CERTIFICATION AND DISCLAIMER

All geophysical data analysis, interpretations, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by Blackhawk senior geophysicists.

This geophysical investigation was conducted using sound scientific principles and state-of-the-art technology. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing, interpretation, and reporting. The results and interpretations were limited by the data obtained in the field and from the client. All original field data files, field notes, observations, and other pertinent information are maintained in the project files at the Blackhawk's Golden office, and are available to the client for a minimum of five years.

A geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, or ordinances.

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REFERENCES

- 1. Lava Beds National Monument Website. Retrieved August 2, 2005 from http://www.nps.gov/labe/content/HISTORY Main.htm
- 2. Resource Management Plan, Lava Beds National Monument. December 1999. Retrieved August 2, 2005 from http://data2.itc.nps.gov/parks/labe/ppdocuments/1999RMP.pdf.
- 3. Dorman, C. Personal communication regarding lava tube occurrences at Lava Beds National Monument. October 2003.
- 4. Lava Beds National Monument Website. Retrieved October 1, 2003 from http://www.nps.gov/carto/LABE.html
- 5. Alt, D. and D.W. Hyndman. <u>Roadside Geology of Northern and Central California</u>. Vancouver: Mountain Press Publishing Company, 2000. p 370.
- 6. Larson, C. and J. Larson. <u>Lava Beds Book</u>. Vancouver: ABC Publishing, 1989. pp 24-25, 29-32, 41-43.
- 7. Wightman et al. Application of Geophysical Methods to Highway Related Problems. Federal Highway Administration, Central Federal Lands Highway Division. Project No. DTFH68-02-P-00083. September 2003
- 8. Ray, M.W. "Electronic Technology Being Used to Map Salt Water Contamination in Developing Areas of Central Oklahoma." Oklahoma House of Representatives Media Division Website. Retrieved on February 27, 2002 from http://www.lsb.state.ok.us/house/NEWS6262.htm
- 9. Wolfe, P.J., E.C. Hauser, and B.H. Richard. Identifying Potential Collapse Features Under Highways. Ohio Department of Transportation. State Job Number 14700(0). Department of Geological Sciences, Wright State University. Dayton, Ohio, March 2003.
- 10. "Pellissippi Case Study." Advanced Geosciences, Inc Company Website. January 19, 2002. Retrieved on February 20, 2004 from http://www.agiusa.com/pellissippi.shtml.
- 11. Miyamoto et al. "Ground Penetrating Radar to detect lava tubes: preliminary results of a GPR application to Fuji volcano, Japan." Retrieved on February 20, 2004 from http://www.lpi.usra.edu/meetings/lpsc2002/pdf/1482.pdf.
- 12. Olhoeft et al. "Hot and Cold Lava Tubes Characterization with Ground Penetrating Radar." In GPR 2000, Proc. of the 8th International Conference on Ground Penetrating Radar, Gold Coast, Australia, 22-25 May 2000, D. A. Noon, G. F. Stickley, and D. Longstaff, eds., SPIE vol. 4084, p. 482-487.

- 13. Taylor, R. S. "Applications of Terrain Conductivity M." Retrieved on February 20, 2004 from http://www.dualem.com/abib.html
- 14. Clark, J.C. "Double Feature at the Bijou: Shear Wave Vibroseis Reflection Seismic Acquired Within a Working Movie Theater."
- 15. National Parks Service. Lava Beds National Monument Geology. February 26, 2001. Retrieved on February 12, 2004 from http://www.nps.gov/labe/Geology.html
- 16. Donnelly-Nolan, J. M. and D.E. Champion. *Geologic Map of Lava Beds National Monument, Northern California.* Map I-1804. Scale 1: 24,000. Reston, Virginia. Department of the Interior Geological Survey, 1998.
- 17. Sims, M., Weinberg, and D., Vollmer. *Monument Road Cave Lava Beds National Monument, California*. Scale 1:360. 1992. Received from LBNM officials on October 10, 2003.