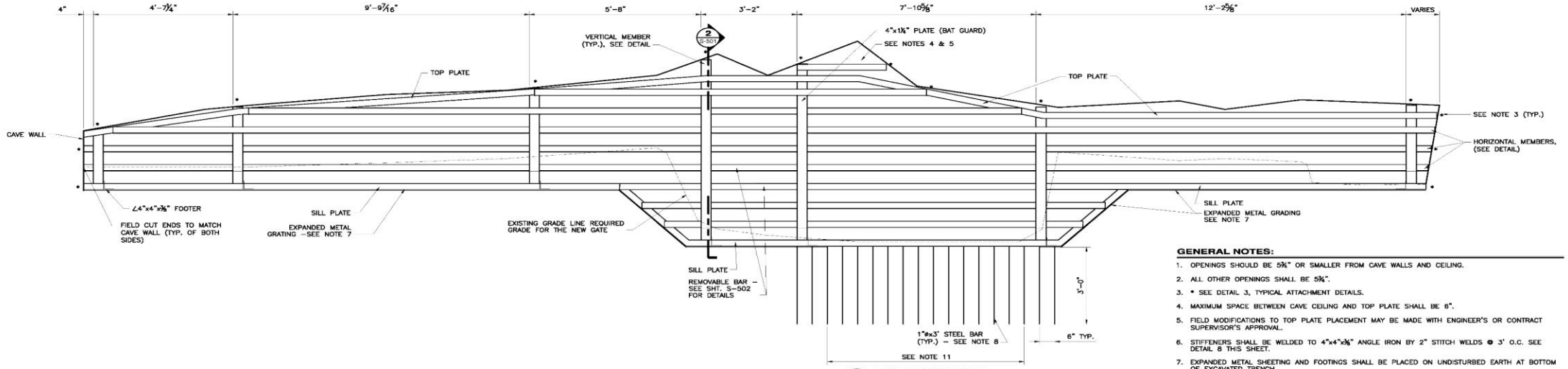
- Full Basic Gate is most suitable for the Lone Hill Onyx Cave
- Low Entrance Ceiling
- Stream Channel
- Wide area inside of the cave near the entrance to accommodate gate and prevent air flow restrictions.



Lone Hill Onyx Cave 3/29/10

Basic Gate Design

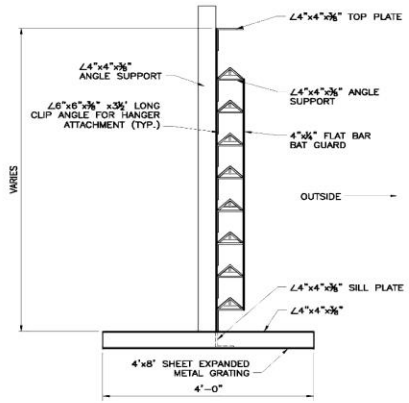
- Expanded Metal EM3 Footing 2’ below grade.
- 4”x4”x3/8” Steel Vertical Columns spaced 15’ or less.
- 4”x4”x3/8 angle steel horizontal members with two 1 ½” x 1 ½” x ¼” stiffeners
- Provide 5 ¾ “ opening between horizontal members.
- 1” Diameter steel pins 8” minimum in rock at ceiling and wall connections.
- 1” Diameter by 3’ steel bars driven in stream channel at 6” on center.
- Removable horizontal bar access.
- 4”x1/4” flat steel covering splices and hangers at vertical column connections.
- Gate Free of sharp edges, burs, spatter and slag.



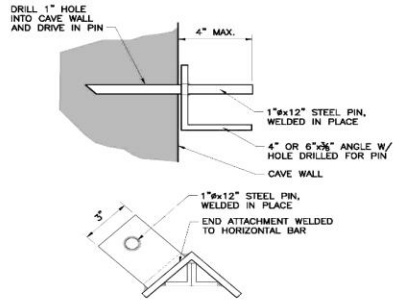
1 GATE ELEVATION
SCALE: 1"=1'-0"

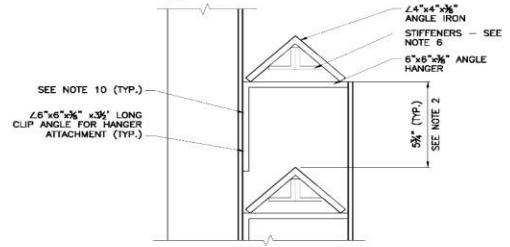
GENERAL NOTES:

