

KARST FIELD ASSESSMENT for I-66 Southern Kentucky Corridor

4th Annual Technical Forum
for

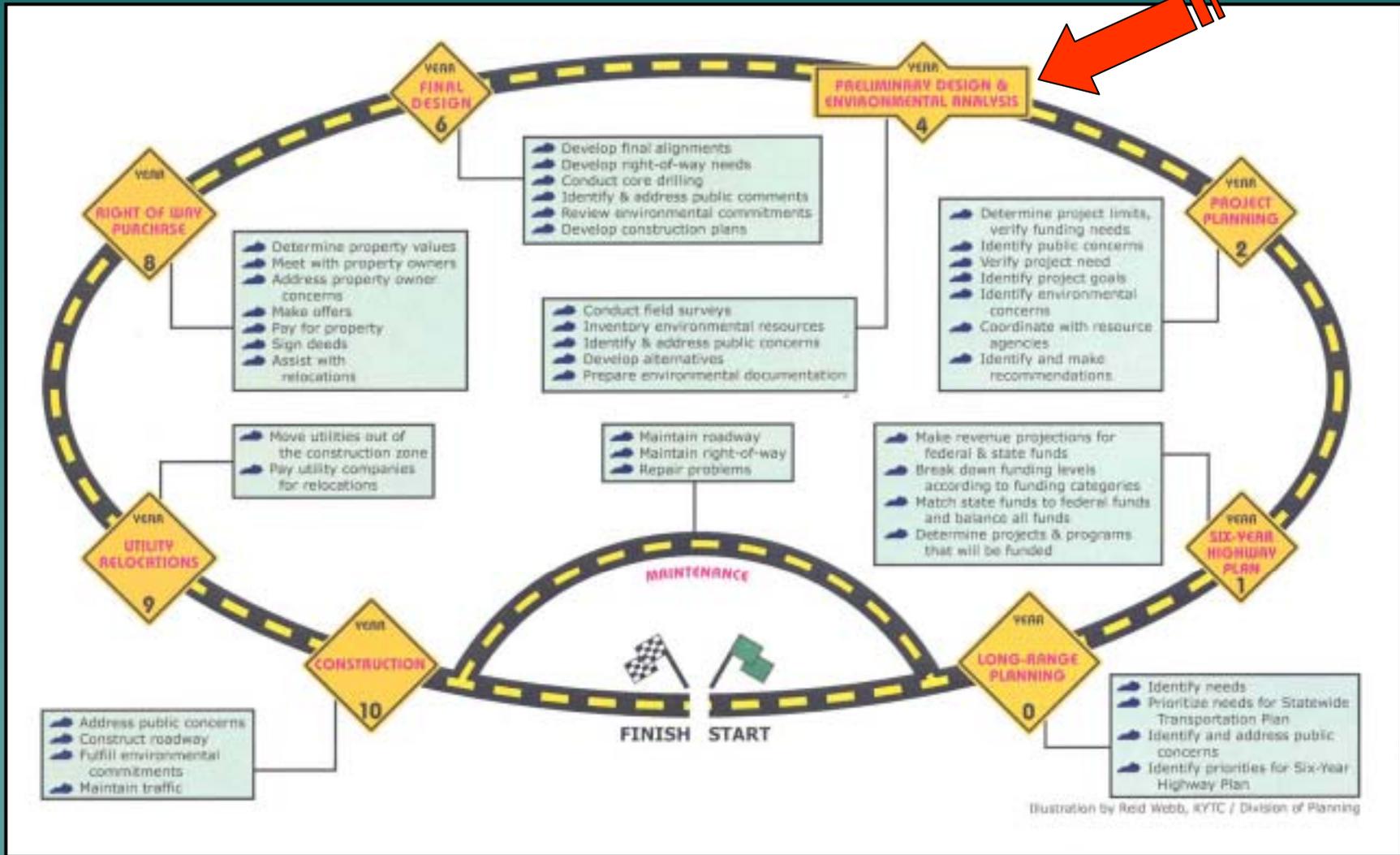
Geohazards in Transportation in the
Appalachian Region

