

March 8, 2015

Mr. Alan Hermely

Environmental Specialist

Federal Emergency Management Agency

Region VI

600 North Loop 288

Denton, Texas 76209

Dear Mr. Hermely:

 I am writing in response to the general call for citizen’s comments regarding the Draft Environmental Assessment-City of Bentonville Improvements to Lake Bella Vista Dam; FEMA-1975-DR-AR/PW1562; Benton County, Arkansas. I have grave concerns regarding the proposed action of investing public funds in rebuilding the Lake Bella Vista dam on Little Sugar Creek in Bella Vista, Arkansas, and ***I strongly recommend that this dam be removed rather than rebuilt***. I base my concern on the current observed leakage through the existing dam, the karst geology of the St. Joe Limestone and the Cotter Dolomite which underlie the dam and much of the Bella Vista area, the well-developed and integrated groundwater drainageways underlying the study area, and most importantly, karst areas underlying the contiguous areas that contribute much of the flow that passes through Lake Bella Vista.

 As a matter of introduction, my name is John Van Brahana. I was employed for 28-years with the U.S. Geological Survey (in the midcontinent region of the United States as an Hydrologist), and 23-years as a Professor of Geosciences at the University of Arkansas, Fayetteville. I retired from the USGS in September of 1999, and from the University in May 2013; I still actively conduct research for both. I earned my Ph.D. in Hydrogeology at the University of Missouri, Columbia, in 1973. Since graduate school, I have collaborated closely with members of the state and federal agencies and nearby academic institutions striving to help address vulnerability of karst lands and water-quality issues in the karst terrane of the Ozarks. This work included supervision of numerous student theses and research projects dealing with karst science, and consulting, conducting, and publishing peer-reviewed research papers nationally and internationally on topics relevant to karst. Dr. Tom Sauer (U.S. Department of Agriculture, Agricultural Research Service) and I developed the Savoy Experimental Watershed (SEW) on Division of Agriculture property contiguous to the Illinois River in northwest Arkansas in the mid-1990s, and since that time this facility has been the center of an intensive infrastructure of long-term karst water-related studies. I am a Professional Geologist (P.G.) registered with the American Institute of Professional Geologists-number 2275, and with the State of Arkansas-Board of Registration for Professional Geologists-number 1884.

 My major objections to the Draft Environmental Assessment lie with ***1) omissions and the superficial level of treatment of the karst hydrology and structural geology of the area***, which have a major control of the interaction of surface and groundwater (Winter et al., 1998) in this well-documented karst area, and thus have an ***2)*** ***unknown impact on water quality of both surface and groundwater***, and on the well-being of the organisms utilizing these environments and related ecosystems. It is my strong opinion that comments regarding karst hydrogeology and water quality in the Draft Environmental Plan are misrepresentative, and ***3) too brief for a meaningful discussion of impacts on endangered species that live within this karst ecosystem; impacts in the Draft Environmental Assessment are significantly understated, and are likely misrepresented***.