1. OPENINGS SHOULD BE 5¾" OR SMALLER FROM CAVE WALLS AND CEILING.
2. ALL OTHER OPENINGS SHALL BE 5¾".
3. * SEE DETAIL 3, TYPICAL ATTACHMENT DETAILS.
4. MAXIMUM SPACE BETWEEN CAVE CEILING AND TOP PLATE SHALL BE 8".
5. FIELD MODIFICATIONS TO TOP PLATE PLACEMENT MAY BE MADE WITH ENGINEER'S OR CONTRACT SUPERVISOR'S APPROVAL.
6. STIFFENERS SHALL BE WELDED TO 4"x4"x⅜" ANGLE IRON BY 2" STITCH WELDS @ 3' O.C. SEE DETAIL 8 THIS SHEET.
7. EXPANDED METAL SHEETING AND FOOTINGS SHALL BE PLACED ON UNDISTURBED EARTH AT BOTTOM OF EXCAVATED TRENCH.
8. 1"ø x 3'-0" STEEL BARS SHALL BE HAND DRIVEN TO THE DEPTHS INDICATED OR UNTIL REFUSAL.
9. 1"ø12" STEEL PINS SHALL BE DRIVEN INTO THE CAVE WALL OR CEILING ROCK A MINIMUM OF 8".
10. HORIZONTAL BARS SHALL BE INSTALLED TO ALLOW BUTT JOINTS TO STAGGER AT VERTICAL SUPPORTS AS MUCH AS POSSIBLE.
11. NO EXPANDED METAL NEEDED.
12. WALL ATTACHMENTS CAN BE LOCATED BOTH INSIDE AND OUTSIDE OF GATE FOR BEST FIT AS DETERMINED BY CONTRACT SUPERVISOR.
13. ALL WELDED CONNECTIONS REQUIRE APPROPRIATE FULL LENGTH WELDS, ¼" MIN. UNLESS NOTED OTHERWISE.

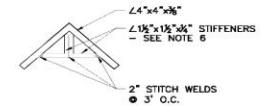


2 GATE SECTION
SCALE: 3/4"=1'-0"

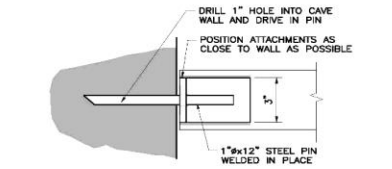


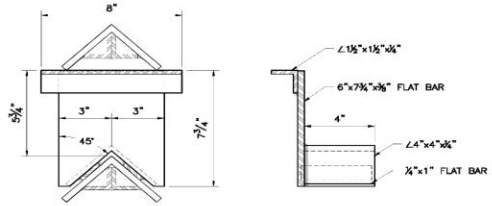


4 HORIZONTAL BAR SPACING & ATTACHMENT
SCALE: 3"=1'-0"

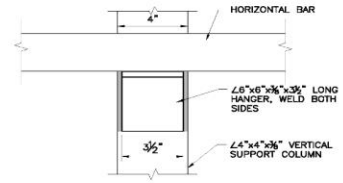


5 HORIZONTAL BAR - STIFFENER
SCALE: 3"=1'-0"

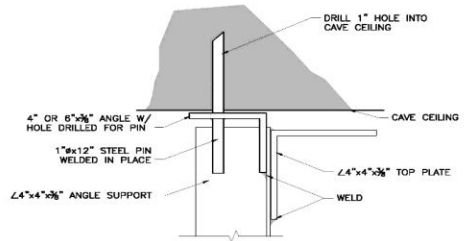




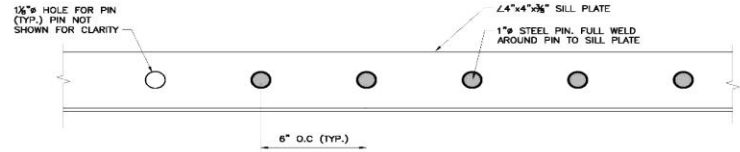
6 HORIZONTAL BAR SPACING GAUGE (OPTIONAL)
SCALE: 3"=1'-0"