August 4 -5 , 2004

I-66 Trans American Corridor Southern Kentucky Corridor



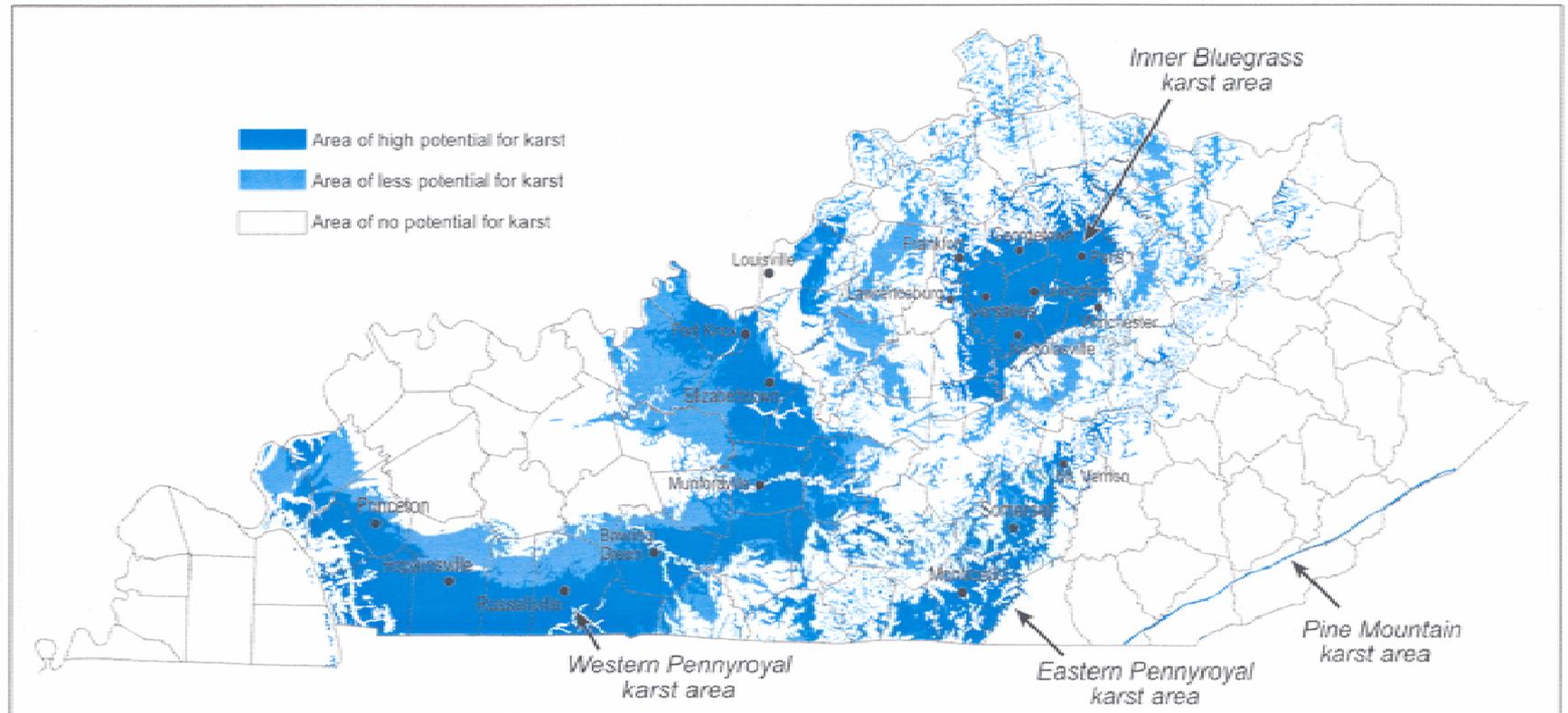
KYTC Project Development Plan



Purpose for Work

- ◆ Karst Field Assessment (KFA) being performed as part of the project Draft Environmental Impact Statement (DEIS).
 - ◆ Determine both potential project impacts on the Karst Terrain and Karst Terrain impacts on the project.
 - ◆ Recommend Avoidance, Minimization, and Mitigation alternatives for the identified impacts.
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Kentucky is Karst Country



Source: KGS Information Circular No.4

KY Karst Facts

- ◆ About 55% of KY is underlain by carbonate rock.
 - ◆ 38% of that area has sinkhole development recognizable on a 7.5 minute topographic map.
 - ◆ 25% of that area has obvious well-developed karst terrain.
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- A decorative graphic at the bottom right of the slide, consisting of a silhouette of a mountain range in a teal color, matching the background.

