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The Reserve
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Dear Mr. Gannon,

I applaud the state's effort to implement strategies to reduce N & P input to Jordan Lake (Proposed Nutrient Strategy for Jordan Reservoir Watershed, NCDWQ, 6-07) because of the risks posed by cyanobacterial harmful algal blooms (CHABs) to human health and ecosystem sustainability. Although nutrient reduction is a laudable longer term goal and approach toward CHAB reduction, it is unlikely that nutrient reduction alone will produce a significant decrease in CHABs for many years. I urge the state to also consider implementation of vertical mixing procedures to achieve almost immediate cessations of CHABs (2 SolarBee attachments). Vertical mixing in and around the New Hope Creek and Haw River inputs will eliminate CHABs in those areas and perhaps in the entire lake. If needed, additional vertical mixing units near drinking water intakes and beaches will provide additional protection for humans and the ecosystem.

I write to you as a private citizen living in a southern Orange County portion of the Jordan Watershed. I gained knowledge of CHABs as a neurotoxicologist with the US EPA after performing research on the adverse human health effects caused by exposure to biotoxins, including cyanotoxins (CV attached). My interest in the health effects of cyanotoxins led me to investigate all areas concerning CHABs. My involvement in CHAB research, publication, and education includes: 1) leading the Interagency, International Symposium on Cyanobacterial Harmful Algal Blooms (ISOC-HAB) in 2005; 2) presenting briefings on CHABs to White House subcommittees on three occasions in 2005; 3) editing the Proceedings of the Interagency, International Symposium on Cyanobacterial Harmful Algal Blooms (ISOC-HAB): State-of-the-science and research needs, Springer Press: Advances in Experimental Medicine and Biology, in press; 4) writing the first two chapters in that monograph (a systems approach to CHABs, a synopsis of CHAB research needs); 5) co-authoring the Scientific Assessment of Freshwater Harmful Algal Blooms, in press (a report mandated by Congress in the expansion and reauthorization of HABHRCA in 2004); co-authoring a report to NOAA - Research Development, Demonstration and Technology Transfer of Methods to Prevent, Control, and Mitigate Harmful Algal Blooms, June, 2007 (to support development of another HABHRCA mandated report) and; 6) presenting keynote talks at CHAB meetings around the US.

As I point out in several of the documents listed above, vertical mixing is the only near-term method to prevent and terminate CHABs that does not have untoward effects on the ecosystem, is cost effective, and is effective indefinitely. As stated in the attached SolarBee Lake Houston report, "SolarBee, Inc. has developed portable long-distance, low-energy, solar-powered SolarBee circulators to improve water quality in lakes and reservoirs. The large machine most commonly used in lakes, the SB10000v12, pumps 3,000 gallons per minute (4.3 MGD) up its intake hose, and creates 7,000 gallons per minute (10 MGD) of induced flow, for a total of 10,000 gallons per minute (14.3 MGD) leaving the machine. Water enters the SolarBee horizontally from a fixed depth in the lake (there is a 1 ft opening between the intake hose and the bottom plate beneath, so water comes to the machine laterally), and a specialized dish that distributes the flow radially outward from the machine at the lake's surface. Since 2001, SolarBees have solved reservoir water quality problem in about 160 US lakes (out of 170) [now over 200], including over 60 municipal drinking water reservoirs. Long-distance mixing is accomplished allowing for maximum spacing at about 30-35 acres per machine (700 ft radius, 1400 ft between machines)." I believe the large units cost about $40,000 each, but could be rented on a trial basis. Please understand that I am not affiliated with SolarBee. I believe that SolarBee is the only company that makes vertical mixers. Aeration alone does not prevent CHABs.

SolarBees were originally developed around 2000 to increase dissolved oxygen (DO) levels in waste water treatment lagoons and reservoirs, and to reduce the intake of manganese and hydrogen sulfide compounds in drinking water processing plants. Reductions in the levels of these compounds is do to lower pH and higher DO in the hypolimnion, resulting in slower rates of resuspension of these compounds and others, including P, into the water column from sediment. The CHAB prevention, improved fish habitat, and submersed macrophyte control outcomes of vertical mixing were originally unknown and unintended. Other benefits of vertical mixing were observed without any reduction in nutrient loading, including significantly improved water clarity, lower pHs, reduced chlorophyll /a /and total P concentrations, increased biodiversity, and increased secondary production (both zooplankton and fish). The specific mechanisms by which vertical mixing prevents CHABs is unknown, although there are several hypotheses proposed for testing. The outcome of vertical mixing, however, is that cyanobacteria and diatoms are selected against while beneficial algae are favored. The capture of nutrients by beneficial algae allows the nutrients to move up the food chain rather that return to the sediment when CHABs die off.

The use of vertical mixers while nutrient loading controls are being implemented will not only eliminate or greatly reduce CHABs in Jordan Lake, but will also reduce levels of nutrients in the water column by inhibiting internal P loading. Vertical mixing can be achieved at a small fraction of the cost of the proposed nutrient strategy. Even this cost might be recovered by reducing the requirements for some of the more costly and less effective nutrient control techniques in appropriate locations. Water utility plants should see a considerable cost savings because of the lack of need to address the taste and odor problems caused by CHABs. I heard that the City of Houston saved about $500,000 during the first year after installing 20 SolarBees to prevent taste and odor problems. Perhaps you could use vertical mixing as a "bargaining chip" during the comment and approval process.

I am "Tar Heel born and bread" (New Bern to Chapel Hill), and have been saddened by the environmental degradation that I have observed in our state since the 1950s. I will be glad to help you address these issues as a private citizen. These views and comments are my own and do not necessarily represent those of the Agency. Nor has the Agency endorsed my involvement with the state as an official duty.

Sincerely,

H Kenneth Hudnell, PhD