1. Specifically, Lake Bella Vista dam site is very close to a major basement fracture, the Bella Vista fault, a structure which cuts the overlying, younger sedimentary rocks from the igneous-rock basement up to land surface, a thickness of several thousand feet. The Bella Vista fault is documented on the geologic map of Arkansas (Haley et al., 1993); it is an ancient feature underlain by preexisting basement faults in the igneous rocks that were reactivated and moved during the oblique closure of the North American and South American plates during the Ouachita orogeny, roughly 300 million years ago (Ma). The Bella Vista fault cuts across Little Sugar Creek less than 1000 feet upstream of Lake Bella Vista, a distance that lies well within the zone of influence of groundwater in this karst setting. Karst hydrogeology studies describe the system of conduits which allow groundwater and organisms to move readily through the subsurface, and the degree of development and adequate characterization require a *thorough study of the entire groundwater basin*, *not just the area of the lake. This assessment of the full natural boundaries of the lake was a task that was omitted in the Draft Environmental Plan.*
2. Lake Bella Vista is a nutrient-rich lake which becomes overgrown with algae during the warm summer months, thereby impacting lake water quality with diurnal spikes of low dissolved oxygen, resulting in eutrophication. Little Sugar Creek and Lake Bella Vista are the regional hydrologic drain for most of the year, and as such, receive runoff and groundwater-derived baseflow from the surrounding uplands. Leakage from numerous septic systems provides a significant amount of effluents, estimated to be about 50 times greater than the seven other lakes in Bella Vista based on lake size, depth, and holding capacity (Darrell Bowman, Biologist and Stream Ecologist for the Property Owners Association of Bella Vista, personal communication, 2015). My concern is that impaired water quality from Lake Bella Vista may be recharged into the aquifer during times of high flow and flooding. The influx of fertilizers and effluents that are transported into this lake facilitate degradation of surface-water quality, a condition which is not anticipated to change, even if the dam is replaced. Under high flow, water movement is reversed as surface water from the lake recharges the groundwater though the same high-permeability karst conduits that facilitate flow from groundwater to surface water for most of the year. These features are called estavelles, and they are common in Ozark karst (Tennyson et al., 2008). *In my opinion, removing the dam will allow the Little Sugar Creek to return to its natural state, sediment behind the dam will be naturally eroded and transported downstream, and the degraded water quality of existing Lake Bella Vista will be replaced with more oxygenated water from upstream.*
3. Intimately related to the framework of subsurface karst conduits and open flowzones, two types of endangered subterranean obligates have been documented in the nearby area. A subterranean obligate is defined as an organism that is “restricted to an aquatic environment and that has a suite of convergent features such as loss of pigment and vision, and adaptive characteristics such as reduced metabolism or increased antennae length” (Graening et al., 2012). These two species are federally-listed organisms known from springs, wells, and caves within several miles of Lake Bella Vista, the endangered species of Ozark cavefish, *Amblyopsis rosae*, and Ozark crayfish, *Cambarus aculabrum*. They are dismissed by the Draft Environmental Assessment as not being impacted because there are no caves underlying Lake Bella Vista. However, the source of baseflow to Little Sugar Creek is derived from groundwater contributions from uplands; numerous caves, sinkholes, losing streams, and springs nearby are very well documented and are part of the dynamic flow regime of Little Sugar Creek. Occurrence of either or both *Amblyopsis rosae* and/or *Cambarus aculabrum* have been established along the Bella Vista fault at Bear Hollow Cave, ~5 miles northeast of Lake Bella Vista; at Dillow Spring, ~2 miles northeast of Lake Bella Vista; at Civil War Cave,~ 4 miles southwest of Lake Bella Vista; at the Centerton Fish Hatchery, ~6 miles southwest of Lake Bella Vista; and at Logan Cave, ~18 miles southwest of Lake Bella Vista (various sources, including Dr. Art Brown, University of Arkansas; Dr. Jim Johnson, University of Arkansas and U.S. Fish and Wildlife Service, emeritus; Mike Slay, The Nature Conservancy; Tom Aley, Ozark Underground Laboratory; and Jonathan Gillip, U.S. Geological Survey). The Bella Vista fault, with its related group of fractures and cracks that cut the soluble limestone bedrock offer numerous potential pathways for interaction between Lake Bella Vista and regional groundwater, as well as for the endangered species within. *Protection of endangered species is a critical element of the National Environmental Protection Act (NEPA), and it is my feeling that this Draft Environmental Assessment has not addressed these questions adequately*, *particularly with respect to the karst.*

 Dams require special engineering study in karst areas, for as they store water behind the structure, the weight of this water has been known to create leaks that can ultimately blow out the clay plugs that fill underlying fractures, causing dam leakage and failure. These are known from numerous similar geologic settings in the Ozarks, and special care must be taken to assess an area before such construction takes place. I am greatly concerned that an adequate environmental assessment of the karst from the surrounding uplands has not been undertaken, and I would like to share my concerns prior to the Federal Emergency Management Agency spending millions of dollars of taxpayer’s money. If you have questions, please feel free to contact me at brahana@uark.edu .

 Respectfully submitted,

 

 John Van Brahana, Professor Emeritus

 Department of Geosciences

 University of Arkansas

***References***

Graening, G.O., Fenolio, Dante B., and Slay, Michael E., 2012, Cave life of Oklahoma and Arkansas—Exploration and conservation of subterranean biodiversity: University of Oklahoma Press, Animal Natural History Series, v. 10, 226 p.

Haley, Boyd R., Glick, Ernest E., Bush, William V., Clardy, Benjamin F., Stone, Charles G., Woodward, Mac B., and Zachry, Doy L., 1993, Geologic map of Arkansas: U.S. Geological Survey, 1 sheet, scale 1:500,000.

Tennyson, Rodney, Terry, Jim, Brahana, Van, Hays, Phil, and Pollock, Erik, 2008, Tectonic control of hypogene speleogenesis in the southern Ozarks—Implications for NAWQA and beyond: *in* Kuniansky, E.L., ed., U.S. Geological survey Karst Interest Group Proceedings, Bowling Green, Kentucky, May 27-29, 2008: U.S. Geolological Survey Scientific Investigations Report 2008-5023, p. 37-46.

Winter, T.C., Harvey, J., Franke, O.L., and Alley, W.M., 1998, Ground water and surface water-A single resource: U.S. Geological Survey, Circular 1139, 79 p.