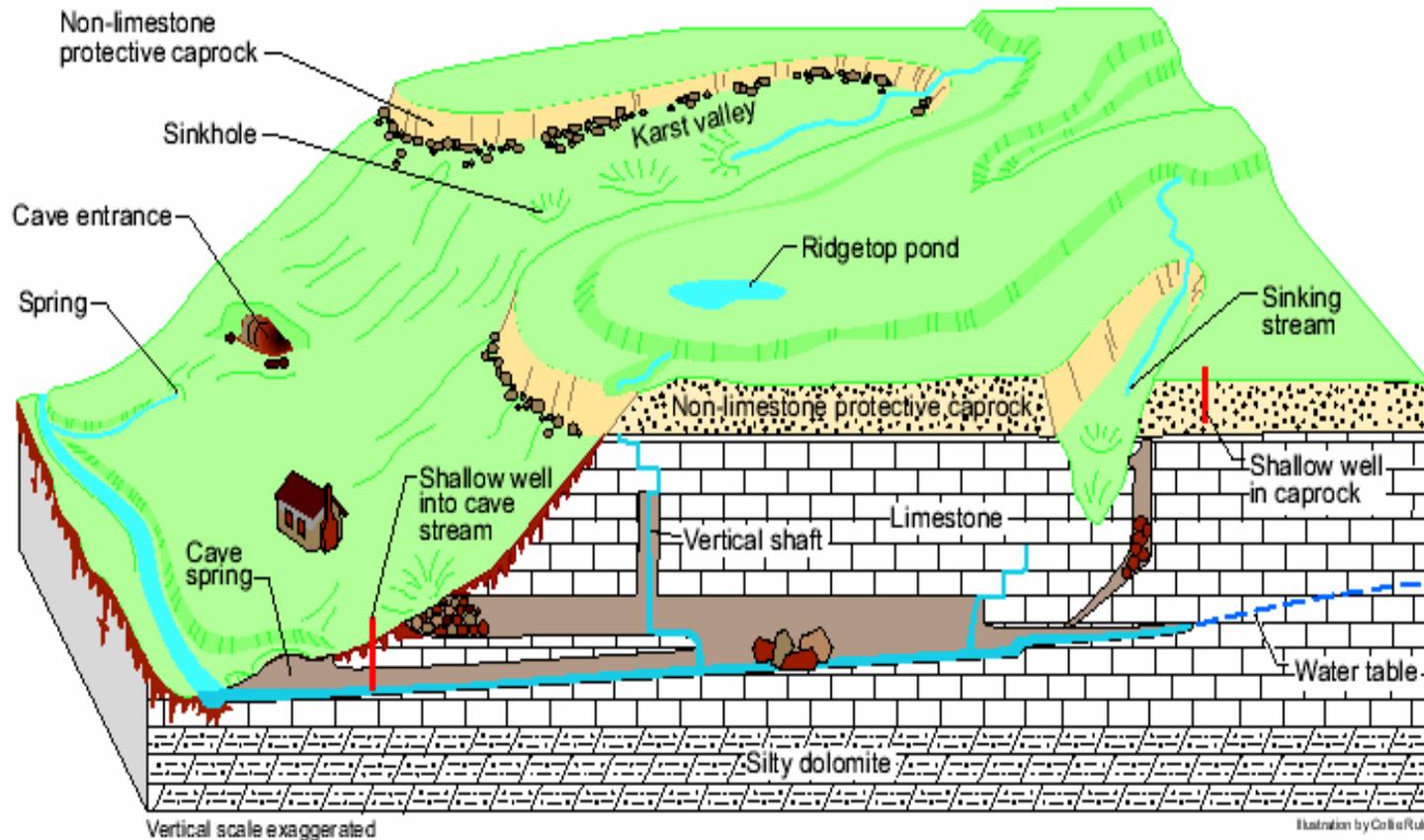
Eastern Pennyroyal Karst

Kentucky Geological Survey
James C. Cobb, State Geologist and Director
UNIVERSITY OF KENTUCKY, LEXINGTON