7 HANGER ATTACHMENT DETAIL
SCALE: 3"=1'-0"



3 TYPICAL ATTACHMENT DETAILS
SCALE: 3"=1'-0"



8 SILL PLATE AND PIN DETAIL
SCALE: 3"=1'-0"

DESIGN AND DEVELOPMENT
MISSOURI DEPARTMENT OF CONSERVATION
P.O. BOX 180, JEFFERSON CITY, MO 65102
(573) 522-4115 www.mdc.mo.gov

WILLIAM H. SCHEPERLE
CIVIL ENGINEER
PE-2007020330

MERAMEC CA

LONE HILL ONYX BAT CAVE GATE

FRANKLIN COUNTY

MARK	DATE	DESCRIPTION
		ISSUE

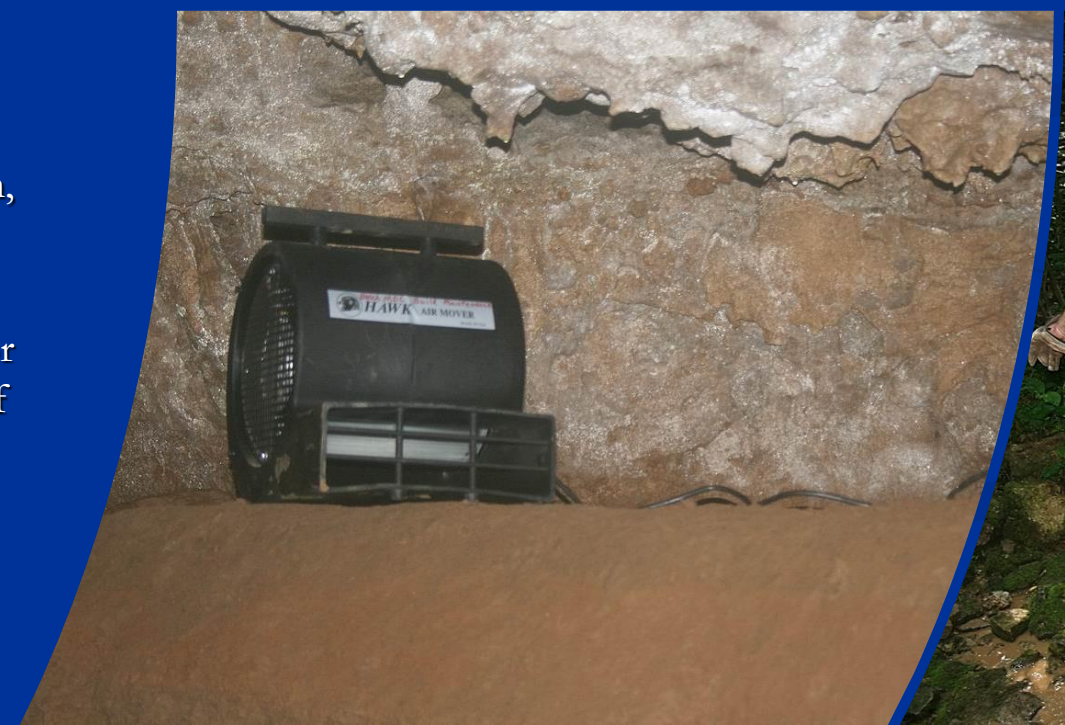
PROJECT NO: **62-02-07**
CAD DWG FILE: 62-02-07_S-SP-01.dwg
DRAWN BY: WHS
DESIGNED BY: WHS
CHECKED BY: HDT
SHEET TITLE

ELEV. & GATE DETAILS

S-501
SHEET 2 OF 3

Logistics of Construction

- Materials list, Prefabricate as many items as possible.
- Identify access route to cave and materials delivery.
- Establish staging area and fabrication area outside of the cave
- Provide adequate ventilation, lighting and sound mitigation measures.
- Provide adequate staffing for manual labor and delivery of materials.
- PPE



Construction Practices to Limit Disturbances

- Obtain necessary permits and clearances
- Time construction during the least impactful time of year.
- Prevent disturbances beyond the cave gate.
- Limit loud noises inside the cave.
- Provide ventilation moving air from inside the cave to outside.
- Keep cave free of trash debris.
- Keep fuel, oil, motorized equipment and chemicals outside of the cave.
- Restore site after construction.
- Fabricate as much of the gate as possible outside of the cave.

Gate Construction

Finished Gate

- Months to design and plan.
- Two days to stage materials and prep site.
- Four days to construct.

QUESTIONS?