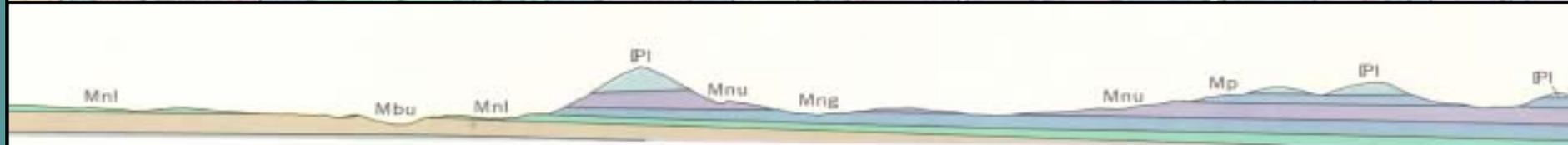
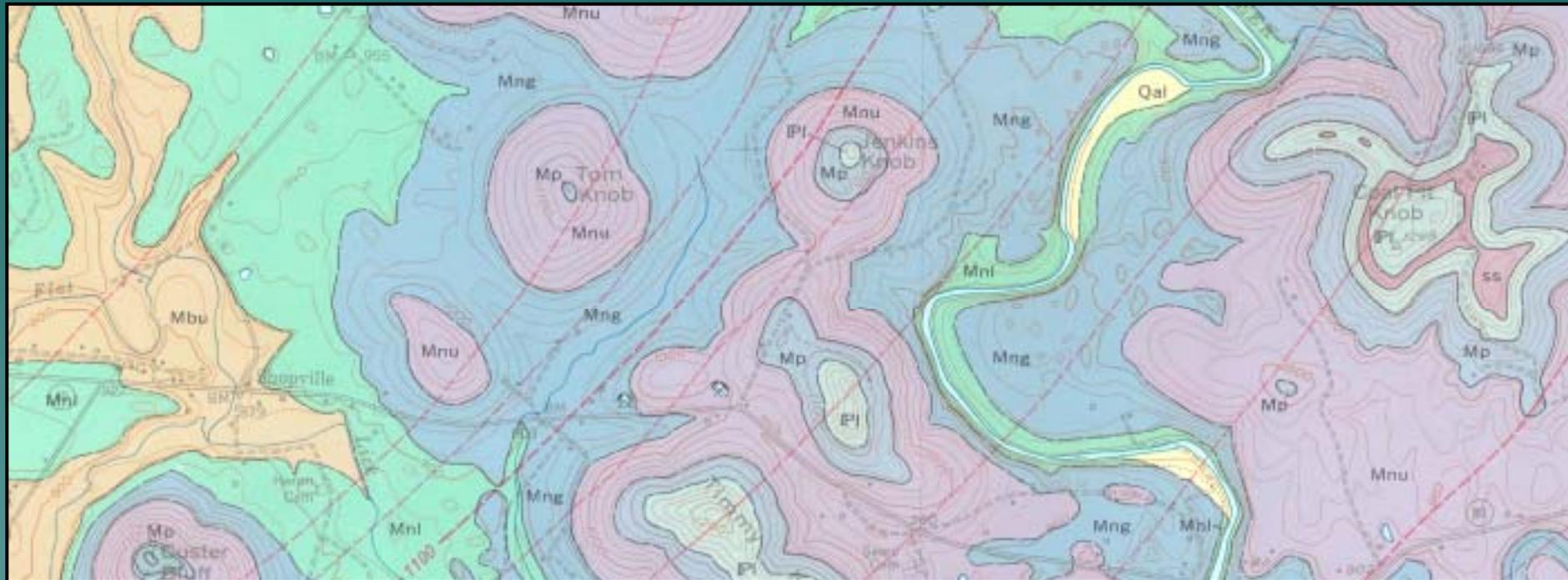
Generalized Block Diagram of the Eastern Pennyroyal Karst

James C. Currens

MAP AND CHART 17
Series XII, 2001



Pulaski County, KY



GEOLOGY OF THE SHOPVILLE QUADRANGLE, KENTUCKY

Pulaski County, KY

- ◆ More than 190 caves have been identified in Pulaski County
- ◆ Several major limestone beds known for the karst formation.
- ◆ All are Mississippian in age (300 to 350 MY).
- ◆ Two notorious formations are the *Saints*;
 - St Louis Formation (20 – 70 ft. thick),
 - St. Genevieve (60 – 100 ft. thick), .
 - Kidder Formation also problematic in the area.

Shopville USGS Map



Study Approach

- ◆ No KYTC or FHWA defined processes for KFA.
- ◆ Modified procedures defined in Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia, January 2003.
 - “ ...defines standards for inventories at various intensity levels, and outlines procedures for deriving karst vulnerability ratings.”

Karst Field Assessment

- ◆ Conduct at the 'site' level to obtain detailed information on karst resources within and adjacent to proposed development, and to assess the vulnerability of the karst unit.
 - ◆ KFA achieved through identifying and understanding the following attributes:
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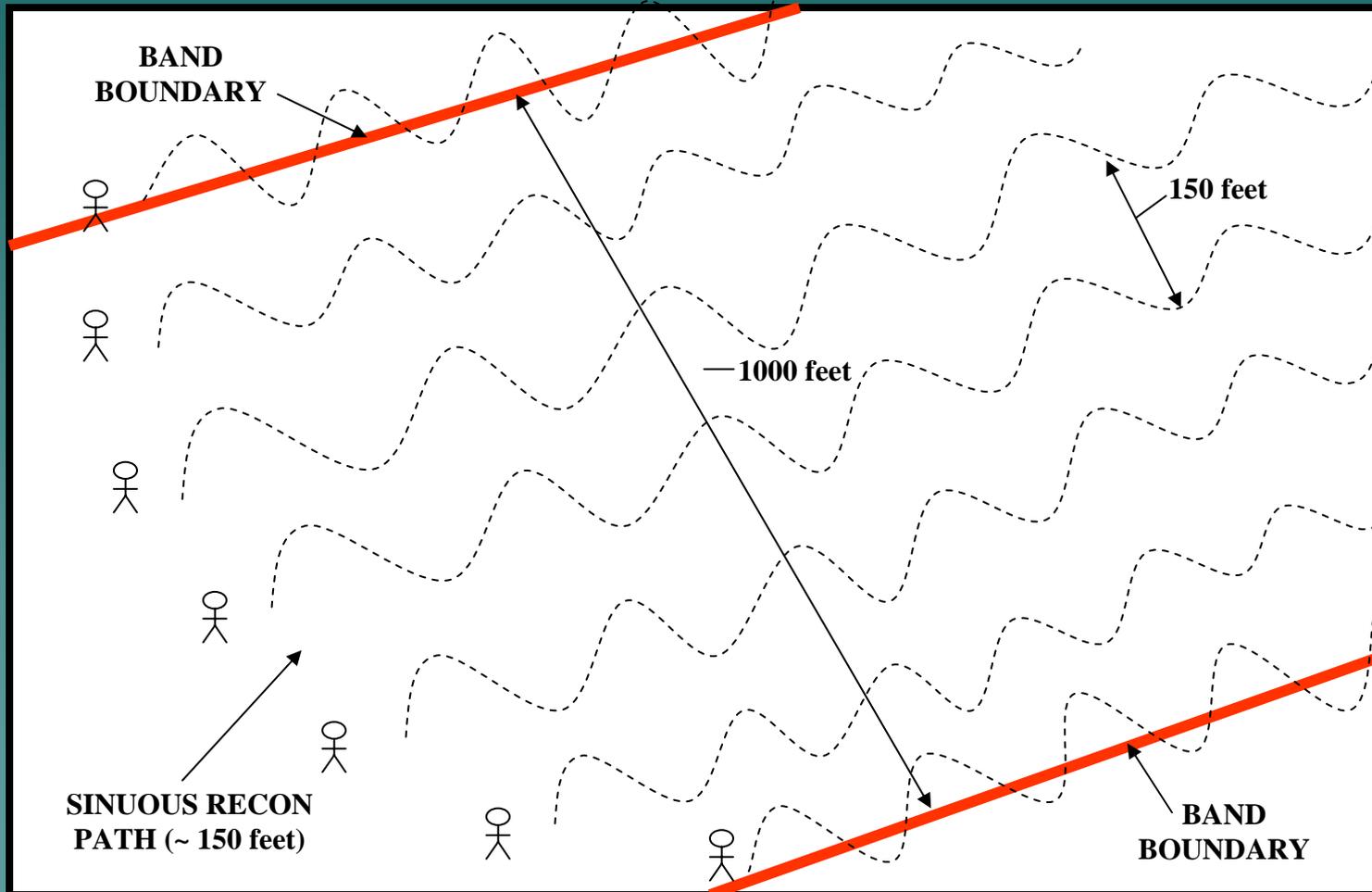
KFA Attributes

1. Karst Unit Boundaries and Geological Characteristics.
2. Distribution and density of surface epikarst development.
3. Thickness and texture of overburden soils.
4. Location, type, density and significance of surface karst features.

KFA Attributes

5. Roughness of the overall karst surface.
 6. Streams and hydrology.
 7. Location of caves and other subsurface cavities
 8. Occurrence of unique or unusual flora or fauna or habitat.
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Karst Field Assessment Inventory Methodology



MULTIPLE TRANSECT RECONNAISSANCE

Karst Field Assessment Surface Features – Aerial View



Karst Surface Features

- ◆ COVER COLLAPSE - The collapse of unconsolidated cover (such as soil) into the underlying cavernous bedrock.



Karst Surface Features

- ◆ GRIKE - A vertical or subvertical fissure in a limestone bedrock developed by solution along a joint.



Karst Surface Features

- ◆ COMPOUND SINK – An area with several sinkholes in close proximity to one another.



Karst Surface Features

- ◆ COMPOUND SINK – An area with several sinkholes in close proximity to one another.



Karst Surface Features

- ◆ CLOSED DEPRESSION - A general term for any enclosed topographic basin having no external drainage, regardless of origin or size.



Karst Surface Features

- ◆ KARREN - Channels or furrows, caused by solution on massive bare limestone surfaces; they vary in depth from a few millimeters to more than a meter and are separated by ridges.



Karst Surface Features

- ◆ KARST VALLEY - A compound sinkhole, sinking valley, or other large karst depression from a few hundred meters to kilometers in size.



Karst Surface Features

- ◆ SINKHOLE - A basin or funnel shaped hollow in limestone, ranging in diameter from a few meters up to a kilometer and in depth from a few to several hundred meters. They can be either dry or wet.



Karst Surface Features

- ◆ SINKING (DISAPPEARING) STREAM - A surface-flowing stream that disappears underground.



Karst Surface Features

- ◆ SPRING - Any natural discharge of water from rock or soil onto the surface of the land or into a body of surface water.

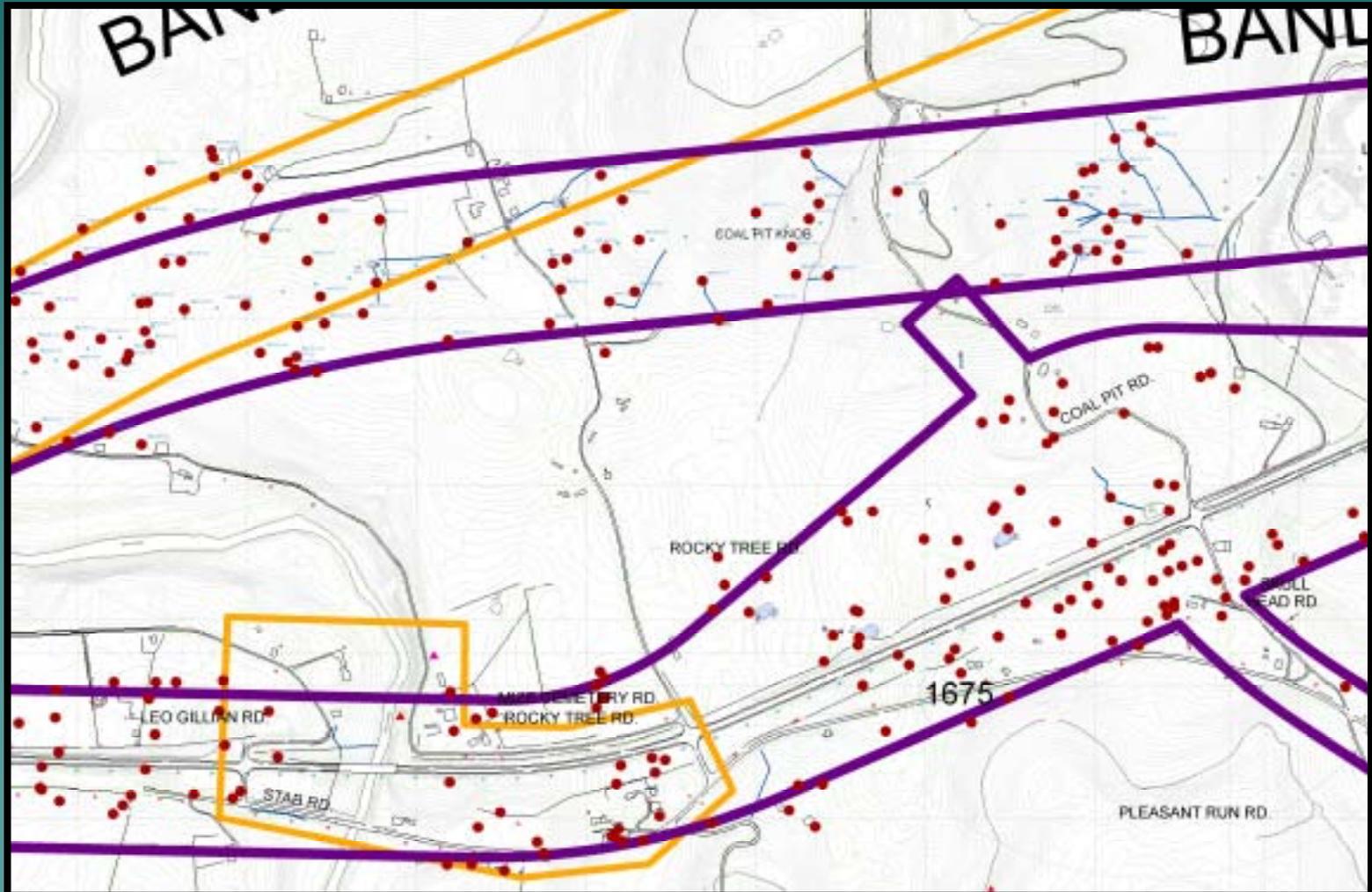


Karst Surface Features

- ◆ SWALLOW HOLE (SWALLET) - A place where water disappears underground into a hole in a stream bed or sinkhole.

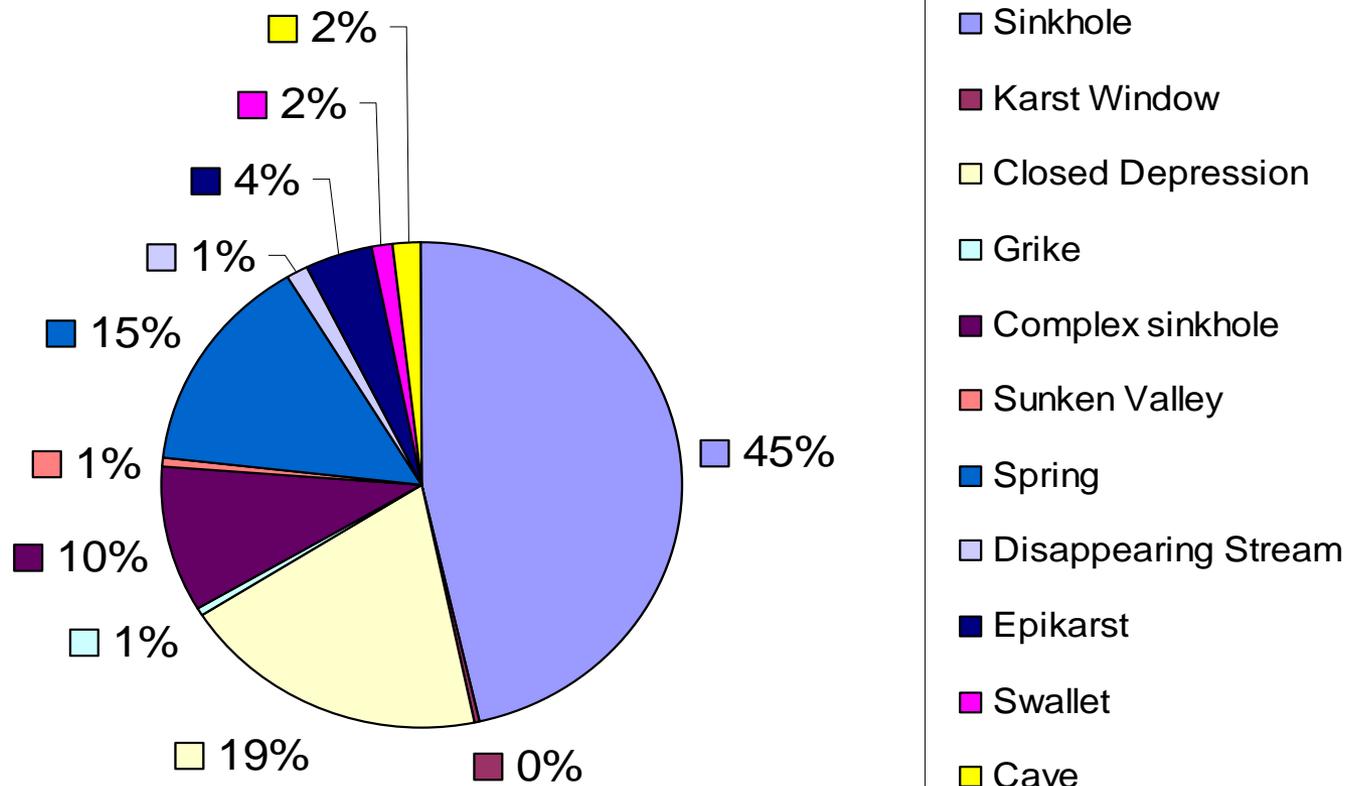


Karst Field Assessment Results



Karst Field Assessment Results

PERCENTAGE OF FEATURES



Karst Field Assessment Results

◆ Sinkholes Averages:

- ◆ Width – 16 feet
- ◆ Length – 23 feet
- ◆ Depth – 4 feet

◆ Closed Depression Averages:

- ◆ Width – 71 feet
- ◆ Length – 96 feet
- ◆ Depth – 5 feet

KFA Cave Fauna Inventory

- ◆ Made > 100 trips to 40+ caves to sample the fauna.
- ◆ Sampling Methods included:
 - Hand sampling.
 - Pitfall traps baited with limburger cheese.
 - Plankton netting of pools.
 - Berlese extraction (for leaf litter).
 - Karaman-Chappuis extraction (for stream gravels).
 - Shrimp-baited sampling jars.

Cave Access



Cave Access



Cave Access



Karst Fauna

Cedar Creek Plankton Drift



Karst Fauna Pitfall Trap



Karst Fauna

Stab Cave Salamander



Karst Fauna Cedar Cave Beetle



Karst Fauna Cave Cricket



Karst Fauna Cave Crawfish



Karst Fauna Cave Milliped



Karst Fauna

Blowing Cave Flowstone



Karst Fauna

Blowing Cave Stalactite



Karst Field Assessment Cave Fauna Results

- ◆ Found 29 species that are troglobitic, i.e. obligate cave inhabitants (typically eyeless and unpigmented).
 - 22 of these 29 species were found in Band B.
 - 23 of these 29 species were found in the KY80 Band.
 - 14 of these 29 species were found in Band D.
- ◆ Found 32 species that are of global rarity (ranked G1-G3).
- ◆ Found some species that are new to science and have yet to be named.

Karst Field Assessment Next Steps

- ◆ Cave Fauna – Continue sampling cycle through fall of 2004.
 - ◆ Developing a Karst Vulnerability Rating criteria for project.
 - ◆ Will use GIS Spatial Analysis to aid in quantifying impacts and performing vulnerability assessment.
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- A decorative graphic at the bottom of the slide showing a silhouette of a mountain range in shades of teal against a darker teal background.

QUESTIONS

